Tuesday, 8:00am - 9:30am

■ TA01

Hilton- Golden Gate 6

Mission Planning I

Sponsor: Military Applications Society

Sponsored Session

Chair: Chase Murray, Auburn University, 3301 Shelby Center, Auburn, AL, United States of America, CCM0022@auburn.edu

1 - Multi-depot Vessel Routing in a Direction Dependent Wavefield

Michael Hirsch, President, ISEA TEK, 620 N. Wymore Road, Suite 260, Maitland, FL, 32751, United States of America, mhirsch@iseatek.com, Daniel Schroeder, Alvaro Maggiar, Irina Dolinskaya

Considerable research has been done on the vehicle routing problem and its variants; however only limited work deals with possible environmental conditions and their effects on the vehicle routes. This research presents the multiple-depot vehicle routing problem for surface vessels; the vehicles must traverse a time-invariant direction-dependent medium. Our model captures environmental effects and vessel dynamics on the considered paths. Multiple heuristics are developed and tested.

2 - A New Approach to Planning Cooperative Missions

Paul Scerri, Carnegie Mellon University, Robotics Institute, 5000 Forbes Avenue, Pittsburgh, PA 15213, United States of America pscerri@cs.cmu.edu, Bob Jacobs

This talk describes initial work using an iterative planning algorithm called DIMS to plan cooperative manned and unmanned vehicle missions against an adversary. The algorithm iterates between planning, simulating and model shaping to quickly find interesting cooperative plans in a very large solution space. With the addition of techniques from game theory, specifically fictitious play, the convergence of the algorithm is further improved.

3 - Dynamic Programming for Task Assignment in Multi-Human Multi-Robot Interaction Systems

Monali Malvankar, University of Western Ontario, Schulich School of Medicine & Dentistry, London, ON, Canada, mmalvan@uwo.ca, Siddhartha Mehta, Eduardo Pasiliao

Multi-human multi-robot interaction is a complex system in which robots, e.g., Unmanned Aerial Vehicles (UAVs), may share information with a group of human operators to perform geographically-dispersed priority-based tasks within a specified time. A dynamic programming model is developed to optimally allocate tasks to teams of human operators with the objective to maximize the overall system performance while considering human factors.

4 - An Adaptive UAV Routing Model with Uncertainty on Intelligence Values

Mike Moskal, University at Buffalo, 342 Bell Hall, Department of Industrial and Systems Eng, Buffalo, NY, 142620, United States of America, mmoskal@buffalo.edu, Rajan Batta

We consider a UAV routing problem to maximize information fulfillment across an entire mission. An area of operation is discretized into a series of grids, each assigned a value representing the importance of surveying that area at that point in time. These values fluctuate as intelligence needs change, introducing an element of uncertainty. The presented model is capable of maximizing information fulfillments, reducing the impact of uncertainty, and delivering a real-time UAV route.

■ TA02

Hilton- Golden Gate 7

Outsourcing, Offshoring, and the Changing Nature of Organizational Boundaries and Architectures

Sponsor: Technology, Innovation Management and Entrepreneurship

Sponsored Session

Chair: Saikat Chaudhuri, The Wharton School, University of Pennsylvania, 2000 Steinberg Hall-Dietrich Hall, 3620 Locust Walk, Philadelphia, PA, 19104, United States of America, saikatc@wharton.upenn.edu

1 - Risk Sharing Partnerships In Outsourced Offshore Knowledge Process Networks

Ravi Aron, Associate Professor, Johns Hopkins University, 100 International Drive, Room 1331, Baltimore, MD, 21202, United States of America, raviaron@jhu.edu, Praveen Pathak

We look at a panel data of 22 pairs of knowledge intensive processes that have been outsourced to offshored providers. Each pair consists of very similar processes wherein one contract has a risk-sharing clause and the other does not, while other features remain the same. We find that over a period of time risk sharing leads to less physical monitoring, higher customer satisfaction and output quality. Our findings have implications for firms sourcing specific capabilities from specialists.

2 - The Human Cost of Complexity: Linking Product Architecture and Employee Turnover

Alan MacCormack, Harvard University, Soldiers Field, Boston, MA, 02163, United States of America, amaccormack@hbs.edu, Dan Sturtevant

Recent studies of software suggest modular systems are cheaper to maintain (in terms of defects) and easier to adapt (in terms of productivity). But few studies explore the human costs that such systems generate for those working within them. In this study, we explore the impact of complexity on employee turnover. We find developers working on the most complex parts of a system are more likely to leave. Our results further highlight the critical links between technical and social systems.

3 - The Determinants and Evolution of Major Inter firm Transactions in the US Apparel Sector

Xiao Zhao, University of Ottawa, 21 Cotswold Crescent, Toronto, ON, M2P1N1, Canada, mimosazhao@gmail.com, Margaret Dalziel

We investigate the determinants of major inter firm transactions, relying on a longitudinal dataset of over 2,000 of the largest transactional relations between publicly traded firms in the U.S. apparel sector. The results indicate the importance of inter firm complementarity, rather than inter firm similarity, in explaining the sector architecture.

4 - The Impact of Offshore Outsourcing Scale, Scope & Vendor Relationships on Firm Market Value Creation

Saikat Chaudhuri, The Wharton School, University of Pennsylvania, 2000 Steinberg Hall-Dietrich Hall, 3620 Locust Walk, Philadelphia, PA, 19104, United States of America, saikatc@wharton.upenn.edu

As outsourcing expands to higher-end tasks, the outcomes and implications remain unclear. Extant literature poses contradictory predictions on the extent a firm should outsource and engage with vendors. We examine a sample of publicly announced IT/ITES outsourcing deals from 2000-2009, and find that greater sophistication of outsourced tasks lowers market value creation for the client, while increased scale has a positive effect. These effects are amplified by longer client-vendor relationships.

■ TA03

Hilton- Golden Gate 7

Social Media and Business Marketing

Sponsor: eBusiness

Sponsored Session

Chair: Bin Zhang, University of Arizona, McClelland Hall, Room 430, P.O. Box 210108, Tucson, AZ, 85721, United States of America, binzhang@arizona.edu

1 - Generative Diffusion of Innovations and Knowledge Networks in Open Source Projects

Zhewei Zhang, Temple University, Philadelphia, PA, 19122, United States of America, zhang@temple.edu, Sunil Wattal, Bin Zhang, Youngjin Yoo

We conceptualize an open source community as a constellation of dynamic, multiple and heterogeneous informal knowledge networks. OSS development is therefore affected by these networks. We identify two knowledge networks, a more professional, developer-project network and a more social, developer-developer network, which a developer can simultaneously belongs to. We argue that the two networks emphasized on different types of knowledge transfer, and have different effects on project development.

2 - Potential of Social Media for Disaster Management

Lucy Yan, Indiana University, Kelley School of Business, Business 570C, Bloomington, IN, 47401, United States of America, yanlucy@indiana.edu, Alfonso Pedraza-Martinez

Social media has been widely used in disseminating information and important messages. It may increase the amount of data available to humanitarian workers in the aftermath of disasters and may also inform the general public. However, little attention has been paid to explore the role of social media on disaster management. We propose a framework to integrate social media in disaster management for real time decision making.

3 - Are Searches on Weekends More Influential on Stock Price?
Qiang Ye, Harbin Institute of Technology, 92 Xidazhi Street, School of Management,, Harbin, 150001, China, yeqiang@hit.edu.cn, Xianwei Liu

This study proposes a new measure using the proportion of the searches done on weekdays in a week. Based on daily search volume data from search engines, we try to explore the search weekend effects and its impact on stock price. We find that searches done on weekends are more influential on future stock price than searches done on weekdays. To validate the empirical findings, we define a week in different orders and got consistent results.

■ TA04

Hilton- Continental 1

Operations Management and Marketing

Sponsor: Manufacturing & Service Operations Management

Sponsored Session

Chair: Xuanming Su, University of Pennsylvania, The Wharton School, Philadelphia, PA, 19104, United States of America, xuanming@wharton.upenn.edu

1 - Dynamic Matching in a Sharing Economy
Ming Hu, Assistant Professor, Rotman School of Management, University of Toronto, 105 St George Street, Toronto, ON, Canada, Ming.Hu@rotman.utoronto.ca, Yun Zhou

Sharing economy has significantly changed many marketplaces in recent years. Examples include the ridesharing services such as Uber. These examples share a common structure of a two-sided market that engages three parties: the supply side, the demand side, and an intermediate firm. In this research, we propose a general framework of dynamically matching supply with demand by the intermediary firm and explore the optimal and heuristic matching policies.

2 - Customer Referral Incentives and Social Media
Evan Sadler, NYU, 44 W 4th St, New York, NY, United States of America, esadler@stern.nyu.edu, Ilan Lobel, Lav Varshney

We study the optimal structure of referral incentive programs that are used to attract customers to businesses. We show that the shift from person-to-person referrals to social media referrals leads to nonlinear payment polices being optimal, but that capped linear policies are a good approximation.

3 - On the Optimality of Synchronizing Pricing and Replenishment with Strategic Customers
Leon Zhu, Associate Professor, University of Southern California, Bridge Hall 401, University Park Campus, Los Angeles, CA, 90089, United States of America, leonyzhu@usc.edu, Ying-Ju Chen

We investigate the joint inventory and revenue management problem with strategic customers for the classical economic order quantity setting. We establish the optimality of the cyclic intertemporal price discrimination even for the homogeneous customer setting. The optimal replenishments and price promotions are synchronized and no capacity rationing is needed. For the heterogeneous customer setting, we find that high frequent intertemporal price discounts can arise as a predominant feature.

4 - Holiday Retailing with Gift Cards
Alice Lu, University of Pennsylvania, Philadelphia, PA, United States of AmericaUniversity of Pennsylvania, xingwei@wharton.upenn.edu, Xuanming Su

Gift cards are popular among retailers and consumers during holidays. Most states require retailers to transfer a portion of unredeemed value on gift cards to the state government. This paper studies the profitability of gift cards and the influence of different state laws on retailer strategies and consumer behavior.

■ TA05

Hilton- Continental 2

Bayesian Estimation and Optimization

Sponsor: Manufacturing & Service Operations Management

Sponsored Session

Chair: Tong Wang, National University of Singapore, 15 Kent Ridge Drive, Singapore, 119245, Singapore, tong.wang@nus.edu.sg

1 - New Approximations for Bayesian Bandit Problems
Michael Kim, Assistant Professor, University of Toronto, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, kimmi@mie.utoronto.ca, Andrew Lim

In his seminal work, Gittins showed that the optimal policy of a multi-armed bandit problem is of index-type. Computing Gittins indices however, are not always easy. For example, Bayesian bandits have infinite dimensional state spaces, and consequently computing the Gittins index is an intractable problem. In this work, we propose new approximation techniques for the DP equations of Bayesian bandits, and show how they lead to explicit solutions that do not require backwards recursion.

2 - A Parsimonious Non-parametric Method for Recommendations
Jeremy Chen, Department of Decision Sciences, National University of Singapore Business School, 15 Kent Ridge Drive, Singapore, 119245, Singapore, jeremy.chen@nus.edu.sg, Weijia Gu, Michael Kim, Sheryl Kimes, Andrew Lim

Recommender systems feature in the business models of many large internet companies. Most recommender systems are based on parametric models of the characteristics of alternative choices and the preferences of users. However, in most settings, usage data is readily available, while data on users and the characteristics of alternatives are not. We present non-parametric methods making recommendations leveraging only usage data. We believe this work is of strong practical significance.

3 - Data-driven Inventory Management with Demand Substitution in Retailing
Anna-Lena Sachs, University of Cologne, Albertus-Magnus-Platz, Cologne, Germany, anna-lena.sachs@uni-koeln.de, Stefan Minner

We formulate a data-driven model that integrates forecasting and inventory optimization by considering the effects of external factors on demand, unobservable lost sales and substitution behavior. Using data from a large European retail, we investigate the trade-off between learning about substitution behavior from highly censored data versus learning about demand from little censored data. We find that more learning about substitution yields slightly better results in terms of profits.

4 - Estimation and Optimization of Logit Demand Model with Covariates, Missing Data, and Auxiliary Info
Tong Wang, National University of Singapore, 15 Kent Ridge Drive, Singapore, SG, 119245, Singapore, tong.wang@nus.edu.sg, Baiyu Li, Andrew Lim

We consider parameter estimation, parameter uncertainty characterization, and decision optimization for an inventory control problem with a demand model that includes customer choice with stochastically changing covariates, missing observations and auxiliary information. Customer arrivals follow a Poisson process, and the choices follow a Logit model. We estimate the parameters using MCMC algorithm in a Bayesian setting, which provides us with a framework to account for parameter uncertainty.

■ TA06

Hilton- Continental 3

Operational Issues in Trade-in Programs

Sponsor: Manufacturing & Service Operations Management

Sponsored Session

Chair: Gil Souza, Associate Professor, Indiana University, Kelley School of Business, Bloomington, IN, 47405, United States of America, gsouza@indiana.edu

1 - Optimal Dynamic Pricing for Trade-in Programs
Mohammad Ghuloum, PhD Student, Indiana University, Kelley School of Business, Bloomington, IN, 47405, United States of America, mghuloum@indiana.edu, Goker Aydin, Gil Souza

Trade-in managers (e.g., college booksellers) start the selling season with zero inventory and have to simultaneously acquire and sell used products. Unlike conventional dynamic pricing models, the inventory is not readily available at the beginning of the horizon. This paper studies the optimal acquisition and selling prices for such firms.

2 - Trade-in Rebates for Price Discrimination and Product Recovery
Mark Ferguson, Professor, University of South Carolina, Columbia, SC, United States of America, mark.ferguson@moore.sc.edu, Gil Souza, Vishal Agrawal

Many OEMs offer trade-in rebates to their existing customers when they purchase newer versions of a product. In business-to-business settings, the amounts of the rebates are often opaque to the firm's other customers, resulting in customized rebate amounts. We investigate how this practice affects the firm's decisions regarding secondary markets and offering remanufactured products.

3 - Consumer Trade-in Program Design and the Quality of Returns
Fei Qin, Postdoctoral Fellow, McGill University, Desautels Faculty of Management, Montreal, QC, H3A1G5, Canada, qinfei99@gmail.com, Michael Fry, Uday Rao

We study the structure of the supply chain facilitating used-product return from, and resale to, end consumers. By modeling a variety of trade-in supply chain structures in practice, we show their impact on the performance of the trade-in firm, the retailer, and the channel.

4 - Lemons, Trade-ins, and Remanufacturing
Ximin (Natalie) Huang, PhD Student, Georgia Institute of Technology, Atlanta, GA, United States of America, ximin.huang@scheller.gatech.edu, Atalay Atasu, Beril Toktay

Trade-in programs have been shown to partially mitigate the lemons problem in secondary markets. In this paper, we show when and how remanufacturing traded-in products can further improve the efficiency in secondary markets.

■ TA07

Hilton- Continental 4

Service Science: Toward Systematic Service System Innovation

Cluster: Tutorials

Invited Session

Chair: Paul Maglio, University of California, Merced, Merced, CA, United States of America, pmaglio@ucmerced.edu

1 - Service Science: Toward Systematic Service System Innovation
Paul Maglio, University of California, Merced, Merced, CA, United States of America, pmaglio@ucmerced.edu

Service science is the study of complex service systems. It may involve methods and theories from operations, industrial engineering, marketing, computer science, psychology, information systems, design, and more. In fact, understanding innovation in service systems often requires combining multiple methods because of the complex ways in which interactions among people, technology, organizations, and information create value in different contexts and under different conditions. Service Science the journal documents empirical, modeling, and conceptual studies of complex service systems, and is the archival record of service science the field. The journal is also helping to shape the field. This tutorial will review the emergence of service science the field by analyzing papers published in Service Science the journal, and discuss the new field's foundations, prospects, and opportunities.

■ TA08

Hilton- Continental 5

Optimization and Modeling for Individual Decision-Making

Cluster: Social Media Analytics

Invited Session

Chair: Theodore Allen, Associate Professor, The Ohio State University, 1971 Neil Avenue, 210 Baker Systems, Columbus, OH, 43210, United States of America, allen.515@osu.edu

1 - SMERT Modeling of #BringBackOurGirls Tweets
Anthony Afful-Dadzie, Lecturer, University of Ghana Business School, P. O. Box LG 78, Legon, Ac, Ghana, afful-dadzie@ug.edu.gh, Theodore Allen

The twitter campaign has brought global attention to the important cause of abducted girls in Nigeria. Subject Matter Expert Refined Topic (SMERT) models permit the exploration of freestyle text in a way that permits intuitive editing of the topic definitions. The results show the range and level of constructive discourse.

2 - DDAER Policy Optimization for Improved Facebook Experiences
Chen Xie, Consultant, Flexis North America Inc. Corporate Operations Department, 110 Polaris Parkway Suite 305, Westerville, OH, 43082, United States of America, chen.xie@flexis.com

Facebook users have many choices to make about how active to be, what types of posts as well as security settings. There are also many ways to measure their success including the numbers of positive events (contacts from friends) and negative events (unwanted contacts). We gather personal experience data and apply dynamic decision approximate empirical reward processes which are a generalization of Markov decision processes. We show how a personal policy can be formed to improve user experience.

3 - SMERT Modeling of Stephen Colbert Tweets
Theodore Allen, Associate Professor, The Ohio State University, 1971 Neil Avenue, 210 Baker Systems, Columbus, OH, 43210, United States of America, allen.515@osu.edu

Stephen Colbert has generated over 3,000 tweets from @StephenAtHome with over 6 million followers. Using our own Subject Matter Expert Refined Topic (SMERT) model, we identify a list of intuitive topics. Then, we chart the evolution over time of issues addressed to try to understand the Colbert mind. Results include the topics of relative fixation and omission.

4 - Experimentation and Modeling of Facebook Privacy Settings
Shih-Hsien Tseng, Assistant Professor, School of Commerce at Kainan University, 33857 No. 1 Kainan Road, Luzhu Shiang, Ta, Taiwan - ROC, tsengsh@mail.knu.edu.tw, Theodore Allen, Chen Xie, Zhenhuan Sui

Hundreds of millions of people use Facebook for pleasure or work. We use planned experiments to explore the impact of privacy settings and activity level on outcomes including the numbers of spam messages, positive contacts, likes, and undesirable contacts. The methods could be applied by others and possibly inform future software development.

■ TA09

Hilton- Continental 6

Novel Techniques in Integer Programming

Sponsor: Optimization/Computational Optimization and Software

Sponsored Session

Chair: Imre Polik, SAS Institute, Cary, NC, 27513, United States of America, imre.polik@gmail.com

1 - Valid Inequalities for Mixed Integer Second Order Cone Optimization (MISOCO)
Aykut Bulut, Lehigh University, 200 W Packer Avenue, Bethlehem, PA, 18015, United States of America, aykut@lehigh.edu, Ted Ralphs

We investigate the computational performance of the valid inequalities for MISOCO problem from literature. These valid inequalities include conic MIR cuts introduced by Atamturk and Narayanan, conic Gomory cuts introduced by Cezik and Iyengar, and disjunctive conic cuts introduced by Belotti et al. We solve the MISOCO problem using a branch and bound scheme and measure the reduction in the size of the search tree due to valid inequalities used.

2 - Using and Reusing Dual Information in Branch and Bound
Menal Güzelsoy, SAS, 100 SAS Campus Drive, Cary, NC 27513, United States of America, menal.guzelsoy@sas.com

In this talk we present several techniques to reuse dual information (such as dual feasible solution and dual rays) later in branch and bound. Bound tightening and branching decisions will both benefit for his extra information. The effectiveness of the ideas will be demonstrated with the SAS/OR mixed-integer linear solver.

■ TA10

Hilton- Continental 7

Dynamic Optimization with Uncertain Demand

Sponsor: Manufacturing & Service Operations Management

Sponsored Session

Chair: Omar Besbes, Associate Professor, Columbia University, 3022 Broadway, New York, NY, 10027, United States of America, ob2105@columbia.edu

Co-Chair: Ciamac Moallemi, Barbara and Meyer Feldberg Associate Professor of Business, Columbia Business School, 3022 Broadway, Uris 416, New York, NY, 10027, United States of America, ciamac@gsb.columbia.edu

1 - Capacity Constraints across Nests in Assortment Optimization under the Nested Logit Model
Jacob Feldman, Cornell University, Ithaca, NY, 14850, United States of America, jbf232@cornell.edu, Huseyin Topaloglu

We consider assortment optimization problems when customers choose according to the nested logit model and there is a capacity constraint limiting the total capacity consumption of all products offered in all nests. For the cardinality constrained case, we develop an effcient algorithm to compute the optimal assortment. When the capacity consumption of each product is arbitrary, we give an algorithm to obtain a 4-approximate solution.

2 - Dynamic Inventory Management with Limited Observations
Juan Chaneton, PhD Student, Columbia Business School, 3022 Broadway, New York, NY, 10027, United States of America, jchaneton15@gsb.columbia.edu, Omar Besbes, Ciamac Moallemi

We consider a dynamic inventory management problem in which the retailer has only partial access to the stochastic process that drives inventory evolution. In such settings, the retailer's decision should account not only for the current inventory state, but also for the way decisions (current and past) affect information acquisition. We assess the impact of this information limitation in a common retailing optimization problem.

3 - Connections between Least Squares Monte Carlo and Math Programming Based ADP

Selvaprabu Nadarajah, Assistant Professor, University of Illinois at Chicago, Liautaud Graduate School of Business, Chicago, IL, United States of America, selvan@uic.edu, Francois Margot, Nicola Secomandi

Least squares Monte Carlo (LSM) and math programming ADP methods are widespread in financial engineering and operations research. We connect recent LSM and math programming ADP methods using an approximate linear programming (ALP) relaxation approach based on restricting the ALP dual. This work provides a new perspective on LSM and additional insights into existing ALP relaxations. We also present methodological extensions motivated by this analysis.

4 - Centralized and Decentralized Dynamic Price and Lead Time Quotation

Baykal Hafizoglu, ASU, Tempe, AZ, United States of America Arizona State University, baykal@asu.edu, Pinar Keskinocak, Esma Gel

We discuss the dynamic price and lead time quotation problem in a make-to-order system under two decision making settings: (1) centralized setting considers a central agent determining price and lead times, and (2) decentralized setting assumes that price and lead time decisions are taken respectively by marketing and manufacturing departments. We explore the optimal policy structure under both settings and discuss the inefficiencies of decentralized decision making.

■ TA11

Hilton- Continental 8

Topics in Supply Chain Management

Sponsor: Manufacturing & Service Operations Management/Supply Chain

Sponsored Session

Chair: Houyuan Jiang, University of Cambridge, Judge Business School, Trumpington Street, Cambridge, United Kingdom, h.jiang@jbs.cam.ac.uk

1 - Optimal Sourcing Decision and Information Sharing Under Multi-tier Disruption Risk in a Supply Chain

Jiho Yoon, Doctoral Candidate, Michigan State University, N468 North Business Complex, Michigan State University, East Lansing, MI, 48824-1121, United States of America, yoon@bus.msu.edu, Claudia Rosales, Srinivas Talluri

We consider a three-tier supply chain consisting of a manufacturer and two suppliers. Both suppliers may experience disruptions; the effect of disruption risk on manufacturer's sourcing decisions is analyzed. We study the effect of information sharing in the supply chain and identify conditions under which the first-tier supplier is willing to share second-tier supplier information.

2 - New Risk Concepts for Supply Chain Design Models

Stefan Nickel, KIT, Kaiserstrasse 12, Karlsruhe, Ba, 76131, Germany, stefan.nickel@kit.edu, Francisco Saldanha da Gama, Iris Heckmann

Risk concepts have been applied in a broad variety of research fields and methodologies. Most of these approaches, however, consider risk as a static concept and do not address the dynamic nature and potential aggravation of risk. We introduce new risk concepts that consider risk as a dynamic concept, whose impact may aggravate over time and propagate through the network. We present mathematical programming models of these risk concepts for different supply chain design models.

3 - To Supply or Not to Supply to a Competing Buyer

Zhibin (Ben) Yang, Assistant Professor, University of Oregon, Eugene, OR, 97403, United States of America, zyang@uoregon.edu, Haresh Gurnani, Xinxin Hu

We study the supplier's allocation of limited production capacity to a buyer that sells to the same market, using a three-stage model. We characterize the buyer and the supplier's market competition equilibrium in which the buyer may strategically withhold excessive supply, and analyze the supplier's capacity allocation and pricing decisions.

4 - Supply Chain Contracting with Limited Demand Information

Houyuan Jiang, Dr, University of Cambridge, Judge Business School, Trumpington Street, Cambridge, United Kingdom, h.jiang@jbs.cam.ac.uk, Serguei Netessine

The well-known wholesale price and buy-back contracts in supply chains are investigated when only limited demand information is available to the retailer and the supplier. We show that these contracts, in particular the buy-back contract, cannot coordinate the supply chain in general. We study supply chain coordination conditions. We characterize efficiency of these contracts.

■ TA12

Hilton- Continental 9

Doctoral Work in Sustainable Operations Management

Sponsor: Manufacturing & Service Operations Management/Sustainable Operations

Sponsored Session

Chair: David Drake, Assistant Professor, Harvard Business School, Boston, MA. United States of America, ddrake@hbs.edu

1 - Service-level Elasticity of Demand for Mobile Money Cash Transactions

Karthik Balasubramanian, Doctoral Student, Harvard Business School, Boston, MA, United States of America kbalasubramanian@hbs.edu, David Drake

"Mobile money" can transform the lives of 2 billion people that live on less than $2 a day. However, the mobile money agents (who exchange cash for electronic value and vice versa) that are crucial to the development of mobile money ecosystems face severe inventory problems. We study the service-level elasticity of demand for cash transactions: how does service level affect demand for an agent's services?

2 - Extended Producer Responsibility (EPR), Secondary Markets & Export Restrictions

Isil Alev, Doctoral Student, Georgia Tech School of Industrial and Systems Engineering, Atlanta, GA, United States of America isilalev@gatech.edu, Vishal Agrawal, Atalay Atasu

EPR-based take-back legislation is the prevalent policy for several durable products such as electronics; however, existing analysis ignores the durable nature of the products and presence of secondary markets. In our work, we analyze the effectiveness of EPR in the presence of secondary markets and show that it may result in unintended adverse environmental outcomes. We then extend our work by analyzing the effect of export bans in practice and show that they exacerbate these adverse outcomes.

3 - The State of Scope 3 Carbon Emissions Reporting in Supply Chains

Christian Blanco, PhD Student, UCLA Anderson School of Management, Los Angeles, CA, United States of America christian.blanco.2016@anderson.ucla.edu, Felipe Caro, Charles Corbett

Protocol organizations previously focused on carbon reporting for emissions emitted from company owned equipment (scope 1) and energy purchases (scope 2), but are increasingly including indirect emissions from upstream suppliers (scope 3). We compare scope 3 emissions disclosed to CDP to a benchmark by Huang et al. (2009). We find firms are beginning to account for an increasing portion of their supply chain's carbon emissions, but opportunities still remain for expanding scope 3.

4 - The Impact of Ecolabeling on the Optimal 'Green' Product Line

Karthik Murali, University of Illinois, Urbana, IL, United States of America, kmurali4@illinois.edu, Michael Lim, Nicholas C. Petruzzi

We study the optimal product line problem through a model of vertical differentiation in the context of 'green' attributes which are characterized by unobservability to consumers and consumer confusion in evaluating the utility derived from these attributes. Ecolabels provided by trusted certifying agencies or firms themselves are used to exhibit 'green' attributes. We characterize ensuing implications of ecolabeling for the environment and derive policy implications for government intervention.

■ TA14

Imperial B

Panel Discussion: Journal Publication Tips

Sponsor: Junior Faculty Interest Group

Sponsored Session

Chair: Shengfan Zhang, Assistant professor, University of Arkansas, United States of America, shengfan@uark.edu

1 - Panel Discussion: Successful Journal Publication Tips

Moderator: Shengfan Zhang, Assistant professor, University of Arkansas, United States of America, shengfan@uark.edu, Panelists: Dan Adelman, Stephen Graves, Jason Merrick, David Woodruff, Michael Gorman

Panel discussion will include editors from Decision Analysis, MSOM, MS, and OR.

■ TA15

Hilton- Exec. Boardroom

DEA Methodology

Cluster: Data Envelopment Analysis

Invited Session

Chair: Ole Bent Olesen, Professor, University of Southern Denmark, Campusvej 55, 5230 Odense, Denmark, ole@sam.sdu.dk

1 - Cone Ratio and Assurance Regions in Slack Based DEA Models – A Challenge

Ole Bent Olesen, Professor, University of Southern Denmark, Campusvej 55, 5230 Odense, Denmarkole@sam.sdu.dk, Niels Christian Petersen

There exists a close link between input or output oriented radial cone ratio DEA and the corresponding DEA model with assurance regions. This link is less straight forward for the case of non-radial slack based measures. In this paper we analyze the relationship between assurance regions and cone ratio formulations of such additive models. Certain problems are identified and their relations to multi-objective programming are discussed.

2 - Pitfalls of the Multi-stage DEA Model with Additive Efficiency Decomposition

Chien-Ming Chen, Nanyang Business School, Nanyang Technological University, 50 Nanyang Ave., Singapore, 639798, Singapore, cmchen@ntu.edu.sg, Sheng Ang

This paper highlights several problems of the multi-stage DEA model with additive efficiency decomposition. We show that the decomposition weights are non-increasing in the sequence of stages and illustrate the problems with a case study.

3 - The Orientation of DEA Models with Dual-role Factors

Wen-Chih Chen, National Chiao Tung University, 1001 Ta Hsueh Rd., Hsinchu, Taiwan - ROC, wenchih@faculty.nctu.edu.tw

In contrast to conventional input/output factors, dual-role factors are those can be both inputs and outputs simultaneously. This study investigates issues on the orientation of DEA models with dual-role factors. We also propose efficiency measures for the cases with dual-role factors.

4 - Stochastic Programming Approach to DEA for Evaluation of Future Efficiency

Yuma Konishi, Osaka University, 2-1 Yamadaoka, Suita, Osaka, Japan, yuma.konishi@ist.osaka-u.ac.jp, Hiroshi Morita

DEA is developed without uncertainty. But there is so much uncertainty that cannot be ignored for future efficiency prediction. Stochastic programming framework of DEA enables us to determine how to take actions before getting observation results, in contrast to after getting one by the deterministic DEA. We show SPDEA approach for evaluating future efficiency to cope with the risk attitudes, and illustrate the difference of evaluation of future efficiency among some risk attitudes.

■ TA16

Hilton- Franciscan A

Dynamic Mechanism Design in Revenue Management

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Santiago Balseiro, Assistant Professor, Duke University, 100 Fuqua Drive, Durham, NC, 27705, United States of America, srb43@duke.edu

1 - Dynamic Allocation and Learning with Strategic Arrivals

Philipp Strack, Microsoft Research New England, One Memorial Drive, Cambridge, MA, 02142, United States of America, philipp.strack@gmail.com, Benny Moldovanu, Alex Gershkov

A designer allocates several indivisible object to a stream of randomly arriving agents. The long-lived agents are privately informed about their value for an object, and about their arrival time to the market. The designer learns about future arrivals from past arrivals, while agents strategically choose when to make themselves available for trade. We inquire whether the complete information, efficient policy is implementable and characterize revenue maximizing mechanisms.

2 - Dynamic Mechanism Design with Budget Constrained Buyers

Santiago Balseiro, Assistant Professor, Duke University, 100 Fuqua Drive, Durham, NC, 27705, United States of America, srb43@duke.edu, Gabriel Weintraub, Omar Besbes

In online advertising, ad slots are typically allocated using a second-price auction or some variation of it. We explore, using a dynamic mechanism design approach, whether other auction formats could improve the auctioneer's profit in the presence of budgets constraints.

3 - On the Durable Good Monopoly Problem

Gerardo Berbeglia, Assistant Professor, Melbourne Business School, 200 Leicester Street, Melbourne, 3053, Australia, g.berbeglia@mbs.edu, Peter Sloan, Adrian Vetta

A duropolist is a monopolist in the market of a durable good. We study the equilibria of the associated bargaining game with atomic consumers and finite horizon that satisfy the standard skimming property. We prove that duropoly profits are always at least as large as static monopoly profits, but never exceed double the static monopoly profits. Lastly, we show that the bounds are tight. The bounds hold regardless of the number of periods, number of consumers, and their specific values.

4 - Bandit Networks: Learning Without Experimentation

Ankur Mani, Massachusetts Institute of Tech, 20 Ames Street #385, Cambridge, MA, 02139, United States of America, amani@MIT.EDU, Ilan Lobel, Josh Reed

We consider a firm consisting of a network of retail stores. None of the retail store managers have an incentive to experiment individually to find the value of alternative policies. We show that under certain conditions, learning occurs in this network of stores regardless of the lack of experimentation.

■ TA17

Hilton- Franciscan B

Behavioral Perspectives

Sponsor: Manufacturing & Service Operations Management/Service Operations

Sponsored Session

Chair: Mirko Kremer, Professor, Penn State University, 460 Business Building, University Park, PA, United States of America, muk22@smeal.psu.edu

1 - Capacity Decisions under Information Asymmetry – Experimental Evidence

William Schmidt, Assistant Professor, Johnson Graduate School of Management, 314 Sage Hall, Ithaca, NY, 14853-6201, United States of America, wschmidt@cornell.edu, Ryan Buell

We examine capacity choices under information asymmetry and find that decision makers more often make choices consistent with Pareto optimization logic. This has material implications for both research and practice as it yields dramatically divergent predictions compared to more commonly modeled alternatives.

2 - Working Smarter Not Harder: Queue Discretion, Batching, and Performance in Outsourced Teleradiology

Maria Ibanez, Doctoral Student, Harvard Business School, Morgan Hall 428, Soldiers Field Road, Boston, MA, 02163, United States of America, mibanez@hbs.edu, Jonathan Clark, Robert Huckman, Bradley Staats

We examine how knowledge workers exert discretion on the order in which to execute tasks and the subsequent performance implications of those choices. Using two and a half years of data on more than 2.7 million cases read by outsourced radiologists working at one of the largest teleradiology firms in the US, we explore potential heuristics in ordering decisions, and how this endogenous ordering affects performance.

3 - Impact of Queueing System Design on Human Servers' Behavior

Masha Shunko, Purdue University, 403 W. State Street, West Lafayette, IN, 47906, United States of America, mshunko@purdue.edu, Julie Niederhoff, Yaroslav Rosokha

In queueing systems with human servers, service rate may depend on many factors. Based on series of lab and field experiments, we analyze the impact of queueing system layout and visibility of the queue length on service speed. We show that layout with parallel queues and good visibility of the queue length are important determinants of workers' speed.

4 - The Impact of Congestion on Diagnostic Accuracy

Mirko Kremer, Professor, Penn State University, 460 Business Building, University Park, PA, United States of America, muk22@smeal.psu.edu, Francis de Vericourt

We investigate decision-making and judgment in the context of diagnostic services systems that pose difficult trade-offs for the (human) server. For instance, in triage systems additional testing improves diagnostic accuracy for one patient, but increases congestion in the system (thus delaying service provision to other patients).

■ TA18

Hilton- Franciscan C

Revenue Management in Retail and Service I

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Andrew Vakhutinsky, Principal Scientist, Revionics, 52 Cannon Ball Rd., Sharon, MA, 02067, United States of America, Andrew.Vakhutinsky@revionics.com

Co-Chair: Natalia Viktorovna, Sr. Operations Research Specialist, SAS Institute, 100 SAS Campus Drive, Cary, NC, United States of America, Natalia.Viktorovna@sas.com

1 - A Simulation Study of BAR by Day Heuristics

Jason Chen, SAS Institute, SAS Campus Drive, Cary, NC, 27513, United States of America, Jason.Chen@sas.com

A BAR (Best Available Rates) by Day policy sets a rate for each occupancy day. The rate of a multi-day stay is equal to the sum of each occupancy day's rate. Its simple form makes this type of policy attractive to many hotels. However, the interaction of multi-day stays that share the same occupancy days makes the difficult network problem even harder to solve. We present the simulation study of several BAR by Day heuristics using real hotel data.

2 - The Re-layout Problem in Grocery Stores

Ilknur Uludag, Industrial and Systems Engineering, 3301 Shelby Center Auburn University, Auburn, AL, 36849-5346, United States of America, izt0002@auburn.edu, Alice E. Smith

In this study,the facility re-layout problem in grocery stores is studied. Although the process of the re-layout in a store is time consuming and costly, the re-layout problem has not been investigated in detail in the retail industry. A mathematical model for the solution of the problem is developed and tested using real world data and randomly generated scenarios. The best solutions by the mathematical model are presented. A greedy heuristic for the problem is proposed for large size problems.

3 - Demand Models for Substitutable Grocery Products

Setareh Borjian, MIT Operations Research Center, Cambridge, MA, United States of America, sborjian@mit.edu, Andrew Vakhutinsky

We describe the demand for a product assortment in a grocery retail category using choice modelling approach. We estimate the parameters of models based on the transactions history from a large national grocery chain, and compare the models using different sales periods. We show that among other factors, promotion has significant effect in demand variation and should therefore be considered as an input to the models to get a more accurate estimation of demand.

4 - An Attribute-based Retail Assortment Model

Jeff Moore, Revionics, 2998 Douglas Blvd, Suite 350, Roseville, CA, 95661, United States of America, jmoore@revionics.com, Bryan Ball, Andrew Vakhutinsky

We will present an analysis of several methods of "sight unseen" demand forecasting for retail goods using attribute-based models. We will describe the product attributes used, the method of holdout testing used to gauge prediction accuracy and to compare models, and the various modeling approaches employed (regression models, decision trees, and random-forests). We will describe how these methods performed across a set of test cases using retail demand history.

■ TA19

Hilton- Franciscan D

Dynamic Learning and Pricing

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Stefanus Jasin, Stephen M. Ross School of Business, University of Michigan, 701 Tappan St, Ann Arbor, MI United States of America, sjasin@umich.edu

1 - Model Selection in Pricing and Revenue Management

Arnoud V. den Boer, University of Twente, Drienerlolaan 5, Enschede, 7522 NB, Netherlands, a.v.denboer@utwente.nl

In optimization problems, simple mathematical models that discard important factors may sometimes be preferred over more realistic models. This can happen if the parameters of the simpler models are easier to estimate than the parameters of the complex model; there thus is a trade-off between modeling error and statistical error. We propose a data-driven method to decide when misspecified models give better results, and apply it to pricing and revenue management problems.

2 - Dynamic Pricing and Demand Learning with Limited Price Experimentation

He Wang, MIT, 77 Mass Ave, E40-130, Cambridge, MA, 02139, United States of America, wanghe@mit.edu, David Simchi-Levi, Alexander Weinstein

In a dynamic pricing problem where the demand function is unknown a priori, price experimentation can be used for demand learning, but in practice sellers are faced with business constraints that prevent them from conducting extensive experimentation. We consider a dynamic pricing model where the seller can only change price for a limited number of times during the sales window, and show that simple policies can achieve asymptotically optimal regret bounds.

3 - Application of Self-Adjusting Controls for Dynamic Pricing with Unknown Demand

George Chen, Stephen M. Ross School of Business, University of Michigan, 701 Tappan Ave, Ann Arbor, MI, 48109, United States of America, georgeqc@umich.edu, Stefanus Jasin, Izak Duenyas

We study the network-RM pricing problem with unknown demand functions in both parametric and nonparametric cases. Using the self-adjusting heuristic, we get the best attainable revenue loss rate in the parametric setting. Moreover, a much sharper performance can be achieved if parametric demand function family is well-separated. We also show that self-adjusting heuristic almost attains the best achievable revenue loss rate for the nonparametric setting if demand is sufficiently smooth.

4 - Near-optimal Bisection Search for Nonparametric Dynamic Pricing with Inventory Constraints and Unknown

Murray (Yanzhe) Lei, PhD, University of Michigan, 701 Tappan Street, R3410, Ann Arbor, MI, 48109, United States of America, leiyz@umich.edu, Stefanus Jasin, Amitabh Sinha

We consider a general class of revenue management problems with inventory constraints, where the price-dependent demand function is unknown. We develop nonparametric dynamic pricing algorithms and provide upper bounds on the revenue losses comparing to a clairvoyant in asymptotic regime: for single-product problems, our algorithm matches the theoretic lower bound; for multiple-product problems, our algorithm outperform existing literature, especially when there are a lot of different products.

■ TA20

Hilton- Yosemite A

Facility Logistics I

Sponsor: TSL/Facility Logistics

Sponsored Session

Chair: Sadan Kulturel-Konak, Pennsylvania State University-Berks, Tulpehocken Rd. PO Box 7009, Reading, PA, United States of America, sadan@psu.edu

1 - Role of Product Exposure in Retail Design

Corinne Mowrey, PhD Candidate, Wright State University, 207 Russ Center, 3640 Col Glenn Hwy, Dayton, OH, 45435, United States of America, mowrey.4@wright.edu, Pratik Parikh

A key aspect of retail facility design, often alluded to but rarely analyzed, is product exposure to the shopper along their travel path. From a shopper's perspective, a greater amount of product exposure means less time spent searching for items of interest. From a manager's perspective, converting a shopper's time from searching to purchasing would likely result in increased sales. We discuss an approach to quantify product exposure for various retail layouts and share preliminary insights.

2 - Flow Balancing with Uncertain Demand for Automated Package Sorting Centers

Luis Novoa, PhD Candidate, George Washington University, Department of Decision Sciences, School of Business, Washington, DC, 20052, United States of America, ljnovoa@gwmail.gwu.edu, David Morton, Ahmad Jarrah

At package carriers' hubs, primary sorters direct incoming packages to secondary sorters for further segregation to the outbound destinations level. We study the problem of assigning package destinations to secondary sorters to balance the hub's workload while considering the uncertainty in package volumes and adhering to loading capacities. Hybrid stochastic/robust formulations, solution algorithms and computational performance are discussed. Benefits from proposed models are quantified.

3 - Dynamic Facility Layout Problem using a Hybrid Approach

Sadan Kulturel-Konak, Pennsylvania State University-Berks, Tulpehocken Rd. PO Box 7009, Reading, PA, United States of America, sadan@psu.edu

This study presents a hybrid approach to solve the Dynamic Facility Layout Problem (DFLP) on the continuous plane with unequal area departments. In our hybrid approach, once the Genetic Algorithms (GA) sets up relative department positions, actual department locations and shapes are determined by solving a Linear Programming (LP) problem. Results for the problems studied in the literature earlier and for newly defined problems will be presented.

4 - SINGA Port – The Next Generation Container Port Concept
Loo Hay Lee, Associate Professor, National University of Singapore, 10 Kent Ridge Crescent, Singapore, Singapore, iseleelh@nus.edu.sg, Dah-Chuan Gong, Brett Peters, Matthew Petering, Ek Peng Chew

We will discuss a project to design a "Sustainable Integrated Next Generation Advanced Port," which can handle 20 million TEUs per annum. A novel container terminal is proposed with features of a double-story structure, indented storage yard, overhead bridge crane, and automated lifting vehicle. We will argue how we overcome the challenges that we have faced. We will also illustrate what analyses have been done to make the final design and explore the research issues behind the project.

■ TA21

Hilton- Union Sq 1

Innovative Solutions for Congestion Mitigation I

Sponsor: Transportation Science & Logistics

Sponsored Session

Chair: Siriphong (Toi) Lawphongpanich, University of Florida, Industrial and Systems Engineering, Gainesville, FL, 32611, United States of America, Lawphong@ise.ufl.edu

Co-Chair: Yafeng Yin, University of Florida, Gainesville, FL, United States of America, yafeng@ce.ufl.edu

1 - Congestion Pricing for Improving Network Service: A Simulation-Based Optimization Approach
Lei Zhang, Associate Professor, University of Maryland, 1173 Glenn Martin Hall, College Park, MD, 20742, United States of America, lei@umd.edu, Xiqun (Michael) Chen

An innovative surrogate optimization is proposed for congestion pricing with computationally expensive objective functions assessed by simulation-based dynamic traffic assignment. Response surfaces are exploited by DIRECT a modification to Lipschitzian optimization. The framework is applied to optimize mileage based tolls of a freeway sub-network. We investigate invariant macroscopic fundamental diagrams validated by fixed and probe traffic flow data. Various optimal toll scenarios are compared.

2 - Profit Maximization of a Private Toll Road with Cars and Trucks
Xiaolei Guo, Assistant Professor, University of Windsor, 401 Sunset Ave., Odette School of Business, Windsor, ON, N9B 3P4, Canada, guoxl@uwindsor.ca

Profit maximization of a private toll road is not only important to the road operator itself, but also important to the government, because understanding the profit-oriented behaviors is the first step to setting proper regulations. This paper looks into the profit maximization problem of a private toll road competing against a free alternative in presence of cars and trucks, where trucks differ from cars in value of time, congestion externality, and pavement damage.

3 - On the Design of Multi-Period Tradable Credit Schemes for Travel Mobility
Mohammad Miralinaghi, Purdue University, 550 Stadium Mall Drive, West Lafayette, IN, 47906, United States of America, smiralin@purdue.edu, Srinivas Peeta

Credit-based congestion pricing is a strategy to mitigate congestion by creating artificial markets for mobility credits. This study develops a multi-period equilibrium modeling framework to capture the evolution of credit price when credit demand and supply vary with time. To enable the central authority to manage the credit supply, transfer fee and reservation credit price are applied to stored credits for consumption in future periods.

4 - Dual-Toll Pricing Problem for Regulating Hazmat Transportation under Nonlinear Delay
Changhyun Kwon, University at Buffalo (SUNY), 318 Bell Hall, Buffalo, NY, 14221, United States of America, chkwon@buffalo.edu, Tolou Esfandeh, Rajan Batta

We investigate a dual-toll setting policy to mitigate the risk of hazmat shipment in transportation networks. We formulate the problem as a bi-level program wherein the first level aims at minimizing the risk via dual toll, and the second level explores the user equilibrium flow pattern of the regular vehicles and hazmat carries. We suggest an inverse optimization procedure and approximate methods based on piecewise linearization.

■ TA22

Hilton- Union Sq 2

Selective and Time Dependent Routing Problems

Sponsor: Transportation Science & Logistics

Sponsored Session

Chair: Mehmet Basdere, Northwestern University, The Technological Institute, 2145 Sheridan Road Room C210, Evanston, IL, 60208, United States of America, mehmetbasdere2016@u.northwestern.edu

1 - The Traveling Salesman Problem with Time-dependent Service Times
Duygu Tas, Postdoctoral Fellow, CIRRELT and Canada Research Chair in Distribution Management, HEC Montreal, Bureau 3520, Pavillon Andre-Aisenstadt, Campus de l'Université de Montreal, Montreal, QC, H3C 3J7, Canada, duygu.tas@cirrelt.ca, Gilbert Laporte, Ola Jabali, Michel Gendreau

The Traveling Salesman Problem (TSP) with time-dependent service times is a generalization of the classical TSP where the duration required to serve any customer is defined as a function of the moment to begin service at that location. This talk will describe the analytical insights derived from the properties of service time and fundamental routing assumptions (e.g., first-in-first-out), and present experimental results obtained by using different service time functions.

2 - Race Course Configuration Problem
Mehmet Basdere, Northwestern University, The Technological Institute, 2145 Sheridan Road Room C210, Evanston, IL, 60208, United States of America, mehmetbasdere2016@u.northwestern.edu, Karen Smilowitz, Sanjay Mehrotra

In this talk, we present a new type of tour finding problem in the marathon course design setting. The aim is to find a valid marathon course that minimizes the average distance to the medical facilities within the region of interest without preventing the public access to those facilities while visiting a predetermined subset of landmark streets. The underlying problem becomes a variant of selective travelling salesman problem.

3 - Solution Methods for the Rural Postman Problem with Time Windows
Ingrid Marcela Monroy Licht, PhD Student, École Polytechnique de Montréal, 2500, Chemin de Polytechnique, Montreal, Canada, ingrid-marcela.monroy-licht@polymtl.ca, Ciro Alberto Amaya, André Langevin

The rural postman problem consists in finding an optimal tour visiting a subset of required arcs. We present a MIP formulation for the case with time windows and we solve the problem using a cutting plane algorithm. A competitive Adaptive Large Neighborhood Search metaheuristic is proposed for solving larger instances. Computational experiments are done on a large set of instances with up to 104 required edges.

■ TA23

Hilton- Union Sq 3

Network Design and Repositioning for Bike-sharing Systems

Sponsor: TSL/Freight Transportation & Logistics

Sponsored Session

Chair: Sin C. Ho, Aarhus University, 8210 Aarhus, Denmark, sinch@asb.dk

Co-Chair: W. Y. Szeto, The University of Hong Kong, Shatin, N.T., Hong Kong- PRC, ceszeto@hku.hk

1 - Bicycle Network Design with Genetic Algorithm
C. S. Shui, The University of Hong Kong, Hong Kong, China, samshui@hku.hk, W. Y. Szeto

This study introduces a bicycle network design problem that maximizes coverage and demand satisfaction simultaneously within a limited budget. Genetic Algorithm is adopted with two repairing operators introduced to improve the solution search. A case study in Tuen Mun, Hong Kong shows that the GA can solve single and bi-objective design scenarios with various budget levels. The tradeoff between two objectives is also investigated through varying the weighting factor.

2 - An Artificial Bee Colony Algorithm for the Public Bike Repositioning Problem

W. Y. Szeto, Shatin, N.T., Hong Kong- PRC
The University of Hong Kong, ceszeto@hku.hk, C. S. Shui

This paper introduces an artificial bee colony algorithm to solve the shared bikes repositioning problem. A modified version is proposed to improve the solution quality of the original version. Two objectives, minimizing total duration and minimizing maximum duration, are examined to show their relationships with the number of operating vehicles.. The trade-off between the service duration and the tolerance of demand dissatisfaction is also illustrated.

3 - Iterated Tabu Search for the Bike Repositioning Problem

Sin C. Ho, Aarhus University, 8210 Aarhus, Denmark, sinch@asb.dk, W. Y. Szeto

We study the static bike repositioning problem where the problem consists of selecting a subset of stations to visit, sequencing them, and determining their pick-up/drop-off quantities under various operational constraints. The objective is to minimize the total penalties incurred at all the stations. We present an iterated tabu search heuristic to solve the described problem. Experimental results show that this heuristic can generate high quality solutions using small computing times.

■ TA24

Hilton- Union Sq 4

Emerging Vehicle and Sensor Technologies

Sponsor: TSL/Intelligent Transportation Systems (ITS)

Sponsored Session

Chair: Stephen Boyles, Assistant Professor, University of Texas at Austin, 301 E Dean Keeton St Stop C1761, Austin, TX, 78712, United States of America, sboyles@mail.utexas.edu

1 - Autonomous Vehicle Intersection Modeling in Dynamic Traffic Assignment

Michael Levin, The University of Texas at Austin, ECJ 6.2, Austin, TX, 78712, United States of America, michaellevin@utexas.edu, Stephen Boyles

Autonomous vehicle intersection policies offer opportunities for capacity increase, which to date have been studied in custom micro-simulations. We propose an algorithm for modeling such policies in dynamic traffic assignment that simplifies tile-based reservation models to ensuring separation at a reduced number of conflict points. The model is compared with published micro-simulation results and used to analyze intersection-auction congestion-pricing under user equilibrium behavior.

2 - Network Contraction Methods for Dynamic Pricing at Charging Stations

Ehsan Jafari, PhD Candidate, The University of Texas at Austin, Austin, TX, United States of America, ejafari@utexas.edu, Stephen Boyles

Dynamic pricing strategies can potentially mitigate load issues on the power grid due to electric vehicle charging. This talk presents network contraction-based methodologies for rapid assessment of pricing strategies.

3 - A Game-theoretical Framework for Traffic Signal Control Systems with Connected Vehicles

Lin Xiao, University of Minnesota, Minneapolis, MN, United States of America, lxiao@umn.edu, Henry X. Liu

In this paper, a game-theoretical framework for traffic signal control with connected vehicles is proposed. The game is designed in the way that connected vehicles and signal controller will determine the signal timing plan via negotiating. This framework utilizes the connected vehicles' two-way communication capability, which didn't attract much attention in previous studies. Numerical study shows that the proposed framework outperforms traditional traffic signal control method with connected vehicles.

4 - Online Auction Designs for Traffic Intersection Operations

R. Jayakrishnan, University of California, Irvine, CA, United States of America, rjayakri@uci.edu, Roger Lloret-Batlle

The purpose of this paper is to analyze the general case of online auctions in the traffic intersection problem. Insights are developed based on a general framework and mechanisms for efficiently utilizing available time budgets, with signal formulations that are not necessarily constrained to traditional cycle designs.

■ TA25

Hilton- Union Sq 5

Public Transportation

Contributed Session

Chair: Ramesh Bollapragada, Professor, San Francisco State University, 1600 Holloway Avenue, San Francisco, CA, 94132, United States of America, rameshb@sfsu.edu

1 - Identifying Communication Needs for Disabled and Elderly during Transportation

Lavanya Marella, Graduate Research Student, University of Tennessee, 511 John D. Tickle Building, 851 Neyland Drive, Knoxville, TN, 37996, United States of America, lmarella@vols.utk.edu, Yuting Li, Eric Arendt, Rapinder Sawhney, Dhanush Agara Mallesh

One of the top barriers preventing the disabled from using public transportation was their ability to ask bus drivers basic questions concerning destination, safety and general comments. The research objective of identifying these communication needs is executed by partnering with three major transit agencies covering five counties in Tennessee and surveying the participants (passengers and drivers). Survey results are data-mined to identify future technological solutions.

2 - Reducing Traffic Congestion on all San Francisco Bay Area Highways

Ramesh Bollapragada, Professor, San Francisco State University, 1600 Holloway Avenue, San Francisco, CA, 94132, United States of America, rameshb@sfsu.edu, Uyen Tran

In this paper, we study the traffic trends of Interstate 80 and US 101 across the nine counties of the San Francisco Bay Area over the time period between 1992 and 2013, discovering the bottlenecks, and presenting several managerial insights, through sensitivity analysis, on how to allocate limited resources that provide the infrastructure to support the locations with the highest potential for traffic growth and, therefore, relieve congestion and reduce traffic time on the studied locations.

3 - Critical Systems Management Issues of Implementing the Positive Train Control Technology in a Region

Yalda Khashe, PhD Candidate, University of Southern California, 3715 McClintock Ave, GER 240, Los Angeles, CA, 90089, United States of America, khashe@usc.edu

Positive Train Control (PTC) is a generic term referring to a range of fully integrated technologies that overlay existing safety systems to prevent train-to-train collision and improve worker safety. One of the challenges that railroad industry is facing for implementing PTC is the complications of introducing this new technology to an already existing system and its effect on the Technological, organizational and human subsystems and their interactions.

■ TA26

Hilton- Union Sq 6

Facility Location

Contributed Session

Chair: Victor Blanco, Universidad de Granada, Fac. Ciencias Economicas y Empresariales, Granada, Spain, vblanco@ugr.es

1 - On the Continuous Fermat-Weber Problem for a Convex Polygon Using Euclidean Distance

Thomas Zhang, Wayzata High School, 4955 Peony Lane, Plymouth, MN, 55446, United States of America, thomaszh3@gmail.com, John Carlsson

We consider the continuous Fermat-Weber problem, where the customers are continuously distributed on a convex polygon. We derive a closed-form expression for finding the average distance from a given point to continuously distributed customers along the boundary, minimize the expression using a Weiszfeld-type procedure, and derive a closed-form formula to find the average distance for a given point to the entire convex polygon, assuming uniform distribution.

2 - A SOCP Formulation for Continuous Location Problems under Refraction

Victor Blanco, Universidad de Granada, Fac. Ciencias Economicas y Empresariales, Granada, Spain, vblanco@ugr.es, Diego Ponce, Justo Puerto

Refraction phenomenon describes the process that occurs when the light changes of medium and the phase velocity is changed but its frequency remains constant. This phenomenon is applicable to model different region-dependent transport systems where each region is allowed to be traversed with a given speed. We extend the Snell's law to any dimension and any lp norms and address the problem of locating a new facility under this effect. Computational experiments run in Gurobi are reported.

3 - Robust Facility Location Optimization with Location-dependent Demands
Juan Carlos Espinoza Garcia, ESSEC Business School, Avenue Bernard Hirsch, CS 50105, Cergy, 95021, France, juancarlos.espinoza@essec.edu, Laurent Alfandari

We present a robust optimization approach to location problems where the allocation of demand is dependent on the final choice of locations. We consider allocation rules from a global perspective (Master planning) and from a demand/supply dependent point of view. We develop the model in the context of differentiated goods, utilizing a hedonic price model for the estimation of demand allocation. Finally, we present an application to New Housing Developments planning.

4 - Integrating Uncertain Data in Disaster Relief Facility Location
Bin Li, University of Arkansas, Bell Engineering Building 4110, Fayetteville, AR, 72703, United States of America, binli@email.uark.edu, Ashlea Milburn

A multi-objective formulation of the minimax regret for the facility location problem that allows decision makers to open an efficient number of facilities when there is demand uncertainty. The problem is motivated by the recent need of integrating social data from multiple sources in order to make optimal decisions. CPLEX is used for solving three different optimization problems based on three different facility location strategies.

■ TA27

Hilton- Union Sq 7

Demand-Responsive Rail Service Design

Sponsor: Railway Applications

Sponsored Session

Chair: Kuilin Zhang, Assistant Professor, Michigan Technological University, 1400 Townsend Drive, 870 Dow Environmental Sciences, Houghton, MI, 49931, United States of America, klzhang@mtu.edu

Co-Chair: Dengfeng Yang, Sr. R&D Engineer, Infor US Inc., 8777 N. Stemmons Freeway, Dallas, TX, United States of America, dengfeng.yang@infor.com

1 - Demand-oriented Trains Timetables for a Single Railway Line
Eva Barrena, HEC and Interuniversity Research Center, CIRRELT, 3000 Chemin de la Côte-Sainte-Catherine, Montréal, Canada, eva.barrena@cirrelt.ca, Leandro C. Coelho, Gilbert Laporte, David Canca

We study the design and optimization of train timetables for a rail rapid transit line adapted to a dynamic demand environment. The objective is to minimize the average passenger waiting time at the stations. We first propose two mathematical programming formulations. We then analyze the properties of the problem before introducing a metaheuristic in order to solve large instances of the problem within short computation times.

2 - Comprehensive Operational Dynamic Real-time Train Re-routing for a Freight Train Network
Alborz Parcham-Kashani, Georgia Institute of Technology, 755 Ferst Drive NW, Atlanta, GA, 30332, United States of America, akashani@gatech.edu, Alan Erera

We present a comprehensive model for the operational problem of dynamically re-routing freight trains in real-time in the event of a network disruption. The model considers the direct and indirect impact of re-routing decisions on the arrival time of rail cars at their final destinations. Compared to past solutions implemented by our sponsor, our model takes into account the potential benefit of avoiding re-routing options that create unnecessary congestion at terminals.

3 - Capacity Evaluation along Baltimore-DC Based on Directional vs. Bidirectional Scenarios of Operation
Hamed Pouryousef, Michigan Tech. University, 824 Dow, CEE Dept. Michigan Tech. Uni, 1400 Townsend Dr, Houghton, MI, 49931, United States of America, hpouryou@mtu.edu, Pasi Lautala

This research takes advantage of the strengths of multiple simulation packages developed in the U.S. and Europe, namely Rail Traffic Controller (RTC), OpenTrack and RailSys, on Baltimore-DC corridor. The main objective was to use their features and capabilities to compare a directional operation approach with current bidirectional approach and estimate the potential speed improvements and eventually better capacity utilization obtained along the segment with directional approach.

4 - Quadratic Programming Model for Optimizing Demand-responsive Transit Timetables
Huimin Niu, Professor and Dean, School of Traffic and Transportation,, Lanzhou Jiaotong University, Lanzhou, China, hmniu@mail.lzjtu.cn, Xuesong Zhou

This talk focuses on optimizing real-time passenger train timetables under time-dependent, geographically distributed demand matrices. A quadratic programming model with linear constraints is developed to dynamically adjust train departure and dwell times at each station to accommodate existing and predicted passenger demands in the near future. We present a few numerical examples to demonstrate the effectiveness of the proposed model.

■ TA28

Hilton- Union Sq 8

Air Transport Data Analysis for Safe and Efficient Operations

Sponsor: Aviation Applications

Sponsored Session

Chair: Eric Feron, Georgia Institute of Technology, 270 Ferst Drive, School of Aerospace, Atlanta, GA, 30332-0150, United States of America, feron@gatech.edu

1 - A Decision Theoretic Approach to Aircraft Collision Avoidance
Mykel Kochenderfer, Assistant Professor, Stanford University, 496 Lomita Mall, Durand Building, Room 250, Stanford, CA, 94305, United States of America, mykel@stanford.edu

The Traffic Alert and Collision Avoidance System (TCAS) is currently mandated worldwide on all large transport aircraft to reduce the risk of collision. TCAS uses deterministic models and heuristic rules, which limit the robustness of the system. This talk presents a decision theoretic approach for designing collision avoidance systems. This approach has been used to produce an optimized system that is poised to become the next international standard for collision avoidance.

2 - Using Analytics to Predict and Reduce Delays in Airport Terminals
John-Paul Clarke, Associate Professor, Georgia Institute of Technology, 270 Ferst Drive, Atlanta, GA, 30332, United States of America, johnpaul@gatech.edu, Harold Nikoue

In this talk, we present a decision support tool that predicts excessive passenger wait times inside the airport based on flight information, smart-phone-derived passenger movement data, and planned staffing levels. As part of this work, we developed a stochastic simulation to model the demand at the airport, and determine how changes in staffing levels can mitigate congestion.

3 - Data-Driven Methods for Detection of Anomalous Trajectories
Nikunj Oza, NASA, nikunj.c.oza@nasa.gov

Currently, problems in the National Airspace are found using exceedances, which are pre-defined, known anomalies. They cannot identify unknown anomalies. Data-driven methods for anomaly detection and identify data points that do not fit statistically with most of the data. These methods have been used to identify previously unknown but safety-relevant anomalies. This talk will describe our recent work on data-driven anomaly detection on radar track data over LAX, DEN, and the New York metroplex.

4 - A Comprehensive Flight Risk Model
Suresh Rangan, Technical Fellow, FedEx, 3131 Democrat Rd, Memphis, TN, 38118, United States of America, Suresh.Rangan@fedex.com, Mingzhou Jin, Ying Zhang

Various risks are involved in flight operations, including crew proficiency, equipment, environment, performance, and external pressures. Based on investigation on the practice and interactions with pilots, a comprehensive risk model is proposed to incorporate the logic relationship between dozens of factors and overall risk. Factor weights are verified with historical data. The model is used to minimize the overall risk and enhance flight safety in the most effective way through optimization.

■ TA29

Hilton- Union Sq 9

Project Management 1

Contributed Session

Chair: Laleh Ghalami, Wayne State University, 4500 Cass Ave., #427, Detroit, MI, 48201, United States of America, laleh.ghalami@wayne.edu

1 - Project and Portfolio Management: Combination of Data Envelopment Analysis and Structural Equation

Roseane Silveira, UFRN, Av Salgado Filho, 3000, Campus Universiterio, Lagoa Nova, Natal, 59072970, Brazil, roseane_rodrigues1@hotmail.com, Mariana Almeida, Jesus Aramayo

In this study, we present a model of combined use of data envelopment analysis and structural equations to construct an evaluation model of project management and portfolio selection applicable to brazilian petroleum industry. This model is possible to evaluate the influences from: project teams; quality and scope, and planning and control for successful management and establish benchmarks in project portfolio. The results can help to make decision for future improvement.

2 - Influence of Contractual Incentive and Trust on Contractor's Cooperative Behavior

Yongcheng Fu, Tianjin University, 92 Weijin Road, Nankai District, Tianjin, 300072, China, fuyongcheng@tju.edu.cn, Lihan Zhang, Yongqiang Chen

This paper distinguished two kinds of contractor's cooperative behavior, task-based behavior and relationship-based behavior, and studied the following research questions: 1) how the combination of contractual incentive and trust influence contractor's cooperative behavior; 2) how to determine the optimal incentive coefficient; 3) what are the boundary conditions for the complementation of contractual incentive and trust.

3 - Knowledge Sharing in the Inter-organizational Teams: The Influence Mechanisms of Relationships and Task Conflicts

Zhi Chen, University of Science and Technology of China, School of Management, Hefei, 230026, China, zhichen@mail.ustc.edu.cn

Knowledge sharing within inter-organizational teams is critical to team creativity. We proposed a model relating team conflict to knowledge sharing, and knowledge sharing to team creativity. The moderating effect of shared leadership on the relationship between team conflict and knowledge sharing were examined.

4 - Constrained Project Allocation Problem

Abdulaziz Alkabaa, PhD Student, University of Tennessee, 851 Neyland Drive, Knoxville, TN, 37996, United States of America, aalkabaa@utk.edu, Alberto Garcia-Diaz

A combined project selection-for-investment and allocation-for-development model is formulated for a transportation agency to maximize the value of benefits derived by users of a highway system subject to budget constraints, using Mahalanobis distances. Projects are developed by in-house engineers or private contractors. An overview of the solution procedure is given.

5 - Refining Engagement: A Team Process Model

Amy Sommer, Assistant Professor, HEC Paris, 1 Rue de la Liberation, Jouy-en-Josas, 78351, France, Sommera@hec.fr, Lisa Stickney, Deanna Kennedy

Team engagement is herein considered through task and relational engagement dimensions. We discuss the link of antecedents to task and relational engagement, team processes, and outcomes. This framework can enhance the way engagement is used for team selection, training, outcomes, and employee retention.

■ TA30

Hilton- Union Sq 10

Vacation and Online Scheduling

Cluster: Scheduling and Project Management

Invited Session

Chair: Marc Posner, Professor, Ohio State University, Integrated Systems Engineering, 1971 Neil Avenue, Columbus, OH, 43210, United States of America, posner.1@osu.edu

1 - Makespan Minimization Subject to Machine Unavailability and Total Completion Time Constraintsi

Yumei Huo, Associate Professor, CUNY at Staten Island, Staten Island, NY, United States of America, yumei.huo@csi.cuny.edu

In this research, we study the preemptive bi-criteria scheduling problems on m parallel machines with machine unavailable intervals. The goal is to minimize the makespan subject to the constraint that the total completion time is minimized. We study the model where each machine can have multiple unavailable intervals, but at any time, there is at most one machine unavailable. We show that there is an optimal polynomial time algorithm for this model.

2 - Minimizing Total Completion Time in Flowshop with an Unavailable Interval on the First Machine

Hairong Zhao, Associate Professor, Purdue University at Calumet, Hammond, IN, 46323, United States of America, hairong@purduecal.edu

We study the problem of minimizing total completion time in 2-stage flowshop with an unavailable interval on the first machine. The problem is NP-hard in the strong sense even if both machines are always available. With availability constraint, many papers have studied the makespan minimization problem, but no research is done on total completion time minimization. Our paper is the first attempt to investigate the problem and our goal is to develop an efficient branch-and-bound algorithm.

3 - Online Production Planning and Information Purchase to Maximize Market Share

Marc Posner, Professor, Ohio State University, Integrated Systems Engineering, 1971 Neil Avenue, Columbus, OH, 43210, United States of America, posner.1@osu.edu, Chris Potts, Nicholas G. Hall

We consider a production planning problem with complete information about current orders. Additional orders become available at a known time. Prior to this time, costly information about these orders may become available. We maximize the proportion of orders completed by their due dates, minus information cost, if purchased. We describe an asymptotically best possible algorithm that maximizes the value of information. Further, we study the sensitivity of performance to decisions.

■ TA31

Hilton- Union Sq 11

Analytics in Cloud

Sponsor: Service Science

Sponsored Session

Chair: Rahul Ghosh, IBM, 3039 Cornwallis Road, Durham, NC, 27709, United States of America, rghosh@us.ibm.com

1 - Statistics @ Scale

Chiranjit Mukherjee, Statistician, Google, 1600 Amphitheatre Pkwy, Mountain View, CA, 94043, United States of America, chiranjitmukherjee@gmail.com

This presentation focuses on available statistical tools and techniques available on/for popular cloud computing environments.

2 - On Outlier Detection and Workload Forecasting for Contact Centers

Rahul Ghosh, IBM, 3039 Cornwallis Road, Durham, NC, 27709, United States of America, rghosh@us.ibm.com, Gyana Parija, Sudhanshu Singh, Santosh Srivastava

Long term forecasting for contact centers with high accuracy is an issue of great importance since it triggers capacity planning, scheduling, hiring and training activities for the contact center. Forecasting for businesses with outliers is more difficult because outliers add an extra layer of randomness to the historical data. We propose a method for forecasting that identifies various kinds of outliers and allows users to assess their impact for analysis and forecasting.

3 - Resource Allocation in Cloud Storage

Ioannis Papapanagiotou, Assistant Professor, Purdue University, 401 N Grant Street, West Lafayette, IN, 47907, United States of America, ipapapan@purdue.edu, Zhihao Yao

Cloud storage solutions have gained immense popularity as a paradigm for the dynamic provisioning of storage services deployed on Backend systems. In this work, we present our vision and discuss the research challenges in the volume request allocation in Cloud storage systems with multiple backend systems. We will present efficient policies that can provide efficient and fast allocation of the volume requests, and can also provide a guaranteed Quality of Service.

4 - Gaining Deeper Insights from Text: Unsupervised Learning Methods Perform Better

Abhinav Shashank, Co-Founder & CEO, InnovAccer, D-66 First Floor, Sector 63, Noida, UP, 201301, India, abhinav@innovaccer.com, Kanav Hasija

Machine Learning techniques with training corpus are useful in extracting entities, objects, emotions, personalities, and other characteristics from text, although are highly context-biased. We, in this paper, present techniques to perform such exercises which are context independent. Good data corpus and re-iteratively tested algorithms are building blocks for these techniques.

■ TA32

Hilton- Union Sq 12

Team Performance

Cluster: Workforce Management and Engineering

Invited Session

Chair: Gretchen A. Macht, Pennsylvania State Unviersity, State College, PA, United States of America, gretchen.macht@gmail.com

1 - Interpersonal Skills, Communication, and Team Performance

Gretchen A. Macht, Pennsylvania State University, State College, PA, United States of America, gretchen.macht@gmail.com, David A. Nembhard, Robert M. Leicht

We consider the degree to which mixed Emotional Intelligence (EI) characteristics of interpersonal skills predict team performance. When specifically examining intellectual tasks the literature demonstrates that interpersonal skills, how individual understand others' emotions, were not significant with engineering project team's performance. This study utilized structural equation models to examine the direct and indirect effects of interpersonal skills on team performance. The current results contribute to the literature by adding further understanding of the mediating variable, such as communication, that exist within the emotional intelligence-performance team dynamic.

2 - The Effect of Task Complexity on Deadline Rush in Individual and Team Performance

Ji-Eun Kim, Pennsylvania State University, State College, PA United States of America, blessedpond@gmail.com

"Deadline rush" occurs when work rate increases as a deadline approaches. Using an Anti-Air Warfare Coordinator (AAWC) task, we show that task complexity is associated with higher deadline reactivity of for both individual and team work. The current result highlights the importance of task complexity in managing and forecasting human behaviors in the presence of deadlines.

3 - Some Effects of Deadline Proximity on Work Performance

David A. Nembhard, Pennsylvania State University, State College, PA, United States of America, dan12@psu.edu, Kenneth Doerr

Deadlines have been known for some time to influence human behavior. However, the management of people and associated deadlines poses unanswered questions. How do deadlines affect individual work rate variability? What role does communication play in team performance in the presence of deadlines? These questions are important to aid managers in making operational and policy decisions regarding deadlines. Results indicate evidence that communication has an effect on performance in the presence of deadlines, and also has some impact on the variability of performance.

■ TA33

Hilton- Union Sq 13

Product Design and Manufacturing

Cluster: New Product Development

Invited Session

Chair: Gulru Ozkan, Clemson University, Department of Management, 120B Sirrrine Hall, Clemson, SC, 29634, United States of America, gulruo@clemson.edu

1 - Product Design in a Decentralized Supply Chain: Value of Information Asymmetry

Narendra Singh, Georgia Tech, Atlanta, GA, United States of America, Narendra.Singh@scheller.gatech.edu, Stelios Kavadias, Ravi Subramanian

We study an OEM's optimal product design and sourcing strategies in a supply chain consisting of an OEM, who has a less-efficient alternative sourcing option, and a more-efficient supplier with the power to dictate contract terms. We show that if the competitiveness of the OEM's alternative source is sufficiently low, the first-best quality is chosen. Further, we show that asymmetric information about the OEM's cost structure may lead to higher profits for both the OEM and the supplier.

2 - Problem-Solving Effort and Success in Innovation Contests: The Role of National Wealth and Culture

Cheryl Druehl, George Mason University, 4400 University Drive, Fairfax, VA, United States of America, cdruehl@gmu.edu, Jesse Bockstedt, Anant Mishra

Innovation contests allow firms to harness specialized skills from diverse participants. We examine the implications of diversity,in terms of national wealth and culture, in such contests on problem-solving effort and success. Also, we examine whether "home bias" effects exist. Using a large dataset from an online logo-design contest and country-level archival data, we find that diversity in wealth and culture do impact problem-solving effort and find evidence of "home bias" effects.

3 - A Behavioral Analysis on the Use of an Intermediary in Manufacturing Outsourcing

Qiong Chen, Clemson University, 100 Sirrine Hall, Clemson University, Clemson, SC, 29631, United States of America, qiongc@g.clemson.edu, Aleda Roth, Gulru Ozkan, Fred Switzer

In this paper, we examine how the perceived capability of the intermediary, perceived costs, time pressure and the type of manufacturing outsourcing decision act to systematically influence manager's decision to outsource production either directly or indirectly through an intermediary. We present a behavioral operations model, constructs and empirically validated measures.

■ TA35

Hilton- Union Sq 15

Risk Analysis Models for Critical Infrastructure and Service Systems

Sponsor: Public Programs, Service and Needs

Sponsored Session

Chair: Joost Santos, Assistant Professor, George Washington University, 1776 G St NW, Suite 101, Washington, DC, 20052, United States of America, joost@gwu.edu

1 - The Strive for Financial Accountability and its Impact on the Utility Created by an NGO

Christian Burkart, WU Vienna University of Economics and Business, Welthandelsplatz 1, D1.4106, Vienna, 1020, Austria, christian.burkart@wu.ac.at, Tina Wakolbinger, Fuminori Toyasaki, Michael Fearon

Financial accountability measures including administrative cost ratios are increasingly employed by donors to quantify aid agencies' performance. Typically lower administrative costs are seen as preferable ignoring possible positive effects. In this paper, we develop an optimization model that analyzes the influence of the consideration of administrative costs on the decision-making behavior and utilities of NGOs, beneficiaries and donors.

2 - Risk Mitigation in a Supply Chain Infrastructure Using Fault-Tree Optimization

Mike Sherwin, Mississippi State University, Mississippi State, MS 39732, United States of America, mds539@msstate.edu, Hugh Medal, Steven Lapp

This paper presents a quantitative approach to improve decisions related to risk mitigation within a supply chain infrastructure using a combination of fault-tree analysis and mathematical optimization. A fault-tree is analyzed to determine the optimum mitigation and resource allocation plan that reduces the probability of an event given budgetary constraints.

3 - Analysis of Drought Mitigation Strategies using Dynamic Input-Output Modeling and Event Trees

Joost Santos, Assistant Professor, George Washington University, 1776 G St NW, Suite 101, Washington, DC, 20052, United States of America, joost@gwu.edu

Climate change is expected to increase the frequency and intensity of droughts in many parts of the world. The adverse effects of droughts can propagate through regional sectors as a result of their inherent interdependencies. In this work, we evaluate three drought management strategies by combining economic input-output modeling with event tree analysis: (i) reducing the initial level of water supply disruption, (ii) managing water consumption, and (iii) prioritizing water-use dependencies.

4 - Estimating the Effects of Utility Disruption on Household Well-being During Hurricane Sandy

Pallab Mozumder, International Hurricane Research Center, Florida International University, Miami, FL, 33199, United States of America, mozumder@fiu.edu, Sisi Meng

Intense winds and flooding brought widespread interruptions to public utility services along Hurricane Sandy's path in the Northeastern US. Using household survey data, we provide an initial estimate of the household damages due to disruption in utility services (electricity, water, gas, telecommunication and public transportation). Understanding major determinants of damages caused by utility disruptions and its impact on household well-being can provide key inputs for disaster management.

■ TA36

Hilton- Union Sq 16

Telecommunications Network Flows and Design

Sponsor: Telecommunications

Sponsored Session

Chair: Stanko Dimitrov, University of Waterloo, 200 University Avenue West, Waterloo, Canada, sdimitro@uwaterloo.ca

1 - Assessing Vulnerability of Wireless Telecommunications Networks

Ozgur Kabadurmus, Assistant Professor, Yasar University, Bornova, Izmir, Turkey, ozk0001@tigermail.auburn.edu

In telecommunications network design problems, survivability and reliability are well known QoS metrics to mitigate service disruptions. In this study, wireless telecommunications network designs obtained by optimization for capacitated resilience and well known network reliability/survivability metrics (k-terminal reliability and traffic efficiency) are compared in terms of their performance (and vulnerability) in network attacks and random failure scenarios.

2 - Compact Formulation of the Network Design Problem: An Empirical Study

Eli Olinick, Associate Professor, Southern Methodist University, Dallas, TX, 75205, United States of America, olinick@lyle.smu.edu, Adam Colley

We present a new formulation for network flows in undirected graphs yielding significantly smaller LP's than those derived from the node-edge or edge-path formulations. This characterization of network flow yields a more compact formulation allowing more efficient solutions including instances either too large or too time consuming to solve by the standard edge-path and node-edge formulations, and is applied to the network design problem in an empirical study.

3 - Generating OSPF Weights from Computed Routing Polices that Account for Active Queue Management

Stanko Dimitrov, University of Waterloo, 200 University Avenue West, Waterloo, Canada, sdimitro@uwaterloo.ca, Jiaxin Liu, Laura Sanita

We present work on generating OSPF weights from routing policies computed for backbone networks that account for active queue management (AQM). We show that for a given all-pairs routing policy, finding bounded integer edge weights such that the given routing policy can be derived using shortest paths is NP-Hard. We test the realizability of OSPF policies accounting for AQM on a set of backbone networks and compare the performance of our generated policies with the policies currently used.

■ TA37

Hilton- Union Sq 17

Public-Private Partnership and Performance Based Logistics Contract Design

Sponsor: Artificial Intelligence

Sponsored Session

Chair: Amir Reza KashaniPour, University of Maryland, College Park, College Park, United States of America, akashani@umd.edu

1 - Bilateral Contract Design for Wind Energy Projects under Uncertainty

Xinyuan Zhu, Graduate Research Assistant, University of Maryland, College Park, University of Maryland, College Park, MD, 20742, United States of America, zxyemily@umd.edu, Qingbin Cui

This paper proposes a stochastic program to design the long-term Power Purchase Agreement (PPA) for wind energy projects. The long-term risks and cash flow volatility are considered through the metric of Conditional Value at Risk (CVaR), and a chance constraint is proposed to depict the electricity buyer's non-regret attitude. The model is applied to the Cape Wind offshore project in US as the case study, and the optimized PPA of the project is discussed through an out-of-sample analysis.

2 - Maintenance Enterprise Resource Planning (MERP): A Budget Simulation for PBL

Rogers Ascef, Lt Col - PhD Candidate, 905 Spruance Rd, Monterey, CA, 93940, United States of America, rascef@nps.edu

One of way to manage Maintenance Supply Chain (MSC) is to use Performance Basic Logistic. One of more arduous tasks of PBL management is to know how much I have to pay to match an operational availability. The research proposes to build a simulation using a proposed model called Maintenance Enterprise Resource Planning (MERP) to predict the budget based in the service level and the quantity of usage of equipment. Also, this simulation can be used to negotiate contracts using PBL.

3 - A Non-cooperative Lease Contract

Maryam Hamidi, Session Chair, University of Arizona, 1127 E. James E. Rogers Way, Room 111, P.O. Box 210020, Tucson, AZ, 85721, United States of America, mhamidi@email.arizona.edu, Ferenc Szidarovszky, Haitao Liao

Here a game-theoretic model is developed to study the process by which the owner (lessor) leases certain equipment to a user (lessee) under a lease contract. The lessor and lessee need to jointly decide on optimal lease period, usage rate and preventive maintenance policy of the leased equipment. The non-cooperative Nash equilibrium is studied to solve this problem and the structural properties of the optimal strategies are investigated and an algorithm is provided to search for the equilibria.

4 - Stockout Compensation: Joint Inventory and Price Optimization in Electronic Retailing

Hement Bhargave, UC Davis, Graduate School of Management, One Shield Avenue, Davis, CA, 95616, United States of America, hemantb@ucdavis.edu, Daewon Sun, Susan Xu

We analyze the effect of offering a lower price during stockout to compensate for a customer's waiting time, using an EOQ-type inventory-modeling framework but solving simultaneously for both the optimal prices and the lengths of the in-stock and stockout periods. The optimal stockout-compensation policy is to choose period lengths and prices such that the two periods have equal effective prices. Compared with a backorder policy without compensation, the stockout compensation policy improves profits and social welfare but at the expense of consumer surplus.

■ TA38

Hilton- Union Sq 18

Health Care Modeling Optimization I

Contributed Session

Chair: Guven Kaya, PhD Student, Industrial Engineering-University of Houston, E222 Engineering Building 2, Houston, TX, 77204, United States of America, gkaya@central.uh.edu

1 - Modeling and Analysis of Primary Care Delivery System

Xiang Zhong, Research Assistant, University of Wisconsin Madison, 1513 University Avenue, Madison, WI, 53705, United States of America, oliver040525@gmail.com, Molly Williams, Jingshan Li, Sally Kraft

In this work, we introduce an analytical model to characterize the general primary care delivery system. A Markov chain model is built to study the in-room services. The in-room processes are aggregated to a single server and the variation of such process is evaluated. A G/G/1 queuing model with general patient arrival and general service distribution is developed to evaluate the patient length of stay and resource utilization.

2 - Outpatient Appointment Scheduling: Challenges and Opportunities in Korea

KwonGi Mun, Rutgers Business School, 1 Washington Park, Newark, NJ, 07102, United States of America, kwongmun@pegasus.rutgers.edu, Yao Zhao, Endre Boros

The rate of growth in health spending in Korea was more than twice the average across OECD countries. We first review the Korean insurance system, and also start to review previous papers that explain mathematical approaches for reducing the waiting time of patients' queue. A main contribution is that a newly designed mathematical method will help hospitals optimize both profit and patients' satisfaction.

3 - Add-on Surgical Case Scheduling with Multiple Objectives and Stochastic Case Durations

Ashkan Hassani, PhD Student, Wayne State University, 4815 Fourth Street, Detroit, MI, United States of America, ashkan.hassani@wayne.edu, Hakimuddin Neemuchwala, Alper Murat

We study the problem of scheduling add-on cases in a multi-OR facility. Perfect information of all add-on cases is available before the start of day. We formulate a multi-criteria stochastic mixed-integer program and develop an efficient algorithm. Objective is to minimize deviations from planned schedule considering resource constraints. Model and results are verified using data from the Detroit VAMC.

4 - A Benders Decomposition Approach for Beam Angle Optimization (BAO) Problem

Guven Kaya, PhD Student, Industrial Engineering-University of Houston, E222 Engineering Building 2, Houston, TX, 77204, United States of America, gkaya@central.uh.edu, Gino Lim, Wenhua Cao

In radiation therapy treatment planning problems, computational effort grows significantly with data and model size. Benders decomposition technique is useful to overcome memory problem. It divides the problem into many smaller problems, so solving small problems can be more effective than solving a single large problem. We apply Benders method to beam angle optimization (BAO) problem. We use fluence map optimization (FMO) model as subproblem. Prostate cancer case is used to show results.

5 - Optimal Time Planning for Hospital Operating Rooms and Surgery Blocks Allocation under Uncertainty

Qiqi Zhang, University of Windsor, 401 Sunset Avenue, Windsor, ON, N9B 3P4, Canada, zhang1be@uwindsor.ca, Yifei Zhang, Guoqing Zhang

To improve hospital operating room (OR) efficiency, we propose both deterministic and stochastic optimization models for hospital surgery allocation and ORs time planning. The objective of the models is to minimize the sum of fixed OR cost, normal operating cost, and overtime operating cost. Different from existing models, we integrate time allocation for each surgery with OR time planning in the stochastic model. Numerical experiments are conducted to test the results for the two models.

■ TA39

Hilton- Union Sq 19

Optimization in Radiation Therapy and Epidemic Control

Sponsor: Health Applications

Sponsored Session

Chair: Hamed Yarmand, Massachusetts General Hospital and Harvard Medical School, Proton Therapy Center, MGH, 30 Fruit Street, Boston, MA, 02114, United States of America, hamedyarmand@gmail.com

1 - A Clinical Approach to Beam Angle Optimization in Radiation Therapy

Hamed Yarmand, Massachusetts General Hospital and Harvard Medical School, Proton Therapy Center, MGH, 30 Fruit Street, Boston, MA, 02114, United States of America, hamedyarmand@gmail.com, David Craft

In current clinical systems for radiation therapy treatment planning optimization the beams are selected manually and the intensities are then optimized. We investigate the potential benefits of incorporating automated beam selection into such clinical systems using our in-house developed algorithm to generated quality-guaranteed treatment plans which use the minimum number of beams.

2 - Interfacing GAMS and MATLAB for Large-scale Optimization

Jagdish Ramakrishnan, Post-doctoral scholar, University of Wisconsin-Madison, Wisconsin Institute for Discovery, Madison, WI, 53715, United States of America, jramakrishn2@wisc.edu, Steven Dirkse, Michael Ferris

For many applications, modeling languages (e.g. GAMS) provide easy prototyping and linking to optimization solvers while statistical software (e.g. MATLAB) provide much better data analysis ability. We developed a faster data transfer tool for large indexed data between GAMS and MATLAB, now part of the latest GAMS distribution. We illustrate its usefulness by solving a large-scale radiotherapy problem and visualizing the results in CERR, a MATLAB based radiotherapy visualization tool.

3 - Cost-effectiveness Assessment of Influenza Control Strategies using an Agent-based Model

Seyed Hossein Moosavi, Concordia University, 1455 Boulevard de Maisonneuve Ouest, Montreal, QC, H3G2B7, Canada, moosavi.hossein@gmail.com, Elnaz Karimi, Ali Akgunduz, Ketra Schmitt

We assess costs associated with a university influenza control policy and compare these to the costs of illness. Probability assessments are derived from an agent-based model which simulates individual behavior in an university population using a variety of intervention strategies. We then conduct a cost-effectiveness analysis to find the best combination of interventions to control the spread of influenza in the target population.

■ TA40

Hilton- Union Sq 20

Healthcare Delivery Optimization

Sponsor: Health Applications

Sponsored Session

Chair: Bryan A. Norman, Associate Professor, University of Pittsburgh, 1033 Benedum Hall, Pittsburgh, PA, 15261, United States of America, banorman@pitt.edu

1 - Integrated Storage and Shelf-space Allocation via Integer Programming

Nazanin Esmaili, PhD Student, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States of America, nae22@pitt.edu, Jayant Rajgopal, Bryan A. Norman

We address the joint allocation of storage and shelf-space, motivated by the management of inventory items that are dispensed at outpatient clinics. We present an integer programming formulation for selecting the items to be stocked, along with their shelf space allocations, in order to maximize the total value which is based on the desirability of stocking items. We propose several valid inequalities in order to improve computational performance and also present a heuristic algorithm.

2 - Using Optimization-Based Techniques to Reduce the Supply of Surgical Instruments

Amy Cohn, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, United States of America, amycohn@med.umich.edu, Daniel Hazlett

We consider the case of building "trays" or "sets" of surgical instruments — all of the instruments needed by a specific surgeon to perform a specific surgery. We investigate ways to reduce the overall need for excessive/redundant levels of instrument inventory by finding a reduced set of tray definitions that still meet each surgeon's needs.

3 - Peri-operative Healthcare Inventory Management in the Real World

James Benneyan, Director, Healthcare Systems Engineering Institute, 360 Huntington Ave, Boston, MA, 02115, United States of America, j.benneyan@neu.edu, Dayna Martinez, Adam Perruzzi

Typical inventory policies can be difficult to implement in many healthcare settings for a variety of reasons, including culture, physician autonomy, and unavailable or inaccurate data. We summarize several recent projects to improve perioperative inventory management practices and reduce associated costs, including establishing PAR levels, replenishment policies, and processed for updating and maintaining accurate preference cards.

4 - Day-of-Discharge Planning at Acute Care Hospitals

Nicholas Ballester, Wright University, Department of Biomedical, Industrial and Human Factors Engineering, Dayton, OH, 45435, United States of America, Ballester.2@wright.edu, Pratik Parikh, Kylie Bertsch, Nan Kong

We explore the tradeoffs within inpatient discharge processes, which affect the steadiness of intra-departmental inpatient flow, through a simulation study. Our focus is specifically on the sequence of events on the day-of-discharge and its effects on discharge time distribution and upstream boarding. Data collected from a local hospital are used to develop and validate our model. We evaluate a variety of discharge strategies and conduct statistical comparisons on process-related metrics.

■ TA41

Hilton- Union Sq 21

Workload, Quality, and Staffing

Sponsor: Health Applications

Sponsored Session

Chair: Wen-Ya Wang, San Jose State University, One Washington Square, San Jose, CA, United States of America, wenya.wang@sjsu.edu

1 - Improving Emergency Medical Services (EMS) with Time-Region-Specific Cruising Ambulances

Jiun-Yu Yu, Assistant Professor, National Tawain University, No. 1, Section 4, Roosevelt Road, Da-An, Taipei, Taiwan - ROC, jyyu@ntu.edu.tw

EMS refers to both patient transport and medical support solution for people with illness or injuries. Recent clinical evidence shows that time spent by the ambulance to arrive at the scene is critical. To reduce the response time, a time-region-specific ambulance cruising policy is proposed. Analytics and GIS are applied to generate the joint time-region distributions to identify high frequency grids. Simulation models are built to examine various ambulance cruising policies.

2 - Behavior-Aware Nurse Staffing

David Cho, Indiana University, Operations & Decision Technologies Dept, Kelley School of Business, Bloomington, IN, 47405, United States of America, ddcho@indiana.edu, Kyle Cattani, Alex Mills, Kurt Bretthauer

This paper presents nurse staffing models that incorporate quality of patient care and workforce behavior, issues often ignored in current research. For example, we consider behavioral issues such as temporary nurse speedup and its impact on patient length-of-stay. We study the question of whether hospitals can simultaneously reduce costs while achieving better patient outcomes.

3 - Physician Panel Design
Wen-Ya Wang, San Jose State University, One Washington Square, San Jose, CA, United States of America, wenya.wang@sjsu.edu, Diwakar Gupta

This study focuses on the physician panel design problem of determining the patient composition (i.e. panel size and types of patient) for physician panels. We investigate how clinics would allocate a heterogeneous pool of patients who have different propensity for requesting urgent appointments to physicians to balance physician workload and cost of serving patients in a timely manner.

4 - Cross-sector Collaboration in a Population Health Framework
Sandra Potthoff, Associate Professor, University of Minnesota, 420 Delaware Street SE, Mayo Mail Code 510, Minneapolis, MN, 55455, United States of America, potth001@umn.edu

The former mayor of Kansas City was surprised when its county health rankings were dead last in the state in spite of the presence of a premier health system. Population health entails more than a highly functioning healthcare system. It requires collaboration across institutional sectors. As healthcare moves to a population health focus, a cross-sector systems approach is needed with new performance metrics of quality and outcomes. This talk describes early efforts to move in this direction.

■ TA42

Hilton- Union Sq 22

Inventory Management in Healthcare

Sponsor: Health Applications

Sponsored Session

Chair: Hossein Abouee Mehrizi, University of Waterloo, 200 University Avenue West, Waterloo, ON, N2L 3G1, Canada, haboueemehrizi@uwaterloo.ca

1 - Blood Platelet Inventory Management with Protection Levels
Alan Scheller-Wolf, Professor, Carnegie Mellon University, Tepper School of Business, Carnegie Mellon University, Pittsburgh, PA, 15213, United States of America, awolf@andrew.cmu.edu, Itir Karaesmen, Ismail Civelek

We consider ordering and allocation of a perishable product with demand for different ages, such as blood platelets. If demand is satisfied with inventory of a different age, a cost is incurred. We propose a simple replenishment and inventory allocation heuristic to minimize the expected total cost that has superior performance compared to existing heuristics in the literature, particularly if supplies are limited.

2 - Optimal Inventory Policy for Perishable Products with Regular and Optional Expedited Replenishmt
William Pierskalla, Professor, UCLA Anderson School, Los Angeles, CA, United States of America, william.pierskalla@anderson.ucla.edu, Lawrence Leung, Deming Zhou

Platelets have a mere three-day life span in U.S. A periodic review inventory system for such a perishable product under two replenishment modes is analyzed. Regular orders are placed at the beginning of a cycle. Within the cycle, the manager has an option of placing an expedited order. For this platelet inventory problem, we prove the existence and uniqueness of an optimal policy that minimizes the expected cost and develop an algorithm to obtain the optimal inventory levels.

3 - Optimal Multi-specialty Surgery Scheduling under Operating Resource and Hospital Bed Constraints
Shrutivandana Sharma, Singapore University of Technology and Design, 20 Dover Drive, Singapore, 138682, Singapore, shrutivandana@sutd.edu.sg, Hossein Abouee Mehrizi

We consider a bed scheduling problem, where the decision is to schedule surgeries of two different types over a finite horizon. The number of surgeries of each type that can be performed in any period is bounded by the availability of operating resources for that type, as well as the total availability of beds. We formulate the problem as a multi-period capacitated inventory problem, and characterize the optimal solution.

4 - Better Intermediation in Two-Sided Markets
Mustafa Akan, Tepper School of Business; Carnegie Mellon University, 5000 Forbes Ave, Pittsburgh, PA, 15213, United States of America, akan@andrew.cmu.edu

This paper proposes a mechanism to maximize the total number of successful matchings by improving the recommendation scheme the intermediaries follow. These recommendations play a crucial role because they shape the beliefs of the agents on the receiving end of the market about the other side.

■ TA43

Hilton- Union Sq 23

Issues Related to Large-scale Data Mining

Sponsor: Computing Society

Sponsored Session

Chair: Philipp Baumann, University of Bern, Department of Business Administration, Schuetzenmattstrasse 14, Bern, 3012, Switzerland, philipp.baumann@pqm.unibe.ch

1 - Sparse Computation for Large-scale Data Mining with Pairwise Affinities
Dorit Hochbaum, Professor, University of California, Berkeley, IEOR Department, Etcheverry Hall, Berkeley, CA, 94720, United States of America, hochbaum@ieor.berkeley.edu, Philipp Baumann

Supervised normalized cut and k-nearest neighbors are two effective classification techniques that employ pairwise affinities. This takes quadratic time and space to generate. Unlike existing sparsification techniques that process the full matrix and round down some of the entries to zero, sparse-computation computes only the high similarity pairs and requires at most linear time. It is demonstrated that sparse-computing delivers dramatic reductions in run times while maintaining high accuracy.

2 - Construction of Index-tracking Portfolios using Data Mining and Linear Programming
Oliver Strub, University of Bern, Department of Business Administration, Schuetzenmattstrasse 14, Bern, 3012, Switzerland, oliver.strub@pqm.unibe.ch, Norbert Trautmann, Philipp Baumann

Index tracking is a popular investment strategy because of the low management and transaction costs. The construction of a tracking portfolio includes selecting an appropriate subset of index constituents, which is computationally expensive. We apply data mining techniques to determine a promising subset in short running time, and linear programming to determine the portfolio weights. This novel approach compares favorably to existing ones in terms of out-of-sample performance and running time.

3 - A Computational Comparison of Machine Learning Methods and the Supervised Normalized Cut
Philipp Baumann, University of Bern, Department of Business Administration, Schuetzenmattstrasse 14, Bern, 3012, Switzerland, philipp.baumann@pqm.unibe.ch, Yan Yang, Dorit Hochbaum

We present a computational study evaluating the binary classification performance of ten machine learning methods. The study includes, for the first time, variants of the recently proposed method of supervised normalized cut. The performance is evaluated in terms of prediction accuracy and run time on various datasets from the UCI Machine Learning Repository. The results demonstrate that k-nearest neighbors, support vector machine and supervised normalized cut perform best in terms of accuracy.

4 - Clustering Categories in Support Vector Machines
Dolores Romero-Morales, Professor in Operations Research, Copenhagen Business School, Denmark, drm.eco@cbs.dk, Emilio Carrizosa, Amaya Nogales Gomez

We propose the Cluster Support Vector Machines (CLSVM) methodology to reduce the complexity of the SVM classifier in the presence of categorical features. Four strategies for building the CLSVM classifier are presented based on solving: the original SVM formulation, a QCQP formulation, and an MIQP formulation as well as its continuous relaxation. We illustrate that our methodology achieves comparable accuracy to that of the SVM with original data but with a dramatic decrease in complexity.

■ TA44

Hilton- Union Sq 24

Energy Information Systems

Sponsor: Information Systems

Sponsored Session

Chair: Wolf Ketter, Professor, Rotterdam School of Management, Burgemeester Oudlaan 50, Rotterdam, 3062 PA, Netherlands, wketter@rsm.nl

1 - Managing Smart Home Energy Consumption through Intelligent Decision Support

Konstantina Valogianni, PhD Candidate, Rotterdam School of Management, Burgemeester Oudlaan 50, Rotterdam, 3062PA, Netherlands, KValogianni@rsm.nl, Wolf Ketter, John Collins, Dmitry Zhdanov

We present a decision support algorithm for smart homes equipped with household appliances and electric vehicles. The presented algorithm is implemented through an intelligent agent, representing the household. We use reinforcement learning and dynamic programming to provide personalized consumption recommendations to household prosumers and evaluate the results under competitive energy markets conditions. By using the algorithm we observe benefits both for the prosumers and the smart grid.

2 - Facilitating Appropriate Compensation of Electric Energy and Reserve through Standardized Contracts

Deung-Yong Heo, PhD Student, Department of Economics, Iowa State University, 260 Heady Hall, Ames, IA, 50011, United States of America, dyheo@iastate.edu, Leigh Tesfatsion

The current design of wholesale power markets makes it difficult to ensure appropriate compensation for many important load-balancing services, such as flexibility in power attributes. This study examines the possibility of facilitating appropriate compensation through the introduction of standardized contracts (SCs) with swing (flexibility) and demonstrates how SCs can be supported by two settlement system permitting efficient load balancing under system constraints and reserve requirements.

3 - Impact of Information Transparency and Social Value Orientation on Smart Grid Balancing

Laurens Rook, TU Delft, Jaffalaan 5, Delft, 2628BX, Netherlands, L.Rook@tudelft.nl, Sudip Bhattacharjee, Xu Han, Wolf Ketter

We tested and found that smart grid balancing under information transparency (where consumers are aware of collective actions for the whole population in different periods) has a better outcome than under no information. We further posited that this effect would be moderated by social value orientation (SVO; the weight people attach to their own benefits relative to those of others).

4 - AgentUDE: The Success Story of the Power TAC 2014's Champion

Serkan Ozdemir, PhD Candidate, University of Duisburg-Essen, DAWIS, Universitat Duisburg-Essen, Schützenbahn 70, Essen, 45127, Germany, serkan.oezdemir@icb.uni-due.de, Rainer Unland

Future smart grid will bring new actors and features such as local producers, storage units and interruptible consumers to the current electricity grid. Power Trading Agent Competition (Power TAC) provides a comprehensive simulation platform to enable various smart grid studies as well as an annual competition in which autonomous brokers trade in the power markets and gain profits. AgentUDE won the 2014 games as the newest participant of the competition utilizing an adaptive and reactive agent.

■ TA45

Hilton- Union Sq 25

Behavior in Supply Chains and Procurement

Sponsor: Behavioral Operations Management

Sponsored Session

Chair: Ruth Beer, PhD Candidate in Technology and Operations, Ross School of Business, University of Michigan, 701 Tappan Street, R4421, Ann Arbor, MI, 48109, ruthbeer@umich.edu

1 - Does the Retailer Lie about Sales Under a Revenue Sharing Contract? An Experimental Investigation

Yinghao Zhang, Assistant Professor, Salisbury University, Perdue Hall 333, 1101 Camden Avenue, Salisbury, MD, 21804, United States of America, YXZHANG@salisbury.edu, Tianjun (TJ) Feng

We investigate whether the retailer will truthfully report the sales data to the supplier under a revenue sharing contract, and how the retailer's truth-telling (or lying) behavior may influence the supplier's contract decisions. Our theory shows that a profit maximizing retailer will always report "zero" sales, leading the supplier in favor of a wholesale price contract. The lab experiment, however, suggests otherwise.

2 - Sourcing Decisions Leading Up To and Following High Impact, Low Probability Disruptions

Kyle Goldschmidt, Pennsylvania State University, 426A Business Building, University Park, PA, 16802, United States of America, khg116@psu.edu, Doug Thomas, Chris Craighead, Mirko Kremer

We examine decision-making regarding supply base diversification when threatened by high impact, low probability (HILP) supply chain disruptions.

3 - Decision Making and Cognition in Multi-Echelon Supply Chains: An Experimental Study

Brent Moritz, Assistant Professor, Penn State University, 469 Business Building, University Park, PA, 16802, United States of America, bmoritz@psu.edu, Arunachalam Narayanan

Individual decision making contributes to the bullwhip effect. Using a large experiment, the cognitive profile of decision-makers results in substantial differences in cost and order quantity variance. We report subject-level decision heuristics: The degree of the underweighting the supply line is linked to an individual's level of cognitive reflection.

4 - The Impact of Decision Rights and Long Term Relationships on Innovation Sharing

Ruth Beer, PhD Candidate in Technology and Operations, Ross School of Business, University of Michigan, 701 Tappan Street, R4421, Ann Arbor, MI, 48109, ruthbeer@umich.edu, Hyun-Soo Ahn, Stephen Leider

We study a supplier's incentives to share an innovation with a buyer when sharing the innovation increases efficiency but makes the supplier vulnerable to the buyer sharing it with other suppliers. We show, both theoretically and experimentally, that the supplier's optimal decision depends on the length of the relationship and in particular, on how the buyer allocates decision rights among its employees.

■ TA46

Hilton- Lombard

Non-traditional Topics in Integer Programming

Sponsor: Optimization/Integer and Discrete Optimization

Sponsored Session

Chair: Siqian Shen, Assistant Professor, University of Michigan, 2793 IOE Building, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States of America, siqian@umich.edu

1 - Isomorphism Pruning on General Integers

Jim Ostrowski, Assistant Professor, University of Tennessee, 525K John D. Tickle Building, 851 Neyland Drive, Knoxville, TN, 37996, United States of America, jostrows@utk.edu, Jeff Linderoth, Francois Margot

Isomorphism pruning helps solve highly symmetric integer programming problems by using symmetry to fix variables and prune branch-and-bound nodes. Implementing isomorphism pruning on general integers has been difficult. In past work, branching on a variable with k many possible values required k-many children. We show how to drop this restriction and allow for a traditional 2-child branching strategy.

2 - Fast Column Generation for Submodular Minimization

Andrew Orso, University of Michigan, 1102 Maiden Lane Ct, Apt 112, Ann Arbor, MI, 48105, United States of America, orso@umich.edu, Siqian Shen, Jon Lee

We present a practical column generation algorithm for the general submodular minimization problem together with computational results demonstrating that our algorithm performs well on a diverse set of instances.

3 - Strengthened Sparse Approximations for Polytopes

Andres Iroume, Georgia Tech, Atlanta, GA, United States of America, airoume3@gatech.edu, Santanu Dey, Marco Molinaro

When MIP-solver use cuts to separate fractional solutions, the preferred option is sparse cuts (those with only a small number of non-zero coefficients). A natural question, recently addressed by Dey, Molinaro and Wang, is; how well can we approximate a polytope P only using sparse cuts. In this talk we address the problem of allowing a limited number on dense cuts (on top of the sparse ones) to strengthen approximate P.

4 - Approximating Sparse Covering Integer Programs Online

Viswanath Nagarajan, University of Michigan, Ann Arbor, MI, United States of America, viswa@umich.edu, Anupam Gupta

We study covering integer programs (CIPs) in an online setting, where the constraints arrive over time. We give an O(log k log L)-competitive randomized online algorithm for solving CIPs. Here k and L denote the row and column sparsity of the constraint matrix. Our algorithm is based on the online primal-dual paradigm, where a novel ingredient is to allow dual variables to increase and decrease throughout the course of the algorithm.

■ TA47

Hilton- Mason A

Robust and Prior-free Optimization – Theory and Applications

Sponsor: Optimization/Optimization Under Uncertainty

Sponsored Session

Chair: Chaithanya Bandi, Kellogg School of Management, Northwestern University, Evanston, IL, United State of America, c-bandi@kellogg.northwestern.edu

1 - Data-driven Learning in Dynamic Pricing using Adaptive Optimization

Phebe Vayanos, MIT Sloan School of Management, 50 Memorial Dr., Cambridge, MA 02142, United States of America, pvayanos@mit.edu, Dimitris Bertsimas

We consider the pricing problem faced by a retailer endowed with a finite inventory of a product offered to price-sensitive customers. The parameters of the demand curve are unknown to the seller who has at his disposal a history of sales data. We show that the seller's problem can be formulated as an adaptive optimization problem with decision-dependent uncertainty set. We obtain a conservative approximation in the form of mixed-binary conic optimization problem that is practically tractable.

2 - A Tractable Analysis of the Transient Behavior of Queues

Nataly Youssef, MIT, 20 Palermo St., Cambridge, MA 02141, United States of America, youssefn@mit.edu, Dimitris Bertsimas, Chaithanya Bandi

We propose a tractable approach for studying the transient behavior of multi-server queues. We model the queueing primitives via polyhedral uncertainty sets inspired by the limit laws of probability. Our approach provides qualitative insights via closed form expressions and produces accurate numerical predictions of transient waiting times for heavy traffic queues with various interarrival and service time distributions, heavy tail coefficients and number of servers.

3 - Resourceful Contextual Bandits

Ashwinkumar Badanidiyuru, Google Research Scientist, Google, 707 Continental Circle, Apt 927, Mountain View, CA, 94040, United States of America, ashwinkumarbv@gmail.com

We study contextual bandits with constraints on resources, which are common in applications such as choosing ads or dynamic pricing of items. We design the first algorithm for solving these problems that improves over a trivial reduction to the non-contextual case. We consider very general settings for both contextual bandits (arbitrary policy sets, Dudik et al. (UAI'11)) and bandits with resource constraints (Badanidiyuru et al. (FOCS'13)), and prove a regret guarantee which is near-optimal.

4 - Algorithmic Linear Regression via Modern Optimization Methods

Angela King, MIT, 77 Massachusetts Ave, E40-129, Cambridge, MA, 02139, United States of America, aking10@mit.edu, Dimitris Bertsimas

Linear regression is one of the most widely applied statistical methods. Some properties of a good model include a parsimonious fit, statistically significant variables, robustness to uncertainty in data, and interpretability. Obtaining a model with all these properties is typically done by trial and error. We algorithmize the process of fitting linear regression models using tools from integer, continuous, and robust optimization and provide evidence that this outperforms standard techniques.

■ TA48

Hilton- Mason B

Network and Graphs 3

Contributed Session

Chair: Patrick O'Reilly, PhD Candidate, Mineral and Energy Economics, Colorado School of Mines, P.O. Box 11, Golden, CO, 80402, United States of America, poreilly@mines.edu

1 - Fast Community Detection Method for Social Network

Cheng-Bang Chen, Penn State University, 445 Waupelani Dr. Apt.K18, State College, PA, 16801, United States of America, czc184@psu.edu

Analyzing the network structure is a powerful tool in studying entity relationships. There are lots of community detection methods, but most of them function just through the network structure. We develop a community detection algorithm with both structure and extra node information which is useful in social network.

2 - Evolution of Market Process in Reverse Supply Chains as Rapidly-Exploring Random Trees

Patrick O'Reilly, PhD Candidate, Mineral and Energy Economics, Colorado School of Mines, P.O. Box 11, Golden, CO, 80402, United States of America, poreilly@mines.edu

Seeing markets as networks is neither new, nor standard. Capturing market emergence has been elusive, yet something that can be characterized with network models, minimally as supply chains, and more extensively as rapidly-exploring random trees (a random graph). Where markets are thought to be missing, they may be emergent, if not already in a less visible, but mature speculative existence. The case of reverse supply chains in durable goods is offered as a timely example.

3 - A New Method to Evaluate the Deterioration-Effect Multi-state Flow Network Reliability

Wei-Chang Yeh, National Tsing Hua University, No.101, Sec. 2, Guangfu Rd., East Dist., Hsinchu City, Taiwan - ROC, weichang.yeh@gmail.com, Yi-Yun Chang

The arcs and nodes of multistate flow network (MFN) are obey the flow conservation law but sometimes arcs would had deterioration-effect. For example, signal transform will decrease if the transmission distance is too great. The deterioration-effect of arcs MFN model called MFNde. An example presented to illustrate how the proposed algorithm that use MP to calculate the deterioration-effect d-minimal path and evaluate the reliability of an MFNde model.

4 - Social Network Formation Modelling

Song Chew, Associate Professor, Southern Illinois University Edwardsville, IL, 62026, United States of America, schew@siue.edu

We present a model for social network formation. In this model, a new born node attaches to a random number of randomly chosen existing nodes. We study the node degree distribution for this model.

5 - A Biased Random-key Genetic Algorithm to Maximize the Accepted Lightpaths in WDM Optical Networks

Celso Ribeiro, Universidade Federal Fluminense, Departamento de CIÍncia da Computaçao, Niteroi, 24210-240, Brazil, celso@ic.uff.br, Julliany Brand„o, Thiago Noronha

Routing and wavelength assignment in optical networks consists in routing a set of lightpath requests, such that lightpaths with common links are assigned to different wavelengths. The goal is to maximize the number of requests that may be accepted, given a set of available wavelengths. We propose a biased random-key genetic algorithm for solving this problem. Computational results show that the average optimality gaps obtained with this heuristic are smaller than 4% for literature instances.

■ TA49

Hilton- Powell A

Network Interdiction Applications

Sponsor: Optimization/Network Optimization

Sponsored Session

Chair: Hugh Medal, Assistant Professor, Mississippi State University, 260F McCain Hall, Mississippi State, MS, 39762, United States of America, hugh.medal@msstate.edu

1 - Experimental Evaluation of Network Robustness against Multi-Strategy Greedy Attacks

Mario Ventresca, Assistant Professor, School of Industrial Engineering, Purdue University, 315 N Grant St, West Lafayette, IN, 47907, United States of America, mventresca@purdue.edu, Dionne Aleman

The robustness of networks versus an attacker who sequentially selects from a number of different strategies, each of which removes one node from the network is investigated. We analyze four robustness measures and six network centrality measures form the set of strategies at the disposal of the attacker. A comparison to single-strategy attack is also performed. Betweenness attacks often outperform random and greedy multi-strategy selection, the latter often becoming trapped in local optima.

2 - Optimal Deployment of Security Resources: Analyzing the Damage and Intervention Cost Tradeoff

Apurba Nandi, Mississippi State University, 1120 East Lee Blvd, Apt 160, Starkville, MS, 39759, United States of America, akn77@msstate.edu, Hugh Medal

The high degree of dependency of today's firms on information systems means that they are highly vulnerable to information theft and sabotage through different forms of security breaches. In this paper, we find the optimal intervention strategies, which minimize the objectives: 1) the loss due to security breaches and 3) the cost of intervention. We formulate the problem as a mixed-integer linear program and develop exact and heuristic solution algorithms.

3 - A Bi-Level Programming Model for the Wireless Network Jamming Placement Problem

Venkata Surya Vadlamani, Mississippi State University, 205 Lynn Ln, Apt# 5F, Starkville, MS, 39759, United States of America, vv66@msstate.edu, Hugh Medal, Burak Eksioglu

We study a network interdiction problem on a multi-hop multi-channel wireless network in which an attacker places jamming devices to minimize the expected throughput of the network. We model the problem as a bi-level attacker-defender mixed integer program. The attacker locates a limited number of jamming devices, and the defender determines an optimal channel hopping strategy. The defender seeks to maximize the equilibrium network throughput, and the attacker seeks to minimize it.

■ TA50

Hilton- Powell B

Optimization, Network 2

Contributed Session

Chair: Fatih Mutlu, Qatar University, MIE Department, Doha, 2713, Qatar, fatihmutlu@qu.edu.qa

1 - An Optimization Model for A Multi-Tier Ring Based Design of a Greenfield Transport Optical Network

Fatih Mutlu, Qatar University, MIE Department, Doha, 2713, Qatar, fatihmutlu@qu.edu.qa, Karam Al-Shorbassi

We develop a multi-tier ring based design for a greenfield transport optical network. Each demand node is assigned to one of the potential nodes and nodes will form a 3-tier ring network structure. The network consists of one tier-1 ring, and multiple tier-2 rings, each of which is connected to two tier-1 nodes, and multiple tier-3 rings, each of which is connected to two different tier-2 nodes. We develop an MIP formulation for the design problem and a construction heuristic.

2 - Age-based Preventive Maintenance in Multi-component Systems: An Integer Programming Approach

Khatereh Ahadi, University of Arkansas, 1601 North Leverett, Apt 20, Fayetteville, AR, 72701, United States of America, khatereh.ahadi@gmail.com, Kelly Sullivan

In this study, we consider a multi-component system in which components become less reliable over time. For this system, we seek to schedule component replacements over a finite time horizon in order to minimize the cost due to component and system failures and replacement of the components. We present a new class of integer programming models derived from a network-based linear programming formulation that represents the system reliability.

3 - Finding Optimal Mean-Risk Routes in Dynamic Stochastic Networks: a Stochastic Dominance Approach

Xing Wu, Assistant Professor, Lamar University, 4400 MLK Parkway, Cherry Engineering RM 2032, Beaumont, TX, 77706, United States of America, xing.wu@lamar.edu

The mean-risk model is widely used in the stochastic routing problems in networks for its compact and easy-to-understand form. The risk is usually defined as the standard deviation of the route travel time. Previous studies solve this model by assuming link travel times following normal distributions and employing the central limit theorem. This study relaxes this constraint and aims to find a general approach to solve this model in dynamic networks based on the stochastic dominance theory.

4 - Stochastic Random Projection Algorithm for Stochastic Network Design Problem

Umit Tursun, Postdoctoral Research Associate, University of Illinois at Urbana-Champaign, 104 S. Mathews Ave. B-14, Urbana, IL, 61801, United States of America, utursu2@illinois.edu, Rakesh Nagi

We consider a comprehensive random projection algorithm for stochastic network design problems under uncertain demand, where the objective and constraints are defined by convex functions and integrality restrictions are imposed on a subset of the decision variables. A stochastic convex random projection optimality algorithm for lower bound and a stochastic random projection feasibility algorithm for upper bound are used in succession converging to the solution set almost surely.

■ TA51

Hilton- Sutter A

Network Flow & Nonlinear Optimization

Sponsor: Optimization/Nonlinear Optimization

Sponsored Session

Chair: Emre Tokgoz, Quinnipiac University, 275 Mount Carmel Ave., Hamden, CT, 06518, United States of America, emre.tokgoz-1@ou.edu

1 - Transportation Network Flow Problems on Manifolds

Emre Tokgoz, Quinnipiac University, 275 Mount Carmel Ave., Hamden, CT, 06518, United States of America, emre.tokgoz-1@ou.edu

Research problems in the network flow theory are mainly in the Euclidean space setting. In this talk, transportation problems will be considered on manifold settings with applications.

2 - Using Neural Networks to Optimize Blood Transfers among US Regions in a Simulated Natural Disaster

Hussein Ezzeldin, ORISE Fellow, OBE, CBER, FDA, 10903 New Hampshire Ave, WO71 room 1009C, Silver Spring, MD, 20993, United States of America, hussein.ezzeldin@fda.hhs.gov, Richard Forshee, Arianna Simonetti

We present a model of the US blood supply network, where the daily blood transfers among regions are optimized by using a Dynamic Neural Networks Heuristic (DNNH). The DNNH is capable of modeling a complex non-linear function of quotidian and forecasted regional factors to optimize the holistic performance of the network. In support of planning for emergency preparedness, blood transfers during normal operational conditions are compared with those simulated for a natural disaster.

3 - A Study on Cascading Failure Phenomenon of Interdependent Supply Chain Networks

Liang Tang, Southeast University, No.2, Sipailou Campus, Nanjing, Nanjing, China, tangericliang@gmail.com, Jie He, Ke Jing

To analyze the robustness of complex interdependent supply chain networks composed of a cyber-layer network and a physical-layer network while the supply chain system suffers from disruption events, a cascading failure model is presented. Through a giant component function and one-to-one directed interdependence relation, time-varied functional equations are constructed to reveal the robustness of supply chain networks. A numerical simulation shows the fragility of such interdependent networks.

■ TA52

Hilton- Sutter B

Conic Optimization

Sponsor: Optimization/ Linear and Conic Optimization

Sponsored Session

Chair: John Mitchell, Professor, Rensselaer Polytechnic Institute, 325 Amos Eaton, Math Sciences, 110 Eighth St, Troy, NY, 12180, United States of America, mitchj@rpi.edu

1 - Strengthening a Second Order Cone Relaxation for Binary Quadratic Polynomial Problems

Julio César Göez, Postdoctoral Fellow, GERAD, Montreal, QC, Canada, jgoez1@gmail.com, Miguel Anjos

This work builds on the second order cone relaxation for binary quadratic problems proposed by Ghaddar, Vera and Anjos (2011) who used a polynomial optimization approach. We explore how this relaxation can be strengthened using additional constraints. In particular, we explore the combination of disjunctive conic cuts with this relaxation. We present computational results on a test set containing various types of binary quadratic polynomial problems.

2 - Using Disjunctive Conic and Cylindrical Cuts in Solving Quantitative Asset Allocation Problems

Sertalp B. Cay, PhD Candidate, Lehigh University, 200 W Packer Ave, Bethlehem, PA, 18015, United States of America, sec312@lehigh.edu, Julio Göez, Tamas Terlaky

The novel methodology of disjunctive conic and cylindrical cuts (DCC) was developed recently to solve mixed integer second order cone optimization (MISOCO) problems. First steps are made in implementing this powerful methodology in a Branch-and-Conic-Cut software package. In this study, we explore the use of this novel methodology in solving asset allocation problems. Preliminary numerical results show that DCC have significant positive impact when solving a set of realistic problem instances.

3 - Relaxing Nonconvex Quadratic Functions by Multiple Adaptive Diagonal Perturbations

Hongbo Dong, Assistant Professor, Washington State University, Neill 103, Pullman, WA, 99164, United States of America, hongbo.dong@wsu.edu

We propose a novel cutting surface procedure to derive strong convex quadratic relaxations for a set defined by a nonconvex quadratic function and some separable constraints. Our relaxations do not use a large number of lifted variables. We design a specialized coordinate minimization algorithm to solve the separation. Computational results show that our approach has potential to be successful in a branch-and-bound approach to solve general mixed-integer quadratically constrained programs.

4 - Completely Positive Reformulations for Optimization Problems

with Complementarity Constraints

John Mitchell, Professor, Rensselaer Polytechnic Institute, 325 Amos Eaton, Math Sciences, 110 Eighth St, Troy, NY, 12180, United States of America, mitchj@rpi.edu, Lijie Bai, Jong-Shi Pang

We derive equivalent convex completely positive reformulations for several classes of nonconvex optimization problems defined over convex cones, including rank-constrained semidefinite programs and quadratically constrained quadratic programs (QCQPs). The first part of the reformulation is to cast the problem as a conic QCQP with just one nonconvex constraint with a special structure. Our results do not make any boundedness assumptions on the feasible regions of the problems considered.

■ TA53

Hilton- Taylor A

Operations - Finance Interface

Cluster: Optimization in Finance

Invited Session

Chair: Dan Iancu, Stanford Graduate School of Business, 655 Knight Way, Stanford, CA, United States of America, daniancu@stanford.edu

1 - How Fast Should You Grow? Balancing Growth and Survival in a Cash Constrained Firm

Vishal Gaur, Cornell University, Johnson School, Ithaca, NY, United States of America, vg77@cornell.edu, Yasin Alan

We analyze the optimal investment policy of a cash constrained firm and compare it to different heuristics commonly used in practice. Through this, we develop practical insights into the relationship between firm growth and probability of survival.

2 - Supply Function Equilibrium in Electricity Markets

John Birge, Jerry W. and Carol Lee Levin Professor of Operations Management, University of Chicago Booth School of Business, 5807 S Woodlawn Ave, Chicago, IL, 60637, United States of America, john.birge@chicagobooth.edu, Nur Sunar

Many financial markets, such as those for electricity, include supply and demand offers that result in the equilibrium prices and quantities. In commodity markets, the actual supply can be uncertain, implying changes in the nature of the equilibrium. This talk will present models for these functions and implications for electricity markets.

3 - Operationalizing Financial Covenants

Gerry Tsoukalas, Wharton, Walnut Street, Philadelphia, PA United States of America, gtsouk@wharton.upenn.edu, Dan Iancu, Nikos Trichakis

We study the interplay between the design of financial covenants and the operational decisions of a retailer that obtains financing through secured (asset-based) lending contracts. While it is widely held that covenants serve to protect lenders, the ways in which a retailer can adapt his operations in response have not been studied. Endogenizing this effect, we show that the retailer can use operational levers (such as "fire sales") to diminish or even circumvent covenant effectiveness.

4 - Impact of Input Price Variability in Stochastic Inventory Systems

David Chen, University of Minnesota, 111 Church Street, Minneapolis, MN, 55455, United States of America, chen2213@umn.edu, Saif Benjaafar, William Cooper

We examine the impact of input price variability and correlation in the context of inventory system with stochastic demand and stochastic input prices. For a general class of such systems, and for a wide range of assumptions regarding price evolution, we show that that higher input price variability leads to lower expected cost.

■ TA54

Hilton- Taylor B

Stochastic Modeling in Financial Engineering

Sponsor: Financial Services Section

Sponsored Session

Chair: Rafael Mendoza-Arriaga, McCombs School of Business, University of Texas at Austin, 1 University Station, Austin, TX, 78712, United States of America, rafael.mendoza-arriaga@mccombs.utexas.edu

Co-Chair: Lingfei Li, Assistant Professor, The Chinese University of Hong Kong, 608 William M.W.Mong Engr Bld, Shatin, Hong Kong - PRC, lfli@se.cuhk.edu.hk

1 - Sticky Reflecting Ornstein-Uhlenbeck Processes and Interest Rate Modeling with Zero Lower Bound

Yutian Nie, Northwestern University, 2145 Sheridan Rd, Evanston, IL, 60208, United States of America, YutianNie2016@u.northwestern.edu, Vadim Linetsky

We study sticky reflecting Ornstein-Uhlenbeck processes which are solutions to SDEs with sticky boundary conditions. We construct sample paths of the solution by means of time change and represent the transition semigroups in terms of spectral expansion. As an application, we propose a Markovian short rate model with zero lower bound based on sticky OU processes under which zero coupon bond and interest rate derivative prices have analytical solutions though eigenfunction expansion.

2 - Long Term Risk and Ross Recovery: A Martingale Approach

Likuan Qin, PhD Candidate, Northwestern University, 2145 Sheridan Road, Evanston, IL, 60208, United States of America, LikuanQin2012@u.northwestern.edu, Vadim Linetsky

We start with a pricing kernel in the semimartingale asset pricing framework and study existence of the long-term forward measure. We show that in the ergodic Markovian environment the Hansen-Scheinkman factorization of the pricing kernel into the permanent and transitory components naturally emerges, and Ross recovery emerges as the special case. The strength of our semimartingale approach is that we naturally extend these concepts to non-Markovian models and, in particular, treat HJM models.

3 - Additive Subordination and its Applications in Finance

Rafael Mendoza-Arriaga, McCombs School of Business, University of Texas at Austin, 1 University Station, Austin, TX, 78712, United States of America, rafael.mendoza-arriaga@mccombs.utexas.edu, Lingfei Li

Applications in finance often require the use of time-inhomogeneous Markov processes. This paper studies additive subordination, which we show is a useful technique for constructing time-inhomogeneous Markov processes with analytical tractability. Additive subordination is the natural time-dependent generalization of the classical Bochner's subordination. We develop an analytical tractable formula for pricing crack spread options, as an application example.

4 - Modeling Electricity Prices: A Time Change Approach

Zhiyu Mo, The Chinese University of Hong Kong, Hong Kong - PRC, zymo@se.cuhk.edu.hk, Rafael Mendoza-Arriaga, Lingfei Li, Daniel Mitchell

We develop a new framework for modeling electricity spot prices by time changing the basic affine jump diffusion, which successfully captures seasonal spikes. Our model is easy to estimate from data and it is tractable for pricing electricity derivatives.

■ TA55

Hilton- Van Ness

Improved Methods for Solving Special Classes of MINLP

Sponsor: Optimization/Global Optimization & MINLP

Sponsored Session

Chair: Francisco Trespalacios, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, ftrespal@andrew.cmu.edu

1 - A New Non-convex Quadratic Programming Approach for Mixed Integer Programming

Jaehwan Jeong, York College of Pennsylvania, 211 Willman Business Center, York, PA, 17402, United States of America, jjeong@ycp.edu, Chanaka Edirisinghe

We present an efficient approach for mixed integer quadratic optimization models based on the iterative use of our previously developed solution method for nonconvex quadratic programming. The method is tested with large-scale investment portfolio selection problems and compared with the MIQP solver in CPLEX.

2 - Logic-based Outer-approximation for the Global Optimization of Generalized Disjunctive Programs

Francisco Trespalacios, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, ftrespal@andrew.cmu.edu, Ignacio E. Grossmann

An alternative way to represent MINLP problems is Generalized Disjunctive Programming (GDP) that involves algebraic equations, disjunctions and logic propositions. In this work we present a logic-based outer-approximation algorithm to find the global solution of non-convex GDPs. The algorithm solves a master MILP and an NLP subproblem. The basic algorithm is improved with three main features: a novel derivation of a new type of cuts, a two-stage partition, and a parallelization of subproblems.

3 - A New Class of Minimum Triangle Inequalities (MINTI) for 0-1 QCQPs

Jitamitra Desai, Professor, Nanyang Technological University, 50 Nanyang Avenue, Singapore, Singapore, jdesai@ntu.edu.sg

We present a new class of minimum triangle inequalities (MINTI) for 0-1 QCQPs. We prove that these inequalities are superior to the traditionally used triangle inequalities, and offer several variations of these new cutting planes. We also present an improved branch-and-bound algorithm that incorporates certain properties from the MINTI cuts, and prove the efficacy of these cuts via our computational results.

4 - The Extended Supporting Hyperplane Algorithm for Convex MINLP Problems

Andreas Lundell, Abo Akademi University, Biskopsgatan 8, Turku, 20500, Finland, andreas.lundell@abo.fi, Jan Kronqvist, Tapio Westerlund

The extended supporting hyperplane (ESH) algorithm can be used to solve convex mixed-integer nonlinear programming (MINLP) problems as sequences of linear and mixed-integer linear programming problems. It is based on the extended cutting plane (ECP) algorithm, however instead of cutting planes, supporting hyperplanes are utilized. In addition, it includes a preprocessing step based on solving linear problems to efficiently obtain a tight linear relaxation of the nonlinear feasible region.

■ TA56

Hilton - Green Room

Software Demonstrations

Cluster: Software Demonstrations

Invited Session

1 - MATLAB: An Environment for Operations Research and Data Analytics

Seth DeLand, MathWorks, robin@mathworks.com

MATLAB is a platform for analysis, visualization, simulation, and optimization. You can access and analyze real-world data and develop customized algorithms that scale to your largest problems. Join us to see how MATLAB can help you explore data, develop algorithms, and integrate analytics into enterprise applications. You'll also learn about new features including mixed-integer linear programming, machine learning, and working with Big Data.

2 - MOSEK ApS - What's New in MOSEK 7.1

Andrea Cassioli, Product Manager, MOSEK ApS, andrea.cassioli@mosek.com

MOSEK 7.1 has just been released! We will show what's new: an improved MIP solver; a simplified interface to some BLAS functions; an extended support for MPS and the new CBF formats; a new automatic conic reformulation tool for quadratic problems; and an overall update of the Fusion API.

■ TA57

Hilton- Golden Gate 1

Assessment Techniques

Sponsor: INFORM-ED

Sponsored Session

Chair: Dionne Aleman, Associate Professor, University of Toronto, 5 King's College Road, Toronto, ON, M5S3G8, Canada, aleman@mie.utoronto.ca

1 - Does the Structure of a Capstone Design Course Matter?

Anita Vila-Parrish, North Carolina State University, Raleigh, NC, United States of America, arvila@ncsu.edu, Renata Konrad, Adrienne Hall-Phillips

The goal of this research is to explore how differing capstone course designs and structures impact student learning and related industry workforce needs. We outline the rationale, study methods, approaches to course organization, structure, and delivery used across two institutions with Industrial Engineering departments.

2 - Final Results of Reliability Testing on Georgia Tech's Oral Presentation Scoring System

Judith Norback, Georgia Tech, Atlanta, GA, United States of America, judith.norback@isye.gatech.edu

We will describe the in- depth reliability testing of the Norback/Utschig Oral Presentation Scoring System and its use at Georgia Tech. Then we will cover implementation of the scoring system in OR/ MS settings. Instructional materials will be distributed.

3 - Crowdmark: An Online Utility for Improved Grading Processes and Engineering Accreditation Review

Dionne Aleman, Associate Professor, University of Toronto, 5 King's College Road, Toronto, ON, M5S3G8, Canada, aleman@mie.utoronto.ca

Crowdmark (CM) is an online utility that allows for collaborative grading and instant delivery of feedback and class statistics to students. We analyze the process of grading via CM v. traditional grading, and find that CM presents significant time-savings and is more conducive to leaving detailed feedback for students. We investigate how CM can automatically collect and analyze assessment data for engineering accreditation review, standardizing and streamlining a typically harrowing process.

■ TA58

Hilton- Golden Gate 2

Production and Scheduling 1

Contributed Session

Chair: Gregory DeYong, Assistant Professor, Southern Illinois University, Rehn Hall 207C, Mail Code 4627, 1025 Lincoln Drive, Carbondale, Il, 62901, United States of America, gdeyong@siu.edu

1 - A Behavioral Perspective on Workload Control Concepts: Setting the Workload Norm for Order Release

Anita Klotz, Research Assistant, University of Innsbruck, Universitaetsstrasse 15, Innsbruck, 6020, Austria, anita.klotz@uibk.ac.at, Hubert Missbauer

Most of the research on production planning and control (PPC) is linked to control structures, mathematical models and algorithms without explicitly considering human behavior. For the implementation of a behavioral perspective on a PPC concept including workload control, we investigate the effect of changing the workload norms on human behavior in a laboratory experiment. Our contribution is to stress the importance of considering behavioral aspects in the specification of workload norms.

2 - Transient Analysis of Bernoulli Serial Production Line with Perishable Products

Feng Ju, University of Wisconsin Madison, 1513 University Avenue, Room 3235, Madison, WI, 53706, United States of America, fju2@wisc.edu, Jingshan Li

In this presentation, a serial production line with Bernoulli reliability model machines, finite buffers and perishable products will be presented. Analytical formulas are derived to evaluate transient performance in two-machine case. In addition, a computationally efficient aggregation-based procedure is introduced to estimate the performance in longer production lines.

3 - Optimal Control of Kanban Systems: Impact of Production and Consumption Rates

Gregory DeYong, Assistant Professor, Southern Illinois University, Rehn Hall 207C, Mail Code 4627, 1025 Lincoln Drive, Carbondale, Il, 62901, United States of America, gdeyong@siu.edu

The traditional kanban control equations ignore the effect of production and consumption rates. Instead, for purposes of cost calculation, production and consumption are considered to be instantaneous events. By modifying the traditional kanban control equations, we are able to evaluate kanban policies more effectively by improving the representation of production and consumption.

4 - A Decomposition Algorithm for the Multi-level Capacity Constrained Lot Sizing Problem

Xue Lu, London Business School, Sussex Pl, London, NW1 4PT, United Kingdom, xlu@london.edu, Zeger Degraeve

Multi-level capacity constrained lot sizing problem (MLSLCP) has high application value, but solving the problem to optimality remains daunting. We decompose the MLCLSP on the time horizon and the multi-level product structure. Computational results show that our algorithm provides a tighter lower bound than all the existing models. We also demonstrate the generality of the decomposition algorithm by extending it to the production routing problem (PRP).

■ TA59

Hilton- Golden Gate 3

Joint Session JFIG/ENRE: Optimization Methods for Invasive Species Control

Sponsor: Junior Faculty Interest Group & Energy Natural Resources and the Environment

Sponsored Session

Chair: Esra Buyuktahtakin, Assistant Professor, Wichita State University, Wichita, KS, United States of America, esra.b@wichita.edu

1 - Cost-effective Acceptance Sampling Plans for U.S. Live Plant Imports Inspection

Robert Haight, USDA Forest Service Northern Research Station, 1992 Folwell Ave, St. Paul, MN, 55108, United States of America, rhaight@fs.fed.us, Cuicui Chen, Rebecca Epanchin-Niell

We address the design of plant import inspections to prevent the introduction of quarantine organisms that threaten U.S. crops and forests. We derive an expression for expected number of accepted infested units (slippage) based on shipment size, infestation rate, sample size, and inspection efficacy. Then, we determine sample sizes for sets of shipments of unknown quality to minimize total expected slippage cost subject to inspection capacity. Optimal plans are compared with current practice.

2 - Optimal Eradication of Invasives: Complications from Structure and Species Interactions

Alan Hastings, Distinguished Professor, Department of Environmental Science & Policy, University of California, One Shields Avenue, Davis, Davis, CA, United States of America, amhastings@ucdavis.edu

I will describe the problem of eradicating an invasive species in an optimal way (minimizing budget or time). Using approaches based on linear programming to look at solutions in a deterministic setting, I will focus on the importance of stage or spatial structure in determining the optimal approach. I will then focus on problems where interactions with other species lead to constraints that change the optimal solution.

3 - An Age-, Density-, and Frequency-Structured Bio-Economic Model for Controlling Invasive Species

Esra Buyuktahtakin, Assistant Professor, Wichita State University, Wichita, KS, United States of America, esra.b@wichita.edu, Eyyüb Kibis, Greg Houseman, Tanner Lampe, Halil Cobuloglu

We present an optimization model to control a biological invasion over time with an objective of minimizing the cost of damage. The age-structured population model includes the seed bank and predicts multi (bi)-logistic rather than simple logistic growth, which may contribute to the lag response in population spread. Additionally, given budget constraints, utilizing control measures every 2-3 years is found to be more effective than yearly control because of the time to reproductive maturity.

■ TA60

Hilton- Golden Gate 4

INFORMS Undergraduate Operations Research Prize

Cluster: INFORMS Undergraduate Operations Research Prize

Invited Session

Chair: Tuncay Alparslan, tuncay.alparslan@american.edu

1 - INFORMS Undergraduate Operations Research Prize

Tuncay Alparslan, tuncay.alparslan@american.edu

The Undergraduate Operations Research Prize Competition is held each year to honor a student or group of students who conducted a significant applied project in operations research or management science, and/or original and important theoretical or applied research in operations research or management science, while enrolled as an undergraduate student. The prize is given each year at the Annual Meeting.

2 - Robust Demand Response Portfolio Management under Operational Uncertainty

Hongfan Chen, Georgia Institute of Technology, Industrial and Systems Engineering, Atlanta, GA, United States of America, Andy Sun, Shijie Deng

In this paper, we consider the demand response (DR) portfolio management problem in an electricity market environment. We particularly study the optimal management of a large number of commercial and industrial resources. We first construct a new mixed-integer optimization model to describe the dynamics of such DR resources. Then, we propose a robust optimization formulation with a new type of uncertainty sets that model the uncertainty in the demand reduction realized by DR resources. An efficient algorithm is proposed to solve the resulting nonlinear mixed integer problem. Computational experiments show the behavior and advantages of the robust optimization model.

3 - Dynamic Resource Allocation Problems with Nonstationary Customer Arrivals: Two-class Case

Chao Qin, University of Michigan, Industrial and Operations Engineering, Ann Arbor, MI, United States of America, umsjtuqc@umich.edu, Cong Shi, Cheng Hua, Huanan Zhang

We study a two-class dynamic resource allocation problem under uncertainty, with the objective of maximizing the expected revenue. The demand for each class of customers is modeled as a nonhomogeneous Poisson process, in which the instantaneous arrival rates can be nonstationary (time-dependent) and correlated, which captures realistic features such as demand seasonality and forecast updating mechanism. We devise an efficient admission control policy, called regret-balancing policy, to solve this class of problems. The key idea is to balance the regret (defined as the difference between the current cost and the hindsight optimal cost) associated with each acceptance or rejection decision. We show that our policy admits a constant worst-case performance guarantee of 2 in terms of regret. We also demonstrate through a comprehensive numerical study that our proposed policy perform consistently near-optimal, with a maximum performance error below 3%. We believe that the key ideas developed in this paper can be broadly applied to other core resource allocation or revenue management problems.

4 - Cash Management System Design for a Major Bank in Turkey

Muberra Ozmen, Middle East Technical University, Industrial Engineering Department, Ankara, Turkey, Engin Yildiz, Gamze Yagiz, Sidika Tunc, Selen Yildirim

An applied project made for a bank is discussed. There is a tradeoff between operational costs and the cost of keeping idle cash at the facilities. To minimize the overall costs while keeping the customer satisfaction at a high level, first the location decisions of the central cash offices (CCOs) and related assignment decisions are considered. Then the cash management system of ATMs is considered. The developed approaches are implemented for a geographical region. The results lead to important savings. A user interface is also developed that allows an easy updating of decisions when there are changes in the system.

5 - Impact of Sensor Measurement Errors in Sensor Positioning in Water Quality Monitoring Networks

Jisu Park, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, United States of America, jpark361@gatech.edu, Chuljin Park, Yongsoon Eun, Mustafa Aral, Seong-Hee Kim

We study the impact of sensor measurement errors in the problem of determining sensor locations in water quality monitoring networks. We develop a probabilistic model for sensor measurement errors and find sensor locations that minimize the expected time until spill detection subject to the reliability of detecting a spill is greater than a pre-specified threshold. Randomness in a contaminant spill and rain events is considered with various levels of bias and variability in sensor measurements.

■ TA61

Hilton- Golden Gate 5

MAS Tutorial Session. Management Innovation to Transform The Department of Defense Logistics Enterprise: An Update

Sponsor: Military Applications Society

Sponsored Session

Chair: Greg Parlier, Past President, MAS of INFORMS, 255 Avian Lane, Madison, AL, 35758, United States of America, gparlier@knology.net

1 - Management Innovation as a Strategic Technology

Greg Parlier, Past President, MAS of INFORMS, 255 Avian Lane, Madison, AL, 35758, United States of America, gparlier@knology.net

Using descriptive, prescriptive, and predictive analytics, the concept of "management innovation as a strategic technology" (MIST) is introduced and applied to DoD's materiel enterprise. Cutting-edge supply chain theory, powerful analytical methods, and innovative planning concepts are applied to this national security resource challenge. The complementary power of OR, advanced analytics, and management innovation for dramatic performance improvement and cost savings is demonstrated.

■ TA64

Parc- Cyril Magnin I

Optimal Policies - Supply Chain Applications

Sponsor: Applied Probability Society

Sponsored Session

Chair: Ananth Krishnamurthy, University of Wisconsin-Madison, 1513 University Avenue, Madison, WI, 53706, United States of America, ananth@engr.wisc.edu

1 - A Stochastic Control Approach to Operationalizing Offshore Production Decisions

Taimaz Soltani, Doctoral Student, Eindhoven University of Technology, Den Dolech 2, Eindhoven, Netherlands, T.Soltani@tue.nl, Arun Chockalingam, Jan C. Fransoo

We consider a firm that can offshore a portion of its production. The firm can change the proportion of offshored production at any point in time. This change incurs both fixed and proportional costs, and the firm faces a time lag between the decision time and the time the change actually occurs. We formulate this problem as a stochastic impulse control problem, and derive optimal control policies that dictate what proportion of production should be offshored at any point in time.

2 - Exploiting Structural Properties to Analyze High Dimensional Multi-Product Manufacturing Systems

Sanket Bhat, University of Wisconsin-Madison, 1513 University Avenue, Madison, WI, 53706, United States of America, sbhat2@wisc.edu, Ananth Krishnamurthy

We analyze a resource allocation problem for multi-product manufacturing systems by formulating a dynamic program. We solve the large dimensional Markov decision process through approximate linear programming approach. By exploiting the structure of the transition probability matrix, we reduce the constraints from exponential to polynomial in number of products. Through numerical studies, we demonstrate the value of divisibility in resources under seasonal demands.

3 - Dynamic Pricing and Inventory Management under Fluctuating Procurement Costs

Renyu Zhang, Olin Business School, Washington University in St. Louis, Campus Box 1156, 1 Brookings Drive, St. Louis, MO, United States of America, renyu.zhang@wustl.edu, Guang Xiao, Nan Yang

We study a periodic review joint pricing and inventory control model under procurement cost fluctuation. The firm adopts the dynamic pricing and dual-sourcing strategy to mitigate the cost fluctuation risk. We characterize the optimal policy and the impact of cost fluctuation upon the optimal decisions. Finally, we conduct extensive numerical experiments that quantify the significant value of dynamic pricing and dual-sourcing in the presence of fluctuating procurement costs and uncertain demand.

4 - Competition Risk in Sourcing Strategies for Assembled Products

Ashesh Kumar Sinha, University of Wisconsin - Madison, 2130 University Ave Apt 77, Madison, WI, 53726, United States of America, asinha4@wisc.edu, Ananth Krishnamurthy

We analyze a system where a product is assembled from multiple components sourced from vendors. The components are classified as core, intermediate, and standard in terms of their design. Using stochastic models we analyze tradeoffs and determine sourcing strategies to mitigate risks of divulging product knowledge while meeting costs and service level objectives.

■ TA65

Parc- Cyril Magnin II

Stochastic Analysis in Games

Sponsor: Applied Probability Society

Sponsored Session

Chair: Ramesh Johari, Stanford University, Huang 311, Stanford, United States of America, ramesh.johari@stanford.edu

Co-Chair: Gabriel Weintraub, Columbia Business School, gyw2105@columbia.edu

1 - Network Security and Contagion

Asuman Ozdaglar, MIT, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, asuman@mit.edu, Daron Acemoglu, Azarakhsh Malekian

We present a model of investments in security in a network of interconnected agents. The network connections introduce the possibility of cascading failures depending on exogenous or endogenous attacks and the profile of security investments by the agents. We provide a characterization of equilibrium and optimal investments as a function of the network structure and position, which is captured in terms of new network centrality measures defined through bottleneck nodes of the network.

2 - Approximations for Repeated Auctions with Budgets

Gabriel Weintraub, Columbia Business School, Columbia University, New York, NY 10027, United States of America, gyw2105@columbia.edu, Santiago Balseiro, Omar Besbes

In this talk we provide novel approximation results for the notion of Fluid Mean Field Equilibrium (FMFE) introduced to study the dynamic bidding strategies of budget-constrained agents in repeated auctions. This setting arises in online advertising markets. First, using a natural scaling, we prove that FMFE provides a good approximation to the rational behavior of agents as markets become large. Second, we show that FMFE provides a good approximation even in small markets with few players.

3 - Unbalanced Random Matching Markets: The Stark Effect of Competition

Itai Ashlagi, MIT, 100 Main st., Cambridge, MA, United States of America, iashlagi@mit.edu, Jacob Leshno, Yash Kanoria

We characterize the core in random matching markets with unequal numbers of men and women. We find that even the slightest imbalance leads to harsh competition on the long side. With high probability the core is small, in the sense that a vanishing fraction of agents have multiple stable partners. Further, under any stable matching, approximately, the short side ``chooses" and the long side is "chosen". Simulations show that these features are observed even in small markets.

4 - A Mean Field Approach to Dynamic Matching Markets

Ramesh Johari, Stanford University, Huang 311, Stanford, United States of America, ramesh.johari@stanford.edu, Nick Arnosti, Yash Kanoria

We present a mean field limit theorem for a certain class of dynamic random matching markets. In our model buyers and sellers dynamically arrive over time, and live for unit lifetime. Upon arrival, sellers apply to a subset of buyers present; upon exit, buyers can screen and/or make offers to applicants. Using a contraction argument, we provide a mean field approximation for this system when the number of buyers and sellers becomes large.

■ TA66

Parc- Cyril Magnin III

Smart Monitoring of Complex Systems

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Shuai Huang, Assistant Professor, University of Washington, Industrial and Systems Engineering, Seattle, WA, United States of America

Co-Chair: Kaibo Liu, Assistant Professor, UW-Madison, 1513 University Avenue, Madison, WI, United States of America, kliu8@wisc.edu

1 - Monitoring Wind Turbine Vibration Based on SCADA Data

Zijun Zhang, Assistant Professor, City University of Hong Kong, SEEM Department, P6600, 6/F, Academic 1, Kowloon Tong, Hong Kong - PRC, zijzhang@cityu.edu.hk

Three data-driven models for detecting abnormalities of wind turbine vibrations reflected in time domain are discussed. The k-means clustering algorithm was applied to develop the first monitoring model. The other two monitoring models for detecting abnormal wind turbine vibration were developed by using the concept of a control chart. The performance of the monitoring models for detecting abnormalities of wind turbines reflected in vibration data was validated with the SCADA industrial data.

2 - Multi-dimensional Dynamic Network Modeling and Change Detection

Jing Li, Associate Professor, Arizona State University, jing.li.8@asu.edu, Na Zou

In many areas involving network data, such as social network analysis and communication network modeling, network entities interact through a variety of channels or the interaction is measured by multiple dimensions. The interaction is also dynamic in nature, i.e., the baseline is changing. In this study, we propose a method based on Kalman filter and Gaussian process models to model multi-dimensional network evolution and detect changes.

3 - Dirichlet Process Gaussian State Machine for Change Detection in Nonlinear Nonstationary Processes

Zimo Wang, Texas A&M University, 1301 Barthelow Dr. 21C, College Station, TX, 77840, United States of America, zimowang@neo.tamu.edu, Satish Bukkapatnam, Wayne Hung

We present a nonparametric Dirichlet Process Gaussian State Machine (DPGSM) model and a hypothesis test to discern incipient changes in dynamic intermittency, which is one of the most common types of nonlinear nonstationary behaviors. Extensive experimental investigations suggest that DPGSM can detect incipient surface damage in sensor-integrated ultraprecision manufacturing processes almost two magnitudes of time earlier compared to any other method tested.

4 - Statistical Microstructure Modeling and Reconstruction of Dual Phase Steels

Nailong Zhang, Wayne State University, 5200 Anthony Wayne Dr, Apt 413, Detroit, Mi, 48202, United States of America, eo9364@wayne.edu, Qingyu Yang

Microstructure modeling and reconstruction of dual phase steels has attracted increasing attention in recent years. However, most of the existing methods only consider a single microstructure sample/image so that the randomness of different samples is ignored. In this study, we propose a new modeling and reconstruction method that captures the variation across different microstructure samples. A case study is conducted by applying the proposed method to the dual phase steel DP 980.

■ TA67

Parc- Balboa

Statistical Approaches to Personalized Healthcare II

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Abe Zeid, Northeastern University, 360 Huntington Ave, Boston, MA, United States of America, zeid@coe.neu.edu

1 - Healthcare Analytics – Predicting Patient Stay through ED Admissions

Yi-Shan Sung, Research Asistant, Penn State, 425 Waupelani Dr., Apt. 509, State College, PA, 16801, United States of America, yqs5097@psu.edu, Paul Griffin, Soundar Kumara, Priyantha Devapriya, Cheng-Bang Chen

With the introduction of 2-mid night rule it is increasingly becoming important to predict patient stay through Emergency Department Admissions. Using admission attributes, clinical parameters and past encounters we develop statistical and graph analytics based techniques to estimate individual patient's expected stay. Results from these in turn will help in developing models for better resource utilization.

2 - Provider Strategic Responses to the Affordable Care Act

Zhongyuan Yu, Stevens Institute of Technology, 1 Castle Point Terrace, Hoboken, NJ, 07030, United States of America, annie.yzy@gmail.com, William Rouse

Healthcare providers are uncertain about how they should best respond to the Affordable Care Act. We present a list of investment strategies and develop a "rich" agent-based approach. By "rich", we mean much richer rule sets and information sources including agents' financial statements and operational performance to address a variety of what-if scenarios. The model, as well a large-scale interactive visualization, facilitates gaining insights important to decision making processes.

3 - Bed Allocation to Reduce Overflow

Jingui Xie, Associate Professor, University of Science and Technology of China, Jinzhai Road 96, Hefei, 230026, China, xiej@ustc.edu.cn, Mabel Chou, Marcus Ang, David Yao

Patients who wait close to six hours are assigned to any available beds in the internal wards. As a consequence, patients are overflowed everywhere, and physicians have to walk all day long to see their patients. To address this issue, we build up an analytical model, and propose different implementable polices. We use the real data from a Singapore hospital and a simulation model to test the proposed polices.

■ TA68

Parc- Davidson

Data Analytics in Simulation

Sponsor: Simulation

Sponsored Session

Chair: Canan Gunes Corlu, Boston University, 808 Commonwealth Avenue, Boston, MA, United States of America, canan@bu.edu

1 - On the Price of Correlation Parameter Uncertainty in Simulation Optimization

Alp Akcay, Assistant Professor, Bilkent University, Ankara, 06800, Turkey, alp.akcay@bilkent.edu.tr, Bahar Biller, Canan Gunes Corlu

We consider a simulation with correlated inputs. We use a multivariate input model for representing the inputs but the correlation parameters of this model are estimated from finite data. In certain cases, the high variability around the correlation parameter estimates increases the value of the expected cost function of the simulation optimization. We discuss the minimization of the expected cost of correlation parameter uncertainty with examples from data-driven inventory management.

2 - Statistical Uncertainty Analysis for Stochastic Simulation with Dependent Input Models

Wei Xie, Rensselaer Polytechnic Institute, 110 8th Street, Center for Industrial Innovation 5207, Troy, NY, 12180-3590, United States of America, xiew3@rpi.edu, Barry Nelson, Russell Barton

When we use simulation to estimate the performance of a stochastic system, the simulation often contains input models with dependent components that were estimated from real-world data. We generalize a metamodel-assisted bootstrapping approach to quantify the impact of dependent input model and simulation estimation error on system performance estimates. Our approach is supported with both theoretical analysis and an empirical study.

3 - Comparing Simulated System Designs under Input Parameter Uncertainty

Bahar Biller, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Avenue, Pittsburgh, PA, United States of America, billerb@andrew.cmu.edu, Canan Gunes Corlu

We study the problem of comparing simulated systems designs under input parameter uncertainty while aiming for a probability of correct selection that exceeds some user-specified value. Using asymptotic normality approximation and Bayesian simulation replication algorithm for capturing parameter uncertainty in the simulation output data, we demonstrate the effectiveness of our comparison procedures as a function of data length, number of replications and number of alternative system designs.

4 - Simulation of Non-Stationary Queueing Systems

Mohammad Mousavi, Stanford University, Stanford, CA, United States of America, mousavi@stanford.edu, Peter Glynn

We discuss the challenges that arise in the planning simulations of systems with time dependent arrival and service rates. Estimating how far back in time a simulation must be initialized is an essential problem in planning simulations. We propound using reflected Brownian motion (RBM) with time-dependent drift and volatility as a guide for estimating this initialization time. We develop the first exact simulation method for RBM with time-dependent drift and volatility.

■ TA69

Parc- Fillmore

Biofuel Supply Chain and Market

Sponsor: Energy Natural Resources and the Environment/ Sustainability and Environment

Sponsored Session

Chair: Guiping Hu, Assistant Professor, ISU, 3014 Black Engineering, Ames, IA, 50011, United States of America, gphu@iastate.edu

1 - Bi-level Programming Model and Algorithm for Decentralized Biofuel Supply Chains

Fengqi You, Assistant Professor, Northwestern University, 2145 Sheridan Road, Evanston, IL, 60201, United States of America, you.fengqi@gmail.com, Dajun Yue

We develop a Stackelberg game modeling and optimization framework for biofuel supply chains with multiple players. The supply chain design problem with leader-follower relationship is formulated as a bi-level programming model, which is reformulated into a single level mixed-integer nonlinear program (MINLP) based on the KKT conditions of the followers' problems. We also develop a tailored branch-and-refine algorithm for the efficient global optimization of the resulting non-convex MINLP.

2 - A Bottom-up Equilibrium Model for Emerging Advanced Biofuel Market

Leilei Zhang, Iowa State University, 3004 Black Engineering, Ames, IA, 50011, United States of America, leileizh@iastate.edu, Yihsu Chen, Guiping Hu

We develop a bottom-up equilibrium model to study the interactions among the stakeholders along the supply chain of the emerging biofuel market considering different levels of substitution among a variety of advanced biofuels. We analyze the effects of substitution of biofuels on famers' land allocation, biofuel production, biofuel blending, and market prices under a variety of market structures. Policies impacts are analyzed on biofuel markets and social welfares.

3 - A Capacitated Lot-Sizing Model for Biofuel Production with Environmental Consideration

Esra Büyüktahtakin, Wichita State University, Wichita, KS, United States of America, Esra.Buyuktahtakin@wichita.edu, Halil Cobuloglu, Alperen Burak Kantas

In this paper, we present a multi-objective mixed-integer programming model for capacitated ethanol production from switchgrass, sugarcane, corn, and wheat. The model minimizes the production cost while considering tax credits and penalties for excessive carbon emission and water consumption. Sensitivity analysis is conducted on its application to a real biorefinery project in Kansas.

■ TA70

Parc- Hearst

Analytics in the Petrochemical and Petroleum Industries

Sponsor: Energy Natural Resources and the Environment/ Natural Resources

Sponsored Session

Chair: Marlize Meyer, Principal Operations Researcher, Sasol, 1 Klasie Havenga street, Sasolburg, 1947, South Africa, marlize.meyer@sasol.com

1 - A Heuristic Approach using Multi-phase Decomposition to Solve IRP Occurring in Bulk Gas Distribution

Tejinder Singh, AIR LIQUIDE, 12800 W. Little York Rd, Houston, TX, 77041, United States of America, tejinder.singh@airliquide.com, Jeffrey Arbogast

This paper solves the inventory routing problem (IRP) occurring in industrial gas distribution where liquefied industrial gases in bulk are distributed to customers with cryogenic tanks for storage. It considers a multi-period IRP with multiple products assuming constant demand rates. The paper details a multi-phase approach based on decomposing the original problem into different sub-problems. Each sub-problem is then solved with a heuristic method applying neighborhood search strategy.

2 - Cooperative Game Theory for Collaborative Logistics in Forestry and Petroleum Industries

Mario Guajardo, Assistant Professor, NHH Norwegian School of Economics, Helleveien 30, Bergen, N-5045, Norway, Mario.Guajardo@nhh.no, Mikael Rönnqvist

We formulate Operations Research models for collaborative logistics arising in forestry and petroleum industries. In the forestry case, the opportunities for collaboration relate to better transportation planning, timber exchange and volume assignments. In the petroleum case, they relate to pooling inventory of spare parts for off-shore platforms. We address coalition structure and cost allocation problems in these cases, using cooperative game theory concepts.

3 - The Effect of Combining RAM Modelling and Stochastic Simulation Modelling on Production Efficiency

Jacques Van Der Westhuizen, RAM Specialist, Sasol, 1 Klasie Havenga Road, Sasolburg, 1947, South Africa, jacques.vanderwesthuizen1@sasol.com

Reliability Availability and Maintainability (RAM) uses Monte-Carlo simulation models to assess key units in the production process and reduce downtime. Sasol has developed an innovative technique that combines RAM with stochastic discrete-event simulation models to assess production risk to its complex gas to liquids value chain. The value of these models has been repeatedly shown through improvements to the bottom line for existing and new plants.

■ TA71

Parc - Lombard

Bidding and Behavior in Procurement Markets

Cluster: Auctions

Invited Session

Chair: Michael N. Katehakis, Rutgers University, Newark, NJ, United States of America, mnk@rutgers.edu

1 - An Empirical Study of Electronic Reverse Auction (ERA) Project Outcomes and Satisfaction

Willem Standaert, Willem.Standaert@UGent.be, Steve Muylle

We develop and empirically test a structural model, which hypothesizes positive relationships between organizational and project antecedents, financial, operational, and strategic ERA project outcomes, and buyer satisfaction. Based on a global field study with 180 purchasing professionals, we found that operational and strategic outcomes were positively related with ERA project satisfaction, while price savings were not.

2 - A Behavioral Model for Overbidding in Sealed-Bid Multi-Attribute Procurement Auctions

Bernardo Quiroga, Pennsylvania State University, State College, PA, United States of America, bernie@psu.edu, Brent Moritz, Daniel Guide, Jr.

In sealed bid auctions, the empirical presence of over-aggressive bidding has been widely documented. Using a laboratory experiment under the independent private values paradigm, we provide a behavioral explanation of this phenomenon. We use a structural estimation of implicit latent private types and their corresponding probability density. We provide results in different contexts, including price-only, quasi-linear-scores, and 'beauty-contest' auctions including dimensions other than price.

3 - Adaptive Bidding in Repeated Auctions

Michael N. Katehakis, Rutgers University, Newark, NJ, United States of America, mnk@rutgers.edu, S. Karti Puranam

We consider the problem of a firm that procures items by bidding in repeated simultaneous auctions. We study adaptive dynamic bidding strategies for the firm that optimize measures of short and long term valuation.

■ TA72

Parc- Stockton

Energy II

Contributed Session

Chair: Mengqi Hu, Mississippi State University, PO Box 9542, Mississippi State, MS, United States of America, mhu@ise.msstate.edu

1 - How Long Do People Keep Reducing Electricity Consumption after Public Pressures?

Shigeharu Okajima, Waseda University, 1-6-1 nishi waseda Shinjyuku ku, Tokyo, Japan, shigeharu.okajima@gmail.com

Japanese media campaigns have begun to support for limiting electricity consumption after the Fukushima nuclear accident. We investigate whether Japanese media campaigns affect Japanese electricity consumption. We found that the commercial sector has reduced electricity consumption, while the residential sector has not changed electricity consumption.

2 - Financial Risk Management of a Lignocellulosic Biorefinery: A Stochastic Programming Approach

Lingfeng Cheng, PhD Student, Cornell University, 111 Wing Dr., Ithaca, NY, 14850, United States of America, lc674@cornell.edu, C. Lindsay Anderson

Bioethanol is a promising fuel alternative. However, given carbon tax constraints and ethanol price uncertainty, how much to produce and how to schedule production is a problem largely neglected. To solve this, we formulate a two-stage stochastic program. In the first stage, a process model is built with carbon tax constraints to determine the optimal production. In the second stage, a scheduling problem is formulated integrating forward contract and CVaR constraints to decrease financial risk.

3 - Collaborative Operation Strategies for Multiple Buildings with CCHP Systems

Mengqi Hu, Mississippi State University, PO Box 9542, Mississippi State, MS, United States of America, mhu@ise.msstate.edu, Rui Dai

To the best of our knowledge, most of the existing research about combined cooling, heating, and power (CCHP) systems focuses on a single building. In this study, we investigate the collaborative operation decisions for multiple buildings with CCHP systems which are allowed to freely share energy and exchange information. A collaborative decision model is presented to determine the optimal strategies that aim to minimize operational cost, primary energy consumption and carbon dioxide emission.

4 - NGL-NA: A New Model of the NGL Market of North America

Robert Brooks, President, RBAC, Inc., 14930 Ventura Blvd, Suite 210, Sherman Oaks, CA, 91403, United States of America, rebrooks@rbac.com

The last decade's "shale gas revolution" has not just recreated the US natural gas industry. It has also revitalized the markets for natural gas liquids and petrochemicals. NGL-NA is a multi-commodity model of the North American market for natural gas liquids. NGL-NA uses optimization techniques to compute flows and prices for each of the various NGL commodities through existing and prospective infrastructure. The presentation will describe the model and results from recently run scenarios.

5 - Equilibrium Investment Strategies in Renewable Portfolio Standards under Uncertainty

Yuta Kamobayashi, Tokyo University of Science, 2641 Yamazaki, Noda-shi, Chiba, Japan, 7414609@ed.tus.ac.jp, Ryuta Takashima

Recently renewable portfolio standard (RPS) has been introduced due to further penetration of renewable energies. In this paper, we propose a two-period competition model in an oligopolistic electricity industry with uncertain demand in order to consider investment behaviors for firms in a framework of the PRS. We analyze an effect of the RPS on investments in renewables and non-renewables. Additionally, we show how a percentage of production from renewables affects the market equilibrium.

■ TA73

Parc- Mission I

Optimization for Critical Infrastructure Resilience

Sponsor: Energy, Natural Res & the Environment/Energy

Sponsored Session

Chair: Feng Qiu, Argonne National Laboratory, 9700 S. Cass Av., Argonne, IL, 60439, United States of America, fqiu@anl.gov

1 - Large-scale Stochastic Power Grid Islanding Operations by Line Switching and Load Shedding

Mehdi Golari, Graduate Research Assistant, University of Arizona, Systems and Industrial Engineering Department, Tucson, AZ, 85719, United States of America, golari@email.arizona.edu, Jianhui Wang, Neng Fan

Under certain contingency states with some failed components or in the process of restoration of a failed power grid, islanding is an efficient method to isolate the failed part to prevent cascading blackout and supply the electricity to the other parts of the power system. We present a large scale stochastic MIP model as well as efficient algorithms to solve the islanding problem.

2 - Assessing and Improving Resilience of Infrastructures to both "Worst Case" and "Most Likely" Events

Dave Alderson, Associate Professor, Naval Postgraduate School, United States of America, dlalders@nps.edu, Jason Ross, Matt Carlyle

Recent events have shown our critical infrastructure systems to be vulnerable to both non-deliberate hazards (e.g., extreme weather, technological failure) and deliberate threats (e.g., terrorist attacks). These events often point to different parts of an infrastructure system as critical, leaving policy makers in a quandary about how to invest a limited budget to increase system resilience. Using a historical example, we contrast and reconcile these views under a common risk-based perspective.

3 - Power System Restoration with Integrated Sectionlization and Generator Start-up Sequencing

Feng Qiu, Argonne National Laboratory, 9700 S. Cass Av., Argonne, IL, 60439, United States of America, fqiu@anl.gov

The restoration process of the bulk power system after a partial or complete blackout relies on generating units with black-start capabilities. In the normal build-up restoration process, the system is sectionalized first into a set of subsystems (islands) in which the generators are started afterwards. In this work, we integrate the two problems into a single model that minimizes the restoration duration for the overall system.

4 - Modeling Disruption Impacts to National Critical Infrastructure

Julia Phillips, Argonne National Laboratory, phillipsj@anl.gov, Stephen Folga

Understanding impacts of disruptions to systems of nation critical infrastructure is a crucial component of national security. The IAC has created a series of linear models for select infrastructure systems that simulate immediate impacts of disruptions to these systems. Outputs include GIS representation of the impacts, as well as information to inform decision makers on critical areas to focus protection or resilience activities towards. Creating links between the models is currently underway

■ TA74

Parc- Mission II

Renewable Energy Integration and Trading in Electricity Markets

Sponsor: Energy, Natural Res & the Environment/Energy

Sponsored Session

Chair: Nur Sunar, University of North Carolina at Chapel Hill, Chapel Hill, NC, United States of America, Nur_Sunar@kenan-flagler.unc.edu

1 - Supply Function Bidding with Uncertain Supply and Demand: Electricity Markets with Renewables

Nur Sunar, University of North Carolina at Chapel Hill, Chapel Hill, NC, United States of America Nur_Sunar@kenan-flagler.unc.edu, John Birge

Despite the high penetration of renewable energy in the electricity generation mix, surprisingly, the implications of supply uncertainty for equilibrium market outcomes and generators' production schedules have not yet been fully analyzed.Using the differential equation theory, our paper shows that if renewable generators strategically bid in electricity markets, the supply uncertainty may have unexpected consequences for equilibrium day-ahead market prices and generators' production schedules.

2 - New Models for Risk Trading

Eddie Anderson, Professor, University of Sydney Business School, University of Sydney, Sydney, Australia, edward.anderson@sydney.edu.au

We introduce a new model for pricing derivatives in a wholesale electricity market, where players trade both to hedge risks and to make profit. The usual analysis derives the forward price from a stochastic model of the underlying dynamics (allowing for risk preferences). We consider a model in which prices arise from market clearing where each player has private information about the underlying price, different degrees of confidence in that information, and different risk preferences.

3 - Competition and Coalition Formation of Renewable Power Producers

Baosen Zhang, Postdoc, Stanford University, 473 Via Ortega, Y2E2 Building, Room 242, Stanford, CA, 94305, United States of America, zhangbao@stanford.edu, Ramesh Johari, Ram Rajagopal

We investigate group formation and strategic behavior of renewable power producers in electricity markets. It has been suggested that renewable producers should form large groups to take advantage of spatial diversity to reduce the uncertainty in their output. We characterize the trade-off between market power and generation uncertainty as a function of group size: there is a sweetspot where groups are large enough to achieve uncertainty reduction, but small enough to have any market power.

4 - SMART-ISO – A Stochastic Model of PJM for Renewables with Robust Cost Function Approximations

Warren Powell, Professor, Princeton University, Sherrerd Hall, Charlton St, Princeton, NJ, 08544, United States of America, powell@princeton.edu, Hugo Simao

SMART-ISO is a carefully calibrated stochastic model of the PJM energy markets and grid which closely matches the PJM decision process with day-ahead unit commitment, intermediate (30 minutes) unit commitment and real-time economic dispatch. We then introduce the idea of a robust cost function approximation policy for unit commitment, which formalizes the approach used by ISOs today. We show that a robust CFA can be tuned to handle relatively high penetrations of off-shore wind.

■ TA75

Parc- Mission III

Simulation and Optimization III

Contributed Session

Chair: Jelmer Van der Gaast, Erasmus University Rotterdam, Burgemeester Oudlaan 50, Rotterdam, Netherlands, jgaast@rsm.nl

1 - Analysis of a Polling System for Dynamic Order Picking

Jelmer Van der Gaast, Erasmus University Rotterdam, Burgemeester Oudlaan 50, Rotterdam, Netherlands, jgaast@rsm.nl

In a dynamic order picking system (DPS), an order picker picks orders in batches that arrive in real-time during its picking cycle, which subsequently changes the order picker's current picking route. We model a DPS as a polling system with batch arrivals and determine the waiting time distribution of an individual order line, as well as, the expected order throughput time. Results show that dynamic order picking lead to short order throughput times compared to traditional batch picking systems.

2 - Simulation-based Robust Revenue Maximization of Complex Truck-Shovel Systems in Surface Coal Mines

Saisrinivas Nageshwaraniyer, University of Arizona, 1502 E 10th St 134, Tucson, AZ, 85719, United States of America, ngsaisrinivas@gmail.com, Young-Jun Son

A robust simulation-based optimization approach is proposed for surface coal mines to maximize revenue. A highly detailed simulation model of a real mine is constructed for case study. Response Surface Methodology is then applied to obtain variance of revenue under the influence of uncontrollable factors such as truck haul times, which are later applied as constraints in optimization. The proposed approach results in higher and robust revenues compared to non-robust optimization formulation.

3 - Labor Capacity Assignment Model for Remanufacturing Environments

Osman Aydas, PhD Student / Research Assistant, University of Wisconsin - Milwaukee, 3202 N. Maryland Ave., Milwaukee, WI, 53211, United States of America, otaydas@uwm.edu, Anthony Ross, Wilkistar Otieno

Study evaluates the performance of labor capacity assignment models of remanufacturing environments characterized by stochastic order arrivals and dynamic labor assignment policies. We consider multiple tiers of repair lead time, seasonality in product flows and different employee skill set requirements for a multistage remanufacturing process. A simulation model is developed to investigate alternatives to achieving the performance targets.

4 - A Comparative Study of TOPSIS, GRA and VICOR Based Taguchi Methods for Optimization of FMS

Berna Dengiz, Professor, Baskent University, Eskisehir Road 20th. km, Ankara, 06510, Turkey, bdengiz@baskent.edu.tr, Yusuf Tansel Ic, Orhan Dengiz, Gozde Cizmeci

This study presents a case study of an FMS considering a multi-response simulation optimization using TOPSIS, GRA and VICOR based Taguchi methods. While reducing simulation experiments with Taguchi design, TOPSIS, GRA and VICOR procedures are used to combine multiple FMS responses into a single response. Optimal configuration is obtained for the FMS with improved performance. Results show that TOPSIS and GRA-based Taguchi methods are better than VIKOR-based Taguchi methods.

■ TA76

Parc- Embarcadero

Succeeding with Revenue Management

Sponsor: The Practice Track

Sponsored Session

Chair: Warren Lieberman, President, Veritec Solutions, 824 Miramar Terrace, Belmont, CA, 94002, United States of America, Warren@veritecsolutions.com

1 - Revenue Management in the Big Data Era

Alex Dietz, Principal Industry Consultant, SAS Institute, SAS Campus Drive, Cary, NC, 27513, United States of America, alex.dietz@sas.com

In the era of Big Data, an impressive array of data has become available to support RM decisions, including competitive prices, customer reviews, and even web logging information. This piece will delve into the practical applications, value, and limitations of this data, based on both research and real-world experience.

2 - Models and Methods

Warren Lieberman, President, Veritec Solutions, 824 Miramar Terrace, Belmont, CA, 94002, United States of America, Warren@veritecsolutions.com

Based on our work in several dozen industries, we have found that certain modeling characteristics can increase the effectiveness of Revenue Management decision support tools. In addition, we have found that organizational structures can significantly affect the quality of Revenue Management/Dynamic Pricing decisions. In this session, we explore the impacts of models and methods on the success of revenue management implementations.

3 - Revenue Management at Disney Cruise Line

Erin Clark, Director, Revenue Management, Disney Cruise Line, 210 Celebration Place, Kissimmee, FL, 34747, United States of America, Erin.Clark@Disney.com

Although relatively small in comparison to many other cruise lines, Disney Cruise Line (DCL) has been a leader in the industry with respect to implementing critical Revenue Management strategies and tactics. While Revenue Management models have certainly been important, so too have DCL's organizational and business process decisions. Our presentation will highlight a variety of aspects of our Revenue Management approach.

■ TA77

Parc- Market Street

Joint Session Analytics/HAS: Topics of Healthcare Analytics II

Sponsor: Analytics & Healthcare

Sponsored Session

Chair: Issac Shams, University of Michigan-Ann Arbor, 1205 Beal Ave, Ann Arbor, MI, 48109, United States of America, issacsh@umich.edu

1 - An Analytics Approach to Designing Patient Centered Medical Homes

Saeede Ajorlou, University of Michigan-Ann Arbor, 1205 Beal Ave, Ann Arbor, MI, 48109, United States of America, saeede@umich.edu

This talk presents an analytics approach to design a Patient Centered Medical Home from an operations management point of view. Aggregating multiple data tables for patient attributes, provider characteristics, and station and division variables, we first developed statistical models with variable selection routines to predict annual portfolio healthcare demands. Then, using these models we proposed stochastic optimization models that assign patients to a set of PCMH teams.

2 - A Simulation-based Approach to Estimate the Proportion of Tuberculosis Recent Transmission

Parastu Kasaie, Postdoctoral Fellow, The Johns Hopkins Bloomberg School of Public Health, 3231 Bishop St, Cincinnati, OH, 45220, United States of America, kasaiept@mail.uc.edu, David W. Dowdy, W. David Kelton

Accurate estimation of the proportion of TB from recent vs. remote transmission is critical to disease-control policy. Existing cluster-analysis approaches of TB strains in studies of molecular epidemiology are crude and prone to bias. We study, via simulation, the accuracy of such estimates in relation to disease incidence, underlying reactivation rate, sampling coverage and duration, and develop a more accurate estimator for the true proportion of incidence due to recent transmission.

3 - Predicting Daily Negative Moods of Young Adults using an Elastic-Net Regularized Model

Fan Wang, University of Arkansas, 4207 Bell Engineering, Fayetteville, AR, 72701, United States of America, fxw005@uark.edu, Shengfan Zhang

Depression and stress are two common negative moods in young adults. This study establishes a logistic regression model to predict daily depression and stress for university students. The explanatory variables involve a variety of personal attributes, such as flu symptoms, daily cellphone use and life style. The elastic-net regularization is used to handle the collinearity problems and estimate the best prediction model. Multiple resampling techniques are used to tune the elastic-net parameters.

■ TA78

Parc- Mason

The Past, Present and Future of Teaching Decision Analysis

Sponsor: Decision Analysis

Sponsored Session

Chair: Ali Abbas, Professor, University of Southern California, Industrial and Systems Engineering, Price School of Public Policy, Los Angeles, CA, United States of America, aliabbas@illinois.edu

1 - Teaching Decision Making with Social Networks

Ali Abbas, Professor, University of Southern California, Industrial and Systems Engineering, Price School of Public Policy, Los Angeles, CA, United States of America, aliabbas@illinois.edu

Teaching decision making with social networks is a new and fun reverse-classroom setting that provides hands-on training and enables students to see immediate benefits of the decision tools they learn in class. This talk summarizes the learning of teaching decision making with Ahoona, a free decision making social network.

2 - DQ 101: An introduction to Decision Quality

Carl Spetzler, Chairman and CEO, SDG, 745 Emerson Street, Palo Alto, CA, 94301, United States of America, cspetzler@sdg.com

This session will review the content of the free MOOC that provides a basic understanding of the elements of DQ. The course requires about 15 hours of effort over five weeks and uses short (3-15 minutes) lectures in a team based online platform. We will also share our experience after having given the course four times.

3 - Innovative Methods and Tools to Teach DA/DQ and Provide On-Demand Decision Support

Mazen Skaf, Managing Director, Strategic Decisions Group, 745 Emerson St, Palo Alto, CA, 94301, United States of America, mskaf@sdg.com

We present innovative tools aimed at teaching the basic principles and methods of DA/DQ, promoting the use of DA, and providing decision support for organizational as well as personal decisions.

4 - Teaching While Doing – Will Universities Join or Get Out of the Game?

Jim Matheson, Chairman, SmartOrg, Inc., 855 Oak Grove Ave Ste 202, Menlo Park, CA, 94025, United States of America, jmatheson@smartorg.com

I began DA in 66-7, and teaching at SU from 68. By mentoring PhD Students, an internship requirement by Bill Linvill, fostered their interest and practical skills. IDs were invented! This year I taught Frontiers in DA by one-day flights and web meetings. Now, SmartOrg is embedding Decision Systems in real organizations, and for the summer has taken on four interns, who will learn much. The future may flip back to internships with mentors and web classes to share experience and learn theory.

5 - Teaching with Ron
Brad Powley, Consultant, SDG, 745 Emerson Street, Palo Alto, CA, 94301, United States of America, bpowley@sdg.com

For many graduate students, being a teaching assistant is a means of funding. Those who served as teaching assistants for Ron Howard's classes will attest that the job itself was one of the most important learning experiences of their university education. This talk will explore Ron's approach to teaching through the unique perspective of his teaching assistants.

6 - What's Past is Prologue: Lessons from Howard Raiffa's Pioneering Multimedia Courses
Patrick Noonan, Professor & Assoc. Dean, Emory University, 1300 Clifton Rd NE, Atlanta, GA, 30322, United States of America, patrick.noonan@emory.edu

The terms "decision analysis" and "multimedia" are both celebrating 50th anniversaries. Early in the history of both, Howard Raiffa started experimenting with unorthodox blends of print, audio and eventually early PC tools to teach DA. Some of these works shine today, not only as important artifacts of DA history and wonderful, still-relevant examples of his gift for explanation, but as guides for how DA education can thrive in an era of ubiquitous Internet, apps, flipped classes and MOOCs.

■ TA79

Parc- Powell I

Medical Applications in Decision Analysis

Sponsor: Decision Analysis

Sponsored Session

Chair: Jeff Stonebraker, Assistant Professor, North Carolina State University, Campus Box 7229, Raleigh, NC, 27695, United States of America, jsstoneb@ncsu.edu

1 - Medical Technology Applications
Phil Beccue, White Deer Partners, 2228 Knollcrest Pl, Westlake Village, CA, 91361, United States of America, Phil@WhiteDeerPartners.com

Medical products are often perceived as the orphan sister to the glamorous drug industry, yet they include essential elements of modern medical care, from CT scanners to robots used by surgeons. With their unique regulatory and financial pressures, product managers have relied on Decision Analysis methods to help navigate the path to success. We discuss the enhanced value that DA is bringing to this business in a number of recent applications.

2 - Implementation of Decision Analysis for Claims Management at Stanford Medical Center
John Celona, Principal, Decision Analysis Associates, 505 Vista Ave, San Carlos, CA, 94070, United States of America, jcelona@sbcglobal.net

Stanford University Medical Center self-insures and manages claims and lawsuits. Beginning five years ago, we developed and implemented a process to enable routine decision analysis of all lawsuits and claims to drive case management strategy and to set reserves for the captive insurance companies. We present the methods and the results, which to date are far superior to the results from previously used actuarial methods.

3 - Implementing Decision Analysis in a Healthcare Information Technology Company
Elayne Ko, Director, Portfolio and Decision Analysis, Pfizer, Inc., Collegeville, PA, United States of America, Elayne.ko@pfizer.com, Tom Stone

The presentation explores the journey and learning of implementing decision analysis in a healthcare information technology (HIT) company. In HIT, the relationship between specific product investment and return is much less direct compared to the typical industries where decision analysis is more prevalent, e.g., pharmaceutical, oil & gas, mining. This poses challenges in evaluating HIT product investments and decision-making, requiring unique approaches to valuation and risk assessment.

4 - Modeling Latent Therapeutic Demand
Jeff Stonebraker, Assistant Professor, North Carolina State University, Campus Box 7229, Raleigh, NC, 27695, United States of America, jsstoneb@ncsu.edu

This presentation discusses a new medical application area of decision analysis. Decision analysis has been applied extensively in medical decision making for the prevention of, diagnosis of, and the treatment of diseases. There are, however, diseases that can't be prevented. These diseases are often under-supplied where treatment is scarce and uncertain and, consequently, suboptimal for patients. We use decision analysis to model the number of people with the disease and how they are treated.

■ TA80

Parc- Powell II

Real Options in Business Strategy

Sponsor: Decision Analysis

Sponsored Session

Chair: Dharma Kwon, Assistant Professor, University of Illinois at Urbana-Champaign, 1206 South Sixth Street, Champaign, United States of America, dhkwon@illinois.edu

1 - Technological Change: A Burden or a Chance
Verena Hagspiel, Norwegian University of Science and Technology, Industrial Economics and Technology Mgt., Trondheim, Norway, verena.hagspiel@iot.ntnu.no, Peter Kort, Claudia Nunes, Pedro Jesus

This paper considers a firm that faces a declining profit stream for its established product. The firm has the option to invest in a new technology with which it can produce an innovative product while having the option to exit as well as suspend operations at any point in time. Besides timing the firm also has to decide about the size of investment.

2 - The Value of Reducing Lead Time under Non-Stationary Demand
Isik Bicer, Mr., University of Lausanne, Quartier UNIL-Dorigny, B,timent Anthropole, Lausanne, 1015, Switzerland, isik.bicer@unil.ch, Suzanne De Treville, Verena Hagspiel

We build newsvendor model on real-options theory and investigate the value of lead-time reduction under the risk of sudden and abnormal changes in demand forecasts. We use a "jump-diffusion" model and apply an Edgeworth series expansion to explore the impact of sudden changes in demand forecasts on the value of lead-time reduction. We show that the value of lead-time reduction increases substantially in the intensity and/or the magnitude of jumps.

3 - Multi-item Search with Holding Costs
Steven Lippman, slippman@anderson.ucla.edu, Sheldon Ross

We consider a multi-item search problem with a holding cost that is linear in the number of unsold items wherein the seller optimally sells n items. Suppose instead that there are n sellers each with one unit to sell. We show that the return to the n sellers in the decentralized problem is the same as the return to the single seller with n units to sell.

4 - Stochastic Dynamic Game of Principal-Agent under Asymmetric Information with Unobservable Action
Youngsoo Kim, University of Illinois, Chicago, IL, United States of America, ykim180@illinois.edu, Dharma Kwon

We study a dynamic game between an employer and an employee. The employer cannot observe the employee's type and effort, but the employer can observe the employee's performance, which is a Brownian motion with drift governed by the employee's type and effort. The employer learns about the employee's type to either dismiss or promote the employee, and the employee reacts by putting an effort. We find Markov Perfect Bayesian equilibria and compare equilibrium strategies for each type of employees.

■ TA81

Parc- Divisadero

Joint Session Data/AI/HAS: Big Data Analytics and Smart Health III

Sponsor: Data Mining, Artificial Intelligence, & Healthcare

Sponsored Session

Chair: Sung Won Han, New York University, 650 First Avenue, New York, NY, United States of America, sungwonhan2@gmail.com

1 - Strategic Lean Implementation in Healthcare
Yong Taek Min, Boston University, Boston, MA, United States of America, ytmin@bu.edu, Jay Kim, Joseph Restuccia, Michael Shwartz

We assess if there are different lean implementation strategies in hospitals and how effective they are in improving quality and efficiency performance. Lean implementation patterns are identified based on hospitals' differing degree of emphasis on lean principles. Quality and efficiency performance of each hospital is analyzed by using CMS database.

2 - Infectious Disease Facility Location and Outbreak Response Strategies for Africa
Neil Desnoyers, Assistant Clinical Professor, Drexel University, 3141 Chestnut Street, Philadelphia, PA, 19104, United States of America, ndesnoyers@drexel.edu

The 2013-2014 outbreak of Zaire ebolavirus demonstrates, "Örapid, reliable diagnostic procedures must be implemented Ö closer to endemic [areas] so that local public health officials Ö need [not] rely on distant reference laboratories."(NEJM doi:10.1056/NEJMp1405314) For Ebola and Lassa viruses, diagnostic procedures must be carried out in a BSL-4 laboratory: Two such exist in Africa. We explore facility location and outbreak response strategies using decision modeling techniques.

3 - Data Fusion of 9-axis Inertial Measurement Unit (IMU) From Modern Pedometer for Health Application
Liang Zhou, LiangZhou@savvysherpa.com

Pedometers use built-in accelerometer to count steps. Along with the additional gyroscope and magnetometer sensors, a modern pedometer is able to capture 9-axis data in real-time. In our study, a data fusion method is developed to integrate the outputs from 3 sensors, and a model based activity classification framework is introduced to identify certain types of ADLs (Activities of Daily Living). Some potential health applications will be discussed.

4 - Modeling and Analysis of Multiple Patient Rapid Response Process
Xiaolei Xie, Tsinghua University, Shunde Building, Beijing, 100084, China, xiexiaolei0209@gmail.com, Jingshan Li, Colleen Swartz, Paul DePriest

Improving efficacy of hospital rapid response operations is crucial, which are designed and implemented to treat deteriorating patients. We present an analytical model with a multi-patient network to characterize such a process and evaluate the mean decision time, which is strongly correlated with care quality. Medical resource sharing issue is addressed using a two-level iteration method. Finally, the impact of other factors, such as time variability of patient in normal status, is studied.

■ TA82

Parc- Haight

Behavioral Issues in Adversarial Preference Modeling

Sponsor: Multiple Criteria Decision Making

Sponsored Session

Chair: Gilberto Montibeller, London School of Economics, Houghton Street, London, United Kingdom, G.Montibeller@lse.ac.uk

1 - A Multiple-Target Defensive Resource Allocation Game with Quantal-Response Attacking Strategies
Jun Zhuang, University at Buffalo, 317 Bell Hall, Buffalo, NY, 14260, United States of America, jzhuang@buffalo.edu, Yan Wang

This research studies a new attacker-defender game over multiple targets, where the attacker is bounded rational and assumed to use quantal-response strategies. We validate the model using real data from both terrorism and counterterrorism databases.

2 - Adaptive Security Resource Allocation for Protecting Wildlife and Fisheries
Milind Tambe, USC, 3737 Watt Way, PHE 410, Los Angeles, CA United States of America, tambe@usc.edu

While previous works have deployed applications with a game-theoretic approach for counter-terrorism, protecting wildlife and fisheries are important domains presenting new research challenges related to learning behavioral models from collected poaching data. We address this challenge and develop a new algorithm that adaptively improves the security resource allocation strategy against the learned behavioral model.

3 - Framing Value-driven Decision Models for Different Classes of Cyber Adversaries
Richard John, Associate Professor, University of Southern California, RTH 310, University Park, Los Angeles, CA, 90089, United States of America, richardj@usc.edu, Heather Rosoff, Detlof von Winterfeldt

Cyber attackers generally have multiple and conflicting objectives that underlie their motivations. Attackers have evolved from single individuals to organized groups, some state-sponsored, with advanced capabilities to attack U.S. cyber systems. For different classes of cyber adversaries, we demonstrate diversity in values and objectives, attitudes toward risk, trade-offs among conflicting objectives, and uncertainty about the outcomes for alternative attack strategies.

4 - On the Behavioral Validity of Adversaries' Judgments in Count-terrorism Models
Sumitra Sri Bhashyam, Houghton Street, wc2 2ae, London, United Kingdom, S.Sribhashyam@lse.ac.uk, Gilberto Montibeller

In adversarial models, terrorist are seen as rational agents that maximize expected utility, as consequentialist decision makers who have clear objectives and stable preferences, and as being capable of appraising dispassionately the decision context. Here we will scrutinize these assumptions, with evidence available from the terrorism and behavioral decision research literatures, and suggest ways that judgments in counter-terrorism models can be modelled to improve their behavioral validity.

■ TA83

Parc- Sutro

Quality and Statistical Decision Making in Health Care Applications

Sponsor: Data Mining

Sponsored Session

Chair: Shuai Huang, Assistant Professor, University of Washington, Industrial and Systems Engineering, United States of America, shuaihuang@usf.edu

1 - Outcome and State Transition Modeling for Adaptive Interdisciplinary Pain Management
Aera Leboulluec, Adjunct Professor, University of Texas at Arlington, 500 West First Street, 420 Woolf Hall, P.O. Box 19017, Arlington, TX, 76006, United States of America, aerakim77@yahoo.com, Victoria Chen, Li Zeng

This research develops a process based on the inverse probability of treatment weighted method to address the endogeneity while estimating state transition and outcome models. First, a method is developed for independent treatments then a general method is developed for correlated treatments.

2 - Development of Clinical Nutrition Staffing Models Based on Patients Electronic Health Records
Kai Yang, Director, Healthcare Systems Engineering Group, Wayne State University, 4815 4th street, Detroit, MI, 48201, United States of America, kai.yang@wayne.edu, Saeede Ajorlou

The objective of this study is to develop clinical workload models for nutritionists based on patients' electronic health records. A comprehensive multilevel database for inpatient admissions and outpatient visits is first assembled that involves patient, clinical, and case-mix risk factors. Then a hierarchical additive model with a feature selection algorithm that determines a subset of the most relevant factors is used to predict nutritional staffing requirements.

3 - Recursive Reconstruction Method for Time Varying Sparse Signal from Noisy Undersampled Measurements
Kaveh Bastani, Virginia Tech, kaveh@vt.edu, Zhenyu Kong

We study the recursive reconstruction of time varying sparse signal from noisy undersampled measurements. This type of problem has been seen in many signal processing applications, like real-time dynamic MRI. We propose a reconstruction method by estimating the global support set of the signal from the covariance matrix of time series measurements. Then, the recursive reconstruction method is proposed based on sparsity analysis of the truncated signal from spike-and-slab prior model.

4 - A Joint Spectral Decomposition Method for Time-dependent Network Data
Shuai Huang, Assistant Professor, University of Washington, Industrial and Systems Engineering, United States of America, shuaihuang@usf.edu, jing li

The network spectral decomposition method has been widely adopted as a critical enabler in many exiting network analysis methods. Considering that existing spectral decomposition method was built for static network, we develop a general methodology for conducting spectral decomposition on time-dependent network data. The proposed methodology is thoroughly evaluated on two important applications that involve time-dependent network data, e.g., the network prediction and network monitoring.

Tuesday, 11:00am - 12:30pm

■ TB01

Hilton- Golden Gate 6

Mission Planning II

Sponsor: Military Applications Society

Sponsored Session

Chair: Michael Hirsch, President, ISEA TEK, 620 N. Wymore Road, Suite 260, Maitland, FL, 32751, United States of America, mhirsch@iseatek.com

1 - UAV Route Planning using Stochastic Dynamic Programming
Aaron Williams, PhD Student, University of Illinois at Champaign-Urbana, 1014 W. Church St., Apt2, Champaign, IL, 61821, United States of America, amwilli2@illinois.edu

We consider the problem of route planning with multiple UAVs with varying degrees of communication on a single map. We present multiple stochastic dynamic programming algorithms to deal with these varying degrees of communication. The stochastic dynamic programming approach has advantages in computational complexity, essential for onboard route planning. We measure the amount of information lost at each communication level.

2 - Sensor Tasking for Unmanned Aerial Vehicles with Limited Communications Bandwidth
Chase Murray, Auburn University, 3301 Shelby Center, Auburn, AL, United States of America, CCM0022@auburn.edu

This talk will explore a sensor tasking problem, where directional sensors operating in multiple modalities must be allocated to time sensitive targets. The system operates in a communications bandwidth-limited environment, such that part of the problem involves deciding the resolution of the data captured as well as the delay between the capture and the broadcast of data. A novel solution approach, making use of the underlying mixed integer linear programming formulation, is presented.

3 - An Exact Method for the Peace-Time Convoy Movement Problem to Minimize Civilian Traffic Disruption
Azar Sadeghnejad Barkousa, University At Buffalo, Industrial & Systems Engineering, Buffalo, NY, 14260, United States of America, azarsade@buffalo.edu, Moises Sudit, Rajan Batta

We seek optimal routing for convoys, with specific time windows and blocking/overtaking constraints, in order to minimize civilian traffic disruption. We offer an exact algorithm based on k shortest path and maximum clique problems. Numerical testing on random networks is performed. CPLEX fails to solve even 6 convoy problems on a 24 node network in 4 hrs. Our method finds an optimal solution for such problems in less than 1 second. A realistic case study from Colombia is our next step.

4 - Measuring the Price of Anarchy for UAV teams
Hector Ortiz-Pena, CUBRC, CUBRC, Buffalo, United States of America, Hector.Ortiz-Pena@cubrc.org, Michael Hirsch, Moises Sudit, Mark Karwan

We develop a formulation to maximize the information gain from a team of autonomous unmanned vehicles (UxVs) to support Intelligence, Surveillance and Reconnaissance (ISR) mission objectives. The formulation is used to evaluate the Price of Anarchy.

■ TB02

Hilton- Golden Gate 7

Business Ecosystem, Networks and Innovation

Sponsor: Technology, Innovation Management and Entrepreneurship

Sponsored Session

Chair: Jianxi Luo, Assistant Professor, Singapore University of Technology & Design, 20 Dover Drive, Singapore, SG, Singapore, luo@sutd.edu.sg

1 - Modeling the Evolution of Generativity and the Emergence of Digital Ecosystems
Jason Woodard, Assistant Professor, Singapore Management University, School of Information Systems, 80 Stamford Road, Singapore, 178902, Singapore, jwoodard@smu.edu.sg, Eric Clemons

Agent-based computational modeling offers a powerful tool for studying decentralized innovation and the emergence of digital business ecosystems. We have created a series of models that show how key features of these ecosystems can evolve, including core components and reusable parts. We find that boundedly rational designers without coordination or foresight can generate ecosystems that satisfy diverse consumer preferences and exhibit robustness to changes in these preferences over time.

2 - Using Transaction Networks to Describe the Structure of Sectors
Margaret Dalziel, University of Waterloo, 200 University Avenue West, Waterloo, Canada, mdalziel@uwaterloo.ca, Xiangyang Yang

Today's products are created by the combined efforts of numerous firms linked together by transactions into vast networks known as sectors. Using a novel dataset of the major transactions in the US economy, we analyze the structure of sectors.

3 - Knowledge Discovery for Business Ecosystem Intelligence
Hyunwoo Park, Georgia Institute of Technology, 85 5th St NW, Atlanta, GA, 30308, United States of America, hwpark@gatech.edu, Rahul Basole, Brandon Barnett

We develop and apply a computational knowledge discovery approach for understanding and visualizing innovation, coopetition, and convergence in business ecosystems.

4 - Transaction Cycle Participation, Vertical Integration, and Innovation: An Empirical Network Analysis
Jianxi Luo, Assistant Professor, Singapore University of Technology & Design, 20 Dover Drive, Singapore, SG, Singapore, luo@sutd.edu.sg

A firm's architecture of participation in the business ecosystem may affect its innovation performance. We analyze the transaction network positions and performances of 227 Japanese electronics firms. The results show that, a firm's participation in inter-firm transaction cycles, instead of sequential transactional relationships, has a positive impact on its innovation performance for vertically-integrated firms, but a negative impact for vertically-specialized firms.

■ TB03

Hilton- Golden Gate 7

IS Research with Policy Implications

Sponsor: eBusiness

Sponsored Session

Chair: Min-Seok Pang, Assistant Professor, Temple University, Philadelphia, PA, United States of America, mins.pang@gmail.com

1 - An Economic Analysis of Shared IT Services in Public Sector
Min Chen, George Mason University, 4400 University Drive, Fairfax, VA, 22030, United States of America, mchen15@gmu.edu, Min-Seok Pang

In this study, we build a simple, stylized economic model to analyze the decisions for developing and pricing of a shared IT service, which is a unique phenomenon in the public sector. Governments collectively share enterprise IT services for public services in order to save costs and to improve their bargaining power vis-a-vis IT vendors. We derive implications for the private-sector IT industries.

2 - Gamification Doesn't Work: The Effect of Virtual Rewards and Reputation on User Contributions
Wei Chen, University of California, San Diego, 9500 Gilman Drive, La Jolla, CA, 92093, United States of America, Wei.Chen@rady.ucsd.edu, Xiahua (Anny) Wei, Kevin Zhu

This study examines the effect of two gamification mechanisms, virtual rewards and reputation, on voluntary user contributions in online communities. We analyze panel data from a knowledge sharing platform, and find that surprisingly, neither virtual rewards nor reputation induce user contributions. It is the relative reputation (ranking) that plays a role. These findings highlight the importance of social comparison in the incentive design of online communities.

3 - An International Investigation of the Market Value Impacts of Energy and Carbon Management Systems
Daniel Rush, University of Michigan, R4431 Ross School of Business, 701 Tappan Street, Ann Arbor, MI, 48109, United States of America, danrush@umich.edu, Nigel Melville

Energy and Carbon Management Systems (ECMS) are a new type of information system that enable organizations to measure and manage their energy, carbon dioxide, and other greenhouse gases. Companies world-wide are adopting ECMS to comply with regulations, further organizational goals, and respond to their stakeholders. Despite this increased adoption, the financial impacts of these systems are not well understood. This international event study thus investigates the market value impacts of ECMS.

4 - The Internet and Hate Crime: Offline Spillovers from Online Access
Jason Chan, NYU, Stern School, New York, NY, United States of America, jchan@stern.nyu.edu, Anindya Ghose, Robert Seamans

In this paper, we empirically investigate the effect of the Internet on racially-driven hate crimes. To understand the link, we study the extent to which broadband availability affects racial hate crimes in the US from 2000-2008. We deploy a set of econometric techniques to account for estimation biases. We find strong evidence that broadband availability increases racial hate crimes and its effects are stronger in areas with higher levels of racism, income inequality, and education attainment.

■ TB04

Hilton- Continental 1

Empirical Supply Chain Studies

Sponsor: Manufacturing & Service Operations Management

Sponsored Session

Chair: Jun Li, Assistant Professor, Ross Business School, University of Michigan, 701 Tappan Street, Ann Arbor, MI, 48109, United States of America, junwli@umich.edu

1 - Supply Chain Disruptions and the Role of Information Asymmetry

William Schmidt, Assistant Professor, Johnson Graduate School of Management, 314 Sage Hall, Ithaca, NY, 14853-6201, United States of America, wschmidt@cornell.edu, Ananth Raman

Disruptions have been found to damage firm value. This may induce (1) managers to behave strategically in revealing operational disruptions and (2) the market to respond differently to disruptions when managers can behave strategically. Both factors distort the true economic impact of disruptions on firm value. Our research sheds light on these tangled relationships.

2 - Risk Propagation in Supply Network

Yixin (Iris) Wang, Ross School of Business, 701 Tappan Street, Ann Arbor, MI, United States of America, iriswang@umich.edu, Jun Li, Ravi Anupindi

The goal of this research is to assess interdependency of risks in supply network and to understand the process of risk propagation using firm-level supplier relationship data and risk event data. We focus on high-tech industry and concentrate on impacts of disruptions on interrelated firms through supplier-buyer relationship or more broadly, through sharing common suppliers/customers. We aim to help firms manage risks more efficiently and acknowledge sub-tier importance.

3 - Systematic Risk in Supply Chain Networks

Nikolay Osadchiy, Assistant Professor, Emory University, 1300 Clifton Rd NE, Atlanta, GA, 30309, United States of America, nikolay.osadchiy@emory.edu, Vishal Gaur, Sridhar Seshadri

The demand uncertainty faced by a firm can be caused by idiosyncratic factors or systematic economic factors. We investigate how systematic risk propagates through supply chain networks using industry-level data for the manufacturing, wholesale trade, and retail trade sectors of the U.S. economy. We find that the systematic risk increases from retailers to wholesalers and manufacturers, and the increase in systematic risk is driven by the aggregation of orders over customers and time.

4 - Supply Chain Network Structure and Firm Returns

Jing Wu, PhD Student, University of Chicago Booth School of Business, 5050 S Lake Shore Dr 3417S, Chicago, IL, 60615, United States of America, wujing@chicagobooth.edu, John Birge

This paper investigates the effects of supply chain connections on firm performance, as reflected in stock returns, at two interaction levels, first-order from directions and second-order from systemic exposures through the network.

■ TB05

Hilton- Continental 2

Dynamic Learning and Decision Making

Sponsor: Manufacturing & Service Operations Management

Sponsored Session

Chair: Hao Zhang, University of British Columbia, 2053 Main Mall, Vancouver, BC, V6T1Z2, Canada, hao.zhang@sauder.ubc.ca

1 - Generalization and Exploration via Randomized Value Functions

Zheng Wen, Stanford University, 555 W Middlefield Rd, Apt. A304, Mountain View, CA, United States of America, wenzheng.ee@gmail.com, Benjamin Van Roy

We consider reinforcement learning problems in which an agent must generalize from past experience and explore to reduce uncertainty. We propose an approach to explore based on randomized value functions and an algorithm — randomized least-squares value iteration (RLSVI) — that embodies this approach. We explain why algorithms using Boltzmann or epsilon-greedy exploration can be highly inefficient and present computational results that demonstrate dramatic efficiency gains enjoyed by RLSVI.

2 - Weakly Coupled Dynamic Program: Information and Lagrangian Relaxations

Fan Ye, Georgia Institute of Technology, 755 Ferst Drive, NW, Atlanta, GA, 30332, United States of America, fye8@gatech.edu, Enlu Zhou, Helin Zhu

"Weakly coupled dynamic program" consists of multiple controlled stochastic processes that evolve independently but subject to a set of linking constraints on the controls. It decouples into lower-dimensional dynamic programs via Lagrangian relaxation on the linking constraint, which also yields a bound on the optimal value. Based on the Lagrangian relaxation, we utilize the information relaxation approach and propose a computationally tractable method to obtain a tighter dual bound.

3 - Learning to Optimize Via Information-Directed Sampling

Daniel Russo, Stanford University, 218 Ayrshire Farm Lane, Apt. 102, Stanford, CA, 94305, United States of America, dan.joseph.russo@gmail.com, Benjamin Van Roy

We offer a fresh, information-theoretic, perspective on the exploration/exploitation tradeoff and propose a new algorithm—information-directed sampling—for a broad class of online optimization problems. We establish a general expected regret bound and demonstrate strong simulation performance for the widely studied Bernoulli, Gaussian, and linear bandit problems. Simple analytic examples show information-directed sampling can dramatically outperform Thompson sampling and UCB algorithms.

4 - Exact Solution to a Dynamic Learning and Decision Making Problem

Hao Zhang, University of British Columbia, 2053 Main Mall, Vancouver, BC, V6T1Z2, Canada, hao.zhang@sauder.ubc.ca

Dynamic decision making is about choosing the best sequence of actions under sequential observations. It is especially challenging when the underlying state (of the machine, patient, customer, etc.) is unobservable. For a large class of problems, e.g. Bayesian learning and sequential hypothesis testing, the underlying state does not change over time. We discuss a general approach for solving such problems, and present an exact solution in the two-state case with interesting structural results.

■ TB06

Hilton- Continental 3

Practice-Based Research in Humanitarian Operations Management

Sponsor: Manufacturing & Service Operations Management

Sponsored Session

Chair: Alfonso Pedraza-Martinez, Assistant Professor, Kelley School of Business, Indiana University, 1309 E 10th Street, Kelley School of Business, IU, Bloomington, IN, 47405, United States of America, alpedraz@indiana.edu

1 - Understanding Fundraising in Humanitarian Supply Chains

Laura Turrini, PhD Student, Kühne Logistics University, Grofler Grasbrook 17, Hamburg, Germany, Laura.Turrini@the-klu.org, Maria Besiou, Joern Meissner

Donations are generally the main income of humanitarian organizations and are central to their successful operations. Due to their voluntary nature, they are difficult to predict, but they can be stimulated, when needed, by the means of fundraising appeals and advertising. But how much should an organization spend in fundraising? And is it always worth it? We model the fundraising activity using data from humanitarian organizations in order to help answering these fundamental questions.

2 - Mitigating the Unintended Impacts of Generosity: The Case of Unsolicited Donations after Disasters

Miguel Jaller, Research Associate, Rensselaer Polytechnic Institute, 306 Gold St. Apt 3B, Brooklyn, NY, 11201, United States of America, jallem@rpi.edu, Johanna Amaya, Jose Holguin-Veras, Luk Van Wassenhove

This presentation introduces a donations management system designed to reduce the impacts of unsolicited donations after disasters. The authors take advantage of empirical work to estimate the flow of donations to be sent after large disasters and strategically manage the flow of information to be sent to the possible donors.

3 - ICT and Humanitarian Supply Chains

Ioanna Falagara Sigala, Vienna University of Economics and Business, Welthandelsplatz 1, Vienna, 1020, Austria, ioanna.falagara.sigala@wu.ac.at, Tina Wakolbinger, William Kettinger

This paper aims to explore the role of information systems in supporting humanitarian organizations in efficiently and effectively delivering humanitarian aid and essential medicines to the people in need. First, we look at the current implementation of an ERP system at different humanitarian organizations.Second, we use agent-based modeling and simulation to highlight how the technology adoption will spread throughout the organization, where points of resistance might exist.

4 - Horizontal Coordination in Humanitarian Operations
Mahyar Eftekhar, Assistant Professor, W.P. Carey School of Business, ASU, BA 440, 300 E Lemon Street, Main Campus, Tempe, AZ, 85287, United States of America, eftekhar@asu.edu, Hongmin Li

Despite their resource and financial limitations and despite the considerable level of demand uncertainty they face, Humanitarian Organizations (HOs) do not typically share resources. In this paper, using both empirical and analytical methods, we consider the potential barriers to resource pooling, as well as its costs and benefits for individual agencies. We find out the circumstances in which resource pooling could yield higher benefits for individual HOs.

■ TB07

Hilton- Continental 4

Cloud Computing

Cluster: Tutorials

Invited Session

Chair: Stefan Voss, University of Hamburg, IWI - Von-Melle-Park 5, Hamburg, 20146, Germany, stefan.voss@uni-hamburg.de

1 - Cloud Computing and Decision Analytics
Stefan Voss, University of Hamburg, IWI - Von-Melle-Park 5, Hamburg, 20146, Germany, stefan.voss@uni-hamburg.de, Leonard Heilig

Cloud computing offers a variety of flexible, on-demand and highly-scalable computing services. The associated flexibility and cost-effectiveness make it a valuable option. We present a classification of decision analytics in the area of cloud computing (e.g., to choose best options and to make predictive statements under uncertainty and information asymmetry). We review related problems, models and techniques applied to support cloud computing oriented decision making. Case studies are given.

■ TB08

Hilton- Continental 5

Joint Session Social Media/MAS: Social Media in Disaster Response

Cluster: Social Media Analytics & Military Applications Society

Invited Session

Chair: Christopher Smith, Director, TRAC-MTRY, U.S. Army, 700 Dyer Road, Monterey, CA, 93943, United States of America, cmsmith1@nps.edu

1 - Using Social and Semantic Network to Analyze a Disaster Response Online Forum
Gail Thomas, Associate Professor, Graduate School of Business & Public Policy, NPS, 555 Dyer Road, Monterey, CA, 93943, gthomas@nps.edu, Jessica Neff, Kimberlie Stephens

Large-scale disaster response often requires the synchronization of military heavy lift and humanitarian assistance. Our study analyzes the actual messages from an online social media forum to determine the dynamic interactions and properties of a knowledge system. We use social network analysis to examine how the search for expertise evolves during the early weeks of the response. Semantic network analysis maps the emergent nature of the communication discourse.

2 - Overview of ISIL's Twitter Communication Network
Gregory Freeman, Naval Postgraduate School, CORE Lab, 589 Dyer Rd. RO-107, Monetery, CA, 93943, United States of America, gsfreema@nps.edu, Rob Schroeder

Twitter accounts associated with the Islamic State of Iraq and the Levant (ISIL) have been prolific propagandists. This presentation overviews how ISIL spreads its messages online and how it is resilient against disruption.

3 - Tweeters of the Storm: Local government use of Social Media during Hurricane Sandy
Rob Schroeder, Naval Postgraduate School, CORE Lab, 589 Dyer Rd. RO-107, Monterey, CA, 93943, rcschroe@nps.edu, Gregory Freeman

While individuals and companies have learned how to effectively use Twitter, how can local governments best leverage the new capability? During Hurricane Sandy many local government groups informally communicated with the public using Twitter, we analyze these local government accounts during the storm in order to compare government use and measure effectiveness.

4 - Looking for Flu Patterns in Twitter Data
Samuel Buttrey, Associate Professor, Department of Operations Research, Code OR/Sb, Naval Postgraduate School, Monterey, CA, 93943, United States of America, buttrey@nps.edu

We examine about 18 months' worth of a 1% sample of Twitter messages for incidence of the words "flu" or "influenza" in English-language tweets originating in the United States. This incidence rate is compared to the actual prevalence of flu as reported by the Centers for Disease Control. Our sample occupies thousands of files and perhaps 5TB of disk space. Some of the practical difficulties associated with handling and analyzing data of this magnitude are addressed.

■ TB09

Hilton- Continental 6

Crowdsourcing and the Cloud

Cluster: Special Sessions

Invited Session

Chair: Charles Weber, Associate Professor, Portland State University, PO Box 751 ETM, Engineering and Technology Management, Portland, OR, 97207, United States of America, webercm@gmail.com

1 - The Role of ICT-based Informal Communication in International R&D Networks
Vesna Babaja, Doctoral Student, Wirtschaftsuniversitaet Wien, Welthandelsplatz 2, Vienna, A-1020, Austria, Vesna.Babaja@wu.ac.at

Informal communication has been shown to help with building trust, reducing uncertainty and transferring tacit knowledge. However, in geographically dispersed R&D collaborations providing space for the development of informal communication may be cost-prohibitive. This study looks at the effectiveness of ICT in this setting by exploring advanced research collaborations between CERN and its academic and industrial partners from all over the world.

2 - Which Incentives Increase the Motivation to Participate in Technology Transfer Projects?
Manuel Burger, Doctoral Student, Wirtschaftsuniversitaet Wien, Welthandelsplatz 2, Vienna, A-1020, Austria, m.burger@wu.ac.at

The explorative study focuses on the researcher as an individual actor in the technology transfer process. The research project deals with motivational structures behind scientists¥ engagement in technology transfer. In particular a case study will be conducted at CERN to explore technology transfer from fundamental research to industry.

3 - Determining the Locus of Influence Online: A Case from High Tech
Charles Weber, Associate Professor, Portland State University, PO Box 751 ETM, Engineering and Technology Management, Portland, OR, 97207, United States of America, webercm@gmail.com, Nitin Mayande

What determines the locus of influence online? A case from a high tech industry identifies structural factors and factors pertaining to information flow

■ TB10

Hilton- Continental 7

Economics of Operations Management

Sponsor: Manufacturing & Service Operations Management

Sponsored Session

Chair: Kenan Arifoglu, Assistant Professor, University College London, Gower Street, London, WC1E 6BT, United Kingdom, k.arifoglu@ucl.ac.uk

1 - Remanufacturing Strategies for OEMs without Remanufacturing Capabilities
Anton Ovchinnikov, Assistant Professor, University of Virginia, 100 Darden Blvd, Charlottesville, VA, United States of America, AOvchinnikov@darden.virginia.edu, Yu Xiong, Yu Zhou

We discuss two strategies for how an OEM without remanufacturing capabilities could interact with independent remanufacturers: outsourcing and relicensing. Factoring in the possibility of unauthorized remanufacturing and the resultant incentive compatibility concern, we discuss which strategy should be used and when. We present analytical results and numerical illustrations with behaviorally-estimated parameters. We then quantify the benefits of bringing remanufacturing in-house.

2 - Licensing Contracts in Conspicuous Markets
Prateek Raj, PhD Student, University College London, Gower Street, London, WC1E 6BT, United Kingdom, p.raj.12@ucl.ac.uk, Kenan Arifoglu

We study licensing in conspicuous markets where, in addition to product's functionality, customers also value brand exclusivity. We consider a brand-owning firm that sells its primary product to conspicuous customers, and also licenses its brand name to a licensing firm selling in a noncompeting market. Contrary to previous literature, we find that royalty contract may perform better than fixed-fee contract. We also develop a mixed contract that improves total profit and coordinates the system.

3 - On Contests with Heterogenous Agents
Ersin Korpeoglu, Tepper School of Business at Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, ekorpeog@andrew.cmu.edu, Soo-Haeng Cho

In a contest in which heterogeneous agents make efforts to develop solutions, existing theory predicts that agents will reduce their efforts as more participants compete for a prize. However, a recent empirical study found that high-ability agents raise their efforts with more participants. This paper offers new explanation for the empirical finding by proposing and analyzing a novel model of a contest. We also characterize when a free-entry contest (open innovation or crowdsourcing) is optimal.

4 - Hedge against Shortages: Supply and Demand Uncertainty Reduction and Comparison Analysis
Mehmet Begen, Ivey Business School - Western University, 1255 Western Road, London, ON, N6G 0N1, Canada, mbegen@ivey.uwo.ca, Xinghao Yan, Hubert Pun

Shortages are widely observed and their consequences are costly in many industries. A main driver of shortages is the uncertain nature of supply and demand. To hedge against shortages and to reduce uncertainties, more information about supply and demand can be obtained by exerting some effort. We perform analysis of the (supply and demand) uncertainty reduction and comparison with and without efforts.

■ TB11

Hilton- Continental 8

Procurement

Sponsor: Manufacturing & Service Operations Management/Supply Chain

Sponsored Session

Chair: Zhixi Wan, Assistant Professor, University of Illinois at Urbana-Champaign, 1206 S Six Street, Champaign, IL, 61820, United States of America, wanzhixi@illinois.edu

1 - Knowledge-Based View on the Use of an Agent in Manufacturing Outsourcing: A Game Theoretic Model
Qiong Chen, Clemson University, 100 Sirrine Hall, Clemson, SC, 29631, United States of America, qiongc@g.clemson.edu, Gulru Ozkan, Aleda Roth, Shouqiang Wang

We evaluate the buyer's dynamic choice of outsourcing channels: directly through in-house procurement department or indirectly through an intermediary agent. Using a two-period game-theoretical model, we demonstrate the critical yet interesting role of outsourcing knowledge therein. In particular, we highlight the effects of direct and indirect learning on the change of buyer's strategies over time.

2 - Optimal Procurement Auction under Multi-Stage Supplier Qualification
Wei Chen, The University of Texas at Dallas, 800 West Campbell Rd, Richardson, TX, 75080, United States of America, wxc103020@utdallas.edu, Milind Dawande, Ganesh Janakiraman

A firm is soliciting price bids from N symmetric suppliers for a sourcing contract. The contract can only be awarded to a supplier who passes multiple stages of qualification test, which must be performed simultaneously in each stage. We obtain the optimal mechanism for the buyer and show that the optimal admission policy in each stage is based on non-uniform reserve prices. We extend our results to a special case of asymmetric suppliers. A descending-meter implementation is also presented.

3 - Favoritism and the Right-of-First-Refusal in Procurement Auctions
Manu Goyal, Assistant Professor, University of Utah, College Of Business, Salt Lake City, UT, United States of America, Manu.Goyal@business.utah.edu, Ali Pilehvar, Wedad Elmaghraby

Long-term relationships with suppliers have several benefits, but these can create inefficiencies and lock-ins which raise procurement costs. Classical procurement auctions lower costs, but result in unsteady short-term relationships with suppliers. The Right-of-First-Refusal can harmoniously resolve this tension: A buyer can lower procurement costs and yet strike steady relationships with preferred suppliers through auctions with the Right-of-First-Refusal granted to the preferred supplier.

4 - Contracting for Capacity under Renegotiation
Eda Kemahlioglu-Ziya, Assistant Professor, Poole College of Management at the University of North Carolina, Raleigh, NC United States of America, ekemahl@ncsu.edu

Two original equipment manufacturers (OEMs) sign fixed-quantity contracts with a contract manufacturer (CM) prior to demand realization. The contracts are renegotiated after demand realization. We aim to understand how an OEM's expected post-renegotiation profit is affected by her ability to negotiate a low wholesale price in the initial contract as well as the ability of the other OEM to do the same. Finally, we identify when the OEMs prefer to leave the CM out of the renegotiation.

■ TB12

Hilton- Continental 9

Regulation Issues in Sustainable Operations

Sponsor: Manufacturing & Service Operations Management/Sustainable Operations

Sponsored Session

Chair: Gal Raz, Associate Professor, University of Virginia, Darden School of Business, Charlottesville, VA, United States of America, razg@darden.virginia.edu

1 - Valuable E-Waste: Implications for Extended Producer Responsibility
Gokce Esenduran, Ohio State University, OH, United States of America, esenduran.1@osu.edu, Atalay Atasu, Luk Van Wassenhove

In a market regulated with take-back legislation, if recycling is profitable then producers have to compete with third-parties in collecting and recycling end-of-life (EoL) products. We answer the question of whether increased collection or recycling targets lead to better environmental or economic outcomes in a competitive market for EoL products.

2 - Firm and Nonprofit Levers to Improve Supplier Environmental Performance
John Khawam, Operations Strategy Lead, Google Inc., 1600 Amphitheatre Parkway, Mountain View, CA, 94043, United States of America, johnkhawam@google.com, Ozgen Karaer, Tim Kraft

We examine how a firm can induce higher environmental quality from a supplier under varying cost and market sensitivity conditions. We consider two methods: supplier competition and cost sharing. Our research is based on our work with an nonprofit as it markets to industries a tool to safely share chemical information.

3 - Competitive Response to Environmental Tax Incentives for Green Technology Adoption
Dmitry Krass, Professor, Rotman School of Management, Univ. of Toronto, 105 St. George st., Toronto, ON, M5S 3E6, Canada, krass@rotman.utoronto.ca, Anton Ovchinnikov

We consider operational aspects of how an industry composed of heterogeneous firms responds to an environmental tax by choosing production quantities and emissions-reducing technologies. We show the existence and uniqueness of the "market-only equilibrium" (with fixed technology choices) and demonstrate its many interesting properties. We then discuss the technology-and-market equilibria under different structural assumptions.

4 - The Environmental Impact of Product Design Choices in Primary and Secondary Markets under Regulation
Vered Blass, Tel Aviv University, Tel Aviv, Tel Aviv, Israel, vblass@post.tau.ac.il, Gal Raz, Cheryl Druehl

This paper examines the impact of DfE innovations of a firm selling new products in a primary market and refurbished products in a geographically distinct secondary market. The firm determines use stage innovation and design-for-refurbishing, its primary and secondary market prices, and its product collection decision. The paper shows the consequences of Extended Producer Responsibility (EPR) and Use stage regulations on the firm's profits and its environmental impact in both markets.

■ TB14

Imperial B

Panel Discussion: Philosophy of Hiring and Advising Graduate Students

Sponsor: Junior Faculty Interest Group

Sponsored Session

Chair: Erick Moreno-Centeno, Assistant Professor, Texas A&M University, 3131 TAMU, College Station, TX, 77845, United States of America, e.moreno@tamu.edu

1 - Philosophy of Hiring and Advising Graduate Students

Moderator: Erick Moreno-Centeno, Assistant Professor, Texas A&M University, 3131 TAMU, College Station, TX, 77845, United States of America, e.moreno@tamu.edu, Panelists: Panos Pardalos, Sheldon Jacobson, Mark Lawley, Suvrajeet Sen

Critical to the success of junior faculty is the success of his/her PhD Students. Here, the panelists will share their proven hiring and advising philosophies. All panelists have a track record of training successful PhDs who now hold academic positions at prestigious institutions. This panel was inspired by the Graduate Students & Faculty Relationship Workshop organized by the INFORMS student chapter at Texas A&M. Panelists: Sheldon Jacobson, Mark Lawley, Panos Pardalos, and Suvrajeet Sen.

■ TB15

Hilton- Exec. Boardroom

Data Envelopment Analysis 1

Contributed Session

Chair: Ya Chen, University of Science and Technology of China, No. 96, JinZhai Road, Hefei, China, ychen10@mail.ustc.edu.cn

1 - Considering Favourability Indices as Part of the Malmquist Index

Kwaku Ohene-Asare, Lecturer, University of Ghana Business School, RT16 LG78, Legon Ghana, Legon, Ghana, kohene-asare@ug.edu.gh

Recently, Asmild and Tam (2007) defined a Global Malmquist Index. The present paper contributes to the extant productivity literature by defining a further decomposition of the global frontier shift, into favourability index and favourability change indices. This is interesting when analysing if technology changes over time affects some observations more than others. The indices have potentially interesting policy implications which we show using empirical data set on Ghanaian banks.

2 - The Performance Measurement of Municipal Governments in Mexico using the Data Envelopment Analysis

Mariana Flores-Serralde, Universidad Nacional Autonoma de Mexico, Av. Universidad No. 3000, Col. UNAM, Del. Coyoacan, Mexico, D.F., 04510, Mexico, mathiana_9@hotmail.com, Oscar Olvera-Neria

The quantification of the public administration performance constitutes a new scenario for the control of the government efficiency. In this study, the Data Envelopment Analysis is used to measure the efficiency of municipal governments in Mexico. The municipalities were stratified by population density. The most efficient municipalities (~0.8 efficiency) are in the north and center of Mexico, which corresponds with regions with major cultural, economic and social development.

3 - Network Data Envelopment Analysis for Sustainable Performance in Brazilian Gas Station

Claudia Francisco, Professor, Federal University of Rio Grande do Norte, Rua Senador Salgado Filho, 3000, Campus Universiterio, Natal, 59000000, Brazil, claudiacacf@hotmail.com, Mariana Almeida, Djalma Silva

In this study, we present a quantitative model Network Data Envelopment Analysis associated with Sustainable Balanced Scorecard for mensure the sustainable performance of fuel stations in Brazil. This results indicate an average performance of 69.42%. With a efficiency decomposition, it can provide a set of recommendations to support the decision making of firms and regulators.

4 - DEA Efficiency Research of High Technology Industries

Liang Gao, University of Science and Technology of China, The School of Public Affairs, Hefei, China, gaol3016@mail.ustc.edu.cn

By construction of two stages network DEA, to evaluate high-tech industrial technology introduction of digestion, absorption and innovation efficiency in China, and put forward the development strategy of the various provinces and cities.

5 - An Extension on Super-efficiency Approach for Slacks-based Measure

Ya Chen, University of Science and Technology of China, No. 96, JinZhai Road, Hefei, China, ychen10@mail.ustc.edu.cn, Yongjun Li

Fang et al. [Fang, H.H., Lee, H.S., Hwang, S.N., & Chung, C.C., 2013. A slacks-based measure of super-efficiency in data envelopment analysis: An alternative approach. Omega, 41, 731-734] develop a slacks-based version of the super slacks-based measure (SBM) and propose a two-stage approach to calculate both super-efficiency score by the super SBM model and efficiency score by the SBM model. In this paper, we extend their approach to consider continuity of efficiency scores.

■ TB16

Hilton- Franciscan A

Revenue Management and Pricing of Multiple Products and Assortments

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Ozge Sahin, Johns Hopkins University, 100 International Drive, Baltimore, MD, 21231, United States of America, ozge.sahin@jhu.edu

1 - Repricing Algorithms in E-Commerce

Dana Popescu, Assistant Professor, INSEAD, 1 Ayer Rajah Ave, Singapore, 138676, Singapore, dana.popescu@insead.edu

We analyze a duopoly where sellers compete using repricing algorithms, which have a built in demand function and use specific pricing rules. We compare the revenues obtained when both sellers use the same software provider with the revenues obtained when the sellers use different providers, for various pricing rules, demand forecast accuracies and frequency of updating.

2 - Strategic Pricing of Ancillary Services: To Bundle or to Unbundle?

Yao Cui, PhD Candidate, University of Michigan, 701 Tappan Ave, Ann Arbor, MI, 48109, United States of America, cuiyao@umich.edu, Izak Duenyas, Ozge Sahin

We consider a firm that sells a main service (e.g., air travel) and an ancillary service (e.g., baggage delivery) to multiple consumer segments (e.g., business travelers and leisure travelers). We study the firm's strategic decision of whether to bundle the ancillary service into the main service or to unbundle. We investigate several factors that affect this decision, including forward-looking vs. myopic consumers, firm's main service price discrimination, and selling through intermediaries.

3 - Real-time Optimization of Personalized Assortments

Hamid Nazerzadeh, Marshall School of Business, University of Southern California, Los Angeles, CA, United States of America, nazerzad@marshall.usc.edu, Negin Golrezaei, Paat Rusmevichientong

Motivated by the availability of real-time data on customer characteristics, we study personalization of the assortment of products for each arriving customer. Using actual sales data from an online retailer, we demonstrate that personalization based on each customer's location can lead to over 10% improvements in revenue. We propose a family of index-based policies that coordinate the assortment decisions with the backend inventory constraints and achieve an optimal competitive ratio.

4 - Pricing Assortments for Online Travel Agents

Ozge Sahin, Johns Hopkins University, 100 International Drive, Baltimore, MD, 21231, United States of America, ozge.sahin@jhu.edu, Ruxian Wang

In this paper we study the assortment selection and pricing problem of online travel agents. We first show that the assortment selection problem is NP complete. Next, we study the pricing problem under both monopoly and competitive scenarios.

■ TB17

Hilton- Franciscan B

Contact Centers

Sponsor: Manufacturing & Service Operations Management/Service Operations

Sponsored Session

Chair: Noah Gans, OPIM Department, Wharton - University of Pennsylvania, Philadelphia, PA, United States of America, gans@wharton.upenn.edu

1 - Service Times in Call Centers: A Data-Based Perspective
Rouba Ibrahim, University College London, London, United Kingdom, rouba.ibrahim@ucl.ac.uk, Haipeng Shen, Pierre L'Ecuyer

We carry out a large-scale data-based study of service times in a call center with heterogeneous agents and multiple call types. We find that the service-time distribution depends strongly on the agent and on time, and that service times are correlated. We develop models that account for these facts. We compare our models to ones commonly used in practice. We find that the goodness-of-fit is much better for our models than for the simplified ones, both in-sample and out-of-sample.

2 - Fluid Models for Customer Service Chat Systems with General Service and Patience Times
Tolga Tezcan, Professor of Operations Management, Simon School of Business, University of Rochester, 3-345 Simon Hall. Simon Business School, Rochester, NY, 14627, United States of America, tolga.tezcan@simon.rochester.edu, Jiheng Zhang

We study customer service chat systems where service and patience times are generally distributed. We propose a framework involving measure-valued processes to model the system dynamics. Deterministic fluid models are developed to provide first-order approximations for system performance. The invariant state of the fluid models provides simple approximations for various performance measures in steady state. Numerical experiments show that these approximations are fairly accurate.

3 - Telephone Call Centers: Asymptotic Optimality of Myopic Forecasting-scheduling Scheme
Han Ye, University of Illinois at Urbana-Champaign, College of Business, Champaign, IL, United States of America, hanye113@gmail.com, Noah Gans, Yong-Pin Zhou, Haipeng Shen

We determine workforce schedules for call center arrivals that are doubly stochastic. Period-by-period arrival rates follow a hidden AR(1) process, and only arrival counts are observed. We formulate stochastic programs to minimize long-run average staffing costs, subject to a long-run average constraint on abandonment. We show that, in steady state, repeated, myopic solution of the single-period problem is stable, has low cost, and meets the abandonment constraint.

4 - Dynamic Scheduling in a Many-Server Two Class System with Service Guarantees and Abandonments
Amy Ward, Professor, USC, Marshall School of Business, BRI401H, Los Angeles, CA, 90089-0809, United States of America, amyward@marshall.usc.edu, Ramandeep Randhawa, Jeunghyun Kim

We study how different models for customer impatience affect scheduling decisions. We do this in the context of a many-server queue with two classes of customers that are distinguished by their patience distribution. Our objective is to minimize the abandonment percentage for one class subject to a promised service level for the other class. For large systems, we characterize the optimal policy structure as a function of the patience distribution.

■ TB18

Hilton- Franciscan C

Revenue Management in Retail

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Kris Johnson, PhD Candidate, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Bldg. E40-149, Cambridge, MA, 02139, United States of America, krisdj@mit.edu

1 - Incorporating Buyer's Paralysis into the MNL Choice Model
Rene Caldentey, Professor, New York University, 44 West Fourth Street, 8-77, New York, NY, 10012, United States of America, rcaldent@stern.nyu.edu, Anisha Patel, Srikanth Jagabathula

We empirically investigate the notion of choice paralysis (i.e., the idea that too many options can paralyze a consumer and make them more prone to not purchasing) and its implications on assortment and inventory decisions. We also propose a modification to the existing MNL model that aims to capture this choice paralysis.

2 - Estimating Willingness to Pay and Willingness to Sell from Negotiations Data
Garrett van Ryzin, Columbia University, 412 Uris Hall, Columbia University, New York, NY, 10027, gjv1@columbia.edu, Robert Phillips, A. Serdar Simsek

In many businesses, the final sales price is the result of a negotiation between buyer and seller - e.g. real estate, autos, consumer finance and B2B commerce. We discuss results on a novel method for estimating willingness-to-pay and willingness-to-sell distributions from negotiations transactions data.

3 - Analytics for an Online Retailer: Demand Forecasting and Price Optimization
Kris Johnson, PhD Candidate, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Bldg. E40-149, Cambridge, MA, 02139, United States of America, krisdj@mit.edu, David Simchi-Levi, Bin Hong Alex Lee

We present our work with Rue La La, an online retailer who offers limited-time discounts on designer apparel. One of their main challenges is revenue management for new products. We use machine learning techniques to build a demand prediction model, the structure of which poses challenges on creating a pricing policy. We develop new theory around multi-product price optimization and use this to create and implement a pricing decision support tool. Results show significant increases in revenue.

■ TB19

Hilton- Franciscan D

Choice and Pricing Models in Revenue Management

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Sumit Kunnumkal, Indian School of Business, AC4 Level 1 4116, Hyderabad, India, Sumit_Kunnumkal@isb.edu

1 - Modeling Dynamic Choice Behavior of Customers
Srikanth Jagabathula, New York University, 44 West Fourth St, New York, NY, 10012, United States of America, sjagabat@stern.nyu.edu, Gustavo Vulcano

The effectiveness of pricing/product assortment decisions in retail operations relies heavily on accurate demand predictions. Motivated by this, we consider the setting in which retailer has access to panel data — sales transactions tagged by customer id. Given this rich data, we present techniques to (a) predict the purchase likelihood for each customer as a function of offer set and promotions and (b) develop a prescription for personalizing promotions.

2 - The Cross Moment Choice Model
Karthik Natarajan, Associate Professor, Singapore University of Technology and Design, 20 Dover Drive, Singapore, 138682, Singapore, natarajan_karthik@sutd.edu.sg

In this talk, I will discuss a new class of discrete choice models that assumes mean and covariance information on the utilities. We show that the choice probabilities for the distribution that maximises expected user utility is efficiently computable with convex optimization. We will provide evidence that the model is a practical alternative to Multinomial Probit in a few applications. The talk is based on joint work with Li Xiaobo, Selin Damla Ahipasaoglu, Rudabeh Meskarian and Tom Magnanti.

3 - Upper Bounds for Choice Network RM
Sumit Kunnumkal, Indian School of Business, AC4 Level 1 4116, Hyderabad, India, Sumit_Kunnumkal@isb.edu, Kalyan Talluri

The deterministic LP is a simple heuristic that obtains an upper bound on the choice network RM value function. The affine and the piecewise linear approximations are more sophisticated methods that obtain tighter bounds than the deterministic LP. We establish analytical limits on how much these methods can further tighten the deterministic LP bound.

4 - Dynamic Pricing versus Fixed Prices in Revenue Management
Alper Sen, Bilkent University, Department of Industrial Engineering, Bilkent, Ankara, 06800, Turkey, alpersen@bilkent.edu.tr

We consider the problem of selling a fixed stock of items over a finite horizon. Arrivals follow a Poisson process. We obtain a general lower bound on the performance of using a fixed price which is 63.2% for one unit of inventory and improves as the inventory increases. For one unit, we obtain tight bounds: 89.8% for constant elasticity and 96.9% for linear price response functions. We also suggest a new dynamic pricing heuristic which performs better than 99.8% in a large number of problems.

■ TB20

Hilton- Yosemite A

Facility Logistics II

Sponsor: TSL/Facility Logistics

Sponsored Session

Chair: Soondo Hong, Assistant Professor, Pusan National University, 2, Busandaehak-ro 63beon-gil, Geumjeong-gu, Pusan, 609-735, Korea, Republic of, soondo.hong@pusan.ac.kr

1 - Setting Cutoff Times for Order Fulfillment Systems with Capacity Degradation

Kevin R. Gue, Professor, Auburn University, Shelby Center, Auburn, AL, 36849, United States of America, guekevi@auburn.edu

In many order fulfillment settings, orders received before a cutoff time are guaranteed to be shipped that evening to meet next-day or two-day service promises. In a system that batches orders for more efficient picking tours, the control system must determine how large a batch pickers can handle as the deadline approaches. The nearer the deadline, the smaller the batch size and the lower the effective capacity. We show how to set the latest possible cutoff time in such a setting.

2 - Technology Infrastructure in Third Party Logistics (3PL) Warehouses: Status, Barriers, and Future

Michael Ogle, Assistant Professor and Undergraduate Director, UNC Charlotte, 9201 University City Blvd., CARC 220, Charlotte, NC, 28223, United States of America, Mike.Ogle@uncc.edu

The rate of technology infrastructure adoption within Third Party Logistics (3PL) warehouses lags behind that of private dedicated facilities owned and operated by manufacturers, retailers and distributors. Despite the lack of scale-enabling automation solutions, third-party logistics continues to grow faster than the U.S. GDP. What are the challenges associated with automating 3PLs and how might they be overcome as projected growth continues for 3PLs? This session addresses those questions.

3 - Bulk Tank Allocation for Industrial Gas Distribution: Heuristic Approach for a Multi-Period Model

Leily Farrokhvar, PhD Candidate, Virginia Tech, Industrial & Systems Engineering (0118), Blacksburg, VA, 24061, United States of America, leily@vt.edu, Kimberly Ellis

We study the bulk tank allocation (BTA) problem for industrial gas distribution. The BTA problem determines the preferred size of bulk tanks to assign to customer sites to minimize total cost, including the initial tank installation costs and the net present value of distribution costs occurring in multiple periods. The problem is modeled as a mixed-integer program and then solved using a heuristic approach which incorporates a two-phase decomposition approach.

4 - Order Batching with Time Constraints in a Parallel-aisle Warehouse: A Multiple-policy Approach

Soondo Hong, Assistant Professor, Pusan National University, 2, Busandaehak-ro 63beon-gil, Geumjeong-gu, Pusan, 609-735, Korea, Republic of, soondo.hong@pusan.ac.kr, Brett Peters, Andrew Johnson

This study analyzes an order batch operation with limited vehicle capacity and specified deadlines to complete orders. We develop a model which partitions orders to batches to minimize the total travel time such that each trip meets the time constraint and capacity limit and determine a suitable operational policy. Each policy is characterized by routing method and associated speed, capacity, and pick time. The proposed model groups orders and selects a best policy among possible policy choices.

■ TB21

Hilton- Union Sq 1

Innovative Solutions for Congestion Mitigation II

Sponsor: Transportation Science & Logistics

Sponsored Session

Chair: Yafeng Yin, University of Florida, Gainesville, FL, United States of America, yafeng@ce.ufl.edu

Co-Chair: Siriphong (Toi) Lawphongpanich, University of Florida, Industrial and Systems Engineering, Gainesville, FL, 32611, United States of America, Lawphong@ise.ufl.edu

1 - Dedicated Bus Service in London, Towards Better Transit and Traffic

Guangzhi Zhang, Tsinghua University, Room 615, Shunde Building, Beijing, 100084, China, zgz11@mails.tsinghua.edu.cn, Lefei LI

Dedicated Bus Service (DBS) is a new urban transit service that bridges bus/metro and private vehicles. By directly connecting high-demand OD pairs, the DBS is expected to alleviate traffic congestion and provide better commuting experiences. We build a simulation model for London traffic network based on TRANSIMS. Experiment result shows that a properly designed DBS can lead to better traffic and transit services. We also investigate the contract design problem for a better performance of DBS.

2 - Optimization-based Methods for Hybrid Transit System

Yihuan (Ethan) Shao, University of Southern California, Industrial and Systems Engineering, 3715 McClintock Avenue, Los Angeles, CA, 90089, United States of America, yihuansh@usc.edu, Fernando Ordonez, Xiaoqing Wang

Considering the traffic congestion in megacity, we propose a new hybrid transit system, which combines a ridesharing system with a fixed-route public transit system. The main idea behind this new system is to take advantage of the flexibility of ridesharing and the low cost of public transit. We developed optimization-based methods to solve the routing problem for the shared vehicles under this system. Computational experiments for these methods expose some interesting results.

3 - Pricing of Parking Games with Atomic Players

Yafeng Yin, University of Florida, Gainesville, FL, United States of America, yafeng@ce.ufl.edu, Fang He, Zhibin Chen

This paper considers a parking competition game where a finite number of vehicles from different origins compete for the same number of parking spaces in a downtown area to minimize their own parking costs. We first define and formulate equilibrium and system optimum assignments of spaces to vehicles, and then discuss various parking pricing schemes to reduce total cost of the parking competition game.

■ TB22

Hilton- Union Sq 2

Designing, Modeling and Managing Disrupted Transportation Networks

Sponsor: Transportation Science & Logistics

Sponsored Session

Chair: Kash Barker, Assistant Professor, University of Oklahoma, 202 W Boyd St, Rm. 124, Norman, OK, 73019, United States of America, kashbarker@ou.edu

1 - Large-scale Evacuation Routing and Scheduling Optimization with Uninterrupted Traffic Flow

Xuechi Zhang, University of Maryland, 0147C Engineering Lab Building, University of Maryland, College Park, MD, 20742, United States of America, zhangxc90@gmail.com, Ali Haghani

This paper develops a two-stage optimization framework for large-scale vehicular evacuation. In the first phase, a mixed integer programming model, with the objectives of minimizing the network clearance time and total in-network time is developed to determine an optimal routing plan. In the second phase, a simulation-based Heuristic is proposed to dynamically generate the time-dependent departure rates. Case study of Maryland Eastern Shore is conducted by using the proposed model.

2 - Fortification of a Transportation Network against Disruptions

Mustafa Y. Sir, Antalya International University, Üniversite Cad. No:2 07190, Dö emealtı, Antalya, Turkey, mustafa.sir@antalya.edu.tr, Gokhan Karakose

Usage of critical structures (e.g., bridges) in a transportation network might get disrupted due to natural disasters such as earthquakes. Previous work defines component-specific vulnerability indices, which do not capture the change in network performance due to multiple simultaneous disruptions. A scenario-based method is proposed to fortify a transportation network against simultaneous disruptions by allocating maintenance resources over critical structures to minimize the economic impact.

3 - Multi-objective Optimization for Scheduling of Contraflow Evacuation

Yingyan Lou, Assistant Professor, Arizona State University, P.O. Box 873005, Tempe, AZ, 85287-3005, United States of America, yingyan.lou@asu.edu, Peiheng Li

Contraflow evacuation scheduling problem is formulated as a multi-objective optimization in this research, with total system travel time and operation cost as two individual objectives. The problem is solved with an enhanced nondominated sorting genetic algorithm that also incorporates adaptive random search based on response surface methodology. Multiple scenarios are investigated using a simulation-based contraflow planning tool. Optimal Pareto sets of scheduling solutions are provided.

4 - Multi-regional Vulnerability Analysis of Freight Transportation Network
Mohamad Darayi, PhD Student, University of Oklahoma, 202 W Boyd St, Rm. 124, Norman, OK, 73019, United States of America, mdarayi@ou.edu, Kash Barker

Oklahoma's central location and economic anchors within the state enforce a special attention given to the multimodal freight transportation network as a connector between business and markets in Oklahoma and the United States. This network is prone to natural/man-made disruptive events which might disable any of the network components. Vulnerability analysis of freight transportation network in a multi-regional, multi-industry interdependent economic context is pursued in this research.

■ TB23

Hilton- Union Sq 3

Inventory Routing Models

Sponsor: TSL/Freight Transportation & Logistics

Sponsored Session

Chair: Kevin Furman, ExxonMobil, 1545 US 22 E, Annandale, NJ, United States of America, kevin.c.furman@exxonmobil.com

1 - An Inventory Routing Problem for Liquefied Natural Gas Distribution Model with Net Present Value Approach
Yousef Ghiami, Technische Universiteit Eindhoven, Eindhoven, 5600 MB, Netherlands, y.ghiami@tue.nl, Tom Van Woensel

Due to its environmental characteristics, Liquefied Natural Gas (LNG) is becoming a more attractive fuel in the energy market. We develop an inventory routing model incorporating the deterioration property of LNG with a net present value approach, followed by numerical analysis.

2 - A Matheuristic for the Multi-vehicle Inventory Routing Problem
M.Grazia Speranza, Professor, University of Brescia, C.da S.Chiara 50, Brescia, Italy, grazia.speranza@unibs.it, Natashia Boland, Claudia Archetti

The Multi-vehicle Inventory Routing Problem (MIRP) is the problem of determining for each time of a discrete horizon the quantities to deliver to customers and the routes at minimum total cost. No stock-out is allowed and the vehicle capacity must be satisfied. We present a matheuristic where mathematical programming models are embedded in a heuristic scheme. Computational results are presented for a large set of benchmark instances that prove the effectiveness of the algorithm.

3 - Inventory Routing and Freight Consolidation of Perishable Goods
Weihong Hu, Georgia Tech, Department of ISyE, Atlanta, GA, United States of America, weihongh@gatech.edu, Alejandro Toriello, Maged Dessouky

We investigate a model of combined inventory routing and freight consolidation with perishability constraints. We design efficient solution methods that utilize the problem structure, including transportation-inventory decomposition, perishability parameter based heuristics, etc. The algorithms are tested with real data from the cut flower supply chain practice in California.

4 - On-Board Blending in Multiproduct Maritime Inventory Routing
Kevin Furman, ExxonMobil, 1545 US 22 E, Annandale, United States of America, kevin.c.furman@exxonmobil.com, Jin-Hwa Song, Myun-Seok Cheon

We introduce a practical problem for simultaneous optimization of ship routing, inventory management and on-board blending of multiple bulk products. In addition to traditional ship routing characteristics, this problem involves variable product value based on blend specifications, time dependent costs, cargo draft limits at ports and allowing routes with multiple pick-ups and drop-offs. We develop a discrete time optimization model and practical solution approaches which address these various real-world issues.

■ TB24

Hilton- Union Sq 4

ITS Best Presentation Award Session

Sponsor: TSL/Intelligent Transportation Systems (ITS)

Sponsored Session

Chair: Stephen Boyles, Assistant Professor, University of Texas at Austin, 301 E Dean Keeton St Stop C1761, Austin, TX, 78712, United States of America, sboyles@mail.utexas.edu

1 - Modeling the Spatiotemporal Propagation of Information in Vehicle-to-Vehicle Communications
Yong Hoon Kim, West Lafayette, IN, 47907, United States of America, kim523@purdue.edu, Srinivas Peeta, Xiaozheng He

This study proposes an analytical model for the spatiotemporal propagation of information in large-scale vehicle-to-vehicle (V2V) communications. The information propagation is described by embedding a propagation model with an analytical traffic flow model. Insights are illustrated using numerical experiments.

2 - Entropy Weighted Average Method for the Determination of Unique Path-Flow Solution for Static Deterministic User Equilibrium Traffic Assignment Problem
Amit Kumar, Purdue University, West Lafayette, IN, United States of America, kumar44@purdue.edu, Srinivas Peeta

This study formulates entropy weighted user equilibrium (EWUE) to determine a unique path-flow solution to the static deterministic user equilibrium traffic assignment problem. The implementation simplicity of the EWUE represents an important benefit over the maximum entropy user equilibrium (MEUE) models proposed in the past. Computational experiments illustrate the characteristics of the EWUE solution.

3 - A Simulation Based Approach for Optimal Road Network Demand Modification
Evan Fields, Massachusetts Institute of Technology, 77 Massachusetts Ave., Boston, MA, United States of America efields@mit.edu, Carolina Osorio

A road network operator may have some capacity to modify demand. We present two contributions to the problem of finding optimal magnitude and location of reduction. First, we use an analytic queueing model to demonstrate several important features of the problem. Second, we present a case study of using simulation based optimization to solve the optimal demand modification problem on a subnetwork of Lausanne.

4 - Fine-grained Modeling of Arterial Traffic: A Data Fusion and Information Integration Approach
Zhanbo Sun, RPI, Troy, NY, 12180, United States of America sunz3@rpi.edu, Peng Hao, Xuegang (Jeff) Ban

In this research, a data fusion and information integration approach is proposed to model and interpret the straffic along urban arterial corridors based on heterogeneous data sources. The method captures variables such as data accuracy, travel time, lane choice and traffic merging at a corridor-level. Results from the method can be directly applied to estimate individual corridor travel times and vehicle trajectories.

■ TB25

Hilton- Union Sq 5

Public Transportation - Railroad

Contributed Session

Chair: Rebecca Scott, University of North Texas, 1155 Union Circle #311396, Denton, TX, 76203, United States of America, rebecca.scott@unt.edu

1 - Modeling the Residual Useful Life of Railroad Bearing Grease
Douglas Timmer, Professor, University of Texas - Pan American, Manufacturing Engineering Department, 1201 West University Dr, Edinburg, TX, 78539, United States of America, timmer@utpa.edu

This research will develop an analytical model or models to predict the residual useful life of railway bearing grease. Modeling techniques to be employed include mechanistic or first principles models based upon process kinetics and empirical models including physics-based reliability models, non-linear regression and neural networks. The analytical model will provide users the ability to predict residual life based upon operational characteristics.

2 - Rescheduling Railway Timetables in Presence of Passenger Transfers Between Lines Within a Transportation Network
Miguel Angel Pozo, Universidad de Sevilla, Facultad de Matematicas, Calle Tarfia s/, Sevilla, 41012, Spain, miguelpozo@us.es, Juan Antonio Mesa, Francisco A. Riejos, Justo Puerto

The problem of coordinating transfers consists of determining timetables which ensure the transfer of passengers between trains from different lines. This paper considers a transit line where a train fleet circulates according to a predetermined timetable. Passengers arrive at according to an assumed deterministic model of arrivals. In this scenario, a service rescheduling forced by an incidence is determined in order to minimize the loss of passengers who require transfers between lines.

3 - Planning for Protection in Rail-Truck Intermodal Transportation
Hassan Sarhadi, PhD Student, Memorial University of Newfoundland, 57 Allandale Road, PO BOX 534, St.John's, NL, A1B 3S7, Canada, hassan.sarhadi@mun.ca, Manish Verma, David Tulett

Railway intermodal transportation is one of the main sources of revenue for major U. S. railways. Due to such an importance, railway companies should make sure that their intermodal chain is working properly. In this presentation, a mathematical model for protection planning of rail-truck intermodal transportation infrastructure facing intentional disruptions will be presented. Then, the model will be applied to an intermodal chain in U. S. to find the best way of protecting its infrastructure.

4 - Causal Loop Simulation Model of Public Transportation Decision Making Factors
Rebecca Scott, University of North Texas, 1155 Union Circle #311396, Denton, TX, 76203, United States of America, rebecca.scott@unt.edu

A causal loop simulation examines the decision making factors that influence the use of public transportation. Factors are visually represented in the developed model that allows evaluating the importance of the optimal decision making factors. Implications are reported in an effort to provide insight for increasing public transportation use.

5 - Combining Cost-benefit Analysis and Transport Optimization
Arnt-Gunnar Lium, Senior Research Scientist, SINTEF, SINTEF Technology and Society Applied Ec, SP. Andersensvei 5, Trondheim, NO-7465, Norway, arnt-gunnar.lium@sintef.no, Marte Fodstad, Truls Flatberg, Michal Kaut

We present a model for long term strategic investments in railroad infrastructure were the traditional cost-benefit analysis is integrated in an optimization setting. We also discuss challenges related to the handling of uncertainty and transportation choice modelling for a real life problem for the Norwegian railroad infrastructure manager (Jernbaneverket).

■ TB26

Hilton- Union Sq 6

Facility Planning and Design

Contributed Session

Chair: Yue Zhang, University of Toledo, 2801 West Bancroft St., Toledo, OH, 43615, United States of America, yue.zhang@utoledo.edu

1 - A Metaheuristic for the Layout and Scheduling Problem in a Job Shop Environment
Eva Selene Hernandez-Gress, Researcher, Autonomous University of Hidalgo, Pachuca-Tulancingo Road km. 4.5, Pachuca, Mexico, evah@uaeh.edu.mx, Mary Carmen Reyna Amador, Juan Carlos Seck Tuoh Mora, Hector Rivera Gómez, Oscar Montaño Arango

We propose in this paper a new approach that jointly addresses the layout of a facility and the scheduling of a sequence of jobs. In real production, these two problems are interrelated. However, they are treated separately in the literature. Our approach is an extension of the job shop problem with transportation delay, where the location of the machines is selected among possible sites. The model minimizes the makespan, combining the travel salesman problem with genetic algorithms.

2 - Block Layout Design on the Foundations of a Circular Flow Pattern under Flexible Bay Structures
Hossein Jahandideh, PhD Student, UCLA, 110 Westwood Plaza, Los Angeles, CA, 90024, United States of America, hossein.jahandideh.1@anderson.ucla.edu, Ardavan Asef-Vaziri

In this paper we develop a procedure for the concurrent design of block layout, material handling network, and pick-up and drop-off stations. We first develop a set of heuristics and a genetic algorithm based on efficient approximations to configure block layouts based on loop flow patterns. The unidirectional loop and station locations are then designed on the chosen layout. A set of improvement algorithms finally integrates the best loop and layout.

3 - Optimal Capacity Investment with Time-Sensitive Demand
Yue Zhang, University of Toledo, 2801 West Bancroft St., Toledo, OH, 43615, United States of America, yue.zhang@utoledo.edu

The research concerns optimizing capacity investment for a single firm or two competing firms facing time-sensitive demand. After studying two basic models for a single firm, we focus on two competitive models, where two competing firms operating a single server are to enter a market sequentially or simultaneously. We obtain the conditions under which the two firms would enter the market and the optimal capacity investment for each firm to maximize its profit if entering.

4 - Locating Charging Facilities for Electric Vehicles
Kiana Roshan Zamir, Graduate Research Assistant, University of Maryland, Dept .of Civil and Environmental Eng., 1173 Glenn Martin Hall, College Park, MD, 20742, United States of America, Kianarz@umd.edu, Ali Haghani

Using new alternative fuels than fossil fuels for motorized transportation vehicles has become more and more popular with the growing concerns on the limitation of fossil fuels and environmental degradation. One of the major challenges for the owners of electric vehicles is lack of charging infrastructures and limited range of these vehicles. In this paper, a model is developed for optimal placement of these facilities along the network.

5 - 1-Refueling Location Problem on a Continuous Tree Network
Sang Jin Kweon, PhD Student, Pennsylvania State University, 232 Leonhard Building, University Park, PA, 16802, United States of America, svk5333@psu.edu, Seong Wook Hwang, Jose A. Ventura

In this talk, we consider a location problem for 1-refueling station on a tree network. We aim to locate the station anywhere on the network, including along the edge. Our objective is to locate a 1-refueling station to maximize the total traffic flow covered in round trips. For this, we derive reduction properties regarding the problem size and optimality conditions. Then, we develop an exact algorithm to determine the set of optimal locations for the refueling station.

■ TB27

Hilton- Union Sq 7

Rail System Performance

Sponsor: Railway Applications

Sponsored Session

Chair: Bo Zou, University of Illinois at Chicago, 2073 Engineering Research Facility, 842 West Taylor Street, Chicago, IL, 60607, United States of America, bzou@uic.edu

1 - A Column Generation Approach for Designing Dynamic Train Service Network
Xuesong Zhou, Associate Professor, Arizona State University, School of Sustainable Engineering, Tempe, AZ, United States of America, xzhou74@asu.edu, Lingyun Meng

This talk presents a holistic modeling approach for integrating transportation demand, train service and infrastructure networks. We develop integer programming models for a train dispatching problem on an N-track network by means of simultaneously rerouting and rescheduling trains. A space-time path reformulation can provide an efficient decomposition mechanism through modelling track capacities and trip demand as side constraints in a Lagrangian relaxation solution framework.

2 - Capacity of Single-Track Railway Lines with Short Sidings to Support Operation of Long Trains
Ivan Atanassov, University of Illinois at Urbana-Champaign, 205 N. Mathews Ave., Urbana, IL, 61801, United States of America, atanass1@illinois.edu, Christopher PL Barkan, Tyler Dick

The use of distributed power locomotives has allowed for greater efficiencies through longer trains, but is complicated by the inadequate length of many existing passing sidings. This research seeks to characterize and analyze the interaction between siding lengths and the length of trains, and its effect on track utilization and train-delay. The analysis includes a discussion of the existing problem, as well as practical implications of the results on planning siding extension programs.

3 - Analysis of Rail Line Capacity on Shared Corridors with Multiple Freight Train Types
Mei-Cheng Shih, Graduate Research Assistant, University of Illinois, Urbana-Champaign, 205 North Mathews Ave. B118, Urbana, IL, 61801, United States of America, mshih2@illinois.edu, Tyler Dick

Expanding rail network line capacity through efficient planning requires an understanding of how traffic mixture affects line capacity and the delay incurred by various classes of trains. This study analyzed the interaction of three different types of trains using simulation. A general transformation between delay and throughput was also developed.

4 - Integrated Network Performance in Denmark
Steven Harrod, Associate Professor, Technical University of Denmark, Room 109A, Building 116, Kgs. Lyngby, 2800, Denmark, stehar@transport.dtu.dk

DTU Transport is investigating how to measure and direct railway services for the benefit of the larger, multimodal transport network. This presentation will present the recommendations of the Danish Congestion Commission and discuss their implications for management of the Danish railway services. Further, the common data foundation managed by the DTU Transport Model Center and its application to analysis of railway performance will be explained.

■ TB28

Hilton- Union Sq 8

Airline Choice-based Pricing and Revenue Management

Sponsor: Aviation Applications

Sponsored Session

Chair: Emmanuel Carrier, Delta Airlines, 30 Delta Boulevard, Atlanta, GA, 30354, Georgia, Emmanuel.Carrier@delta.com

1 - The Impact of Advance Purchase Deadlines on Airline Customers' Search and Purchase Behaviors

Laurie Garrow, Georgia Institute of Technology, School of Civil Engineering, Atlanta, GA, 30332, United States of America, laurie.garrow@ce.gatech.edu, Susan Hotle, Matthew Higgins

Few studies have investigated how individuals respond to advance purchase deadlines and price uncertainties induced by these deadlines. We model individuals' search and purchase behaviors using an instrumental variable approach that corrects for price endogeneity. We find search increases just prior to an advance purchase deadline and that some consumers who want to travel just after an advance purchase deadline are willing to travel a day or two later in order to avoid paying a higher fare.

2 - Willingness to Pay Forecaster for Airline Demand Forecasting

Abinav Rameesh, Associate Scientist, PROS, 8333 Braesmain Drive, Apartment 1416, Houston, TX, 77025, United States of America, arameesh@pros.com, Wei Wang

Forecasting models are evolving to incorporate a market of price sensitive customers, looking for the cheapest available fare. As customers "buy down" to the lowest available class they reveal their true "Willingness to Pay". The Willingness to Pay model holds that a customer's true willingness is greater than the paid fare and is derived from the distribution of paid fares. At PROS, we have conducted simulations to explore the behavior of this model and its impact on demand forecasting.

3 - Implementation of MNL Choice Models in PODS Network D6: First Steps

Emmanuel Carrier, Delta Airlines, 30 Delta Boulevard, Atlanta, 30354, Georgia, Emmanuel.Carrier@delta.com, Larry Weatherford

This presentation summarizes results of Passenger Origin Destination Simulator (PODS) research on how to implement our MNL choice model in a large "domestic" network with two airlines competing in 482 O&D markets. Based on the choice model parameter estimates, a new MNL path forecast is created. Revenue results are presented when comparing this new MNL forecaster vs. classic methods like leg standard, path standard and hybrid forecasting, under both leg and network optimization.

4 - Discrete Choice and Semi-supervised Learning for Air Travel Shopping Data

Jie Yang, Graduate Student, Northwestern University, 2145 Sheridan Road, Evanston, IL 60208, Evanston, Il, 60208, United States of America, jieyang2011@u.northwestern.edu, Diego Klabjan, Sergey Shebalov

Travel agents get itineraries from global distribution systems. The resulting air travel shopping data consists of requests and return itineraries but not bookings. We combined discrete choice modeling and semi-supervised learning to estimate bookings. We report findings based on real world data from a major global distribution system provider.

■ TB29

Hilton- Union Sq 9

Project Management 2

Contributed Session

Chair: Vishwanath Hegde, Professor, California State University East Bay, 25800 Carlos Bee Blvd, Hayward, CA, 94542, United States of America, vish.hegde@csueastbay.edu

1 - A Two-Phase Algorithm of DCF Maximisation for the Milestone-Settled Project

Piotr Lebkowski, Professor, AGH Univ. of Science and Technology, al. Mickiewicza 30, Krakow, PL 31-059, Poland, plebkows@zarz.agh.edu.pl, Marcin Klimek

The paper presents a RCPSP settled by contractual milestones. The criterion analysed here is the maximisation of aggregate discounted cash flows from the contractor's perspective, known as an RCPSP problem with Discounted Cash Flows. The cash flows analysed here cover the contractor's cash outflows, related to the commencement of individual activities, and cash inflows after the fulfilment of individual milestones. The authors propose a two-phase algorithm for solving the problem defined.

2 - Bi-objective Resource-constrained Project Scheduling with Net Present Value and Robustness

Yangyang Liang, HuaZhong University of Science and Technology, HUST University of Wuhan,China, Wuhan, China, yangliang0419@sina.com, Nanfang Cui

This paper involves the RCPSP problem with discounted cash flows, the objective is to build a robust schedule that maximize the project net present value and minimize the stability cost, simultaneously. The tabu search algorithm is used to obtain a satisfying solution based on STC scattered buffer method. Finally a comprehensive computational experiment is performed to confirm the availability and feasibility of the algorithm.

3 - Determining Project Duration in Project Portfolio Environments

Vishwanath Hegde, Professor, California State University East Bay, 25800 Carlos Bee Blvd, Hayward, CA, 94542, United States of America, vish.hegde@csueastbay.edu, Zinovy Radovilsky

In this paper, we examined resource allocation patterns across projects and the project duration in a portfolio of projects over eleven years. We identified the variables that impact project duration in multiple project settings. The resource allocation and duration estimation approaches were contrasted between multiple project and the single project management environments.

4 - Robust Optimization of the Resource Allocations in Projects Networks

Nasim Nezamoddini, State University of New York at Binghamton, 13 Goethe St., Binghamton, NY, United States of America, nnezamo1@binghamton.e, Sarah Lam

In this research, project resource planning has been addressed when some activities may fail due to the unexpected events. Failures are expressed in terms of delays that system will face and it is assumed that failure probability of each activity will be decreased with allocating more resource. To identify the most critical activities that need to be protected, two stage stochastic model with objective of minimizing resource allocation cost and expected delay penalties has been presented.

■ TB30

Hilton- Union Sq 10

Supply Chain Scheduling and Optimization

Cluster: Scheduling and Project Management

Invited Session

Chair: Shengbin Wang, Assistant Professor, North Carolina A&T State University, 1601 East Market Street, Merrick 116, Greensboro, NC, 27411, United States of America, swang@ncat.edu

1 - Remanufacturing Scheduling Systems: A Comparison of Academic Progress with Industry Practice

Roger Gagnon, Director-Master of Science in Management, North Carolina A& T State University, 1601 E. Market Street, 312 Craig Hall, Greensboro, NC, 27411, United States of America, gagnonr@ncat.edu, Shona Morgan

We review the academic progress made in remanufacturing scheduling systems and compare this to the practices in industry. We report on academic advancements made in scheduling system methodologies, objective functions, and complexities. We survey members of ARPA to learn the techniques used to schedule remanufacturing operations and the difficulties encountered. Survey results are compared with academic progress in remanufacturing scheduling and the results of previous industry surveys.

2 - A Continuous-time Model and Meta-heuristic Algorithm for the Aluminum Scheduling Problem

Qingxin Guo, The Logistics Institute, Northeastern University, NO. 3-11, Wenhua Road, Heping District, Shenyang, China, guoqingxin@ise.neu.edu.cn, Lixin Tang

We consider a short-term scheduling problem of aluminum industry. The characterization of aluminum production process are a bit different from the steel or chemical engineering industries. The proposed problem is formulated by a continuous-time model. We develop a meta-heuristic algorithm to solve this model. The proposed approach is compared with a well-known optimization software. The computational results show the efficiency and effectiveness of the proposed formulation and approach.

3 - An Adaptive Partitioning Algorithm for Solving Supply Chain Optimization Problems
Weiwei Chen, Assistant Professor, Rutgers Business School, 1 Washington Park, Newark, NJ, 07102, United States of America, wchen@business.rutgers.edu

Many supply chain optimization problems, such as inventory control problem, can be expressed as sequential decision making problems. When the problem size becomes large, derivative-free random search algorithms have been popularly used to solve the problem. In this talk, an adaptive partitioning algorithm is developed to exploit derivative information to speed up the search for optimal policy. Numerical tests on an inventory control problem show the effectiveness of the proposed algorithm.

4 - Disaster Relief Operations Scheduling with Multiple Resources
Yuan Hong, Assistant Professor, University at Albany, SUNY, 1400 Washington Ave., Albany, NY, 12222, United States of America, hong@albany.edu, Shengbin Wang

We study an operations scheduling problem commonly encountered in the process of providing relief, support and assistance in affected areas after a disaster or a humanitarian catastrophe occurs. Each operation requires multiple resources from a set of distribution centers with an independent fleet. We consider the operations/transportation costs as well as a penalty cost if missing the pre-specified deadline. An approximation solution to minimize the total cost is proposed and analyzed.

5 - A Two-stage Stochastic Integer Linear Programming (SILP) Model for Phlebotomist Scheduling
Laquanda Leaven, Assistant Professor of Supply Chain Management, North Carolina Agricultural and Technical State University, 1601 East Market Street, 337 Merrick Hall, Greensboro, NC, 27411, United States of America, ltleaven@ncat.edu

A Two-Stage Stochastic Integer Linear Programming (SILP) Model was formulated to determine better phlebotomist schedules for the preanalytical stage in hospital laboratories. The objective is to balance phlebotomist workload between and within shifts. By implementing the recommendations of this study, hospital laboratories should see significant improvements in patient satisfaction, workload balance, and resource utilization, which are all considered cost savings strategies.

■ TB31

Hilton- Union Sq 11

Overcoming Business Impact Uncertainty

Sponsor: Service Science

Sponsored Session

Chair: Genady Grabarnik, St Johns University, 8000 Utopia Parkway, Queens, Ne, 11439, United States of America, grabarng@stjohns.edu

1 - On Exact Estimate in the Palm Khinchin Theorem
Genady Grabarnik, St Johns University, 8000 Utopia Parkway, Queens, NY, 11439, United States of America, grabarng@stjohns.edu, Larisa Shwartz, Haim Michlin

In the services science requests are described by discrete distribution, and in many cases we may consider that a number of requests' streams are merged to create load on service provider. The Palm-Khinchin theorem states that merging a large number of independent identical discrete distributions will generate distribution with exponential time between event (requests) arrivals. We provide estimates for merge of finite number of distributions to be close exponential distribution.

2 - Hierarchical Multi-Label Classification over Ticket Data using Contextual Loss
Larisa Shwartz, IBM TJ Watson Research, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States of America, lshwart@us.ibm.com, Genady Grabarnik

This paper models a determination of a ticket type as a hierarchical multi-label classification problem. A loss function is proposed by considering the contextual miss-classification information to the hierarchy of labels to support different scenarios in IT environments. An optimal prediction rule is developed. We introduced a greedy algorithm to predict the multiple labels of a ticket, without violating the hierarchy consistence. Extensive empirical studies over the ticket data are conducted.

3 - Performance Measurements of IT Service Associates under Random Load
Haim Michlin, Technion, Technion City, Haifa, Israel, yefim@technion.ac.il, Genady Grabarnik, Larisa Shwartz

We used sequential test (SPRT) to assess effects of innovation for a case when load of the service teams being constant over time. The method works with random arrival of service requests. We design performance test based on concepts of Repeated Significance Test (RST), which allowed us to take into account variable number of SAs. We show superiority of the test in comparison to fixed sample size test (FSST) in ASN. We also compare RST with SPRT when size of service team is constant.

4 - Non-statistical Representation of Uncertainty: A Topological Approach
Victor Tang, Research Scientist, MIT, 55 Deerfield Lane South, Pleasantville, NY, 10570, United States of America, victor.w.tang@gmail.com

Risk and Uncertainty are conflated by even academic researchers. Risk can be characterized statistically; uncertainty cannot. Risk has drawn the lion's share of research attention. We concentrate on what lions have neglected. We characterize uncertainty using set theory and topology. We discuss the social-technical systems design and management implications of this approach. We focus specifically on the uncertainty of unknown-unknown's. We present a prescriptive framework for decision analysis.

5 - Business Driven Optimization of Cloud-based IT Services
Mauro Tortonesi, Assistant Professor, University of Ferrara, Via Saragat 1, Ferrara, FE, 44122, Italy, mauro.tortonesi@unife.it, Genady Grabarnik

Through virtualized resources, dynamic pricing schemes, and federated environments, Cloud Computing allows seamlessly reconfigurable IT architectures. This enables service providers to dynamically optimize their infrastructure to match customer request load while minimizing operational costs. Our work focuses on business driven optimization of Cloud-based IT services, proposing a resource allocation model, ILP and computational intelligence based optimization, and a decision support tool.

■ TB32

Hilton- Union Sq 12

Workforce Planning II

Cluster: Workforce Management and Engineering

Invited Session

Chair: Michael Hewitt, Loyola University Chicago, 820 N. Michigan Ave, Chicago, IL, 60611, United States of America, mhewitt3@luc.edu

1 - Allocating Inflexible Labor Costs in Dynamic Markets
Aaron Chonko, Captain, Naval Postgraduate School, Monterey, CA, United States of America, awchonko@nps.edu, Kenneth Doerr, Robert Eger, Travis Rudge

We explore the way demand forecasts impact cost competitiveness by driving labor costs. At the distribution center we study, markets are dynamic, but labor costs are relatively static. Forecasts of demand and workload are used to determine capacity (number of workers). Either an inaccurate forecast, or an inaccurate method of predicting workload from a forecast, can leave a distribution center with a mismatch between their costs and market prices. This mismatch is problematic in environments such as the one in our field study, where labor cost has little flexibility relative to the competition.

2 - Stochastic Assignment with Individual Learning
Silviya Valeva, University of Iowa, Iowa City, IA, United States of America, silviya-valeva@uiowa.edu, Barrett Thomas, Michael Hewitt

We consider the problem of assigning workers to a series of tasks, the completion of which yields a finished product. We seek to maximize the expected revenue generated from sales of the finished product while facing uncertain future demand and taking into account the workers' learning abilities. We formulate the problem as a two-stage stochastic integer program. Results demonstrate the value of modeling learning as well as the trade-off between cross-training and inventory.

3 - Workforce Staffing and Planning Models that Recognize Human Learning
Michael Hewitt, Loyola University Chicago, 820 N. Michigan Ave, Chicago, IL, 60611, United States of America, mhewitt3@luc.edu, Barrett Thomas

When hiring for a team or project, organizations must balance the experience and aptitude of their hires against a budget. In this research, we extend previous work that enabled us to solve large-scale scheduling problems that include non-linearities associated with quantitative models of human learning to include workforce selection. With a computational study, we derive insights into how to compose a workforce for various budget levels.

4 - The Flexible Break Assignment Problem for Hierarchical Tour Scheduling Problems
Ferdinand Kiermaier, Technical University of Munich, Arcisstrafle 21, Munich, Germany, ferdinand.kiermaier@tum.de, Markus Frey, Jonathan Bard

Many personnel scheduling problems require the explicit assignment of shifts and days-off to individual employees taking into account information such as skills and overtime balances while incorporating break regulations. We present a decomposition that includes hierarchical skills and the possibility to use different break regulations. Moreover, we provide a classification scheme for breaks regulations discussed in literature and show the merits of using flexible break regulations.

■ TB33

Hilton- Union Sq 13

Operations/Finance Interface 1

Contributed Session

Chair: Yunpeng Pan, Assistant Professor, South Dakota State University, Mathematics&Statistics, Box 2220, Brookings, SD, 57007, United States of America, yunpeng.pan@sdstate.edu

1 - A Valuation Framework Using Real Options and Big Data for Selecting Cloud Data Center Sites
Yunpeng Pan, Assistant Professor, South Dakota State University, Mathematics&Statistics, Box 2220, Brookings, SD, 57007, United States of America, yunpeng.pan@sdstate.edu, Zhiguang Wang, Carrie Steinlicht

We develop a valuation framework based on real options and Big Data for selecting cloud computing data center sites. The model takes into account costs and customer proximity as well as industry factors such as fiber paths and population reach. Optimization of data center operations is embedded in the model. Both service providers and local/regional governments with the intent to recruit data centers can use our valuation framework to assess the impact of their strategic policy decisions.

2 - The Midas Touch: The Effect of Gold Hedging on Inventory and Profit Variance
Panayotis Markou, IE Business School, Calle Maria de Molina 11, Madrid, Spain, pmarkou.phd2016@Student.ie.edu, Daniel Corsten

We empirically investigate the effects of risk management practices on firm operational variables. Specifically, we test the impact of financial hedging on inventory and profit variance by leveraging a unique and novel database highlighting the amount of gold hedged by mining companies. Our results show that hedging has a significant influence on firm inventory levels and profit variance, and also provide initial support for analytical models in the Operations field.

3 - Aggregate Production Planning under Financial Constraints
Maxim Bushuev, Assistant Professor, Kent State University, 1835 Beacon Hill Cir #21, Cuyahoga Falls, OH, 44221, United States of America, mbushuev@kent.edu

The research focuses on Aggregate Production Planning (APP) problem with financial elements which is modeled as convex stochastic dynamic programming model. The APP problem is concerned with determining the production rate and work force level over a given horizon in order to meet the demand and minimize the expected cost. Financial elements include bankruptcy cost and capital structure which is an additional decision variable. Three demand forms are used: constant, trend, and seasonality.

4 - Access to Pre-shipment Finance: Does Buyer's Guaranty Help?
Boray Huang, National University of Singapore, 1 Engineering Drive 2, E1A-06-25, Singapore, SG, 117576, Singapore, borayhuang@nus.edu.sg, Andy Wu, David Chiang

This paper studies a Buyer-Backed Purchase Order Financing (BPOF) scheme in a simplified supply chain with one main manufacturer buying from two sources: A low-cost but unreliable SME supplier, and the high-cost but reliable spot market. We identify the properties of the buyer's optimal joint sourcing and credit-guarantee decisions under different risk-free interests in the capital market. Through numerical experiments, BPOF is shown to significantly improve the manufacturer's profitability.

■ TB34

Hilton- Union Sq 14

Models for Emergency Medical Services

Sponsor: Public Programs, Service and Needs

Sponsored Session

Chair: Laura McLay, Associate Professor, University of Wisconsin-Madison, 1513 University Ave, Madison, WI, 53706, United States of America, lmclay@wisc.edu

1 - Optimizing Compliance Tables for Ambulance Repositioning
Armann Ingolfsson, University of Alberta, School of Business, Edmonton, AB, T6G2R6, Canada, aingolfs@ualberta.ca, Ramon Alanis, Fernanda Campello, Bora Kolfal

Compliance tables are commonly used to specify ambulance repositioning policies. We study multiple methods for performance evaluation and optimization of compliance tables, ranging from a greedy heuristic combined with a realistic Markov chain model, to an integer program combined with much simpler performance evaluation. We use stochastic ordering to show that the integer program can be used to obtain bounds on performance. We study how "nesting" and "doubling up" impact performance.

2 - A Stochastic Programming Approach for Real-time Ambulance Redeployment with Restricted Workload
Shakiba Enayati, North Carolina State University, 111 Lampe Dr., Raleigh, NC, 27695, United States of America, senayat@ncsu.edu, Maria Mayorga, Osman Ozaltin

Ambulance redeployment is a strategy to potentially help to increase coverage when some ambulances become unavailable. However, redeployment may not always be possible or practical due to EMS providers' workload restrictions. Moreover, excessive ambulance relocation can cause emergency service providers to have undesirable fatigue and back pain. This paper presents a stochastic programming approach, implemented in real time to maximize expected coverage subject to provider workload restrictions.

3 - The Vehicle Mix Decision in Emergency Medical Service Systems
Kenneth Chong, Cornell University, 257 Rhodes Hall, Ithaca, NY, 14853, United States of America, kcc66@cornell.edu, Shane Henderson, Mark Lewis

We consider the problem of selecting the number of Advanced Life Support (ALS) and Basic Life Support (BLS) unitsó the vehicle mixó to deploy in an ambulance fleet. To this end, construct an optimization-based framework under which quantitative comparisons can be made, that takes into account the effects of the vehicle mix decision on how ambulances are assigned to bases and dispatched in real time. We test our models via numerical experiments on a large-scale emergency medical service system.

4 - Spatial Queueing Models of Wildfire Evolution
James MacGregor Smith, Professor, University of Massachusetts, 874 North Pleasant Street, Amherst, MA, 01002, United States of America, jmsmith@ecs.umass.edu, Alexander Stepanov

We develop a stochastic wildfire model based upon a discretized random flow process with state dependent queueing models. Utilizing a tesselated landscape data base of Voronoi polygons for thirteen different fuel types, we develop a state dependent queueing model algorithm for predicting the expected flow time of the wildfire. The advantage of the state dependent model is that general rates of spread can be utilized to model the path of the fire through the network of Voronoi polygons.

■ TB35

Hilton- Union Sq 15

Joint Session SPPSN/Minority Issues: Panel Discussion- Publishing Community and Humanitarian Operations Research in High-Impact Journals

Sponsor: Public Programs, Service and Needs & Minority Issues Forum

Sponsored Session

Chair: Michael Johnson, Associate Professor, University of Massachusetts Boston, 100 Morrissey Blvd., McCormack Hall Room 3-428A, Boston, MA, 02125-3393, United States of America, Michael.Johnson@umb.edu

Co-Chair: Emmett Lodree, University of Alabama, 361 Stadium Drive, Tuscaloosa, AL, United States of America, ejlodree@cba.ua.edu

1 - Panel Discussion: Publishing Community and Humanitarian Operations Research in High-Impact Journals
Michael Johnson, Associate Professor, University of Massachusetts Boston, 100 Morrissey Blvd., McCormack Hall Room 3-428A, Boston, MA, 02125-3393, United States of America, Michael.Johnson@umb.edu, Panelists: Vedat Verter, Stefanos Zenios, Emmett Lodree, Roman Slowinski

Journal quality rankings are often used by academic units to make important assessments regarding faculty performance including tenure and promotion decisions. This criterion can be problematic for researchers in the community and humanitarian operations areas because "top-tier" journals are often not the most appropriate outlets for this type of research. This panel will attempt to articulate the characteristics papers that are likely to be successful in top-tier titles, and discuss other strategies for justifying research quality in these areas. Confirmed participants (so far): - Vedat Verter (Socio-Economic Planning Sciences) - Stefanos Zenios (Operations Research) (we're likely to get either Stephen Graves or Pinar Keskinocak of Manufacturing and Services Operations Management) Sponsoring subdivisions: Minority Issues Forum; Section on Public Programs, Services and Needs

■ TB36

Hilton- Union Sq 16

Optimization Techniques for Reliable Operation of Mobile Communication Systems

Sponsor: Telecommunications

Sponsored Session

Chair: Albena Mihovska, Associate Professor, Center for TeleInfrastruktur-Aalborg University, Fredrik Bajers Vej 7C1, Aalborg, 9000, Denmark, albena@es.aau.dk

1 - Mathematical Model for Optimized Node Selection in Resource-Constrained Environments

Albena Mihovska, Associate Professor, Center for TeleInfrastruktur-Aalborg University, Fredrik Bajers Vej 7C1, Aalborg, 9000, Denmark, albena@es.aau.dk

A main concern related to Internet of Things (IoT) research efforts is the realization of autonomous decision-making and communications between the resource-constrained nodes, part of a dynamic topology. This contribution proposes a novel mathematical model to define the node interactions in a resource-constrained environment and optimize the selection of a partner for the most reliable communication depending on the needs of the service required.

2 - The Next Billion of Devices and Beyond: Getting Ready for Machine-to-Machine (M2M)

Rasmus Nielsen, Cisco Systems, 855 Tasman Dr, San Jose, United States of America, rhnielsen@ieee.org, Mahbubul Alam

The next wave of connectivity will consist of Machine-to-Machine (M2M) devices with usage patterns much different from what is currently seen from the human-driven network traffic. This paper investigates the challenges of connecting this large number of devices and supporting their specific requirement while proposing ways and methods to addresses these challenges in the form of optimizing networks specific to such devices in terms of scalability, performance, security and reliability.

3 - Topological Optimization of Reliable Networks under Dependent Failures

Javiera Barrera, Universidad Adolfo Ibañez, Faculty of Engineering, Santiago, Chile, javiera.barrera@uai.cl, H Cancela, Eduardo Moreno

We address the design problem of a reliable network. Previous work assumes that link failures are independent. We discuss the impact of dropping this assumption. We show that under a common-cause failure model, dependencies between failures can affect the optimal design. We also provide an integer-programming formulation to solve this problem. Furthermore, we discuss how the dependence between the links that participate in the solution and those that do not can be handled. Other dependency models are discussed as well.

■ TB37

Hilton- Union Sq 17

Data Mining and Machine Learning

Sponsor: Artificial Intelligence

Sponsored Session

Chair: Dave Choi, Carnegie Mellon University, Hamburg Hall 2101C, 5000 Forbes Ave, Pittsburgh, PA, 15213, United States of America, davidch@andrew.cmu.edu

1 - Data-driven Individual and Joint Chance-Constrained Optimization via Kernel Density Estimation

Bruno A. Calfa, Graduate Student, Carnegie Mellon University, 5000 Forbes Ave, Pittsburgh, PA, 15213, United States of America, bacalfa@gmail.com, Ignacio E. Grossmann, Scott J. Bury, John M. Wassick, Anshul Agarwal

We propose a data-driven, nonparametric approach to reformulate (conditional) individual and joint chance constraints with right-hand side uncertainty into algebraic constraints. The approach consists of using Kernel Density Estimation (KDE) to approximate unknown "true" continuous probability density/distribution functions. We propose a new way of specifying the phi-divergence tolerance based on point-wise standard errors of the smoothing estimates with respect to the asymptotic distribution.

2 - Approximate Formulations for Chance Constrained Problems

Gabriela Martinez, Postdoctoral Associate, Cornell University, 319 Riley-Robb Hall, Ithaca, NY, United States of America, mgm256@cornell.edu, C. Lindsay Anderson

We propose an approximate formulation for chance constrained optimization models with ambiguous probability distribution of the random parameters of the optimization model. In this work, the uncertainty of the distribution is described by confidence regions constructed from order statistics of historic data of the uncertain parameters.

3 - Ensemble Recommendation and Segmentation for Large Datasets

Jorge Silva, SAS, 100 SAS Campus Dr, Cary, NC, United States of America, jorge.silva@sas.com, Jared Dean, Susan Haller, Patrick Hall, Ilknur Kabul

Recommender systems are a growing application of data mining and machine learning. We describe a recommendation and segmentation framework based on an ensemble of models, leveraging parallel computation. We employ a flexible factorization machine model, using not only recorded user-item access but also side information. Using a parallel Monte-Carlo procedure, the learned factors are clustered under multiple hypotheses, producing robust and interpretable ensemble estimates for large datasets.

■ TB38

Hilton- Union Sq 18

Health Care Modeling Optimization II

Contributed Session

Chair: Srinivasa Puranam, La Salle University, 1900 W Olney Ave, Philadelphia, PA, 19102, United States of America, kartys.here@gmail.com

1 - Appointment Scheduling of Outpatient Surgical Services in a Multistage Operating Room Department

Payman Jula, Associate Professor, Simon Fraser University, 8888 University Drive, Burnaby, BC, V5A 1S6, Canada, pjula@sfu.ca

We address the appointment scheduling of multistage operating room departments with stochastic service times serving multiple patient types. We discuss many challenges, such as the limited availability of multiple resources (e.g., staff, operating rooms, surgeons, and recovery beds), and the compatibility of patient and surgeon types. Simulation-based optimization methods have been proposed to minimize the patients' wait time, patients' completion time, and number of surgery cancellations.

2 - Coordinating Contracts in Value-Based Healthcare Delivery

Tannaz Mahootchi, PhD Candidate, Wilfrid Laurier University, 75 University Ave. West, Waterloo, ON, N2L 3C5, Canada, tmahootchi@wlu.ca, Ignacio Castillo, Logan McLeod

Value-based healthcare delivery requires reforms to different components of the healthcare system including organizational structure, outcome/cost measurement, and reimbursement. This study looks at coordinating contracts between healthcare purchasers and healthcare providers in this context. A dynamic principal-agent model is used to model the interactions between treatment strategy and health outcomes where there is a single responsible entity for both the health outcomes and costs of care.

3 - Robust Post-donation Blood Screening Strategies under Prevalence Rate Uncertainty

Hadi El Amine, PhD Candidate, Virginia Tech, 1228 University City Blvd., Apt F67, Blacksburg, VA, 24060, United States of America, hadi@vt.edu, Ebru Bish, Douglas Bish

Blood product safety, in terms of being free of transfusion-transmittable infections, is crucial. Under prevalence rate uncertainty, various objective functions, including minimization of a mean-variance objective and minimization of the maximum regret, were considered in order to determine a "robust" post-donation blood screening strategy that minimizes the risk of releasing an infected unit of blood into the blood supply. Efficient and exact algorithms are provided.

4 - On the Determination of Optimal Ordering Policies for Blood Products with Blood Transfers

Srinivasa Puranam, La Salle University, 1900 W Olney Ave, Philadelphia, PA, 19102, United States of America, kartys.here@gmail.com, David Novak, Marilyn Lucas

We investigate the determination of optimal order policies for blood products when blood transfers exist from other hospitals. We develop an analytical model to propose simple decision rules and compare these rules to existing policies - relying on real-world data from the Blood Bank of a local hospital.

5 - The Mahalanobis Distance Approach to Minimization of Kidney Discard Rate

Philip Appiah Kubi, PhD Candidate, Ohio University, 14 Pine St., Apt # 1B, The Plains, OH, 45780, United States of America, pa809911@ohio.edu, Park Namkyu

In 2011 over 5,000 people died on the kidney waitlist while the discard rate also increased from 12.7% in 2002 to 17.9% in 2011. This paper discusses the prospects of minimizing the kidney discard rate by applying the Mahalanobis distance (MD) model to kidney allocation. This approach will offer candidates with kidneys of virtually the same quality over time, hence are presented with minimal incentive to reject a kidney offer.

■ TB39

Hilton- Union Sq 19

Managing Capacity and Demand in Healthcare Services

Sponsor: Health Applications

Sponsored Session

Chair: Craig Froehle, University of Cincinnati, 2925 Campus Green Dr, Lindner College of Business, Cincinnati, OH, 45221-0130, United States of America, craig.froehle@uc.edu

1 - A Queuing Evaluation of Partial Flexibility in Healthcare Systems with Multi-priority Patients

Elham Torabi, University of Cincinnati, 2925 Campus Green Dr, Lindner College of Business, Cincinnati, OH, 45221-0130, United States of America, torabiem@mail.uc.edu, Yann Ferrand, Michael Magazine, Uday Rao, Craig Froehle

Resource flexibility can improve responsiveness to customers/jobs in different priority groups. Using the context of an emergency department, we develop queueing models to determine the ideal degree of flexibility based on number of resources and uncertainty in various system parameters, such as arrival and service rates for each priority group.

2 - The Impact on LOS of a Reduction in ED Ultrasound Order Processing Time

Anita Tucker, Harvard Business School, Morgan Hall, Soldiers Field, Boston, MA, 02163, United States of America, atucker@brandeis.edu, Jillian Berry Jaeker, Michael Lee

We use a process change at two EDs to test whether increasing capacity increases wait times due to additional services being provided. We find that an increase in capacity for ultrasounds (U/S) resulted in an 11.5% increase in the probability of an U/S being ordered, and the increased demand for U/S resulted in longer times to return other tests. Consequently, the average length of stay for increased by nearly 30 minutes, and the waiting time to enter the ED increased by 26 minutes.

3 - Quality & Efficiency Implications of Interruptions & Information Overload on Decision-Making

Lauren Laker, University of Cincinnati, 2925 Campus Green Dr, Lindner College of Business, Cincinnati, OH, 45221-0130, United States of America, lakerln@mail.uc.edu, Craig Froehle

Research suggests that the timing of interruptions during a cognitive task can affect the quality and timeliness of decision-making in knowledge-intensive work environments. We hypothesize that providing framing, or directed learning, beforehand can improve decision-making by reducing information overload, partly mitigating the effects of interruptions. We evaluate these effects through controlled experiments. Initial findings are presented.

4 - Improving Service Levels in Hospital Porter Services

Ken Klassen, Professor, Brock University, Goodman School of Busin, 500 Glenridge Ave, St. Catharines, ON, L2S 3A1, Canada, kklassen@brocku.ca, Sean Brown

Causes of poor porter services can be difficult to identify. The hospital under study was experiencing such long wait times that all calls were reported as urgent ("STAT") and patients were often not ready when the porter arrived because arrival times were uncertain. The hospital had different systems for segregated sets of porters, and workloads were unequal. This study uses multiple quantitative and qualitative techniques to understand and analyze the system and to provide recommendations.

■ TB40

Hilton- Union Sq 20

Stochastic Modeling in Healthcare Delivery

Sponsor: Health Applications

Sponsored Session

Chair: Nan Liu, Assistant Professor, Columbia University, 600 W. 168th St., 6th floor, New York, NY, 10032, United States of America, nl2320@columbia.edu

Chair: Pengyi Shi, Assistant Professor of Operations Management, Purdue University, Krannert School of Management, West Lafayette, IN, United States of America, shi178@purdue.edu

1 - A Simulation Algorithm to Staff for Time-varying Arrivals and Multiple Customer Classes

Leon Cui, University of Rochester, 620 University Park, Rochester, NY, United States of America, leon.cui@Simon.Rochester.edu, Tolga Tezcan, Ozlem Yildiz

We propose a data-driven heuristic algorithm to find the minimum staffing level required in a queueing system with time-varying arrivals and multiple customer classes, given a service level criterion for each customer class. Our algorithm has been implemented by the transportation department of a local research hospital. Its validity is supported by results from the hospital, and by numerical experiments.

2 - OptiCare: An Outpatient Capacity Planning Tool for Integrated Care Access

Jivan Deglise-Hawkinson, University of Michigan, 820 S First Street Apt 2, Ann Arbor, MI, 48103, United States of America, jivan@umich.edu, Jonathan Helm, Thomas Rohleder, Mark Van Oyen, Todd Huschka, David Kaufman

Our capacity planning model seeks to meet targets on the access to an initial/root appointment by patient type and plan for a patient mix. A root visit usually generates a series of other appointments in both the initial department and in other medical areas. Our approach uses integer programs to optimize a booking plan that is also sensitive to utilization and incorporates stochastic models of future return visits and downstream appointments generated to follow up on the initial visit.

3 - Overflow Policies for Emergency Department Patients Awaiting Inpatient Beds

Pengyi Shi, Assistant Professor of Operations Management, Purdue University, Krannert School of Management, West Lafayette, IN, United States of America, shi178@purdue.edu, Jim Dai

Emergency department patients who wait to be admitted to inpatient wards sometimes have to be overflowed to a non-primary ward when they wait too long. Overflowing patients may alleviate the system congestion temporarily, but could reduce the quality of care delivered. We study a queueing system to gain insights into the impact of overflow policies on various performance measures. We also evaluate how different factors such as the bed capacity and discharge timing affect the overflow rate.

■ TB41

Hilton- Union Sq 21

OR/MS in Healthcare Quality and Patient Safety

Sponsor: Health Applications

Sponsored Session

Chair: Laila Cure, Western Michigan University, 1903 W. Michigan Ave, Kalamazoo, MI, 49008-5336, United States of America, laila.cure@wmich.edu

1 - Optimized Dual Shewhart-EWMA Statistical Control Charts for Hospital-acquired Infection Surveillance

Salah Haridy, Northeastern University, 360 Huntington Avenue, Boston, MA, United States of America, s.haridy@neu.edu, Dayna Martinez, James Benneyan, Arthur Baker, Deverick Anderson

Early detection of hospital-acquired infection (HAI) outbreaks remains an important problem across the U.S. We develop an optimized dual Shewhart-EWMA approach that minimizes the expected number of additional HAIs by allocating detection power between two sets of control limits under random outbreak sizes. Numerical testing and application to 10 years of infection surveillance data across 40 community hospitals outperformed traditional methods by 20-to-360% reductions in additional HAIs.

2 - Informing Resuscitation Decisions in Acute Care by Capturing Provider-specific Model Uncertainty

Muge Capan, North Carolina State University, 400 Daniels Hall, College of Engineering, Raleigh, NC, United States of America, mcapan@ncsu.edu, Jeanne Huddleston, Julie Ivy

Modeling physiological deterioration to inform resuscitation decisions involves the challenge of specification of the input parameters. Specifically, cost parameters require translation of provider preferences. We develop analytical models for determining optimal patient-specific resuscitation policies. We consider care providers' risk-sensitive behavior to capture model uncertainty due to subjective cost parameters, and variability in the value of providers with different expertise.

3 - Impact of the Disease Surveillance System in Epidemiologic Characterization of Pandemic Outbreaks

Eric Meisheri, Western Michigan University, 4601 Campus Drive, Kalamazoo, MI, 49008, United States of America, eric.r.meisheri@wmich.edu, Diana Prieto, Peter Holvenstot, Richard VanEnk

In the U.S., most of the information about a developing influenza pandemic comes from data collected by State viral surveillance systems. This study explores the effect of surveillance system, and behavioral factors on the accuracy of pandemic trend prediction. The authors used a specimen submission and testing simulation developed over an existing agent based disease spread model. The results were analyzed to determine the most significant factors and interactions.

4 - Modeling and Analysis of Inpatient Care Rounds
Laila Cure, Western Michigan University, 1903 W. Michigan Ave, Kalamazoo, MI, 49008-5336, United States of America, laila.cure@wmich.edu, Ewing Tiong

We study the problem of planning patient care rounds in a shift by a healthcare provider assigned to a specific set patients within an inpatient care unit, when personnel has been scheduled and resources have been allocated. This research investigates inpatient care work planning decisions and proposes an OR- based model to study such decisions. The model will help identify needs and challenges in developing decision-support tools for the provision of high quality care using available resources.

■ TB42

Hilton- Union Sq 22

Joint Session HAS/QSR/Analytics: Advanced Predictive Analytics for Health and Wellness Assurance

Sponsor: Health Applications, Quality, Statistics and Reliability, & Analytics Section

Sponsored Session

Chair: Trung Le, Texas A&M, College Station, TX United States of America, trung.le@tamu.edu

Co-Chair: Satish Bukkapatnam, Texas A&M University, College Station, TX, United States of America, satish@tamu.edu

1 - Personalized Prognostics of Cardiorespiratory Disorders: A Case Study for Obstructive Sleep Disorder
Trung Le, Texas A&M, College Station, TX, United States of America trung.le@okstate.edu, Satish Bukkapatnam

A personalized prognosis method based on a nonparametric statistical (Dirichlet Process Mixture Gaussian Process-DPMG) model to estimate the state evolution from a normal to an anomalous state and hence the distribution of the time till impending disorders has been reported. Validations using data from ECG Apnea Database-Physionet suggest that the model can predict the time till the onset of a disorder (apnea episode) to within 15% of the actual observed times 1-45 minutes ahead of inception.

2 - Statistical Shape Analysis and Prediction of Soft Tissue Insertions on the Tibial Plateau
Cao (Danica) Xiao, PhD Student, University of Washington, Seattle, 3900 Northeast Stevens Way, Mechanical Engineering Building, room G6, Seattle, WA, 98195, United States of America, danicaxiao@gmail.com, Liying Zheng, W. Art Chaovalitwongse, Xudong Zhang

Our study characterized the soft tissue insertion centroids and outlines on the tibial plateau and their inter-relationships with tibia outlines. We use coordinates conversion, outline detection, and windowing to extract 36 features from tibia outlines. Then we use KNN with three different measures to predict soft tissue locations(centroid and outlines) based on tibia outline features. Results show high prediction accuracy.

3 - Penalized Estimation of DAGs from Partial Orderings
Ali Shojaie, University of Washington, F646 Health Sciences Building, Department of Biostatistics, Seattle, WA, 98195, United States of America, ashojaie@uw.edu

Directed acyclic graphs (DAGs) are widely used to define causal relationships among variables, and play a critical role in diverse application areas. Although, learning DAG structures from observational data is very challenging, it can be efficiently performed if the causal ordering among the variables is known. In this talk, we will extend discuss estimation of DAGs from partial or set orderings, and present an efficient algorithm for learning the structure of high dimensional DAGs.

■ TB43

Hilton- Union Sq 23

Data Analysis

Sponsor: Computing Society

Sponsored Session

Chair: Jason Sauppe, PhD Candidate, University of Illinois at Urbana-Champaign, 201 North Goodwin Avenue, Urbana, IL, 61801, United States of America, sauppe1@illinois.edu

1 - The Role of Optimization and Covariate Balance in Observational Studies
Jason Sauppe, PhD Candidate, University of Illinois at Urbana-Champaign, 201 North Goodwin Avenue, Urbana, IL, 61801, United States of America, sauppe1@illinois.edu, Sheldon Jacobson

Observational, or non-random, data exist in many areas of study. However, such data require the use of appropriate methods of adjustment in order to derive unbiased causal estimates. Matching methods have long been used for this purpose, but improvements in computational power and optimization techniques now allow for the use of more general adjustment methods based on covariate balance measures. This talk will explore several assumptions and models related to these adjustment methods.

2 - Second-Order Cone Programming for Nonnegative Regression with P-Spline
Yu Xia, Assistant Professor, Lakehead University, Business Administration, 955 Oliver Rd., Thunder Bay, ON, P7B 5E1, Canada, yxia@lakeheadu.ca, Farid Alizadeh

We consider regression by B-splines with a penalty on high-order finite difference of the coefficients of adjacent B-splines. The penalty prevents overfitting. The underlying function is assumed to be nonnegative. The model is casted as a second-order cone programming problem, which can be solved efficiently by modern optimization techniques. The method is implemented in MATLAB.

3 - Cooperative Data Analysis in Supply Chains Using Selective Information Disclosure
Michael Hahsler, SMU, P. O. Box 750123, Dallas, TX, 75275, United States of America, mhahsler@lyle.smu.edu

Many modern products (e.g., consumer electronics) consist of hundreds of complex parts sourced from a large number of suppliers. In such a setting, finding the source of defects in the final product becomes more difficult and may be hampered by limited information disclosure between parties. In this work we investigate the effectiveness of strategies of selective information disclosure in order to perform cooperative data analysis in a supply chain context.

■ TB44

Hilton- Union Sq 24

Economics of Information Systems

Sponsor: Information Systems

Sponsored Session

Chair: Marius Florin Niculescu, Georgia Institute of Technology, Scheller College of Business, 800 West Peachtree St. NW, Atlanta, GA, 30308, United States of America, Marius.Niculescu@scheller.gatech.edu

1 - Influence of Social Media in Flash Sales: An Exploratory Study
Karthik Babu Nattamai Kannan, PhD Student, Scheller College of Business, Georgia Institute of Technology, 800 West Peachtree NW, Office # 4277, Atlanta, GA, 30308, United States of America, KarthikBabu.NK@scheller.gatech.edu, Yu Jeffrey Hu, Sridhar Narasimhan

In this study, we explore the role played by social media activities in promoting sale of products sold in flash sales. We collected both sales and aggregate social media data for new products launched by a popular e-commerce firm. We use this data to evaluate how Facebook likes, Pinterest pins and internal social media activities impact sales.

2 - Economics of Online Distribution of Video Content
Marius Florin Niculescu, Georgia Institute of Technology, Scheller College of Business, 800 West Peachtree St. NW, Atlanta, GA, 30308, United States of America, Marius.Niculescu@scheller.gatech.edu, Hemant Bhargava

In this study, we explore the strategic decision faced by video content aggregators whether to release fresh content for binge or staggered consumption. We consider various video content consumption patterns as well as different types of content.

3 - What is the Relationship between Market Structure and Digitized Customer Experience?
Philipp Herrmann, University of Paderborn, Warburger Strafle 100, Paderborn, Germany, Philipp.Herrmann@wiwi.uni-paderborn.de, Mohammad Rahman

We study the relationship between local market structure and digitized customer experience in the form of online ratings. We find a small negative correlation between market size and the average of the digitized customer experience. Also, larger markets allow for a substantially broader range of qualities. These relationships are best explained by a model were the provisioning of a higher quality increases marginal costs but does not affect fixed costs.

4 - Electronic Commerce and Spatial Arbitrage
Hemang Subramanian, PhD candidate, Information Technology and Management, Georgia Institute of Technology, 800 W Peachtree Street, Atlanta, GA, 30308, United States of America, Hemang.Subramanian@scheller.gatech.edu, Eric Overby

The lack of market efficiency creates opportunities for spatial arbitrage in which an arbitrageur purchases products in low-priced locations and resells them in high-priced locations. We study spatial arbitrage in a wholesale used vehicle industry, where two e-channels operate i.e. a webcast and a standalone e-market. Overall, using a quasi-natural experiment, we find that arbitrage reduced as e-commerce diffused, while some arbitrage shifted from the physical market to the standalone e-market.

■ TB45

Hilton- Union Sq 25

Modeling Human Behavior in OM

Sponsor: Behavioral Operations Management

Sponsored Session

Chair: Karen Zheng, Massachusestts Institute of Technology, Sloan School of Management, Cambridge, MA, 02142, United States of America, yanchong@mit.edu

1 - Newsvendor Selling to Loss Averse Consumers with Stochastic Reference Points
Sami Najafi-Asadolahi, Assistant Professor, Santa Clara University, Leavey School of Business, 500 El Camino Real, Santa Clara, CA, 95053, United States of America, snajafi@scu.edu, Opher Baron, Ming Hu, Qu Qian

We study a newsvendor who repeatedly sells a single perishable product to two types of consumers: regular consumers, who have a given consumption utility and whose market size is uncertain, and bargain hunters, who have a low valuation and are abundant. The regular consumers are loss averse with random reference levels that represent their beliefs about possible price and availability. We show the impact of loss aversion on the newsvendor's inventory and pricing decisions.

2 - Bounded Rationality in Supply Chain Interactions
Basak Kalkanci, Associate Professor, Georgia Institute of Technology, 800 West Peachtree Street NW, Atlanta, GA, 30308, United States of America, Basak.Kalkanci@scheller.gatech.edu, Georgia Perakis

We investigate the impact of a retailer's bounded rationality in a two-tier supply chain. We show that the supplier's and retailer's profit are not necessarily monotone in the retailer's rationality. We quantify the value of using minimax regret criterion when the retailer's rationality is not known.

3 - The Design of Experiential Services with Acclimation and Memory Decay
Uday Karmarkar, UCLA, 110 Westwood Plaza, Gold Hall, Suite B-512, Los Angeles, CA, 90066, United States of America, uday.karmarkar@anderson.ucla.edu, Aparupa Das Gupta, Guillaume Roels

In this talk, we study how to schedule activities and allocate duration to them in a service encounter so as to maximize ex-post customer satisfaction, when customers are subject to acclimation and memory decay. We show that, when considered individually, memory decay and acclimation yield the same encounter designs, whereas when they are considered jointly, they act as opposing forces.

4 - Pricing with Anticipation
Javad Nasiry, Assistant Professor, HKUST, LSK Building, HKUST, Hong Kong, Hong Kong - PRC, nasiry@ust.hk, Ioana Popescu

We study a market where customers derive emotional utility from anticipating pleasurable purchase outcomes, but experience disappointment if outcomes fall short of what they anticipated. In this context, we show that firms can profit by adopting randomized pricing policies.

■ TB46

Hilton- Lombard

Recent Advances in Conic Integer Programming

Sponsor: Optimization/Integer and Discrete Optimization

Sponsored Session

Chair: Fatma Kilinc-Karzan, Assistant Professor, Carnegie Mellon University, 5000 Forbes Ave, Pittsburgh, PA, 15213, United States of America, fkilinc@andrew.cmu.edu

1 - Techniques in Convexification of Separable Polynomial Inequalities
Mohit Tawarmalani, Professor, Purdue University, 403 W. State Street, West Lafayette, IN, United States of America, mtawarma@purdue.edu, Jean-Philippe P Richard

We develop convexification techniques for inequalities defined using a separable polynomial. Within this framework, we discuss various decomposition results in convexification. We highlight the important role played in convexification by transformations to positive-homogeneity. We discuss their merits vis-à-vis concavifying transformations. We provide explicit convex hull descriptions when variables are unbounded and discuss their use with bounded variables.

2 - How to Convexify the Intersection of a Second Order Cone and a Nonconvex Quadratic
Fatma Kilinc-Karzan, Assistant Professor, Carnegie Mellon University, 5000 Forbes Ave, Pittsburgh, PA, 15213, United States of America, fkilinc@andrew.cmu.edu, Samuel Burer

We study sets defined by the intersection of a second-order-cone representable (SOCr) constraint, a single homogeneous nonconvex quadratic and an affine hyperplane. Under mild conditions, we derive simple, computable convex relaxations given by a new SOCr constraint. Under further conditions, we prove that our relaxations capture precisely the corresponding convex hull. Our approach unifies and extends previous results, and we illustrate its applicability and generality with many examples.

3 - The Power of a Negative Eigenvalue: Aggregation Cuts for Nonlinear Integer Programming
Sina Modaresi, Graduate Research Assistant, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States of America, sim23@pitt.edu, Juan Pablo Vielma

Aggregation technique is a cut generating procedure which can be used to obtain general intersection cuts. However, it might fail to yield convex constraints or closed form expressions even in the quadratic case. We study an extension of the aggregation technique which is to relax the convexity requirement on the implied inequality and allow one negative eigenvalue. We then show that convex hull of any set described by two quadratic inequalities (convex or not) is conic quadratic representable.

4 - A Computational Study on Non-convex QCQP's
Gonzalo Munoz, Columbia University, 500 W. 120th Street, New York, NY, 10027, United States of America, gonzalo@ieor.columbia.edu, Daniel Bienstock

In this talk we present experimental results solving difficult QCQP instances using a variety of nonstandard formulations, branching and cutting plane techniques. Joint work with D. Bienstock.

■ TB47

Hilton- Mason A

Risk-Averse Dynamic Optimization

Sponsor: Optimization/Optimization Under Uncertainty

Sponsored Session

Chair: Andrzej Ruszczynski, Distinguished Professor, Rutgers University, 100 Rockafeller Road, Piscataway, NJ, 08550, United States of America, rusz@business.rutgers.edu

1 - Dynamic Risk Measure for Controlled Discrete-Time Stochastic Processes with Application to POMDP
Jingnan Fan, PhD Student, Rutgers University, 100 Rockafeller Road, Piscataway, NJ, 08854, United States of America, kellyfjn@gmail.com, Andrzej Ruszczynski

We consider dynamic risk measures for general controlled discrete-time stochastic processes. We introduce the condition of stochastic conditional time-consistency. We prove that the risk measure must have a special structure involving a risk transition mapping as a law-invariant risk measure on the state space. Then we apply the results to two classes of problems: controlled fully-observable Markov processes and controlled partially-observable Markov processes.

2 - Methods for Solving Infinite-Horizon Risk-Averse Dynamic Programming Problems
Andrzej Ruszczynski, Distinguished Professor, Rutgers University, 100 Rockafeller Road, Piscataway, NJ, 08550, United States of America, rusz@business.rutgers.edu, Ozlem Cavus

The total cost problem for discrete-time controlled Markov models is considered. The objective functional is a Markov dynamic risk measure of the total cost. Two solution methods, value and policy iteration, are proposed, and their convergence is analyzed. In the policy iteration method we analyze a version of the nonsmooth Newton's for policy evaluation. The results are illustrated on a credit limit control problem.

3 - Risk-averse Dynamic Programming for Clinical Trial Design
Curtis McGinity, Rutgers University, 100 Rockafeller Road, Piscataway, NJ, 08854, United States of America, curtis.mcginity@gmail.com, Andrzej Ruszczynski

We consider the problem of optimal dose escalation for early stage clinical trial design. We formulate the risk-averse dynamic programming problem, develop dynamic programming equations, and compare the risk of several myopic and look-ahead optimal policies under dynamic measures of risk.

4 - Time-consistent Approximations: Empirical Results for the Dow Jones Industrial Average
Tsvetan Asamov, Post-doctoral associate, Princeton University, Sherrerd Hall, Princeton, NJ, 08544, United States of America, tasamov@princeton.edu, Andrzej Ruszczynski

We use dynamic time-consistent formulations to approximate problems having a single coherent risk measure applied to the aggregated costs over all time periods. The dual representation of coherent risk measures is used to create a time-consistent cutting plane algorithm. Additionally, we also develop methods for the construction of universal time-consistent upper bounds. The performance of the techniques is tested using monthly return data for the components of the Dow Jones Industrial Average.

■ TB48

Hilton- Mason B

Optimization, Combinatorial 1

Contributed Session

Chair: Daniele Catanzaro, Professor, Rijksuniversiteit Groningen, Nettelbosje 2, Groningen, 9747 AE, Netherlands, d.catanzaro@rug.nl

1 - Flow Shop Machines Just-in-Time Scheduling
Muminu Adamu, Dr, University of Lagos, Akoka Yaba, Lagos, Nigeria, madamu@unilag.edu.ng

In this paper, the scheduling to maximize the weighted number of Just-In-Time (JIT) jobs on flow shop machines is considered. This problem is known to be NP Complete for due dates involving interval in time. The problem formulation is suggested, two greedy heuristics are proposed for solving the problem. A numerical example to illustrate its use and extensive computational experiments performed with promising results are presented. Likely areas of extensions are provided.

2 - A Catalog of ILP Formulations for the Job Sequencing and Tool Switching Problem
Daniele Catanzaro, Professor, Rijksuniversiteit Groningen, Nettelbosje 2, Groningen, 9747 AE, Netherlands, d.catanzaro@rug.nl

We investigate the a particular version of path dependent Traveling Salesman Problem, called the Job Sequencing and Tool Switching Problem. We develop new integer linear programming formulations for the problem and we prove theoretically and computationally that they are better than the alternative ones currently described in the literature.

3 - Two-dimensional Bin Packing Problem with Hatch Constraint
Takashi Imamichi, Researcher, IBM Research - Brazil, Av. Pasteur 138/146, Botafogo, Rio de Janeiro, RJ, 222700-50, Brazil, tima@br.ibm.com, Bruno da Costa Flach

Two-dimensional bin packing problem asks us to find a layout of a set of given rectangular items into a set of given rectangular bins. The objective is to minimize the number of bins. In this talk, we introduce an additional "hatch constraint" that requires finding a sequence of items to place into the bin through the "hatch". The hatch constraint arises from the ship hold packing problem as a real-world application. We introduce a heuristic approach and preliminary computational results.

4 - Optimal Assignment for In-Air Training
Yasaman Khodadadegan, Consultant, American Airlines, 1920 W University Dr, Tempe, AZ, 85281, United States of America, Yasaman.Khodadadegan@aa.com, Xin Liu, Tuell Green

When it comes to training pilots on a different aircraft type, time is money. The quicker the pilot can get fully qualified on the new aircraft type, the sooner the pilot will be available for productive work. Using the existing flight sequences, required training hours and cycles, pilot start date, instructor availability, and air operation rules, we determine the schedule for the pilots and instructors that minimizes the time required to complete the air-operation training.

■ TB49

Hilton- Powell A

Social and Economic Network Models

Sponsor: Optimization/Network Optimization

Sponsored Session

Chair: Alexander Nikolaev, University at Buffalo (SUNY), 312 Bell Hall, Buffalo, NY, 14260, United States of America, anikolae@buffalo.edu

1 - Potential Games with Exogenous Uncertainty
Harikrishnan Sreekumaran, Doctoral Candidate, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47907, United States of America, harikrishnan@purdue.edu, Andrew Liu

Potential games are a class of games in which best response dynamics can be proven to converge to Nash equilibria. In this work, we analyze potential games with exogenous uncertainty under common knowledge assumptions. We show that sampling-based approximation schemes can be combined with decentralized algorithms to compute the equilibria of such games. Numerical results will be presented with the proposed approach applied to several application examples such as network design games.

2 - Stochastic Optimization Model for Capacity Expansion in Transportation Networks
Areesh Mittal, Graduate Student, University of Texas at Austin, 2900 Cole Street, #202, Austin, TX, 78705, United States of America, areeshmittal@utexas.edu, Jennifer Duthie, Bismark Singh, David Morton

We consider the problem of selecting links for capacity expansion in a transportation network, when the budget is uncertain, with the goal of minimizing expected total system travel time. To obtain nested solutions for increasing values of budget, we build a two-stage stochastic optimization model in which links are prioritized in the first stage and then selected in the second stage according to that priority list. We demonstrate our work on the Sioux Falls network.

3 - Interdicting Social-Functional Networks
Paul (Lee) Ewing, Research Associate Professor, Operations Research, Naval Postgraduate School, 1411 Cunningham Rd., Monterey, CA, 93943, United States of America, plewing@nps.edu, Matt Carlyle, Peter Nesbitt

We offer a targeting tool that quantitatively analyzes the effects of interdicting managers in a network constructed from disparate sources. We model the adversary with a bi-level optimization model to include the managers, resources and processes necessary to its function. This model delivers a quantitative assessment of an adversary's ability to achieve its goals and suggests interdiction plans to delay the adversary's activities.

4 - A Subjective Evidence Model for Influence Maximization in Social Networks
Mohammadreza Samadi, Graduate research Assistant, University at Buffalo (SUNY), 327 Bell Hall, Buffalo, NY, 14260, United States of America, msamadi@buffalo.edu, Alexander Nikolaev, Rakesh Nagi

We introduce a new model of subjective evidence propagation in social networks. Investigations with the model in the presence of competition shed light on the phenomena of belief reinforcement and viral spread of products/technologies. The NP-Hard influential seed selection problem is first solved as an MIP. Second, an efficient Lagrangian Relaxation heuristic with guaranteed bounds is designed. Third, problem-specific iterative seed selection procedures are explored via extensive testing.

5 - Understanding the Emergence of Power Laws in Empirical Data
Sushant Khopkar, University of Buffalo (SUNY), Buffalo, NY, United States of America, skhopkar@buffalo.edu, Alexander Nikolaev, Rakesh Nagi

Many online social network account owners have lots of connections, surpassing the Dunbar number of 150. We present a model that explains tie formation by bridging the gap between small and scale-free worlds. It explains how the information about a person may propagate from friends to the masses. It shows that a power law emerges, by the principles that are different from those of preferential attachment. It provides a means for evaluating how likely a talented individual is to become popular.

■ TB50

Hilton- Powell B

Optimization Methodologies 1

Contributed Session

Chair: Firdevs Ulus, Princeton University, Princeton University ORFE, Sherrerd Hall 322, Princeton, NJ, 08544, United States of America, fulus@princeton.edu

1 - Building Collaborative Optimization Model of the Electric Vehicles Business Ecosystem

Chunyan Duan, Doctoral Student, 1. Tongji University, School of Economics and Management; 2. University of Washington, Department of Industrial & Systems Engineering;, 1. A403, Sino-French Center, Tongji University, No.1239, Siping Road, Shanghai, 200092, China, duanchunyan77@163.com, Jianxin You

Recently, the industrialization and commercialization of the electric vehicles are urgent for more and more countries in the world. However, the current research mainly focuses on the framework and the definition of the concept. In this paper, we build collaborative optimization model of the electric vehicles business ecosystem by using the method of collaborative optimization, and finally propose the strategies and policy suggestions.

2 - Parametric Simplex Algorithm for Linear Vector Optimization Problems

Firdevs Ulus, Princeton University, Princeton University ORFE, Sherrerd Hall 322, Princeton, NJ, 08544, United States of America, fulus@princeton.edu, Birgit Rudloff, Robert Vanderbei

We propose a parametric simplex algorithm for linear vector optimization problems; it works for any dimension. In each iteration, it provides a set of inequalities, which defines the current partition of the parameter space. In addition to the simplex arguments, one needs to eliminate the redundant inequalities. This is similar to the vertex enumeration procedure, used in most of the objective space based algorithms. However, this algorithm doesn't require to solve a LP in each iteration.

3 - Nonlinear Time Series Generation Model Change Estimation for Individual and Business Service

Jianjun Lu, Associate Professor, College of Economics and Management, China Agricultural University, No. 17, Qinghuadong Road, Haidian Distri, Beijing, 100083, China, ljjun@cau.edu.cn

We deal with the individual and business service prediction by using the method of estimation of changes in nonlinear time series generation model. Particle Filters(PF) is applied to determine the best description of the time-varying nonlinear system based on the measure of likelihood, Genetic Programming(GP) is applied for online detection of changes in models and the estimation of functional forms of dynamics by assuming that the state equation is modified from the current functional form.

4 - Government's Fund Allocation to Small Medium Size Businesses After Disaster Hits: Optimization Model

Saba Pourreza, University of North Texas, 1155 Union Circle #311160, BLB. 399A, Denton, TX, 76203, United States of America, saba.pourrezajourshari@unt.edu, Cigdem Kochan, Brian Sauser

Access to government funding is an effective way to enhance the resilience for disturbed small medium size businesses (SMB). This study constructs an optimization model to maximize the community impact of SMBs. The model finds the optimum quantity that each SMB needs to create enough number of jobs and productions. KEYWORDS:Resource allocation, Resilience, Government funding, Mathematical modeling, Optimization model, Small medium size firm, Disaster relief

■ TB51

Hilton- Sutter A

Data-driven Methods for Decision Making

Sponsor: Optimization

Sponsored Session

Chair: Nathan Kallus, MIT, 77 Massachusetts Ave., E40-149, Cambridge, MA, 02139, United States of America, kallus@mit.edu

Chair: Dimitris Bertsimas, Professor of Operations Research and Statistics, Massachusetts Institute of Technology, Massachusetts Institute of Technology, Sloan School of Management, E40-147, Cambridge, MA, 02139, United States of America, dbertsim@mit.edu

1 - From Predictive to Prescriptive Analytics

Nathan Kallus, MIT, 77 Massachusetts Ave., E40-149, Cambridge, MA, 02139, United States of America, kallus@mit.edu, Dimitris Bertsimas

We construct novel predictive-prescriptive mechanisms that optimize decisions based directly on historical data and predictive observations. We prove almost-sure convergence to the prescient policy even when data is not IID but rather observations from an evolving system like a market or social network. We consider real-world examples in inventory management.

2 - Recent Progress on the Power of Static-robust Solutions

Vineet Goyal, Columbia University, New York, NY United States of America, vgoyal@ieor.columbia.edu, Brian Lu

In this talk, I will present recent progress on the performance of static robust solutions for two-stage adjustable robust linear programs under constraint-coefficient uncertainty. Our analysis provides important insights for developing near-optimal solution policies for adjustable robust linear optimization problems.

3 - Decomposable Markov Decision Processes: A Fluid Optimization Approach

Velibor Misic, Massachusetts Institute of Technology, 77 Massachusetts Ave E40-149, MIT ORC, Cambridge, MA, 02139, United States of America, vvmisic@mit.edu, Dimitris Bertsimas

Decomposable MDPs are problems where the system and its dynamics can be decomposed along multiple components. We propose a fluid optimization approach for such problems that achieves tractability by exploiting decomposability. We show that this approach achieves strong performance in restless bandit problems, optimal stopping problems and network revenue management.

■ TB52

Hilton- Sutter B

Linear Programs and Generalizations

Sponsor: Optimization/ Linear and Conic Optimization

Sponsored Session

Chair: John Mitchell, Professor, Rensselaer Polytechnic Institute, 325 Amos Eaton, Math Sciences, 110 Eighth St, Troy, NY, 12180, United States of America, mitchj@rpi.edu

1 - A Polynomial-time Rescaled von Neumann Algorithm for Linear Feasibility Problems

Dan Li, ISE Department, Lehigh University, 200 West Packer Avenue, Bethlehem, PA, 18015, dal207@lehigh.edu, Kees Roos, Tamas Terlaky

We propose a rescaled von Neumann algorithm with complexity O(n^5size(A)). This is the first polynomial-time variant of the von Neumann algorithm. It is based on Chubanov's so called Basic Procedure, whose outcome is an evidence that the solution has at least one small coordinate so that we are able to rescale the linear system without changing the problem. Some numerical experiments are presented as well. We also improve the performance of Chubanov's method.

2 - Steplength Thresholds for Invariance Preserving of Discretization Methods of Dynamical Systems

Yunfei Song, PhD Student, Lehigh University, 337 S. New St. Apt. 202, Bethlehem, PA, 18015, United States of America, yus210@lehigh.edu, Zoltan Horvath, Tamas Terlaky

Steplength thresholds for invariance preserving of two discretization methods on a polyhedron are considered. For Hilton- Taylor Approximation type methods, we prove that a valid threshold can be obtained by finding the first positive zeros of a finite number of polynomial functions. Furthermore, an efficient algorithm is proposed to compute the threshold. For rational function type methods, we derive a valid threshold, which can be computed by using the analogous algorithm, for invariance preserving.

3 - Iteration-Complexity for IPMs Based on the Central Path Curvature

Murat Mut, Lehigh University, 200 W. Packer Ave, Bethlehem, PA, United States of America, mhm309@lehigh.edu, Tamas Terlaky

This talk centers around the theoretical iteration-complexity of certain interior-point algorithms in Linear Optimization. I highlight two curvature measures of the central path relevant to the complexity, the geometric and Sonnevend's curvature. Based on the new research by Mut-Terlaky 2013-2014, I discuss future research problems and the possibility of attempting to relate the two curvatures in a general setting and its further implications for IPMs.

4 - Worst-case Linear Optimization under Uncertainties

Jiming Peng, University of Houston, Houston, TX United States of America, jopeng@uh.edu

In this talk, we consider the so-called worst-case linear optimization (WCLO) with uncertain data. Particularly, we consider a scenario where the uncertainty arises in the right-hand-side of the constraints. When the generic L_2 norm is used to define the uncertain set, the WCLO is NP-hard. We then discuss how to obtain a lower bound to WCLO via tractable non-convex relaxation and when the relaxation is exact. preliminary numerical results will be reported as well.

■ TB53

Hilton- Taylor A

Economics/ Finance

Contributed Session

Chair: Abul Jamal, Professor, Southeastern Louisiana University, College of Business, Hammond, LA, 70402, United States of America, ajamal@selu.edu

1 - A Study of the Behavior of the Peso/USD Exchange Rate

Abul Jamal, Professor, Southeastern Louisiana University, College of Business, Hammond, LA, 70402, United States of America, ajamal@selu.edu, Yu Hsing

This Study examines the movements of the Peso/USD exchange rate based on the monetary model. It assumes that the purchasing power parity holds and that the nominal exchange rate is equal to the relative prices in the two countries. We will compare the Frankel, Bilson and the Dornbusch models. The estimates based on time series data were adjusted for autocorrelaton and heteroskedasticity. Results show the relationship of the exchange with relative money supply, interest rates, inflation and GDP.

2 - Are Targets for Renewable Portfolio Standards Too Low? A Complementarity-Based Policy Analysis

Afzal Siddiqui, University College London, Gower Street, London, United Kingdom, afzal.siddiqui@ucl.ac.uk, Makoto Tanaka, Yihsu Chen

We compare optimal renewable portfolio standards targets under a benchmark central planning setting with those under deregulated ones with and without market power. The latter two are formulated as bi-level problems. We show that setting a renewable portfolio standards target without considering the market structure could lead to sub-optimal market outcomes.

3 - How do Investor Relations Related Disclosures on Facebook Contribute to the Information Environment?

Tawei Wang, University of Hawaii at Manoa, 2404 Maile Way, BUSAD E602C, Honolulu, HI, 96822, United States of America, twwang@hawaii.edu, Ju-Chun Yen, Hsiao-Lun Lin

This paper focuses on how investor relations related disclosures on Facebook contributes to a firm's information environment. We first explore what investor relations related disclosures are made on Facebook by S&P 1500 firms in the one year period from October 2012 to September 2013. Then we investigate the association between such disclosures and a firm's information environment. Implications are discussed.

4 - The Stock Market Effects of Implementing ERP: Evidence from China

Xia Pan, Associate Professor, Sun Yat-sen University, Lingnan College, Guangzhou, Ch, 510275, China, panxia@mail.sysu.edu.cn, Yongqin Xie, Liujie Xu

We collect data on the events that Chinese publicly listed companies implement ERP systems and investigate the reaction on these companies' stock prices. Following the methodology that was used in financial research, we did an event study to test if the implementation ERP system has positive effect on the companies' stock market performance.

5 - Is the Ranking from Data Envelopement Analysis Useful for Stock Selection?

Liujie Xu, Student, Sun Yat-sen University, Lingnan College, Sun Yat-sen University, Guangzhou, 510275, China, panxpapers@gmail.com, Xia Pan

We applied Data Envelopement Analysis on a input and output data from publicly listed companies of retail industry. After the ranking results obtained from DEA, we compare the results with measures of the companies stock. We found out that DEA selection is partially useful in stock selection for investments.

■ TB54

Hilton- Taylor B

Tutorials in Financial Services

Sponsor: Financial Services Section

Sponsored Session

Chair: Ning Cai, Hong Kong University of Science & Technology, Clear Water Bay, Kowloon, Hong Kong - PRC, ningcai@ust.hk

1 - Asset-Liability Management

John Birge, Jerry W. and Carol Lee Levin Professor of Operations Management, University of Chicago Booth School of Business, 5807 S Woodlawn Ave, Chicago, IL, 60637, United States of America, john.birge@chicagobooth.edu

This tutorial will present theory and computational approaches to asset-liability management over time. The emphasis will be on dynamic approaches including updates for estimates of trend and volatility and the incorporation of transaction costs.

2 - Portfolio Choice with Learning

Andrew Lim, Professor, National University of Singapore, 15 Kent Ridge Drive, Singapore, 119245, Singapore, andrewlim@nus.edu.sg

I survey methods from computational Bayesian statistics and discuss recent methods for applying these algorithms to solving high dimensional dynamic portfolio choice problems with learning and generalizations of the Black-Litterman model.

■ TB55

Hilton- Van Ness

Euclidean Distance Geometry Problems

Sponsor: Optimization/Global Optimization & MINLP

Sponsored Session

Chair: Marcia Fampa, Universidade Federal do Rio de Janeiro, PESC/COPPE- Cidade Universitaria, Centro de Tecnologia, Bloco H, Sala 319, Rio de Janeiro, Brazil, fampa@cos.ufrj.br

1 - Solving Euclidean Steiner Tree Problems in n-space

Marcia Fampa, Universidade Federal do Rio de Janeiro, PESC/COPPE- Cidade Universitaria, Centro de Tecnologia, Bloco H, Sala 319, Rio de Janeiro, Brazil, fampa@cos.ufrj.br, Wendel Melo, Jon Lee

The Euclidean Steiner tree problem in n-space is defined as follows: Given a set of points in R^n, find a tree of minimal Euclidean length that spans these points, using or not additional points in its construction. We present a branch-and-bound framework for solving this NP-Hard problem, with procedures to improve upper and lower bounds at the nodes of the enumeration tree, as well as a procedure to avoid the evaluation of symmetric solutions.

2 - Exploiting Symmetry in the Discretizable Molecular Distance Geometry Problem

Carlile Lavor, Associate Professor, University of Campinas, IMECC - UNICAMP, Campinas, Brazil, clavor@ime.unicamp.br, Leo Liberti

The Discretizable Molecular Distance Geometry Problem (DMDGP) is a subset of the Distance Geometry Problem, where the search space can be represented by a binary tree that can be explored by employing a Branch & Prune (BP) algorithm. This binary tree may contain several symmetries, which are directly related to the total number of solutions of the DMDGP. We will show how these symmetries can be used to speed up the BP algorithm.

3 - Euclidean Hub-and-Spoke Networks

John Carlsson, Assistant Professor, University of Minnesota, 111 Church Street SE, Minneapolis, MN, 55455, United States of America, jgc@umn.edu

We consider the problem of designing an optimal hub-and-spoke network in Euclidean space: the "spokes" of the network are distributed continuously over a service region, and our objective is to determine the optimal number of hubs and their locations. We consider seven different backbone network topologies for connecting the hub nodes, namely the Steiner and minimum spanning trees, a TSP tour, a star network, a capacitated vehicle routing tour, a complete bipartite graph, and a complete graph.

4 - Some Challenges in n-dimensional Euclidean Distance Geometry Problems
Rosiane deFreitas, Professor PhD, Institute of Computing - UFAM, Av. Rodrigo Otavio, 3000, Aleixo, Campus, Campus Setor Norte, Bl. IComp, Manaus, AM, 69077-000, Brazil, rosiane@icomp.ufam.edu.br, Jayme Szwarcfiter, Nelson Maculan, Bruno Raphael Dias, Clarice Santos

The relationship between Euclidean distance geometry and graph theory will be explored, where some operational research problems will be considered, involving theoretical models and computational techniques proposed for channel allocation problems in wireless networks, and determining of the structure of protein molecules. Implicit enumeration algorithms will be presented, addressing issues of feasibility and optimality of solutions, with emphasis on the method of branch-prune-and-bound.

■ TB56

Hilton - Green Room

Software Demonstrations

Cluster: Software Demonstrations

Invited Session

1 - Analytic Solver Platform: Integrated Data Mining, Simulation and Optimization in Microsoft Excel
Daniel H. Fylstra, Frontline Systems Inc., Incline Village, NV, United States of America, daniel@solver.com

Analytic Solver Platform in Microsoft Excel has everything you need for forecasting and data mining, Monte Carlo simulation and risk analysis, and conventional and stochastic optimization -- where its solving power actually surpasses “enterprise” analytic software costing far more. See how you can use it to build your own analytic expertise and teach others, leveraging what you already know, build and solve industrial-scale models with the world’s best Solvers, and effectively communicate business results.

2 - Gurobi Optimization, Inc. - Distributed Optimization Including Concurrent and Parallel MIP
Ed Rothberg, Gurobi Optimization, Inc., Houston, TX, United States of America, rothberg@gurobi.com

In this tutorial you’ll learn about the expanded distribution algorithm capabilities in the new Gurobi 6.0 release. In addition to distributed tuning and distributed concurrent optimization, the new release also includes a distributed MIP solver, which allows you to use multiple machines to solve a MIP model faster. We’ll talk about the design of this new capability, give details on how to use it, and present performance results.

■ TB57

Hilton- Golden Gate 1

Flipped Classrooms

Sponsor: INFORM-ED

Sponsored Session

Chair: Patrick Noonan, Professor & Assoc. Dean, Emory University, 1300 Clifton Rd NE, Atlanta, GA, 30322, United States of America, patrick.noonan@emory.edu

1 - The Flipped Classroom of Operations Management: A Not-For-Cost-Reduction-Platform
Ardavan Asef-Vaziri, Professor, California State University Northridge, 18111 Nordhoff Street, Northridge, CA, 91330-8245, United States of America, ardavan.asef-vaziri@csun.edu

By delivering lectures via screen capture technology, the class time is no longer spent on teaching basic concepts, but rather on more value-added activities. A flipped classroom is an online course because its online components must outperform the best of the online courses. It is also a traditional course because not even a single class session is cancelled while all the lectures are delivered online.

2 - Flipping Engineering Probability and Statistics – Lessons Learned
Rick Olson, Assoc. Dean, Shiley-Marcos School of Engineering, University of San Diego, 5998 Alcala Park, San Diego, CA, 92110, United States of America, r_olson@sandiego.edu

This paper summarizes the lessons learned while teaching Engineering Probability and Statistics using the Flipped Classroom strategy. Compared to earlier offerings, the material was covered in less time and test scores on a common final exam increased. Class organization is described. The preparation of online materials is summarized. Student performance is analyzed and compared to previous offerings. Course evaluations are examined to gain insight into student attitudes to flipped classes.

3 - Flipping through the Field: Guiding Real-World Projects
Patrick Noonan, Professor & Assoc. Dean, Emory University, 1300 Clifton Rd NE, Atlanta, GA, 30322, United States of America, patrick.noonan@emory.edu

Working on real problems with real clients can provide students with rich learning opportunities. However, they can be train wrecks for everyone: students who gain only frustration; clients disappointed with return on investment; faculty who struggle to provide the right guidance to all. Faculty can steer students and clients toward success by drawing on a toolkit of best practices of the consulting profession.

■ TB58

Hilton- Golden Gate 2

Production and Scheduling 2

Contributed Session

Chair: Liang Zhang, University of Connecticut, 371 Fairfield Way, Ellington, CT, 06269, United States of America, liang@engr.uconn.edu

1 - Operation Control in Bernoulli Production Lines to Reduce Energy Consumption
Liang Zhang, University of Connecticut, 371 Fairfield Way, Ellington, CT, 06269, United States of America, liang@engr.uconn.edu, Zhiyang Jia, Jorge Arinez, Guoxian Xiao

In this work, we study the performance evaluation and control of Bernoulli serial lines to reduce energy consumption in the system. Specifically, the Markov chain model of the system is derived and closed-form formulas for calculating the performance measures are provided. Then, based on these formulas, properties of the performance measures as functions of system and control parameters are investigated. The efficacy of the analysis is demonstrated by numerical examples.

2 - Real-time Capable Heuristics for the Capacitated Lot-sizing and Scheduling Problem
Rudolf Bauer, University of Wuppertal, Gauflstrafle 20, Wuppertal, 42119, Germany, rbauer@winfor.de, Stefan Bock

Motivated by a real-world application, we consider the capacitated lot-sizing problem with linkage, sequence dependency and backorders. In order to tackle the problem, a variable neighborhood search and a genetic algorithm are applied. Moreover, dynamic events, such as incoming requests or machine breakdowns, have to handled. Therefore, we propose a new real-time approach that is based on a rolling-horizon scheme. First results of applying our procedure to real-world instances are presented.

3 - Risk-based Capacity Planning for Biotherapeutic Production Operations
Martin Wortman, Professor, Texas A&M Unversity, Dept of ISEN, College Station, TX, 77843-3131, United States of America, wortman@tamu.edu, Cesar Malave

Commitment and expansion of production capacity in the manufacture of biotherapeutics presents challenges that are dissimilar to traditional productions operations. We report a risk-based approach to capacity planning that is particularly useful in exploring the impact of emerging single-use systems as a technology for biotherapeutic production.

4 - A Preventive Maintenance Framework in Dairy Production Operations
Hiram Moya, Assistant Professor, The University of Texas-Pan American, 1201 West University Drive, Edinburg, TX, 78539, United States of America, MoyaH@utpa.edu, Maria Fernanda Vargas Zuluaga

Dairy plant operations suffer frequent downtime due to cleaning operations and different adjustments. This highly perishable product is delivered daily to different locations regionally; and any downtime reduces production capacity and limits operations. This work proposes a troubleshooting process to identify causes of downtime and minimization of operation disruptions by applying a combination of heuristics and linear programming to improve preventive maintenance and standardization.

5 - A Production Model with a Flexible Period of Order Satisfaction
Cristian Palma, Assistant Professor, Universidad del Desarrollo, Avda Sanhueza 1750, Concepcion, Ch, 4040418, Chile, cristianpalma@ingenieros.udd.cl

Customers demand multiple products in what is known as a production order. Optimization models for production planning aggregate different orders and meet product demands by periods based on the orders deadlines. We present a model that explicitly considers production orders rather than products, and provides the flexibility of completing an order before its deadline, allowing a more flexible use of resources when possible. The formulation of the model and its benefits are discussed.

■ TB59

Hilton- Golden Gate 3

Panel Discussion: Academic Leadership

Sponsor: Women in OR/MS

Sponsored Session

Chair: Siqian Shen, Assistant Professor, University of Michigan, 2793 IOE Building, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States of America, siqian@umich.edu

1 - Panel Discussion: Academic Leadership

Moderator: Siqian Shen, Assistant Professor, University of Michigan, 2793 IOE Building, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States of America, siqian@umich.edu, Panelists: Alice E. Smith, Vicki Bier, Canan Bilen-Green, Julie Higle

WORMS panelists will share their stories and paths to academic leadership, lessons learned from being female leaders, work-life balance, and satisfactions of taking administrative roles. They not only have successful career but also mentored many academicians. The panel will solicit feedback and discussion in lieu of long presentations.

■ TB60

Hilton- Golden Gate 4

Inventory Management I

Contributed Session

Chair: Nicholas Leifker, Asst. Professor, St. John Fisher College, 3690 East Ave., Rochester, NY, 14618, United States of America, nleifker@sjfc.edu

Chair: Bhavin Shah, Assistant Professor, Indian Institute of Management Indore, Faculty Block C, First Floor,, Prabandh Shikhar, Rau-Pithampur Road,, Indore, MP, 453556, India, bhavinj@iimidr.ac.in

1 - Nonperishable Inventory Control when Demand is Unknown

Tingting Zhou, Rutgers Business School, 1003B, 1 Washington Park, Newark, NJ, 07102, United States of America, tingzhou@pegasus.rutgers.edu, Michael N. Katehakis, Jian Yang

We study the periodic control of a nonperishable product inventory when demand is i.i.d. with an unknown distribution. In the backlogging case, we find that the regret will not grow much over time when we use the newsvendor formula on the empirical demand distribution. We also plan to address lost sales with demand censoring and various other topics.

2 - Optimal Ordering Policy for Brownian Inventory Models with Quantity-dependent Set-up Costs

Dacheng Yao, Assistant Professor, Chinese Academy of Sciences, No.55, Zhong Guan Cun East Road, Haidian District, Beijing, 100190, China, dachengyao@amss.ac.cn, Shuangchi He, Hanqin Zhang

We study a stochastic inventory system whose demand is modeled as a Brownian motion with a positive drift. When the system manager places an order to replenish the inventory, a setup cost that depends on the order quantity is incurred. Assuming the holding and shortage cost to be a convex function of the inventory level, we investigate the optimal ordering policy that minimizes the long-run average cost. We prove that the optimality can be achieved by an (s; S) policy with s<=S.

3 - Dynamic Inventory Control using Leading Economic Indicators

Benjamin Roujas, Master's Degree Candidate, Tsinghua University, Department of Industrial Engineering, Beijing, 100084, China, broujas@gmail.com, Wanshan Zhu

We consider a single item, finite horizon, periodic review inventory system where the demand is forecasted by Bayesian Linear Regression. The explanatory variables in the regression are leading economic indicators that are assumed to be independent and identically distributed. We study the impact of the indicators on the optimal policy, and evaluate the value of observing them. Finally, to reduce the computational complexity , we compare several heuristics .

4 - An Integrated Model of Optimization of the Final Order of Spare Parts

Nicholas Leifker, Asst. Professor, St. John Fisher College, 3690 East Ave., Rochester, NY, 14618, United States of America, nleifker@sjfc.edu, Philip Jones, Timothy Lowe

At the end of a product's life cycle, companies may place a final order of spare parts to satisfy all future demand for the part. Determining the optimal policy can be complicated when products contain multiple types of parts in which the failure rates of the parts and products are not independent; in such cases, the optimal final order quantities for all part types must be determined simultaneously. We explore the concavity properties of this optimization problem, and present a solution method.

5 - Multimodularity of Industrial Ecosystem with a Generalized Serial Multi-Echelon Inventory System

Wei Yang, Associate Professor, Long Island University at Post, 720 Northern Blvd, Brookville, NY, 11545, United States of America, wei.yang@liu.edu, Youyi Feng, Baichun Xiao

We study the sustainability and multimodularity of an industrial ecosystem where there exists a generalized serial multi-echelon inventory system with multiple locations. Each location creates a main product to serve its external demand and a byproduct as the input to its immediate downstream location.

■ TB61

Hilton- Golden Gate 5

DIME/PMESII 2

Sponsor: Military Applications Society

Sponsored Session

Chair: Dean Hartley, Principal, Hartley Consulting, 106 Windsong Ln, Oak Ridge, TN, 37830, United States of America, DSHartley3@comcast.net

1 - Influence by Design

Karen Guttieri, Professor, Naval Postgraduate School, 3642 Arbutus Ave, Palo Alto, CA, 94303, United States of America, karen.guttieri@gmail.com

Military Information Support Operations inform and influence behavior of foreign populations. Doctrine takes a linear problem-based approach to develop products (pamphlets, messages) to address ill-defined problems in dynamic media environments. Alternatively, design thinking is an iterative, solution-based approach. Using mock examples, the paper demonstrates the use of visual analogies, redefining problems, coding requirements to build products, and the development and testing of prototypes.

2 - Incorporating the Rule of Law In Resiliency Analyses

John Hummel, Argonne National Laboratory, 9700 S. Cass Avenue/DIS-221, Argonne, IL, 60440, United States of America, jhummel@anl.gov, L. Paul Lewis, Ignacio Martinez-Moyana

The "Rule of Law" is a critical feature of stable countries. There is no definition for the rule of law, but its core relates to the influence and authority of law within society and the constraints it creates on the behavior of officials and the general population. We will focus on how rule of law assessment data can be incorporated into regional resiliency assessments and address some of the challenges associated with the data and how the contexts behind the data can be captured and assessed.

3 - Engineering an IW Model using the IW Ontology

Dean Hartley, Principal, Hartley Consulting, 106 Windsong Ln, Oak Ridge, TN, 37830, United States of America, DSHartley3@comcast.net

Using the IW Ontology, discussed in an earlier presentation, we will see how one can "engineer", rather than "dream up", IW models. I will use analogies with LegoÆ modeling and HO gauge railroad modeling to illustrate the concept and connect these concepts to the elements of the IW Ontology.

■ TB64

Parc- Cyril Magnin I

Scheduling of Queues

Sponsor: Applied Probability Society

Sponsored Session

Chair: Douglas Down, McMaster University, 1280 Main Street West, Hamilton, ON, Canada, downd@mcmaster.ca

1 - Approximations and Optimal Control for State-dependent Limited Processor Sharing Queues

Varun Gupta, Assistant Professor, University of Chicago, 5807 S Woodlawn Avenue, Chicago, IL, 60637, United States of America, varun.gupta@chicagobooth.edu, Jiheng Zhang

We study the problem of control of a processor sharing (PS) server where the service rate depends on the number of jobs occupying the server. Our principle contributions are: (1) We propose an axiomatic approach to derive a state-dependent drift function starting from a discrete system we desire to control. This drift function is used to formulate a diffusion control problem. (2) We propose a novel numerical algorithm, average cost iteration, to solve the resulting diffusion control problem.

2 - Scheduling and Job Assignment in Server Farms with Setup Delays
Esa Hyytia, Docent, Senior Research Scientist, Aalto University, Department of Communications and Network, P.O.Box 13000, Aalto, 00076, Finland, esa.hyytia@aalto.fi, Samuli Aalto, Rhonda Righter

We consider the job assignment problem to heterogeneous parallel servers, that can be switched off to save energy. Costs include energy related running costs and performance related mean response times. Servers have a setup delay and they process jobs according to FCFS, PS or LCFS, among which LCFS turns out to be the most robust discipline under the presence of setup delays. It is insensitive to job size distribution and works especially well when service times are highly variable.

3 - Stragglers and Phase Overlapping in Mapreduce Systems
Adam Wierman, California Institute of Technology, 1200 E California Blvd, Pasadena, CA, United States of America, adamw@caltech.edu, Xiaoqi Ren, Ganesh Ananthanarayanan, Minlan Yu, Micheal Chien-Chun Hung

MapReduce is a scalable parallel computing framework for big data processing. It exhibits multiple processing phases, and thus an efficient job scheduling mechanism is crucial for ensuring efficient resource utilization. This talk will discuss scheduling techniques for mitigating the impact of stragglers and optimizing the overlapping between phases in MapReduce systems.

4 - Control of Energy-Aware Servers
Vincent Maccio, McMaster University, 1280 Main Street West, Hamilton, Canada, macciov@mcmaster.ca, Douglas Down

We consider routing customers to servers that are energy aware, i.e. they can be turned on or off according to a particular policy. We show that it is in general preferable to configure the queues differently. We then present initial results on how queues should be configured when there are multiple servers and a single queue (i.e. no routing decision is required on arrival).

■ TB65

Parc- Cyril Magnin II

Academic Job Search Panel

Cluster: INFORMS Career Center

Invited Session

Chair: Pelin Pekgun, Assistant Professor, University of South Carolina, 1014 Greene Street, Moore School of Business, Columbia, SC, 29208, United States of America, pelin.pekgun@moore.sc.edu

1 - Academic Job Search Panel
Pelin Pekgun, Assistant Professor, University of South Carolina, 1014 Greene Street, Moore School of Business, Columbia, SC, 29208, United States of America, pelin.pekgun@moore.sc.edu, Panelists: Garrett van Ryzin, Mark Daskin, Beril Toktay, Margaret Brandeau

Please join us for an informative discussion on the academic job search process. Senior faculty from business and engineering schools will discuss key points on academic interviews and do's and don't's associated with the job search.

■ TB66

Parc- Cyril Magnin III

Technometrics Invited Session: Novel Statistical Methods with Interesting Applications

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Peihua Qiu, Professor, University of Florida, 2004 Mowry Road, 5th Floor CTRB, Gainesville, FL, 32611-7450, United States of America

1 - Modeling Conditional Distributions For Functional Responses, With Application to Traffic Monitoring
Kehui Chen, Assistant Professor, University of Pittsburgh, 2706 Cathedral of Learning, Pittsburgh, PA, 15260, United States of America, Khchen@pitt.edu, Hans-George Mueller

Motivated by problems involving a traffic monitoring system in which trajectory data are obtained from GPS-enabled mobile phones, we propose a novel approach to functional regression, where the mean and covariance function of the response are assumed to depend on predictors. We demonstrate the method by constructing predicted curves and corresponding prediction regions for traffic velocity trajectories for a future time period, using current traffic velocity fields as predictor functions.

2 - Dynamic Factor Model Applied to Hourly Electricity Price Analysis
Jesus Juan, Professor, Universidad Politécnica de Madrid, C/ José Gutierrez Abascal, 2, Madrid, 28006, Spain, jesus.juan@upm.es, Jaime Carpio, Damian Löpez

Exponential smoothing has become a popular technique to forecast time series. In this work we show the advantages of its multivariate version and present some properties of the model which allows us to perform a dynamic factor analysis. The practicality of the method is demonstrated by its application to hourly electricity price predictions in some day-ahead markets, such as Omel, Powernext, and Nord Pool markets.

3 - Statistical Methods for Degradation Data with Dynamic Covariates & an Application to Weathering Data
Yili Hong, Associate Professor, Department of Statistics, Virginia Tech, 213 Hutcheson Hall, Blacksburg, VA, 24060, United States of America, yilihong@vt.edu, Deborah Stanley, Xiaohong Gu, Yuanyuan Duan, William Meeker

Degradation data are widely used to obtain reliability information. It is common nowadays to dynamically record usage and other environmental variables (e.g., temperature and humidity). We introduce a class of models for analyzing degradation data with dynamic covariate information. We use general path models with random effects to describe degradation paths. The proposed methods are illustrated with an application for predicting life of organic coatings in a complicated dynamic environment.

■ TB67

Parc- Balboa

Complex Process Modeling and Monitoring

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Kaibo Wang, Associate Professor, Tsinghua University, Department of Industrial Engineering, Beijing, 100084, China, kbwang@tsinghua.edu.cn

Co-Chair: Chia-Jung Chang, Assistant Professor, Pennsylvania State University, 310 Leonhard Building, University Park, PA, 16802, United States of America, cchang@psu.edu

1 - Statistical Monitoring of the Hand, Foot and Mouth Disease
Peihua Qiu, Professor, University of Florida, 2004 Mowry Road, Gainesville, FL, 32610, United States of America, pqiu@ufl.edu

To prevent the outbreak of infectious diseases like the Hand, Foot and Mouth Disease (HFMD), effective disease surveillance systems would be especially helpful to give signals of disease outbreaks as early as possible. In this paper, we propose a three-step procedure for analyzing disease surveillance data, and our procedure is demonstrated using the HFMD data collected during 2008-2009 in China.

2 - Simultaneous Monitoring of Process Mean and Covariance Matrix via Penalized Likelihood Estimation
Arthur Yeh, Professor, Bowling Green State University, Dept. of Applied Stats and ORs, Bowling Green, OH, 43403, United States of America, byeh@bgsu.edu, Kaibo Wang, Bo Li

The advantage of utilizing the penalized likelihood estimation in constructing multivariate control charts is that it produces sparse and more focused estimates of the unknown population parameters which can improve the performance of the resulting charts. We propose new penalized likelihood estimation based control charts for simultaneously monitoring the mean vector and the covariance matrix. The performance of the proposed charts is assessed by Monte-Carlo simulations and a real example.

3 - Information Sources Selection in Multi-Mode Statistical Process Monitoring
Hila Chalutz Ben-Gal, Afeka College of Engineering, Industrial Engineering, Tel Aviv, Israel, hilab@afeka.ac.il, Marcelo Bacher

We consider a monitoring of multi-mode dynamic systems, where data gathered from multiple distributed sensors do not represent unequivocally the mode the system is operating in. A major goal is to identify in which mode the system is operating and distinguish between a situation of gradual deviation from a mode, which is a classical SPC task, and a situation of a sudden change from one operation mode to another, which is a clustering task.

4 - Fast Output Analysis via Sparse Grid Experimental Designs
Matthew Plumlee, Georgia Institute of Technology, Atlanta, GA, United States of America, mplumlee@gatech.edu

Random field models are widely employed to develop a predictor of an expensive function based on observations. In high dimensional settings, the traditional framework for developing a predictor is often too computationally expensive to be practical. We demonstrate that when sparse grid experimental designs are employed the resulting optimal predictor is quick to compute and has reasonable accuracy.

■ TB68

Parc- Davidson

Learning in Optimization and the Exploration/Exploitation Tradeoff

Sponsor: Simulation

Sponsored Session

Chair: Peter Frazier, Assistant Professor, Cornell University, 232 Rhodes Hall, Ithaca, NY, 14853, United States of America, pf98@cornell.edu

1 - Parallel Bayesian Global Optimization, with Application to Metrics Optimization at Yelp

Jialei Wang, PhD Student, Cornell University, Frank HT Rhodes Hall, 292, Ithaca, NY, 14853, United States of America, jw865@cornell.edu, Scott Clark, Eric Liu, Peter Frazier

We consider parallel global optimization of expensive-to-evaluate functions, and propose an efficient method based on stochastic approximation for implementing a conceptual Bayesian optimization algorithm proposed by Ginsbourger et al. (2010). We also introduce an open-source software implementation of this algorithm, called Metrics Optimization Engine, developed in collaboration with engineers at Yelp, Inc. and used internally at Yelp to optimize prediction models and performance metrics.

2 - Learning in Combinatorial Optimization: What and How to Explore

Sajad Modaresi, PhD Candidate, Duke University, 100 Fuqua Drive, Durham, NC, 27708, United States of America, sajad.modaresi@duke.edu, Juan Pablo Vielma, Denis Saure

We study sequential combinatorial optimization under model uncertainty. We show resolving implied exploration vs. exploitation trade-off efficiently is related to solving an Optimality Cover Problem (OCP) which simultaneously answers the questions of what information to collect and how to do so. We develop a policy that adaptively constructs and solves OCP at a decreasing frequency and show it is efficient. We extensively test performance against relevant benchmark in both long- and short-terms.

3 - Parallel Bayesian Policies for Finite-Horizon Multiple Comparisons with a Known Standard

Weici Hu, PhD Candidate, Cornell University, 295 Rhodes Hall, Ithaca, NY, 14853, United States of America, wh343@cornell.edu, Peter Frazier

We consider the problem of multiple comparisons with a known standard, in which we allocate simulation effort across a finite number of alternatives, so as to determine which alternatives have mean performance above a known threshold. We assume parallel computing resources and a fixed simulation budget. We consider this problem in a Bayesian setting. We provide tractable upper bounds on the value of the Bayes-optimal policy, and a heuristic index policy motivated by the upper bounds.

4 - Bayesian Optimal Learning with Discrete Prior Resampling

Si Chen, Princeton University, Sherrerd Hall, Charlton Street, Princeton, NJ, 08544, United States of America, sichen@princeton.edu, Kristofer Reyes, Warren Powell

We propose a knowledge-gradient policy based on a small set of discrete priors sampled from a multi-dimensional nonlinear parametric model. At each time step, the policy utilizes the value of information and Bayesian statistics to make decisions, and resamples the discrete priors according to their assigned weights. We present an application to solve a Bayesian optimal search program in material science, namely discovering the set of controllable parameters to match a specific release profile.

■ TB69

Parc- Fillmore

Socially-Responsible Operations Management

Sponsor: Energy Natural Resources and the Environment/ Sustainability and Environment

Sponsored Session

Chair: Mili Mehrotra, University of Minnesota, 321 19th Ave South, Minneapolis, MN, United States of America, milim@umn.edu

1 - The Impact of Buyer-Manufacturer Interaction on Energy Efficiency Investments

Jason Nguyen, Carlson School of Managment, University of Minnesota, Minneapolis, MN, United States of America nguy1762@umn.edu, Mili Mehrotra, Karen Donohue

We investigate the equipment-focused EE investment decision in the context of a supply chain where a capital constrained manufacturer sets the investment level and its buyer sets contract prices. We solve for the investment level and pricing strategy both when the buyer is and is not informed of the EE improvement opportunities. We delineate the impact of the buyer's awareness and different contracting mechanisms on the optimal investment level as well as the resulting profit levels.

2 - Design Implications of Extended Producer Responsibility: Durable or Recyclable Products?

Ximin (Natalie) Huang, PhD Student, Georgia Institute of Technology, Atlanta, GA, United States of America, ximin.huang@scheller.gatech.edu, Beril Toktay, Atalay Atasu

We consider a monopolist who has two product design options to manage the end-of-life costs/revenues associated with its products: making products more durable or recyclable. We explore how the recyclability and durability choices are affected by the requirements of take-back legislation.

3 - Sustainability Planning for Healthcare Information Exchanges

Tharanga Rajapakshe,University of Florida, Gainesville, FL, United States of America, tharanga.rajapakshe@warrington.ufl.edu, Chelliah Sriskandarajah, Subodha Kumar

Even though there has been a substantial federal funding since 2010, very few Healthcare Information Exchanges (HIEs) are currently operational. A key obstacle faced by HIEs is long-term financial sustainability. Motivated by this observation, our focus in this work is to understand the operational decisions of an HIE and provide insights that would ensure the long term survival.

4 - Promoting Clean Technology Products: To Subsidize Consumers or Manufacturer?

Guangrui Ma, The Hong Kong University of Science and Technology, Room 3208, Dept. of IELM, Clear Water Bay, Kowloon, Hong Kong - PRC, magr@ust.hk, Ho-Yin Mak, Michael Lim, Zhixi Wan

We study the dynamic adoption process of Clean Technology Products (e.g., electric vehicles, solar panels), which is often hampered by the chicken-and-egg dilemma: firms are reluctant to invest in support infrastructure before sufficient adoption; in contrast, consumers hesitate to adopt CTPs without such infrastructure. We study how the government interventions such as subsidies (either to the firm or consumers) and mandated information disclosure can help or harm the CTP adoption.

■ TB70

Parc- Hearst

Natural Resources

Contributed Session

Chair: Bruno da Costa Flach, Research Staff Member, IBM Research - Brazil, Av. Pasteur 138/146, Botafogo, Rio de Janeiro, RJ, 222700-50, Brazil, bflach@br.ibm.com

1 - Incorporating Covariates in Hierarchical Deterministic Models

Edward Boone, Associate Professor of Statistics, Virginia Commonwealth University, 1015 Floyd Ave, Richmond, VA, 23112, United States of America, elboone@vcu.edu

Deterministic models, such as differential equations, are common to understand complex relationships through time. An additional complexity is introduced when covariates that drive parameters are employed. We present a Bayesian approach using a hierarchical model structure to incorporate covariates in these models. This is illustrated using an environmental example concerning fish in the Murray-Darling River.

2 - Intertemporal Fairness and the Exploitation of Nonrenewable Resources

Thomas Weber, Associate Professor, Ecole Polytechnique Federale de Lausanne, EPFL CDM MTEI OES, ODY 3 01, Station 5, Lausanne, 1015, Switzerland, thomas.weber@epfl.ch

The multitude of possible rules and the lack of justification for any single one of them renders the sharing of resources across generations difficult and subjective. We propose a notion of intertemporal fairness, in discrete and continuous time, which is robust, as it singles out an allocation that is 'simultaneously best' relative to all feasible Lorenz-undominated allocations. For exhaustible resources, the resulting fair allocation ensures positive consumption by all future generations.

■ TB71

Parc - Lombard

Auctions and Mechanism Design

Cluster: Auctions

Invited Session

Chair: Rudolf Müller, Maastricht University, Maastricht, Netherlands, r.muller@maastrichtuniversity.nl

1 - Cake Cutting Algorithms for Piecewise Constant and Piecewise Uniform Valuations

Chun Ye, PhD Candidate, Columbia University, 500 West 120th Street, IEOR Department Rm 315, New York, NY, 10027, United States of America, cy2214@columbia.edu, Haris Aziz

Cake cutting is one of the most fundamental settings in fair division and mechanism design without money. In this work, we consider different levels of three fundamental goals in cake cutting: fairness, Pareto optimality, and strategy-proofness. We identify maximal subsets of properties that can be attained by certain cake cutting algorithm and minimal subsets of properties that are incompatible with each other.

2 - Optimal Mechanisms with Simple Menus

Pingzhong Tang, Assistant Professor, Tsinghua University, Beijing, China,, kenshinping@gmail.com, Zihe Wang

We consider revenue-optimal mechanism design for one buyer and two independent items. We obtain two categories of structural results on the optimal mechanisms. The first category of results states that, under a certain condition, the optimal mechanism has a monotone menu. The second category of results states that, under certain conditions, the optimal mechanisms have few menu items.

3 - A Dynamic Mechanism Design for Scheduling with Different Use Lengths

Ryuji Sano, Kyoto University, Yoshida-Honmachi, Sakyo-ku, Kyoto, Japan, 606-8501,sano@kier.kyoto-u.ac.jp

This paper considers a dynamic allocation problem in which many perishable goods are allocated at each period. Agents want to keep winning goods for a long time, and the necessary lengths are private information. We characterize incentive compatibility and analyze the efficient and optimal mechanisms.

4 - Multi-item Auctions with Exclusivity Margin

Rudolf Müller, Maastricht University, Maastricht, Netherlands, r.muller@maastrichtuniversity.nl, Greg Csapo, Hemant Bhargava

We study the problem of finding the profit-maximizing multi-item mechanism that is deterministic, individually rational, and incentive compatible in a setting, where bidders attach additional value for getting the item exclusively, thus hold two-dimensional private information. We design simple and practical mechanisms for a modest sacrifice on revenue. Their performance is demonstrated by approximation guarantees via provable upper bounds on the optimal revenue and by numerical simulations.

■ TB72

Parc- Stockton

Energy - Optimization

Contributed Session

Chair: Heungjo An, Assistant Professor, King Fahd University of Petroleum & Minerals, KFUPM POBox 167, Dhahran, 31261, Saudi Arabia, hjan@kfupm.edu.sa

1 - An Acceleration Technique for Solving Non-linear Problems in the Chemical Industry

Heungjo An, Assistant Professor, King Fahd University of Petroleum & Minerals, KFUPM POBox 167, Dhahran, 31261, Saudi Arabia, hjan@kfupm.edu.sa

This paper provides an acceleration technique of distributive recursion to solve a large-scale planning problem which involves the non-linear pooling problem. The embedded structure of a linearized problem can be transformed to a generalized flow problem in a cyclic network. This study proposes an effective dynamic programming algorithm to solve the generalized flow sub-problem under Column Generation scheme. Computation tests evaluate the efficacy of the approach and analyze solvability.

2 - A Mixed-integer Linear Program for the Optimal Design of Human-powered Fitness Facilities

Kristopher Pruitt, Assistant Professor of Mathematics, US Air Force Academy, 2354 Fairchild Dr. Ste 6D-222, USAFA, CO, 80840, United States of America, kristopher.pruitt@usafa.edu

We present an optimization model with distributed-energy applications in the health and fitness industry. The mixed-integer linear program determines the blend of memberships, facility size, and equipment (power generating, neutral, and consuming) that maximizes profit (membership revenue less capital and operational costs) subject to the demands for floor space, power, and equipment-types. The presentation includes both analytical conditions for economic viability and a numerical case study.

3 - A Combined Approach of Simulations and DP to Value Storage Facilities

Marcus Hildmann, Doctoral Student, ETH Zurich, Physikstrasse 3, ETL G 24.2, Zurich, 8092, Switzerland, hildmann@eeh.ee.ethz.ch, Sebastiano Rossi

Large scale deployment of renewable energy increase the need for storage. Then again, the market conditions become less and less profitable for storage plants. We present an algorithm to value storage participating at several markets, such as day-ahead, real time and ancillary services markets simultaneously. We use a combined approach of simulations and dynamic programming to value the plant as a set of convex optimization problems. This allows to determine the revenue streams from the markets.

4 - Deadline and Quantity-differentiated Pricing of Energy Services

Florian Salah, PhD Student, Institute of Information Systems and Marketing, KIT, Englerstr. 14, Karlsruhe, 76131, Germany, florian.salah@kit.edu, Christoph Flath

Demand side flexibility is key to stable and cost-efficient integration of variable energy resources. Current energy-only transactions in power markets fail to properly incentivize this flexibility. Consequently, new market designs and transaction objects are required. To this end, quality-of-service concepts can play an important role. We present an extended deadline-differentiated pricing model facilitating both temporal and quantity-based service differentiation.

■ TB73

Parc- Mission I

Multilevel Optimization Problems in Energy I

Sponsor: Energy, Natural Res & the Environment/Energy

Sponsored Session

Chair: Sauleh Siddiqui, Assistant Professor, Johns Hopkins University, 3400 N Charles St, Baltimore, MD, 21218, United States of America, siddiqui@jhu.edu

1 - Network Expansion to Mitigate Market Power

Daniel Huppmann, German Institute for Economic Research (DIW Berlin), Mohrenstrafle 58, Berlin, Germany, dhuppmann@diw.de, Alexander Zerrahn

Lack of transmission capacity hampers the integration of the electricity market and thereby precludes reaping the full benefits of competition. We investigate the extent to which transmission grid expansion promotes competition, efficiency and welfare. This work proposes a three-stage model for grid investment, endogenizing the trade-off between costs of grid investment and benefits from reduced market power potential.

2 - Modeling Decisions of Plug-in Electric Vehicle (PEV) Aggregators: An MPEC Approach

Sonja Wogrin, Comillas Pontifical University, Calle Alberto Aguilera 23, Madrid, Spain, sonja.wogrin@iit.upcomillas.es, Tomas Gómez, Ilan Momber

Coordinated charging schedules of plug-in electric vehicles (PEVs) by an aggregator may lead to increased system efficiency in allocating resources in generation, transmission and distribution. Hence, we propose an MPEC to optimize the PEV aggregator's decisions in different electricity markets, using indirect load control by determining optimal retail prices for the PEV. Results of a case study indicate that the aggregator's profits depend on providing the right price signals to the customers.

3 - Optimizing Wind and Hydropower Systems with Bi level Stochastic Dynamic Programming

Christine Shoemaker, Professor, Cornell University, 210 Hollister Hall, CEE, Ithaca, NY, 14853, United States of America, cas12@cornell.edu, Kyle Perline, Sue Nee Tan

We present a bi level Stochastic Dynamic Programming for managing interconnected wind and hydropower systems, based on data from Bonneville Power Authority. Computational effort is reduced with a response surface approximation of the future value function. The decisions in the upper level are day-ahead market commitments and in the lower level are related to the volume of water released to produce power. The stochastic factor is the wind energy produced by the system over a short time step.

4 - Strategic Bidding of a Large Electricity Consumer: A Complementarity Approach

Jalal Kazempour, Postdoctoral fellow, Johns Hopkins University, 3400 N Charles St. Mechanical Eng. Dep., Latrobe 223, Baltimore, MD, 21218, United States of America, skazemp1@jhu.edu, Antonio J. Conejo, Carlos Ruiz

We describe a complementarity model to assist an electricity consumer in making bidding decisions to alter pool prices to its own benefit. The strategic behavior of this consumer is represented through a bilevel model: the upper-level problem represents strategic bidding actions while the lower-level problems represent pool clearing. Uncertainties on actions of producers and other consumers are characterized through of scenarios. The resulting model is a large-scale mixed-integer LP problem.

■ TB74

Parc- Mission II

Accounting for Risk in Investments in Electric Power Systems

Sponsor: Energy, Natural Res & the Environment/Energy

Sponsored Session

Chair: Fernando de Sisternes, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, ferds@mit.edu

Co-Chair: John Parsons, Senior Lecturer, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, jparsons@mit.edu

1 - Conditional CAPM Models in Capacity Investment Equilibrium Models

Andreas Ehrenmann, GDF Suez, Bruxelles, Belgium, Andreas.Ehrenmann@gdfsuez.com, Gauthier De Maere, Yves Smeers

Investment decisions are commonly based on the CAPM model in practice. We consider different formulations of conditional CAPM as stochastic discount rate that we use in capacity expansion models. These formulations are meant to account for the impact of renewable penetration in the European power market. The models are of the equilibrium type and formulated as complementarity problems. We discuss their properties and implementation.

2 - Risk Adjustment in Stochastic Investment Planning Models

Gauthier De Maere, GDF Suez, Bruxelles, Belgium, gauthier.demaeredaertrycke@gdfsuez.com, Andreas Ehrenmann, Daniel Ralph, Yves Smeers

We consider a stochastic version of the standard capacity expansion model with risk averse agents with behaviour represented by the so called "Good Deal" risk measure. We consider two counterfactuals for representing risk trading: no risk trading and a complete risk trading. We apply the model to a real situation of decommissioning of conventional plants in the European power market.

3 - A Dynamic Model for Risk Pricing in Generation Investments

Fernando de Sisternes, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, ferds@mit.edu, John Parsons

We show how to incorporate standard risk pricing principles into the popular Monte Carlo simulation analysis. Using this new framework we illustrate how different risk premia can be naturally derived from first principles for different electricity generation technologies, and how the risk attributable to each technology depends on the electricity price level at the time that the investment takes place.

4 - Risk Aversion in Transmission Infrastructure Planning using Two-Stage Programming

Harry van der Weijde, Vrije Universiteit Amsterdam, Department of Spatial Economics, De Boelelaan 1105, Amsterdam, 1081HV, Netherlands, h.vanderweijde@gmail.com, Ben Hobbs, Francisco Munoz

In the context of applications to the UK and WECC regions, we discuss how explicit consideration of risk aversion in transmission planning can affect optimal first stage investments in a large two-stage planning model. We consider risk-neutral, risk-averse, and min max regret formulations and results, considering long run technological, economic, and policy uncertainties. Theoretical and practical challenges include generator risk aversion and solving large-scale nonlinear models.

■ TB75

Parc- Mission III

Stochastic Processes

Contributed Session

Chair: Fikri Kucuksayacigil, Iowa State University, 240 Raphael Avenue, Unit 15, Ames, IA, 50014, United States of America, fksayaci@iastate.edu

1 - Modeling the Electricity Supply Stack with Time-changed Processes

Vishwakant Malladi, Doctoral Student, UT Austin, 1 University Station B65000, McCombs School of Business, Austin, TX, 78712, United States of America, vishwakant@gmail.com, Stathis Tompaidis, Rafael Mendoza-Arriaga

We present a framework for modeling the supply stack of electricity generators using time-changed processes. We demonstrate how the use of time-changed processes can be adapted to a factor structure that allows to model for correlated outages across generator types, locations, and links to the transmission network. Results of the calibration of the models using real data are presented.

2 - Monotonicity Properties of Processor Sharing Queues with Abandonments

Dwi Ertiningsih, PhD Student, Leiden University, Niels Bohrweg 1, Leiden, Netherlands, dwiertiningsihd@math.leidenuniv.nl, Flora Spieksma

Consider a processor sharing queue with abandonments and retrials. This can be modelled as a process on a two-dimensional state space. The service time distribution is not required to be exponential and the immediate cost is assumed linear. The aim is to study properties of the average and discounted cost value functions. By a coupling argument we show that the value function is convex and supermodular.

3 - Hybrid Kriging Optimization Using Gradient Estimation

Sayak Roychowdhury, Graduate Research Associate, The Ohio State University, Integrated Systems Engineering, 1971 Neil Avenue, Columbus, OH, 43210, United States of America, roychowdhury.6@osu.edu, Theodore Allen

In stochastic black box optimization, we aim to reach the optimal solution using fewer number of evaluations. In our proposed hybrid algorithm, we are determining the next best point of evaluation using alternatively the expected improvement function and gradient decent. Then, we prove convergence of the hybrid method to a KKT point under general assumptions. Performances of various gradient estimation methods are compared on a number of test functions.

4 - Malmquist Productivity Index Analysis Based on StoNED: Case of Norwegian Electricity Distribution Company

Xiaomei Cheng, Norwegian School of Economics, Department of Business and Management, Science, NHH, Helleveien 30, Bergen, 5045, Norway, xiaomei.cheng@nhh.no, Endre Björndal, Mette Björndal

In the study of regulating electricity distribution utilities, estimates of the past productivity performance play a key role in the future requirements. The main purpose of this paper is to construct a Malmquist productivity index based on stochastic non-parametric envelopment of data (StoNED) to study the recent productivity change in terms of 123 Norwegian electricity distribution companies during 2004-2012.

5 - Revenue Management: A Continuous-time Application to Airport Carparks

Andreas Papayiannis, Post-Doctorate Researcher, The University of Manchester, Flat 502, The Lock Building, Manchester, M1 5BD, United Kingdom, andreas.papayiannis@manchester.ac.uk, Paul Johnson, Dmitry Yumashev, Peter Duck

We investigate the revenue management (RM) problem encountered in airport carparks, where spaces are sold in advance online. Currently, most RM practices in this sector are simple adjustments to those developed for hotels, exploiting the strong similarities of the two industries. However, unlike in hotels where the day of the week strongly affects the price of a room, a distinct setting appears where the daily price of a parking space depends heavily on the length-of-stay of the booking.

■ TB76

Parc- Embarcadero

Joint Session CPMS/Analytics: Panel Discussion: What is Industry Looking for in Analytics Hires?

Sponsor: CPMS, The Practice Section & Analytics Section

Sponsored Session

Chair: Jeffrey Camm, Head of the Department of Operations, Business Analytics, and Information Systems, The University of Cincinnati, 2925 Campus Green Dr., Cincinnati, OH, 45221, United States of America, cammjd@UCMAIL.UC.EDU

1 - Panel Discussion: What is Industry Looking for in Analytics Hires?

Moderator: Jeffrey Camm, Head of the Department of Operations, Business Analytics, and Information Systems, The University of Cincinnati, 2925 Campus Green Dr., Cincinnati, OH, 45221, United States of America, cammjd@ucmail.us.edu, Panelists: Melissa Bowers, Jeff Winters, Russ Labe, Goutam Chakraborty, Pooja Dewan

Panel Discussion: What is Industry Looking for in Analytics Hires? In this session, panelists will discuss the results of several studies whose aim is to ascertain the characteristics and skill sets of positions that come under the umbrella of analytics. The studies are the on-going work of a subcommittee of the INFORMS Masters in Analytics Committee.

■ TB77

Parc- Market Street

Applications and Spreadsheets

Sponsor: Analytics

Sponsored Session

Chair: Thomas Groleau, Business Division Chair, Carthage College, 2001 Alford Park Drive, 210 Clausen Center, Kenosha, Wi, 53140, United States of America, tgroleau@carthage.edu

1 - Leveraging Analytics to Drive Business Decisions in Agriculture

Vardges Ter-Hovhannisyan, Strategic Scientist, Monsanto, 800 N Lindbergh, St. Louis, MO, 63167, United States of America, vardges.ter-hovhannisyan@monsanto.com, Naveen Singla, Nalini Polavarapu, William Leeds, Paul Skroch

An analytics strategy is an essential part of any data-driven business. We present an integrated analytics platform designed to drive business decisions and provide prescriptive solutions for an agricultural R&D pipeline. The main pillars of the platform (OR, predictive analytics, and geospatial modeling) are leveraged to solve real-life complex problems in agriculture. We discuss the scientific approach of the analytics platform and the resulting business impact provided to our organization.

2 - Growth Model for a Large Medical Center

Dustin Kuchera, Operations Manager, Mayo Clinic, 626 8th St SW, Rochester, MN, 55902, United States of America, Kuchera.Dustin@mayo.edu

This model depicts a complex medical center as many small components, including outpatient appointments, surgeries, and inpatient stays. A decision-maker can adjust these components in the model and estimate the impact on resources throughout the larger system.

3 - Pimp My Spreadsheet

Thomas Groleau, Business Division Chair, Carthage College, 2001 Alford Park Drive, 210 Clausen Center, Kenosha, Wi, 53140, United States of America, tgroleau@carthage.edu

There are many user-developed spreadsheets in use that work well for their designed purpose but, like early computer programs, are poorly documented and difficult for anyone other than the original developer to understand. We will show before and after examples of spreadsheets that were revised for improved usability.

■ TB78

Parc- Mason

Spatial Analysis for Multicriteria Decisions

Sponsor: Decision Analysis

Sponsored Session

Chair: Jay Simon, Assistant Professor, Naval Postgraduate School, Monterey, CA, United States of America, jrsimon@nps.edu

1 - Decision Analysis with Geographically Varying Outcomes: Preference Models and Applications

L. Robin Keller, Professor, Operations & Decision Technologies, The Paul Merage School of Business, University of California, Irvine, University of California, Irvine, Irvine, CA, United States of America, lrkeller@uci.edu, Craig Kirkwood, Jay Simon

We present decision analysis methodology for decisions based on data from geographic information systems. We discuss conditions that may conform with the decision maker's preferences over a set of alternatives, and we present specific forms for value or utility functions that are implied by these conditions. The methodology is applied to 2 hypothetical urban planning decisions involving water use and temperature reduction in regional urban development, and fire coverage across a city.

2 - Multi-criteria Spatial Risk Analysis

Valentina Ferretti, Dr. PhD, Technical University of Turin, Corso Castelfidardo 30/A, Turin, 10138, Italy, valentina.ferretti@polito.it, Gilberto Montibeller

There is a broad literature on spatial multi-criteria evaluation in the environmental domain, and some attempts of conducting risk analysis in this context. Most of these attempts neither employ a proper risk analytical framework nor provide a clear conceptual framework for allocating resource on mitigating actions. To address these weaknesses, in this paper we conceptualize a multi-criteria spatial risk analysis assessment to support spatial environmental decision-making processes.

3 - D2M2: Multi-Objective, Spatial Optimization for Regional Material Management

Matthew Bates, Research Environmental Engineer, US Army Corps of Engineers, 696 Virginia Rd, Concord, MA, 01742, United States of America, Matthew.E.Bates@usace.army.mil, Kelley Philbin, Igor Linkov, Todd Bridges

The D2M2 (Dredged Material Management Decisions) software model brings transparency, flexibility, and mathematical rigor to regional material management by analyzing thousands of combinations of source and placement sites to allocate material along various possible routes. We demonstrate optimization for economic and multiple impact objectives for dredging planning in the Long Island Sound region of NY/CT, based on site distribution, equipment, transportation links, storage availability, etc.

4 - Markov Cost-Effectiveness Analysis for Cancer Treatment

Jiaru Bai, University of California-Irvine, Irvine, CA, United States of America, jiarub@uci.edu, L. Robin Keller

We present a way to build a Markov decision tree to model cancer progression and cost-effectiveness analysis for two or more cancer treatments. We propose several problems researchers can encounter in this kind of research and provide possible solutions. The method is used for a clinical study comparing two cervical cancer treatments.

■ TB79

Parc- Powell I

Organizational Challenges in Decision Making

Sponsor: Decision Analysis

Sponsored Session

Chair: John Lehman, Galway Group, LP, 3050 Post Oak Boulevard, Suite 1300, Houston, TX, 77056, United States of America, johnlehman@att.net

1 - Making Collaborative Decisions

Daniel Owen, Managing Director, Stretegic Business Processes, Inc., 146 Windward Way, Indian Harbour Beach, FL, 32937, United States of America, owendl@aol.com

Combining the work of four noted authors has provided a theoretical framework for collaborative decisions built on the foundation of decision analysis. The resulting collaborative process aggregates, rather than compromises, the understandings of decision makers at four steps. The value increase from the collaborative process is typically fifty to one-hundred percent.

2 - Auditing Decisions: How to Check for Build-in Decision Quality
Roberto Ley-Borras, Director, Consultoria en Decisiones, Orizaba, Orizaba, Veracruz, Mexico, rley@decidir.org

Since the quality of a decision is given by the quality of the decision process it is derived from, we can audit the decision's quality by verifying that the decision frame was well selected, the set of fundamental objectives is complete and pertinent, alternatives are creative and span the whole range of possibilities, and similarly verifying key aspects of the remaining DA process. This talk presents a nine-factor decision quality audit approach that is easy to apply yet fairly comprehensive.

3 - The Collaborative Design Process
Stephen Barrager, Publisher, Baker Street Publishing, San Francisco, CA, 94123, United States of America, steve@bakerstreetpublishing.com

Most big decisions involve many people: decision makers, stakeholders, and experts. Typically the people involved have different motives, different cultures, different experience, and differenct educational backgrounds. What are the norms for decision making in these situations? This talk reviews several group process and learning norms. We discuss how the Collaborative Design process supports these norms. It provides a normative framework for applying both hard and soft tools.

4 - What the Mating Behavior of Birds Can Teach Us about Corporate Decision Making
John Lehman, Galway Group, LP, 3050 Post Oak Boulevard, Suite 1300, Houston, TX, 77056, United States of America, johnlehman@att.net

The combination of technology and theory has failed to produce the dramatic improvement in the quality of corporate decisions that some predicted. In this presentation I suggest that this failure comes in part because too little attention has been paid to the environment in which decisions are made. Specifically, I propose that organizational decision processes are not constructivist rational, but rather resemble the ecological rationality of biological systems shaped by natural selection.

■ TB80

Parc- Powell II

Behavioral Decision Theory

Sponsor: Decision Analysis

Sponsored Session

Chair: Enrico Diecidue, INSEAD, Bd de Constance, Fontainebleau, France, Enrico.Diecidue@insead.edu

1 - Beta-Delta or Tau-Delta? A New Parameterization of Quasi-Hyperbolic Discounting
Han Bleichrodt, Professor, Erasmus University, 3000 DR Rotterdam, Netherlands, bleichrodt@ese.eur.nl

In the quasi-hyperbolic (beta, delta) model, beta is commonly taken as an index of time inconsistency. We show that beta is not suited for this purpose because it interacts with delta. We propose a proper index of time inconsistency, which has a natural interpretation as the time period over which the decision maker is vulnerable to dynamic inconsistencies. We give an empirical illustration of our index by reanalyzing the data from Tanaka et al. (2010).

2 - Testing for Excess Movement in Beliefs
Ned Augenblick, University of California, Berkeley, 545 Student Services Building, 1900, Berkeley, CA, 94720-1900, United States of America, ned@haas.berkeley.edu, Matthew Rabin

We develop a new method to test if belief streams are consistent with Bayesian updating, with an emphasis on whether beliefs move around too much or too little to reflect rational use of information. Our tests do not make any a priori assumptions about the informational structure by taking advantage of a universal property of any Bayesian process: in expectation, the sum of squared changes of beliefs must equal the change in uncertainty. We apply the test to three belief datasets.

3 - Measuring Ambiguity Aversion: Experimental Tests of Subjective Expected Utility
Charlie Sprenger, Assistant Professor, Stanford University, Landau Economics Building, Stanford, CA, United States of America, cspreng@stanford.edu

The canonical model of decisionmaking under subjective uncertainty, Subjective Expected Utility (SEU), is routinely rejected by the phenomena first introduced by Ellsberg (1961), wherein behavior between two subjective bets is inconsistent. We return to the consistency implications of SEU to consider another form of inconsistency: incoherent treatment of a single subjective bet when mixing with objective outcomes.

4 - Delayed Resolution of Uncertainty: a Measurement
Enrico Diecidue, INSEAD, Bd de Constance, Fontainebleau, France, Enrico.Diecidue@insead.edu

We report the results of an experiment measuring preferences for delayed resolution of uncertainty. We detect a systematic effect: decision makers are willing to reduce their probability of winning a prize in a lottery in order to resolve the uncertainty at an earlier stage. In addition we model the impact of resolution of uncertainty under prospect theory. Implications are discussed.

■ TB81

Parc- Divisadero

Analytics for Network and Text Data

Sponsor: Data Mining

Sponsored Session

Chair: Shawn Mankad, Assistant Professor, University of Maryland, 4316 Van Munching Hall, College Park, MD, 20742, United States of America, smankad@rhsmith.umd.edu

1 - Charting Collections of Connections in Social Media: Creating Maps and Measures with NodeXL
Marc Smith, Chief Social Scientist, Social Media Research Foundation, 2617 Hallmark Drive, Belmont, CA, 94002, United States of America, marc.smith.email@gmail.com

Social media can be a bewildering stream of comments, a daunting fire hose of content. With better tools and a few key concepts from the social sciences, the social media swarm can be brought into clearer focus to reveal key people, topics and sub-communities. The Social Media Research Foundation's NodeXL project makes analysis of social media networks accessible to most users of the Excel spreadsheet application. With NodeXL, network charts become as easy to create as pie charts.

2 - Large Exposure Estimation with Automatic Business Group Identification
Margrét Bjarnadöttir, University of Maryland, 4324 Van Munching Hall, University of Maryland, College Park, MD, 20742, United States of America, margret@rhsmith.umd.edu, Sigridur Benediktsdottir

Empirical evidence suggests that large exposure rules are difficult both for regulators to enforce and for financial institutions to implement. We present a data-driven analytical network model that automatically and algorithmically creates groups of related parties, highlights missing critical information, and identifies unreported business partners. We include a case study highlighting large exposure violations and systemic risk leading up to the banking crash in 2008.

3 - Measuring Influence in Social Networks through Information Diffusion Modeling
George Michailidis, University of Michigan, Ann Arbor, MI, United States of America, gmichail@umich.edu

A key question in many social platforms is to determine who are the most influential members in such networks. We modify a popular rank prestige algorithm, by modeling the weights used to reflect users' activity, as opposed to users connectivity. Such activity is captured through the information they post, rebroadcast or comment on and modeled as multivariate interacting counting processes. We discuss estimating the model parameters and illustrate the results on a real data set from Twitter.

4 - Structural Topic Models
Margaret Roberts, molly.e.roberts@gmail.com, Brandon Stewart, Edoardo Airoldi

Social scientists often want to make inference about social processes that drive discourse. We develop a topic model which supports this type of research by modeling the relationships between observed covariates and topics. In our model, topical prevalence and content are specified as a generalized linear model with arbitrary numbers of document covariates. We apply to model to news reports about China, where we allow the prevalence of topics to evolve over time and vary across newswires.

■ TB82

Parc- Haight

Advances in Multiobjective Programming

Sponsor: Multiple Criteria Decision Making

Sponsored Session

Chair: Margaret Wiecek, Clemson University, Mathematical Sciences, Clemson, SC, United States of America, wmalgor@clemson.edu

1 - The Triangle Splitting Method for Biobjective Mixed Integer Programming

Natashia Boland, Unversity of Newcastle, University Drive, Newcastle, Australia, natashia77@gmail.com, Hadi Charkhgard, Martin Savelsbergh

We present the first criterion space search method, the triangle splitting method, for finding all nondominated points of a biobjective mixed integer program. The algorithm maintains, at any point in time, a diverse set of nondominated points, and is ideally suited for fast approximation of the nondominated frontier.

2 - Efficient Storage of Nondominated Data in Biobjective Mixed Integer Programming

Nathan Adelgren, Graduate Assistant, Clemson University, E-1a Martin Hall, Clemson University, Clemson, SC, 29634, United States of America, nadelgr@g.clemson.edu, Pietro Belotti, Akshay Gupte

Branch-and-bound (BB) methods for biobjective mixed-integer linear programs (BOMILP) use upper and lower bound sets for fathoming, so it is desirable to efficiently store the data which defines these sets. To this end, we present a new data structure in the form of a modified binary tree. The structure takes points and line segments as input and stores the nondominated subset of the input. Experimental results show that use of the structure improves the performance of BB.

3 - New Polyhedral Cone Models for Pointwise Preferences in Variable Domination Structures

Alexander Engau, Assistant Professor, University of Colorado Denver, 1250 14th Street, Denver, CO, 80202, United States of America, alexander.engau@ucdenver.edu

We present several new results and models for variable preferences in multiobjective programming and multiple-criteria decision-making. Unlike a few related approaches in the existing literature, our new preference models can be characterized by classes of polyhedral ordering cones , which facilitate their use both for modeling and computational optimization. A detailed analysis of the underlying cones will be given, and a few computational consequences and preliminary results will be addressed.

■ TB83

Parc- Sutro

Image and Functional Data Analysis: Methods and Applications

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Kamran Paynabar, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30327, United States of America, kamran.paynabar@isye.gatech.edu

1 - An Adaptive Measurement Strategy for Characterizing Time Variant Surfaces using Image Data

Chenhui Shao, University of Michigan, Ann Arbor, 2350 Hayward St., Ann Arbor, MI, 48109, United States of America, chshao@umich.edu, S. Jack Hu, Judy Jin

A new adaptive measurement strategy is developed to characterize time varying tool surface conditions due to degradation. The proposed multi-scale spatial model of surface image data captures both the global degradation trend and local spatial variability of tool surfaces. The model goodness of fit, which uses residual, gradient, and spatial autocorrelation, is used to provide a systematic decision where adaptive measurements are most necessarily needed under a given accuracy requirement.

2 - Image Defect Detection with Smooth-Sparse Decomposition

Hao Yan, PhD Student, Georgia Institute of Technology, 755 Ferst Dr, NW, Atlanta, GA, 30332, United States of America, yanhao@gatech.edu, Kamran Paynabar, Jianjun Shi

Image based defect detection is popular for product inspection due to recent development in sensing technology. Existing techniques are all two-step 'first smooth then detect' approach. We propose a one-step smooth-sparse decomposition technique, which combines smoothing technique and variable selection to separate the defect region from smooth background under noisy environment. The effectiveness and efficiency of the proposed method has been tested in both simulation and case study.

3 - Sparse Particle Filtering for Modeling Space-Time Dynamics in the Stochastic Sensor Network

Yun Chen, USF, 14219 Les Palms Circle, Apt. 101, Tampa, FL, 33613, United States of America, yunchen@mail.usf.edu, Hui Yang

Wireless sensor network has emerged as a key technology for monitoring space-time dynamics of complex systems. However, traditional sensor networks demand reliable sensor readings. This paper presents a novel strategy of stochastic sensor networks that relax the hardware constraints. Experimental results demonstrated the effectiveness of sparse particle filtering to support the stochastic design and harness the uncertain information for modeling space-time dynamics of complex systems.

Tuesday, 12:30 - 2:30pm

INTERACTIVE SESSION

Interactive Session

Hilton Grand Ballroom A – B

Tuesday Interactive Session

Chair: Hari Balasubramanian, University of Massachusetts-Amherst, Amherst, MA, United States of America, hbalasub@admin.umass.edu

1 - Evaluation of Courses in a Higher Education Institution

Cesar Pandolfi - DocÍncia, Universidade do Rio Grande do Sul, Alvaro Ferreiro Porto, Caxias do Sul, Brazil, cesar.pandolfi@fsg.br

The objective is to evaluate the changes in data collection for courses evaluation in a higher education institution. It has been used the internal consistency analysis and multivariate analysis. It is characterized as a case study, applied and descriptive. It has shown that the results can be grouped into three levels of satisfaction. It serves as basis for analysis and reorganization of the practices adopted by the courses.

2 - Clustering Items on the Web through Modelling user Communities

Masssey Cashore, University of Waterloo, Waterloo, ON, Canada, jmcashor@uwaterloo.ca, Xiaoting Zhao, Peter Frazier

The challenge of discovering structure in unlabelled data is important as ever in today's society. The cornerstone problem in this setting is clustering, that is, partitioning the items in a manner that coincides with the structure of the items. In this paper we present a probabilistic model of user-item interaction that allows us to cluster items and users, taking into account both user interaction data and item content. The model hinges on the assumption that users exist in communities and items exist in clusters such that the interest of a user in an item is completely determined by the user's community membership and the item's cluster membership. We construct a Gibbs sampler for inference, and apply the Gibbs sampler to a real life dataset from arXiv.org. Comparing the community clusters to a simpler clustering methods, we see several improvements in recommendation system accuracy, and the ability to partition items based on a real-world phenomenon from arXiv.org.

3 - Delivery Vehicle Routing at the Regional Food Bank of Oklahoma

Weikao Wu, Oklahoma State University, Stillwater, OK, United States of America, weikao@ostatemail.okstate.edu, Andrea Lewis, Katie Luster

The Regional Food Bank would like to meet the needs of the growing population of hungry in Oklahoma. To do this, they have to improve the efficiency of their operations, reduce their delivery costs and increase their delivery capacity. This paper reports on our project seeking improvements in the routing of their delivery operations. We identified several improvements to their current software usage which will enable the Food Bank to better route deliveries. Resulting cost savings will allow for over 6 million additional meals to be provided annually by the Food Bank based on projections developed from the test cases.

4 - Location Optimization for AYGAZ Auto Gas Facilities

Birce Sari, Koc University, Istanbul, Turkey, birsari@ku.edu.tr, Kerem Uzun, Ceren Yavuz, Beyza Turan

A location decision for distribution centers and their service regions is often one of the most critical fundamentals for success of an organization. This project summarizes the system and dynamics of Aygaz auto gas business in Turkey and suggests the deterministic model formulation of facility location problem in order

to minimize the overall cost. Our aim is to allocate feasible number of auto gas storage facilities in different cities, creating a new supply channel for Aygaz; in addition to Aygaz's six port terminals. The results of the project will be taken into consideration by strategic management of Aygaz for prospective investments.

5 - Missed Opportunities in Preventing Hospital Readmissions: Redesigning Post-discharge Checkup Policies

Michael Hu, University of Michigan, Ann Arbor, MI, United States of America, humich@umich.edu, Xiang Liu, Jonathan E. Helm, Mariel S. Lavieri, Ted A. Skolarus, Kedi Wu

Hundreds of thousands of patients experience hospital readmissions every year, negatively impacting patients and placing a tremendous burden on the national healthcare system. Post-discharge checkup policies can reduce readmissions through early detection of health conditions, however, the methods behind designing effective checkup policies are poorly understood. Under current practice, up to 67% of patients are readmitted before the first scheduled checkup. We develop an analytical model based on delay-time analysis to identify the optimal type, number, and timing of checkups. Analyzing the structure of optimal policies, we develop schedules that avert at least 32% more readmissions than current practice.

6 - System of Systems Architecture Generation using Evolutionary Algorithms & Negotiation Strategy

Siddhartha Agarwal, Missouri University of Science and Technology, Department of Engineering Management Rolla, MO, 65401, United States of America, sa265@mst.edu

Our attempt is to present a module within integrated SoS architecting model called FILA-SoS (flexible intelligent and learning architectures for systems of systems). FILA-SoS capabilities include SoS meta architecture generation, flexible and robust architecture assessment, and final architecture implementation through simulated negotiations.The paper uses evolutionary algorithms-Fuzzy nets to generate meta-architectures.

7 - Multi-resolution Analysis (MRA): Integrating Methodologies for Today's Analytical Challenges

John Tindle, Director, Analytical Services, TASC, Inc., 1795 Jet Wing Drive, Suite 100, Colorado Springs, CO, 80916, United States of America, john.tindle@tasc.com

The premise of Multi-Resolution Analysis (MRA) is that complex domains of capability should be analyzed from different perspectives with tailored models and tools appropriate for each perspective, but with the 5 OR & DA segments of the analysis integrated to provide traceability of cause and effect for combined total impact.

8 - Optimal Bidding Strategy Based on Parametric Linear Programming Considering Incomplete Information

Feng Gao, Ventyx, an ABB Company, 451 El Camino Real, Santa Clara, CA, United States of America, feng.gao@ventyx.abb.com, Kory Hedman

Electricity market participants face risks and uncertainties associated with the changing market environment. A profit-driven bidding system is crucial for generation companies to maintain a competitive position. This paper presents an optimal bidding strategy derived by parametric linear programming and extends it to consider incomplete information. We show that the proposed algorithm is able to utilize the characteristics of piecewise staircase offer curves in contrast to existing methods.

9 - Optimization of Treatment Decision for Glycemic Control for Patients with Type 2 Diabetes

Yuanhui Zhang, Center for Disease Control and Prevention, 4770 Buford Highway, Chamblee, GA, 30341, United States of America, yuanhui.zhang@gmail.com, Nilay Shah, Steven Smith, Jennifer Mason, Brian Denton

The main objective for care of type 2 diabetes is to control the patient's glycated hemoglobin (HbA1c) to reduce the risk of the diabetes complications. Uncertainty in the progression of HbA1c and the treatment effects make treatment decisions challenging. We present a Markov decision process to maximize the patient's expected quality-adjusted life years prior to major complications. We present the structure of the optimal policy and compare it to current guidelines.

10 - A Web Tool for Model-based Decision Support

Joseph Kahn, Novartis Pharmaceuticals, 1 Health Plaza, East Hanover, NJ, 07960, United States of America, joseph.kahn@novartis.com, Richard Nixon, Peter Danenberg, Vineet Joshi, Chien-Hsun Huang, Dipika Mukherjee

Decision models yield insights for drug development, but lack of automation hampers systematic use. Hence, we developed a web-based tool, incorporating decision analysis best practices. The tool compares "strategy table" scenarios, identifying influential parameters and risks. Its uses have included trial design, and prioritizing among indications. The tool drives models in the open-source R language. By automating decision models, the tool facilitates faster insights and reduces manual errors.

11 - Evaluation of Breast Cancer Mammography Screening Policies Considering Adherence Behavior

Mahboubeh Madadi, University of Arkansas, 900 N Leverett, Fayetteville, AR, 72701, United States of America, mmadadi@email.uark.edu, Louise Henderson, Shengfan Zhang

Incorporating heterogeneity in women's adherence behavior, a randomized partially observable Markov chain model is developed to evaluate a wide range of screening mammography policies. Screening policies are compared in terms of quality adjusted life years (QALYs) and breast cancer lifetime mortality risk. Our results show that women with perfect adherence do not always experience higher QALYs. However, in terms of lifetime mortality risk women with higher adherence rate always have lower risk.

12 - Hospitalists and Hospital Productivity

Rezwan Haque, Harvard Business School, Soldiers Field Road, Boston, MA, 02163, United States of America, rhaque@hbs.edu, Robert Huckman

We investigate an important recent trend in inpatient care: the emergence of primary care doctors, known as hospitalists, who spend all of their professional time in the hospital. We find that hospitalist use is associated with reductions in length of stay for the most complex patients. This outcome could be due to the fact that hospitalists develop more process familiarity, which enables them to be better at tasks such as care coordination that are especially important for complex patients.

13 - Bank Marketing Analysis using Multivariate Techniques

Nasim Nezamoddini, State University of New York at Binghamton, 13 Goethe St., Binghamton,NY, 13905, United States of America, nasim.nezam@gmail.com

This research applies multivariate techniques to find customers willing to invest in new projects. To increase the accuracy of the predictions, different types of customers are identified using clustering techniques. Then specialized prediction models are built in terms of advertisement strategies, customers' characteristics and their attitude obtained by factor analysis.

14 - Integrating Relativity into Multi-attribute Utility Model: An Application on Product Improvements

Selin Erguncu, Doctoral Candidate, Koc University, Istanbul, Turkey, serguncu@ku.edu.tr

Building on MAUT, we propose a framework that recognizes 'relativity' effect in multi-alternative evaluations. We show that each alternative under consideration acts as a 'reference point' for others and choosing an alternative (vs. rating it) decreases its perceived utility. Applying our framework on the assessment of product improvements, we further show that improving a poor (vs. strong) attribute is a better strategy and improvements are more attractive for first-time buyers (vs. switchers).

15 - A Statistical Human Resources Planning in a Call Center

Kosuke Shaku, Tokyo Gas Co., Ltd., 5-20 Kaigan 1-chome, Minato-ku, Tokyo, Japan, shaku@tokyo-gas.co.jp, Toshinori Sasaya, Koji Takayasu

A call center is considered as a queueing network and some results from queueing theory are often applied to calculate the necessary number of agents to maintain a desired service level. However, the actual situation in a call center is complicated compared to the prerequisites of basic formulae in queueing theory such as Erlang C formula because of varieties in both inbounding calls and agent skills. We present a new statistical human resources planning to avoid such problems.

16 - Linguistic Indicators of Satisfaction and Intent in Online Text-based Customer Service Chats

Justin WIlliams, University of Arizona, 1130 E. Helen St., McClelland Hall 430, Tucson, AZ, 85721, United States of America, jwilliams@cmi.arizona.edu, Lee Spitzley

Online, text-based chat is an important way for companies to provide customer support through a web interface. It is unclear how the customer service representative's (CSR) language influences the customer's satisfaction and likelihood to recommend the product. We propose to study the language of CSRs in an online customer support scenario to identify meaningful language characteristics that have an ability to predict satisfaction and likelihood to recommend the product.

17 - Real-time Integrated Airport Surface Operations Management

Yu Zhang, Assistant Professor, University of South Florida, 4202 E. Fowler Ave, ENB 118, Tampa, FL, 33620, United States of America, yuzhang@usf.edu, Qing Wang

This paper describes a real-time integrated airport surface operations management (RTI-ASOM) that provides optimal 4-D trajectories for aircraft between gate and runway with the objective of minimizing taxi delay and maximizing runway throughput. The use of MIP formulation, Dynamic Programming for runway sequencing, and Visual Basic scripted interface solve the large-scale optimization problem instantly, with examples based on one-day track data at LaGuardia Airport (LGA).

18 - Monitoring and Predicting the Patient's Length of Stay in Hospital Using Regression Control Charts

Nasibeh Azadeh-Fard, PhD Student, Virginia Tech, 250 Durham Hall, Blacksburg, VA, 24060, United States of America, nasibeh@vt.edu, Jaime Camelio

Modified Early Warning Scoring (MEWS) system, a triage tool that is widely used by healthcare providers, can quickly determine the severity of patient's illness. The goal of this study is to assess the correlation between admission MEWS and patient's length of stay in the hospital. We utilize this correlation to further monitor the length of stay using the regression control charts. This tool can help hospital staff to predict patient's length of stay, which can lead to more effective management of patient's needs, as well as early resource allocation.

19 - Integrated Optimization on Outsourcing and Production Decisions in Global Supply Chain

Lu Zhen, Professor, Shanghai University, Shang Da Road 99#, School of Management, Shanghai, 200444, China, lzhen@shu.edu.cn

Manufacturers in China are facing decisions on supplier adoption in overseas and domestic markets, production plans for customers in the two markets. These decisions are intertwined. This paper studies an integrated optimization problem on outsourcing and production decisions under environment of global supply chain and China's export-oriented tax policies. A three stage decision model is proposed. A cross entropy based solution method is also developed for solving the three stage model.

20 - Children for Wealth- Fertility Competetion

Bumi Camara, University of Goettingen, Platz der Sieben 5, Goettingen, 37073, Germany, bcamara@uni-goettingen.de

This paper examines the inter-play between inheritance laws and poverty among women in Africa and how this interaction induces high fertility for women in polygamy. I provide evidence of fertility competition among women in polygamy. Polygamy but not monogamy is associated with high fertility if the husband is affluent. Birth spacing is much shorter and contraceptive use is less likely among co-wives whose husband owns inheritable wealth. Results imply intergenerational poverty in Africa.

21 - Salesforce Contracts Equilibrium for Inventory Optimum with Customer Loyalty Moderating Effects

Yu-Ching Chern, National Taiwan University, No. 1, Sec. 4, Roosevelt Road, Taipei, Taiwan - ROC, d02546004@ntu.edu.tw, Gwo-Hshiung Tzeng

We present a multistage model to optimize firm's contracts which induce salesmen's productive behaviors and elicit market demand information.Our model aims to simultaneously resolve the moral hazard and the adverse selection problems.Employing the firm's equilibrium strategy and salesforce's optimal actions,the inventory cost and profits outperforms other existing compensation schemes.Results also indicate that loyal customer base act as implicit incentives to motivate salesperson's performance.

22 - Clinical Prediction of Metastatic Disease among Newly Diagnosed Prostate Cancer Patients

Maria Correa, Department of Industrial Engineering, St. Mary's University, 1 Camino Santa Maria, San Antonio, TX, 78228, United States of America, marifercorreag@hotmail.com, Brian Denton, Selin Merdan, Paul Womble, David Miller, Jianyu Liu

Computed Tomography (CT) and Bone Scan (BS) are imaging tests for detection of metastatic disease among prostate cancer patients. We performed statistical validation of predictive models for CT and BS outcomes to help physicians decide when to recommend patients for imaging. We applied several methods for internal and external validation including leave-one-out and bootstrapping. We present results from our analysis and discuss plans for implementation of the models in a smart phone application.

23 - Multi Sales Channel Competition with Product Returns: The Impact of Restocking Fee Legislation

Rita Difrancesco, WHU-Otto Beisheim School of Management, Burgplatz 2, Vallendar, 56179, Germany, rita.difrancesco@whu.edu, Arnd Huchzermeier

With the explosive growth of the internet, the brick-and-mortar stores are either integrated or substituted by the online channel. We model the multiple sales channels competition with product returns and analyze the equilibrium structure. We investigate the effect of restocking fees and a new EU legislation concerning free returns.

24 - A Comprehensive Sensitivity Analysis of Travel Time Reliability

Meredith Cebelak, University of Texas at Austin, 1616 Guadalupe St., Suite 400, Austin, TX, 78701, United States of America, mcebelak@utexas.edu, Jia Li, C. Michael Walton

Travel time reliability is a key performance measure of transportation systems. This study examines the simultaneous impacts of infrastructure capacity variability due to inclement weather, incidents, and infrastructure maintenance, and demand variations due to feedback mechanisms and elasticity. A comprehensive sensitivity analysis is perform on travel time using a HCM tool and experiment design, revealing critical contributing factors on daily travel time uncertainty along freeway corridors.

25 - International Analysis of Government Strategies for Service Sector Innovation

Jessica Brooks, Science Policy Fellow, IDA - Science and Technology Policy Institute, 100 I St. SE, Washington, DC, 20003, United States of America, jnbrooks@ida.org

To observe the position of service innovation in the context of broader science and technology innovation policy, the innovation strategies of 15 nations were analyzed. Trends in policy content, including the relationship to IT innovation strategy, are described in order to understand the global landscape of service innovation policy.

26 - Flow Path Design in Automated Material Handling Systems

Kelly Bartlett, Georgia Institute of Technology, 755 Ferst Dr., Atlanta, GA, 30332, United States of America, kelly.bartlett@gatech.edu, Shabbir Ahmed, Junho Lee, George Nemhauser, Joel Sokol

In automated material handling systems, dynamic routing has been shown in improve routing efficiency over traditional static routing methods. We demonstrate via high-fidelity simulation that altering flow path design for use with dynamic routing improves routing efficiency by an additional 25%. To facilitate this analysis, we present an automated layout generation tool that allows efficient generation of thousands of potential configurations.

27 - Deductible Insurance and the Transfer of Risk

Christopher Gaffney, Stevens Institute of Technology, 1 Castle Point Terrace, Hoboken, NJ, United States of America, cgaffney@stevens.edu

We provide a mean-variance analysis of insurance demand, showing that deductible insurance is preferable to coinsurance. Furthermore, adding either a stop-loss limit or a deductible to the coinsurance model results in an optimal insurance plan equivalent to deductible insurance. An argument concerning the societal benefit of insurance is also given.

28 - A Lagrangian Decomposition Approach for Renewable Energy Investment and Operational Decision Model

Alireza Ghalebani, PhD Student, University of South Florida, 4202 East Fowler Avenue, ENB 118, Tampa, FL, 33613, United States of America, alireza@mail.usf.edu, Tapas Das

We studied the structural property of a distributed green energy generation optimization model in order to solve it more efficient comparing to the commercial solvers. The model is an incentive based mixed integer programming optimization for design and control of grid-connected hybrid power systems. It fits well for regions with net-metering policy and time varying price of electricity.

29 - Evaluating Cost and Service Level Tradeoffs in a Production and Inventory System with Disruption

Jue Gong, Graduate Student, University of Pittsburgh, 3700 O'Hara St., Pittsburgh, PA, 15261, United States of America, jug29@pitt.edu, Louis Luangkesorn

In a production and inventory system with production disruptions, production uncertainty can be managed through setting the produce-up-to level and sizing the production capacity to provide resiliancy. But these choices result in costs for inventory holding and production capacity and the service level of the system. We develop a Markov-chain model for both periodic and continuous-review policies to explore and illustrate the tradeoffs between operating costs, capacity costs, and service level.

30 - Modeling of Emergency Management of Urban Extreme Storm Floods Based on Strong Reciprocity

Liu Gaofeng, Hohai University, No.200, North Jinling Road, Xinbei District, Changzhou, 213022, China, gaofengliu@hhu.edu.cn

Strong reciprocity theory is introduced into modeling of emergency management of urban extreme storm floods (UESF). Simulations are performed in the example of Jingdezhen city, and the results show that the government strong reciprocity helps to promote emergency cooperation. Besides, rewards and punishment, strong ability of acquiring and processing information, extensive publicity and education can all improve emergency cooperation efficiency and effectiveness of UESF.

31 - Analysis of Nonselective and Selective Advertising Strategies in an Oligopoly Setting

Chloe Fletcher, College of Charleston, 66 George Street, Charleston, SC, 29424, United States of America, fletcherca@g.cofc.edu, Jason Howell

Firms with the ability to identify customers of other firms may implement a strategy where the advertising effort towards competitors' customers differs from that towards uncommitted customers. We present dynamic models for advertising in an oligopoly with fixed market size and sales decay: a nonselective model in which the advertising effort is the same for both types of customers, and a selective model that gives firms the capability to allocate effort across the two categories differently.

32 - Food vs Biofuel: Analysis of Land-use Competition And Environmental Impacts
Halil Cobuloglu, Wichita State University, 1845 Fairmount St, Wichita, KS, United States of America, halil.cobuloglu@gmail.com, Esra Buyuktahtakin

In this study, we develop a mixed integer optimization model in order to investigate the economic and environmental tradeoffs between biofuel and food production. This model maximizes the total profit of farmers while satisfying sustainable food supply. Optimal decisions include allocation of lands to food and energy crops, seeding time, harvesting time and amount, and budget allocations to farm operations. The model is applied in Kansas by considering the production of corn and switchgrass.

33 - Re-envisioning Decision Quality at ConocoPhillips
John Hasar, Development Lead, ConocoPhillips, Rubislaw House, Anderson Drive, Aberdeen, AB15 6FZ, United Kingdom, john.hasar@conocophillips.com, Sharon Rode

ConocoPhillips is changing how and what they share around Decision Quality. Earlier emphasis focused on translating data into quantitative format. While modeling and analysis are needed, not everyone has to be an analyst. Better alternatives are reached by teams highly involved in framing the decision and communicating their knowledge.

34 - Efficient Batch Scheduling for a Petrochemical Blending Plant with a Shared Pipeline Network
Alessandro Hill, University of Antwerp, Prisstraat 13, Antwerp, 2018, Belgium, alessandro.hill@uantwerpen.be, Trijntje Cornelissens, Kenneth Sorensen

We develop an effective scheduling heuristic for realistic production planning of a multi-product, multi-BOM petrochemical blending plant with a complex shared pipeline system. The model takes takes into account component pumping, blending, intermediate storage and filling of the finished products. Our algorithm dynamically prioritizes the production orders and the used dedicated resources to optimize multiple operational objectives. We apply the algorithm to real-world scenarios.

35 - Optimization Strategies for the Best Performance of Healthcare Authority Databases using DM
Yohany Jimenez, Researcher, LOGYCA, Avenida El Dorado N∫ 92 - 32 Modulo G5 P, Bogota, Colombia, yjimenez@logyca.org, Miguel Jimenez, Lauren Castro, Laura Manotas, Diana Ramirez, Heyder Paez, Luis Ramirez

This paper deals with the application of Data Mining (DM) algorithms as an approach to optimize the performance of data processing of the healthcare authority databases, where huge amount of data is managed regarding the new affiliations to the National Healthcare System and reports on the validation of this data are done at a monthly basis. This strategies are integrated to a Decision Support System (DSS) that was implemented as part of the research project.

36 - The Impact of Security in Maintaining Reliable Distributed Control Systems
M. Eric Johnson, Professor, Vanderbilt University, Owen Graduate School of Management, Nashville, TN, 37203, United States of America, Eric.Johnson@vanderbilt.edu, Andrei Sleptchenko

We consider the role of security in the maintenance of an automated system, controlled by a network of sensors and simple computing devices. Such systems are widely used in transportation, utilities, healthcare, and manufacturing. We formulate a stochastic model to examine the repair policies for both real and suspected failures.

37 - The Impact of Multi-skilling on Personnel Scheduling in the Retail Industry
Cesar Henao Botero, PhD Student, Pontificia Universidad Catolica de Chile, Avda. Vicuña Mackenna 4860, Macul, Department of Transportation Engineering, Santiago, Chile, cahenao@uc.cl, Juan-Carlos Muñoz Abogabir, Juan-Carlos Ferrer Ortiz

Retail personnel inflexibility is one of the sources for over- and understaffing. We propose analyze the impacts of assigning multi-skilled personnel to different store departments and its potential for improving schedule efficiency. Our model determines which employees are trained to work in which departments and their assignments over a one-week planning horizon. Some multi-skilling policies are derived from data obtained from a large retail firm in South America.

38 - The Effect of Socioeconomic Inequalities on Public Education Performance in Developing Countries
Maria Cristina Gramani, Insper, Rua Quata, 300, Vila OlÌmpia, Sao Paulo, 04546042, Brazil, mariacng@insper.edu.br

The main objective of this study was to add evidence of the effects of the socioeconomic inequalities on the educational performance. The main question here is: What socioeconomic factor more influences the educational performance? How can we do better? We propose a two-stage model which includes: (1) an educational performance model and, (2) a socioeconomic-education model that identifies characteristics that differentiate the most and least efficient groups.

39 - Integrating Timetabling and Vehicle Scheduling: Tradeoff Between Transfers and The Fleet Size
Omar Ibarra, Post-doc Researcher, Pontificia Universidad Catolica de Chile, Vicuña Mackenna 4860, Macul, Santiago, Chile, oibarrar@uc.cl, Ricardo Giesen, Yasmin Rios-Solis

In transit systems there is a trade-off between the level of service and operating costs. This study presents a bi-objective integrated model for timetabling and vehicle scheduling problems that maximizes passenger transfers and minimizes the fleet size. We implement an epsilon-constraint method to solve our formulation and analyze the trade-off between the two criteria in terms of Pareto fronts. Numerical experiments show that our proposed approach can solve scenarios with up to 50 bus lines.

40 - Evaluation of Construction and Improvement Heuristics for Classification Using Markov Blankets
Daniel Gartner, TUM School of Management, Arcisstr. 21, Munich, Germany, daniel.gartner@tum.de, Rema Padman

This study examines a construction heuristic in connection with a tabu search-based improvement heuristic for classification in high dimensional data sets. Using the UCI machine learning data repository, we evaluate computation times and information about the evolution of the Markov blanket graphical models during the construction and the improvement phase. We compare the performance of the construction and improvement heuristic using classification accuracy as evaluation measure.

41 - Profiling Facebook Users' Privacy Behaviors
Bart Piet Knijnenburg, University of California, Irvine, Informatics Department, Irvine, CA, 92617, United States of America, bart.k@uci.edu, Heather Richter Lipford, Pamela Wisniewski

Social Networks users typically exploit only a subset of the available privacy controls. Using factor analysis and clustering techniques on Facebook users' privacy behaviors, we uncovered six privacy management profiles. We demonstrate that the variability in these profiles is partially due to a lack of awareness regarding the available controls.

42 - Clustering Subgraphs for Repeated Motifs
Nam Lee, Johns Hopkins University, 100 Whitehead Hall, 3400 North Charles Street, Baltimore, MD, 21214, United States of America, nhlee@jhu.edu

We consider a problem of grouping multiple graphs into several clusters using singular value thesholding and non-negative factorization. We derive a model selection information criterion to estimate the number of clusters. We demonstrate our approach using ``Swimmer data set'' as well as simulated data set, and compare its performance with two standard clustering algorithms.

43 - Are You Sure this is the Clothing Style You Defined?
Yusan Lin, PhD Candidate, Pennsylvania State University, 301D Grubb, White Course Apartments, University Park, PA, 16802, United States of America, yusan@psu.edu

When marketing clothing products, it is necessary for the sellers to be aware of the styles of their products, and the kind of consumers they are targeting. However, how does one make sure the style they define is correct? We leveraged the fashion-focused social network, lookbook.nu, and examined whether their definition of styles corresponds to the network structure.

44 - Entropy Maximization with Stochastic Dominance and Moment Constraints for Distribution Approximation
Alexander Mafusalov, PhD Student, University of Florida, 303 Weil Hall, Gainesville, FL, 32611-6595, United States of America, mafusalov@ufl.edu

Entropy maximization with linear constraints (second order stochastic dominance constraint, first and second moment constraints) is proposed for sample distribution approximation problem. Solution is a piece-wise Gaussian function. The second moment convergence implies solution convergence to sample distribution. Cross-validation with likelihood maximization is used to adjust second moment proximity.

45 - Issues in Resiliency for the Australian Food Supply Chain
Leorey Marquez, Research Scientist, CSIRO, Gate 5, Normanby Road, Clayton, VI, 3168, Australia, leorey.marquez@csiro.au, Rodolfo Garcia-Flores, Simon Dunstall

Roughly one-third of food produced for human consumption is lost or wasted globally. At the same time, food production is under threat from climate change, competing land uses, erosion and clean water shortages. This poster showcases recent work aimed at understanding key elements of resilience in the Australian food supply chain. These studies investigate points of vulnerability, the types of threats that can occur in the event of a severe emergency and the strategies needed to address them.

46 - Optimal Combination of Multiple Diagnostic Tests with Application to Prostate Cancer

Selin Merdan, Department of Industrial and Operations Engineering, University of Michigan, 1640 McIntyre Street, Ann Arbor, MI, 48109, United States of America, smerdan@umich.edu, Brian Denton, Christine Barnett

In the early detection and diagnosis of disease, multiple tests are used to discriminate between patients with and without the disease. In the context of cancer, there are several risk factors that predict the presence of the disease; however, the optimal assignment of diagnostic tests to patients based on these risk factors is not known. We present a new model to optimally classify patients for composite diagnostic testing such that false positive and false negative results are minimized.

47 - Bayesian Analysis to Determine Phase Change Time in Stem Cells

Louis Luangkesorn, Research Assistant Professor of Industrial Engineering, University of Pittsburgh, 1048 Benedum Hall, 3700 O'Hara St., Pittsburgh, PA, 15261, United States of America, lol11@pitt.edu, Ali Hjaar

Understanding the dynamics of stem cell differentiation can help in using stem cells in therapeutic and other medical applications. However, measuring the change in cell samples is difficult. This makes it difficult to parameterize mathematical models. Bayesian calibration methods are useful in cases where there are few samples and measurement error. We apply Bayesian methods and show how they lead to more useful estimates of parameters relating to the stem cell reproductive cycle.

48 - A Game-theoretic Procedure for Bridge Construction Cost Allocation

Saurav Kumar Dubey, PhD Student-Department of Industrial and Systems Engineering, University of Tennessee at Knoxville, 1615 Laurel Avenue, Knoxville, TN, 37916, United States of America, skumardu@utk.edu, Alberto Garcia-Diaz, Dongju Lee

The proposed method integrates traffic capacity and load requirements to allocate bridge costs among vehicle classes, using two game-theoretic criteria known as Aumann-Shapley value and Shapley value, and an incremental allocation procedure.Players are defined as vehicle classes, axle load applications, or lanes.The gross-weight based incremental procedure determines marginal costs.

49 - Cost Estimation Method for R&D Research Fund of Government in Korea

Dong-Guen Kim, Associate Research Fellow, Korea Institute of S&T Evaluation and Planning (KISTEP), Dongwon Industry Bldg., 275 Yangjae-dong, Seoul, Korea, Republic of, dgkim@kistep.re.kr

In Korea, the preliminary feasibility study(PFS) is carried for the newly proposed large-scaled government programs. In case of a PFS on R&D programs, the estimation of project cost is needed. In this study, the method of estimation on R&D project cost are researched. Using the historical data about simliar R&D project, the distributions of R&D project costs are investigated and the methodology for estimation on parameters of project cost is developed.

50 - Multiple Criteria Simulation Optimization: Further Refinements

Esmeralda Niño, Graduate Student, University of Puerto Rico at Mayagüez, PO BOX 9000, Mayagüez, 00680, Puerto Rico, esmeralda.nino@upr.edu, Mauricio Cabrera-RÌos, Bryan Rosas

In particular, this work improves upon the use of Data Envelopment Analysis to determine the efficient frontier, as well as, the use of a single-pass algorithm previously proposed by our research group. The results show a rapid convergence to a more precise characterization of the Pareto-efficient solutions. The revised algorithm is illustrated by a series of cases in manufacturing systems simulation.

51 - Iterated Local Search for Flexible Job Shop Scheduling Problems with Resource Constraints

Dimitris Paraskevopoulos, Assistant Professor, University of Bath, Claverton Down, Bath, BA2 7AY, United Kingdom, dp465@bath.ac.uk, Christos Tarantilis, Panagiotis Repoussis

This work presents an Iterated Local Search (ILS) algorithm for flexible Job shop scheduling problems with deadlines, sequence dependent setup times, machine availabilities and most importantly resource constraints. The proposed ILS introduces new compound moves and consorts with an adaptive perturbation mechanism. Experiments on randomly generated problem instances are reported.

52 - Consumer Loan Acquisition Decisions in the Context of Economic Uncertainty

Kanshukan Rajaratnam, University of Cape Town, 4.70 Leslie Social Science Building, Rondebosch, 7700, South Africa, kanshukan@gmail.com

We incorporate forecasts of future economic conditions into acquisition decisions for scored consumer loan portfolios. The portfolio manager must choose both a cutoff score and its associated level of capitalization prior to account performance. In this research, we consider the scoring and regulatory capital decision under multiple economic scenarios. We construct the set of efficient operating points in the market-share and profit space.

53 - How to Complete Subsequent Deals? Breadth and Depth of M&A Success in Semiconductor industry

Jieun Hwang, Seoul National University, LG #59-110, Daehak-dong, Gwanak-gu, Seoul, Korea, Republic of, jieun_sara@hotmail.com, Taewoo Roh

Previous studies on M&A have neglected the importance of deal completion. Based on organizational learning theory, we find that firms can learn to complete the deal from prior success acquisition experience. We examine that intra-industry acquisition experience increases the deal completion and the deal speed in semiconductor industry. Moreover, inter-industry acquisition experience moderates the relationship.

54 - The KANBAN Gamification in a Strategic Operation Management Simulation

Felipe Reis Graeml, Centro Universitario da FEI, Departamento de Engenharia de Produçao, Brazil, fgraeml@fei.edu.br, Mauro Sampaio

This article presents the results of a simulation performed with students, using gamification to teach KANBAN in an Operations Management context. The article defends and justifies the use of "gamification" as an alternative to support theoretical classes, diminishing the effect of learning inhibits, increasing the retention of knowledge for longer period, and stimulating skills development on students.

55 - A Fuzzy Linguistic Based Decision Support System for Evaluating Remanufacturability of Products

Thomas Omwando, University of Wisconsin Milwaukee, 3200 N Cramer Street, EMS 503, Milwaukee, WI, 53211, United States of America, tomwando@uwm.edu, Anthony Ross, Wilkistar Otieno

Remanufacturing as an end of life disposal option faces challenges due to uncertainties associated with product attributes. This work presents a decision support system based on a 2-tuple fuzzy linguistic computing approach to integrate qualitative and quantitative product attributes in determining the remanufacturability of a product. The model is applied to assess the suitability of remanufacturing two products manufactured by a global industry based in the mid-west region of the USA

56 - Extending the Complexity of Covering-routing Problem Considering Maximum Returns to Critical Areas

Maria Jose Pinto Lamosa, Dra., IEAv/CTA, Trevo Cel Av. Jose A. A. do Amarante, 1, S„o José dos Campos, Brazil, maju@ieav.cta.br, MÖnica Maria De Marchi

The problem consists on determining routes with minimum costs and maximum returns to critical areas. We had solved it using a multi-objective model, but the simplifications considered in that model became difficult to apply it in real scenarios. A new model is proposed including features and limitations to the problem, as the associated time and the entity autonomy/capacity. The problem has been applied in scenarios where monitoring is required like disaster management and airspace surveillance.

57 - Predictive Dialing in the Cloud

Douglas Samuelson, InfoLogix, Inc., 8711 Chippendale Court, Annandale, VA, 22003, United States of America, infologix1@aol.com

We extend earlier methods to perform predictive dialing in a Cloud-based virtual call center, with much more flexibility of operational behaviors and consequently a more complex control problem. Big Data and Big Computing methods yield high utilization with acceptably low numbers of abandoned calls.

58 - Destructive Leadership and its Organizational Impact: A Critical Discourse Perspective

Masato Suzuki, Tokiwa University, 1-430-1,Miwa, Mito-shi, Japan, msuzuki0107@gmail.com

The purpose of this study is to investigate leaders' abuse to subordinates and its organizational impact from critical discourse perspectives. While a lot of studies have examined destructive leadership, little is known about how organizational abuse unfolds in organization. Combining dairy analysis and follow up interviews, this study shows that the impact of leaders' abuse to subordinates is not confined to a worker abused, but to behaviors which not abused employees do in organization.

59 - Deducing Patient Placement Decisions in Hospitals; An Integer Programmin Approach

Nooshin Valibeig, Northeastern University, 360 Huntington Avenue, Boston, MA, 02115, United States of America, n.valibeig@neu.edu, Jacqueline Griffin

Hospitals operations are captured in several independent information systems, resulting in lost information about underlying decision processes. We use integer programming to integrate a flow and a census data set to extract important underlying characteristics of the system. Additionally, we analyze the accuracy and robustness of the model using simulated data.

60 - Method of Characteristic Functions for Networks with Fixed Node Degrees
Vladimir Tsurkov, Head of Department, Computing Centre of Russian Academy of Sciences, Vavilov Str., 40, Moscow, 119333, Russia, tsur@ccas.ru

Classes of networks with fixed node degrees and weights of arcs and loops not exceeding a given parameter are studied. Characteristic functions are found that depend on vector components and a parameter; the non-negativeness of this parameter is the network existence criterion. The sums of arc weights on each subset after decomposition and the sum of arc weights incident upon the nodes of subsets are treated as variables. Formulas for the upper and lower bounds for these variables are obtained.

61 - Scheduling Urgent and Normal Jobs in a Two-machine Flowshop
Sang-Oh Shim, Hanbat National University, Dept of Business Administration, Hanbat, Deokmyung-Dong Yuseong-Gu, Daejeon, Ko, 305-719, Korea, Republic of, mizar0110@gmail.com

In this research,a problem of scheduling urgent and normal jobs in a two-machine flowshop is addressed to minimize total tardiness and the maximum completion time for urgent jobs and normal normal jobs, respectively. Several heuristics to obtain an feasible solution in a reasonable time are developed. To evaluate the performance of the proposed algorithms, computational experiments are done on randomly generated instances.

62 - Using Mixed-effect Models to Monitor Product Quality in Interchangeable Manufacturing Processes
Abbase Saghaei, Science and Research Branch Islamic Azad University, Hessarak, 1477893855, Tehran, Iran, a.saghaei@srbiau.ac.ir, zahra pishravian, Mehrdad Nikoo

Interchangeable Manufacturing Processes create different distributions of data, which usually the traditional methods cannot model them. This paper presents a new method for phase II monitoring geometric profiles of gears with different distributions of data. At first, a functional data clustering method is used to cluster the profiles. Then, a mixed-effect model is proposed to consider both within and between clusters variations. The proposed method has shown good performance in such processes.

63 - Stochastically Constrained Simulation Optimization on Integer-ordered Spaces
Kalyani Nagaraj, Virginia Tech, 250 Durham Hall, Blacksburg, VA, United States of America, kalyanin@vt.edu

We present a provably efficient algorithm for optimizing a system whose objective function and the functions forming the set of constraints are observable only via a stochastic simulation parameterized by a finite number of integer-ordered variables. Additionally, we present heuristics for automatically tuning the algorithm parameters that demonstrated good finite-time performance.

64 - Robust Dynamic Pricing for Oligopolistic Service Providers with Fixed Inventories
Yiou Wang, Pennsylvania State University, 244 Leonhard Building, University Park, PA, 16801, United States of America, yiw5120@psu.edu, Terry Friesz, Tao Yao, Ke Han

The problem of robust dynamic pricing of an abstract commodity with fixed inventories specified at initial time is formulated as a continuous time generalized dynamic Nash game and developed into a robust continuous time quasi-variational inequality. We then show the equivalent variational inequality and give effective algorithms based on this. Numerical examples consist of the comparison between robust and stochastic formulations and quantification of efficiency of such supply chain.

65 - Price Discount and Inventory Planning with Binding Reservation
Jianghua Wu, Associate Professor, Renmin University of China, School of Business, 59 Zhonguancun Street, Beijing, China, jwu@ruc.edu.cn

In this paper, we consider the strategy of a firm to use price discounts to implement binding reservation. The firm offers a price discount to customers in exchange for the option to fulfill their orders at the end of the selling season if there is inventory available. The firm can use the advance order information to update demand information. We derive the optimal discount and inventory decision, and then evaluate the impact of various parameters on the performance.

66 - Portfolio Optimization for Options: An Approximate Dynamic Programming Approach
Yaxiong Zeng, Northwestern University, 2145 Sheridan Road, IEMS, Evanston, IL, 60208, United States of America, yaxiongzeng2015@u.northwestern.edu, Diego Klabjan

In portfolio optimization, option has played a relatively small role with few papers discussing its potential impact. In our paper, we design a novel ADP algorithm for European option portfolio and an ADP-embedded non-standard progressive hedging algorithm for American option portfolio. We are the first to add American options into portfolios and explicitly take optimal exercise time into account. By simulation, we compare our algorithms against existing ones and conclude ours perform better.

67 - The Impact of Information Sharing and IT on Customer Service Performance
Wenjie Zhang, Xi'an Jiaotong University, No.28, Xianning West Road, Xi'an, 710049, China, wenjie363@qq.com, Gang Li

Information sharing and IT constitute an important base of competitive advantage for organizations, as they enable the level of customer service. This study proposes a model to analyze the effects of Information sharing and IT on delivery service and after sale support service,and considers the Interaction effects of Information sharing and IT. A large-scale survey was used to tests these relationships and findings provide several theoretical and practical implications for future research.

68 - Adaptive Decision Making of Breast Cancer Mammography Screening: A Heuristic Regression-Based Model
Fan Wang, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, fxw005@uark.edu, Shengfan Zhang

Mammography screening, although effective in reducing breast cancer morality, has high false-positive rates. We develop a regression-based decision model to determine if a mammogram is necessary for various women. The explanatory variables include several risk factors. The optimal decisions are expected to result in the least loss of life expectancy.

69 - From Theory to Practice: Implementation of a Resource Allocation Model in Health Departments
Emine Yaylali, Senior Service Fellow, Centers for Disease Control and Prevention, 1600 Clifton Road, Atlanta, GA, 30329, United States of America, wqq3@cdc.gov, Stephanie Sansom, Arielle Lasry

HIV resource allocation models can synthesize surveillance, programmatic and research data to guide the distribution of HIV prevention dollars among people and programs. Many theoretical models for HIV resource allocation have been developed, although few have been used and evaluated across multiple sites. We developed an HIV resource allocation model that was piloted and evaluated in four health departments. We present health departments' evaluations of their use of the model and its results.

Tuesday, 1:30pm - 3:00pm

■ TC01

Hilton- Golden Gate 6

Mission Planning III

Sponsor: Military Applications Society

Sponsored Session

Chair: Chase Murray, Auburn University, 3301 Shelby Center, Auburn, AL, United States of America, CCM0022@auburn.edu

1 - Usability Analysis of a Task-based Mission Supervisory Control Interface
Luca Bertuccelli, United Technologies Research Center, 411 Silver Lane, East Hartford, CT, 06108, United States of America, luca.bertuccelli@utrc.utc.com, Francesco Leonardi, Jeffrey Peters, Amit Surana

Task-based supervisory control enables an operator to provide a list of tasks that the vehicle team must accomplish and has been shown to have advantages over vehicle-level supervisory control, where an operator manages single vehicles. However, there is little understanding into how users make decisions while using a task-based user interface. This work presents early usability results in user interaction with a task-based user interface under varying number of total vehicles supervised.

2 - Anticipatory Routing of UAVs Using a Game Theoretic Approach
Michael Couche, University at Buffalo, 342 Bell Hall, Buffalo, NY, 14260, United States of America, mjcouche@gmail.com

The UAV routing algorithm takes advantage of game theory solution principles to predict routing in different scenarios. One of the most interesting scenarios is that in which UAVs are modeled as competitive players in the search for information. This scenario provides insights to effective search and routing when the UAVs are decentralized, over an n-step planning horizon. An in depth look into mixed strategy equilibria is also given.

3 - An Approach to Decision Making for Performance Improvement of Military Weapon Systems
Tae Bo Jeon, Professor, Kangwon National University, IE Dept,, 192-1 Hyoja 2 Dong, Chuncheon, 200-701, Korea, Republic of, tbjeon@kangwon.ac.kr

PI (Performance Improvement) is a widely accepted acquisition alternative for existing military weapon systems. A revised hierarchical model for PI has been presented in this study. Through careful examination of PI characteristics, we deducted major evaluation components - maintainability/operability, fulfillment of performance, easiness/effectiveness in PI, and battlefield environment/mission adaptability. We then drew sub-components within each category with carefully designed questions.

4 - Maximizing Autonomous Agent Connectivity
Michael Hirsch, President, ISEA TEK, 620 N. Wymore Road, Suite 260, Maitland, FL, 32751, United States of America, mhirsch@iseatek.com

In this research, we consider the problem of maximizing the connectivity for a set of autonomous agents in a mobile ad-hoc network. Each agent has a starting point and an ending point, and there are certain locations that must be visited by at least one agent. Heuristics are developed and results are presented.

■ TC02

Hilton- Golden Gate 7

Technology, Innovation Management and Entrepreneurship Section Best Paper Winner Presentation

Sponsor: Technology, Innovation Management and Entrepreneurship

Sponsored Session

Chair: Sinan Erzurumlu, Associate Professor, Babson College, 231 Forest St, Babson Park, MA, 02457, United States of America, serzurumlu@babson.edu

1 - Employee Non-Compete Agreements
Matt Marx, MIT Sloan, 100 Main St., Cambridge, MA, United States of America, mmarx@mit.edu

I will review our and related work on Employee Non-Compete Agreements, including individual, firm-level, and regional implications. The status of pending legislation will be reviewed.

■ TC03

Hilton- Golden Gate 7

The Social Crowd: New Research in Social Media and Crowdsourcing

Sponsor: eBusiness

Sponsored Session

Chair: Kevin (Yili) Hong, Assistant Professor, Arizona State University, 300 E Lemon St, Tempe, AZ, 85287, United States of America, ykhong1@asu.edu

Co-Chair: Gordon Burtch, Assistant Professor, University of Minnesota, 321 19th Ave. S, Minneapolis, MN, 55455, United States of America, gburtch@umn.edu

1 - The Value of Multi-dimensional Rating Systems: An Information Transfer View
Kevin (Yili) Hong, Assistant Professor, Arizona State University, 300 E Lemon St, Tempe, AZ, 85287, United States of America, ykhong1@asu.edu, Pei-yu Chen, Ying Liu

This paper examines the value of multi-dimensional online rating systems from an information transfer perspective. Our identification hinges on a natural experiment on TripAdvisor that allowed us to identify the causal effect of adopting a multi-dimensional rating system with a difference-in-difference approach. Based on data from TripAdvisor and Yelp, we find consumers' ratings for the same restaurants are higher in TripAdvisor after its adoption of the multi-dimensional rating system.

2 - The Effect of Social Media Marketing Content on Consumer Engagement: Evidence from Facebook
Dokyun Lee, PhD Student, University of Pennsylvania, JHH 5th Floor, 3730 Walnut Street, Philadelphia, PA, 19104, United States of America, leedok@wharton.upenn.edu, Harikesh Nair, Kartik Hosanagar

We study the effect of social media content on customer engagement using data on Facebook. We do so by content-coding more than 100,000 messages with Natural Language Processing algorithms. We find that inclusion of persuasive content - like emotional content - increases engagement with a message. We find that informative content - like mentions of prices - reduce engagement when included in messages in isolation, but increase engagement when provided in combination with persuasive attributes.

3 - A Double Digital Divide? Matching Platforms and HIV Incidence among the Digitally Disadvantaged
Brad Greenwood, University of Maryland, College Park, MD, United States of America, brad.n.greenwood@gmail.com, Ritu Agarwal

We examine how platforms for the solicitation of casual sex influences the incidence rate of HIV by race, gender, and SES. Using a census of 12 million patients in Florida, we find that the largest negative effect accrues to historically at risk populations (i.e. African Americans and the socio-economic lower class) that, ironically, are also disadvantaged with respect to digital inequalities. Economically, this translates into a financial burden of $592 million in the State of Florida alone.

4 - Asymmetric Social Influence from Personalized Social Cues
Sean Taylor, Research Scientist, Facebook, 1 Hacker Way, Menlo Park, CA, 94025, United States of America, sjt@fb.com, Eytan Bakshy, Dean Eckles, Sinan Aral

We aim to characterize which social relationships transmit the most social influence. Our methodology characterizes the dyadic factors which moderate influence, conditional on exposure to peer behaviors. In our experiment, we select ad exposures where viewers could potentially be exposed to social cues involving two different peers and randomly choose one of the two peers, providing exogenous variation in the dyadic characteristics of friends displayed in the social cue component.

■ TC04

Hilton- Continental 1

Energy Markets and Demand Management

Sponsor: Manufacturing & Service Operations Management

Sponsored Session

Chair: Owen Wu, Indiana University, Bloomington, IN, United States of America, owenwu@indiana.edu

1 - Demand Response in Energy Markets: Voluntary and Involuntary Load Curtailment Contracts
Ruben Lobel, University of Pennsylvania, 3730 Walnut St, JMHH - Suite 500, Philadelphia, PA, 19104, United States of America, rlobel@wharton.upenn.edu, Kaitlin Daniels

As energy consumption grows, electricity grids are turning to demand response (DR) to meet peak demand and lower prices. These programs allow forgone energy consumption to be sold on the market during peak demand events. This project compares the performance of two types of DR contracts: involuntary, under which consumers relinquish control of their energy consumption in return for payment, and voluntary, which allow consumers to decide to reduce their load during each peak event.

2 - Demand Side Management Programs in Energy Markets: An Empirical Approach
Ozge Islegen, Assistant Professor of Managerial Economics and Decision Sciences, Northwestern University, Kellogg School of Management, 2001 Sheridan Road, Evanston, IL, 60208, United States of America, o-islegen@kellogg.northwestern.edu, Baris Ata

Demand side management (DSM) programs flatten or shift peak electricity demand by modifying the consumption patterns of end-consumers. These programs have become widely applicable with the introduction of "smart grids" which can communicate the consumption and price data throughout the power system. In this study, we model the decision-making process of individual electricity consumers under DSM programs and estimate the impact of these programs via a series of counterfactual analyses.

3 - Smart Homes with Price-Responsive Thermostats
Dan Adelman, Professor of Operations Management, University of Chicago Booth School of Business, 5807 S. Woodlawn Avenue, Chicago, IL, 60637, United States of America, dan.adelman@chicagobooth.edu, Canan Uckun

We develop a framework for a smart home's thermal appliances to respond optimally to dynamic electricity price signals, and for assessing the resulting market price equilibrium in a large service region. We show that under certain conditions it is socially optimal for the electricity utility to pass spot prices down to consumers. We present extensive numerical results on ComEd's residential electricity service.

4 - Curtailment and Subsidies: How Renewable Energy Policies Affect Power Market Competition
Owen Wu, Indiana University, owenwu@indiana.edu, Majid Al-Gwaiz, Xiuli Chao

We study the impact of intermittent renewable generation (such as wind and solar power) on electricity market competition, with the focus on the effects of renewable energy policies. Two sets of policies are considered: the production-based subsidies and the operating policies on renewable energy curtailment. The power market competition is modeled as a supply function competition between generators with different levels of flexibility.

■ TC05

Hilton- Continental 2

Retail Operations

Sponsor: Manufacturing & Service Operations Management

Sponsored Session

Chair: Vidya Mani, Assistant Professor, Pennsylvania State University, 461 BB, University Park, State College, PA, 16802, vmani@psu.edu

1 - Allocation of Decision Rights in Retail Supply Chains
Qingning Cao, Vanderbilt University, 401 21st Ave S, Nashville, 37203, United States of America, qingning.cao@vanderbilt.edu, Mumin Kurtulus, Sezer ‹lkü

Our paper studies the implications of allocating decision rights (retail assortment, inventory ownership) in a supply chain. In particular, we identify product and market characteristics that lead to a win-win situation for the manufacturer and the retailer, when the manufacturer takes over both the assortment and inventory decisions and the associated risks.

2 - Flexible Products and Dynamic Preferences
Karthik Ramachandran, Associate Professor, Georgia Institute of Technology, Scheller College of Business, 800 West Peachtree NW, Atlanta, GA, 30308, United States of America, Karthik.Ramachandran@scheller.gatech.edu, Aydin Alptekinoglu

Consumers often have needs that change in a dynamic fashion over time due to physiological, mental or environmental variations. We address a product design dilemma in satisfying such dynamic preferences: should a firm offer multiple standard products, each designed for a specific purpose, or a flexible product that can be reconfigured by consumers as their preferences change?

3 - Inventory Stocking and Rationing for an Omni-Channel Retailer
Elnaz Jalilipour Alishah, PhD Student, University of Washington, Michael G. Foster School of Business, ISOM Department, Seattle, WA, 98195, United States of America, jalilipo@uw.edu, Kamran Moinzadeh, Yong-Pin Zhou

We consider a retailer operating an online and offline store with independent demand. Online demand can be satisfied using offline inventory at a cost, but not vice versa. For a given stocking level, we characterize the offline store's rationing policy; at any time, there exists an inventory threshold above which online demand will be satisfied. We develop and test heuristics to simplify implementation of rationing policy. We then extend the heuristics to retailer with multiple offline stores.

4 - Inventory Management in Online Retailing under Operational Realities
Jason Acimovic, The Pennsylvania State University, 462 Business Building, University Park, PA, 16802, United States of America, jaa26@smeal.psu.edu, Stephen Graves

Inventory management in online retailing presents new challenges. We partner with an online retailer to discover, investigate, and overcome these challenges. Specifically, we investigate how the status quo decentralized replenishment policy performs suboptimally. This is especially true under operational realities such as supply perturbations. We find evidence of these operational realities on actual data and propose a policy that is robust to them.

■ TC06

Hilton- Continental 3

Managing Supply Chain Disruptions

Sponsor: Manufacturing & Service Operations Management

Sponsored Session

Chair: Sang Kim, Yale School of Management, 165 Whitney Ave, New Haven, CT, 06511, United States of America, sang.kim@yale.edu

1 - Disruption Risk and Optimal Sourcing in Multi-Tier Supply Networks
Erjie Ang, Stanford Graduate School of Business, 655 Knight Way, Stanford, CA, 94305, United States of America, erjieang@stanford.edu, Robert Swinney, Dan Iancu

We study a supply chain with three levels: Tier 2 suppliers prone to disruption risk that sell to Tier 1 suppliers who sell to a manufacturer that sells finished goods to the market. We show that as overlap in Tier 2 increases, the manufacturer should rely less on direct mitigation (procuring excess inventory and multi-sourcing from Tier 1) and rely more on indirect mitigation (inducing Tier 1 to procure excess inventory and multi-source).

2 - Global Sourcing: Impact of Sourcing Strategies on Supply Chain Resilience
Serguei Netessine, Professor, INSEAD, 1 Ayer Rajah Avenue, Singapore, 138676, Singapore, serguei.netessine@insead.edu, Nitish Jain, Karan Girotra

We use ship manifest data to study the impact of supply chain structure upon resilience of global supply chains.

3 - Multi-Sourcing and Miscoordination in Supply Chain Networks
Kostas Bimpikis, Assistant Professor, Stanford GSB, 655 Knight Way, Stanford, CA, United States of America, kostasb@stanford.edu, Alireza Tahbaz-Salehi, Douglas Fearing

This paper studies the endogenous formation of supply chain networks when procurement is subject to disruption risk. We argue that the presence of non-convexities in the chain (e.g., due to non-convex production technologies or financial constraints) may create a wedge in the sourcing incentives of firms at different tiers, leading to the formation of overly fragile supply chains.

4 - Preventing and Mitigating Supply Disruptions Under Inventory Competition
Sang Kim, Yale School of Management, 165 Whitney Ave, New Haven, CT, 06511, United States of America, sang.kim@yale.edu

Motivated by recent shortages of generic injectable drugs in the U.S., we analyze a model that captures random production shutdown and restoration and the competing firms' decisions on inventories to mitigate the impact of resulting supply shortages. We identify conditions under which product availability becomes higher or lower due to inventory competition.

■ TC07

Hilton- Continental 4

Identification, Assessment and Correction of Ill-Conditioning and Numerical Instability in Linear and Integer Programs

Cluster: Tutorials

Invited Session

Chair: Ed Klotz, IBM, Incline Village, NV, United States of America, klotz@us.ibm.com

1 - Identification, Assessment and Correction of Ill-Conditioning and Numerical Instability in Linear and Integer Programs
Ed Klotz, United States of America, klotz@us.ibm.com

The implementation of linear (LP) and mixed integer programming (MIP) algorithms on finite precision computers can create numerical challenges which are not addressed in the mathematical descriptions of these algorithms given in many introductory and more advanced textbooks and courses. Rounding errors associated with finite precision can be magnified due to ill-conditioning or numerical instability, resulting in unexpected, possibly inconsistent results. This tutorial helps the optimization practitioner identify sources of ill-conditioning and numerical instability, assess the cause and take appropriate remedial action. After discussing some finite precision computing fundamentals, it considers different measures of ill-conditioning, each one of which provides the simplest explanation of ill-conditioning on certain types of LP and MIP models. We then consider remedies for these numerical challenges: (i) optimizer parameter settings that treat the symptoms and (ii) diagnostic tactics that resolve the underlying MIP or LP issue.

■ TC08

Hilton- Continental 5

Joint Session Social Media/MAS: Diplomacy, Sentiment, & Social Network Analysis Using Social Media

Cluster: Social Media Analytics & Military Applications Society

Invited Session

Chair: Christopher Smith, Director, TRAC-MTRY, U.S. Army, 700 Dyer Road, Monterey, CA, 93943, United States of America, cmsmith1@nps.edu

1 - What's the Story with Digital Diplomacy and Credibility: Twitter, Narrative and Op. Pillar of Defense

Theo Mazumdar, Doctoral Candidate and Annenberg Fellow, USC, 500 N. Rossmore Ave., Apt. 315, Los Angeles, CA, 90004, United States of America, bmazumda@usc.edu

During Operation Pillar of Defense, the Israel Defense Forces (IDF) launched the most comprehensive digital diplomacy program ever undertaken by a warring nation. Focusing on the IDF's unprecedented use of Twitter, identifying and manipulating narrative elements, and through an experimental design and survey, this study is the first to empirically assess the effect of narrative on source credibility in a social media crisis diplomacy campaign.

2 - Modeling and Sensitivity Analysis to MADM Overlay to SNA

William Fox, Professor, Naval Postgraduate School, Department of Defense Analysis, Monterey, CA, 93943, United States of America, wpfox@nps.edu

We address several networks with various approaches such as DEA, AHP, TOPSIS, and SWA in order to identify the key nodes in the network. Of critical importance is being able to apply some sensitivity analysis to these methods. We suggest some sensitivity analysis method and illustrate them in context of SNA.

3 - Mapping Sentiment Polarity during a Real-Time Event at a Local and Global Level

Patrick Dudas, CIV/PhD Student, University of Pittsburgh, 135 N. Bellefield Ave., Pittsburgh, PA, 15213, United States of America, pmdudas@nps.edu

Provided is an exploratory and deterministic mapping of sentiment polarity of Twitter data at both the local-level to a dynamic, interactive visualization and presenting this representation at a higher, global level utilizing a map to showcase sentiment changes as time and location change. Coupling the two approaches may yield a more complete understanding of user-driven sentiment as real-time events or moments occur.

4 - Using Probabilistic Modeling and Data Facilitators to Filter Out the Noise in Social Media

Mark Gerner, Booz Allen Hamilton, Washington, DC, United States of America, Gerner_Mark@bah.com, Michael Abramovich, Alex Golub-Sass

Though prevalence and volume of social media data continues to grow exponentially, there has been little advancement in methods used by analysts to distinguish noise from the signal. We examine a process we've implemented at a Fortune 100 company to connect 4 years of social media conversation to internal investment and business-outcome related datasets. The resulting model helps marketing and communication departments focus their attention on signals in order to optimally allocate resources.

■ TC09

Hilton- Continental 6

Cognitive Decision Support Tool for Policy Makers

Cluster: Cognitive Analytics

Invited Session

Chair: Michal Rosen-Zvi, IBM, 27 Halamed He St, Jerusalem, Israel, ROSEN@il.ibm.com

1 - Using Decision Analysis in a Healthcare Institution

Adriana L. Chavez, MD Anderson, 1400 Holcombe Blvd, Unit 0466, Houston, TX, 77030, United States of America, alchavez@mdanderson.org

The use of decision analysis increases clarity in health care decision situations by helping to efficiently drive projects towards value creation and consensus building. DA is particularly useful in healthcare institutions because of the multiple stakeholders and high-stakes outcomes such as patient health and safety. Examples of DA applications in an internal consulting setting at MD Anderson Cancer Center will be presented.

2 - Decision Practice in Pharma

Keith Gardner, Principal Decision Scientist, AstraZeneca, 1200 Trinity Dr, Alexandria, VA, 22314, United States of America, keith.gardner@astrazeneca.com

We present a strategic view of risk structure and assessment for pharmaceutical development. This includes a model for combining probability of success, time to launch and net present value. We also discuss organizational challenges and behavior mitigation, graphical presentation of results and our effort to build and expand the practice. We present examples of MCDA, decision trees, probabilistic modeling, portfolio methods, processing of data and handling uncertainty, and some outcomes.

3 - A Simulation Based Decision Support System for Policy Makers

Michal Rosen-Zvi, IBM, 27 Halamed He St, Jerusalem, Israel, rosen@il.ibm.com

A simulation model of cervical cancer progression and for HIV is presented. This model can be used for making complex decisions such as vaccination plans (for cervical cancer) and resource allocations for prevention treatments.

■ TC10

Hilton- Continental 7

Information and Competition in Supply Chains and Service Systems

Sponsor: Manufacturing & Service Operations Management

Sponsored Session

Chair: Xin Geng, PhD Candidate, The University of British Columbia, 2329 W Mall, Vancouver, Canada, Xin.Geng@sauder.ubc.ca

1 - On the Value of Imperfect Advance Demand Information for Lost-Sales Inventory Systems

Engin Topan, Eindhoven University of Technology, Postbus 513, Eindhoven, 5600MB, Netherlands, e.topan@tue.nl, Rommert Dekker, Geert-Jan Van Houtum, Tarkan Tan

Motivated by real-life applications, we consider a lost-sales inventory system with imperfect advance demand information (ADI). We assume that ADI is imperfect in reliability and timing, there are yet demand occurrences without ADI and excess stock due to imperfect ADI can be cleared. We propose a model with a general representation of imperfect ADI to investigate the value of ADI. A partial characterization of the optimal policy and also an extensive numerical study are provided.

2 - Online Exchanges for Coordinating Industrial Surplus Chains

Suvrat Dhanorkar, PhD Candidate, University of Minnesota, 321 19th Avenue South, Minneapolis, MN, 55455, United States of America, dhano002@umn.edu, Kevin Linderman, Karen Donohue

Increasingly, Online Material & Waste Exchanges (OMWEs) facilitate the transaction of industrial surplus consisting of unused materials, by-products and waste. We examine opportunities for effectively matching buyers and sellers on these exchanges. Empirical analysis is conducted using archival data on more than 4500 surplus items and 100,000 buyer-seller interactions.

3 - Complete versus Partial Collusion in Competing Coalitions

Omkar Palsule Desai, Assistant Professor, Indian Institute of Management Indore, Rau Pithampur Road, Indore, India, omkardpd@iimidr.ac.in

In view of the merger paradox, a grand coalition of small producers seems to be a natural outcome. Multiple competing coalitions exhibiting distinct performance efficiencies depending on technologies and coalition forms adopted exist in industries such as milk, coffee. We adopt endogenously determined sharing rules to provide an alternate explanation to coalition formation. We show that the competing coalitions need not have (a)symmetric forms and they necessarily not form complete collusion.

4 - Fairness among Servers when Capacity Decisions are Endogenous

Xin Geng, PhD Candidate, The University of British Columbia, 2329 W Mall, Vancouver, Canada, Xin.Geng@sauder.ubc.ca, Tim Huh, Mahesh Nagarajan

We look at a service system with two servers and a single class arrivals. We examine the effect of routing policies on servers when they care about fairness, and when they can endogenously choose capacities. We study the two-server game where the servers' objective functions have a term explicitly modeling fairness. Theoretical results concerning the existence and uniqueness of the Nash equilibrium are proved for some policies. Further managerial insights are given based on simulation studies.

■ TC11

Hilton- Continental 8

Supply Chain Risk Management

Sponsor: Manufacturing & Service Operations Management/Supply Chain

Sponsored Session

Chair: Loo Hay Lee, Associate Professor, National University of Singapore, 10 Kent Ridge Crescent, Singapore, Singapore, iseleelh@nus.edu.sg

1 - Mitigation Strategies for a Manufacturer Subject to Supply and Demand Risk

Nickolas Freeman, University of Houston, Melcher Hall Room 280, Houston, TX, 77204, United States of America, nfreeman@bauer.uh.edu, Sharif Melouk, John Mittenthal, Burcu Keskin

We consider disruption mitigation strategies for a capacitated manufacturer with supply and demand uncertainty. Sub-components dictate the quality of the manufactured products. Using an analytical model, we investigate and compare mitigation strategies including multi-sourcing, downward substitution, and in-house production.

2 - Assessing the Efficiency of Risk Mitigation Strategies in Supply Chains

Hakan Yildiz, Assistant Professor, Michiagn State University, 632 Bouge Street, East Lansing, Mi, 48824, United States of America, yildiz@bus.msu.edu, Srinivas Talluri, Thomas Kull, Jiho Yoon

We evaluate supply chain risk mitigation strategies in the presence of a variety of risk categories, risk sources, and supply chain configurations. We combine an empirically grounded simulation methodology with data envelopment analysis to analyze and rank alternative mitigation strategies. Our research presents several interesting and useful managerial insights for deciding what strategies are most capable of mitigating risks in a variety of contexts.

3 - Study of Supply Chain Risk under information Sharing

Loo Hay Lee, Associate Professor, National University of Singapore, 10 Kent Ridge Crescent, Singapore, Singapore, iseleelh@nus.edu.sg, Ek Peng Chew, Yi Tao

The increasing complexity of supply chains worldwide has caused them to be susceptible to supply chain disruptions. However, if different echelons in a supply chain are willing to share the information, the impact of the disruptions can be minimized. In this talk, we will demonstrate how systems dynamics model can be used to estimate the value of the information sharing.

■ TC12

Hilton- Continental 9

Sustainability Issues in Supply Chain Management

Sponsor: Manufacturing & Service Operations Management/Sustainable Operations

Sponsored Session

Chair: Damian Beil, Associate Professor, Stephen M. Ross School of Business, University of Michigan, 701 Tappan St, Ann Arbor, MI, 48109, United States of America, dbeil@umich.edu

Co-Chair: Sam Aflaki, Assistant Professor, HEC Paris, 1 Rue de la Liberation, Paris, France, aflaki@hec.fr

1 - Total-Cost Procurement Auctions with Sustainability Audits to Inform Bid Markups

Damian Beil, Associate Professor, Stephen M. Ross School of Business, University of Michigan, 701 Tappan St, Ann Arbor, MI, 48109, United States of America, dbeil@umich.edu, Luk Van Wassenhove, Karca Aral

In this paper, we explore whether the buyer should conduct sustainability audits in order to make a more informed total-cost procurement decision. We find that although the audits are used for resolving uncertainty about suppliers' relative sustainability levels, greater uncertainty about supplier sustainability levels and a less sustainable supplier base do not necessarily make the audits more valuable for the buyer.

2 - Recovery Legislations or Taxation/Subsidy Based Policies? A Mixed Approach Might be More Effective

Shumail Mazahir, PhD Candidate, HEC, Jouy en Josas, 78350, France, shumail.mazahir@hec.edu, Sam Aflaki

We study the take back schemes such as recovery legislations and compare them with taxation/subsidy based schemes in a stackelberg game setting where the policy maker selects a policy and its policy parameters based on its welfare function and the firms maximizes their profits considering these policy parameters.We compare the environmental and economical performance with each of these schemes and present conditions where one policy performs better than the other.

3 - Optimal Feed-in-tariff Policies: The Role of Supply Chain Intermediaries

Shadi Goodarzi, HEC Paris, 1 rue de la Liberation, Jouy en Josas, 78350, France, shadi.goodarzi@hec.edu, Andrea Masini, Sam Aflaki

We assess the effectiveness of FIT policies in promoting renewable technologies taking into account the decisions of supply chain intermediaries. Modeling a three-tire supply chain that includes potential adopters, technology manufacturers and an electricity supplier, we show that the ability of policy makers in inducing adoption is greatly affected by the intermediaries market characteristics, an understanding of which sheds new light on the structure and magnitude of optimal FIT policies.

4 - Extended Producer Responsibility (EPR) for Pharmaceuticals

Beril Toktay, Professor, Georgia Institute of Technology, 800 West Peachtree Street NW, Atlanta, GA, 30308, United States of America, beril.toktay@scheller.gatech.edu, Isil Alev, Atalay Atasu, Ozlem Ergun

EPR, which holds producers responsible for environmentally safe treatment of their products, has emerged as the preferred policy for managing pharmaceutical overage. To analyze its effectiveness, we develop a game-theoretic model representing interactions in the pharmaceutical chain with a focus on factors causing overage. We uncover conditions for effective EPR implementation and critical factors determining stakeholder perspectives on EPR in the pharmaceuticals context.

■ TC14

Imperial B

Joint Session JFIG/ENRE: Models and Analysis of Invasion Processes

Sponsor: Junior Faculty Interest Group & Energy Natural Resources and the Environment

Sponsored Session

Chair: Esra Buyuktahtakin, Assistant Professor, Wichita State University, Wichita, KS, United States of America, esra.b@wichita.edu

Co-Chair: Robert Haight, USDA Forest Service Northern Research Station, 1992 Folwell Ave, St. Paul, MN, 55108, United States of America, rhaight@fs.fed.us

1 - Measuring Damages and Modeling Feedbacks between Economic and Ecological Systems

Travis Warziniack, Research Economist, USFS Rocky Mountain Research Station, 240 W. Prospect Rd, Fort Collins, CO, 80525, United States of America, twwarziniack@fs.fed.us

We describe integrated modeling efforts between social and natural scientists, sacrifices in complexity that may exist when working across disciplines, and whether those sacrifices are worth it. The session is built around a discussion about the spread of invasive species in the Laurentian Great Lakes and integrating a computable general equilibrium economic model with the Ecopath with Ecosim food web model. The speaker is an economist, and tips for working with such a species are given.

2 - The Cost of Simplicity: The Accuracy-Complexity Tradeoff for Disease Transmission Models

Danqi Luo, Bryn Mawr College, 101 North Merion Ave, BoxC-1121, Bryn Mawr, PA, 19010, United States of America, dluo@brynmawr.edu, Benjamin Armbruster

We study the differences of disease transmissions in the characteristics of an epidemic in a single population model versus a more heterogeneous model in terms of the number of subpopulations and stages of infection. The differences in attack rate and prevalence of steady states are computed in order to measure the cost of aggregation in SIR and SIS models. Under the symmetric mixing assumption, the aggregated model is a good alternative to the heterogeneous model.

3 - Investing in Classical Biological Control of Legacy Pests

Karen Jetter, Economic Researcher, University of California, Agricultural Issues Center, 1 Shields Ave, Davis, CA, 95616, United States of America, jetter@primal.ucdavis.edu, John Steggall, Dave Luscher, Mark Hoddle, Keith Warner, Charles Goodman

This study will present a risk analysis for biological control programs of legacy exotic arthropod pests that established in California prior to 1990. This project develops a selection criteria based on pest characteristics, current technology, and economics to pick legacy pests of tree and vine crops in Californian with a high probability of being effectively managed with biological controls. It then estimates the expected net benefits of investing in biological control for those pests.

4 - A Unified Model for the Analysis of the Distribution and Abundance of Invasive Species

Andrew Paul Gutierrez, Professor, University of California, Berkeley, Center for the Analysis of Sustainable, Agricultural Systems (CASAS Global), Kensington, CA, 94707, United States of America, casas_global@berkeley.edu, Luigi Ponti

The majority of invasive species are heterothermic and their distribution and abundance is largely determined by weather and by species they interact with. The biology is complex, but is simplified by analogous biological processes that determine their distribution and abundance under extant and climate change scenarios. Several systems are explored.

■ TC15

Hilton- Exec. Boardroom

Data Envelopment Analysis 2

Contributed Session

Chair: Ke Wang, Dr., Beijing Institute of Technology, 5 S. Zhongguancun St., Beijing, 100081, China, kewang2083@gmail.com

1 - Identifying the Role of Foreign Technology on Efficiency Change for Achieving MDGs using Panel DEA

Bo Kyeong Lee, Yonsei University, Shinchon, Seodaemungu, Seoul, Korea, Republic of, lee.bokyeong@yonsei.ac.kr, Soyoung Sohn

We study the role of foreign technology on efficiency change in developing countries in achieving Millennium Development Goals (MDGs). To measure efficiency change in panel data, we employ a Data Envelopment Analysis based Malmquist Productivity Index. The data includes indicators of MDGs as outputs and the endogenous factors as inputs for 43 developing countries between the early 1990s and the late 2000s. We regress pure efficiency change against the factors showing foreign technology inflows.

2 - A New Method for Congestion Measurement

Jun Wang, University of Science and Technology of China, No.96, JinZhai Road Baohe District, Hefei, 230026, China, wangjun1200@mail.ustc.edu.cn, Yan Wu

The paper represents congestions theories containing the undesirable output which are widespread existed in the production practice. So our proposed methodology not only promotes the development of congestion theory, but also takes both desirable and undesirable output combine in the DEA framework. Our methodology can contribute managers' better trade-off between economic development and environmental protection.

3 - Dynamic Network Data Envelopment Analysis-DEA on Evacuation Performance

Oscar Herrera-Restrepo, PhD Candidate, Virginia Tech, 4339 Taney Avenue Apt 401, Alexandria, VA, 22304, United States of America, oscar84@vt.edu, Joseph Trainor, Kostas Triantis, Pamela Murray-Tuite, Praveen Edara

This paper proposes a theoretical representation of a slacks-based dynamic network DEA approach for measuring evacuation performance when a ramp closure strategy is considered. It includes an integrated conceptual framework that incorporates stakeholder perspectives, evacuation-related systems and processes. The approach allows for the discovery of potential performance improvement actions that can inform the definition of future requirements of transportation evacuation strategy designs.

4 - Measuring Brazilian Hospital's Efficiency with Dynamic Data Envelopment Analysis

Marianna Cruz Campos, UFRN, Av Campos Sales, Tirol, Natal, 59020300, Brazil, mariannaccampos@gmail.com, Fernanda Rocha, Mariana Almeida

Data Envelopment Analysis was applied to evaluate the performance and efficiency of brazilian public hospitals. Using dynamic model to measured the productivity and returns to scale of 49 general hospitals between 2011 until 2013. The results showed that the best practices can improve the future scenarios of inefficient units.

5 - Energy Efficiency index via Data Envelopment Analysis (DEA): Methodology and application

Ke Wang, Dr., Beijing Institute of Technology, 5 S. Zhongguancun St., Beijing, 100081, China, kewang2083@gmail.com

Within a joint production framework of considering desirable & undesirable outputs, this study proposes several energy efficiency indices based on i) traditional DEA with undesirable outputs transformation technique; ii) directional distance function relying on weak disposability assumption; iii) range adjusted measure relying on natural & managerial disposability assumptions; and iv) multi-directional efficiency analysis from which both efficiency status and efficiency patterns can be detected.

■ TC16

Hilton- Franciscan A

Omni-channel Retail Analytics

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Pavithra Harsha, Research Staff Member, IBM Research, 1101 Kitchawan Road, Room 34-225, Yorktown Heights, NY, 10598, United States of America, pharsha@us.ibm.com

1 - Assortment Optimization in the Presence of Multiple Channels and Consumer Preference Uncertainty

Srikanth Jagabathula, New York University, 44 West Fourth St, New York, NY, 10012, United States of America, sjagabat@stern.nyu.edu, Daria Dzyabura

Most models of consumer purchase used in operations focus on purchases from a single channel (typically brick-and-mortar). However, with the proliferation of retail channels, there is a need to account for channel switching behavior in making operational decisions. We propose a choice model that accounts for channel switching through preference uncertainty. We validate this mdoel on real-world data and quantify the gain in revenues obtained through accounting for the channel switch behavior.

2 - A Novel Approach to Demand Modeling and Pricing for Omni-channel Retailers

Pavithra Harsha, Research Staff Member, IBM Research, 1101 Kitchawan Road, Room 34-225, Yorktown Heights, NY, 10598, United States of America, pharsha@us.ibm.com, Markus Ettl, Shiva Subramanian

Consumers are increasingly navigating across multiple channels to make purchases and retailers are finding that traditional approach to pricing channels in silos needs to be reconsidered. We present a comprehensive framework for omni-channel retailing to model and estimate the substitutions across channels. Further, we present an integrated price optimization problem across retail channels and locations with cross channel effects to maximize the retailer's total profitability with computations.

3 - Integrated Pricing and Inventory Optimization in an Omni-channel Environment

Joline Uichanco, Assistant Professor, University of Michigan, Ross School of Business, 701 Tappan Street, Ann Arbor, MI, 48109, United States of America, joline.uichanco@gmail.com, Markus Ettl, Pavithra Harsha, Shiva Subramanian

Lifecycle pricing is traditionally done for a single sales channel where inventory is exogenous. However, this ignores customers channel-switching due to differences in prices in different channels. We develop an optimization model for joint price and inventory management in an omni-channel retail environment. In our model, inventory is not exclusive to one channel (e.g. buy online pickup in store). Our model also considers demand uncertainty with both a stochastic model and a robust model.

4 - Optimizing Purchasing and Handling Costs in Supply Chain Procurement

Gonzalo Romero, U. of Toronto, 105 St George Street, Toronto, ON, M5S 3E6, Canada, gromeroy@mit.edu, Georgia Perakis, Retsef Levi

We introduce a new model that minimizes the purchasing and handling costs induced by case pack selection in procurement contracts. We prove structural results that lead to a practical method to both selecting the best case pack size per SKU, and serving orders at the distribution center. Specifically, we show that a threshold policy is optimal for serving orders. Furthermore, we implement this method on real data from a large utility company, finding significant supply chain cost reductions.

■ TC17

Hilton- Franciscan B

Dynamic Pricing in Service Systems

Sponsor: Manufacturing & Service Operations Management/Service Operations

Sponsored Session

Chair: Ramandeep Randhawa, USC, Marshall School of Business, Los Angeles, CA, United States of America, ramandeep.randhawa@marshall.usc.edu

1 - Optimal Dynamic Pricing with Demand Model Uncertainty: A Brownian Model of Learning and Earning

Bora Keskin, The University of Chicago Booth School of Business, 5807 S. Woodlawn Avenue, Chicago, IL, 60637, United States of America, bora.keskin@chicagobooth.edu

We consider a Brownian model of dynamic pricing with demand model uncertainty, in which a firm sells a product over a continuous time horizon. The firm is uncertain about the price-sensitivity of the demand for the product, and continuously updates its prior belief on the price-sensitivity by making observations on the market responses to prices. We derive and solve a partial differential equation to show how the value of learning should be projected onto prices in an optimal fashion.

2 - Value of Dynamic Pricing in a Congestible System

Jeunghyun Kim, USC, Marshall School of Business, Los Angeles, CA, United States of America, jeunghyun.kim.2015@marshall.usc.edu, Ramandeep Randhawa

Charging a higher premium for a highly demanded service is natural for firms seeking to increase revenue. In the context of a single server queue, we study and quantify the value of dynamic pricing. We find that surprisingly the conventional heavy traffic regime, which is optimal in large systems under a static pricing scheme, is no longer optimal. While the optimal pricing scheme is complex, we prove that a two-price policy is near optimal.

3 - Intertemporal Pricing without Priors

Ying Liu, New York University, 44 W 4th St, New York, NY, United States of America, yliu2@stern.nyu.edu, Ilan Lobel, Rene Caldentey

We consider a monopolist selling a product to a population of consumers who are heterogeneous in valuations and arrival times. We study the policies that attain minimum regret when selling to either myopic or strategic customers. We characterize the set of optimal policies and demonstrate their structural properties.

■ TC18

Hilton- Franciscan C

Managing Customer Behavior in Service and Retail Systems

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Eren Cil, University of Oregon, 1208 University of Oregon, Eugene, OR, United States of America, erencil@uoregon.edu

1 - Intertemporal Pricing and Strategic Rationing When Selling to Snobbish Consumers

Kenan Arifoglu, Assistant Professor, University College London, Gower Street, London, WC1E 6BT, United Kingdom, k.arifoglu@ucl.ac.uk, Sarang Deo, Seyed Iravani

We develop a stylized analytical model to understand why firms selling to snobbish (exclusivity-seeking) consumers display several differences in their pricing and rationing strategies. We show that the snobbish consumer behavior provides another explanation for these differences. Also we find that when selling to snobbish consumers, price markdowns are not always associated with excess inventory and the negative impact of strategic consumer behavior is lower.

2 - Sharing Aggregate Inventory Information with Customers: A Strategic Way of Cross-selling

Hyoduk Shin, University of California-San Diego, 9500 Gilman Drive, La Jolla, CA, United States of America, hshin@rady.ucsd.edu, Ruomeng Cui

Why do some firms share their inventory information with customers? We provide an answer to this question through an angle of product variety. We also show why firms share partial (or aggregate) inventory information with their customers rather than full information or no information by considering cross-selling of differentiated products.

3 - Strategies in Fairness-Sensitive Markets

Steven Shugan, Professor, University of Florida, 1405 W University Avenue, Room 219, Gainesville, FL, 32605, United States of America, steven.shugan@warrington.ufl.edu, Jihwan Moon

We study fairness sensitive markets where market norms determine fair and unfair fees. Rational consumers only engage in search when their firm deviates from the market norm (an information event). We find that adverse cost shocks cause firms to charge unfair fees regardless of whether consumers are fairness-sensitive. However, the transition to the new equilibrium depends on whether consumers are fairness-sensitive because high-quality firms can delay ostensibly unfair actions.

4 - From Used to New: Increasing Profit through Product Renewals

Michael Pangburn, University of Oregon, 1208 University of Oregon, Eugene, OR, 97405, United States of America, pangburn@uoregon.edu, Euthemia Stavrulaki

Product deterioration over time can benefit a manufacturer by driving repeat sales. Although planned obsolescence is an established strategy, some firms promote product longevity by offering a product renewal service. We show that such renewal service has the potential to increase revenues sufficiently to offset the additional expense, particularly for costly products. We also prove that the manufacturer can increase profits by committing in advance to the price of its refresh service.

■ TC19

Hilton- Franciscan D

Contemporary Topics in Revenue Management

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Fredrik Odegaard, Ivey Business School, Western University, 1255 Western Road, London, ON, N6G 0N1, Canada, fodegaard@ivey.uwo.ca

1 - Airline Switching Revenue with Price-Guarantees

Fouad Mirzaei, Ivey Business School, Western University, London, ON, Canada, fhassanmirzaei@ivey.uwo.ca

Many airlines permit ticket holders to change the time of their fight by paying a switching fee. Although the switching fee is a revenue item for the airline, a low or high fee could cause operational challenges, such as unsold capacity or lost sales. This raises a question that what fee should be set for switching. We model a single firm, which delivers two comparable services over two sequential periods and derive the optimal switching fee.

2 - Assortment Competition with the Decoy Effect

Xinchang Wang, Georgia Institute of Technology, School of Industrial and Systems Enginee, Atlanta, GA, 30332-0205, United States of America, xwang336@gatech.edu, Anton Kleywegt

We describe product assortment competition in a duopoly with decoys among candidate products. We characterize the Nash equilibria for different settings, and use models of learning to study the evolution of the competition and the stability of the equilibria. In some settings, all pure equilibria are stable, and all mixed equilibria are unstable. We also show settings in which the learning processes cycle without convergence to any equilibrium.

3 - On the Implications of Airfare Price Volatility on Transacted Prices, Sales and Revenue

Benny Mantin, Assistant Professor, University of Waterloo, 200 University Ave. W., Waterloo, Canada, bmantin@uwaterloo.ca, Eran Rubin

The airline industry has embraced the internet to frequently update prices of airline tickets. Many markets exhibit a considerable level of price volatility. Do these price movements induce consumers to pay more for the tickets and increase sales volumes at the same time? Controlling for market characteristics, we provide new insights on the link between price volatility, transacted airfares (level and dispersion), sales (fill rates), as well as revenues.

4 - Bundling with Dependent Valuations: The Price of Independence

Mihai Banciu, Bucknell University, 119 Taylor Hall, Lewisburg, PA, 17837, United States of America, mmb018@bucknell.edu, Fredrik Odegaard

We investigate the problem of pricing bundles of products when the valuations for the underlying components are dependent. We examine all possible bundling strategies, derive near-optimal prices for both the bundle and the components, and investigate how the total revenue when dependence is accounted for compares with the revenue obtained under the typical assumption of independence. We find that sacrificing dependency for tractability can lead to arbitrarily bad outcomes for the seller.

■ TC20

Hilton- Yosemite A

Facility Logistics III

Sponsor: TSL/Facility Logistics

Sponsored Session

Chair: S.Gökhan Özden, Mr., Auburn University, Shelby Center Room 3333, Auburn, AL, 36849, United States of America, sgo0002@auburn.edu

1 - Robust Design of Unit Load Storage Systems

Pratik Mital, PhD Candidate, Georgia Institute of Technology, 755 Ferst Drive, NW, Atlanta, GA, 30332, United States of America, pmital3@gatech.edu, Pratik Mital, Marc Goetschalckx, Edward Huang

We present a formulation for the design unit load storage system design problem under uncertainty which is a mixed-integer non-linear stochastic optimization problem. We also present a methodology that identifies all Pareto-optimal configurations with respect to the bi-objective of minimizing the expected value of the scenario costs and a risk term such as the standard deviation of the scenario costs, A case study and numerical experience will be also be shared.

2 - Optimal Assignment Models for AS/RS with Multiple In-the-Aisle Pick Positions

Faraz Ramtin, University of Central Florida, 4000 Central Florida Blvd, Orlando, FL, 32816-2993, United States of America, faraz.ramtin@ucf.edu, Jennifer Pazour

An AS/RS with multiple in-the-aisle pick positions (MIAPP-AS/RS) is a semi-automated case-level order fulfillment technology. We provide algorithms to find the optimal assignment of SKUs to pick positions that minimizes the expected travel time subject to different operating policies, demand profiles, and shape factors. Also, we derive closed-form models by assuming an infinite number of pick positions in the aisle to approximate the optimal assignment's expected travel time.

3 - Transport, Logistics and Supply Chain Network Design: Applications and Research Gaps

Reza Zanjirani Farahani, Kingston University London, KHBS 215, Kingston Business School, Kingston Hill, Kingston Upon Thames, United Kingdom, zanjiranireza@gmail.com

Network design comprises strategic decisions including the number, location, capacity and allocation of facilities in transport, logistics and supply chain systems. Network design has wide range of applications such as in business, urban, maritime, emergency and global logistics networks. Stimulated from real-life applications and practitioners' needs, this presentation tries to review traditional applications and research works in the literature and provides new insights for academics.

4 - Optimizing Non-Traditional Warehouse Designs for Order Picking Operations

S.Gökhan Özden, Mr., Auburn University, Shelby Center Room 3333, Auburn, AL, 36849, United States of America, sgo0002@auburn.edu, Alice E. Smith, Kevin R. Gue

The proposed research offers an approach that reduces the costs of most costly operation in a warehouse - order picking. We search through non-traditional designs by using evolutionary strategies. Since every fitness calculation includes allocating products and calculating the optimal pick tours of hundreds or thousands of pick lists, function evaluation is very time consuming. We discuss techniques that shorten overall computation time. This research is funded by NSF.

■ TC21

Hilton- Union Sq 1

TSL Prize Winners

Sponsor: Transportation Science & Logistics

Sponsored Session

Chair: M.Grazia Speranza, Professor, University of Brescia, C.da S.Chiara 50, Brescia, Italy, grazia.speranza@unibs.it

1 - TSL Prize Winners

M.Grazia Speranza, Professor, University of Brescia, C.da S.Chiara 50, Brescia, Italy, grazia.speranza@unibs.it

The TSL 2014 Prize Session finalists will present their award-winning work in this session. Prize committee chairs will say a few words about the winning selections.

■ TC22

Hilton- Union Sq 2

Coordinating Decentralized Transportation Systems

Sponsor: Transportation Science & Logistics

Sponsored Session

Chair: Luyi Gui, Assistant Professor, Paul Merage School of Business, UC Irvine, Irvine, CA, United States of America

1 - Strategies to Consolidate Freight of Perishable Products

Christine Nguyen, University of Southern California, 3715 McClintock Ave, GER 240, Los Angeles, CA, 90089, United States of America, nguyen7@usc.edu, Xiaoqing Wang, Alejandro Toriello

We study a supply chain of perishable products, where suppliers have low demands and consolidate their product to achieve economical shipping rates. We develop an efficient heuristic approach that balances the inventory cost with the shipping cost. The heuristic considers the trade-off between holding inventory for future shipments and consolidating to ship today. A sensitivity analysis demonstrates the effect of inventory costs on the volumes shipped at the FTL, LTL or courier rate.

2 - The Cost of Equivalence in Rationing Air Transportation Capacities

Douglas Fearing, The University of Texas at Austin, 2110 Speedway, Stop B6500, Austin, TX, United States of America, doug.fearing@mccombs.utexas.edu

In the presence of severe weather disruptions, regulators are forced to ration aircraft arrivals into impacted airports and air sectors. The ration-by-schedule approach utilized in practice does not distinguish individual aircraft based on size, passenger counts, or operational considerations. Using optimization and simulation based on historical flight data, we investigate the extent to which this creates inefficiencies in the operation of the air transportation system.

3 - Trust and Reciprocity in Firms' Capacity Sharing

Xing Hu, University of Oregon, 484 Lillis, 1208 University of Oregon, Eugene, OR, 97403, United States of America, xingh@uoregon.edu, Rene Caldentey

We study a reciprocal incentive system that facilitates efficient capacity sharing between two service firms who have limited and substitutable capacity. We model two firms each controlling an M/M/1/1 queue, where customers not served by the host firm might be rerouted to the other firm. We incorporate a scoring system that records the numbers of favors exchanged between the firms.

4 - Managing Decentralized Resource Sharing in Carrier Alliances under Demand Uncertainty

Luyi Gui, University of California-Irvine, Irvine, CA, United States of America, luyig@uci.edu, Ozlem Ergun

We study the design of market-based resource sharing agreements to motivate and regulate capacity sharing in carrier alliances under demand uncertainty. We focus on designing a robust capacity exchange mechanism, aiming at achieving high routing efficiency over the entire service network of the alliance under multiple potential demand scenarios. We characterize how the structure of the service network affects the robustness of the mechanism, and propose capacity pricing solutions accordingly.

■ TC23

Hilton- Union Sq 3

Network Design Models and Methods

Sponsor: TSL/Freight Transportation & Logistics

Sponsored Session

Chair: Michael Hewitt, Loyola University Chicago, 820 N. Michigan Ave, Chicago, IL, 60611, United States of America, mhewitt3@luc.edu

1 - Filtering in B&C for Multicommodity Capacitated Network Design

Bernard Gendron, Univeristé de Montreal, Chemin de la Tour, Montreal, H3C 3J7, Canada, Bernard.Gendron@cirrelt.ca, Mervat Chouman, Teodor Gabriel Crainic

We study the impact of different filtering methods embedded into a specialized branch-and-cut algorithm for the multicommodity capacitated network design problem. Contrary to the preprocessing techniques used in state-of-the-art MIP solvers, these filtering methods exploit the structure of the problem, while being applicable to a very large class of network design problems. Computational results will be presented on a large set of randomly generated instances.

2 - Continuous Time Service Network Design Problem
Michael Hewitt, Loyola University Chicago, 820 N. Michigan Ave, Chicago, IL, 60611, United States of America, mhewitt3@luc.edu, Luke Marshall, Martin Savelsbergh, Natashia Boland

For a consolidation carrier to deliver goods in a cost-effective manner they must consolidate shipments, which in turn requires coordinating the paths for different shipments in both space and time. We propose an iterative refinement algorithm that will recognize that a truck may dispatch at any point in time without resorting to an a priori enumeration of all possible time points. We will illustrate its computational effectiveness on a wide array of instances.

3 - Integrating Resource Acquisition and Repositioning into Transportation Planning under Uncertainty
Maciek Nowak, Associate Professor, Loyola University Chicago, 1 E. Pearson, Chicago, IL, 60611, United States of America, mnowak4@luc.edu, Michael Hewitt, Walter Rei, Teodor Gabriel Crainic

Service network design formulations are often used in the planning processes of consolidation-based carriers. This research proposes a model that determines the number of resources to acquire, where to locate them, and the service network design executed by those resources to transport customer shipments. The model explicitly recognizes that there is uncertainty regarding the volume of shipments to transport, planning for the use of external resources to accommodate fluctuations in demand.

4 - A Multimodal Network Flow Problem with Perishable Products and Asset Management
Maryam SteadieSeifi, PhD Student, Eindhoven University of Technology, Den Dolech 2, Eindhoven, 5612AZ, Netherlands, M.Steadie.Seifi@tue.nl, Nico Dellaert, Tom Van Woensel, Wim Nuijten

We present an optimization model and a solution algorithm for a horticultural transportation system with multiple transport modes, highly perishable products, demand and supply dynamics, and management of the reusable transport units. We integrate dynamic allocation and repositioning of the RTIs with a synchronized flow of products, in order to find the trade-off between quality requirements and operational considerations and costs. We also present detailed computational results and analysis.

■ TC24

Hilton- Union Sq 4

Professional Development Workshop

Sponsor: TSL/Intelligent Transportation Systems (ITS)

Sponsored Session

Chair: Yingyan Lou, Assistant Professor, Arizona State University, P.O. Box 873005, Tempe, AZ, 85287-3005, United States of America, yingyan.lou@asu.edu

1 - Professional Development Workshop
Yingyan Lou, Assistant Professor, Arizona State University, P.O. Box 873005, Tempe, AZ, 85287-3005, United States of America, yingyan.lou@asu.edu, Stephen Boyles, Henry X. Liu

This professional development seminar is intended for young researchers. The panel will discuss topics such as identifying research problems, developing a long-term research plan, and the right mindset for approaching academic careers in today's environment.

■ TC25

Hilton- Union Sq 5

Transportation Planning I

Contributed Session

Chair: Jens Brunner, Universit‰t Augsburg, Universitatsstrafle 16, Augsburg, Germany, jens.brunner@wiwi.uni-augsburg.de

1 - A Hybrid Genetic Algorithm for Scheduling Food Bank Collections and Deliveries
Luther Brock, E T Care Health and Medical, 8007 N Point Blvd, Winston-Salem, NC, 27406, United States of America, lgbrockiii@hotmail.com, Lauren Davis

This research addresses vehicle routing challenges experienced by food banks. The essential features of this problem consists of constructing routes that encompass food collections, food deliveries, constraints on vehicle capacity, food spoilage, and operator workday, as well as collection and delivery frequency. A genetic algorithm-based metaheuristic is presented to solve the routing problem. Its ability to find good solutions for routing problems of varying sizes is demonstrated.

2 - Multi Traveling Salesmen Problem with Time Windows: A Real World Application
Haluk Yapicioglu, Anadolu University, Proje Birimi, Yunusemre Kampusu, Eskisehir, 26470, Turkey, hyapicio@anadolu.edu.tr

In this study, a new type of TSP problem that arises from a real world problem is introduced. Anadolu University administers exams six times a year throughout Turkey. In each city, university representatives must visit every exam location at least once. The exams are scheduled over four sessions. The mathematical programming formulation of the problem is presented with two different objective functions. Comparison of these two models is provided based on four problem instances.

3 - Type III Sensitivity Analysis of Right-hand-Side Parameters in Dual Transportation Problems
Kang-Ting Ma, National Tsing Hua University, No.101, Sec. 2, Guangfu Rd., HsinChu, 30013, Taiwan - ROC, d9734802@oz.nthu.edu.tw, Shu-Cherng Fang, Ue-Pyng Wen

Feasible solutions in transportation problems are inherent. To realize increments/decrements to/from which supplies/demands with shadow prices invariant is more important than perturbation ranges of keeping shipping pattern invariant. Type III sensitivity analysis keeps shadow prices at optimal shipping pattern invariant. In this paper, labeling algorithms are proposed to obtain the perturbation ranges of type III sensitivity analysis of the right-hand-side parameters of transportation problems.

4 - Optimizing Towing Processes at Airports
Jens Brunner, Universitat Augsburg, Universitatsstrafle 16, Augsburg, Germany, jens.brunner@wiwi.uni-augsburg.de, Jia Yan Du, Rainer Kolisch

We present a mathematical model that assigns tractors to aircraft. The objective function minimizes costs subject to operational restrictions such as technical compatibility of tractor types. The model considers a heterogeneous fleet, time windows, multiple depots, and multiple trips. To solve the model we present a column generation based heuristic. Computational results using real-world data highlight how schedulers can be supported in their daily work.

5 - A New Formulation for the Empty Railcar Distribution Problem
Ruhollah Heydari, Northeastern University, Mechanical & Industrial Engineering Dep., 360 Huntington Avenue, Boston, MA, 02115, United States of America, Emanuel Melachrinoudis

We formulate the empty railcar distribution problem as a multi-commodity capacitated network flow model with setup costs on blocks. The term "multi-commodity" refers to multiple car types considered in the model and the term "capacitated network flow" refers to the capacity constraints on the blocks and trains. Binary variables are used to formulate the "setup costs on the blocks" and gain economies of scale by making fewer larger blocks.

■ TC26

Hilton- Union Sq 6

Transportation, Maritime I

Contributed Session

Chair: Yingfeng Wang, City U of HK, Tat Chee Ave, Kowloon, Hong Kong - PRC, gilbertwyf@gmail.com

1 - Evading the Chasing from a Maneuverable Pirate Ship
Yu Wang, PhD Candidate, Hong Kong University of Science and Technology, Academic Building, Rm 5567, Clear Water Bay, Kowloon, Hong Kong - PRC, ywag19@gmail.com

Recently piracy attacks have become a serious safety problem for maritime logistics in some areas. While various strategies have been taken, such as rerouting, the problem cannot be resolved completely. We consider a decision making problem in which a vessel being chased by a pirate needs to decide its sailing angle and speed to evade. We formulate this as a nonlinear optimal control problem. We consider the evasion condition for direct heading and also turn policy for the vessel to evade.

2 - Evaluating Risk of International Transportation for Energy Resources
Shigeki Toriumi, Dr, Chuo University, 1-13-27 Kasuga, Bunkyo-ku, Tokyo, 112-8551, Japan, toriumi@ise.chuo-u.ac.jp, Ryuta Takashima, Keisuke INADA

In Japan, energy and natural resources are imported by the maritime transport. It is, therefore, necessary to consider procurement of overseas energy resources and risk management of resource transportation. In this work, we define country risk and chokepoint risk using portfolio theory. Then, we propose a model for determining import countries and its volume. Finally, we analyze the relationship between the transport cost and risk by means of the LLI's vessel movement database.

3 - Risk Analysis of Shipbuilding-Shipping Industries: Findings from China, Japan and South Korea
Yingfeng Wang, City University of Hong Kong, Tat Chee Ave, Kowloon, Hong Kong - PRC, gilbertwyf@gmail.com, John Liu, Sheng Li

We conduct risk analysis of shipbuilding-shipping industries, with a particular focus on systemic risk measures. We use the model to address recent findings that idiosyncratic risk based models (such as the well-known mean-variance model) become ineffective or even inappropriate for asset assessment under predominance of systemic risk, in the context of national shipbuilding industries of China, Japan and South Korea, and their correlations with international shipping and trade markets.

■ TC27

Hilton- Union Sq 7

Advanced Analytics Tools for Smart Railroad Terminal Operations

Sponsor: Railway Applications
Sponsored Session

Chair: Behnam Behdani, Sr. Operations Research Specialist, BNSF Railway, 2400 Western Center Blvd., Fort Worth, TX, 76131, United States of America, Behnam.Behdani@BNSF.com

1 - Mixed Integer Programming Model for Optimizing Multi-level Operations Process in Rail Yards
Xuesong Zhou, Associate Professor, Arizona State University, School of Sustainable Engineering and th, Tempe, AZ, United States of America, xzhou74@asu.edu, Tie Shi

This talk presents a time-expanded multi-layer network flow model to describe the connection between different layers of rail yard operations. A mixed integer programming is developed to schedule the humping and pullback engine activities by jointly considering tightly interconnected components. A novel lot-sizing modeling framework and related valid inequality formulations are introduced to model the assembling jobs for outbound trains.

2 - New Frontiers in Yard and Terminal Analytics at CSX
Jeremiah Dirnberger, Manager-Network Modeling, CSX, 500 Water St, J315, Jacksonville, FL, 32202, United States of America, Jeremiah_Dirnberger@csx.com

Rail network management can be divided into three distinct primary functions: yards, terminals and line-of-road. Traditionally, the terms yard and terminal have been used interchangeably. However, in order to get a more complete picture of network capacity, these terms should be defined separately. This presentation will show how CSX has separated the analysis of these two functions and will also discuss the advances in the analytical tools that CSX uses to monitor and improve performance.

3 - Simulation Based Yard Case Studies
Krishna Jha, Vice President, Optym, LLC, 2153 SE Hawthorne Road, Gainesville, Fl, 32641, United States of America, krishna.jha@optym.com

Yards play a vital role in railroad operations. Generally, a railcar spends more time in yards than that on line-of-roads in its itinerary. With the growing traffic demand, railroads are looking for ways to improve yard throughput while providing quality service to customers. In this talk, we will present couple of case studies performed for large hump yards using a state-of-the-art simulation system to improve the throughput and the service level.

4 - Planning of Mechanical Locomotive Facilities for Repair, Maintenance, Service and Fueling
Siyang Xie, University of Illinois at Urbana-Champaign, 3150 Newmark Civil Engineering Lab, 205 N. Mathews Ave, Urbana, IL, 61801, United States of America, sxie13@illinois.edu, Yanfeng Ouyang, Zhaodong Wang, Xi Chen, Kamalesh Somani

We present a mixed-integer model that helps plan fixed and movable facilities for multiple types of locomotive mechanical work (e.g., repair, maintenance and service, and fueling). The decisions include (i) locations, capacities and capabilities of fixed facilities, (ii) fleet mix and size, routes, and home locations for movable facilities, and (iii) assignments of work to facilities. A series of solution algorithms are developed to solve this highly complex problem via empirical cases.

■ TC28

Hilton- Union Sq 8

Emerging Issues in Airport-Airline Gate Management and Operations

Sponsor: Aviation Applications
Sponsored Session

Chair: Jasenka Rakas, University of California, Berkeley, 107B McLaughlin Hall, NEXTOR II, Berkeley, CA, 94720, United States of America, jrakas@berkeley.edu

1 - The Role of Airports in Airline Competition: The U.S. Experience
Richard Golaszewski, Executive Vice President, GRA, Incorporated, 115 West Av, Suite 201, Jenkintown, Pe, 19046, United States of America, richg@gra-inc.com

Airline competition depends on the ability to access passengers in specific markets. Airport infrastructure can be key, especially when there are constraints on slots, gates, or other facilities. FAA and DOT policies require airports to submit competition plans in certain cases. This occurs when the airport reaches long-term agreements on airport gates, or other facilities. The FAA may intervene if an airport enters into exclusive contracts with an airline that could hamper new entrants.

2 - Dynamic Collaborative Gate Allocation
Mattan Mansoor, Associate, L.E.K. Consulting, 1453 Kyle Court, Sunnyvale, CA, 94087, United States of America, mattanmansoor@gmail.com, Joshua Sachse, Hoang Nguyen, Jasenka Rakas, Katharina McLaughlin, Alex Cuevas, Joanna Ji

Most airport gate allocations in the U.S. are currently optimized within each airline and not across the system (i.e., airport). Dynamic Collaborative Gate Allocation (DCGA) involves dynamic stochastic optimization modeling that helps airlines and airports collaboratively determine gate usage. These improved gate-sharing policies increase airport capacity without additional infrastructure and reduce flight delays, fuel usage and carbon emissions while improving the experience for passengers.

3 - Mobile Gate Design
Patrick Poon, UC Berkeley, 869 Charmain Dr., Campbell, CA, 95008, United States of America, PATRICK452@berkeley.edu, Ken Poon, Benny Chung, Graeme Scott, Steven Chen, Gohki Kobayashi, Ken Lim, Steven Van Leeuwen, Xiao Lin, Jasenka Rakas

This study addresses the shortage of gate capacity by proposing a Mobile Gate Design concept. The proposed concept increases gate maneuverability and gate physical mobility to dynamically meet different demands of aircraft-mixes by using next generation technology for maneuvering and managing parking spaces, jet bridges and gate locations. The proposed design should revolutionize traditional gate capacity management, while preserving passenger safety and jet bridge security.

4 - Solving Collaborative Gate Allocation Problem by the Bee Colony Optimization Algorithm
Jasenka Rakas, University of California, Berkeley, 107B McLaughlin Hall, NEXTOR II, Berkeley, CA, 94720, United States of America, jrakas@berkeley.edu, Milos Nikolic, Dusan Teodorovic

We develop a Swarm Intelligence-based model for the Collaborative Gate Allocation problem using the Bee Colony Optimization (BCO) metaheuristics as a problem solution. The BCO algorithm belongs to the class of population-based algorithms, mimicking the way bees look for nectar as the way to look for the best solution. We show that with the BCO algorithm, airlines and airports can significantly reduce delays and generate fast, high-quality solutions.

■ TC29

Hilton- Union Sq 9

Project Management 3

Contributed Session

Chair: Jingwen Zhang, Northwestern Polytechnical University, No.127,Youyi West Road, Xi'an, 710072, China, zhangjingwen@nwpu.edu.cn

1 - Probabilistic Measurement of Project Delay Cost
Feng Xu, Georgia Southwestern State University, 800 GSW State University Drive, Americus, GA, 31709, United States of America, feng.xu@gsw.edu

Many projects end with cost overruns due to delays in project delivery. This risk is usually managed using contingency and management reserves included in cost baseline and budget plan. Both reserves are commonly calculated as percentages of aggregated expected value of project activities' costs. This paper analyzes delay induced cost separately using established probability distribution functions, with the purpose to provide accurate measurements for project reserve analysis.

2 - Earned Value Analysis with Stochastic Activity Durations and Costs in Project Scheduling Problems
Jingwen Zhang, Northwestern Polytechnical University, No.127,Youyi West Road, Xi'an, 710072, China, zhangjingwen@nwpu.edu.cn

The duration and cost of an activity are modelled as random variables; accordingly the upper and the lower bounds for stochastic cumulative cost curves over time statistically represent the range for the budget cost of work scheduled, so the uncertain earned value analysis (EVA) is probed. The conclusions indicate that project managers can obtain a degree of flexibility when adopting uncertain EVA to monitor status during project execution, which differs greatly from deterministic situations.

3 - Optimization of Multi-mode Cash Flow Balanced Project Scheduling in Uncertainty Environment
Minjing Ning, Xi'an Jiaotong University, No.28, Xianning West Road, Xi'an, China, 344859543@qq.com, Zhengwen He

The balance between cash outflows and inflows is very significant for the smooth implementation of large and complex construction projects. However, for the disturbances of uncertainty factors, it is difficult to keep this balance throughout the execution of projects continuously. In the light of the fact above, this research involves the problem of how to schedule projects so that the balance of cash flows can be maintained under the uncertainty environment.

4 - An Operational Framework to Manage a Project
Narasimhan Ravichandran, Professor, Indian institute of management, Vastrapur, Ahmedabad, GU, 380015, India, nravi@iimahd.ernet.in

Based on a real life opportunity experienced by the author in managing a construction project an operational framework is developed to conduct detailed negotiation with the service provider for the early completion of the project with appropriate financial implications.The framework can be generalised to address similar issues in a variety of contexts.

5 - Enabling Contextual Factors Analysis for Project Risk Mmanagement
Anton Talantsev, PhD candidate, research assistant, Stockholm University, Borgarfjordsgatan 12, Kista, Stockholm, 164 40, Sweden, antontal@dsv.su.se, Aron Larsson

We approach the concept of contextual factors (CFs) and their impact on project performance with risk analysis. The approach suggests a scenario-based judgments elicitation process to define parameters of the CFs Magnitude and Impact functions, Monte-Carlo simulation to handle stochastic representation, non-additive impact aggregation function, and a Probability/Threat-Favor classification scheme to provide comprehensive and balanced risk-opportunity analysis of external project context.

■ TC30

Hilton- Union Sq 10

Models and Algorithms for Sequencing and Scheduling in Applied Transportation Problems

Cluster: Scheduling and Project Management

Invited Session

Chair: Brian Lemay, University Of Michigan, Industrial and Operations Engineering, 1205 Beal Avenue, Ann Arbor, MI, 48109-2117, United States of America, blemay@umich.edu

1 - Crash Test Scheduling for Vehicle Safety Assessment
Yuhui Shi, University Of Michigan, Industrial and Operations Engineering, 1205 Beal Avenue, Ann Arbor, MI, 48109-2117, United States of America, yuhuishi@umich.edu, Amy Cohn, Marina Epelman, Daniel Reich

We develop, implement, and analyze models and algorithms for scheduling the sequencing and timing of vehicle crash tests for the development and safety-testing of new vehicle lines.

2 - A Time-Constrained Vehicle Routing Problem with a Heterogeneous Fleet: Algorithms and Analysis
Young-Chae Hong, University of Michigan, Industrial and Operations Engineering, 1205 Beal Avenue, Ann Arbor, MI, 48109-2117, United States of America, hongyc@umich.edu

We consider a new variant of the Time-Constrained Heterogeneous Vehicle Routing Problem (TCHVRP). The travel time of any given arc vary by vehicle type within a heterogeneous fleet. Each vehicle type has its own limit on total travel time allowed. We formulate TCHVRP as a path-based model, which we solve using column generation. We introduce several different methods to solve the pricing problem and conclude with empirical analyses to assess the impact of data on our algorithm performance.

3 - Optimal Download Scheduling for Multi-Satellite, Multi-Ground Station Missions
Brian Lemay, University Of Michigan, Industrial and Operations Engineering, 1205 Beal Avenue, Ann Arbor, MI, 48109-2117, United States of America, blemay@umich.edu

We address the problem of scheduling data downloads from a constellation of satellites to a network of ground stations. Our optimization model incorporates the energy and data dynamics of the system to ensure feasible download schedules. We introduce alternative scheduling methods for comparison purposes and test each method on a variety of scenarios. We identify the types of scenarios that benefit most from optimization and study the effects of system enhancements such as improved solar panels.

4 - Optimally Scheduling Satellite Communications under Uncertainty
Jeremy Castaing, University Of Michigan, Industrial and Operations Engineering, 1205 Beal Avenue, Ann Arbor, MI, 48109-2117, United States of America, jctg@umich.edu

We consider the problem of scheduling and managing the download of data from a collecting satellite to receiving ground stations. We design models to compute optimal download schedules over the planning horizon. We introduce uncertainty in the model by assuming that each ground station is only available with a certain probability and we develop algorithms to create more robust download schedules while handling the complexity of the stochastic optimization models.

■ TC31

Hilton- Union Sq 11

Staffing and Resource Allocation in Public and Private Service Systems

Sponsor: Service Science

Sponsored Session

Chair: Arthur Swersey, Professor of Operations Research, Yale School of Management, Box 208200, New Haven, Ct, 06520, United States of America, arthur.swersey@yale.edu

1 - Using Customer Counts to Improve Retail Labor Scheduling
Michele Samorani, University of Alberta, Edmonton, AB, Canada samorani@ualberta.ca, Armann Ingolfsson, Ivor Cribben, Osman Alp

In this project, we use data on customer traffic, transactions, and staffing to optimally schedule staff at retail stores. We use time series models to forecast customer hourly traffic, we use predicted traffic and staffing levels to forecast conversion (transactions/traffic), and we use the resulting models to develop profit-maximizing staff schedules. A Canadian retail chain has agreed to test our schedules.

2 - Optimal Staffing Policies in Robotic Surgery
Senay Solak, University of Massachusetts Amherst, Isenberg School of Management, Amherst, MA, 01003, United States of America, solak@isenberg.umass.edu, Armagan Bayram, Oz Harmanli

Based on our data-based finding that experience of each team member is a key determinant of operating room (OR) time in robotic surgery, we develop policies for hospitals to determine surgical team configurations that would maximize OR efficiency. The policies are derived through stochastic optimization, and can be implemented through spreadsheet based methods. The value of the proposed policies is assessed through comparisons with historical surgical team configurations at a major hospital.

3 - The Value of Patient Information in Allocating Emergency Medical Service Resources
Laura McLay, Associate Professor, University of Wisconsin-Madison, 1513 university ave, Madison, WI, 53706, United States of America, lmclay@wisc.edu, Soovin Yoon

This talk explores how the value of patient information affects the usage of ambulances in terms of locating, dispatching, and staffing ambulances. We focus on the revelation of patient information over the course of each call as well as performance goals across different districts. We explore these issues through a discrete optimization model and analyze the results using data from a real-world setting.

4 - Improving Fire Department Productivity: Merging Fire and Emergency Medical Units
Arthur Swersey, Professor of Operations Research, Yale School of Management, Box 208200, New Haven, Ct, 06520, United States of America, arthur.swersey@yale.edu

Under this innovative plan dual-trained teams of fire medics respond to medical emergencies or fire incidents. We describe how the plan was used in New Haven, Ct. before falling victim to political pressures. We present cost savings, and derive response time performance measures using a spatial queuing model. We then discuss how a variant of the plan is now being used in St. Paul, Minn.

■ TC32

Hilton- Union Sq 12

Service Science - Telemarketing and Call Centers

Contributed Session

Chair: Tian Sun, Kijiji China, Guangyuan Xi Rd 55 rm1808, Shanghai, China, suntian@baixing.com

1 - Predictive Modeling to Identify Prospective Customers for Effective Telemarketing

Tian Sun, Kijiji China, Guangyuan Xi Rd 55 rm1808, Shanghai, China, suntian@baixing.com, Zhe Liang

Telemarketing often fails to identify potential customers, causing low conversion rate and poor customer experience. We present effective predictive models to generate candidate phone list based on the customer historical data obtained from a telemarketing company. Models are tested on the real-life operations, indicating significantly improved conversion rate.

2 - Call Center Staffing Optimization with Uncertainty in Arrival, Service and Abandonment Rates

Tahir Ekin, Assistant Professor, Texas State University, 601 University Dr. McCoy 411, San Marcos, TX, 78666, United States of America, tahirekin@gmail.com, Tevfik Aktekin

We consider the short term dynamic staffing problem for a call center operating with uncertainty in arrival, service and abandonment rates. Bayesian inference is utilized to deal with uncertainty. Dependency of abandonment on previous staffing decisions is also considered. To solve the resulting stochastic program, we present the use of a simulation based algorithm which is based on constructing an augmented probability model in decision and random variable spaces.

3 - A Review of Informatics-oriented Product-Service Systems: Concept, Characteristics, and Challenges

Jun-Yeon Heo, Postech, Eng Bldg. 4-316, 77 Cheongam-ro, Nam-gu, Pohang, Korea, Republic of, bluejy@postech.ac.kr, Ki-Hun Kim, Chang-Ho Lee, Kwang-Jae Kim

A product-service system (PSS) is an integrated bundle of products and services which aims at creating customer value. Recently, with the advancement of ICT and analytics technologies, informatics is utilized in PSSs. Such type of PSS is called informatics-oriented PSS and has different properties compared with conventional PSSs. In this talk, we provide a review of informatics-oriented PSS. Based on the review, we clarify the concept of the PSS and discuss its characteristics, and challenges.

4 - Experienced Based Routing in Call Center

Thomas Robbins, Associate Professor, East Carolina University, 3212 Bate Building, Greenville, NC, 28590, United States of America, robbinst@ecu.edu

We examine assumptions commonly made in modeling call centers, in particular that agents are homogeneous, statistically equivalent servers. Using empirical data we explore an environment where agents increase their productivity over time but eventually leave the organization. We consider the implication of this heterogeneity and explore a routing policy that attempts to exploit it; routing to agents based on their availability and their experience relative to other available agents.

5 - Optimizing Agent's Roles in a Large Call Center

Moeed Haghnevis, Senior Resource Planning Analyst, Progressive Casualty Insurance, 4550 S 44th Place, Phoenix, AZ, 85040, United States of America, moeed_haghnevis@progressive.com, Michael Durbin

The sets of skills assigned to agents in a call center define their role (profile) within a workgroup. The goal of this project is to minimize the number of roles needed to staff and schedule workgroups while staffing needs are met for each skill given call type and workload requirements. Moreover, this project improves overall utilization of agents by standardizing the sets of skills assigned to agents in each workgroup and eliminating specialization that does not add value.

■ TC33

Hilton- Union Sq 13

Operations/Finance Interface 2

Contributed Session

Chair: Zhan Pang, Lancaster University, Management School, Lancaster, LA1 4YX, United Kingdom, z.pang@lancaster.ac.uk

1 - Dynamic Financial Hedging and Inventory Control under Demand and Price Uncertainty

Zhan Pang, Lancaster University, Management School, Lancaster, LA1 4YX, United Kingdom, z.pang@lancaster.ac.uk, Qing Ding, Panos Kouvelis

Many firms are experiencing the challenge of increasing commodity price volatilities in procurement while facing uncertainty in demand. Financial derivative and inventory are typical instruments to hedge against the price and demand risks. How should a firm coordinate the hedging and inventory control strategies under both demand and price uncertainties? What is the relationship between financial hedge and inventory in a dynamic environment?

2 - Pooling Operations and Receivables

Kasper van der Vliet, Eindhoven University of Technology, Den Dolech 2, 5612 AZ, Eindhoven, Netherlands, k.v.d.vliet@tue.nl, Matthew Reindorp, Jan C. Fransoo

Risk pooling has many applications in operations research and finance, but these are often studied independently. We explore the possibility of interaction between pooling applications: two firms can pool operations, which allows for a reduction in the marginal cost of production; pool receivables, which allows for a reduction in capital cost by factoring; or both. We determine the value of each pooling application and identify conditions that entail a benefit to coordinating them.

3 - Mitigating Supplier Distress: Purchase Order Finance, Advance Payment Discount and Backup Production

Lima Zhao, Assistant Professor, WHUñOtto Beisheim School of Manage, Burgplatz 2, Vallendar, NA, 56179, Germany, lima.zhao@whu.edu, Arnd Huchzermeier

This paper examines a capital constrained supply chain consisting of one retailer and two suppliers. The retailer has three strategies to manage supplier financial distress and mismatch risk: Purchase order finance(POF), advance payment discount(APD), and backup production. Pre-shipment finance (POF/APD) and backup supply can be complements or partial substitutes for the retailer, depending on demand variability.

4 - Risk Control of Financial Logistics Based on VaR (Value at Risk) and Case Study

Shuyan Lin, The University of Hong Kong, Dept. of IMSE, The University of Hong Kong, Hong Kong, Hong Kong - PRC, shuyan.lin@yahoo.com

This paper studies the risk control of financial logistics during the cooperation of logistics firms, small and medium-sized enterprises (SME), and banks. A simple game-theoretical example shows that the win-win cooperation can be reached in some cases. A case study illustrates that there has been a new trend of using transparent and trackable information as pledge. Since credit system remains imperfect, we further assess the liquidation ability of such novel pledge using VaR methodology.

■ TC34

Hilton- Union Sq 14

Transportation and Security under Uncertainty

Sponsor: Public Programs, Service and Needs

Sponsored Session

Chair: Gino Lim, Department Chair, Hari and Anjali Agrawal Faculty Fellow, Associate Professor, University of Houston, E206 Engineering Building 2, Houston, TX, 77204, United States of America, ginolim@uh.edu

1 - Robust Liquefied Natural Gas Shipping Problem under Shamal Disruptions

Jaeyoung Cho, PhD Student, University of Houston, 333 Dominion Drive, #1021, Katy, TX, 77450, United States of America, uncmac.rokag@gmail.com, Hamid Parsaei, Taofeek Biobaku, Selim Bora, Gino Lim

The purpose of this study is to propose a robust LNG supply chain management model against potential disruptions of Shamal wind. It is formulated in multi-period vehicle routing problem with time windows to maximize overall revenue and also generates optimal vessel routes visiting multiple depots with multiple vessels considering dust storm impact. We also consider cargo tank filling limits and its effects called 'sloshing' as this can cause structural damage.

2 - Supply Chain Node Resilience and Importance

Selim Bora, Texas A&M University at Qatar, PO Xob 23874, Doha, Qatar, selim.bora@qatar.tamu.edu, Taofeek Biobaku, Jaeyoung Cho, Hamid Parsaei, Gino Lim

Our goal is to design supply chain networks (SCN) that are resilient under stress by incorporating the concept of node importance. We propose node criticality index (NCI), to give a quantitative measure of the resiliency and importance of components of the SCN. The model is based on the idea of resiliency triangle. Our results show that NCI gives valuable information to decision makers for designing resilient supply chains and assessing the resiliency of existing systems.

3 - Optimal Deployment of Underwater Sonar System

Taofeek Biobaku, PhD Student, University of Houston, University of Houston, Houston, TX, United States of America, tobiobaku@uh.edu, Gino Lim, Jaeyoung Cho, Selim Bora, Hamid Parsaei

In this paper, we study optimal sonar deployment planning to detect underwater threats. We propose a new multi-optimization model to detect potential threats by placing under-water sonars within a port, estuary or waterway of interest. Results from our numerical experiments indicate that our model and deployment strategy provides adequate coverage even under strict budget limits in a multi-period deployment scheme.

■ TC35

Hilton- Union Sq 15

Models for Health Care Delivery

Sponsor: Public Programs, Service and Needs

Sponsored Session

Chair: Ravi Anupindi, David B. Hermelin Professor of Business Administration, Ross School of Business, 701 Tappan Avenue, Ann Arbor, MI, 48109, United States of America, anupindi@umich.edu

1 - Understanding the Efficiency of In-country Global Health Programs

Gemma Berenguer, Purdue University, 403 W. State St., West Lafayette, IN, 47906, United States of America, gemmabf@purdue.edu, Ananth Iyer, Prashant Yadav

Using population reproductive health programs as an example, the goal of this work is to study the major efficiency drivers of global health programs. In particular, we study the effects of environmental conditions and donor fragmentation on the efficiency of global health programs at the country level. To analyze these relationships, we employ a benchmarking tool (three-stage DEA-SFA model) that evaluates the efficiency of a set of sub-saharan african country programs.

2 - Giving it Away to Increase Profits? Price Discrimination and the Effect of Free Goods

Jacob Chestnut, PhD Candidate, University of Michigan, 701 Tappan St. R0400, Ann Arbor, MI, 48109, United States of America, jacob.chestnut@gmail.com, Hyun-Soo Ahn, Ravi Anupindi

We consider a provider serving customers who are heterogeneous in their willingness-to-pay and desired quality. A standard approach is to model as an adverse selection problem, which results in a non-linear pricing schedule. Motivated by empirical evidence that consumer's utility becomes discontinuous when the goods are offered for free, we examine situations where giving away for free can indeed increase the provider's profit.

3 - Public Procurement of Multiple Health Products: The Effect of Alternative Distribution Channels

Iva Rashkova, Management Science and Operations, London Business School, Sussex Place, Regent's Park, London, NW1 4SA, United Kingdom, irashkova@london.edu, Jérémie Gallien

Motivated by Global Fund grant recipients, we study the periodic inventory procurement of multiple health products subject to a common uncertain fund disbursement schedule. The objective is to minimize expected health costs when demand and delivery lags are random, and inventory may be available at alternative channels such as private pharmacies. We derive near-optimal heuristics for the dynamic allocation of funds, characterize their theoretical performance, and discuss managerial insights.

4 - Forecasting the National Deceased Donor Organ Availability for Liver Transplantation

David Hutton, University of Michigan, 1415 Washington Heights, SPH II: M3525, Ann Arbor, Mi, 48109, United States of America, dwhutton@umich.edu, Mariel Lavieri, Wesley Marrero, Neehar Parikh, Kunal Sanghani, Yongcai Xu

We performed secondary analysis of the UNOS OPTN database of adult liver transplant recipients and adult donors from 1999-2012 to project donor organ utilization from 2014-2023. It is estimated that population growth will outpace the growth of available donor organs, thus likely exacerbating the existing liver graft shortage. Strategies to increase organ availability are warranted in order to alleviate this shortage and prevent waitlist dropout.

■ TC36

Hilton- Union Sq 16

Information Systems 1

Contributed Session

Chair: Maryam Eslamichalandar, Conservatoire National des Arts et Métiers (CNAM), Cédric, 2 Rue Conté, Paris, France, mechalandar@gmail.com

1 - Subsidizing Subscriber Internet Access by Content Providers – An Economic Analysis

Soo Hyun Cho, University of Florida, 2901 SW 13th St. Apt 251, Gainsville, FL. United States of America, soohyun.cho@warrington.ufl.edu, Subhajyoti Bandyopadhyay

Internet service providers (ISPs) are experimenting with a business model that allows content providers (CPs) to subsidize Internet access for consumers as an incentive for accessing CPs' content. We develop a game-theoretical model to analyze the effects of this business model. We find that the ISP would adopt a pricing mechanism that induces the more competitive CP to subsidize subscribers' Internet access. The results have several implications on the ongoing net neutrality debate.

2 - Obtaining Value from the Customization of Packaged Business Software: A Model and Simulation

Bryon Balint, Assistant Professor, Belmont University, 1900 Belmont Boulevard, Nashville, TN, 37212, United States of America, bryon.balint@belmont.edu

Software vendors and anecdotal evidence recommend that businesses should customize packaged software as little as possible. However, businesses continue to exceed budgets on implementing and maintaining customized software, often significantly. In this paper I model the primary factors in the customization decision. Simulation techniques are used to illustrate the conditions under which customization is likely to provide value, as well as conditions under which customization should be avoided.

3 - Listen to Your Customers! Product Feature Extraction from Online Customer Reviews

Aindrila Chakraborty, PhD Student, School of Business,University of Connecticut, 2100 Hillside Road Unit 1041, Storrs, CT, 06269, United States of America, aindrila.chakraborty@business.uconn.edu

It has always been a challenging task to determine which product/service attributes or features are the most important to the markets that influences consumers' purchasing decisions. Customer reviews provide a wealth of information regarding consumers' thoughts, beliefs and experiences with a product. The paper proposes a text mining method to extract product features from reviews which is helpful for product designers also in designing new products or modifying existing products.

4 - A Branch-and-Price Approach for Deployment of Multi-tier Cloud Services

Björn Nygreen, Professor, Norwegian University of Science and Technology, Dept. of Industrial Econ & Tech mngnt, Trondheim, 7491, Norway, bjorn.nygreen@iot.ntnu.no, Anders Nordby Gullhav

We present a branch-and-price approach for solving a deployment problem faced by a provider of multi-tier services. The problem consists of finding a cost-efficient mapping between a set of replicated service components and the infrastructure while providing a satisfactory quality of service. The main decisions are the selection of replication levels of the components and where to place the resulting replicas. Our results show that branch-and-price performs better than a direct MIP formulation.

■ TC37

Hilton- Union Sq 17

Intelligent Heuristics and Systems

Sponsor: Artificial Intelligence

Sponsored Session

Chair: Sam Thangiah, Professor, Slippery Rock University, Artificial Intelligence and Robotics Lab, 250 ATS, Slippery Rock, PA, 16057, United States of America, sam.thangiah@sru.edu

1 - Approximating School Buses Required for a School District using Population Data

Larry Wilson, Slippery Rock University, 250 ATS, Slippery Rock, PA, 16057, United States of America, lpw1002@sru.edu, Sam Thagiah, Cody Young, James Mullen, Sean Brown, Theresa Wajda

We describe a study done for a school district on using population and road networks data available from the U.S. Census Bureau to determine the approximate number of school buses required to transport regular students in a school district in the state of Pennsylvania.

2 - Analysis on Consensus of Opinion Dynamics using Clustered Social Networks

Kuru Ratnavelu, Professor, Institute of Mathematical Sciences, University of Malaya, Pantai Valley, Kuala Lumpur, 50603, Malaysia, kururatna2012@gmail.com, Jeeva Sathya Theesar Shanmugam

The structure of human communication is formulated as social network where edge of the network defined by human interactions. In general non-consensus in opinion formation leads to chaos and various models were exhibited for opinion dynamics. The present theoretical opinion dynamics model is corroborated on the topology of clustered network data. The results are compared with few other opinion dynamics models. This study is expected to help in understanding the collective human decision making.

3 - A Brain-Computer Interface to Control Mobile Robots

Sam Thangiah, Professor, Slippery Rock University, Artificial Intelligence and Robotics Lab, 250 ATS, Slippery Rock, PA, 16057, United States of America, sam.thangiah@sru.edu, Jordan Schiller, Stephen Bierly, Marc Sensenich, Emily Day, Aaron Weckerly

The Brain-Computer Interface (BCI) research project uses an Electroencephalogram (EEG) to receive neural signals from a user's brain, analyze the data and filter thought patterns and commands. Once a pattern is recognized and classified as a particular command, the command is sent to a mobile robot. The goal of the BCI research project is to create a symbiosis between a user's thoughts and the actions of a mobile robot.

■ TC38

Hilton- Union Sq 18

Health Care Modeling Optimization – Planning and Optimization

Contributed Session

Chair: Kazim Topuz, Graduate Asistant, Wichita State University, 3540 N Inwood St, Wichita, KS, 67226, United States of America, mktopuz@gmail.com

1 - Realistic Patient Scheduling Methods

Michael Samudra, KU Leuven, Naamsestraat 69, Leuven, 3000, Belgium, Michael.Samudra@kuleuven.be, Erik Demeulemeester, Brech Cardoen

In one of Belgium's largest hospitals, UZ Leuven, approximately every third patient receives surgery later than medically advised. In order to improve the current situation, the lateness of patients has to be understood. Surgeons do their scheduling themselves and do not use algorithms to support their decision. As a consequence, we analyzed scheduling mechanisms that are easy to apply manually. Additionally, we also identify those combinations that best match the hospital data.

2 - Load Balancing in Prioritized Surgery Scheduling Environment

Kazim Topuz, Graduate Asistant, Wichita State University, 3540 N Inwood St, Wichita, KS, 67226, United States of America, mktopuz@gmail.com, M Bayram Yildirim

Minimizing the waiting time is challenging due to the variability in surgery duration's with resource and time constraints. Patients are assigned to a day of operation, based on the availability of provider, room and patient desire as well as priority/target value. In this study, (1) a load balancing model formulated for weekly scheduling and (2) several heuristics proposed for in day scheduling. (3) Results of the computational experiments evaluated and best heuristic solutions presented.

3 - Care on Demand in Nursing Homes: A Queueing Theoretic Approach

Rene Bekker, VU University Amsterdam, De Boelelaan 1081a, Amsterdam, Netherlands, r.bekker@vu.nl, Karin van Eeden, Dennis Moeke

Nursing homes face ever-tightening budgets, requiring improvements in the allocation of care workers for the daily care of residents. Insight in the care delivery process is however lacking, partly due to absence of data. In this talk, we present the characteristics of care requests based on real-life `call button' data. Based on this we propose a queueing model that can be used by nursing home managers to determine the number of care workers required to meet specific service levels.

4 - Hierarchical Associative Evidential Chain-based Fusion Reasoning for Medical Diagnosis

Haiyan Yu, PhD Candidate, Tianjin Univ., Mailbox 9069, College Of Management and, 92 Weijin Road, Nankai District, Tianjin, 300072, China, yhy188@gmail.com

A fusion reasoning model is proposed for heterogeneous information in diagnostic decisions. Case sequences from multi-source information are associated with rule antecedents using evidential chains. The balance of the enhancement of reasoning accuracy and the reduction of misdiagnosis loss is traded off. The interpretable evidential chains contribute to information sharing and enhance the applicability and robustness of diagnostic decision.

■ TC39

Hilton- Union Sq 19

Hospital Capacity and Resource Management

Sponsor: Health Applications

Sponsored Session

Chair: Cecilia Zenteno, Massachusetts Institute of Technology, 77 Massachusetts Avenue, E62-389, Cambrdige, Ma, 02139, United States of America, ceciliaz@mit.edu

1 - Stochastic Operating Room Planning with Recovery Flow

Maya Bam, University of Michigan, 1205 Beal Avenue, 2828 IOE Building, Ann Arbor, MI, 48109-2117, United States of America, mbam@umich.edu, Brian Denton, Mark Van Oyen

Surgery scheduling is impacted by operating room availability, surgeons, and downstream resources, like the post-anesthesia care unit. We present a new approach, based on our collaboration with a mid-sized hospital, that combines mixed integer programming with discrete event simulation to create schedules that optimize the tradeoff between operating room overtime and operating room blocking.

2 - Staffing Service Systems with Load Dependent Service Rate

Galit Yom-Tov, Technion-Israel Institute of Technology, Technion City, Haifa, Israel, gality@tx.technion.ac.il, Jing Dong, Pnina Feldman

Most OM literature assumes that service times are independent of the load of the system. However, in many Healthcare systems the two are correlated. For example, patients' condition may worsen if treatment is delayed, resulting in longer stays. We examine how load-related slowdown affects the operational performance. We develop and analyze fluid and diffusion approximations of an Erlang-A model with load-dependent service times. We propose methods to stabilize and improve system performance.

3 - Efficient Resource Allocation and Cost Accounting in Healthcare Networks

Fernanda Bravo, MIT, 100 Main St, E62-459, Cambridge, MA, 02139, United States of America, fbravo@mit.edu, Marcus Braun, Retsef Levi, Ali Aouad

This paper presents a novel optimization driven approach to address the issue of effective consolidation in healthcare delivery networks. Specifically, we provide a framework that allows us to understand the true cost of service and to support strategic resource allocation and system design decisions in a multi-site network. In addition, we report on the application of our approach to a real healthcare delivery network and describe the projected impact and managerial insights derived from it.

4 - Surgical Supply Inventory Management in Large Academic Medical Centers

Cecilia Zenteno, Massachusetts Institute of Technology, 77 Massachusetts Avenue, E62-389, Cambridge, Ma, 02139, United States of America, ceciliaz@mit.edu, Matt Schlanser, Retsef Levi, Peter Dunn, Bethany Daily

Massachusetts General Hospital performs over 36,000 operations per year. Surgical supplies come either individually packaged and sterilized (soft goods), or procured in pre-assembled custom packs. We study the composition of the surgical packs and how to combine them with soft goods to satisfy the demand driven by the surgeons' requirements, while optimizing their base stock levels. We prescribe a modular pack structure to reduce inventory levels and associated costs via demand pooling.

■ TC40

Hilton- Union Sq 20

Healthcare Operations Research

Sponsor: Health Applications

Sponsored Session

Chair: Soroush Saghafian, Arizona State University, Tempe, AZ, United States of America, Soroush.Saghafian@asu.edu

1 - Incorporating Time-Varying, Modifiable Risk Factors in Chronic Disease Models

Margaret Brandeau, Professor, Stanford University, MS&E Department, Stanford, CA, 94305, United States of America, brandeau@stanford.edu, Jeremy Goldhaber-Fiebert

Risk factors (e.g., smoking) increase chronic disease incidence and severity. We develop a methodology for embedding time-varying, modifiable risk factors in chronic disease models, and for calibrating the models using available, cross-sectional data. We illustrate feasibility with the policy-relevant example of smoking, and smoking cessation programs, in India. We show that incorporating exposure-change rates can improve estimates of chronic disease outcomes and outcomes of interventions.

2 - Forecasting and Dynamic Adjustment of Staffing Levels in Hospital Operating Rooms

Su Xie, Stanford Graduate School of Business, 655 knight way, Stanford, CA, 94305, United States of America, xiesu@stanford.edu, Stefanos Zenios

This paper considers the problem of setting nurse staffing levels for a hospital operating room. The goal is to reduce total nurse staffing costs, which include an hourly staffing salary for scheduled nurse time plus an overtime rate when surgeries take longer than scheduled (and therefore nurses need to stay beyond their scheduled time).

3 - Admission and Discharge Decisions in ICU

Huiyin Ouyang, UNC at Chapel Hill, 2000 Baity Hill Dr, Apt 215, Chapel Hill, NC, 27599, United States of America, ouyang5@live.unc.edu, Nilay Argon

In this paper, we consider a model for an ICU with patients whose health status change during their care at the hospital. We formulate an MDP model to gain some insights into which patients have larger benefit from ICU to help make admission and discharge decisions. We find a condition under which ICU is more preferable than the general ward, and we prove that under this condition the optimal discharge policy when the ICU is full is of threshold type.

4 - Capacity Planning for Long-Term Care Networks with Homogenous Patient Population

Yan Li, Purdue University, West Lafayette, IN, 47907, United States of America, li528@purdue.edu, Nan Kong, Mark Lawley

Long-term care (LTC), mainly in the forms of nursing homes and home- and community-based services, has placed huge economic burden on the US health care system. Given a finite homogenous patient population and a finite monetary budget, we study the capacity planning for each set of services. We propose a migration network model for patient flows and a newsvendor model for network-wide profit maximization. We present both analytical solutions and numerical results to draw managerial insights.

■ TC41

Hilton- Union Sq 21

Health Care, Strategy, and Policy 1

Contributed Session

Chair: Dawei (David) Zhang, Assistant Professor, University of Scranton, 800 Linden St, Scranton, PA, 18510, United States of America, dawei.zhang@scranton.edu

1 - The Role of Familiarity on Productivity: The Case of Cardiac Surgey Operations

Emmanouil Avgerinos, PhD Student, University College London, 10 Gough House, Windsor street, London, N18QA, United Kingdom, emmanouil.avgerinos.10@ucl.ac.uk, Bilal Gokpinar

Fluid teams are commonly used by a variety of organizations to perform similar and repetitive yet highly critical and knowledge-intensive tasks. In this paper, we develop and test a model of knowledge transfer based on team composition in fluid team operations. Using a unique dataset of 6,206 cardiac surgeries from the cardiac unit of a private hospital in Europe over seven years, we investigate knowledge transfer mechanisms through which team familiarity may influence productivity.

2 - IT and Hospital Performance

Dawei (David) Zhang, Assistant Professor, University of Scranton, 800 Linden St, Scranton, PA, 18510, United States of America, dawei.zhang@scranton.edu, Victoria Mitchell, Barrie Nault

Hospitals in the US are progressively becoming overwhelmed by the mounting number of tasks as the U.S. population continues to make strides in longevity. Consequently, hospitals have been making investments in information technology (IT), hoping to improve healthcare decisions. Surprisingly, there is a gap in the IS literature on the impact of IT on hospital performance. Our study aims to shed light on the role of health IT in affecting hospital performance.

3 - Explaining Outstanding Hospital Performance on Multiple Fronts

Carol Theokary, Assistant Professor of Business, Mills College, 5000 MacArthur Boulevard, Oakland, CA, 94613, United States of America, ctheokary@mills.edu, Kate Karniouchina

Motivated by the hospital value-based purchasing program that is designed to promote better clinical outcomes for hospital patients, as well as improve their experience of care during hospital inpatient stays, we use a large dataset featuring more than 2,000 hospitals to empirically examine how the latest addition of a cost efficiency component to the scoring system affects overall hospital performance.

4 - Saving Patient Ryan - Can Health IT Make Patient Care Safer? Evidence from Pennsylvania Hospitals

M Zia Hydari, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15146, United States of America, zia@cmu.edu, William Marella, Rahul Telang

Patient safety is widely expected to benefit from health IT but the evidence of its impact on safety is inconclusive. We estimate the impact of advanced Electronic Medical Records (EMRs) on patient safety using a panel of Pennsylvania hospitals over 2005ó2012. Using a differences-in-differences identification strategy, we find that EMRs lead to a 27% decline in patient safety events. Thus, we provide evidence to stakeholders that hospitals' adoption of advanced EMRs improves patient safety.

■ TC42

Hilton- Union Sq 22

Joint Session HAS/Analytics: Analytics for Chronic Care Decision-Making

Sponsor: Health Applications, Health Applications, & Analytics Section

Sponsored Session

Chair: Shinyi Wu, Associate Professor, University of Southern California, 1150 S. Olive Avenue, Suite 1400, Los Angeles, CA, 90015, United States of America, shinyiwu@usc.edu

1 - Considering Multiple Perspectives in Simulation Modeling for Better Implementation of Interventions

Irene Vidyanti, Los Angeles Department of Public Health, 3530 Wilshire Boulevard, Los Angeles, CA, 90010, United States of America, irenevidyanti@gmail.com, Shinyi Wu

This research makes the case for considering multiple perspectives by analyzing cost-benefit of several Diabetic Retinopathy screening strategies from the societal, payer, and medical system perspectives using a simulation model. Optimal screening strategy differs based on perspective taken. As different parties have different interests but cooperation from all is required for successful implementation, having this information is useful to determine incentives to facilitate implementation.

2 - Developing Depression Symptoms Prediction Models to Improve Depression Care Outcomes

Haomiao Jin, University of Southern California, 3650 McClintock Avenue, Rm 340, Los Angeles, CA, 90089, United States of America, haomiaoj@usc.edu, Shinyi Wu, Irene Vidyanti, Paul Di Capua, Brian Wu

This study targets to develop depression symptoms prediction models from a rich dataset yielded from a recent, large-scale clinical trial. Bench model was developed using the historical scores of a depression symptom scale called PHQ-9 to predict the PHQ-9 thereafter. Additional predictors were then added to improve the accuracy of prediction. The prediction models developed in this study are useful predictive analytics tools that can assist in improving depression care outcomes.

3 - Cost-effectiveness of Colorectal Cancer Screening Interventions Incorporating Patient Choice

Maria Mayorga, Associate Professor, North Carolina State University, 111 Lampe Dr., Raleigh, NC, 27695, United States of America, memayorg@ncsu.edu, David Cornejo, Kristen Hassmiller Lich

We present an individual-based simulation model that accounts for heterogeneity in patient screening behavior; cancer progression is affected by individuals' characteristics and their screening and mode decisions. A set of discrete choice models determine patients' compliance and modality choices. We consider several distinct public health interventions that affect people's choice behavior. Cost effectiveness is evaluated with respect to several outcomes, such as life-years up-to-date.

4 - Using Microsimulation to Analyze Long-term Care Transition

Hambisa Keno, Purdue University, West Lafayette, IN, 47907, United States of America, hkeno@purdue.edu

A state-transition microsimulation model is presented for long-term care (LTC) transition processes and service utilization. The four states (care settings) in the model are home, nursing home, home care, and hospital. For each patient, the model captures the semi-Markov LTC transition process in two steps: which care setting to transition and the dwelling duration before the transition. Our model was validated based on a prospective cohort study. The model will be used to assess various intervention scenarios on service utilization.

■ TC43

Hilton- Union Sq 23

Computational Optimization and Applications

Sponsor: Computing Society

Sponsored Session

Chair: Andrew Trapp, Worcester Polytechnic Institute, 100 Institute Rd., Worcester, MA, 01602, United States of America, atrapp@wpi.edu

1 - Solving Semidefinite Programs over Symmetric, Diagonally Dominant Matrices

David Phillips, U.S. Naval Academy, Mathematics Department, Annapolis, MD, 21401, United States of America, dphillip@usna.edu, R. Michael Lewis, Rui Zhang

We consider semidefinite programs (SDPs) over symmetric, weakly diagonally dominant matrices. This class of SDPs has applications to network design and large scale instances are intractable for general SDP solvers. We present a potential function method that is provably and practically efficient. A key distinction of our algorithm is that we penalize the linear matrix inequality. We know of no other work that adopts this strategy.

2 - Speeding Up Modified Support Vector Machines with Decomposition

Talayeh Razzaghi, Postdoctoral Research Fellow, School of Computing, Clemson University, Clemson, SC, 29634, United States of America, trazzag@clemson.edu, Petros Xanthopoulos, Qipeng Zheng

Modified Support Vector Machines (SVMs) with ramp loss and hard margin loss functions are usually employed when outliers are present in the data. The success of solution methods is limited due to expensive computation, particularly for large datasets. To overcome this deficiency, we present a decomposition technique aiming to speed up the training process.

3 - Bayesian Global Optimization of Expensive Functions with Low-dimensional Noise

Peter Frazier, Assistant Professor, Cornell University, 232 Rhodes Hall, Ithaca, NY, 14853, United States of America, pf98@cornell.edu, Jing Xie, Sethuraman Sankaran, Abhay Ramachandra, Saleh Elmohamed, Alison Marsden

In many applications of simulation optimization, most of the variability in the output measure of interest is determined by a small number of random exogenous inputs. Motivated by an application to the design of cardiovascular bypass grafts using a computationally-expensive physics-based stochastic simulator, we provide a new Bayesian global optimization method that exploits this low-dimensional structure to improve performance.

4 - Hierarchies of Bounds for Multistage Stochastic Mixed-integer Programs

Gabriel L. Zenarosa, PhD Student, University of Pittsburgh, 3700 O'Hara Street, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States of America, glz5@pitt.edu, Oleg Prokopyev, Andrew Schaefer

Many practical dynamic decisions under uncertainty can be formulated as multistage stochastic mixed-integer programs (SMIPs). Unfortunately, multistage SMIP instances are large, making them nearly impossible to solve. SMIP instances must be decomposed into manageable problems. We propose a framework for scenario tree decomposition—a novel approach for multistage SMIPs—where lower and upper bounds are obtained by solving SMIPs over subsets of the scenario tree.

■ TC44

Hilton- Union Sq 24

Online Social Networks and Content Generation

Sponsor: Information Systems

Sponsored Session

Chair: De Liu, University of Kentucky, 550 S Limestone St,, Lexington, KY, 40506, United States of America, de.liu@uky.edu

1 - How do Consumers use Social Shopping Sites? The Impact of Social Endorsements

Pei Xu, PhD Student, University of Kentucky, 3800 Nicholasville Rd Apt 31626, Lexington, KY, 40503, United States of America, xupei124@gmail.com, De Liu

Social shopping is a new form of e-commerce that uses social media to connect consumers and facilitate collaborative shopping. This research aims to understand how product endorsements via the social channel influence the amount of private consideration and public endorsement a product can receive. Based on the theory of social contagion, herding effect and identity-signaling theory, we argue that the working mechanisms of social endorsements differ in consumers' private and public behaviors.

2 - Examining user Content Similarity and Network Growth within Content-based Online Social Networks

Mitchell Church, Assistant Professor, Slippery Rock University, Slippery Rock, PA, 16057, United States of America, mitchell.church@sru.edu, Xia Zhao, Lakshmi Iyer

Using a unique dataset from Pinterest, our study examines how rich-media diffusion and network growth are affected by the actions and rich-media content similarity of users within content-based social networks. Our findings show that content similarity between network users impacts how Pinterest users receive, share and consume rich-media content. Additionally, we show that user actions and content similarity influence the growth and structure of content-based networks.

3 - The Role of Social Networks in Online Reviewing

Zhihong Ke, University of Kentucky, 550 S Limestone St,, Lexington, KY, 40506, United States of America, zhihong.ke@uky.edu, De Liu

Extant research on user content generation has primarily focused on what motivates users to contribute content, and less on the effects of informational and social environment surrounding these users. The aim of this study is to examine how a user's contribution to an online review platform is affected by reviews of his/her friends from both informational and social perspectives.

■ TC45

Hilton- Union Sq 25

Behavioral Aspects in Forecasting and Inventory Decisions

Sponsor: Behavioral Operations Management

Sponsored Session

Chair: Michael Becker-Peth, Assistant professor, University of Cologne, Albertus-Magnus-Platz, Cologne, Germany, michael.becker-peth@uni-koeln.de

1 - The Effect of Group Identity on Supply Chain Forecasting and Ordering

Felix Papier, Associate professor, ESSEC Business School, Av. Bernard Hirsch, Cergy, 95021, France, papier@essec.edu, Torsten Gully, Ulrich Thonemann

We analyze a supply chain in which a demand planner provides demand forecasts to a production planner, who cannot observe the effort that the demand planner invests. We use a game theoretic model and laboratory experiments to show that social preferences affect the alignment between both planners: Some demand planners invest effort and production planners anticipate this effort. We show that group identity can be used to increase social preferences and to align the supply chains.

2 - Improving the Effectiveness of Forecasting Processes: A Case Study in the Food Industry

Stefanie Protzner, Rotterdam School of Management, Erasmus University, Burgemeester Oudlaan 50, Rotterdam, 3062PA, Netherlands, sprotzner@rsm.nl, Steef van de Velde, Laurens Rook

Lack of trust and transparency between sales, marketing and supply chain is a serious problem in forecasting processes of many organizations harming the credibility of the forecast and the overall process. In this study, we explore the effects of a re-design of a forecasting process. Results show that changes in ownership structure and process flow and performance based inclusion can reduce dysfunctional biases, improve forecast accuracy and the effectiveness of the forecasting process.

3 - Task Decomposition and Newsvendor Decision Making

Yun Shin Lee, Assistant Professor, Korea Advanced Institute for Science and Technology, 85 Hoegiro Dongdaemoon-gu, Seoul, Korea, Republic of, yunshin@business.kaist.ac.kr, Enno Siemsen

We separate newsvendor order decisions into point forecasts, uncertainty judgments, and service level decisions in a behavioral laboratory experiment. Point forecasts are influenced by the underlying overage and underage cost parameters, and suffer from demand chasing. Uncertainty judgments are subject to overconfidence, and service level decisions suffer from a cognitive dissonance bias where service levels are rarely set below 50 percent.

4 - Empirical Newsvendor Decisions under a Service Level Contract
Michael Becker-Peth, Assistant Professor, University of Cologne, Albertus-Magnus-Platz, Cologne, Germany, michael.becker-peth@uni-koeln.de, Stefan Minner, Ulrich Thonemann, Anna-Lena Sachs

Analyzing the newsvendors in laboratory experiments gives new insights into the behavioral aspects of decision makers. However, a valid question is whether the results of those experiments can be transferred to real world decisions. We test this by analyzing the decisions of real decision makers. Our findings indicate that real decision makers show similar decision biases as students in laboratory environments and we find a new decision bias, as our decision maker optimizing multiple products.

■ TC46

Hilton- Lombard

MIP Theory and Multi-level Applications

Sponsor: Optimization/Integer and Discrete Optimization

Sponsored Session

Chair: J. Cole Smith, Professor, University of Florida, 303 Weil Hall, Gainesville, FL, 32611, United States of America, jcsmith@clemson.edu

1 - The Level-d Partial Convexification Cut for 0-1 Mixed Integer Program
Youngho Lee, Korea University, Sung Buk Ku, Seoul, Korea, Republic of, yhlee@korea.ac.kr, Junsang Yuh, Jeongyi Moon

The level-d partial convexification closure is obtained by augmenting all the partial convexification cuts generated from level-d RLT polyhedron. We present an algorithm for approximately optimizing over the level-d partial convexification closure. This is accomplished by iteratively solving the separation problem that projects the extended space of the RLT formulation into the original space. We present computational results on well-known benchmark instances from MIPLIB 3.0.

2 - Shortest-path Interdiction with Dynamic Attacks
Jorge A. Sefair, University of Florida, 303 Weil Hall, Gainesville, FL, 32608, United States of America, j.sefair@ufl.edu, J. Cole Smith

We study a shortest-path interdiction problem in which two agents (user and an interdictor) interact in a network. The user travels the network intending to reach a destination node at the minimum cost, while the interdictor attacks some arcs to increase the traversing cost. To maximize the user's shortest path, the interdictor can attack while the interdictor travels the network, i.e., the interdictor can initially attack a subset of arcs and, after observing the user's reaction, attack again.

3 - On a General Framework for Three-stage Interdiction Problems with Fortification
Leonardo Lozano Sanchez, PhD Student, University of Florida, 303 Weil Hall, Gainesville, FL, 32698, United States of America, llozano@ufl.edu, J. Cole Smith

Interdiction problems with fortification involve two players who compete in a sequential game where a defender fortifies his system in anticipation to an optimal attack. We present a solution framework that is build upon the intuition of sampling the third-stage problem to obtain upper bounds while adding cuts to the first-stage problem. We conducted computational experiments on the shortest path problem achieving compelling results over large instances with up to 53,658 nodes and 192,084 arcs.

4 - Effectively Handling Indicator Constraints in IBM-Cplex
Andrea Lodi, Professor, University of Bologna, DEIS, Viale Risorgimento 2, Bologna, 40136, Italy, andrea.lodi@unibo.it, Pierre Bonami

Mixed Integer Linear Programming (MILP) models are commonly used to model indicator constraints, which either hold or are relaxed depending on the value of a binary variable. However, classical bigM formulations are notoriously weak and MILP solvers have serious difficulties to deal with them. Motivated by a class of Classification problems with Ramp Loss functions on which Mixed Integer Nonlinear Programming models with nonconvex constraints are solved better than the equivalent MILP formulations, we describe an entirely new and effective implementation of the way IBM-Cplex handles indicator constraints. The implementation is based on the iterative strengthening of the constraints at the nodes through local cutting planes. (Joint work with Pierre Bonami.)

■ TC47

Hilton- Mason A

Stochastic/robust Optimization Application in Energy Systems

Sponsor: Optimization/Optimization Under Uncertainty

Sponsored Session

Chair: Muhong Zhang, Arizona State University, 5910 W Park Ave., Chandler, United States of America, muhong.zhang@asu.edu

1 - Integration of Progressive Hedging and Dual Decomposition for Stochastic Integer Programs
Ge Guo, PhD Student, Iowa State University, 610 Squaw Creek Drive, Unit 13, Ames, IA, 50010, United States of America, geguo@iastate.edu, Sarah M. Ryan

We present a method for integrating the Progressive Hedging Algorithm (PHA) and the Dual Decomposition (DD) method for stochastic mixed-integer programs using PySP and DDSIP. A method to transform non-anticipativity weights from PHA to Lagrange multipliers in DD is found. Fast progress in early iterations of PHA speeds up convergence of DD to an exact solution. We report computational results on stochastic server location and unit commitment instances.

2 - Reserve Response Sets for Unit Commitment under Wind Uncertainty
Joshua Lyon, PhD Candidate, Arizona State University, P.O. Box 875706, Tempe, United States of America, jdlyon@asu.edu, Muhong Zhang, Kory Hedman

Uncertainty from renewable resources is a growing concern for power system schedulers. Deterministic models remain in favor due to their computational tractability, but they may overlook solutions that respond well to forecast deviations. One problem is that deterministic policies rarely consider the cost of dispatching reserves. In this research, we propose a decomposition algorithm that determines reserve requirements based on cost criteria as well as reserve deliverability.

3 - Strong Formulation for Unit Commitment Problems
Kai Pan, PhD Student, University of Florida, Weil Hall 411, Gainesville, FL, 32611, United States of America, kpan@ufl.edu, Jean-Paul Watson, Yongpei Guan, Qianfan Wang

We propose a strong formulation for unit commitment problem. The computational experiments verify its effectiveness in solving the unit commitment problem efficiently.

4 - Mathematical Determination of Reserve Requirements in Unit Commitment Problem
Chao Li, PhD Student, Arizona State University, 2343 W Main Street, Apt 2097, Mesa, AZ, 85201, United States of America, Chao.Li.cidse@asu.edu, Muhong Zhang

System reliability is critical in power system operation. Stochastic programming and robust optimization have been proposed to model uncertainties. However, both are limited in applications due to computational challenges. Reserve requirements are adopted by system operators. In this work, reserve requirement policies are determined systematically based on polyhedron structures. A case study will be presented to compare the performance of the proposed methods versus rule-of-thumb rules.

■ TC48

Hilton- Mason B

Optimization, Combinatorial 2

Contributed Session

Chair: Kresimir Mihic, Oracle Labs, 501 Island Parkway #3102, Belmont, CA, 94002, United States of America, kresimir.mihic@oracle.com

1 - Generalized Decomposition for Non-linear Problems
Kresimir Mihic, Oracle Labs, 501 Island Parkway #3102, Belmont, CA, 94002, United States of America, kresimir.mihic@oracle.com, Alan Wood

We present Randomized Decomposition (RD), a method for solving non-linear, non-convex mathematical programs. RD is similar to Bender's Decomposition but does not require any knowledge of the problem structure. Instead, the problem is partitioned into random subsets of decision variables, each of the sub-problems represented by the random subsets are optimized, and the process is repeated. Sub-optimal solutions are permitted at certain points in the solution process to help escape local optima.

2 - The Paired Assignment Problem
Vardges Melkonian, Ohio University, 1 Ohio University, Athens, OH, 45701, United States of America, melkonia@ohio.edu

We consider a variation of the maximum bipartite matching problem where each completed task must have at least two agents assigned to it. We prove that the basic solutions of LP-relaxation are half-integral. It is shown that a fractional basic solution can be further processed to obtain an optimal solution.

3 - Formulating a Realistic Mixed Model Assembly Line Balancing Problem
Anas Alghazi, PhD Candidate, Clemson University, Freeman Hall, Clemson, SC, 29634, United States of America, aalghaz@clemson.edu, Mary Elizabeth Kurz

We investigate the formulation of the mixed model line balancing problem that captures realistic characteristics such as zoning constraints and parallel stations. Since the problem is NP-Hard, making use of the structure of the problem is important in order to be able to solve reasonably sized problems to optimality. Different exact solution procedures and formulation techniques are studied to achieve this goal.

4 - Computational Complexity of the Deterministic Annealing Algorithm
Pratik Mayur Parekh, Graduate Student, University of Illinois, Urbana-Champaign, Coordinated Science Laboratory, 1308 West Main St., Urbana, IL, 61801, United States of America, pparekh2@illinois.edu, Carolyn Beck

The deterministic annealing approach to clustering is derived on the basis of the principle of maximum entropy and produces natural hierarchical clustering solutions through a sequence of phase transitions. In this article, the computational complexity for the classic DA algorithm is analyzed through analytical derivation and simulation study. We have also applied smoothing analysis to study the variation in complexity for small perturbations of input data.

■ TC49

Hilton- Powell A

Network Optimization and Routing Problems

Sponsor: Optimization/Network Optimization

Sponsored Session

Chair: Qie He, Department of Industrial and Systems Engineering, University of Minnesota, 111 Church St, SE, Minneapolis, MN, 55455, United States of America, qhe@umn.edu

1 - Algorithms in Traveling Salesman Problem with Continuous Arc Cost Distribution
Zhouchun Huang, University of Central Florida, 4000 Central Florida Blvd., University of Central Florida, Orlando, FL, 32816, United States of America, zhouchun.huang@knights.ucf.edu, Qipeng Zheng

The formulation of Traveling Salesman Problem that incorporates risk managements with conditional value-at-risk is proposed. As a commonly occurring continuous probability distribution, Gaussian distribution is applied to describe the uncertain arc costs. several algorithms including a new cutting plane method are developed to solve the problem in both small-sized or large-sized networks.

2 - Branch-and-Cut-(and-Price) for the Chance-Constrained Vehicle Routing Problem
Thai Dinh, Graduate Student/Research Assistant, University of Wisconsin-Madison, 1513 University Avenue, Madison, WI, 53706, United States of America, tndinh@wisc.edu, Ricardo Fukasawa, James Luedtke

We study algorithms for the chance-constrained vehicle routing problem, in which a limit is imposed on the probability that truck capacity is exceeded. We present a branch-and-cut algorithm that requires minimal assumptions on the random demands, and also a branch-and-cut-and-price algorithm for the case when demands are independent normal. Computational results will be presented.

3 - Inventory Routing Problem for a Single Perishable Product with Stochastic Demands
Mahmood Rezaei, Researcher, University of Liege, Rue Louvrex 14, Liege, 4000, Belgium, m.rezaei@ulg.ac.be, Yves Crama, Tom Van Woensel, Martin Savelsbergh

We consider an inventory routing problem where perishable products are dispatched from a central depot to a set of geographically dispersed stores. Demands to each store are stochastic. The objective is to maximize the total profit of the network (the total revenue minus the total transportation costs) during an infinite planning horizon. We develop 4 different approaches to model and solve the problem. The solution methods are compared by simulation and managerial insights are drawn.

4 - Minimum Concave Cost Flows in Capacitated Grid Networks
Qie He, Department of Industrial and Systems Engineering, University of Minnesota, 111 Church St, SE, Minneapolis, MN, 55455, United States of America, qhe@umn.edu, Shabbir Ahmed, Shi Li, George Nemhauser

We study the minimum concave cost flow problem over a two-dimensional grid network (CFG), where one dimension represents time and the other represents echelons. We give a characterization of the computational complexity of CFG based on the grid size, the distribution of sources and sinks over the grid, and arc capacity values. Our algorithms and hardness results generalize complexity results for many variants of the lot-sizing problem, and answer several open questions on serial supply chains.

■ TC50

Hilton- Powell B

Optimization Methodologies 2

Contributed Session

Chair: Yaping Wang, Texas A&M University, 3131 TAMU, College Station, TX, 77843, United States of America, ypwang@neo.tamu.edu

1 - Lung Cancer: New information from Old Data
Katia Camacho-Caceres, Graduate Student, 10 Ramirez Silva, Mayaguez, 00680, Puerto Rico, katia.camacho@upr.edu

This work re-examines lung cancer microarray data with a multiple criteria optimization-based strategy. This strategy does not require any adjustment of parameters by the user and is capable to converge consistently to important genes potential biomarkers even in the presence of multiple and incommensurate units across microarrays. Groups with distinct smoking habits and gender are contrasted to elicit a set of highly differentially expressed genes, several of which are associated to lung cancer

2 - A Rigid Point Set Registration Approach for Aligning Two Metrology Data with Different Resolution
Yaping Wang, Texas A&M University, 3131 TAMU, College Station, TX, 77843, United States of America, ypwang@neo.tamu.edu, Erick Moreno-Centeno, Yu Ding

Given two misaligned metrology datasets with different cardinality and resolution from the same manufacturing part surface, a crucial step to get better prediction of the underlying true surface is to find correspondences between the two datasets. We combine down sampling, solving downsized problem to optimality, partial solution propagation, and iterative local search to obtain solutions with much higher quality than other commonly used approaches within reasonable amount of time limit.

3 - Deploying OPL Optimization Models on Client-server Architectures
Vincent Beraudier, OPL Program Manager - CPLEX Optimization Studio, IBM, Porte Neuve, Bat A, 4 Av Alphonse MorelL, Grasse, 06130, France, vincent.beraudier@fr.ibm.com

CPLEX Optimization Studio enables you to take advantage of all your computing resources locally or remotely. Using the OPL modeling language and its dedicated UIs, we will demonstrate how to take advantage of all your computing resources in minutes to create, debug and deploy optimization models. We will take you through all the steps of implementing optimization projects, including formulating the optimization model, integrating it with user data, and deploying the project on a server.

4 - Semidefinite and Copositive Relaxation of Polynomial Optimization by Using Symmetric Tensors
Xiaolong Kuang, Student, Lehigh University, 425 Montclair Avenue, Bethlehem, PA, 18015, United States of America, kuangxiaolong0731@gmail.com, Luis Zuluaga

We study relaxation of general polynomial optimization problem over the cones of positive semidefinite and completely positive tensors, which are natural extensions of the cones of positive semidefinite and copositive matrices. Then we characterize the relationship between Lagrangian bounds, semidefinite bounds and copositive bounds of polynomial optimization.

■ TC51

Hilton- Sutter A

Optimization Society Prizes

Sponsor: Optimization

Sponsored Session

Chair: Sanjay Mehrotra, Professor, Northwestern University, Evanston, IL, United States of America, mehrotra@iems.northwestern.edu

1 - Optimization Society Student Paper Prize
Santanu Dey, Georgia Tech, 765 Ferst Drive, NW, Atlanta, United States of America, santanu.dey@isye.gatech.edu

The INFORMS Optimization Society Student Paper Prize was established in 2006 and is awarded annually at the INFORMS Fall National Meeting to one or more student(s) for an outstanding paper in optimization that is submitted to and received or published in a refereed professional journal during the three calendar years preceding the year of the award. The prize serves as an esteemed recognition of promising students who are looking for an academic or industrial career.

2 - The INFORMS Optimization Society Prize for Young Researchers
Andrzej Ruszczynski, Distinguished Professor, Rutgers University, 100 Rockafeller Road, Piscataway, NJ, 08550, United States of America, rusz@business.rutgers.edu

The INFORMS Optimization Society Prize for Young Researchers was established in 1998 and is awarded annually to one or more young researcher(s) for an outstanding paper in optimization that was accepted, or published in a refereed professional journal within the last four years. All authors must have been awarded their terminal degree within the last eight years. The prize serves as an esteemed recognition of promising colleagues who are at the beginning of their career.

3 - The Farkas Prize of the INFORMS Optimization Society
Yinyu Ye, Professor, Stanford University, Huang 308, Stanford, CA, 94025, United States of America, yyye@stanford.edu

The Farkas Prize of the INFORMS Optimization Society was established in 2006 and is awarded annually at the INFORMS Fall National Meeting to a mid-career researcher for outstanding contributions to the field of optimization, over the course of their career. Such contributions could include papers (published or submitted and accepted), books, monographs, and software. The awardee will be within 25 years of their terminal degree as of January 1 of the year of the award. The prize serves as an esteemed recognition of colleagues in the middle of their career.

4 - The Khachiyan Prize for Lifetime Accomplishments in Optimization
Tamas Terlaky, Professor, Lehigh University, 200 W. Packer Ave, Bethlehem, PA, United States of America, terlaky@lehigh.edu

The Khachiyan Prize of the INFORMS Optimization Society was established in 2010 and is awarded annually at the INFORMS Fall National Meeting to an individual or a team for life-time achievements in the area of optimization. The award recognizes a sustained career of scholarship from nominees who are still active at the year of the nomination. The prize serves as an esteemed recognition of innovativeness and impact in the area of optimization, including theory and applications.

■ TC52

Hilton- Sutter B

Optimization, Convex

Contributed Session

Chair: Cun Mu, PhD Student, IEOR, Columbia University, 500 West 120th Street, Rm. 315, Columbia University, New York, NY, 10027, United States of America, cm3052@columbia.edu

1 - Subgradient Optimization for Parametric Nonlinear Programming
Jonathon Leverenz, Clemson University, Clemson University, Clemson, SC, 29634, United States of America, jlevere@clemson.edu, Margaret Wiecek

Parametric Programming is used to address uncertainty in optimization problems. Solutions are functions of the parameter and are typically obtained using approximations of the primal problem. Subgradient optimization has not previously been applied in this setting but can improve the quality of these solutions when used to solve the dual problem. An algorithm is presented along with a basic convergence result and illustrative examples.

2 - A Semi-definite Programming Approach for Optimal Selection in Tree Breeding
Makoto Yamashita, Tokyo Institute of Technology, 2-12-1-W8-29, Oookayama, Meguro-ku, Tokyo, Se, 152-8552, Japan, Makoto.Yamashita@is.titech.ac.jp, Tim Mullin

In tree breeding, we wish to optimize parent-genotype contributions in grafted seed orchards, achieving the greatest genetic value in the orchard seed while maintaining essential genetic diversity. We represent this optimization problem as a semi-definite program, and we combine the SDPA solver into open-source optimal selection software, OPSEL. This approach has considerable flexibility, and we found from numerical results that the semi-definite program provides a valuable solution.

3 - Linear Inverse Problems for Multi-structured Signals – With Application in Low-rank Tensor Recover
Cun Mu, PhD Student, IEOR, Columbia University, 500 West 120th Street, Rm. 315, Columbia University, New York, NY, 10027, United States of America, cm3052@columbia.edu, Bo Huang, John Wright, Donald Goldfarb

Recovering a multi-structured signal from incomplete information is a recurring problem in signal processing and machine learning. In this talk, we first give a negative result on the common approach of minimizing the sum of individual sparsity inducing norms (e.g. \ell_1, nuclear norm). Then we demonstrate that, for the low-rank tensor recovery problem, it is possible to design a better model by exploiting those structures jointly.

4 - Largest Inscribed Rectangles In Geometric Convex Sets
Mehdi Behroozi, PhD Student, University of Minnesota, 111 Church St. SE, Minneapolis, MN, 55455, United States of America, behro040@umn.edu, John Carlsson, Shuzhong Zhnag

We consider the problem of finding maximum area inscribed box inside a compact and solid convex set, representable in finite number of inequalities. For the traditional 2-dimensional n-gon problem, we present optimization based exact and approximation algorithms, which find the largest inscribed axis-aligned rectangle for any given direction of axes in $\mathcal{O}(n)$ time and compute $(1-\epsilon)$-approximation to the largest inscribed rectangle in $\mathcal{O}(\frac{n}{\epsilon})$ time.

5 - An Efficient Algorithm for the Nested Resource Allocation Problem
Thibaut Vidal, LIDS — Massachusetts Institute of Technology, 77 Massachusetts Avenue, Room 32-D566, Cambridge, MA, 02139, United States of America, vidalt@mit.edu, Nelson Maculan, Patrick Jaillet

We propose an exact polynomial algorithm for a nested resource allocation problem with convex costs and constraints on partial sums of resource consumptions, in the presence of either continuous or integer variables. This resource allocation problem appears prominently in a variety of applications related to production and resource planning, scheduling, ship speed optimization and vehicle routing.

■ TC53

Hilton- Taylor A

Finance, Portfolio Analysis 1

Contributed Session

Chair: Jinming Xie, The Chinese University of Hong Kong, Dept. of Syst. Eng. & Eng. Manag., Shatin, Hong Kong - PRC, jmxie@se.cuhk.edu.hk

1 - Are Markets Efficient? An Exercise in Predicting Exchange Rates
Arnav Sheth, Assistant Professor, Saint Mary's College of California, 380 Moraga Rd, Moraga, CA, 94556, United States of America, aas3@stmarys-ca.edu, Adam Duncan

Institutional traders trade foreign equities through the foreign exchange market at a benchmark rate called the WM/Reuters Fixing Rate, or the WM Fix. This indicates that a strong relationship between the WM Fix and equity indices exists. We test the predictability of the WM Fix, and exchange rates in general, using stepwise regression techniques and we find that such a relationship does indeed exist. This puts into question the hypothesis of informational efficiency in financial markets.

2 - Empirical Pricing Kernels: A Revisit
Jinming Xie, The Chinese University of Hong Kong, Dept. of Syst. Eng. & Eng. Manag., Shatin, Hong Kong - PRC, jmxie@se.cuhk.edu.hk, Duan Li

In this research, we revisit the empirical pricing kernels estimated by the option prices and the underlying asset prices. We estimate a time series of empirical pricing kernels non-parametrically and find that they consistently have oscillating shapes. Similar phenomenon are found in both the US and Hong Kong market. Besides, these oscillating shapes provide support to the Friedman and Savage utility function theory based on real market data.

3 - Financial Risk in Multifractal Asset Returns
Woojin Chang, Associate Professor, Seoul National University, 1 Gwanak-ro Gwanak-gu, Seoul, Korea, Republic of, changw@snu.ac.kr, Ho Jin Lee

Multifractal Processes provide long memory in volatility, fat-tail distribution behavior, and the moment scaling. We applied the Multifractal Model of Asset Returns, which was introduced by Calvet, Fisher, and Mendelbrot in 1997, to financial risk models such as Value at Risk and Expected shortfall. Both simulations and empirical studies are conducted to confirm the validity of our application.

4 - Set-valued Shortfall Risk Measures for Multi-asset Markets with Frictions
Cagin Ararat, PhD Candidate, Princeton University, 1 Charlton Street, Sherrerd Hall, Princeton, NJ, 08540, United States of America, cararat@princeton.edu, Birgit Rudloff, Andreas H. Hamel

In a multi-asset market with frictions, existence of individual utility functions for assets is assumed and the corresponding utility-based set-valued shortfall risk measures are studied. Their values are defined as the solutions of certain convex set optimization problems. Using a recent set-Lagrange duality, dual problems are obtained and they give rise to multi-objective versions of optimized certainty equivalents. Examples include the entropic risk measure and average value at risk.

5 - Enhancing Rebalancing Gains through Randomization and the use of Portfolio Tactics
Maximilian Goer, PhD Candidate, Princeton University, 12 Lawrence Dr, Apt 501, Princeton, NJ, 08540, United States of America, mgoer@princeton.edu, Woo Chang Kim, John Mulvey

It is well established that rebalancing gains or 'volatility pumping' can enhance the risk-reward characteristics of a portfolio. Due to increasing correlations between the major asset classes, these gains are hard to capture in practice. We show that rebalancing gains can be achieved by using portfolio tactics and selective randomization to decide which tactics are invested at any given time. Special attention will be given to the commodities space.

■ TC54

Hilton- Taylor B

Quantitative Financial Risk Management

Sponsor: Financial Services Section

Sponsored Session

Chair: Samim Ghamami, Economist, Federal Reserve Board, 20th Street and Constitution Ave NW, Washington, DC, 20551, United States of America, samim.ghamami@frb.gov

Co-Chair: Bo Zhang, IBM T.J. Watson Research Center, 1101 Kitchawan Road, Yorktown Heights, NY, United States of America, bozhang@gatech.edu

1 - Large Dimensional Factor Models Based on High-frequency Observations
Markus Pelger, University of California, Berkeley, Department of Economics, 508-1 Evans Hall, Berkeley, CA, 94720, United States of America, markus.pelger@berkeley.edu

This paper develops an inferential theory for factor models of large dimensions based on high-frequency observations. I estimate the number of factors and derive consistent and asymptotically normal estimators of the loadings and factors for very general stochastic processes in continuous time. The estimation approach can separate factors for systematic large sudden movements, so-called jumps factors, from continuous factors. I apply the approach to the U.S. equity market.

2 - Optimal Importance Sampling of Default Losses
Alexander Shkolnik, UC Berkeley, Berkeley, CA, United States of America, ads2@stanford.edu, Kay Giesecke

We develop an importance sampling estimator of large-loss probabilities in reduced-form models of name-by-name default timing. Such default timing models are widely used to measure portfolio credit risk and to analyze securities exposed to correlated default risk. In contrast with classical methods, our approach does not require knowledge of the loss transform and is implementable for virtually any model. We discuss the technical conditions guaranteeing asymptotic optimality of the estimator.

3 - Systemic Risk with Central Counterparty Clearing
Hamed Amini, EPFL, Extranef 249, Lausanne, 1015, Switzerland, hamed.amini@epfl.ch

We study a financial network in a stochastic framework. We measure systemic risk in terms of a coherent valuation principle. The framework allows us to examine the effects on systemic risk and price contagion of multilateral clearing via a central clearing counterparty (CCP). This is based on joint work with Damir Filipovic and Andreea Minca.

4 - Static Models of Central Counterparty Risk
Samim Ghamami, Economist, Federal Reserve Board, 20th Street and Constitution Ave NW, Washington, DC, 20551, United States of America, samim.ghamami@frb.gov

International standard setting bodies have outlined a set of principles for central counterparty (CCP) risk management; they have also devised CCP risk capital requirements on banks for their CCP exposures. There is still no consensus on how CCP risk should be measured coherently in practice. Based on novel applications of well-known mathematical models in finance, we introduce a coherent CCP risk measurement framework that gives a risk sensitive definition of the CCP risk capital.

■ TC55

Hilton- Van Ness

Stochastic MINLP With Endogenous Uncertainty

Sponsor: Optimization/Global Optimization & MINLP

Sponsored Session

Chair: Ban Kawas, IBM Research, 1101 Kitchawan Rd, Yorktown Heights, NY, 10598, United States of America, bkawas@us.ibm.com

1 - Transit Network Design Problem with Uncertain Demands
Chungmok Lee, Research Staff Member, IBM Research Ireland, Damastown Industrial Estate, Mulhuddart, Dublin, 15, Ireland, chungmok@ie.ibm.com, Rahul Nair

We consider a transit network design problem (TNDP) with uncertain demands. Typically the transit networks are very large and the formulation of the problem often requires nonlinear constraints making solving of the problem difficult. We present a decomposition approach enabling us to exploit the special structure of problem, which naturally localizes the uncertain demands only to user-behavior modeling sub problems. We then apply robust optimization to warrant solutions over uncertain demands.

2 - Distribution Shaping and Scenario Bundling for Stochastic Programs with Endogenous Uncertainty
Ban Kawas, IBM Research, 1101 Kitchawan Rd, Yorktown Heights, NY, 10598, United States of America, bkawas@us.ibm.com, Marco Laumanns, Steve D. Prestwich

Stochastic programs are usually formulated with probability distributions that are exogenously given. Handling endogenous uncertainty still remains a largely unresolved challenge. We develop a new approach to handle decision-dependent probabilities based on the idea of distribution shaping. We demonstrate on a pre-disaster planning problem and solve a recently considered instance of the Istanbul highway network to optimality within seconds, for which only approximate solutions had been known.

■ TC56

Hilton - Green Room

Software Demonstrations

Cluster: Software Demonstrations

Invited Session

1 - Syncopation Software - Decisions Large and Small, Made Faster and Better with DPL
Chris Dalton, CEO, Syncopation Software

This demonstration will explore the full range of DPL products. With DPL 8's convenient Excel add-in interface, performing a quick analysis on a spreadsheet takes just a few clicks, all right in Excel's ribbon. Moving beyond the basics, DPL's influence diagrams, decision trees and fault trees make quick work of a broad range of problems, from business valuation to tough security analyses. Need to make that decision 100 times? DPL's Portfolio version has you covered, including a new turnkey system for portfolio data management.

2 - FICO - Optimization on the FICO® Analytic Cloud
Oliver Bastert, FICO, Maximilianstr. 35a, Munich, Germany, OliverBastert@fico.com

This demo will show you how to turn an optimization model into a full optimization application, using FICO® Xpress Optimization Suite. We will also demonstrate how to deploy this application on the FICO® Analytic Cloud, with just a few clicks. Through the FICO Decision Management Platform, FICO's new cloud-based tools platform, you can build, implement and scale complex solutions combining predictive analytics, rules and optimization.

■ TC57

Hilton- Golden Gate 1

Curriculum Development

Sponsor: INFORM-ED

Sponsored Session

Chair: Peter Bell, Ivey Business School, 1255 Western Road, London, ON, N6G 0N1, Canada, pbell@ivey.uwo.ca

1 - Embed Decision Making in Middle School Mathematics
Kenneth Chelst, Wayne State University, 4815 Fourth St. MEB, Detroit, MI, 48201, United States of America, kchelst@wayne.edu, Asli Salhi-Koca, Thomas Edwards

Almost all middle school mathematics is simply descriptive and does not ask the student to use the information to make a quantitative based decision. Ratios, rates and percentages are critical skills developed in middle school mathematics. A standard example is: the ratio of boys to girls in a class is 3:2. If the class has 30 students how many are girls? We will demonstrate how to transform this and other standard textbook examples into practical decision making contexts.

2 - SAS Analytics Certificate Programs for Universities
Mike Speed, Analytical Consultant, SAS Institute, 9312 Lake Forest Ct S, College Station, TX, 77845, United States of America, mike.speed@sas.com, Jerry Oglesby, Curt Hinrichs

Over three dozen universities have partnered with SAS to offer certificate programs that provide their graduates with recognition for sought-after skills in the job market. Certificate programs vary by institution with some being more specialized in specific areas such as data mining while others being more general such as analytics. The talk will provide an overview of the programs, benefits and requirements for interested faculty and universities.

3 - MIT BLOSSOMS: A Gentle Introduction to OR for High School Classes
Richard Larson, Professor, MIT, E40-233, Cambridge, MA, 02139, United States of America, rclarson@mit.edu, Elizabeth Murray

The MIT BLOSSOMS program presents a freely available repository of interactive video lessons for high school STEM classes, STEM = Science, Technology, Engineering and Math. In its 7th year, we review BLOSSOMS, its "Teaching Duet" pedagogical model, its use in teacher Professional Development, its eight country partners, and its gentle introduction to OR concepts depicted in many BLOSSOMS lessons. Examples: applied probability, LP, social networks and graph theory.

■ TC58

Hilton- Golden Gate 2

Production and Scheduling 3

Contributed Session

Chair: Jian Chen, The University of Hong Kong, LG108, Composite Building, HKU, Hong Kong, Hong Kong - PRC, justinchenjian@gmail.com

1 - Stochastic Lot Sizing Problem with Controllable Processing Times
Esra Koca, Bilkent University, Department of Industrial Engineering, Bilkent, Ankara, 06800, Turkey, ekoca@bilkent.edu.tr, M. Selim Akturk, Hande Yaman Paternotte

We consider the stochastic lot sizing problem with controllable processing times. We assume that the compression cost function is a convex function as it may reflect increasing marginal costs of larger reductions and may be more appropriate when the resource life, energy consumption or carbon emission are also taken into consideration. We formulate the problem as a second order cone program (SOCP), use the recent advances in SOCP to strengthen it and then solve by a commercial solver.

2 - Rich Project Scheduling Based on Decomposition
Mehmet Gulsen, Asst. Professor, Baskent University, Baglica Kampus, Etimesgut, Ankara, 06810, Turkey, mgulsen@baskent.edu.tr, Huseyin Guden, Arda Turkgenci

We consider the rich project scheduling problem with multi-projects, multi-modes, resource constraints, divisible and indivisible tasks, and cost-time trade off which is motivated by an actual instance. Since the proposed model needs too much time and memory for solving large instances a heuristic method, based on the decomposition, is proposed for such instances. Critical path method and another model are used to reduce the size of the model. The method was tested in the actual instance.

3 - Robust Design and Operation of Red Blood Cell Production in a Parallelized Hollow Fibre Bioreactor
Ruth Misener, Royal Academy of Engineering Research Fellow, Imperial College London, South Kensington Campus, London, United Kingdom, r.misener@imperial.ac.uk, Nicki Panoskaltsis, Maria Fuentes Gari, Eirini Velliou, Stratos Pistikopoulos, Athanasios Mantalaris

Recent work developed a novel, biomimetic, cost-effective three-dimensional hollow fiber bioreactor for growing healthy red blood cells ex vivo. Experiments to empirically improve the bioreactor are cost- and labor-intensive, so we propose robust superstructure optimization for bioreactor design. We discuss the potential of our superstructure design strategy not only on this individual bioreactor but also more generally on bioprocess optimisation.

4 - Synchronization of Production Scheduling and Shipment in an Assembly Flowshop
Jian Chen, The University of Hong Kong, LG108, Composite Building, HKU, Hong Kong, Hong Kong - PRC, justinchenjian@gmail.com, George Q. Huang, Hao Luo, Jun Qiang Wang

We study a synchronized scheduling problem of production simultaneity and shipment punctuality in a two-stage assembly flowshop. Simultaneity seeks that all products belonging to a same customer order are simultaneously completed. Punctuality attempts to meet orders' individual due dates. Two performance measures is presented. We develop a scheduling model by balancing the two criteria. Genetic algorithm is used for solving the model. Numerical studies reach several significant findings.

■ TC59

Hilton- Golden Gate 3

Special Session: Best of Women in OR/MS

Sponsor: Women in OR/MS

Sponsored Session

Chair: Güzin Bayraksan, Associate Professor, Ohio State University, 1971 Neil Ave., Columbus, OH, 43210, United States of America, bayraksan.1@osu.edu

1 - How Near-Miss Events Amplify or Attenuate Risky Decision Making
Robin Dillon-Merrill, Georgetown University, 517 Hariri, McDonough School of Business, Washington, DC, 20057, United States of America, rld9@georgetown.edu

Exposure to near-misses alters responses to future risky events, and the results of exposure are not always the same. We differentiate two types of near-miss events: vulnerable, in which the events are viewed as disasters that almost happened, and resilient, in which the events are understood as disasters that did not occur. We show that vulnerable near-misses reduce future risk-taking behavior whereas resilient near-misses do not. We also offer recommendations for communicating risk.

2 - Optimization with Multivariate Conditional Value-at-Risk Constraints
Nilay Noyan, Associate Professor, Sabanci University, Sabanci University, Istanbul, 34956, Turkey, nnoyan@sabanciuniv.edu, Gabor Rudolf

For many decision making problems under uncertainty, it is crucial to specify decision makers' risk preferences based on multiple stochastic performance measures. We introduce a multivariate risk-averse preference rule based on CVaR and develop optimization models with multivariate CVaR constraints. For finite probability spaces we develop a cut generation algorithm, where each cut is obtained by solving a MIP. We show that our results can be extended to a wider class of coherent risk measures.

3 - Learning Consumer Tastes through Dynamic Assortments
Canan Ulu, Georgetown University, McDonough School of Business, Georgetown University, Washington, DC, 20057, United States of America, cu50@georgetown.edu, Dorothee Honhon, Aydin Alptekinoglu

We model this problem as a discrete time dynamic program where each period the firm chooses an assortment based on the prior distribution over consumer tastes. The consumers then choose a product that maximizes their own utility and the firm observes sales. We order assortments based on their information content and show that the optimal assortment cannot have lower information content than the myopically optimal assortment.

■ TC60

Hilton- Golden Gate 4

Inventory Management II

Contributed Session

Chair: Burcu Keskin, Associate Professor, University of Alabama, 300 Alston Hall, Tuscaloosa, Al, 35487, United States of America, bkeskin@cba.ua.edu

1 - Managing Disruption Risks: Aligning Inventory, Dual Sourcing and Agility Capacity Decisions

Florian Lücker, École Polytechnique Fédérale de Lausanne, EPFL - TOM Odyssea 4.16, Station 5, Lausanne, Switzerland, florian.luecker@epfl.ch, Ralf W. Seifert

In this talk we investigate the relationship between the three operational risk mitigation measures safety inventory, dual sourcing, and agility capacity by modeling a manufacturing firm. We quantify the decrease in inventory levels in the presence of dual sourcing and agility capacity. Furthermore, we show how to determine optimal inventory and dual sourcing decisions holistically. Within our modeling framework we introduce an operational metric that quantifies supply chain resilience.

2 - Sparsity-constrained Inventory Positioning in Online Retailing

Annie Chen, Massachusetts Institute of Technology, 77 Massachusetts Ave, Cambridge, MA, 02139, United States of America, anniecia@mit.edu, Stephen Graves

Many online retailers operate with a large network of fulfillment centers. To reduce their operational overhead, the retailer will limit the number of fulfillment centers that hold each item. We formulate an optimization problem to position the inventory in their network, and propose a computationally efficient algorithm for solving it.

3 - Base-stock Policies for Lost Sales Models: Aggregation and Asymptotics

Joachim Arts, Eindhoven University of Technology, Postbus 513, Eindhoven, 5600MB, Netherlands, j.j.arts@tue.nl, Retsef Levi, Bert Zwart, Geert-Jan Van Houtum

We consider the optimization of base-stock policies for periodic review lost sales inventory models. We take an unconventional view of the state space that allows for aggregation. We derive asymptotic results for approximations within this aggregations. The rate of convergence of these asymptotics is independent of the lead time. Numerical results show that these approximations lead to optimality gaps of 0.01% on average.

4 - An Integrated Supplier Selection and Inventory Problem with Lateral Transshipments

Burcu Keskin, Associate Professor, University of Alabama, 300 Alston Hall, Tuscaloosa, Al, 35487, United States of America, bkeskin@cba.ua.edu, Mohammad Firouz, Sharif Melouk

We study the supplier selection problem of a firm operating multiple warehouses that face stationary stochastic demands, allowing multi-sourcing from suppliers and lateral transshipments among warehouses to mitigate the risks that arise from supplier quality, capacity, and disruptions. We use simulation-optimization approach to solve the problem and show the inherent trade-off between multi-sourcing and single sourcing under different disruption scenarios.

■ TC61

Hilton- Golden Gate 5

Military Applications Research at RAND

Sponsor: Military Applications Society

Sponsored Session

Chair: Adam Resnick, RAND Military Applications, xx, xx, United States of America, adam_resnick@rand.org

1 - Evaluating Basing Options for Optimizing Accessibility for Global Response Force

Jeremy Eckhause, Operations Researcher, RAND Corporation, 1200 S. Hayes St., Arlington, VA, 22202, United States of America, eckhause@rand.org, Christopher Pernin, Michael Schwille, Katharina Best

For a global response force to achieve its mandate, rapid access to almost any point on the globe is essential. Since the long-term presence of the US is difficult to predict, using of a set of intermediate bases may be required for establishing fast and sustainable access to large numbers of contingency locations. We present an approach for identifying a robust set of intermediate bases for ensuring global access and a methodology for identifying new bases as infrastructure requirements change.

2 - How Deployments Affect the Capacity and Utilization of Army Military Treatment Facilities

Adam Resnick, RAND Military Applications, United States of America, adam_resnick@rand.org

The Army wished to understand whether the Army's Force Generation cycle, designed to make the generation of deployable units more predictable, created ebbs and flows in the ability of military treatment facilities to provide care and respond to changing family needs as soldiers and care providers deploy and return home. This study examines how the cycle affects capability and soldier health care utilization at Army military treatment facilities and how it affects family health care utilization.

■ TC64

Parc- Cyril Magnin I

Market Microstructure and High Frequency Asymptotics

Sponsor: Applied Probability Society

Sponsored Session

Chair: Josh Reed, New York University, 44 W 4th St, New York, NY, 10012, United States of America, jreed@stern.nyu.edu

1 - Hydrodynamic Limit of Order Book Dynamics

Xuefeng Gao, Assistant Professor, The Chinese University of Hong Kong, William M. W. Mong Engineering Building, Shatin, Hong Kong - PRC, xfgao@se.cuhk.edu.hk, Jim Dai, Ton Dieker, Shijie Deng

We study the temporal evolution of limit order book shape on the macroscopic time scale, motivated by a desire to better understand the interplay among order flows, order book shape and price impact. Our main result states that in the scaling regime where time goes to infinity and price tick size goes to zero, a pair of measure-valued processes representing the sell-side shape and buy-side shape of an order book converges weakly to a pair of deterministic measure-valued processes.

2 - A Model for Queue Position Valuation

Kai Yuan, Columbia University, 3022 Broadway, 4J, Uris Hall, New York, NY, 10027, United States of America, KYuan17@gsb.columbia.edu, Ciamac Moallemi

We develop a model for valuing limit orders based on their relative queue position by identifying two important components of positional value: a static component that relates to the tradeoff at an instant of trade execution between earning a spread and incurring adverse selection costs; a dynamic component, which captures the optionality associated with the future value that accrues by locking in given queue position. Moreover, the model can be empirically calibrated.

3 - High Frequency Trading in Limit Order Markets: Stochastic Modeling and Asymptotic Analysis

Rama Cont, Imperial College, London, SW7 2AZ, United Kingdom, r.cont@imperial.ac.uk

We propose a stochastic model for a limit order market which captures the coexistence of high and low frequency and examine the consequences of HFT on price dynamics, volatility and liquidity. A detailed study of empirical HF data points to a multi-scale heavy traffic regime in which the limit order book may be described as a measure-valued Markov process, solution of a stochastic free boundary problem whose properties give some insight into how HFT affects price and order book dynamics.

4 - Scaling Limit of a Limit Order Book Model via the Regenerative Characterization of Lévy Trees

Peter Lakner, NYU Stern School of Business, New York, NY, United States of America, plakner@stern.nyu.edu, Josh Reed

We consider a one-sided limit order book model in a high frequency regime. Our main result shows that in the case where the mean displacement from the current best bid at which a new order is placed is positive, the measure-valued process describing the whole limit order book converges to a simple functional of reflected Brownian motion. A cornerstone of our approach is the regenerative characterization of Lévy trees proved by Weill.

■ TC65

Parc- Cyril Magnin II

Industry Job Search Panel

Cluster: INFORMS Career Center

Invited Session

Chair: Anne Robinson, Director of Supply Chain Strategy and Analytics, Verizon Wireless, Anne.Robinson@VerizonWireless.com

1 - Industry Job Search Panel

Moderator: Anne Robinson,Director of Supply Chain Strategy and Analytics, Verizon Wireless, Anne.Robinson@VerizonWireless.com, Panelists: Daniel H. Fylstra, Theresa Kushner, Thomas Olavson

MIT claims that 67% of companies see having analytics capabilities as a driver for their competitive advantage. However, according to TDWI, 46% of companies listed inadequate staffing or skills as the top barrier for realizing value from their data and analytics investments. What does it take to successfully position yourself for a career in big data and analytics in an organization? How do you identify the right employers who "get it" and will position you on a successful (and lucrative) job path? What are the other skills and leadership qualities required to be successful? Listen to a panel of industry experts answer these questions and more.

■ TC66

Parc- Cyril Magnin III

Panel Discussion on "Publishing in Quality and Reliability: The Editor's Perspective"

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Tirthankar Dasgupta, Associate Professor, Harvard University, 1 Oxford Street, 7th Floor, Harvard Statistics Department, Cambridge, MA, 02138, United States of America, dasgupta@stat.harvard.edu

1 - Voice of the Editor (JQT)

Moderator: Bradley Jones, SAS/JMP, Bradley.Jones@jmp.com

The editor of the Journal of Quality Technology will share his perspectives and experiences with the audience and answer questions pertaining to publication.

2 - Voice of the Editor (Quality and Reliability Engineering International)

Douglas Montgomery, Arizona State University, United States of America, doug.montgomery@asu.edu

The editor of Quality and Reliability Engineering International will share his perspectives and experiences with the audience and answer questions pertaining to publication.

3 - Voice of the Editor (Technometrics)

Peihua Qiu, Professor, University of Florida, 2004 Mowry Road, Gainesville, FL, 32610, United States of America, pqiu@ufl.edu

The editor of Technometrics will share his perspectives and experiences with the audience and answer questions pertaining to publication

4 - Voice of the editor (IIE Transactions)

Jianjun Shi, Professor, Georgia Institute of Technology, 765 Ferst Dr NW, Atlanta, United States of America, jianjun.shi@isye.gatech.edu

The editor of IIE Transactions (Quality and Reliability Engineering) will share his perspectives and experiences with the audience and answer questions pertaining to publication.

■ TC67

Parc- Balboa

Application of Game-Theoretical Methods in Supply Chain, Reliability and Inventory

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Maryam Hamidi, Session Chair, University of Arizona, 1127 E. James E. Rogers Way, Room 111, P.O. Box 210020, Tucson, AZ, 85721, United States of America, mhamidi@email.arizona.edu

1 - Mining Leasing Contracts through Games Theory: Chilean Mine Case Study

Diego Carrasco, Pontificia Universidad Católica de Chile, vicuña mackena 4860, Santiago, RM, 7820436, Chile, dncarras@uc.cl, Maryam Hamidi, Haitao Liao, Rodrigo Pascual

The objective of this article is to present a methodology to assess mining leasing contracts decisions. The modeling of the problem considers a fleet composed of multicomponent equipment, each having different increasing failure rates. This failure rate is affected by the usage intensity given by the lessee to the equipment, and the quality of maintenance given by the lessor. The problem formulation is through games theory. It is tested on a haul trucks fleet operating in a mine in Chile.

2 - Revenue Sharing Contracts When Retailers can be Dishonest

Eda Kemahlioglu-Ziya, Assistant Professor, Poole College of Management at the University of North Carolina, Raleigh, NC United States of America, ekemahl@ncsu.edu, Seb Heese

To investigate the impact of dishonest information transfer, we consider a single-supplier single-retailer supply chain that operates under a contract with a revenue sharing clause, providing the retailer incentive to underreport sales revenues. We study the impact of cheating on the different supply chain constituents. We show that when the retailer can exert sales effort, a supplier might benefit from the retailer's dishonesty.

3 - Impact of Collaborative Incentive on Supply Chain Member Performance

Liyan Wang, Tongji University, Shanghai, China, ker820416@163.com, Minghai Ye

The objective of this paper is to uncover the nature of supply chain collaboration and explore its impact on supply chain member performance based on collaborative incentive. A three level model including a manufacture, a retailer and a salesperson is established based on game theory. The key propositions of the paper are listed as follows: both the manufacturer and the salesperson are beneficiaries of the collaborative incentive, while the retailer benefits or not is uncertain.

4 - Application of Game Theory on Inventory Level Decision Making

Masoud Vaziri, University of Rhode Island, University of Rhode Island, Kingston, RI, 02881, United States of America, masoudvaziri@my.uri.edu, manbir sodhi

Spare parts can be very profitable for corporations. This paper studies spare parts inventory games as N-person non-zero-sum single-shot games involving the OEM and the market in a non-cooperative setup. The OEM decides on its pricing strategy as well as the order-up-to stock level and resulting in a mixed strategy solution.

■ TC68

Parc- Davidson

New Directions in Applied Probability

Sponsor: Applied Probability Society

Sponsored Session

Chair: David A. Goldberg, Assistant Professor, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332, United States of America, dgoldberg9@isye.gatech.edu

1 - State Space Collapse for Critical Multistage Epidemics

Florian Simatos, Researcher, Inria, 23 avenue d'Italie, Paris, 75013, France, florian.simatos@inria.fr

We study a multistage epidemic model generalizing the SIR model, where individuals go through K stages of the epidemic before being removed. Infected individuals infect susceptible ones, who directly go to the same stage of the epidemic; or they go to the next stage of the epidemic. For this model, we identify the critical regime in which we establish diffusion approximations. Surprisingly, the limiting diffusion exhibits an unusual form of state space collapse which we analyze in detail.

2 - Scheduling using Interactive Oracles

Jinwoo Shin, Assistant Professor, KAIST, 291 Daehak-ro, Yuseong-gu, Daejeon, Korea, Republic of, jinwoos@kaist.ac.kr, TongHoon Suk

Since Tassiulas and Ephremides proposed the maximum weight scheduling algorithm in 1992, extensive research efforts have been made for resolving its high complexity issue. In this paper, we resolve the issue by developing a generic framework for designing throughput-optimal and low-complexity scheduling algorithms in constrained queueing networks via establishing a rigorous connection between iterative optimization methods and low-complexity scheduling algorithms.

3 - High-dimensional Estimation with Geometric Constraints
Elena Yudovina, University of Michigan Dept of Statistics, 439 West Hall, 1085 S University Ave, Ann Arbor, MI, 48109, United States of America, yudovina@umich.edu, Yaniv Plan, Roman Vershynin

Consider measuring an (unobserved) vector x in R^n through inner product with some (observed, possibly random) measurement vectors a_1, ..., a_m. The measurements may be nonlinear, e.g. because of clipping; they can even be one-bit, giving only the sign of the inner product. We give a simple procedure for recovering x, which is completely agnostic with respect to the nature of the nonlinearity, and gives essentially the best possible error bounds in several natural models.

4 - A Sensitivity Approach to Model Uncertainty
Henry Lam, Boston University, 111 Cummington Mall, Boston, MA, United States of America, khlam@bu.edu

Virtually any type of performance analysis of stochastic systems builds on model assumptions that, to various extents, deviate from the truth. I will demonstrate an optimization-based methodology to assess the impact of this model error, using Kullback-Leibler divergence as a model discrepancy measurement. Our contribution is a new infinitesimal approximation that reduces the typically difficult optimization problems into tractable simulation problems for suitably defined sensitivity quantities.

■ TC69

Parc- Fillmore

Joint Session ENRE/JFIG: Analysis of Biomass/Biofuel Production: Economic and Environmental Impacts

Sponsor: Energy Natural Resources and the Environment/ Sustainability and Environment & Junior Faculty Interest Group

Sponsored Session

Chair: Halil Cobuloglu, PhD Candidate, Wichita State University, 1845 Fairmount St, Wichita, KS, United States of America, halil.cobuloglu@gmail.com

1 - Supply Chain Design and Management for Biocrude Production via Waste from Pulp & Paper Plants
Mohammad Marufuzzaman, Mississippi State University, Industrial & Systems Engineering, PO Box 9542, Starkville, MS, 39762, United States of America, maruf237@gmail.com, Sushil Poudel, Sandra D. Eksioglu

The objective of this research is to develop an optimization model to design and manage a biocrude supply chain network using waste generated from pulp & paper facilities. We propose a two-phase Analytic Center Cutting Plane algorithm to solve this challenging NP-hard problem. We tested the performance of the algorithm on a case study which we develop using data from the southeast region of U.S. Furthermore, we employ ArcGIS to visualize and validate the results from the optimization model.

2 - Sequential Location-Allocation Optimization of Fast Pyrolysis Facilities
Yihua Li, Iowa State University, 0076 Black Engineering, Ames, IA, 50011, United States of America, yihuali@iastate.edu, Guiping Hu, Wright Mark

A mixed integer linear programming (MILP) model is formulated to perform sequential expansion planning of biofuel production system with fast pyrolysis, hydroprocessing and refining technology. A case study in Iowa shows a sequential spatial construction under different levels of processing goal and the potential of drop-in fuels production in Iowa.

3 - Food vs Biofuel: An Optimization Approach to Analyze Land-use Competition and Environmental Impacts
Halil Cobuloglu, PhD Candidate, Wichita State University, 1845 Fairmount St, Wichita, KS, United States of America, halil.cobuloglu@gmail.com, Esra Buyuktahtakin

In this study, we develop a multi-objective mixed-integer optimization model to investigate trade-offs and competition between biomass and food production. The model maximizes total benefits and provides optimal decisions at the farm level while considering economic and environmental impacts such as soil erosion, GHG emission, nitrogen pollution, biodiversity, and food sustainability. Results are demonstrated with an application in Kansas by considering switchgrass and corn production.

4 - Bioenergy Supply Chain Network Design Model to Enhance Biomass Quality Characteristics
Krystel Castillo, Assistant Professor, The University of Texas at San Antonio, One UTSA Circle, San Antonio, TX, 78249, United States of America, krystel.castillo@utsa.edu, Erin Webb

This paper has two main contributions. First, a biomass supply chain network design model including quality uncertainties as well as operational costs is presented in order to capture the impact of the prevention or pretreatment activities to improve the moisture and ash content and reduce the energy consumption in the drying process and ash disposal at the conversion facility. Second, a metaheuristic method is proposed to solve this problem.

■ TC70

Parc- Hearst

Sustainability I

Contributed Session

Chair: Raja Jayaraman, Assistant Professor, Khalifa University, Department of Industrial & Systems Engin, Abu Dhabi, United Arab Emirates, raja.jayaraman@kustar.ac.ae

1 - A Case Study for Analyzing Air Pollution Impact Factors
Vahid Hosseini, Assistant Professor, Sharif University of Technology, Department of Mechanical Engineering, Tehran, Iran, vhosseini@sharif.edu, Hossein Shahbazi, Masoud Hamedi

Tehran is the capital city of Iran and one of the largest cities in western Asia, ranked 19th in the world with a population of 8.5 million. Air pollution is a major problem in Tehran, and has been influenced by several factors during recent years including rapid population growth, increasing personal car ownership, low technology level of produced vehicles and use of old vehicles with high fuel consumption. This study aims to investigate the impact of such parameters on Tehran air quality.

2 - Application of Green Supply Chain Management Strategies in Various Industries
Suna Cinar, PhD Student, Wichita State Unniversity, Wichita State University, Industrial Eng, 1845 Fairmount, Wichita, KS, 67260-0035, United States of America, sxcinar@wichita.edu, M Bayram Yildirim

Due to increasing environmental awareness, companies around the world want to become environmental friendly by reducing the amount of waste produced, amount of energy used, and by meeting the current environmental regulations. Green supply chain management is one of effective practices that can help industries including manufacturer, supplier to collaborate and create a green supply chain in their organization.

3 - Using Priming to Design Features that Influence Sustainable Purchases
Erin MacDonald, Assistant Professor, Iowa State University, 2020 Black Engineering Building, Ames, IA, 50011, United States of America, erinmacd@stanford.edu, Jinjuan She

This research strives to communicate a product's sustainability to the consumer through product features that trigger the consumer to value and seek further sustainability information during purchase. A novel design technique uses psychological priming to help designers create such features. We found that priming successfully enhances designers' skills. As tested with realistic prototypes, the features created affect consumers' thoughts of sustainability during product evaluation and purchase.

4 - Wal-Mart's Dilemma: Sales Growth vs. Inventory Growth
Seungjae Shin, Mississippi State Unveristy, Meridian, 2212 5th Street, Meridian, MS, 39301, United States of America, sjshin1204@gmail.com

Wal-Mart's business target is making a higher sales growth rate than inventory growth rate. Comparing with financial ratios of its competitors, Wal-Mart has significantly better ratios for day-in-inventory and cash-conversion-cycle. Regression analysis reveals that day-in-inventory, cash-conversion-cycle, and per employee cost-efficiency have similar effect on both sales growth rate and inventory growth rate. Supply chain ratio has more effect on inventory growth rate than sales growth rate.

5 - Sustainability and Firm Performance: The Mediating Role of Innovation
Paulo Gomes, Visiting Assistant Professor, Babson College, Babson Park, Wellesley, MA, United States of America, pgomes@babson.edu, Graça Silva

Do you need to innovate in order to profit from being green? This study investigates the mediating role of innovation on the relationship between sustainability practices and firm performance based on statistical analysis of data from manufacturing firms in Europe. We distinguish between three types of practices inbound, outbound and production. Results show that product innovation mediates the relationship between sustainability practices and sustainable performance.

■ TC71

Parc - Lombard

Pricing and Computation in Package Auctions

Cluster: Auctions

Invited Session

Chair: Ben Lubin, Assistant Professor, Boston University, 595 Commonwealth Ave, Room 621A, Boston, MA, 02215, United States of America, blubin@bu.edu

1 - Computational Techniques for Incentive Auctions
David Bergman, School of Business, University of Connecticut, One University Place, Stamford, CT, United States of America, david.bergman@business.uconn.edu, Andre Cire, Robert Day

The Federal Communications Commission is creating rules for and planning to run a voluntary incentive auction for broadcast TV spectra. In this talk we discuss how to model the problem of assigning stations to channels in the final repacking stage of the auction, and discuss various computational techniques that can be applied to solve for a valid repacking, including recently introduced binary decision diagram-based optimization.

2 - Informative Pricing in Package Auctions
Sebastien Lahaie, Researcher, Microsoft Research, 641 Avenue of the Americas, New York, NY, 10011, United States of America, slahaie@microsoft.com

The notion of informative prices is important in package auctions and motivates design choices such as linear prices, but the concept remains informal in the literature. Prices are informative if they give good estimates of the final cost of bundles, and drive the auction to convergence in a small number of rounds. We formalize the concept and derive implications using ideas from online and statistical learning.

3 - A Bayes-Nash Equilibrium Analysis of Payment Rules for Core-Selecting Combinatorial Auctions
Ben Lubin, Assistant Professor, Boston University, 595 Commonwealth Ave, Room 621A, Boston, MA, 02215, United States of America, blubin@bu.edu, Benedikt Bunz, Sven Seuken

In this paper, we use computational methods to study approximate Bayes-Nash equilibria of payment rules for core-selecting combinatorial auctions. Within these equilibria, we study the incentives, fairness, and efficiency of a wide range of existing and novel payment rules.

■ TC72

Parc- Stockton

Energy III

Contributed Session

Chair: Wei Yuan, PhD candidate, IMSE,USF, 4202 East Fowler Avenue, ENB 118, Tampa, FL, 33620, United States of America, weiyuan@mail.usf.edu

1 - Reinforcement Learning for Energy Consumption Prediction of Converter Steelmaking Process
Yanyan Zhang, Northeastern University, 3-11 Wenhua Road, Heping District, Shenyang, China, zhangyanyan@ise.neu.edu.cn, Lixin Tang

The energy consumption prediction aims at estimating the amount of energy resources to be used. The problem is challenging owing to the coupling of energy consumption, regeneration, conversion, and the time-varying characteristic of production environment. This paper develops SVM based Q-learning method to deal with the energy prediction problem. Experimental results show that RL method is stable and with no less than 95% prediction accuracy.

2 - Cost-effective Power Grid Defending with Transmission Line Switching
Wei Yuan, PhD candidate, IMSE,USF, 4202 East Fowler Avenue, ENB 118, Tampa, FL, 33620, United States of America, weiyuan@mail.usf.edu, Bo Zeng

Optimal power grid protection through defender-attacker-defender (DAD) model is a state-of-art approach for power system defending problem. In this research, we introduce transmission line switching as a cost-effective post-contingency mitigation operation into the DAD model. Exact algorithm is designed and numerical studies validate the effectiveness of transmission switching.

3 - Dynamic Allocation of Mobile Plants to Monetize Associated or Stranded Natural Gas under Uncertainty
Siah Hong Tan, PhD Candidate, Massachusetts Institute of Technology, 77 Massachusetts Ave, Cambridge, MA, 02139, United States of America, tansh@mit.edu, Paul Barton

Associated or stranded gas presents a challenge to monetize due to its low volume and lack of supporting infrastructure. Mobile plants which produce GTL fuel or LNG on a small scale have been identified as attractive but yet unproven routes to gas monetization, We examine a multi-stage optimization framework which allocates mobile plants in a field under uncertainty of prices, supply and demand and perform a case study of monetizing associated gas in the Bakken shale play.

4 - Some Polyhedral Results for DCOPF Problem with Switching
Burak Kocuk, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States of America, burak.kocuk@gatech.edu, Santanu Dey, Andy Sun

Transmission line switching in power networks has become increasingly important in practice. However, underlying theory of this problem is not well-studied. In this work, we first prove some hardness results. Then, we propose a new formulation based on cycles, which is used to find valid inequalities and polyhedral results. Furthermore, we consider the problem with cardinality constraint. Finally, numerical results are provided.

5 - A Two-stage Price-based Unit Commitment Model for GENCOs with Wind Penetration
Yidong Peng, North Dakota State University, Industrial & Manufacturing Engineering, 1410 14th Avenue North Room 202 CIE, Fargo, ND, 58102, United States of America, yidong.peng@ndsu.edu, Jing Shi

In this study, we propose a two-stage stochastic programming model to solve Price-Based Unit Commitment problem (PBUC) for GENCOs with wind penetration. The proposed model considers both day-ahead and real-time electricity markets. The first stage deals with GENCOs' bidding strategies in day-ahead market, as well as the day-ahead PBUC, while the second stage considers GENCOs' real time actions in corresponding to the electricity price in the real-time market and volatility of wind power output.

■ TC73

Parc- Mission I

Storage and Demand Side Resources in Power Systems

Sponsor: Energy, Natural Res & the Environment/Energy

Sponsored Session

Chair: Yongpei Guan, University of Florida, Weil 413, Gainesville, FL, 32611, United States of America, guan@ise.ufl.edu

1 - Optimal Control of Plug-In Hybrid Electric Vehicles with Market Impact and Risk Attitude
Lai Wei, PhD Candidate, University of Florida, 387 Maguire Village, Apt 2, Gainesville, FL, 32603, United States of America, laiwei@ufl.edu, Yongpei Guan

We develop optimal electricity storage control policies for plug-in hybrid electric vehicles for the benefit of an energy market participant. We explore the cases for aggregators to participate only in a real-time market and in both the real-time and day-ahead markets. For each developed model, we analyze the properties of the value function and explore the corresponding optimal policy structure. Finally, through numerical study, we discuss the insights.

2 - Determining the Marginal Cost for Pumped-storage Plants for use in the Real-time Market
Goran Vojvodic, PhD Student, George Washington University, Department of Decision Sciences, School of Business, Washington, DC, 20052, United States of America, goranv@gwu.edu, David Morton, Ahmad Jarrah

In the energy sector, there is a huge interest in grid-level storage and efficiency in terms of resource usage. We deal with both topics and argue that a precise estimation of the marginal cost for pumped-storage units is needed. We introduce the concept of forward-looking thresholds and provide a stochastic optimization-based approach in order to estimate the thresholds. We demonstrate the stability and quality of our methodology and its superiority compared to an expected value based approach.

3 - Large Scale Optimization in Energy Systems
Mona Asudegi, University of Maryland, 9348 Cherryhill Road, Apt 811, College Park, MD, 20740, United States of America, asudegi@umd.edu, Ali Haghani

Developing an advanced system which can accommodate green energy and technologies such as solar, wind energy, and many more in the electric power grid and also applying an appropriate demand management system are fundamental keys toward resolving some of the energy concerns in the world. This study is focused on developing a demand response model and also an efficient heuristic algorithm for solving the model for the electric grid system.

4 - Value of Pumped Storage Hydropower in Ancillary Service Markets
Zhi Zhou, Argonne National Laboratory, 9700 South Cass Avenue, Argonne, IL, 60439, United States of America, zzhou@anl.gov, Thomas Veselka, Vladimir Koritarov, Matthew Mahalik, Todd Levin

Energy storage facilities are becoming increasingly important in integrating variable generation into the power grid. Besides energy price arbitrage, a pumped storage plant can provide various ancillary services. We model the optimal operation strategy of a pumped storage system in a two-settlement electricity market and the associated ancillary service market. The value of pumped storage is analyzed for different levels of variable renewable generation in the system.

■ TC74

Parc- Mission II

Stochastic Programming in Energy

Sponsor: Energy, Natural Res & the Environment/Energy

Sponsored Session

Chair: Canan Uckun, Argonne National Laboratory, 9700 S. Cass Avenue, Lemont, IL, 60439, United States of America, cuckun@anl.gov

1 - Capacity Adequacy and Revenue Sufficiency in Electricity Markets with Wind Power
Todd Levin, Computational Engineer, Argonne National Laboratory, 9700 S. Cass Ave., Bldg. 221, Argonne, IL, United States of America, tlevin@anl.gov, Audun Botterud

We present a computationally efficient stochastic MIP that determines optimal generator expansion decisions, as well as periodic unit commitment and dispatch. The model is applied to analyze the impact of increasing wind power capacity on the optimal generation mix and the profitability of thermal generators. We find that increasing wind penetration reduces energy prices while the prices for operating reserves increase. Additionally, no thermal units are profitable without scarcity pricing.

2 - Optimizing a Battery Storage for the Regulation Service using Approximate Dynamic Programming
Bolong Cheng, Princeton University, Olden Street Engineering Quadrangle, Electrical Engineering, Princeton, NJ, 08544, United States of America, bcheng@princeton.edu, Warren Powell

There is growing interest in the use of battery storage to provide ancillary services to the electricity grid. We focus on the frequency regulation market of the PJM grid, where the storage unit needs to react to a control signal every two seconds. In addition, we also want to minimize the energy consumption during the optimization horizon and control the degradation from frequent charge/discharge cycles. We develop an approximate dynamic programming algorithm that optimizes the use of battery.

3 - Stochastic Optimization for Unit Commitment – A Review
Qipeng Zheng, Assistant Professor, University of Central Florida, Industrial Engineering & Management Sys, Orlando, FL, 32817, United States of America, Qipeng.Zheng@ucf.edu, Jianhui Wang, Andrew Liu

With the high penetration of renewables, increasing deregulation of the electricity industry and growing demands on system reliability, recent research has been focusing on transition from traditional deterministic approaches to stochastic optimization for unit commitment. Related literature has grown rapidly in the past several years, this talk is to review the works that have contributed to the modeling and computational aspects of stochastic optimization based UC, and discuss future research.

4 - An Improved Stochastic Unit Commitment Formulation to Accommodate Wind Power
Canan Uckun, Argonne National Laboratory, 9700 S. Cass Avenue, Lemont, IL, 60439, United States of America, cuckun@anl.gov, Audun Botterud, John Birge

The expansion of renewable resources, especially weather-based resources such as wind, creates more uncertainty and variability in the operation of the power grid. In this work, we propose an improved stochastic programming formulation to address these challenges. The proposed formulation improves the standard two-stage stochastic unit commitment problem by producing dynamic unit commitment decisions over time rather than fixing them in the first stage.

■ TC75

Parc- Mission III

Reliability I

Contributed Session

Chair: Arda Vanli, Assistant Professor, Industrial and Manufacturing Engineering Department. Florida State University, 2525 Pottsdamer St., Tallahassee, FL, 32310, United States of America, avanli@fsu.edu

1 - Condition Monitoring of Composites with Guided-wave Sensors
Arda Vanli, Assistant Professor, Industrial and Manufacturing Engineering Department. Florida State University, 2525 Pottsdamer St., Tallahassee, FL, 32310, United States of America, avanli@fsu.edu, Spandan Mishra

This study proposes a new statistical approach for damage identification and degradation monitoring of composites with guided-wave sensors. The features of Lamb-wave sensor signal that are sensitive to through-thickness cracks and delaminations are first identified using principle component analysis. An updating strategy is developed for Bayesian posterior distribution of the features with new condition data to make continuous assessment of the condition of the structure.

2 - Optimal Allocation of Resources in Reliability Growth Testing
MohammadHossein Heydari, University of Arkansas, Department of Industrial Engineering, 4129 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, mhheydar@uark.edu, Kelly Sullivan, Edward Pohl

Reliability growth testing seeks to identify and remove failure modes in order to improve the reliability of a product entering the market. We seek to deploy limited testing resources across a series-parallel system (i.e., at the system, subsystem, and component levels) in effort to maximize the reliability of a product upon entering the market, considering cost-benefit tradeoffs in testing at each level. We present a simulated annealing heuristic and analyze results for a set of experiments.

3 - A Synthesis of Feedback and Feedforward Control for Stationary and Nonstationary Disturbance Models
Lihui Shi, data scientist, eBay, 523 122nd PL Apt 3, Bellevue, WA, 98005, United States of America, shilihui@uw.edu, Kailash Kapur

Process adjustment strategy is an important part of the process improvement methods. For continuous improvement and proactive strategies, we propose the periodic shift disturbance models, and investigate the feedforward control application from a new disturbance decomposition framework. We combine feedforward control with feedback control for maintaining the stability of the process and delivering products at target values.

4 - Design Decision Process and Sensitivity Analysis for Multi-state Systems with Multi-state Components
Carlos Solorio, CETYS University, Calzada CETYS S/N, Mexicali, Mexico, carlos.solorio@cetys.mx

The level of complexity in the process of designing real life systems has grown tremendously. Highly reliable systems are needed, considering this high level of complexity. The analysis should consider the way components affect the whole system reliability. The performance measures developed are used for comparing two or more systems at a point in time and over a time horizon, and they also consider the disutility function, which help in selecting the best system.

5 - Random Field Modeling with Insufficient Snapshots for Probability Analysis and Design
Zhimin Xi, Assistant Professor, University of Michigan - Dearborn, 4901 Evergreen Rd, Dearborn, MI, 48128, United States of America

This paper proposes a new random field modeling method using a Bayesian Copula. The proposed method is composed of three key ideas: (i) determining the marginal distributions of random field variables, (ii) determining optimal Copulas to model the bivariate distributions of the random field variables, and (iii) modeling a joint probability density function of the random field variables. Two case studies were employed for the purpose of demonstrating.

■ TC76

Parc- Embarcadero

Practical & Tactical Pricing Decision Support Approaches

Sponsor: The Practice Track

Sponsored Session

Chair: Jim Mullin, VP, Planning Analytics, Veritec Solutions, 824 Miramar Terrace, Belmont, CA, 94002, United States of America, Jim@veritecsolutions.com

1 - Practical Tactical Pricing Decision Systems - Industry Examples
Jim Mullin, VP, Planning Analytics, Veritec Solutions, 824 Miramar Terrace, Belmont, CA, 94002, United States of America, Jim@veritecsolutions.com

This talk will provide an overview of practical decision support systems used for helping companies make more efficient and profitable pricing decisions. Examples of applications in several industries will be discussed.

2 - Using OR Analytics in Social Media Advertising
Brad Smallwood, VP, Advertising, Facebook, bsmallwood@fb.com

This talk will cover practical quantitative methods employed by social media companies to support tactical decision-making in advertising pricing and targeting. Specific emphasis will be given to real world examples over the last few years as the industry has grown rapidly and analytic techniques have evolved.

3 - Effective Pricing Decisions and Process for the Self-Storage Industry
Kevin Bowman, Director, Pricing & Revenue Management, kevin.bowman@storage-mart.com

This talk provides some background on the history and evolution of the self-storage industry, with a focus on how prices are set. In the last 3-4 years, substantial progress has been made in the use of data analytics to support a more formal pricing process. The result is that the industry leaders have moved towards a proactive, data-driven approach that is enabling them to separate their performance from slower-movers.

■ TC77

Parc- Market Street

Joint Session Analytics/HAS: Clinical Analytics, Informatics and Clinical Decision Making

Sponsor: Analytics & Healthcare Applications

Sponsored Session

Chair: John Zaleski, Chief Informatics Officer, Nuvon, Inc., 4801 S. Broad Street, Suite 120, Philadelphia, PA, 19112, United States of America, jzaleski@nuvon.com

1 - Early Warning Notifications Developed Using Medical Device Data
John Zaleski, Chief Informatics Officer, Nuvon, Inc., 4801 S. Broad Street, Suite 120, Philadelphia, PA, 19112, United States of America, jzaleski@nuvon.com

While much of the automatically collected medical device data in inpatient wards is obtained for the purpose of charting and documentation, collecting such data can offer greater clinical benefit. This presentation will survey some of the protocol- and guideline-based patient care management directives and detail how commonly-collected and automated medical device data can facilitate rapid decision making.

2 - Critical Medical Decisions
Adam Seiver, Senior Director and Chief, Medical Affairs, Philips Healthcare, Therapeutic Care, 27869 Saddle Court, Los Altos Hills, CA, 94022, United States of America, adam.seiver@philips.com

Despite massive investment, the electronic medical record disappoints when helping critical care clinicians make and execute high-quality decisions. This talk will: 1. Present three scenarios that highlight features of critical care decision-making. 2. Propose a decision-analytic (DA) framework for analyzing critical care decisions 3. Storyboard a DA-based computer system under development intended to help the critical care team make and execute high-quality critical care decisions.

3 - Modular Multi-parameter Clinical Decision Support on an EMR-independent Platform
Jim Fackler, Associate Professor, Johns Hopkins Univ. Sch. of Medicine, 318 Overhill Road, Baltimore, MD, 21210, United States of America, jim@jhmi.edu

Bridging data and decisions in an intensive care unit can be, quite literally, life and death. 300 data streams of varied data density and fidelity come from one patient. Although time-series analyses of single parameters adds value (e.g. heart rate variability), decisions will best be supported with multi-parameter "chunking" of data for analytics. This talk will discuss the role of 1) a modular clinical decision support system and 2) an EMR-independent architecture for its implementation.

■ TC78

Parc- Mason

Decision Analysis 4

Contributed Session

Chair: Jing Chen, Associate Professor, Dalhousie University, 6100 University Avenue, Halifax, NS, B3H 4R2, Canada, jchen@dal.ca

1 - Customer Returns, Pricing, and Personalization in an Online-Retail Dual Channel
Jing Chen, Associate Professor, Dalhousie University, 6100 University Avenue, Halifax, NS, B3H 4R2, Canada, jchen@dal.ca, Bintong Chen

The retailing industry today increasingly distributes product through both retail and online channels. Advances in data collection and analytics technology make it possible to implement personalized pricing in an online channel. An online channel, however, usually incurs significantly higher rates of customer returns. We examine how customer returns and personalized pricing affect a retailer's decision on whether to add an online channel in addition to a retail channel.

2 - Analysis of Supplier Performance using MAUT and Simulation
Hardik Bora, Iowa State University, Ames, IA, United States of America, hdbora@iastate.edu, Anuj Mittal, Pratik Pingle, Caroline Krejci

The analysis of supplier performance and identification of suppliers for improvement is essential to ensure product quality and to allocate organizational resources rationally. We describe a methodology that combines multi-attribute utility theory and Monte Carlo simulation to analyze various supplier performance metrics and rank suppliers accordingly, using case study data.

3 - The Effect of Educational Programs on Individual Protective Behaviors Toward Seasonal Influenza
Elnaz Karimi, Concordia University, 3440 Durocher, Apt.1405, Montreal, H2X2E2, Canada, karimi.lnz@gmail.com, Ketra Schmitt, Ali Akgunduz

A Health Belief Model (HBM)-based questionnaire was administered to two groups of undergraduate students to determine the predictors of seasonal influenza interventions. While the control group received only the questionnaires, the treatment group was subjected to an educational program about flu. The behavioral predictors in both groups were assessed based on a multivariate regression analysis.

4 - Bargainers Negotiating Attributes with Strict Tradeoffs
Michael Menasco, Emeritus, at University, San Bernardino, 9132 Hoopa Drive, Kelseyville, CA, 95451, United States of America, menasco_sr@mchsi.com, Abhik Roy

We construct necessary conditions for two bargainers negotiating over n attributes in a lexicographic order of attributes. We show negotiated outcomes are equivalent in both preference (utility) and attribute spaces. We begin with the basic case, whereby, there is constant rate of substitution between two attributes x and y (Keeney and Raiffa, 1976)and apply these results to three attributes (x, y, z).

5 - A Hierarchical Model for Making General Search Decisions
Matthew Oster, Pacific Northwest National Laboratory, 902 Battelle Blvd, Richland, WA, United States of America, matthewoster@gmail.com, Dale Henderson, Samrat Chatterjee

Searching for a lost plane at sea or a buried nuclear warhead requires careful planning and resources. Decisions related to choice of strategies, tactics, and resources are often made at different administrative levels. We propose a hierarchical structuring of this decision space in which many search policies may be shaped.

■ TC79

Parc- Powell I

Joint Session DAS/SPPSN: Decision Analysis in Policy Applications

Sponsor: Decision Analysis & Public Programs, Service and Needs
Sponsored Session

Chair: Karen Jenni, Insight Decisions, 2200 Quitman St, Denver, CO, 80212, United States of America, kjenni@insightdecisions.com

1 - Decision Analysis without Decision Makers
Karen Jenni, Insight Decisions, 2200 Quitman St, Denver, CO, 80212, United States of America, kjenni@insightdecisions.com

For a recent systematic multi-attribute based evaluation of alternative nuclear fuel cycles, current decision-makers specified only the factors that should be considered. Instead of further guidance on value functions, we were directed to consider multiple policy perspectives. We will describe several innovative techniques used to assure that an appropriately broad set of value perspectives could be considered, and the benefits of those approaches to the study sponsors.

2 - Turning Water into Wine: Decision Analysis Applied to Water Issues in the Heart of Napa Valley
Timothy Nieman, President, Decision Applications, 1390 Grove Court, Saint Helena, Ca, 94574, United States of America, tnieman@decisionapplications.com

Application of rigorous decision analysis framing and modeling methods can be very useful to small municipal government decision making, yet these applications face unique challenges. We discuss an application to water management issues in Napa Valley using Monte Carlo based climate modeling as a foundation for policy decisions, illustrating both the challenges and rewards of institutionalizing better decision methodologies at this level of government.

3 - Choosing Cleanup Strategy for Canada's Faro Mine – Challenges for Environmental Decision Analysis
Lee Merkhofer, Lee Merkhofer Consulting, 22706 Medina Court, Cupertino, CA, 95014, United States of America, lmerkhofer@prioritysystem.com

A description of a collaborative decision analysis, wherein members of Canada's Federal government, Yukon government, Indian tribes, and local citizens worked together to see if they could reach agreement on what to do about the abandoned Faro mine, a "toxic nightmare" that was once the largest lead and zinc mine in the world. Challenges and limitations of DA for resolving controversial environmental policy problems are well illustrated.

4 - Decision Analytical Applications in Ecosystem Recovery Planning
Bill Labiosa, Regional Science Coordinator, U.S. Geological Survey, Northwest Region, 909 1st Ave, 8th Floor, Seattle, WA, 98104, United States of America, blabiosa@usgs.gov

Within the context of the ecosystem recovery planning processes of the lead State agency in Puget Sound, WA, I will focus on two examples of the use of decision analytical framing and tools: 1) multi-attribute models to prioritize ecosystem recovery strategies involving multiple agencies and diverse stakeholders and 2) probability models to assess and represent uncertainty within a large model-based expert assessment used to rank "ecosystem threats" at watershed and coastal ecosystem scales.

■ TC80

Parc- Powell II

Recent Advances in Utility Theory

Sponsor: Decision Analysis
Sponsored Session

Chair: Ali Abbas, Professor, University of Southern California, Industrial and Systems Engineering, Price School of Public Policy, Los Angeles, CA, United States of America, aliabbas@illinois.edu

1 - Multiattribute Utility Functions Satisfying Mutual Preferential Independence
Ali Abbas, Professor, University of Southern California, Industrial and Systems Engineering, Price School of Public Policy, Los Angeles, CA, United States of America, aliabbas@illinois.edu, Zhengwe Sun

We discuss the general form of multiattribute utility functions that satisfy the ordinal condition of mutual preferential independence, and present methods for their assessments.

2 - Expected Utility, Parameter Uncertainty and Narrow Framing
Manel Baucells, USC Center for Social and Economic Research, 12025 Waterfront Drive, Playa Vista, Ca, 90094, United States of America, mbaucells@gmail.com, Rakesh Sarin

Can decisions made in isolation be optimal for the grand problem? For monetary decisions, we offer a simple proof that only logarithmic utility permits narrow framing in the presence of learning. Under parameter uncertainty, we show that narrow framing, learning, and ambiguity aversion cannot coexist. With no learning, aversion to parameter uncertainty reduces the optimal amount invested, and we provide a heuristic support for partial Kelly strategies based on such aversion.

3 - Multiattribute Ordinal Utility Functions
David Bell, Harvard Business School, Boston MA, United States of America, dbell@hbs.edu, Ali Abbas

We discuss desirable conditions that allow practical assessment of multiattribute ordinal utility functions.

4 - Revisiting Even Swaps
Debarun Bhattacharjya, IBM T.J. Watson Research Center, 1101 Kitchawan Road, Route 134, Yorktown Heights, NY, 10598, United States of America, debarunb@us.ibm.com, Jeffrey Kephart

Even swaps (Hammond et al. 1998, 1999) is an interactive method that solves deterministic multi-attribute decision problems by iteratively removing columns and rows from the consequence table representation of the problem. We revisit the even swaps method, presenting (i) new properties such as the conditions under which an even swap is feasible; (ii) heuristics including a Bayesian method that learns preferences while guiding the user; and (iii) results from extensive experiments.

■ TC81

Parc- Divisadero

Social Media and Network Analysis in Data Mining

Sponsor: Data Mining
Sponsored Session

Chair: Onur Seref, Assistant Professor, Virginia Tech, Pamplin 1007, Blacksburg, VA, 24061, United States of America, seref@vt.edu

1 - Successful Delivery in Vehicle Routing
Fahrettin Cakir, University of Iowa, Department of Management Sciences, Iowa City, 52242, United States of America, fahrettin-cakir@uiowa.edu

Recent trend in businesses is to explore big data to discover facts they did not know before. Researchers resort to data-mining to increase business knowledge. However, there has been relatively little attention paid to the vehicle routing problem. Specifically, we focus on the problem of making successful delivery to locations. We study the correlation between the probability of successful delivery between locations and show why this information is valuable for logistics companies.

2 - Influence-Guided Community Detection in Social Networks
Wenjun Wang, PhD Student, The University of Iowa, S283 Pappajohn Business Building, Iowa City, IA, 52242, United States of America, wenjun-wang@uiowa.edu, Nick Street

Using a new influence cascade model, we proposed an effective algorithm (IGSK) for community detection in binary networks. In this paper, we extend it to weighted networks to incorporate the weights on edges. Moreover, we present a novel influence-guided label propagation algorithm (IG-LPA) to uncover the hierarchical community structure in social networks. Tests on real-world networks and synthetic benchmarks demonstrates its excellent performance in terms of both accuracy and efficiency.

3 - Corporate Competitive Actions on Social Media: An Empirical Analysis
Alan G. Wang, Virginia Tech, Blacksburg, United States of America, alanwang@vt.edu, Yuhong Li, Weiguo Fan

An increasing number of firms have adopted social media for various business purposes. We focus on two dominant social media platforms, Facebook and Twitter, and empirically examine corporate competitive actions (CA) in social media. We aim to reveal the types of competitive actions undertaken by corporates on social media, the differences in competitive actions between social media and traditional media, and the effect of social media competitive actions on corporate performances.

4 - A Computational Rhetoric Framework for Mining Online Stock Commentaries
Onur Seref, Assistant Professor, Virginia Tech, Pamplin 1007, Blacksburg, VA, 24061, United States of America, seref@vt.edu, Michelle Seref, Alan Abrahams

We develop a computational rhetoric methodology that combines data mining, machine learning, and natural language processing to analyze rhetorical moves in online stock pitch arguments of players from an online investment game. We derive predictive models to determine a player's stock prediction accuracy and their influence in their online community. We compare our framework to conventional text mining methods to highlight the contribution of our computational rhetoric approach.

■ TC82

Parc- Haight

MCDM & Service Science: Theory and Applications

Sponsor: Multiple Criteria Decision Making

Sponsored Session

Chair: Adiel T. de Almeida Filho, Assistant Professor, Universidade Federal de Pernambuco, Caixa Postal 7471, Recife, PE, 50630-971, Brazil, adieltaf@googlemail.com

1 - Tackling Uncertainty in Complex MCDA and MAUT Problems
Lisa Scholten, Eawag, Swiss Federal Institute of Aquatic Science and Technology, Ueberlandstrasse 133, P.O. Box 611, Duebendorf, ZH, 8600, Switzerland, lisa.scholten@eawag.ch, Nele Schuwirth, Peter Reichert, Judit Lienert

We present a new approach for tackling uncertainties in preference elicitation and predictive modeling of complex MCDA/MAUT problems and apply it to water infrastructure planning in Switzerland. A two-step procedure for preference elicitation is combined with uncertainty and global sensitivity analyses (UA, GSA). We will show the usefulness of UA and GSA to explore the importance and contribution of often ignored uncertainties and to focus on those crucial for discriminating alternatives.

2 - Integrating Stakeholders in an MCDA-process for Sustainable Water Infrastructure Planning
Judit Lienert, Dr., Eawag, Swiss Federal Institute of Aquatic Science and Technology, Ueberlandstrasse 133, P.O. Box 611, Duebendorf, ZH, 8600, Switzerland, judit.lienert@eawag.ch, Jun Zheng, Lisa Scholten

We focus our talk on stakeholder participation in an exemplary MCDA for sustainable water infrastructure planning. We combined a stakeholder with a social network analysis to identify main actors and their objectives. These were confirmed in a group workshop, in which we also generated alternatives for water infrastructures, and socio-economic future scenarios. Preference elicitation for the MCDA was done online and in interviews. We present main results of the case study and of lessons learnt.

3 - Examining Customer Service Features on Retail Websites
Kaveepan Lertwachara, Professor, California Polytechnic State University, 1 Grand Avenue, San Luis Obispo, CA, 93407-0304, United States of America, klertwac@calpoly.edu, Anteneh Ayanso

This research examines customer service functionalities implemented on top online retail sites in the U.S. Our study aims to determine the relationship between retailers' customer service performances, website traffic, and online sales. Our analysis is based on the Customer Service Life Cycle (CSLC) theory which includes four customer service stages: Requirements, Acquisition, Ownership, and Retirement.

4 - Service Design & Optimization in a Multi-channel Customer Support Environment
Ehud Rattner, University College Dublin, School of Business, Belfield, Dublin 4, Ireland, ehud.rattner@ucdconnect.ie, Vincent Hargaden, Paula Carroll

We develop a framework for service design and delivery in a multi-channel customer support environment. Using a linear programming approach, we optimize agent allocation, where the objective function is a weighted abandon rate. Hard constraints include agent availability and business metrics, time for agent training is a soft constraint.

■ TC83

Parc- Sutro

Optimization Models and Algorithms for Data Mining with Uncertainties

Sponsor: Data Mining

Sponsored Session

Chair: Neng Fan, University of Arizona, Systems and Industrial Engineering, Tucson, AZ, United States of America, nfan@email.arizona.edu

1 - Support Vector Machine Classification with Robust Chance Constraints
Ximing Wang, University of Florida, Gainesville, FL, 32611, United States of America, x.wang@ufl.edu, Panos Pardalos

In this talk, we explored approximation schemes for robust chance constraints in support vector machine classification assuming the moment information of the uncertain data are given. With an exact approximation and solving algorithm, the problem can be solved efficiently.

2 - Data-driven Support Vector Machines with Uncertainties
Neng Fan, University of Arizona, Systems and Industrial Engineering, Tucson, AZ, United States of America, nfan@email.arizona.edu, Elham Sadeghi

In this talk, we discuss data-drive support vector machines with uncertainties by robust optimization, chance-constrained optimization models and algorithms.

3 - Smartly Sharing your Information against User Account Linkage across Multiple Online Social Networks
Yilin Shen, benoit.shen@gmail.com, Hongxia Jin

Users are posting their personal status without being aware of how their information is shared across multiple OSNs. We first identify a practical and easy-to-conduct attack model to accurately link user accounts across OSNs, in which only very few public user information is needed. In order to defend against this attack, we develop the first countermeasure which keeps as much as user's information visible and meanwhile prevents users' accounts from being linked on various OSNs via k-anonymity.

Tuesday 4:30pm - 6:00pm

■ TD01

Hilton- Golden Gate 6

Search Theory

Sponsor: Military Applications Society

Sponsored Session

Chair: Michael Hirsch, President, ISEA TEK, 620 N. Wymore Road, Suite 260, Maitland, FL, 32751, United States of America, mhirsch@iseatek.com

1 - Graph Search with Delayed, Out-of-Sequence, and Incomplete Observations
David Casbeer, Air Force Research Laboratory, 2210 8th St, R300, WPAFB, OH, United States of America, david.casbeer@us.af.mil

A UAV is searching for a ground vehicle on a road network that is out-fitted with unattended ground sensors (UGSs). The UGSs are communication constrained and can only relay observations when the UAV visits them. The UAV lacks the ability to detect and identify the evader and must visit the UGSs to learn the evader's location. This scenario leads the UAV's control actions to depend on delayed, out-of-order, and incomplete observations. UAV control policies for guaranteed capture are discussed.

2 - When to Believe an Informant: A Model for Human Intelligence
Michael Atkinson, Naval Postgraduate School, 1411 Cunningham Road, Monterey, CA, United States of America, mpatkins@nps.edu, Moshe Kress

A searcher desires to find a target hiding in one of n cells. The searcher receives a stream of intelligence tips about the location of the target from an imperfect informant. At any time the searcher can engage the cell he thinks contains the target. There is urgency for the searcher to engage the cell quickly before the target executes an attack. If the target executes his attack, the searcher incurs some cost. If the searcher engages the wrong cell, additional collateral damage occurs.

3 - Dynamic Search Time Allocation Problem in a Complete Graph
Yan Xia, University at Buffalo, 342 Bell Hall, Buffalo, NY, 14260-2050, United States of America, yanxia@buffalo.edu, Rajan Batta, Rakesh Nagi

Decentralized method of routing a fleet of vehicles rarely considers workload sharing under stochastic environment. In this paper, we investigate the benefit of workload sharing for a decentralized, stochastic routing and time-allocation problem motivated by reconnaissance applications of unmanned aerial vehicles (UAVs). We develop two tractable routing methods with sharing for any given routing method with no sharing. One of the methods is guaranteed to be better the no-sharing method.

4 - CADSIM: A Tool for Analyzing Multiparty Strategic Interactions
Paul Scerri, Carnegie Mellon University, Robotics Institute, Pittsburgh PA, United States of America, pscerri@cs.cmu.edu, Joe Mola, Elan Freedy, Amos Freedy

Military analysts must often try to understand complex strategic interactions involving multiple parties with a mixture of cooperative and adversarial relationships. We present CADSIM, a tool that uses MDPs to explore a strategy space. The tool builds on an algorithm called TREMOR that manages a very large state space by focusing on interactions between actors, but otherwise computing policies independently. Graphical tool support empowers analysts to work with complex models.

■ TD02

Hilton- Golden Gate 7

Technology Entrepreneurship in China

Sponsor: Technology, Innovation Management and Entrepreneurship

Sponsored Session

Chair: Yanbo Wang, Assistant Professor, Boston University, 595 Commonwealth Avenue, Boston, MA, United States of America, wyanbo@bu.edu

Co-Chair: Chuck Eesley, Assistant Professor, Stanford Univ., Huang Engineering Center Room 355, 475 Via Ortega, Stanford, 94305, United States of America, cee@stanford.edu

1 - Firm Performance & State Innovation Funding: Evidence from China's Innofund Program
Yanbo Wang, Assistant Professor, Boston University, 595 Commonwealth Avenue, Boston, MA, United States of America, wyanbo@bu.edu

Leading industrial economies have historically employed innovation subsidies with the aim of overcoming the market failures associated with financing tech-oriented small firms. Although our understanding of these policies' impact is mixed, industrializing economics have begun to embrace similar policies. Using a regression discontinuity design, this project investigates how a major innovation subsidy program in China impact firm performance, including survival, patenting, and refinancing.

2 - Innovation Paradox of Returnees: Evidence from China's High Technology Industries
Haiyang Li, Rice University, Houston, TX, United States of America haiyang@rice.edu, Jiangyong Lu, Seong-Jin Choi, Xiaohui Liu

We investigate why technology ventures led by returnees who in general enjoy technology advantage underperform the ventures led by their local counterparts. With a sample of technology ventures in China's high technology industries, we found that while returnee ventures have a higher level of innovation input, their innovation efficiency is lower than their local counterparts. Our results also show that innovation efficiency mediates the negative effect of returnees on venture performance.

3 - Political Hazards and Firms' Geographic Focus
Nan Jia, Assistant Professor, Marshall School of Business, University of Southern California, BRI 306, 3670 Trousdale Pkwy, Los Angeles, CA, 90089, United States of America, Nan.Jia@marshall.usc.edu, Kyle Mayer

We examine the relationship between the geographic focus of a firm's sales and the firm's vulnerability to expropriation hazards in the form of unauthorized levies. Although expanding outside the home location can initially increase a firm's exposure to government expropriation, we find that this effect reverses when a firm's sales outside its home location reach the point at which the firm pose a credible threat to exit the market in which it is being targeted.

4 - Does Institutional Change in Universities Influence High-Tech Entrepreneurship? Evidence from China
Chuck Eesley, Assistant Professor, Stanford Univ., Huang Engineering Center Room 355, 475 Via Ortega, Stanford, CA, 94305, United States of America, cee@stanford.edu, Delin Yang, Jamber Li

We examine how policies that attempt to change educational institutions to be more innovative affect the beliefs and behaviors of alumni entrepreneurs as well as the performance of firms they start. We address this question by studying how China's Project 985, an educational reform that attempted to foster innovation within a subset of Chinese universities, impacted entrepreneurs' beliefs regarding innovation.

■ TD03

Hilton- Golden Gate 7

Economics of Online Services

Sponsor: eBusiness

Sponsored Session

Chair: Mingdi Xin, Assistant Professor, University of California at Irvine, United States of America, mingdi.xin@uci.edu

1 - Optimal Timing of Sequential Distribution: Day-and-Date Strategy in the Movie Industry
Hyoduk Shin, University of California-San Diego, 9500 Gilman Drive, La Jolla, CA, United States of America, hshin@rady.ucsd.edu, Terrence August

We present a model of consumer choice that examines trade-offs between substitutable products (theatrical and video forms), the possibility of purchasing both alternatives, and a congestion externality affecting consumption at theaters. We characterize the market conditions under which a studio should pursue direct-to-video, day-and-date, and delayed video release strategies.

2 - Cardinality Bundling with Constrained Prices
Jianqing Wu, Purdue University, 403 W. State Street, West Lafayette, In, 47906, United States of America, wu35@purdue.edu, Mohit Tawarmalani, Karthik Kannan

Cardinality bundling (CB) is a kind of bundling strategies where firms set prices that depend only on the size of the bundle. The existing analytical framework of CB lacks sub-additivity constraints on bundle pricing, which limits its application in reality. In this study, we solve the CB problem with additional constraints on bundle prices: marginal decreasing prices; unit decreasing prices; and the general sub-additive prices. In addition, we provide gap analysis between different CB models.

3 - Spreading Goodwill through Social Media: Gratitude, Network Distance, and Charitable Giving
Dobin Yim, Fordham University, 113 West 60th Street, New York, NY, 10023, United States of America, dyim@fordham.edu

We explore how expression of gratitude affects charitable giving behavior, conditional on the distance the message travels over social networks. We extract message patterns from an online charitable giving campaign on Twitter and show that gratitude is positively associated with donation behavior. However, this positive effect dissipates over network distance. We discuss the implications of our findings and future direction of the study.

■ TD04

Hilton- Continental 1

Pharmaceutical and Healthcare Supply Chains

Sponsor: Manufacturing & Service Operations Management

Sponsored Session

Chair: Hui Zhao, Penn State University, Smeal College of Business, University Park, United States of America, huz10@psu.edu

1 - Recruitment Stocking Processes
Anh Ninh, RUTCOR, Rutgers Center for Operations Research, 100 Rockafeller Rd, Piscataway, NJ, 08954, United States of America, ninhtuananh@gmail.com, Yao Zhao, Benjamin Melamed

We define a general class of inventory control problems - recruitment stocking problems (RSP), where one needs to recruit a target number of subjects through multiple locations. RSP can be found in clinical trials, marketing research as well as recruitment of employees and military forces. We provide a mathematical characterisation of RSP and its performance metrics both exactly and approximately.

2 - Gatekeeper or Roadblock: Tradeoffing Evidence Generation and Access to New Drug

Hui Zhao, Penn State University, Smeal College of Business, University Park, United States of America, huz10@psu.edu, Leon Xu

The rocketing R&D cost and the flat number of new drugs approved over decades imply an unprecedented crisis in drug innovation productivity and post questions to the current drug innovation regulation. We consider alternatives to tradeoff access and evidence generation. Based on detailed modeling, we propose remedies for the accelerated approval pathway instituted in 1992 to speed up the development of new drugs but failed its original purpose.

3 - Coordination of the Influenza Vaccine Supply Chain in the Presence of Costly Demand Effort

Xinghao Yan, Ivey Business School - Western University, 1255 Western Road, London, ON, N6G 0N1, Canada, xyan@ivey.uwo.ca, Greg Zaric

We study influenza vaccination supply chain consisting of a government, a vaccine manufacturer, and population. We show that the optimal order quantity is never less than the critical vaccination demand, defined as the demand without vaccine shortages. The optimal critical vaccination demand may not lead to herd immunity. We provide sufficient and necessary conditions for the existence of coordinating contracts in different contract families, defined according to which decisions are verifiable.

4 - Designing Health Care Supply Chain for Cardiovascular Diseases: A Predictive Analytic Application

Kingshuk Sinha, Professor, Mosaic Company Professor of Corporate Responsibility, Carlson School of Management, University of Minnesota, Minneapolis, MN, United States of America, ksinha@umn.edu, Bhupinder Juneja, Ujjal Mukherjee

We report the results of an empirical study where socio-economic considerations are accounted for in designing a health care supply chain for cardiovascular diseases. A "big" data set on cardiovascular diseases is analyzed using predictive analytic techniques to develop a risk model for the population level disease condition.

■ TD05

Hilton- Continental 2

Retail Operations

Sponsor: Manufacturing & Service Operations Management

Sponsored Session

Chair: Dorothee Honhon, Assistant Professor, University of Texas at Dallas, Naveen Jindal School of Management, Dallas, TX, 75080, United States of America, Dorothee.Honhon@utdallas.edu

Co-Chair: Amy Xiajun Pan, Assistant Professor, University of Florida, Department of ISOM, Warrington College of Business Administr, Gainesville, FL, 32611, United States of America, amy.pan@ufl.edu

1 - Econometric Analysis of Customer Conversion in eRetail

Nikolay Osadchiy, Assistant Professor, Emory University, 1300 Clifton Rd NE, Atlanta, GA, 30309, United States of America, nikolay.osadchiy@emory.edu, Vishal Gaur

We model the process of customer acquisition and conversion in retail. Using the data from an online specialty retailer, we estimate parameters of the customer conversion process and discuss implications for advertising and promotion planning.

2 - Optimal Pricing and Ordering Policy for Perishable Products

Amy Xiajun Pan, Assistant Professor, University of Florida, Department of ISOM, Warrington College of Business Administr, Gainesville, FL, 32611, United States of America, amy.pan@ufl.edu, Zumbul Atan, Dorothee Honhon

We consider the problem of a retailer managing fresh and perishable/old products. Depending on the shelf display, consumers have different purchase behavior. We provide the optimal discounting policy for the old products and ordering policy for the fresh products, and propose effective heuristics.

3 - Dynamic Assortments in Online Retailing

Bharadwaj Kadiyala, PhD Student, University of Texas at Dallas, 800 West Campbell Road, Richardson, TX, 75080, United States of America, bxk121930@utdallas.edu, Dorothee Honhon, Canan Ulu

Online retailing offers a unique opportunity to gather information about customer preferences. The extent to which this information is censored depends largely on the framework in which websites operate i.e., where and how much information about products is displayed to customer during their browsing process. Using a Bayesian framework, we study assortment decisions with information obtained from online sales and customer clicks, with the aim of maximizing profits.

4 - Selling to Nanostores

Jiwen Ge, PhD Candidate, Eindhoven University of Technology, De Lismortel 38, Eindhoven, 5612AR, Netherlands, J.Ge@tue.nl, Dorothee Honhon, Jan C. Fransoo, Lei Zhao

Nanostores are small retail stores which are prevalent in mega-cities. Consumer Packaged Goods manufacturers frequently send salespersons to visit nanostores and generate sales. We build MDP models to optimize a manufacturer's sales effort strategy while considering the suboptimal behavior of the nanostores. Optimal polices and parametric results are derived.

■ TD06

Hilton- Continental 3

Disruption Risk Management

Sponsor: Manufacturing & Service Operations Management

Sponsored Session

Chair: Nitin Bakshi, Assistant Professor, London Business School, NW1 4SA, London, United Kingdom, nbakshi@london.edu

1 - Inducing Suppliers to Improve Reliability with Contracts and Delegation

Woonam Hwang, PhD Candidate, London Business School, Regent's park, London, NW14SA, United Kingdom, whwang@london.edu, Nitin Bakshi, Victor DeMiguel

Suppliers can mitigate supply risk by improving their processes or overproducing, but their mitigating actions are often not directly contractible. We investigate how buyers can use contracts and delegation to induce the suppliers to improve reliability. We find that, although suboptimal, simple contracts can often generate high efficiency. Also, delegating the production quantity decision to the supplier can mitigate the problem of incentive alignment, resulting in higher efficiency.

2 - Increasing Supply Chain Robustness through Process Flexibility and Strategic Inventory

Yehua Wei, Assistant Professor, Duke University, 100 Fuqua Drive, Durham, NC, 27708, United States of America, yehua.wei@duke.edu, He Wang, David Simchi-Levi

In this talk, we consider a combination of process flexibility and strategic inventory as an effective disruption mitigation strategy. For a manufacturer with multiple plants, we analyze K-chain flexibility designs in which each plant is capable of producing exactly K products. We find that while 2-chain can be very effective in disruption mitigation, 3-chain is significantly more robust than 2-chain when there is demand uncertainty.

3 - Responsible Sourcing in Supply Chains

Robert Swinney, Associate Professor, Duke University, 100 Fuqua Drive, Durham, NC, 27516, United States of America, robert.swinney@duke.edu, Hau Lee, Ruixue Guo

We analyze the sourcing decision of a buyer choosing between two supplier types: responsible suppliers are costly while risky suppliers are less expensive but may experience responsibility violations. Some consumers are socially conscious, willing to pay for a responsibly sourced product and willing to punish (by exiting) if there is a responsibility violation. We find the buyer's optimal sourcing strategy and determine how market and supply chain characteristics drive incentives to source responsibly.

■ TD07

Hilton- Continental 4

INFORMS Analytics Maturity Model

Cluster: INFORMS Communities

Invited Session

Chair: Barry List, Director of Commuications, INFORMS, 5521 Research Park Dr., Catonsville, MD, 21228, United States of America, barry.list@informs.org

1 - Launching INFORMS Analytics Maturity Model 2.0

Norm Reitter, Director, Analytics, CANA Advisors, 7371 Atlas Walk Way, Gainesville, VA, 21055, United States of America

The IAMM has been developed over two years to provide organizations with a probing way to do self-assessment and plan for the future. The IAMM committee chair explains how it has gone from beta version to launch date at the INFORMS Annual Meeting.

2 - How Business, Government and Consultants Can Use the New INFORMS Maturity Model
Aaron Burciaga, Senior Manager, North America Inventory Analytics Lead, Accenture, 4305 Majestic Lane, Fairfax, VA, 22033, United States of America, adburciaga@gmail.com

The IAMM is a diagnostic and planning tool that can be used not only by business, but also by government agencies and consultants working with a variety of organizations. Aaron Burciaga, a key participant in the model's development, demonstrates how it can be used to full advantage.

3 - What Every Academic Needs to Know About the Maturity Model
Barry List, Director of Commuications, INFORMS, 5521 Research Park Dr., Catonsville, MD, 21228, United States of America, barry.list@informs.org

Academics can gain advantage from the IAMM by acting as advisors to industry. INFORMS Communications Director Barry List reviews the academic/industry connection.

■ TD10

Hilton- Continental 7

Supply Chain Design

Sponsor: Manufacturing & Service Operations Management

Sponsored Session

Chair: Nico Vandaele, Professor Dr., KU Leuven, Naamsestraat 69, Leuven, 3000, Belgium, Nico.Vandaele@kuleuven.be

1 - A Stakeholder Perspective as a Basis for Sustainable Supply Chain Design
Catherine Decouttere, Senior researcher, KU Leuven, Naamsestraat 69 Box 3555, Leuven, 3000, Belgium, catherine.decouttere@kuleuven.be, Nico Vandaele, Stef Lemmens

A 5-step framework is presented which embeds sustainability in supply chain modelling: stakeholder analysis, key performance setup, model and scenario building, scenario ranking and final choice. We focus on the first and second step: the stakeholder analysis reveals the number, type and interrelationships between the stakeholders; here from a concise set of key performance indicators is derived. We include technical, economical and value based KPI's based on real-life industrial evidence.

2 - Integrated Supply Chain Network Design for Vaccines: A Literature Review
Stef Lemmens, PhD-researcher, KU Leuven, Naamsestraat 69 Box 3555, Leuven, 3000, Belgium, stef.lemmens@kuleuven.be, Nico Vandaele, Catherine Decouttere

Companies all over the world are confronted with designing the supply chain of their businesses. The aim of this literature review is twofold. We provide an updated overview on integrated supply chain network design and we study the concepts for a peculiar pharmaceutical product: vaccines. This presentation provides an overview of different supply chain network characteristics, supply chain performance measures and show how uncertainty is incorporated in the design of a supply chain network.

3 - Horizontal Collaboration and Fairness
Philippe Chevalier, Professor, UCLouvain, Voie du Roman Pays 34, L1.03.01, Louvain-la-Neuve, 1348, Belgium, philippe.chevalier@uclouvain.be, Alejandro Lamas

We model participants to the supply chain as a capacitated lot sizing problem and study how fairness can be implemented to foster fair and efficient horizontal collaboration in a supply chain.

4 - Designing Supply Chain Interfaces under Asymmetric Information
Per Agrell, Université Catholique de Louvain, 34 Voie du Roman Pays, L1.03.01, Louvain-la-Neuve, 1348, Belgium, per.agrell@uclouvain.be, Peter Bogetoft

Delegation of upstream supplier coordination to contract manufacturers is found in practice, but disputed. We study the organizational and contractual choice of a coordinator to either control or delegate the investment decision of some shared resource to a CM or to an upstream supplier in a three-stage supply chain. The analysis derives closed-form results for the economic performance for different delegation schemes under asymmetric information on investment cost.

■ TD11

Hilton- Continental 8

MSOM Fellows Session

Sponsor: Manufacturing & Service Operations Management

Sponsored Session

Chair: Gal Raz, Associate Professor, University of Virginia, Darden School of Business, Charlottesville, VA, United States of America, razg@darden.virginia.edu

1 - Multidimensional Approximation Algorithms for Capacity-expansion Problems
Robin Roundy, Brigham Young University, Provo, UT, 84602, United States of America, robin@mathematics.byu.edu, Van-Anh Truong

We develop high-dimensional approximation algorithms to compute provably near-optimal capacity-expansion policies. Our approach is computationally efficient and produces a policy with expected cost of no more than twice that of an optimal policy. We overcome the curse of dimensionality using cost-separation schemes. This is the first approximation technique for multimachine, multiproduct systems with stochastic, nonstationary, correlated demands.

2 - Operations Management and the Discounting-Risk Neutrality Conundrum
Matthew J. Sobel, Case Western Reserve University, Weatherhead School of Management, Cleveland, OH, 44106, United States of America, Matthew.sobel@case.edu

The following result from preference theory does not square with empirical reality: if a decision-maker's preferences are consistent with time discounting, then they are consistent with risk neutrality. In my experience, operations managers are sensitive to both timing and risk. This talk sketches the conundrum, outlines a possible solution, and describes some consequences for research in operations management.

3 - The Service and Information Economy: Research Opportunities
Uday Karmarkar, UCLA, 110 Westwood Plaza, Gold Hall, Suite B-512, Los Angeles, CA, 90066, United States of America, uday.karmarkar@anderson.ucla.edu

The US economy is already dominated by services and information. These trends are also present in all large economies in the world. I discuss opportunities for research in Operations and Technology Management related to these substantial economic shifts.

■ TD12

Hilton- Continental 9

Emerging Issues in Sustainable Operations

Sponsor: Manufacturing & Service Operations Management/Sustainable Operations

Sponsored Session

Chair: Isil Alev, Doctoral Student, Georgia Tech School of Industrial and Systems Engineering, isilalev@gatech.edu

1 - The Implications of Extended Warranties on a Closed-Loop Supply Chain
Wayne Fu, Georgia Institute of Technology, 800 West Peachtree NW, Atlanta, GA, United States of America, Wayne.Fu@scheller.gatech.edu, Atalay Atasu

Extended warranties can improve the product value perceived by customers. But they also expand the obligation of manufacturers. In this study, we establish a stylized model that accounts for the effects of warranties, endogenizes the allocation decisions, and demonstrates the impact of extended warranties on product-line choices, and overall profitability. We also highlight the relationship between extended warranties offering and product-line choices.

2 - Strategic Allocation of Medical Surplus
Wee Meng Yeo, YeoWee.Meng@scheller.gatech.edu

To bridge the gap between medical surplus and needs, the Medical Surplus Recovery Organization (MSRO) allows recipients to pick items under full information visibility. Each recipient can either order or wait. We characterize the equilibrium strategies that are Pareto-optimal threshold. We investigate an alternative strategy where MSRO dictates the choice of its recipient and shipment. We develop novel insights and frameworks guiding the operational strategies for a medical-surplus supply chain.

3 - Effect of Government Subsidies on the Adoption of Energy Efficient Products
Haoying Sun, Assistant Professor, Texas A & M University, 301K Wehner, 4217 TAMU, College Station, TX, 77845, hsun@mays.tamu.edu, Steve Gilbert

We use the durable goods framework to study how the timing of the government subsidy program on energy efficient products affects the manufacturer's production and investment decisions and how this in turn affects the energy consumption.

4 - Impact of E-Waste Regulations on the Sale and Lease Strategies
Ni Fang, HEC Paris, 1, Rue de la Libération, Jouy en Josas, 78350, France, ni.fang@hec.edu, Andrea Masini

While e-waste regulation is becoming increasingly popular to minimize the environmental impact, its actual effects remain unclear. In this paper, we study impact of e-waste legislations on the regulated manufacturer's distribution channel strategies amid manufacturer's free choice of dealing with off-lease units in monopoly environment.

■ TD14

Imperial B

Joint Session WORMS/JFIG/MIF: Speed Networking

Sponsor: Women in OR/MS, Junior Faculty Interest Group, & Minority Issues Forum

Sponsored Session

Chair: Susan Martonosi, Associate Professor, Harvey Mudd College, Claremont, CA, United States of America, martonosi@g.hmc.edu

Co-Chair: Julie Ivy, North Carolina State University, 111 Lampe Drive, Campus Box 7906, Raleigh, NC, United States of America, jsivy@ncsu.edu

Co-Chair: Esra Buyuktahtakin, Assistant Professor, Wichita State University, Wichita, KS, United States of America, esra.b@wichita.edu

1 - Speed Networking
Esra Buyuktahtakin, Assistant Professor, Wichita State University, Wichita, KS, United States of America, esra.b@wichita.edu

Are you looking for a new research collaborator? Eager to branch out into a new area of research? Looking to establish professional connections outside of your institution? WORMS, MIF and JFIG invite you to this Speed Networking session. Participants will be grouped according to broad research interests and will meet successively in pairs to share research backgrounds and contact information. Bring your business cards!

■ TD15

Hilton- Exec. Boardroom

Revenue/Yield Management I

Contributed Session

Chair: Pawan Chowdhary, IBM Research Center, 650 Harry Rd, San Jose, CA, 95120, United States of America, chowdhar@us.ibm.com

1 - Differentiated B2B Pricing Strategy for Service Configurations
Pawan Chowdhary, IBM Research Center, 650 Harry Rd, San Jose, CA, 95120, United States of America, chowdhar@us.ibm.com, Zhengliang Xue, Markus Ettl

We study a method to price personalized service configurations. A seller has to deal with request-for-quotes of fully customized packages. A top-down and bottom-up approach is applied to estimate buyer's purchase probability for any configuration based on historical data. In a B2B setting, client relationship is considered in pricing decision, which is incorporated into a utility model assessing market value of configuration and impact of relationship. The business impact is justified by data.

2 - Immediate vs. Past-Purchase Based Retail Price Discounts
Michael Pangburn, University of Oregon, 1208 University of Oregon, Eugene, OR, 97405, United States of America, pangburn@uoregon.edu, Monire Jalili

Retailers commonly offer an immediate discount percentage off regular price. In contrast, some retailers apply a credit toward a future purchase, based on the customer's prior purchase. We contrast the efficacy of these two discounting strategies to better understand conditions under which prior-purchase based discounts may outperform immediate discounts.

3 - Optimal Keyword Bidding in Search Based Advertising
Baris Selcuk, Assoc.Professor, Bahçesehir University, Ciragan cad., Ciragan cad., Istanbul, 34353, Turkey, bariselcuk@gmail.com, Ozgur Ozluk

In search-based advertising, advertisers bid on keywords to have an impact on their ad's placement. An advertiser must bid correctly for each keyword in order to maximize the expected revenue while keeping the daily costs in mind. We construct an optimization model that maximizes total expected advertising revenue while keeping the total costs below a given advertising budget where the stochastic relationship between the bid prices and the click-through-rates is considered.

■ TD16

Hilton- Franciscan A

New Applications of Pricing and Revenue Management

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Georgia Perakis, William F. Pounds Professor, Massachusetts Institute of Technology, Sloan School of Management, Cambridge, MA, 02142, United States of America, georgiap@mit.edu

1 - Optimization Models and Insights for Promotion Planning
Maxime Cohen, PhD Candidate, MIT, maxcohen@mit.edu, Georgia Perakis, Kiran Panchamgam

We study the Promotion Optimization Problem, i.e., deciding which items to promote, at what time and at what price. Our formulation includes several business rules that arise in practice. We build demand models from data in order to capture the stockpiling behavior as well as cross items effects. This gives rise to a hard problem. We then propose efficient LP based methods, show theoretical performance guarantees and validate our results using real data.

2 - Scheduling with Testing
Yaron Shaposhnik, MIT, 77 Massachusetts Avenue, Bldg. E40-149, Cambridge, United States of America, shap@mit.edu, Retsef Levi, Thomas Magnanti

We study a new class of scheduling problems that captures a common tradeoff between using resources for processing jobs, and investing resources to 'test' jobs and learn more about their uncertain attributes. This can inform future decisions, but also delay service. We derive intuitive structural properties of the optimal policies, and use a new cost-accounting scheme to devise a surprisingly low dimensional dynamic programming formulation, which ultimately leads to an FPTAS.

3 - Data-driven Bundle Pricing with Dynamic Product Valuation and Substitution Effects
Wei Sun, Researcher, IBM T J Watson Research Center, 1101 Kitchawan Road, 05-034D, Yorktown Heights, NY, 10598, United States of America, sunw@us.ibm.com, Anshul Sheopuri, Dashun Wang

We study bundle pricing for technology products and services (e.g., handset with plans, console with games), where dynamic product valuations (willingness to pay) and substitution effect within a product group are prominent. We propose a data-driven method that fits a copula model over the joint valuations with sales data. A case study on a telecom company demonstrates the importance of incorporating dynamic valuation, product substitution and correlations in the joint distribution.

4 - Data-driven Newsvendor with a Mixture Distribution
Chongli Daniel Chen, Operations Research Center, MIT, 77 Mass Ave, Bldg E40-130, Cambridge, MA, 02139, United States of America, dcchen@mit.edu, Retsef Levi, Georgia Perakis

We consider a newsvendor facing demand that is a mixture of known finite distributions, but with unknown weights. Given a small sample of the true distribution, we formulate the problem as a robust optimization problem using a mixture distance to define the uncertainty set. This results in a tractable linear program, and we prove convergence properties. Preliminary simulations show good performance for small sample sizes. This approach is general and can be adapted for different cost functions.

■ TD17

Hilton- Franciscan B

Empirical Studies in Healthcare Operations Management

Sponsor: Manufacturing & Service Operations Management/Service Operations

Sponsored Session

Chair: Nan Liu, Assistant Professor, Columbia University, 600 W. 168th St., 6th floor, New York, NY, 10032, United States of America, nl2320@columbia.edu

Co-Chair: Pengyi Shi, Assistant Professor of Operations Management, Purdue University, Krannert School of Management, West Lafayette, IN, United States of America, shi178@purdue.edu

1 - A Comprehensive Probabilistic Framework for Prediction of Patients' Readmission to Medical Centers

Adel Alaeddini, University of Texas at San Antonio, One UTSA Circle, San Antonio, United States of America, Adel.Alaeddini@utsa.edu, Jon Stauffer, Kurt Bretthauer, Jonathan Helm

The problem of readmission to medical centers after getting discharged often causes serious problems to both patients and medical centers. In this study we develop a comprehensive probabilistic framework based on integration of survival models, and local regression analysis to provide an accurate real-time estimate of readmission, personalized for each patient. We also design a comprehensive optimization model to find the optimal parameters of the proposed framework.

2 - Consequences of Delays in Patient Transfers Out of the Mass General Hospital ICU

David Scheinker, dscheink@gmail.com, Sara Dolcetti, Benjamin Christensen, Retsef Levi, Ulrich Schmidt, Tara Tehan, Bethany Daily, Peter Dunn

More expert guidelines exist to prevent transfer delay to an Intensive Care Unit than transfer delay from an ICU. We test the assumption that a patient delayed in the ICU is no worse off than she would be in a general care unit. In particular, we examine the impact of transfer delays from the ICU on total patient length of stay. We find that ICU transfer delays extend total patient hospital length of stay. This finding allows us to more accurately quantify the financial impact of such delays.

3 - The Effect of Health Plan Type on the Utilization of Advanced Diagnostic Imaging

Xin Zheng, Boston University, 595 Commonwealth Ave, Boston, United States of America, xinzheng@bu.edu, Rona Doncaster, Amy McLaughlin, Justin Ren, Anita Tucker, Jonathan Beebe

Using 2010 Thomson-Reuters MarketScan commercial claims and encounters database, we found that HMO beneficiaries overall uses about 339 millions less and HDHP beneficiaries uses around 392 millions less imaging studies than PPO beneficiaries given all the control variables in these plans the same. These differences could be the potential source for unwanted health care usage. Understanding this can help us reduce health care waste from the costly imaging studies.

4 - An Analysis of Patient Preferences and Choice Behavior in Outpatient Appointment Scheduling

Nan Liu, Assistant Professor, Columbia University, 600 W. 168th St., 6th floor, New York, NY, 10032, United States of America, nl2320@columbia.edu, Stacey Finkelstein, Beena Jani, David Rosenthal, Margaret Kruk

Patient choice of an outpatient appointment depends on her preferences over a variety of attributes associated with the appointment and how she makes trade-off among them. By conducting discrete choice experiments on different populations, we investigate a comprehensive set of "operational" attributes that can affect patient choice. We also explore heterogeneity in patient preferences and explain this heterogeneity by identifying individual characteristics that can modify patient preferences.

■ TD18

Hilton- Franciscan C

Customer Choices, Upgrades and Prices

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Metin Cakanyildirim, University of Texas at Dallas, Campbell Road, Richardson, United States of America, metin@utdallas.edu

1 - Dynamic Pricing and Replenishment with Customer Upgrades

Oben Ceryan, Assistant Professor, Department of Decision Sciences, LeBow College of Business, Drexel University, 3220 Market St., Philadelphia, PA, 19104, United States of America, oc43@drexel.edu, Ozge Sahin, Izak Duenyas

We study the impact of product upgrades on a firm's pricing and replenishment policies by considering a multiple period, two-stage model where the firm first sets prices and replenishment levels, and after observing the demand, it decides whether to upgrade any customers to a higher quality product. We characterize the structure of the optimal upgrade, pricing, and replenishment policies and find that offering upgrades assists in preserving the vertical price differentiation of the products.

2 - Revenue Management under Customer Choice Behavior with Cancellations and Overbooking

Dirk Sierag, CWI, Science Park 123, Amsterdam, Netherlands, D.D.Sierag@cwi.nl, Jean-Pierre van der Rest, Bert Zwart, Rob van der Mei, Ger Koole

In many application areas such as airlines and hotels a large number of bookings are cancelled. We propose a revenue management model that takes cancellations into account in addition to customer choice behaviour. Numerical results show that the model without cancellations can lead to a revenue loss of up to 20%. The combination of the model, tractable and well-performing solution methods, and an accurate parameter estimation method ensures that the model can efficiently be applied in practice.

3 - National and Store Brand Advertising and Pricing Strategies

Stanko Dimitrov, University of Waterloo, 200 University Avenue West, Waterloo, Canada, sdimitro@uwaterloo.ca, Jen-Yi Chen

In this presentation we discuss different pricing and advertising decisions competing national and store brands can take. We consider three cases, when both advertising and pricing decisions are made at the same time, and when one decision is fixed and the other must be made. We find that the allowing both pricing and advertising decisions to be made in unison leads to boundary solutions. We conclude with interpretations of our results and future research directions.

4 - WTP-Choice Model

Metin Cakanyildirim, University of Texas at Dallas, Campbell Road, Richardson, United States of America, metin@utdallas.edu, Varun Gupta

We propose a WTP (Willingness To Pay)-choice model and use it to compare equilibrium prices, demands and profits of several contexts: without considering inventory and with stockouts - lost sales and backorders. One of the interesting results with independent WTPs is the loose coupling of retailers; equilibrium prices are not coupled but profits are. Dependent WTPs can cause price cycles. Empirical comparisons with (mixed) Logit are also presented.

■ TD19

Hilton- Franciscan D

Pricing and New Product Development in Supply Chains

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Chia-Wei Kuo, National Taiwan University, 1, Sec. 4 Roosevelt Road, Taipei, 106, Taiwan - ROC, cwkuo@ntu.edu.tw

1 - Simultaneous vs. Sequential Crowdsourcing Contests

Lu Wang, Rotman School of Management, 105 St. George Street, Toronto, Canada, Lu.Wang12@Rotman.Utoronto.Ca, Ming Hu

In a crowdsourcing contest, innovation is outsourced by an innovating firm to an open crowd whose members compete in generating best solutions. We consider two mechanisms when innovation demands expertise in multiple attributes. One is to run a simultaneous contest, where a single solution is simultaneously submitted by each contestant. The other is to run multiple sequential sub-contests, with each dedicated to one attribute. Which mechanism should the firm choose?

2 - Dynamic Pricing with Gain-Seeking Reference Price Effects
Zhenyu Hu, University of Illinois at Urbana-Champaign, 104 S. Mathews Ave., Urbana, IL, 61801, United States of America, hu48@illinois.edu, Peng Hu, Xin Chen

We study a dynamic pricing problem of a monopolist facing an aggregate demand with gain-seeking reference price effects. We show that even the myopic pricing strategy leads to complex dynamics over time. We then consider a special case, in which consumers only remember the price in the last period and the demand is mainly driven by promotions. Our results suggest that a skimming cyclic pricing strategy is optimal. Conditions are derived to guarantee the optimality of high-low pricing strategies.

3 - Contract Design for Cloud Computing Service with Service Level Consideration
Kwei-Long Huang, Assistant Professor, National Taiwan University, No. 1, Sec. 4, Roosevelt Rd., Taipei, 106, Taiwan - ROC, craighuang@ntu.edu.tw, Carol Hsu, Chia-Wei Kuo, Chao-Lung Yang

Design of contracts for cloud computing service with resource guarantee is considered. A service provider determines pricing and resource allocation by offering two types of contracts with different service levels. Each contract specifies price and associated penalty if the provider cannot fulfill the requested resource. Optimal pricing and resource allocation decisions as well as the equilibrium contracts of the service provider are analyzed based on the dynamics of the model characteristics.

■ TD20

Hilton- Yosemite A

Facility Logistics IV

Sponsor: TSL/Facility Logistics

Sponsored Session

Chair: Suzanne Marcotte, Associated professor, ESG-UQAM, Dept Management and technology, P.O. Box 8888, Downtown Station, Montreal, Qc, H3C3P8, Canada, Suzanne.Marcotte@cirrelt.ca

1 - A GPU Accelerated Sub-gradient Lagrangian Search for the Quadratic Assignment Problem
Rakesh Nagi, Professor and Department Head, University of Illinois at Urbana-Champaign, 104 S. Mathews Ave., Urbana, IL, 61801, United States of America, nagi@illinois.edu, Ketan Date

The Quadratic Assignment Problem (QAP) is the fundamental problem in facilities layout. It is strongly NP-hard. In this work, we study a linearization model for the QAP and parallelize the sub-gradient Lagrangian search algorithm using graphics processing unit (GPU). We show this method can be used to obtain quick and strong lower bounds on the large instances of the QAP.

2 - Models for Unit Load Storage System Design
Pratik Mital, PhD Candidate, Georgia Institute of Technology, 755 Ferst Drive, NW, Atlanta, GA, 30332, United States of America, pmital3@gatech.edu

Unit load storage systems are by far the most common storage system architectures. Different objectives and hardware implementations have yielded a large variety of models. Characteristics of the various models and a hierarchy of the models will be presented.

3 - Designing a Rotated Aisle Layout for Improved Facility Performance
Dean Marinchek, Ohio University, 270 Stocker Center, Athens, OH, 45701, United States of America, dm089112@ohio.edu, Dale Masel

Traditionally, aisles in a manufacturing facility are designed to run parallel to the walls of the facility, which means that travel can't follow the shortest distance between two points. To allow more direct travel between departments, this work uses a layout in which main aisles running across the facility divide it into bays. The departments are arranged with the main aisles parallel to the walls of the facility and then the main aisles are rotated to reduce the overall travel distance.

4 - Evaluation of Dynamic Deployment of Production, Storage and Handling Resources in a Modular Facility
Suzanne Marcotte, Associated Professor, ESG-UQAM, Dept Management and technology, P.O. Box 8888, Downtown Station, Montreal, Qc, H3C3P8, Canada, Suzanne.Marcotte@cirrelt.ca, Ben Montreuil

We previously proposed a design methodology for a dynamic deployment of production, storage and handling resources in a modular facility design. Indeed, facilities can be modeled as a grid on which generic modules can be located. Resources such as production, storage and handling resources are to be assigned to these modules to minimize the total cost trough time. We provide empirical results and insights in this paper through a case study of a computer refurbishing and recycling facility.

■ TD21

Hilton- Union Sq 1

Innovative Solutions for Congestion Mitigation III

Sponsor: Transportation Science & Logistics

Sponsored Session

Chair: Siriphong (Toi) Lawphongpanich, University of Florida, Industrial and Systems Engineering, Gainesville, FL, 32611, United States of America, Lawphong@ise.ufl.edu

Co-Chair: Yafeng Yin, University of Florida, Gainesville, FL, United States of America, yafeng@ce.ufl.edu

1 - Maintenances & Repair Planning Model Based on Day-to-Day Dynamic Traffic Assignment
Terry Friesz, Penn State, 305 Leonhard Building, University Park, PA, 16802, United States of America, tfriesz@psu.edu, Terry Friesz, Ke Han, Yuqi Sun

We propose a maintenance & repair planning model based on day-to-day dynamic traffic assignment. This model captures both transient congestion caused by M&R activities in progress and post-project effects as a result of improved road quality and capacity. An optimal M&R planning strategy, which accounts for both maintenance and congestion costs, is solved with heuristics.

2 - Speed Harmonization for A Bottleneck Based on Vehicle-to-Infrastructure Communications
Hao Yang, Postdoctoral Associate, Virginia Tech Transportation Institute, 3500 Transportation Research Plaza, Blacksburg, VA, 24061, United States of America, yhharolduci@gmail.com, Hesham Rakha

Capacity drop at bottlenecks is one major cause of congestion and road instability. This study proposes a speed harmonization strategy with vehicle-to-infrastructure (V2I) communications to solve this problem. The strategy provides variable speed limits, which force probe vehicles travel with smaller speed and constrain inflow rates to bottlenecks, based on a feedback control system. Experiments show that the strategy significantly mitigates congestion when capacity drop happens at a bottleneck.

■ TD22

Hilton- Union Sq 2

Emergency Response Capability Modeling

Sponsor: Transportation Science & Logistics

Sponsored Session

Chair: Halit Uster, Southern Methodist University, Lyle School of Eng., Dallas, TX, 75275, United States of America, uster@smu.edu

1 - Assessing the Responsiveness of a Healthcare Network to Sudden Surge Demand
Mercedeh TariVerdi, mercedeh.t@gmail.com, Elise Miller-Hooks, Yanshuo Sun, Eirini Kastrouni

An urban disaster event can lead to sudden surge demand for urgent healthcare. To a community, efficient response by the healthcare system is as vital as the performance of each individual facility. A queueing system conceptualization of a network of hospitals in NYC is taken in assessing system performance.

2 - A Heuristic Method for Relevant Performance Measures in a Dynamic Ambulance Management Model
Thije van Barneveld, Centrum Wiskunde en Informatica, Science Park 123, Amsterdam, 1098 XG, Netherlands, t.c.van.barneveld@cwi.nl, Sandjai Bhulai, Rob van der Mei

In serious life-threatening emergency situations, the ability of ambulance service providers to arrive at the emergency location within a few minutes to provide medical aid makes the difference between survival or death. In this talk, we focus on Dynamic Ambulance Management: how to redeploy the available ambulances if an ambulance becomes busy? We present a DAM-model and we propose a heuristic for making ambulance redeployments in this presentation.

3 - Equity Modeling and Resource Management for Hospital Evacuations
Esra Agca, Kadir Has University, Istanbul, Turkey, esra.agca@khas.edu.tr, Douglas Bish

We present a hospital evacuation transportation model for multiple evacuating hospitals, which may be managed by different hospital groups, sharing available evacuation resources in the same region. The proposed model is an IP with a system-level utilitarian objective of minimizing the average evacuation risk. We discuss equity issues that arise with resource sharing employing an equity modeling framework based on the social welfare function of risk-based utilities for each hospital and each patient.

4 - Emergency Response Network Design Integrating Supply and Demand Sides under Data Uncertainty
Jyotirmoy Dalal, Ph D candidate, Texas A&M University, 3131 TAMU, College Station, TX, 77843, United States of America, jyotirmoy.dalal@gmail.com, Halit Uster

We consider an emergency response network design problem focusing on both cost-effective relief distribution (supply side) and fast evacuation (demand side). We explore the effects of uncertainties of demand, supply, various cost components, and available infrastructure. We present computational results and analysis based on data from a network serving coastal Texas.

■ TD23

Hilton- Union Sq 3

Joint Inventory and Location Models

Sponsor: TSL/Freight Transportation & Logistics

Sponsored Session

Chair: Jianing (Jenny) Zhi, The University of Alabama, 300 Alston Hall, Box 870226, Tuscaloosa, AL, 35404, United States of America, jzhi@crimson.ua.edu

1 - An Inventory Modulated Capacitated Facility Location Model with Correlated Demands
Kayse Maass, University of Michigan, 1205 Beal Ave., Ann Arbor, MI, 48109, United States of America, leekayse@umich.edu, Mark Daskin, Siqian Shen

While current capacitated fixed charge location problems use inflexible capacities, in reality, facility managers have many operational tools to extend capacity or to allow the facility to accept demands in excess of the capacity constraint for short periods of time. Our model begins to capture these operational extensions and has the potential to reveal operating policies that take advantage of spatial and temporal correlations in demand that would not be evident in current models.

2 - Dynamic Inventory Rebalancing of Vehicle Sharing Systems under Nonstationary Demand
Cathy Xia, Associate Professor, Ohio State University, Columbus, OH, United States of America, xia.52@osu.edu

We present a decentralized approach to dynamically manage the inventory of vehicles at different locations in a sharing system. Our approach is robust and adaptive to arbitrary nonstationary demand patterns and provides long-term guarantees on achieving a given service availability target.

3 - Production Planning with Price-Dependent Supply Capacity
Z. Melis Teksan, University of Florida, ISE Dept. 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States of America, zmteksan@gmail.com, Joseph Geunes

We consider a producer who procures input for production, where the available supply of the input depends on the price offered to suppliers. The producer seeks a production and supply-pricing plan that minimizes the cost incurred while meeting a set of demands over a finite number of discrete time periods. The most general version of the problem is NP-Hard. We provide polynomial-time algorithms for practical special cases, and a new and efficient algorithm for convex-cost lot sizing problems.

4 - An Integrated Location and Inventory Problem with Multiple Newsvendors
Jianing (Jenny) Zhi, The University of Alabama, 300 Alston Hall, Box 870226, Tuscaloosa, AL, 35404, United States of America, jzhi@crimson.ua.edu, Burcu Keskin

In a newsvendor setting, we compare a direct shipment option from a supplier to multiple retailers with a consolidated shipment from a supplier to a DC and then to retailers. While the direct shipment considers only inventory decisions, the consolidated shipment problem is an integrated location-inventory problem where the location of the DC is on a continuous plane. For various transportation costs, we identify the conditions that impact the expected profits.

■ TD24

Hilton- Union Sq 4

Optimal Sensor Locations in Traffic Networks

Sponsor: TSL/Intelligent Transportation Systems (ITS)

Sponsored Session

Chair: Kuilin Zhang, Assistant Professor, Michigan Technological University, 1400 Townsend Drive, 870 Dow Environmental Sciences, Houghton, MI, 49931, United States of America, klzhang@mtu.edu

Co-Chair: Dengfeng Yang, Sr. R&D Engineer, Infor US Inc., 8777 N. Stemmons Freeway, Dallas, TX, United States of America, dengfeng.yang@infor.com

1 - The Influence of Sampling Procedures in Freight Tour Synthesis
Carlos Gonzalez-Calderon, Postdoctoral Research Associate, Rensselaer Polytechnic Institute, 110 8th St, JEC 4037, Troy, NY, 12180, United States of America, gonzac8@rpi.edu, Xuegang (Jeff) Ban, Jose Holguin-Veras

This paper introduces an entropy-maximization model to estimate the flows of delivery tours on the basis of traffic counts, and develops heuristic approaches to identify the location of the traffic counts that should support the estimation process. Three heuristics are defined and implemented. The performing of the formulation and the heuristics are tested in the Sioux Falls network.

2 - Reliable Mobile Sensor Network Design through Optimizing Packets Transmissions in VANETs
Dengfeng Yang, Sr. R&D Engineer, Infor US Inc., 8777 N. Stemmons Freeway, Dallas, TX, United States of America, dengfeng.yang@infor.com, Kuilin Zhang

A vehicular ad hoc sensor network (VANET) uses cars as mobile nodes to create a mobile sensor network. Packets transmission paths in the VANET are likely disrupted due to weak radio strength of vehicle moving dynamics and environment changes. We formulate a mixed-integer linear programming model to determine optimal packets scheduling and routing in the VANET to enhance a reliable mobile sensor network connectivity. Customized branch-price-cut and heuristic algorithms are proposed.

3 - Enhancing Observability of Dynamic Traffic Systems: A Stochastic Linear Programming Approach
Kuilin Zhang, Assistant Professor, Michigan Technological University, 1400 Townsend Drive, 870 Dow Environmental Sciences, Houghton, MI, 49931, United States of America, klzhang@mtu.edu, Xuesong Zhou

Measuring observability for static traffic state variables such as OD, path and link flow, has received increasing attention recently. We present a holistic approach to model the observability for practically important performance measures, such as corridor-level travel time dynamics and reliability, under various sensor network design plans. A novel two-stage stochastic linear programming framework is developed to quantify and optimize the value of information from heterogeneous sensors.

■ TD25

Hilton- Union Sq 5

Transportation Planning II

Contributed Session

Chair: Haihong Xiao, HEC Paris, 1, Rue de la Libération, PhD Office, Jouy en Josas, 78351, France, haihong.xiao@hec.edu

1 - Long-haul Freight Selection for Last-mile Cost Reduction
Arturo Pérez Rivera, PhD Student, University of Twente, P.O. Box 217, Enschede, 7500 AE, Netherlands, a.e.perezrivera@utwente.nl, Martijn Mes

We consider the planning problem a company faces when it must transport multiple freights from a single origin to different, and far away, destinations on a regular basis (e.g., daily trips). In each trip, freights are consolidated for the long-haul and transported to their destinations in the last-mile. Last-mile costs depend on the combination of freights transported in each trip. We study how these costs can be reduced, over time, by using look-ahead consolidation polices for the long-haul.

2 - GreenYourRoute Platform for Environmentally Friendly Vehicle Routing
Erotokritos Skordilis, University of Thessaly, Ogl 39, Volos, Greece, erskordi@gmail.com, George Saharidis, George Kolomvos, George Liberopoulos

The objective of the proposed research is to develop a Decision Support System (DSS) for a web based platform which will help individuals and companies move commodities in the most environmental friendly way, minimizing environmental externalities (e.g. CO2 emissions) and transportation costs. The developed platform which is the final outcome of an FP7 European research project, referred to as GreenRoute project.

3 - Truck-Trailer Routing Problem with Intermediate Inventory Facilities for Industrial Gas Distribution
Haihong Xiao, HEC Paris, 1, Rue de la Libération, PhD Office, Jouy en Josas, 78351, France, haihong.xiao@hec.edu, Laoucine Kerbache, Soumia Ichoua, Nicoleta Neagu

The truck and trailer routing problem with intermediate inventory facilities(TTRPIIF) is a variant of the well known vehicle routing problem (VRP). Different from the VRP, in the TTRPIIF, customers are serviced by a fleet of trucks and trailers, Due to some characters, each type of industrial gas can only be carried on by a particular type of trucks, the truck can execute one or two “trips” on one route.

4 - Highway Improvement Project Selection by Multi-Objectives
Peter Kelle, Professor, Louisiana State University, ISDS Department, BEC 2213, Baton Rouge, LA, 70803, United States of America, qmkell@lsu.edu, Helmut Schneider

In highway improvement project selection several objectives must be considered; some of them are based on perceptions, some others are costly and difficult to measure. We use available crash data as proxy measures and for hazard perception in a multi-criteria selection under budget constraint. In the application case we analyze four years of accident data at 23 thousand of potential locations.

■ TD26

Hilton- Union Sq 6

Transportation, Maritime II

Contributed Session

Chair: Cagatay Iris, PhD st., Technical University of Denmark, Bygningstorvet 116B, Building 115, room, DTU, Copenhagen, 2800, Denmark, cagai@transport.dtu.dk

1 - Port-Hinterland Container Dwell Time Analysis: The Shippers Effect
Panagiotis Ypsilantis, PhD Student, Rotterdam School of Management, PO Box 1738, Rotterdam, Netherlands, pypsilantis@rsm.nl, Rob Zuidwijk

Container dwell times are considered a crucial performance indicator of container terminals affecting both their capacity as much as their attractiveness to shippers that usually face long lead times. We analyze data derived from an intermodal carrier, in the Netherlands, and assess the main determinants of container dwell times. Our results demonstrate that next to other factors, the shippers and their strategies have a very significant effect on the development of dwell times.

2 - Stowage Planning Models in Cargo Composition Analysis
Dario Pacino, Technical University of Denmark, Bygningstovet 115, Kgs. Lyngby, 2800, Denmark, darpa@transport.dtu.dk, Alberto Delgado Ortegon, Rune Möller Jensen

The last decade has seen a growing interest on automated stowage planning solutions from both the industry and academia. Recently, stowage planning models have proven to scale to industrial level application. Operational stowage planning is, however, not the sole application. In this presentation, we show how stowage planning models can also be used at the tactical level. In particular, we show how revenue and vessel utilization can be analyzed by our models in terms of cargo composition.

3 - Container Relocation Problem under Truck Appointment System in Container Terminals
Dusan Ku, PhD Stu., University of Auckland, Level 4 (ISOM), 12 Grafton Road, Auckland, 1010, New Zealand, d.ku@auckland.ac.nz, Tiru Arthanari, Tava Olsen

We study the container relocation problem with truck appointment system (TAS). Though mainly purposed to reduce the number of trucks during peak hours and improve their turn-time, the TAS can also lend itself to minimising yard reshuffling for pickups. To this end, a stochastic dynamic programming model is formulated and a B&B method with the abstraction heuristics computes the expected number of reshufflings. A heuristic is proposed and its performance is compared with that of the B&B method.

■ TD27

Hilton- Union Sq 7

Optimization for Rail Planning

Sponsor: Railway Applications

Sponsored Session

Chair: Mingzhou Jin, The University of Tennessee, 525D John D. Tickle Buidling, Knoxville, TN, 37996, United States of America, jin@utk.edu

1 - Classification Track Assignment in Railway Hump Yards
Mingzhou Jin, The University of Tennessee, 525D John D. Tickle Buidling, Knoxville, TN, 37996, United States of America, jin@utk.edu, Haodong Li

The classification track assignment in a hump yard determines tracks for all blocks following predetermined hump and assemble times. This paper proposes an integer program to minimize dirty tracks and pullback operations subject to classification tracks capacity constraints and track number constraints for outbound trains. A Lagrangean relaxation-based algorithm is proposed. The application of the model and the efficiency of the solution approach are demonstrated by a real-world hump yard.

2 - Integrated Modeling of Strategic Train Operation Planning on a Shared-Use Corridor
Bo Zou, University of Illinois at Chicago, 2073 Engineering Research Facility, 842 West Taylor Street, Chicago, IL, 60607, United States of America, bzou@uic.edu, Ahmadreza Talebian

We develop a hypergraph based approach to model strategic operation planning on shared use rail corridors. Given the passenger train scheduling priority, passenger and freight side costs are sequentially minimized. We propose a solution approach which takes advantage of the problem structure and leads to efficient solution time. The impact of speed heterogeneity and delay tolerance on corridor performance is examined. We also demonstrate the model applicability to a real case study in the US.

3 - Strategies to Control a Shortest Path Based Railroad Blocking Network
Erick Wikum, Principal Scientist, Tata Consultancy Services, Seven Hills Park, 1000 Summit Drive, Milford, OH, 45150, United States of America, erick.wikum@tcs.com

With "algorithmic blocking," routes for rail movements are generated by solving shortest path problems. We describe algorithmic blocking, motivate the need for corresponding control mechanisms, and explain the main control mechanisms behind algorithmic blocking. Then, we present strategies to ensure the routes returned by algorithmic blocking are those desired by railroad experts. In the process, we present a new approach to the calibration of the block costs used to compute shortest paths.

4 - Optimization-based Train Dispatching Systems in Operation in Europe
Leonardo Lamorgese, Researcher, SINTEF ICT Optimization, Trondheimsveien 17, Oslo, Os, 0560, Norway, leonardo.lamorgese@sintef.no, Carlo Mannino

Train dispatching is the process of directing train movements on a railway. When delays or disturbances occur, dispatchers take decisions to minimize deviations. We show that this optimization problem can be tackled effectively by integer programming using suitable exact and approximate decomposition techniques, so improving train punctuality. Dispatching systems based on our algorithms for main line and large stations are in operation in Italy, Norway and Latvia.

■ TD28

Hilton- Union Sq 8

Control of Airport Operations for Congestion Mitigation

Sponsor: Aviation Applications

Sponsored Session

Chair: Alexandre Jacquillat, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Building E40-246, Cambridge, MA, 02139, United States of America, alexjacq@mit.edu

1 - Speed Control
Michael Levin, The University of Texas at Austin, ECJ 6.2, Austin, TX, 78712, United States of America, michaellevin@utexas.edu, Travis Waller, David Rey

Sector and airport capacity oversaturation is often resolved through human-assigned radar vectors, which may strongly affect en-route delay and fuel consumption, and are seldom fair with regards to airlines operations costs. Therefore, speed control based models provide an attractive framework to coordinate and separate aircraft. We use these controls in a combined sector and airport model that integrates equity. Results are analyzed by a simulation of air traffic between several major airports.

2 - Managing Capacity Uncertainty in Ground Delay Programs through En Route Speed Control
James Jones, University of Maryland, College Park, MD, 20742, United States of America, jonesjc1@umd.edu, David Lovell, Michael Ball

Capacity uncertainty at airports during inclement weather creates challenges in scheduling flights during Ground Delay Programs. We present a stochastic programming model to manage this uncertainty using both speed control and ground delays. The model demonstrates strong potential to reduce the amount of airborne holding and ground delay particularly in the event of an early weather pattern clearance.

3 - Modeling the Airport Runway Configuration Selection Process
Jacob Avery, Massachusetts Institute of Technology, Cambridge, MA, United States of America, avery2@mit.edu, Hamsa Balakrishnan

An airport's runway configuration refers to the combination of runways being used to serve arrivals and departures. Air traffic controllers choose runway configuration by considering factors such as wind speed and direction, visibility, demand, coordination with surrounding airports, and noise mitigation. We present a maximum likelihood discrete-choice model of the decision process for runway selection. We demonstrate our approach using data from Newark, LaGuardia, and San Francisco airports.

4 - Airline-Driven Ground Delay Programs: Motivation, Models and Benefit Assessment
Chiwei Yan, PhD Student, Operations Research Center, MIT, 77 Massachusetts Avenue, E40-130, Cambridge, MA, 02139, United States of America, chiwei@mit.edu, Michael Ball, Prem Swaroop, Cynthia Barnhart, Vikrant Vaze

We develop an airline-driven ground delay program (GDP) planning framework to inform the design of GDP parameters. Contrary to existing optimal planning methods, ours takes into account private preferences and business objectives of airlines. We develop a novel voting mechanism to facilitate the framework, which is also applicable to other multi-player context where decision space is continuous. Benefit assessment based on both simulated and realistic environment suggests promising results.

■ TD29

Hilton- Union Sq 9

Operations Management/Manufacturing

Contributed Session

Chair: Deanna Kennedy, Assistant Professor, University of Washington Bothell, 18115 Campus Way NE, Bothell, WA, 98011, United States of America, kennedy.deanna@gmail.com

1 - The Effects of Disruptions to Lean Operations: How Responding Means Waste Creation
Deanna Kennedy, Assistant Professor, University of Washington Bothell, 18115 Campus Way NE, Bothell, WA, 98011, United States of America, kennedy.deanna@gmail.com, Anthony Stillman, Ashley Thayer, Jiansheng Xu, M. Travis Maynard, Amy Sommer

Lean organizations strive to remove all excess waste from processes. However, they may be forced to create waste when disruptions happen. We examine disruptions by lean manufacturers and service providers in healthcare and compare their responses. Insights about how learning and complexity contribute to the responses are discussed.

2 - Process Parameters under Multiple Objectives
Amit Mitra, Professor, Auburn University, Harbert College of Business, 419 Lowder Hall, Auburn, AL, 36849-5266, United States of America, mitraam@auburn.edu

Product manufacturing often requires multiple operations with subsequent operations being influenced by those preceding it. It is of interest to determine process parameter values, such as mean and standard deviation associated with corresponding operations. Such determination may be under multiple objectives, some of which may be conflicting to each other.

3 - Mapping Product Characteristics onto Optimal EOL Strategies
Daniel Steeneck, Virginia Tech, 250 Durham Hall, Blacksburg, VA, 24061, United States of America, steeneck@vt.edu, Subhash C Sarin

Recently, much attention has been devoted to research in reverse supply chain (RSC) management. This has been motivated both by academic interest and by the significant impact that the RSC activities, including remanufacturing, have on a nation's economy and the environment. In this presentation, we will discuss how a product's characteristics influence a manufacturer's decision regarding the appropriate value-recovery strategy and product design to employ.

4 - Design of a Production and Distribution System with Production Disruptions
Louis Luangkesorn, Research Assistant Professor, University of Pittsburgh, 1048 Benedum Hall, 3700 O'Hara St., Pittsburgh, PA, 15261, United States of America, lol11@pitt.edu, Jue Gong, Bopaya Bidanda

Production capacity decisions can be in a setting where severe production disruptions can occur. One area is prison industries, where prison inmates are employed to provided needed goods such as food for other state institutions. This system would be subject to unplanned disruptions for administrative, safety, and security reasons. We use Bayesian data analysis to justify assumptions for the production and distribution with disruptions model, then provide analytical results.

■ TD30

Hilton- Union Sq 10

Operations Management/Marketing Interface I

Contributed Session

Chair: Régis Chenavaz, Assistant Professor, Kedge Business School, Domaine de Luminy, Marseille, France, r.chenavaz@gmail.com

1 - Control Theory Application in a Traditional Budget Spending Problem for a Small to Medium Size Firm
Gurkan Akalin, Assistant Professor, Eastern Illinois University, 4008 Lumpkin Hall, Charleston, IL, 61920, United States of America, gurkanakalin@hotmail.com

In this paper, a mathematical model is developed based on the control theory in order to find an optimum budget spending for advertising and quality improvements in small to medium size firms when there is additional word of mouth pressure. Further managerial insights are presented.

2 - Dynamic Lot Sizing and Product Diffusion Model for New Products
Xiang Wu, Huazhong University of Science and Technology, School of Management, 1037 Luoyu Road, Wuhan, China, hsiangstevenwu@gmail.com, Haoxuan Xu, Jinlong Zhang, Yeming Gong

This paper considers dynamic lot sizing and pricing policies for new products, where the retailer faces a time-varying demand. We incorporate product diffusion into dynamic lot sizing model with price effects, and explain how to combine ordering and pricing policies to maximize the revenue.

3 - Group Buying: Retail Stores' Performance and Implications
Qijun Qiu, The University of Hong Kong, RM 723, 7/F, K.K.Leung Building, The University of Hong Kong,Pokfulam RD., Hong Kong, Hong Kong - PRC, angieq@hku.hk, Benjamin Yen

We study a new promotion strategy, Group Buying (GB), in which consumers enjoy a price discount by forming a group. We build monopoly and competition models to examine if and how store offers GB in a sustainable manner. We find that store's decision depends on the market pattern and its regular pricing policy, while it still can manage to secure a reasonable profit. Further, store competition affects the equilibrium in a quite dramatic way. All these explain the prevalence of GB worldwide.

4 - Consideration of Options Demand Forecasting in the Design of Option Bundles
Radu Constantin Popa, Technische Universitat Munchen, Arcisstr. 21, Munich, 80333, Germany, radu.c.popa@tum.de, Martin Grunow, Thomas Stablein

Option bundling is the sale of several options as a package, which can improve forecasts. However, no existing bundle design method focuses on the accuracy of options demand forecasting. Instead, revenue maximization is used as standard objective. Since the resulting bundles do not level options demand enough to lead to better forecasts, we developed a clustering method integrating the improvement of forecasting with revenue maximization. We tested the method on data from the automotive sector.

■ TD31

Hilton- Union Sq 11

Retail Service Operations

Sponsor: Service Science

Sponsored Session

Chair: Olga Perdikaki, Texas A&M University, MS 4217 TAMU, College Station, United States of America, operdikaki@mays.tamu.edu

1 - Analyzing Big-box Retailer in an Emerging Market
Aditya Jain, Assistant Professor, Indian School of Business, Gachibowli, Hyderabad, India, Aditya_Jain@isb.edu, Mehmet Gumus, Saibal Ray

We consider the impact of the entry of a big-box retailer in a market dominated by small retailers. The small retailers are characterized by local coverage of the market, whereas the big-box retailer provides services valued by customers. Since both types of retailers obtain supplies from a common manufacturer, big-box retailer's entry affects the supply conditions. Our work thus highlights roles of direct competition as well as indirect supply side effect on small retailers and customers.

2 - The Effectiveness of Targeted Return Management in Retailing
Mehmet Sekip Altug, Assistant Professor, George Washington University, School of Business, Washington, DC, 20052, United States of America, maltug@gwu.edu

As retailers offer more lenient return policies, customer abuse and fraudulent returns are also on the rise. In order to combat that situation, instead of changing the return policies for everyone, retailers started to implement a tool that identifies those "bad" customers. In a newsvendor framework, I study a monopolist retailer's first-period inventory, price and return policy decisions where the retailer selectively changes its second-period return policy and discuss its impact on profit.

3 - Getting a Second Opinion: Category Advisors
Alper Nakkas, Associate Professor, Nova School of Business and Economics, Campus de Campolide, Lisbon, 1099-032, Portugal, nakkas@skku.edu

Category captainship, which is a common category management implementation in the retailing industry, can have a tremendous impact on the retailer's bottom line performance. In order to better align the incentives of the category captains, retailers often seek advice from other non-captain manufacturers as well, manufacturers who often referred to as category advisors. Our research investigates the consequences of using a category advisor on the category captainship implementations.

4 - An Integrated Approach for Retail Budget Allocations across Store Labor and Marketing Activities
Olga Perdikaki, Texas A&M University, MS 4217 TAMU, College Station, United States of America, operdikaki@mays.tamu.edu, Subodha Kumar, Chelliah Sriskandarajah

We establish the relationship between weekly sales of a retail store with respect to weekly store traffic, weekly store labor hours, and intra-day traffic variability within a week. We develop an optimization model that allocates store budget across store labor, advertising, and arrival variability reduction efforts to maximize store sales. We present a framework that incorporates the output of the budget allocation model to support salesforce scheduling and discuss managerial implications.

■ TD32

Hilton- Union Sq 12

Service Science II

Contributed Session

Chair: Xiaowei Zhang, HKUST, Hong Kong, China, xiaowiez@ust.hk

1 - Contracting Service Outsourcing with Objective and Subjective Performance Metrics
Zhi Ouyang, School of Management, Xiían Jiaotong University, No. 28 at Xianning West Road of Xiían, Xi'an, China, ouyangzhi1987@stu.xjtu.edu.cn, Qin Su

As to the poor service quality in outsourcing practice, we introduce subjective performance metrics into traditional outsourcing contacting. Based on the contract theory, we analyze the optimal performance for service outsourcing and investigate the reward and punishment mechanism for performance changes. We suggest the situation where the subjective requirements are needed and show optimal objective incentive factor needs to be modified with subjective requirement for higher outsourcing results

2 - Staffing Call Centers After Learning
Xiaowei Zhang, HKUST, Hong Kong, China, xiaowiez@ust.hk, Bangxian Wu

Queueing-theoretic methods have been widely used for designing appropriate call center staffing rules. However, the assumptions of many queueing models are often violated due to the heterogeneity and sophistication of real systems. It is conceivable that the queueing-theoretic staffing rules may not be accurate. In this talk, we will present a framework that attempts to learn the modeling error from data so that necessary adjustment can be made to make the staffing rules more reliable.

3 - Typology-based Analysis of New Service Development
Thomas Meiren, Fraunhofer IAO, Nobelstr. 12, Stuttgart, Germany, thomas.meiren@iao.fraunhofer.de, Ilyas Khan

Based on empirical data from 200 service companies a typology of services was derived and used for the analysis of their service development activities. Depending on the type of service the study shows clear differences concerning strategy, customer integration, development process and methods. The presentation discusses the main findings and provides recommendations for practitioners.

4 - The Three Laws of Service
Robin Qiu, Penn State, 30 E. Swedesford Road, Malvern, PA, 19355, United States of America, robinqiu@psu.edu

By rethinking service encounters, we introduce the new three laws of service. Based on the three laws of service for service encounters, we can view the systems behavior of a service organization as the dynamics of cocreation-oriented service networks. Examples will be used to elucidate the corresponding concepts and principles.

■ TD33

Hilton- Union Sq 13

Health Care Modeling Optimization III

Contributed Session

Chair: Daniel Gartner, Carnegie Mellon University, The H. John Heinz III College, Pittsburgh, PA, 15213, United States of America, dgartner@andrew.cmu.edu

1 - An Implementation of Operating Room Scheduling System in Aichi Medical University Hospital
Mari Ito, Graduate School of Mathematical Sciences and Information Engineering, Nanzan University, d13mm002@nanzan-u.ac.jp, mari.1211.ito@gmail.com, Seto, 489-0863, Japan, d13mm002@nanzan-u.ac.jp, Atsuo Suzuki, Yoshihiro Fujiwara

We develop a support system for generating schedules of operations in Aichi Medical University Hospital. At the result, the schedule obtained has the high efficiency of utilization of operating rooms. We estimate the processing time of operations, than assign the operations to the available time slot operating rooms by integer programming method.

2 - Elective Surgery Scheduling to Improve Patient Safety
Joonyup Eun, PhD Student of Industrial Engineering, Purdue University, 315 N. Grant Steet, West Lafayette, IN, 47907, United States of America, eunj@purdue.edu, Sang-Phil Kim, PhD, Yuehwern Yih, PhD

Surgery scheduling without considering patient health condition exposes patients to be at risk of sentinel events or decreases patient safety. This research describes an operating room planning problem in which patients with different health conditions are scheduled for elective surgery. The problem deals with diseases which not only exacerbate patient health condition with the lapse of waiting time, but also have different severity when they are diagnosed.

3 - Delay Modeling and Analysis Approach for Surgical Scheduling
Maryam Khatami, PhD Student, Wayne State University, 4815 Fourth Street, Detroit, MI, United States of America, maryam.khatami@wayne.edu, Alper Murat

We model the delay propagation in surgical operations to improve elective case scheduling practices. Given the extent of resource sharing, effectiveness of a schedule greatly depends on how delays with different sources and duration could be eliminated via resource de-coupling and absorbed with slack time allocation. Using data from a Detroit hospital with 30 ORs, we construct delay propagation networks and present analysis results from employing delay elimination and reduction strategies.

4 - On Coordinating Anesthesiology and Internal Medicine in a Patient-Centered Surgical Home
Douglas Morrice, Professor, University of Texas at Austin, 2110 Speedway Stop B6500, Austin, TX, 78712, United States of America, Douglas.Morrice@mccombs.utexas.edu, Luci Leykum, Susan Noorily, Dongyang Ester Wang, Kumar Muthuraman, Jonathan Bard

In this paper, we consider different levels of coordination of Anesthesia and Internal Medicine services through patient scheduling in a Patient-Centered Surgical Home. Our work is motivated by a study conducted at the University of Texas Health Sciences Center, San Antonio and its affiliated teaching hospital.

5 - Flexible Hospital-wide Scheduling of Elective Patients
Daniel Gartner, Carnegie Mellon University, The H. John Heinz III College, Pittsburgh, PA, 15213, United States of America, dgartner@andrew.cmu.edu, Rainer Kolisch, Rema Padman

We evaluate three model extensions of Gartner and Kolisch (2014) in which elective patients are scheduled hospital-wide to maximize contribution margin given clinical pathways and scarce resources: First, we decide whether or not a patient is admitted. Second, we decide on the assignment of a patient to one out of several wards (e.g. for multi-morbid patients). Third, we allow for overtime of human resources. In an experimental study, we evaluate these extensions based on real-world data.

■ TD34

Hilton- Union Sq 14

Transport Risk Management

Sponsor: Public Programs, Service and Needs

Sponsored Session

Chair: Vedat Verter, Professor, McGill University, 1001 Sherbrooke Street West, Montreal, QC, H3A 1G5, Canada, vedat.verter@mcgill.ca

1 - A Time-Dependent Road Ban Design Problem In Hazmat Transportation Network

Tolou Esfandeh, PhD Student, University at Buffalo (SUNY), Industrial and Systems Engineering, Buffalo, NY, 14260, United States of America, tolouesf@buffalo.edu, Rajan Batta, Changhyun Kwon

In this talk, we develop and analyze a time dependent road-ban policy to mitigate the risk of hazardous material (hazmat) transportation. By closing roads at particular times, we aim to route hazmat trucks in paths that are dissimilar as far as possible in order to reduce the likelihood of accidents involving hazmat and simultaneously reducing road congestion.

2 - Regulating Intermodal Transportation of Hazardous Materials

Manish Verma, Associate Professor, McMaster University, 1280 Main Street W, Hamilton, ON, L8S 4M4, Canada, mverma@mcmaster.ca, Ginger Ke, Ghazal Assadipour

This research suggests two distinct bi-level programming driven optimization frameworks to assist the government in regulating the usage of intermodal terminals for hazardous material transportation. In the first policy, the government closes certain intermodal terminals; while in the second one, the government deters the carrier from using certain terminals by imposing tolls. Distinct hybrid particle-swarm optimization based solution methodology is also proposed to solve the resulting models.

3 - A Bi-objective Model for the Used Oil Location-routing Problem

Jiahong Zhao, School of Transportation & Logistics, Southwest Jiaotong University, 111 Erhuanlu Beiyiduan,Chengdu,Sichuan, Chengdu, 610031, China, zhao.jiahong@mail.mcgill.ca, Vedat Verter

We present a bi-objective model for the used oil location-routing problem to minimize the total cost and environmental risk. Focusing on hazardous materials contained in used oils that are airborne on release,we propose an environmental risk measure by incorporating the Gaussian plume model in the box model. To solve the problem,we used a modified weighted goal programming approach. The application of the proposed approach in Chongqing of Southwest China provided interesting managerial insights.

4 - Regulating Hazmat Transportation by Game Theory

Stefano Giordani, University of Rome, "Tor Vergata", Via del Politecnico 1, Rome, Italy, stefano.giordani@uniroma2.it, Massimiliano Caramia, Lucio Bianco, Veronica Piccialli

We study a toll setting policy to regulate hazmat transportation, where the regulator aims at minimizing the network total risk and achieving risk equity by minimizing the maximum link total risk. The idea is discouraging hazmat carriers from using links with high risk concentration, assuming that the toll paid by a carrier on a link depends on the link total risk, i.e., by all the carriers' route choices. The model is a bilevel problem where the inner problem is a Nash game among the carriers.

■ TD35

Hilton- Union Sq 15

Joint Session DAS/SPPSN: Decision Analysis Insights for Homeland Security

Sponsor: Decision Analysis & Public Programs, Service and Needs

Sponsored Session

Chair: Robin Dillon-Merrill, Georgetown University, 517 Hariri, McDonough School of Business, Washington, DC, 20057, United States of America, rld9@georgetown.edu

1 - Perceived Risk, Fear and Avoidance Behavior: The Economic Value of Risk Communication

William Burns, Professor, Decision Research, 1201 Oak St Suite 200, Eugene, OR, 97401, United States of America, william_burns@sbcglobal.net

Respondents nationwide participated in a risk communication experiment in which they were exposed to risk communication messaging and then several days later a simulated terrorist attack on an airline. Those receiving a risk message that informed them that DHS could respond effectively to possible attacks reported less fear and intention to cancel planned air travel. Economic modeling of these mitigating results, show significant reductions in loss to the airline industry and U.S. economy.

2 - Your Money or Your Privacy: Eliciting Trade-offs for Cyber Security

Heather Rosoff, Research Assistant Professor, University of Southern California, 3710 McClintock Avenue, RTH 314, Los Angeles, CA, 90089, United States of America, rosoff@usc.edu, Kenneth Nguyen, Richard John

In the cyber world, individuals must decide how to protect their privacy from threats ranging from individual hackers to larger organizations (marketers, government). In doing so, they are forced to assess what values they are willing to trade-off to protect their privacy. In this presentation, we evaluate individuals' smartphone purchase preferences based on trade-off assessments between privacy, cost, processing speed, available apps for download, ease of interface, and server quality.

3 - An Experimental Study of Response to a Near Miss Loss of Coolant Accident (LOCA)

Richard John, Associate Professor, University of Southern California, RTH 310, University Park, Los Angeles, CA, 90089, United States of America, richardj@usc.edu, Jinshu Cui, Heather Rosoff

Public response to a near miss LOCA was using a video scenario simulation of an unfolding crisis at a local nuclear power plant. Over 900 respondents were randomly assigned to one of 18 conditions, using a 3 (cause of LOCA) by 3 (attribution for near miss) by 2 (resolution) between-groups factorial design. Affect, risk perceptions, and behavioral intentions at 3 separate time points were included in an SEM constructed to account for all 3 manipulated variables and demographic variables.

4 - Near-Misses and the Challenges for Cyber Security Decision Making

Robin Dillon-Merrill, Georgetown University, 517 Hariri, McDonough School of Business, Washington, DC, 20057, United States of America, rld9@georgetown.edu

Much about cybersecurity technologies and practices is known but not put into practice. We believe one understudied factor is the impact of prior near-miss events. A near-miss may occur but if there are no salient cues of a possible bad outcome, people appear to mistake such good fortune as an indicator of system resiliency. In several studies, we study people's reaction to near-miss events in the cyber-context. We discuss the implications of our studies for risk communication.

■ TD36

Hilton- Union Sq 16

Information Systems 2

Contributed Session

Chair: Zhuoxin Allen Li, PhD Student, University of Texas at Austin, 2110 Speedway Stop B6500, Austin, TX, 78703, United States of America, zhuoxin.li@phd.mccombs.utexas.edu

1 - IT and Productivity Paradox: A Firm-level Empirical Research with Dynamic DEA Methods

Jiawen Liu, Huazhong University of Science and Technology, 1037 Luoyu Road, Wuhan, China, jiawen_liu@hust.edu.cn, Yeming Gong

While some researches argue that IT can improve the enterprise productivity, others maintain the impact of IT is negative. Using 67 samples from enterprises in Asia, Europe and US, we develop a dynamic two-stage DEA model, allowing intertemporal effects in efficiency measuring, to study IT productivity paradox.

2 - Dynamic Backing Behaviors in Online Crowdfunding with Network Externalities

Zhuoxin Allen Li, PhD Student, University of Texas at Austin, 2110 Speedway Stop B6500, Austin, TX, 78703, United States of America, zhuoxin.li@phd.mccombs.utexas.edu

Online crowdfunding enables entrepreneurs to fund their project by soliciting small investments from a large number of potential investors over the Internet. In addition to the static project information provided by the entrepreneur, investors also assess a project's prospect based on other investors' backing decisions. We develop a dynamic structural model that captures investors' backing behaviors and estimate the model using data collected from a major crowdfunding platform.

3 - Budget Allocation over Cybersecurity Investment Categories through a Portfolio Approach
Yueran Zhuo, PhD Candidate, University of Massachusetts Amherst, 121 Presidents Drive, 226, Amherst, MA, 01003, United States of America, yzhuo@som.umass.edu, Senay Solak

Cybersecurity is an indispensable component of business success. The deterioration of cyber environment has increased the need for efficient planning of cybersecurity investments. We develop a generic framework to optimize budget allocation over cybersecurity investment categories to achieve the maximum protection against cyber-attacks under multiple industry background settings. Numerical and analytical analyses are conducted to conclude managerial insights separately for different industries.

4 - TamagoCar – Using a Simulation App to Explore Demand Response to Energy Tariffs
Ksenia Koroleva, Rotterdam School of Management, Burgmeester Oudlaan 50, Rotterdam, Netherlands, koroleva@rsm.nl, Micha Kahlen, Wolf Ketter

We propose to study the behavior of electric vehicle (EV) users with a specifically designed application, TamagoCar, which combines real world driving behavior with a simulated EV environment. The uncertainty about the future price, range anxiety and uncertainty about future travel are hypothesized to reduce price sensitivity of demand for electricity. Participants adjust their behavior in response to real-time price changes and smooth out the demand peaks, thus favorably impacting the grid.

5 - Disease Co-Contingencies and Impact on Test Alert Closure Times in E-Patient Portals
Yazan Alnsour, PhD Student, Business School, University of Colorado Denver, 1475 Lawrence St., Denver, Co, 80202, United States of America, yazan.alnsour@ucdenver.edu, Jiban Khuntia, Todd Trautman

Comorbidity and contiguous disease lead to multiple alerts in e-portals. This study explores how concerns with comorbidity leads to a better result in closing alerts. Using e-Portal datasets for diabetes patients, our analysis provides evidence that comorbidity conditions lead to early closure of alerts, and complement each click and view of the alerts; in comparison to contiguous disease. We compare and contrast these results with patients with renal insufficiency as focal diseases.

■ TD37

Hilton- Union Sq 17

Big Data 1

Contributed Session

Chair: Samik Raychaudhuri, 24/7 Customer Pvt. Ltd., EGL Business Park, Off Intermediate Ring Road, Bangalore, 560071, India, samikr@gmail.com

1 - Machine Learning to Recognize Customer Intent in Big Data
Samik Raychaudhuri, 24/7 Customer Pvt. Ltd., EGL Business Park, Off Intermediate Ring Road, Bangalore, 560071, India, samikr@gmail.com, Ravi Vijayaraghavan

In this presentation, we will discuss some of the ML models that we use in various channels to ferret out customer intent from the voluminous "big data" - which are collected through our interaction with the customers at various touchpoints.

2 - Leveraging Big Data to Enhance user Engagement
Wesley Gifford, IBM T.J. Research Center, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States of America, wmgifford@us.ibm.com, Yi-Min Chee, Ashish Jagmohan, Anshul Sheopuri

Many businesses devote considerable effort to maintaining user engagement. In this work we study the problem of identifying users who would be most suited for engagement actions, the best content to recommend to them based on a variety of novel mechanisms, and the appropriate time to engage such users. Models are developed which capture relevant user dynamics and performance results are given based on experiments using real-world data.

3 - Group Sparse Optimization via Nonconvex Regularization
Yaohua Hu, Zhejiang University, 38 Zheda Road, Hangzhou, ZJ, 310027, China, hyh19840428@163.com

In this paper, we investigate the theoretical properties and design an efficient numerical algorithm for the group sparse optimization. We introduce the group restricted eigenvalue condition, and apply it to establish the oracle result and recovery bound for the $\ell_{p,q}$ regularization problem. We also apply the proximal gradient method to solve the $\ell_{p,q}$ regularization problem and present some numerical results on both simulated data and real data in gene transcriptional regulation.

4 - Streaming Analytics for High Velocity Big Data IoT Platforms
Michiel Van Herwegen, Ghent University, Tweekerkenstraat 2, Gent, 9000, Belgium, michiel.vanherwegen@ugent.be, Dirk Van den Poel

Using an actual IoT application deployed on a lambda architecture cloud platform, this study covers the challenges of streaming analytics when the high velocity aspect must be met in an IoT context that also has to scale to millions of simultaneous devices. In order to achieve highly scalable algorithms that can cope with incomplete information, we reworked batch ensemble algorithms for streaming data to cope with common IoT data issues while retaining the core properties of the algorithm.

5 - The Fundamentals of Responsive Processes: Exploiting Context in an Entropy-Based Analytic Framework
Andy Bruntsch, PhD Cand., The Hong Kong University of Science and Technology, Clear Water Bay, Kowloon, Hong Kong, Hong Kong - PRC, abruntsch@ust.hk

In an era of pervasive customer focus a processes' capability to dynamically respond to escalating process requirements in the most efficient, yet feasible and still compliant way is no longer optional. A novel analytical approach is presented based on an analogy. It establishes entropy for quantifying dynamic change in the context of a process and for modeling its translation into dynamic process behavior. Application to an extensive dataset of a patenting process shows the practical relevance.

■ TD38

Hilton- Union Sq 18

Health Care Modeling Optimization IV

Contributed Session

Chair: Guohua Wan, Professor, Shanghai Jiao Tong University, 535 Fahuazhen Road, Shanghai, 200052, China, ghwan@sjtu.edu.cn

1 - An Optimization Framework to Improve Patient Safety in Radiation Therapy Care Delivery Process
Pegah Pooya, North Carolina State University, 111 Lampe Dr, Campus Box 7906, Raleigh, NC, United States of America, ppooya@ncsu.edu, Prithima Mosaly, Julie Ivy, Lukasz Mazur, Katharin Deschesne

We develop an optimization framework to improve the process reliability and patient safety of radiation therapy care delivery process for cancer patients. The use Safety Barriers (SB) in radiation oncology is a widely recognized method for detecting potential errors before they reach the patient. In this study, a Dynamic Programming model is developed to optimize the location and elements of Safety Barriers (SB).

2 - Multi-level HIV Prevention Funds Allocation Process – Asymmatric Information
Monali Malvankar, University of Western Ontario, Schulich School of Medicine & Dentistry, London, ON, Canada, mmalvan@uwo.ca, Greg Zaric, Xinghao Yan

HIV prevention funds often traverse several levels of decision-making. We model the process of allocation of prevention funds in which an upper-level decision maker allocates funds to multiple lower-level decision makers as a dynamic programing model. The upper-level decision maker attempts to improve outcomes through use of a priori information.

3 - A Mixed Integer Programming Approach to Surgery Scheduling with Simultaneous Decision Making
Halil Ibrahim Guenduez, Assistant Professor, RWTH Aachen University, Kackerstr. 7, Aachen, 52072, Germany, guenduez@or.rwth-aachen.de, Martin Baumung

Our work covers a real case of surgeon and elective surgery scheduling for a small clinic department in University Hospital Aachen, Germany, and aims at improving the scheduling in order to reduce costs related to the operating room time while considering different resources simultaneously. For this purpose, we developed a mixed integer linear programming model, which aims at minimizing the costs for the operating room time required to perform all of the surgeries.

4 - Scheduling Surgical Operations in a Large Chinese Hospital
Guohua Wan, Professor, Shanghai Jiao Tong University, 535 Fahuazhen Road, Shanghai, 200052, China, ghwan@sjtu.edu.cn, Liwei Zhong, Guochun Tang

We study the surgical operations scheduling problem in a large Chinese hospital. We first model the problem as a deterministic multimachine scheduling problem to determine the assignment of the jobs to operating rooms and the sequence of the jobs in each operating room. Then, given the job sequence and assuming random processing times, we determine the job starting times by an appointment scheduling model. These models and algorithms are built in a real scheduling system running in the hospital.

5 - Scheduling of Operating Room Activities with a Balanced Distiribution of Surgical Services

Bülent Cekiç, Dr., Hacettepe University, Hacettepe University Beytepe Campus, Department of Business Administration, Ankara, 06800, Turkey, bulentc@hacettepe.edu.tr

This study aims to find an optimal solution to the balanced distribution of surgical services to operating rooms. For that matter, a mixed integer programming model is developed. The objective function of the model aims to minimize setup costs and provides a weekly balanced distribution of operating rooms to surgical services. The results shows that the alternative scenarios exhibit more balanced operation distributions and a flexible operating room usage with less time and setup costs.

■ TD39

Hilton- Union Sq 19

Kidney Exchange Models

Sponsor: Health Applications

Sponsored Session

Chair: Yichuan Ding, Assistant Professor, Sauder School of Business, University of British Columbia, 2053 Main Mall, Vancouver, BC, V6T1Z2, Canada, Daniel.Ding@sauder.ubc.ca

1 - Optimizing over Pure Stationary Equilibria in Consensus Stopping Games

Amin Dehghanian, University of Pittsburgh, 1061 Benedum Hall, 3700 O'Hara St,, Pittsburgh, PA, 15261, United States of America, amd120@pitt.edu, Murat Kurt, Andrew Schaefer

We consider consensus stopping games, a class of stochastic games that requires the consent of all players to terminate the game. We show that each consensus stopping game may have many pure stationary equilibria, which in turn raises the question of equilibrium selection. We develop an efficient algorithm to find a best pure stationary equilibrium of a consensus stopping game. We discuss an application of this class of games in the context of kidney exchanges.

2 - Current Challenges in Kidney Exchange

Itai Ashlagi, MIT, 100 Main St., Cambridge, MA, United States of America, iashlagi@mit.edu

Different practices will be explored followed by models that explain some of the achievements of some kidney exchange clearinghouses. I will further empirical findings that shed light on the kidney exchange marketplace.

3 - Experiences from a Large Kidney Exchange, and New Results on Dynamic, Failure-aware, Fair Matching

Tuomas Sandholm, Carnegie Mellon University, 5000 Forbes Ave., Pittsburgh, PA, 15213, United States of America, sandholm@cs.cmu.edu, John Dickerson

Modern kidney exchanges conduct complex matching with 2-cycles, 3-cycles, and altruistic-donor-triggered chains that extend potentially infinitely. I will share learnings from running the optimization side of the UNOS kidney exchange since its inception in 2010. It now includes 59% of the US transplant centers. I will present new experiments on advanced kidney exchange matching that combines dynamic matching via potentials, matching that is cognizant of pre-surgery edge failures, and fairness.

4 - Rationing Non-Directed Donors in Kidney Exchange

Chris Ryan, The University of Chicago Booth School of Business, Chicago, IL, United States of America, christopher.ryan@chicagobooth.edu, Yichuan Ding, Dongdong Ge, Simai He

Historically, non-directed donors (NDDs) have been allocated to the decreased-donor waitlist. Recently, use of NDDs in exchanges has increased the number of transplants but reduced prospects for patients without donors. We take a non-asymptotic approach to quantify the marginal benefit of NDDs to the exchange pool. When the pool size is not moderately large and the proportion of low sensitized patients is above a threshold, the marginal benefit of NDDs diminishes quickly.

■ TD40

Hilton- Union Sq 20

Dynamic Programming in Health Care

Sponsor: Health Applications

Sponsored Session

Chair: Steven Shechter, Associate Professor, University of British Columbia, 2053 Main Mall, Vancouver, BC, V6T-1Z2, Canada, steven.shechter@sauder.ubc.ca

1 - Managing Healthcare Systems: Speedup versus Admission Control

Galit Yom-Tov, Technion-Israel Institute of Technology, Haifa, Israel gality@techunix.technion.ac.il, Carri Chan

Waiting, admission control and speedup of service rates have been used to manage congestion in Service Systems. We examine a multi-server queueing system which allows for admission control and speedup. We characterize properties of the optimal control, and do performance evaluation of a queueing system with a two-threshold policy. We use the approximation analysis to characterize the region of the optimal solution, and develop a greedy heuristic to derive a near-to-optimal solution.

2 - Issuing Policies for Hospital Blood Inventory

Alireza Sabouri, University of British Columbia, Vancouver, BC, V6T 1Z2, Canada, alireza.sabouri@sauder.ubc.ca, Tim Huh, Steven Shechter

We propose a model for allocating red blood cells for transfusion to patients, which is motivated by recent evidence suggesting that transfusing older blood is associated with increased mortality rate. We study the properties of blood issuance policies that balance the trade-off between "quality" measured in average age of blood transfused and "efficiency" measured in the amount of shortage. Based on our analysis, we design efficient issuance policies and evaluate their performance.

3 - Dynamic New Patient Consult Scheduling for Medical Oncology

Antoine Sauré, Post-Doctoral Fellow, Sauder School of Business, University of British Columbia, 2053 Main Mall, Vancouver, BC, V6T 1Z2, Canada, antoine.saure@sauder.ubc.ca

Motivated by an increasing demand for cancer care and long waits for new patient consults, we undertook a study of medical oncology scheduling practices at a regional cancer center. As a result, we formulated and approximately solved a discounted infinite-horizon MDP model that seeks to identify good policies for allocating oncologist consultation time to incoming new patients, while reducing waits in a cost-effective manner. The benefits from the proposed method are evaluated using simulation.

■ TD41

Hilton- Union Sq 21

Health Care, Strategy and Policy 2

Contributed Session

Chair: George Miller, Altarum Institute, 3520 Green Court, Suite 300, Ann Arbor, MI, 48105, United States of America, george.miller@altarum.org

1 - Measuring the Efficiency of Home Health Agencies

Mehmet Kilinc, University of Arkansas, Bell Engineering, Fayetteville, AR, 72701, United States of America, mkilinc@uark.edu, Ashlea Milburn

The objectives of this study are to analyze the efficiency of home health agencies by Data Envelopment Analysis (DEA) and to investigate differences in efficiency across a study area. Some of the research questions that this study aims to address are: How much variation is there in efficiency in home healthcare industry? What are the driving factors determining efficiency of agencies? What are the best practices? What are the possible policy interventions to improve inefficient agencies?

2 - Assessing the Benefits and Costs of Prevention from Multiple Stakeholder Perspectives

George Miller, Altarum Institute, 3520 Green Court, Suite 300, Ann Arbor, MI, 48105, United States of America, george.miller@altarum.org, Charles Roehrig

We describe a new analysis tool for characterizing the value of an investment in nonclinical primary prevention from the multiple perspectives of organizations that can influence the investment. Applications to smoking and obesity interventions illustrate how stakeholder-specific value is affected by (1) the time horizon and costs of interest, (2) the costs associated with increased longevity caused by an intervention, and (3) the impact of improved treatment on the benefits of prevention.

3 - Capacity Planning for Cancer Prevention
Aaron Ratcliffe, University of North Carolina Greensboro, 438 Bryan Building, PO Box 26170, Greensboro, NC, 27402-6170, United States of America, aaron.ratcliffe@uncg.edu, Ann Marucheck, Wendell Gilland

We analyze a queuing network to study the relationship between screening guidelines and capacity planning for colorectal cancer. The screen provider chooses its capacity to balance the cost of cancer detection delay with the cost of additional capacity. Patients spend a random time at home before scheduling a repeat screen. We consider the impact of other provider interventions such as price changes and education efforts about screening guidelines.

4 - Risk Assessment of Occupational Injuries Using Accident Severity Grade
Nasibeh Azadeh-Fard, PhD Student, Virginia Tech, 250 Durham Hall, Blacksburg, VA, 24060, United States of America, nasibeh@vt.edu, Anna Schuh, Jaime Camelio

To identify workplace hazards, safety surveillance techniques have been used, including official accident severity metric. However, the definition of severity used by these tools does not consider important employee and workplace factors with potential significant impacts on accident severity. A new severity scoring and risk assessment system is introduced which considers multiple influential factors that improves risk assessment and the estimation of accident severity.

5 - Cigarette Packet Pictorial Warning: Is There Any Impact on New, Old, and Non-Smokers
Siddhartha Rastogi, Assistant Professor, IIM Indore, Rau-Pithampur Road, IIM Indore, Indore, 453331, India, srastogi@iimidr.ac.in, Rajhans Mishra

India made pictorial warning on cigarette packets mandatory following most industrial nations. However, it is not ascertained in case of India if this warning has had any desirable impact. We seek to assess this impact on three different groups of adults, namely - smokers, initiators, and non-smokers. We use survey method with purposive sampling and triangulate our results with those of international studies. The study hopes to contribute with marketing and policy insights.

■ TD42

Hilton- Union Sq 22

Joint Session HAS/Analytics: Big Data Analytics in Healthcare

Sponsor: Health Applications & Analytics Section

Sponsored Session

Chair: Hao Zhang, University of Maryland School of Medicine, 22 S Greene St, Baltimore, MD, 21201, United States of America, hzhan001@umaryland.edu

1 - Applying Advanced Analytics to Generate Value from Big Data in Health
Juergen Klenk, Principal Scientist, Exponent, Inc., 1800 Diagonal Road, Suite 500, Alexandria, VA, 22314, United States of America, jklenk@exponent.com

Fueled by legislative catalysts (e.g., HITECH, ACA) and remarkable discoveries that demonstrate the actual value of data driven decision making in organizations (e.g., Erik Brynjolfsson, MIT), the Healthcare Industry is now rushing to generate value from Big Data. We will review key components of a Big Data Analytics strategy, demonstrate how it can be successfully implemented to benefit your organization, and discuss specific examples related to Personalized Medicine and Wellness.

2 - Parallel Predictive Modeling Platform for Healthcare Analytic Research using EHR
Jimeng Sun, Associate Professor, School of Computational Science and Engineering, Georgia Tech, 266 Ferst Drive, Atlanta, GE, 30363, United States of America, jsun@cc.gatech.edu

Healthcare analytics research increasingly involves the construction of predictive models for disease targets across varying patient cohorts using electronic health records (EHRs). We implemented this platform using Map-Reduce to enable independent tasks to run in parallel in a cluster computing environment.

3 - Electronic Health Records for Decision Support - Meaningful Use of Complex Medical Data
Eva Lee, Professor & Director, Georgia Institute of Technology, Ctr for OR in Medicine & Healthcare, Atlanta, GA, 30332, United States of America, eva.lee@gatech.edu

This work is joint with Grady Memorial Hospital and the Children's Healthcare of Atlanta. We focus on identifying reasons behind the recurrence of patient admissions, and designing classification models to predict potential readmissions. Large scale data analysis and results will be presented. This is critical given the Affordable Care Act is beginning to implement readmission penalties. The algorithmic approach could detect readmission triggers without human monitoring.

4 - Understanding Temporal Patterns in Drug Therapy
Margrét Bjarnadóttir, University of Maryland, 4324 Van Munching Hall, University of Maryland, College Park, MD, 20742, United States of America, margret@rhsmith.umd.edu

Non-adherence to drug therapy can lead to worsening of conditions and health decline. Summary statistics are often used to describe adherence, but they do not adequately capture patients' different adherence patterns, which vary widely. In this study we propose a methodology to understand drug adherence in large scale populations through clustering and Eventflow, a novel interactive visualization tool, summarizing prescription patterns of large patient cohorts.

■ TD43

Hilton- Union Sq 23

Data-driven Service Systems

Sponsor: Computing Society

Sponsored Session

Chair: Omid Nohadani, Associate Professor, Northwestern University, 2145 Sheridan Road, Evanston, IL, 60208, United States of America, nohadani@northwestern.edu

Co-Chair: Jocelyn Dunn, Visiting Pre-Doctoral Fellow, Northwestern University, Industrial Eng. and Management Sciences, Evanston, IL, 60208, United States of America, jocelyn.dunn@northwestern.edu

1 - Data-driven Approaches for Planning Equipment Maintenance
Ying Tat Leung, IBM Research - Almaden, 650 Harry Road, San Jose, CA, 95120, United States of America, ytl@us.ibm.com, Hyung-il Ahn, Axel Hochstein

With increasing availability of data, quantitative approaches for planning equipment maintenance have evolved beyond the classic statistical approach in the last two decades. We present an example of how straightforward historical data reporting, the traditional time-based maintenance model, a more equipment-specific condition-based one, and a most assertive predictive maintenance approach are used simultaneously to provide different types of information to aid the maintenance planner.

2 - Robust Data-Driven Categorization for Service System Usage
Omid Nohadani, Associate Professor, Northwestern University, 2145 Sheridan Road, Evanston, IL, 60208, United States of America, nohadani@northwestern.edu, Jocelyn Dunn, Gerhard Klimeck

When defining categories of service system usage, typically, dissension among multiple criteria is observable. These criteria measure different aspects of data and have unknown importance in categorization. With uncertain weights on these multiple criteria, a robust data-driven approach is developed and applied to nanoHUB usage data to deduce, validate, and optimize categories of usage. The proposed method is generic and free of assumptions enabling targeted improvement of diverse systems.

3 - CityScan: Urban Predictive Analytics
Mallory Nobles, Carnegie Mellon University, 5000 Forbes Ave, Pittsburgh, PA, 15213, United States of America, mallory.nobles@gmail.com, Seth Flaxman, Daniel Neill

We present CityScan, a novel approach to urban predictive analytics. CityScan applies state-of-the-art detection methods to identify emerging clusters of various leading indicators, and uses these clusters to predict when and where an event of interest is likely to occur. It has been deployed in Chicago to predict emerging events relevant to city operations, including hot-spots of violent crime and rodent infestations, and achieves high accuracy at fine-grained spatial and temporal resolutions.

■ TD44

Hilton- Union Sq 24

Social Media Consumer Analytics

Sponsor: Information Systems

Sponsored Session

Chair: Ramesh Shankar, Associate Professor, University of Connecticut, 2100 Hillside Road, Unit 1041, Storrs, CT, 06269, United States of America, Ramesh.Sankaranarayanan@business.uconn.edu

1 - Firm's Social Media Efforts, Consumer Behavior, and Firm Performance: Evidence from Facebook

Sunghun Chung, Postdoctoral Fellow, McGill University, 1001 Sherbrooke Street West, Montreal, QC, H3A1G5, Canada, sunghun.chung@mcgill.ca, Animesh Animesh, Kunsoo Han, Alain Pinsonneault

This study theorizes and empirically examines how firm's social media efforts influence consumer behavior and firm performance. Using detailed data collected from Facebook pages, we find that richness and responsiveness of a firm's social media efforts are significantly associated with the firm's market performance, captured by abnormal return and Tobin's q. Interestingly, the intensity of firm's social media effort is not significantly associated with firm performance.

2 - WOM, Cast and Fans: Movie Demand Prediction using Derived Networks

Yang Wang, University of Utah, David Eccles School of Business, 1655 East Campus Center Drive, Salt Lake City, UT, 84112, United States of America, yang.wang@business.utah.edu, Olivia Sheng, William Moore, Vandana Ramachandran

WOM and movie sales can be correlated according to past studies. Can future movie demand prediction using WOM be enhanced by linkage between movies established via common casts, crews or fans? Using data from the most popular Chinese movie review platform, douban.com, we improve demand forecasts for foreign movies shortly after their premiere outside China via Hierarchical Bayesian Modeling and the aforementioned linkage amongst movies.

3 - Factors Driving Customer Engagement in Location-Based Social Media

Ram Gopal, Professor, Department Head, University of Connecticut, 2100 Hillside Road Unit 1041, Storrs, CT, 06269, United States of America, ram.gopal@business.uconn.edu, Ramesh Shankar, Lei Wang, Joseph Pancras

Retailers are increasingly utilizing location-based services via mobile devices to enhance customer engagement. We develop a two stage model of location-based customer engagement in Foursquare to seek how business characteristics, geographic proximity and demographic similarity together affect customer engagement. We find a persistent spatial interdependence, a spatial phenomenon that we term 'social congregation' effect, and a temporal agglomeration effect in the restaurant industry.

4 - Linguistic Features and Peer-to-Peer Loan Quality: A Machine-learning Approach

Mingfeng Lin, University of Arizona, 1130 E. Helen St, Tucson, AZ, 85721, United States of America, mingfeng@email.arizona.edu, Qiang Gao

We study the information value of linguistic features in predicting loan qualities in online peer-to-peer lending, using transactions data from a leading platform. Using both explanatory and predictive models, we find that linguistic features, or how borrowers write their loan request descriptions, can differentiate good and bad loans. Interestingly, investors are not always able to interpret such information, suggesting that our machine learning approach can help improve market efficiency.

■ TD45

Hilton- Union Sq 25

Quality and Inventory Issues in Behavioral Operations

Sponsor: Behavioral Operations Management

Sponsored Session

Chair: Elena Katok, Ashbel Smith Professor, University of Texas at Dallas, 800 W. Campbell Drive, Dallas, TX, 75080, United States of America, ekatok@utdallas.edu

1 - The Effect of Social Influence on Consumers' Switching Behavior under Quality Competition

Dayoung Kim, Cornell University, 301K Sage Hall, Ithaca, NY, 14850, United States of America, dk668@cornell.edu, Andrew Davis, Vishal Gaur

We conduct a laboratory experiment to investigate the effect of social influence on consumers' choices between firms competing on service quality. First, we examine how consumers choose between two firms differing in service quality, absent social influence, and how this behavior impacts market share and uncertainty in demand. We then explore how the presence of social influence affects these same performance metrics, and provide managerial implications for both high and low quality firms.

2 - Cry Wolf or Equivocate? Credible Forecast Guidance in a Cost-loss Game

Elena Katok, Ashbel Smith Professor, University of Texas at Dallas, 800 W. Campbell Drive, Dallas, TX, 75080, United States of America, ekatok@utdallas.edu, Gary Bolton

What is the most credible way to convey forecast uncertainty to the users of expert models? We test two ways - give end users uncertainty information, or give them specific recommendations. We find that the effectiveness of both methods is hampered by a cry wolf effect, but substantially more so for recommendations. People are particular sensitive to the cry-wolf effect when the optimal decision is to take a counter-intuitive action.

3 - How Supplier Scorecards Affect Quality: A Behavioral Study

Elena Katok, Ashbel Smith Professor, University of Texas at Dallas, 800 W. Campbell Drive, Dallas, TX, 75080, United States of America, ekatok@utdallas.edu, Zhixi Wan

Supplier scorecards are used to evaluate existing suppliers and motivate them to deliver high quality, by linking current performance with future contracts. We present an analytical model of supplier behavior with scorecards, and investigate it in the laboratory.

4 - The Bright and Dark Sides of Perception Biases in Inventory Decisions

Yaozhong Wu, National University of Singapore, Singapore, 119245, Singapore, yaozhong.wu@nus.edu.sg

We study the impact of perception biases in competing inventory decisions. We analyze how a manager's perception bias affects each other's inventory decisions and performances in strategic interactions, and more importantly who benefits from these biases in the short and long runs. We show that a perception bias can serve as a competitive advantage in the sense that a biased manager can achieve a higher profit than an unbiased competitor.

■ TD46

Hilton- Lombard

Dynamic Combinatorial Optimization under Uncertainty

Sponsor: Optimization/Integer and Discrete Optimization

Sponsored Session

Chair: Alejandro Toriello, Assistant Professor, Georgia Tech ISyE, 765 Ferst Dr NW, Atlanta, GA, 30332, United States of America, atoriello3@isye.gatech.edu

1 - Randomized Minmax Regret for Combinatorial Optimization under Uncertainty

Andrew Mastin, MIT, EECS & LIDS, Cambridge, United States of America, mastin@mit.edu, Sang Chin, Patrick Jaillet

We consider a randomized model for minmax regret combinatorial optimization under uncertainty, where an optimizing player selects a probability distribution over solutions and an adversary selects costs with knowledge of the player's distribution. While the deterministic minmax regret versions of most polynomial solvable problems are NP-hard, we show that under this randomized model, the minmax regret version of any polynomial solvable combinatorial problem becomes polynomial solvable.

2 - New Efficient Algorithms for the Time Cost Tradeoff Problem in Project Management

Dorit Hochbaum, Professor, University of California, Berkeley, IEOR Department, Etcheverry Hall, Berkeley, CA, 94720, United States of America, hochbaum@ieor.berkeley.edu

The time-cost trade-off problem (TCT) is to determine the extent of expediting, or crashing, of activities in a project so as to benefit most from early completion incentives. We describe two polynomial time algorithms that provide a new interpretation of old algorithms: one solving the primal and the other solving the dual.

3 - Semi-Infinite Relaxations for the Dynamic Knapsack Problem with Stochastic Item Sizes

Alejandro Toriello, Assistant Professor, Georgia Tech ISyE, 765 Ferst Dr NW, Atlanta, GA, 30332, United States of America, atoriello3@isye.gatech.edu

We consider a knapsack problem in which item sizes are stochastic and realized after an attempted insertion, and the decision maker chooses an item to insert dynamically based on remaining capacity. We derive relaxations of polynomial and pseudo-polynomial size based on different approximations of the value function, relate them to previous work and compare them.

4 - A MIP Model and Solution Approach for Supply Chain Planning with Time-Aggregated Quantity Discounts

Aly Megahed, Research Staff Member, IBM Research - Almaden, 650 Harry Road - Office D3-428, San Jose, CA, 95120, United States of America, aly.megahed@us.ibm.com, Pratik Mital

We present a supply chain planning problem with time-aggregated quantity discounts. Such discounts are given on aggregated order quantities (e.g. total annual orders that were placed on a monthly basis). A MIP-based local search algorithm is developed as a solution approach. Numerical results that show the efficiency of that algorithm are shared.

■ TD47

Hilton- Mason A

Information, Networks and Big Data

Sponsor: Optimization/Optimization Under Uncertainty

Sponsored Session

Chair: Eugene Perevalov, Lehigh University, IS&E Department, Bethlehem, PA, 18015, United States of America, eup2@lehigh.edu

1 - Predicting Long-Term Product Ratings in Business-to-Consumer Online Systems

Alexander Nikolaev, University at Buffalo (SUNY), 312 Bell Hall, Buffalo, NY, 14260, United States of America, anikolae@buffalo.edu, Sushant Khopkar

Online users often rely on observed product ratings. However, when an average product rating is based on a small number of ratings, they may not feel confident about the product, even if the average is high. This paper presents a new Bayesian Network (BN) method for predicting the long-term average product rating. Compared to Running Average and Linear Regression predictors, the BN method works particularly well around the time of product introduction when prediction accuracy is most valuable.

2 - Education Supply Chains and Network Science – A Preliminary Investigation

Soundar Kumara, Allen E. Pearce/Allen M. Pearce Professor, The Pennsylvania State University, 222 Leonhard Building, Industrial Engineering, University Park, PA, 16802, United States of America, skumara@psu.edu, Gerhard Klimeck, Yi-Shan Sung, Cheng-Bang Chen, Jim Slopsema, Lynn Zentner, Mike Zentner

On-line education can be equated with supply chains, where different educational modules and tools can be considered as products; students, researchers and others can be considered as customers. In this talk we deal with longitudinal data from nanohub on-line learning and research resource usage (from Purdue University) to investigate product mix, and capacity requirements by using statistical and Graph analytics.

3 - On the Theory of Information Extraction

Xing Wang, Student, Lehigh University, 205 Summit Street, Bethlehem, PA, 18015, United States of America, xiw313@lehigh.edu, Eugene Perevalov

The classical Information Theory provides tools for optimizing information transmission by virtue of properly describing information quantity. On the other hand, in order to optimize information acquisition from sources, a general quantitative description of information accuracy and, respectively, of the structure of the sources' knowledge is needed. We describe the basics of a general theory of information accuracy that naturally extends the classical information theory in this direction.

■ TD48

Hilton- Mason B

Optimization, Robust 1

Contributed Session

Chair: Mohammad Javad Feizollahi, Phd Candidate, Georgia Institute of Technology, 765 Ferst Drive NW, Suite 439 (main building), Atlanta, GA, 30332-0205, United States of America, feizollahi@gatech.edu

1 - A Method for Robust Parameter Design with a Categorical Response

Gonca Karabulut, Production Engineer, Unilever, Camalti Sitesi A2 Blok No:13 Atasehir, Istanbul, Turkey, goncabacanli@gmail.com, Gülser Köksal

A relatively simple and effective method called Logistic Regression Model Optimization (LRMO) is studied for analysis of categorical response data for product design. Its performance is compared with those of four other design optimization methods for an ordered categorical response: Accumulation Analysis (AA), Weighted Signal-to-noise Ratio (WSNR), Scoring Scheme (SS), Weighted Probability Scoring Scheme (WPSS).

2 - Uncertainty Quantification for Robust Optimization and Extended Relational Algebra of Polytopes

Abhilasha Aswal, International Institute of Information Technology, Bangalore, 26/C Electronics City, Bangalore, KA, 560100, India, abhilasha.aswal@iiitb.ac.in, Anushka Chandrababu, GNS Prasanna

Our robust polyhedral representation of uncertainty allows a simple quantification of amount of information driving the optimization. We can establish info equivalences and create new constraint sets, equal in info to an old constraint set. An extended relational algebra of polytopes enables a qualitative visualization of the relations among alternative constraint sets. We show that our approach is computationally simpler than stochastic alternatives and more expressive than robust alternatives.

3 - The Robust Deviation Quadratic Assignment Problem

Mohammad Javad Feizollahi, Phd Candidate, Georgia Institute of Technology, 765 Ferst Drive NW, Suite 439 (main building), Atlanta, GA, 30332-0205, United States of America, feizollahi@gatech.edu, Igor Averbakh

We consider a generalization of the classical quadratic assignment problem, where material flows are uncertain, and only upper and lower bounds are known for each flow. The objective is to find a minmax regret solution. We present an exact Benders decomposition algorithm, a tabu search based heuristic, and a hybrid approach that allows us to combine the speed of heuristics with the rigor and precision of the exact method. We discuss the results of extensive computational experiments.

4 - A Robust Optimization Inventory Model with Uncertain Demand and Lead Time

Mohammad Rahdar, Iowa State University, Iowa State University, Ames, IA, 50011, United States of America, rahdar@iastate.edu, Guiping Hu, Lizhi Wang

A robust optimization model is proposed to explicitly address the uncertain demand and lead time in an inventory model. The model has a tri-level structure. The top level makes ordering decision in the current period, the middle level identifies the worst scenario for all the future periods, and the bottom level is a deterministic inventory model for the remaining periods of the planning horizon. We propose an exact algorithm for the tri-level programming model and report the numerical results.

5 - Robust Vehicle Routing Problem with Time Windows

Da Lu, PhD Student, University of Waterloo, 200 University Ave West, Waterloo, ON, N2L 3G1, Canada, d4lu@uwaterloo.ca, Fatma Gzara

This paper proposes a robust model for the vehicle routing problem with time windows where customer demands are uncertain. The uncertainty is defined as a set of cardinality constrained supports. We propose a branch-and-price-and-cut algorithm to solve the problem. The subproblem is a robust counterpart of shortest path problem with resource constraints(SPPRC) that is solved by solving a series of SPPRC. A new separation strategy tailored for the robust case is developed to find violated cuts.

■ TD49

Hilton- Powell A

Combinatorial Optimization and Social Network Analysis

Sponsor: Optimization/Network Optimization

Sponsored Session

Chair: Cynthia Wood, Rice University, 6100 Main St. - MS 134, Houston, TX, 77005, United States of America, ciw2@rice.edu

1 - Upper Bound on the Clique Number of a Graph

Chitra Balasubramaniam, Texas A&M University, 3131 TAMU, College Station, 77843, United States of America, bcvaidyanath@neo.tamu.edu, Sergiy Butenko

The Maximum Clique Problem has many practical applications that include social network analysis, fault tolerance, and protein interaction networks among others, but it is intractable. We develop a good upper bound for this problem using clique relaxations and compare the results with the bounds from literature.

2 - A Branch-decomposition Algorithm for the p-Median Problem

Caleb Fast, Rice University, 6100 Main St. - MS 134, Houston, TX, 77005, United States of America, ccf5@rice.edu, Illya Hicks

This talk presents results from using a dynamic programming algorithm on branch decompositions of linear relaxations to approximate optimal solutions of p-Median problems. This problem is NP-hard, making an approximation algorithm attractive. This talk compares the branch decomposition algorithm with a standard integer program solver and heuristics for the problem.

3 - Community Detection in Dynamic Social Networks

Aaron Schecter, Northwestern University, 1424 Main St, Evanston, IL, 60202, United States of America, aschec@gmail.com, Noshir Contractor

Research on the identification of communities has focused on their detection in static networks. With the increased availability of time-stamped digital trace data it is now possible to model the dynamics of communities where ties appear, disappear, or change in intensity. We utilize a hierarchical clustering algorithm and a fuzzy clustering algorithm to identify dynamic communities based on cohesion and structural equivalence respectively. We use simulations to validate our methods.

4 - Finding the Maximum Weighted Co-2-Plex in a {Claw, Bull}-Free Graph

Cynthia Wood, Rice University, 6100 Main St. - MS 134, Houston, TX, 77005, United States of America, ciw2@rice.edu

The maximum weighted co-2-plex problem determines a subset of vertices of maximum total weight of a given graph, in which each vertex has degree at most one. This talk presents two polynomial time algorithms for solving MWC2P problem in {claw, bull}-free graphs.

■ TD50

Hilton- Powell B

Optimization, Metaheuristics 1

Contributed Session

Chair: Rym M'Hallah, Associate Professor, Kuwait University, PO Box 5969, Safat, Kuwait, 13060, Kuwait, rymmha@yahoo.com

1 - An Iterated Local Search Variable Neighborhood Descent for the m-Machine Flowshop

Rym M'Hallah, Associate Professor, Kuwait University, PO Box 5969, Safat, Kuwait, 13060, Kuwait, rymmha@yahoo.com

This paper considers the minimal earliness tardiness -machine permutation flow shop scheduling problem with distinct due dates and no inserted idle time when a job is waiting. It presents a mixed integer program, and approximately solves it using V, a fast iterated local search variable neighborhood descent. The results prove the good performance of V, which matches 20.02 % existing upper bounds and tightens 70.54% ones with a 0.07% average deviation.

2 - Transmission Expansion Planning using Multivariate Interpolation

Ebrahim Mortaz, Auburn University, Auburn, AL 36849, Auburn, United States of America, emortaz@auburn.edu, Jorge Valenzuela

The total cost of the Transmission Expansion Planning (TEP) problem consists of investment and operation costs. In this research, we propose a multivariate interpolation method to compute the operation cost for the TEP problem in which the demand changes from hour to hour and the fuel price from day to day. A binary particle swarm optimization is also proposed to solve the problem. We compare our method with traditional methods based on the total cost of the obtained expansion plans.

3 - Mitigating Irreducible Complexity in Evolutionary Algorithms via Initial Population Seeding

Matthew Hoffman, Sandia National Laboratories, P.O. Box 5800, MS 1188, Albuquerque, NM, 87185-1188, United States of America, mjhoffm@sandia.gov, Jack Gauthier, Geoffry Pankretz

Logical constraints confound evolutionary operations in combinatorial optimization problems, leading to "Irreducible Complexity" - the existence of viable (possibly optimal) solutions that cannot be discovered by traditional evolutionary means. We discuss one avenue for mitigating this issue: seeding the initial population with solutions that satisfy the logical constraints least likely to be satisfied by chance. We will demonstrate efficacy of such seeding by comparing results vs. status quo.

4 - A Comparative Study of Algorithms to the Social Team Formation Problem

Victor Cavalcante, Researcher, IBM Research, Rodovia Jornalista Fco. Aguirre Proença, Km 09 - Chacaras Assay, Hortol,ndia, SP, 13186-525, Brazil, victorfc@br.ibm.com, Steven Tsukamoto, Ana Paula Appel, Thiago Rosario, Vagner Santana

Team members' ability to work together is paramount in collaborative tasks. Thus, assembling effective teams to perform collaborative tasks requires considering not only skills, capabilities or availabilities, but also contemplating social links among potential team members. This Social Team Formation Problem is the subject of the current work, where an implementation of a GRASP meta-heuristic is depicted and experimental results are reported and compared with other optimization approaches.

5 - Many Heuristics are Better than One: A Data-driven Approach to Solving MAX-CUT

John Silberholz, PhD Candidate, MIT, 77 Massachusetts Ave, E40-149, Cambridge, MA, 02139, United States of America, josilber@mit.edu, Swati Gupta, Iain Dunning

Can graph properties predict the performance of heuristics on NP-hard problems? Can multiple heuristics be combined into a method that outperforms any single one of them? What is the value added of a new heuristic? We address these questions by constructing a large test bed of instances and implementing 40 published heuristics for MAX-CUT. We show that a hybrid method outperforms any single heuristic and discuss how large-scale test beds and code repositories can improve heuristic evaluation.

■ TD51

Hilton- Sutter A

Data Mining in Medical and Engineering Domain

Sponsor: Data Mining

Sponsored Session

Chair: Cao (Danica) Xiao, PhD Student, University of Washington, Seattle, 3900 Northeast Stevens Way, Mechanical Engineering Building, Room G6, Seattle, WA, 98195, United States of America, danicaxiao@gmail.com

1 - Mining the Structure of Aggregate Energy Demand for Large Consumer Populations

Adrian Albert, Senior Scientist, C3 Energy, 1300 Seaport Blvd, Redwood City, CA, 94062, United States of America, adrian.albert@c3energy.com, Ram Rajagopal

We study the structure in consumption variability of large groups of residential consumers. Variability in aggregate demand is of particular importance for utilities, since they have to make advance decisions on bids into day-ahead and spot markets. We develop a method to form portfolios of individual consumers for which the aggregate is predictable in some sense. For this we design an algorithm to estimate the covariance structure between users that uses past history and exogenous covariates.

2 - Support Vector Data Description-Based Clustering Validity Index

Young-Seon Jeong, Chonnam National University, Dept. of Industrial Engineering, Gwangju, Korea, Republic of, young.jeong@jnu.ac.kr, Soo-Hyun Lee, Jae-Yun Kim, Myong-Kee Jeong

This talk presents a novel clustering validity index (CVI) based on a support vector data description (SVDD) based compactness. Unlike the existing CVIs, which are sensitive to arbitrary shapes of a clustering, the proposed CVI can accurately evaluate a clustering compactness in kernel space. The preliminary results show that the proposed CVI can achieve the accurate compactness for arbitrary shapes of a clustering such as a lengthy stick shape.

3 - A Markov Model to Predict the Future Diabetes Burden in the U.S.
Ji Lin, Centers for Disease Control and Prevention, 4770 Buford Highway, Building 107, MS F-73, Atlanta, GA, 30341, United States of America, xhi6@cdc.gov, Theodore Thompson, Yiling Cheng, Xiaohui Zhuo, Ping Zhang, Edward Gregg, Deborah Rolka

Forecasting of future diabetes prevalence is helpful for formulating health policy and allocating resources. A Markov model is developed to predict prevalence of diabetes for demographic cohorts. Future prevalence depends on current prevalence, incidence, mortality, and migration. Transition probabilities are estimated by statistical modeling on U.S. Census projections and National Health Interview Survey. The system is represented in difference equations and solved by Monte Carlo Simulation.

4 - Decomposed K Nearest Neighbors
Cao (Danica) Xiao, PhD Student, University of Washington, Seattle, 3900 Northeast Stevens Way, Mechanical Engineering Building, room G6, Seattle, WA, 98195, United States of America, danicaxiao@gmail.com, W. Art Chaovalitwongse

DKNN is a variant of KNN that considers the distance to the class prototypes of nearest neighbors as the classification rule, as opposed to the majority votes. Our DKNN also has a training process to learn the distance metric that minimizes classification errors and maximize the margin of decision boundary. Furthermore, DKNN introduces a regularization term (Frobenius or L1) to increase robustness and improve prediction accuracy.

■ TD52

Hilton- Sutter B

Optimization, Constraint Programming

Contributed Session

Chair: Qingwei Jin, Associate Professor, Zhejiang University, Department of Management Science and Eng, Hangzhou, Zh, 310058, China, qingweijin@gmail.com

1 - Graphic Method for n-variable Linear Programming with Two Constraints
Youkang Fang, Professor, Beihai College of Beihang University, 88 Yintan Street, Beihai, 536002, China, fykfyk2004@163.com

In this paper, we show that any linear programming with n variables and two constraints can be solved by using two dimensional graphic method at most twice, and the the degeneracy problem in the simplex method is no more a problem in our method.

2 - Evolutionary Multi Point Search In CPLEX Studio's Constraint Programming Solver Engine
Renaud Dumeur, Principal Architect, Constraint Programming Product Development, IBM, 9 Rue de Verdun, Gentilly, 94250, France, renaud.dumeur@fr.ibm.com, Paul Shaw

In this talk, we present the Multi Point search used in CP Optimizer, the Constraint Programming solver of IBM ILOG CPLEX Studio. After a short introduction to both Constraint Programming and Evolutionary Computation, we will present how the later is hybridized with the former to implement MultiPoint search, as well as information about its usage, parameterization and performance on a large sets of integer and scheduling problem instances.

3 - Semidefinite Relaxation Based Branch and Bound Algorithm for Nonconvex QCQP
Qingwei Jin, Associate Professor, Zhejiang University, Department of Management Science and Eng, Hangzhou, Zh, 310058, China, qingweijin@gmail.com, Cheng Lu

To globally solve convex quadratically constrained quadratic programming problems with nonconvex objective functions, we design a semidefinite relaxation based branch and bound algorithm. We add valid nonconvex constraints, use their convex relaxation and design a branch and bound algorithm to tighten the relaxations, which enforces the nonconvex constraints being satisfied gradually. Numerical experimental results show that the proposed algorithm is very effective.

4 - Optimal Solutions to a Root Minimization Problem over a Polynomial Family with Affine Constraints
Mert Gurbuzbalaban, Postdoctoral Researcher, Massachusetts Institute of Technology, MIT/Lab for Information and Decision Sys, 32 Vassar St., Building 32-D614, Cambridge, MA, 02139, United States of America, mert@cims.nyu.edu, Michael Overton, Julie Eaton, Sara Grundel

We consider the problem of minimizing the root radius and abscissa over the space of monic polynomials of degree n subject to k affine constraints on their coefficients, motivated by some challenging optimal design problems in control. This is a difficult optimization problem due to the nonsmoothness and nonconvexity of the objective function. We prove that there exists an optimizer with at least n-k+1 active roots and present numerical experiments.

5 - A New Globally Convergent Incremental Newton Method
Mert Gurbuzbalaban, Postdoctoral Researcher, Massachusetts Institute of Technology, MIT/Lab for Information and Decision Sys, 32 Vassar St., Building 32-D614, Cambridge, MA, 02139, United States of America, mert@cims.nyu.edu, Asuman Ozdaglar

We develop and analyze a new globally convergent incremental Newton method for minimizing the sum of strongly convex functions, motivated by machine learning problems over large data sets and distributed optimization over networks. We discuss its convergence rate and prove its linear convergence under some assumptions.

■ TD53

Hilton- Taylor A

Finance, Portfolio Analysis 2

Contributed Session

Chair: Mehmet Benturk, Student, Lincoln University, 401 15th St, Oakland, CA, 94612, United States of America, mbenturk@yahoo.com

1 - The Effect of Taste Change on Optimal Portfolio Selection when Assets Exhibit Varied Liquidity
Mehmet Benturk, Student, Lincoln University, 401 15th St, Oakland, CA, 94612, United States of America, mbenturk@yahoo.com, Aharon Hibshoosh

We analyze optimal portfolio selection where some assets are illiquid and are leveraged with different interest rates and different collateral value limits. We assume a taste change when the market changes from bear to bull. We decompose the effect of taste change on asset selection into a substitution effect and income effect. In a portfolio with risky investments and with leverage we derive and characterize the efficient frontier under alternative assumptions on leverage determination.

2 - Portfolio Optimization using Gini-based Risk Measures
Ran Ji, PhD, George Washington University, 2201 G St, NW, Funger Hall 415, Washington, DC, 20052, United States of America, jiran@gwmail.gwu.edu, Srinivas Y. Prasad, Miguel Lejeune

We formulate portfolio optimization models that employ the Gini Mean Difference (GMD) risk measure. We introduce the Mean-Gini Ratio metric that jointly accounts for the expected return and GMD criteria, and show that it is SSD consistent and LP solvable. Computational and cross-validation results as well as comparisons with other risk measures will be presented. Practical insights about the influence of the risk aversion coefficient will be illustrated.

3 - A Black Litterman Model for CVaR Optimization
Cagatay Karan, PhD Student, North Carolina State University, 2152 Burlington Labs, 2500 Stinson Drive, Raleigh, NC, 27695, United States of America, ckaran@ncsu.edu, Tao Pang

The Black Litterman Model (BLM) has contributed to modern portfolio theory a new perspective where the investor views and market equilibrium expected excess returns are combined in a Bayesian manner to get the optimal portfolio weights. Bertsimas, Gupta and Paschalidis(2012) have showed that one can get BLM type results by using inverse optimization. We will show our algorithms and numerical results for the BLM type optimization problems under CVaR risk measure.

4 - Computing near-optimal Value-at-Risk portfolios using Integer Programming techniques
Onur Babat, Lehigh University, 217 West Packer Avenue Apt:106, Bethlehem, PA, 18015, United States of America, onur.babat@lehigh.edu, Luis Zuluaga, Juan C. Vera

We consider the Value-at-Risk (VaR) portfolio optimization problem, which is an extension of Markowitz model in which VaR is used instead of variance as the risk measure. The VaR model can be formulated as an integer programming (IP) problem, and the formulation can be solved for small to mid-size instances in a reasonable amount of time. We exploit the IP formulation to develop an efficient algorithm to solve larger scale instances of the VaR model. Relevant numerical experiments will be given.

5 - A Model Selection Method for Option Pricing
Berk Orbay, Bogazici University, Suna sok. 34 Etiler, Istanbul, Turkey, berk.orbay@boun.edu.tr, Refik Güllü, Wolfgang Hörmann

Empirical evidence on comparison of option pricing models shows that there is no consensus on a single dominating model for all contract parameters and over different time periods. We propose a clustering method to find the relevant regions of contract parameters for model selection. Then, we use a decision rule to select the most suitable model over these regions. Finally, we provide out-of-sample testing results using different assets and option pricing methods over different time periods.

■ TD54

Hilton- Taylor B

Optimal Stopping with Applications to Finance and Economics

Sponsor: Financial Services Section

Sponsored Session

Chair: Dharma Kwon, Assistant Professor, University of Illinois at Urbana-Champaign, 1206 South Sixth Street, Champaign, United States of America, dhkwon@illinois.edu

1 - A Dynamic Analysis of Short Time Work Arrangements
Kuno Huisman, Tilburg University, Post Office Box 90153, Tilburg, Netherlands, K.J.M.Huisman@uvt.nl

This paper analyses the temporary unemployment regulations that were introduced during the recent recession. We view these measures as a collection of real options that governments provide to ?rms and value these options. The e?ect of such measures on the liquidation decision of the ?rm is studied and in addition the e?ect of government limitations on the duration of the program. Temporary unemployment measures delay a ?rm's liquidation. However, the programme is not necessarily good for welfare

2 - Detection with Post-Change Drift Uncertainty
Heng Yang, Graduate Center, CUNY, 365 fifth avenue, New York, NY, 10016, United States of America, hyang@gc.cuny.edu, Olympia Hadjiliadis, Mike Ludkovski

We consider the problem of quickest detection of an abrupt change when there is uncertainty about the post-change distribution. The objective is to find a decision rule to minimize a measure of worst detection delay of the min-max type subject to a frequency of false alarm constraint. In this effort, we discuss two different rules: the first rule is a delayed version of CUSUM algorithm, and the second rule is an online composite CUSUM-based stopping time.

3 - Optimal Mean Reversion Trading with Transaction Cost and Stop-Loss Exit
Tim Leung, Columbia University, 500 West 120th Street MC4704, New York, United States of America, tl2497@columbia.edu, Xin Li

Motivated by the industry practice of pairs trading, we study the optimal timing strategies for trading a mean-reverting price spread. An optimal double stopping problem is formulated to analyze the timing to start and subsequently liquidate the position subject to transaction costs. We apply a probabilistic methodology and derive the optimal price intervals for entry and exit. We also incorporate a stop-loss constraint and investigate its impact on the optimal timing strategies.

4 - Sequential Replacement under Uncertainty in the Population Distribution
Dharma Kwon, Assistant Professor, University of Illinois at Urbana-Champaign, 1206 South Sixth Street, Champaign, United States of America, dhkwon@illinois.edu, Steven Lippman

We study the impact of uncertainty in the problem of sequential replacement of projects with unknown quality and unknown population distribution of quality. The decision-maker can operate one project at a time, observe the performance, update his belief on the quality and the population distribution, and replace it with another project from the population. Our novel result: the real option value is decreasing in the uncertainty in the population distribution.

■ TD55

Hilton- Van Ness

Integer Nonlinear Programming and Applications – 2

Sponsor: Optimization/Global Optimization & MINLP

Sponsored Session

Chair: Monique Guignard, Professor, University of Pennsylvania, OPIM Dept., the Wharton School, 3730 Walnut Street, Philadelphia, PA, 19104-6340, United States of America, guignard_monique@yahoo.fr

1 - Using MINLP in Real Time Crossdock Optimization
Heng Zhang, University of Pennsylvania, 200 S 33rd St., Philadelphia, PA, 19104, United States of America, hengzhang24@gmail.com, Monique Guignard, Peter Hahn

The Crossdock Door Assignment Problem (CDAP) determines door assignments once for the entire planning period, thus possibly sacrificing operational efficiency. We propose a dynamic approach that repeatedly solves the CDAP when information needs updating in response to events during the planning period. We use for that our fast Convex Hull MatHeuristic CHH, designed for general MINLPs with linear constraints. Simulation demonstrates the superiority of the dynamic approach over the static one.

2 - Combined Multiproduct Maritime Inventory Routing & Blend Scheduling: Approaches to Large-Scale MINLP
Nicolas Sawaya, ExxonMobil, 800 Bell Street, Houston, United States of America, nicolas.sawaya@exxonmobil.com, Ahmet Keha, Jin-Hwa Song, Kevin Furman, Myun-Seok Cheon

We introduce a very large-scale problem for simultaneous optimization of ship routing, inventory management and tank blending of multiple bulk products. Nonlinearities arise due to the blending of products in on-shore tanks in order to meet demand specifications as well as achieve value uplift. We examine multiple modeling and solution approaches to solve this MINLP problem.

3 - Using SDP-based Convexification for Quadratic MIP Problems
Monique Guignard, Professor, University of Pennsylvania, OPIM Dept., the Wharton School, 3730 Walnut Street, Philadelphia, PA, 19104-6340, United States of America, guignard_monique@yahoo.fr, Lucas Letocart, Michael Bussieck

We review SDP-based methods for convexifying the quadratic objective function of MINLP problems with linear constraints. We describe how they can be used in conjunction with commercial MINLP optimization software, and discuss implementation issues. We report on numerical experiments with quadratic knapsack problems, generalized assignment problems and crossdock door assignment problems.

■ TD56

Hilton - Green Room

Software Demonstrations

Cluster: Software Demonstrations

Invited Session

1 - SAS - Building and Solving Optimization Models with SAS
Ed Hughes, SAS, United States of America, Ed.Hughes@sas.com

SAS provides a comprehensive set of data and analytic capabilities, including statistical analysis, data and text mining, econometrics and forecasting, and operations research methodsóoptimization, simulation, and scheduling. OPTMODEL from SAS provides a powerful and intuitive algebraic optimization modeling language and unified support for building and solving LP, MILP, QP, NLP, CLP, and network-oriented models. We'll demonstrate OPTMODEL for basic and advanced problems, highlighting its newer capabilities and its support for both standard and customized solution approaches.

2 - American Optimal Decisions - Portfolio Safeguard (PSG): Advanced Nonlinear Mixed-Integer Optimization Package
Stan Uryasev, University of Florida, 303 Weil Hall, Gainesville, FL, 32611, United States of America, uryasev@ufl.edu

Portfolio Safeguard is an advanced nonlinear mixed-integer optimization package used in risk management, statistics, financial engineering, military, medical and other applications. Design and solve complex optimization problems with built-in functions (maximum, StDev, variance, probability, VaR, CVaR, Drawdown, cardinality, fixed-charge, spline, recourse etc.) See real-life case studies at www.aorda.com/aod/psg.action.

■ TD57

Hilton- Golden Gate 1

Panel Discussion: Publishing in INFORMS Transactions on Education

Sponsor: INFORM-ED

Sponsored Session

Moderator: Armann Ingolfsson, University of Alberta, School of Business, Edmonton, AB, T6G2R6, Canada, aingolfs@ualberta.ca

1 - Panel Discussion: Publishing in INFORMS Transactions on Education

The panelists include ITE editors and authors who have published recently in ITE. The authors will discuss their experiences with submitting articles to ITE, successful and not. The editors will provide suggestions to authors who wish to submit their work to ITE—in particular, articles about case studies and about educational games.

2 - Experiences in Publishing in ITE
Theresa Roeder, Associate Professor, San Francisco State University, College of Business, 1600 Holloway Ave, San Francisco, CA, 94132, United States of America, tmroeder@sfsu.edu, Timothy C. Y. Chan, Keith Willoughby, Susan Martonosi

This presentation discusses the author's experiences in submitting a variety of articles to ITE, both successfully and not. We discuss the different subject matters as well as the submission and review process.

■ TD58

Hilton- Golden Gate 2

Scheduling I

Contributed Session

Chair: Yu "Washington" Zhang, UNC Chapel Hill, 101 Misty Woods Circle Apt R, Chapel Hill, NC, 27514, United States of America, yuzhang@email.unc.edu

1 - ATM Replenishment Scheduling

Yu "Washington" Zhang, UNC Chapel Hill, 101 Misty Woods Circle Apt R, Chapel Hill, NC, 27514, United States of America, yuzhang@email.unc.edu

We consider an ATM replenishment problem where the bank operates multiple ATMs in the same area. If a customer finds an ATM without any cash available, certain cost will be incurred. The replenishment cost is non-linear in the sense that the bank will pay more money for replenishing multiple ATMs by sending out one truck for each ATM than filling them up altogether. We present structures of the optimal strategy and study a heuristic policy which is easy to implement.

2 - A Collaborative Scheduling Method for Quay Crane Dual Cycling in Container Terminals

Yujiao Sun, Dalian University of Technology, No.2 Linggong Road, Ganjingzi District, Dalian, China, sunyujiao@mail.dlut.edu.cn, Xiangpei Hu

Dual cycling is a rising Quay Crane scheduling method that has proved to be of high economical and environmental advantages. However, yard reshuffles and the integration of loading and unloading operations make it a complex problem. We propose a collaborative scheduling strategy, which coordinates the operational sequence of containers on Yard Cranes, Yard Trucks, and Quay Cranes. Based on this strategy, we formulate a mixed integer programming model and solve it by a hybrid genetic algorithm.

3 - Enhancing HPC Scheduling through Predictive Analytics

Sarah Powers, Oak Ridge National Labs, One Bethel Valley Rd., Oak Ridge, TN, United States of America, powersss@ornl.gov

Foreknowledge of job arrivals to a High Performance Computing (HPC) system provides valuable information to the job scheduler. Optimizing the utility earned by the system is key for both users and administrators. This talk will discuss the use of predictive modeling, data mining and simulation to enable better scheduling criteria in a heterogeneous computing environment.

4 - Stochastic Scheduling of Patients to Maximize Number of On-time Appointments

Esmaeil Bahalkeh, Ohio University, 1602 apt,15 S.Shafer st,, university commons, Athens, OH, 45701, United States of America, eb867213@ohio.edu, Gursel A. Suer

In this study, we have proposed a stochastic math model to schedule the patients. The model determines the patients' appointment times considering a certain level of risk. The objective is to generate a sequence where the number of patients who can be seen by their appointment time is maximized. Other patients are given higher priority in the next period.

5 - Scheduling Learning Dependent Jobs in Assembly Lines Considering Ergonomic Factors

Flavio S. Fogliatto, Federal University of Rio Grande do Sul, IE Department, Porto Alegre RS, Brazil, ffogliatto@gmail.com, Michel Anzanello, Marcia Echeveste, Ana Rita Facchini

We propose a method to select clustering variables aimed at grouping customized product models into families. Two groups of clustering variables are considered: those generated by expert assessment on product features, and those representing workers' learning rate, obtained through learning curve modeling. The method integrates the "leave one variable out at a time" elimination procedure with a k-means clustering technique.

■ TD59

Hilton- Golden Gate 3

Panel Discussion with Department Chairs: How to Recruit, Retain, and Support Women and Minority Students

Sponsor: Women in OR/MS

Sponsored Session

Chair: Lauren Davis, Associate Professor, North Carolina A&T State University, 1601 East Market Street, Greensboro, NC, 27411, United States of America, lbdavis@ncat.edu

Chair: Banafsheh Behzad, Assistant Professor, California State University, Long Beach, Department of Information Systems, College of Business Administration, Long Beach, CA, 90840, United States of America, behzad1@illinois.edu

Co-Chair: David Morrison, University of Illinois, Urbana-Champaign, 1624 T St Apt 4, Sacramento, CA, 95811, United States of America, drmorr0@gmail.com

1 - Panel with Department Chairs: How to Recruit, Retain, and Support Women and Minority Students

Moderator: Banafsheh Behzad, Assistant Professor, California State University, Long Beach, Department of Information Systems, College of Business Administration, Long Beach, CA, 90840, United States of America, behzad1@illinois.edu, Panelists: Rakesh Nagi, Mark Daskin, Janis Terpenny, J. Cole Smith

Women and students of color continue to be underrepresented in engineering fields. To address these concerns, this panel session holds a discussion on effective strategies for recruiting, retaining, and supporting women and minority students. Several engineering department chairs will present ideas which support attracting women and underrepresented minority students to engineering fields.

■ TD60

Hilton- Golden Gate 4

Inventory Management III

Contributed Session

Chair: Min Wang, Drexel University, 3141 Chestnut Street, Philadelphia, United States of America, mw638@drexel.edu

1 - Critical Level Rationing in Inventory Systems With Continuous Demand

Pablo Escalona, Universidad Técnica Federico Santa MarÌa, Avenida España 1680, ValparaÌso, Chile, pablo.escalona@usm.cl, Fernando Ordonez

This paper analyzes the use of a critical level policy for an inventory system that provides differentiated service-levels for two demand classes (high and low priority). We considering an inventory system with continuous review (Q,r) policy and demand classes that are modeled through continuous distributions. We look for closed form optimal solution under mild assumptions. We separate our analysis in two cases, when demand follows a distribution with positive support and a normal distribution.

2 - Last Time Buy and Re-use of Parts

Sina Behfard, University of Twente, Ravelijn building, Hallenweg 17, Enschede, 7522 NH, Netherlands, s.behfard@utwente.nl, Matthieu van der Heijden, Ahmad Al Hanbali, Henk Zijm

Spare part availability is essential for capital goods with a long service period. Sourcing decisions are hard once production of spares ceases while the remaining service period is long. We develop a decision support model to optimize the mix of supply sources (a last order before production stops, repair of failed parts, and recovery of useable parts from phased-out systems). We show that repairs and asset recovery are attractive, even when expensive, because of the postponement effect.

3 - Stabilizing Costs in a Continuous Review Inventory System: A Bi-Objective Approach

Gonca Yildirim, Assistant Professor, Cankaya University, Industrial Engineering Department, Ankara, Turkey, goncayildirim@cankaya.edu.tr, Dincer Konur

Focusing on cost minimization in a continuous review inventory system can result in cost variability between replenishment cycles due to stochastic nature of the demand. This cost fluctuation may be undesirable for planning purposes in practice. This study adopts a bi-objective approach that minimizes total costs and its range. A numerical study is conducted to demonstrate how costs can be stabilized using our approach.

4 - Optimizing Inventory's Contribution to Profitability in a Regulated Utility

Linda Li, Student, the University of Alabama, 1105 17th Street Tuscaloosa, Apt 5102A, Tuscaloosa, 35401, United States of America, lczy1985@163.com, Chuck Schmidt, David Miller

Through DEA model, we first investigates a group of electric utilities when the resource is inventory which implies these firms procure a significant extra amount in inventory (materials and supplies). Then we construct an analytical model of the inventory policy controlling the extra buying of material that will be inventoried and added to the firm's rate base.

5 - Decision Rules for Emergency Replenishments in an Inventory System

Sven Axsater, Professor, Lund University, Box 118, Lund, Sweden, sven.axsater@iml.lth.se

This paper provides a new decision rule for emergency replenishments in an inventory system. The decision rule is a generalization of a previous decision rule suggested and evaluated in Axs‰ter (2003, 2007). An improvement step is added to this rule. The decisions are based on complete information about the system state. It is possible to handle batch ordering, compound Poisson demand and emergency replenishments that take time. Emergency replenishments will always lead to lower expected costs.

■ TD61

Hilton- Golden Gate 5

Joint Session MAS/DAS: Military Decision Analysis Applications

Sponsor: Military Applications Society & Decision Analysis

Sponsored Session

Chair: Greg Parnell, Professor, Dept of Industrial Engineering, University of Arkansas, Fayetteville, AR, 72701, United States of America, gparnell@uark.edu

1 - Automated Commercial Imagery Adjudication

Freeman Marvin, Executive Principal, Innovative Decisions, Inc., 8230 Old Courthouse Road, Suite 460, Vienna, VA, 22182, United States of America, ffmarvin@innovativedecisions.com

The National System for Geospatial Intelligence (NSG) expects to increase reliance upon commercial sensors in coming years, to decrease costs and increase capacity. Due to technological advances, modern commercial imagers are now able to address a wide range of intelligence questions. Unfortunately, the process by which analysts can task commercial imagery is inefficient. This paper examines economic and decision analytic methods to improve the value of commercial imagery to national security.

2 - Combining Technology and Soft Skills in the Bayesia Expert Knowledge Elicitation Environment (BEKEE)

Joe Tatman, Innovative Decisions, Inc., 8230 Old Courthouse Road, Suite 460, Vienna, VA, 22182, United States of America, jatatman@innovativedecisions.com, Amanda Hepler, Gary Smith, Sean Tatman, Bill Patchak, Suzanne Mahoney, Dennis Buede

US Army CECOM Equipment Diagnostic Analysis Tool (CEDAT) project requires building of Bayesian networks using subject matter experts anywhere in the world. The technology of BayesiaLab BEKEE was combined with IDI experience in the soft skills of expert elicitation to develop a process for CEDAT enabling online experts to contribute effectively to all phases of Bayesian network model building. The process is being transferred to the CEDAT model builders and initial applications are underway.

3 - Program Objectives Memorandum (POM): Alternative Decision Analytic (DA) Approaches

Terry Bresnick, Innovative Decisions Inc., 3132 NW 63rd St, Boca Raton, FL, United States of America, bresnick@ix.netcom.com

DoD and the IC all prepare POMs, but there is little consistency in approach. We review 3 approaches spanning the spectrum of applications. USMC uses a balance beam approach to produce an order-of-buy. An IC agency built the POM around a MODA framework aimed at information needs. Several DoD/IC organizations use incremental benefit/cost analysis to produce a Pareto-optimal efficient frontier. Pros and cons of each will be discussed along with "social" aspects of implementation.

4 - Development of the Bayesian Enterprise Analysis Model

Mark Gallagher, Technical Director, HQ USAF A9, 1570 Air Force Pentagon, Washington, DC, 20330, United States of America, Mark.Gallagher@pentagon.af.mil, Justin Sorice, David Blum

The Bayesian Enterprise Analysis Model (BEAM) is a military enterprise analysis tool to evaluate force structure and strategies across the US Department of Defense in multiple scenarios. BEAM will evaluate alternative force structures including future systems against an adaptive adversary that varies allocations in response to observations. The presentation will highlight current development achievements, lessons learned and future research goals.

■ TD62

Hilton- Plaza A

Social Media Sentiment

Cluster: Social Media Analytics

Invited Session

Chair: Les Servi, The MITRE Corporation, 202 Burlington Road, Bedford, MA, 01730, United States of America, lservi@mitre.org

1 - Network Contagion in Social Media

Chaitanya Kaligotla, PhD Student, INSEAD, Boulevard de Constance,, Fontainebleau, 77300, France, Chaitanya.kaligotla@insead.edu

This research studies the diffusion of inaccurate information versus that of competing accurate information, within the same network over time. This talk investigates how the dynamics of influence spreads over networks is effected by network structure. The project involves a mix of theoretical analysis and empirical analysis from mined Social Network data.

2 - What Social Media Sentiment Can (And Cannot) Tell Us About Public Opinion

Clay Fink, John Hopkins, Applied Physics Lab, 11100 Johns Hopkins Rd, Laurel, MD, 20723, United States of America, finkcr1@jhuapl.edu

We contrast sentiment expressed on Twitter in Nigeria toward president Goodluck Jonathan. We find that Twitter sentiment is more negative but correlates with surveys by region and over time. These results hold after reweighting survey results by factors associated with Twitter use.

3 - Heuristics for Secretary Pool Problems

Donald Gaver, Distinguished Professor of Operations Research, Naval Postgraduate Schoo, Monterey, CA, 93943, United States of America, DGaver@nps.edu, Patricia A. Jacobs

Classical single-secretary optimum selection (examine field for 1/e opportunities; pick 1st > max therein in remaining time) is generalized to cover the s >= 1 selection problem. Various alternative formulations are proposed and explored. Selection of superior organization teams from a candidate universe is a Social Media objective.

4 - Non-linear Dynamics of Human Emotions Expressed by Twitter Data and its Implication

Les Servi, The MITRE Corporation, 202 Burlington Road, Bedford, MA, 01730, United States of America, lservi@mitre.org, Waldemar Karwowski, Nabin Sapkota, Tareq Ahram, Dylan Schmorrow

Exploration of the extent that human emotions, expressed in Twitter data, have chaotic and non-linear dynamics has profound implications in forecasting a population's mood. This study examined such dynamics found in 7320 data points, collected from hourly data representing over 380,000 Twitter messages.

■ TD63

Hilton- Plaza B

Behavioral OR and Applications of Cognitive Analytics

Cluster: Cognitive Analytics

Invited Session

Chair: Horst Samulowitz, IBM Watson Research Center, 1101 Kitchawan Rd, Yorktown Heights, United States of America, samulowitz@us.ibm.com

1 - Text Analytics and Sentiment Analysis: Past, Present and Future

Richard Socher, Stanford, Serra Mall, Stanford, United States of America, richard@socher.org

Sentiment analysis is both linguistically interesting and crucial to business intelligence. In this talk, I will first describe overly simple methods for sentiment analysis that have been used in the past. Next, I will describe current methods of sentiment analysis and demo an easy to use tool for text and sentiment classification: etcml.com. In the third part, I will introduce more sophisticated models based on recursive deep learning which may supersede currently used algorithms.

2 - Analytics Integrated into Cognitive Algorithms Environment
Ali Koc, IBM TJ Watson Research Center, 1101 Kitchawan Rd,, Yorktown Heights, United States of America, akoc@us.ibm.com, Chandra Reddy, Meinolf Sellmann, Horst Samulowitz

We study analytic techniques and algorithms that integrate into cognitive computing and algorithms environment. The techniques have to be efficient and flexible enough to facilitate interactivity with the user and visualization. We present the work on a pre-disaster planning problem that strengthens a rural area transportation network, and on a fire evacuation planning problem. The specific applications solve extreme linear resource constraints with non-linear/stochastic objective functions.

3 - On the Importance of Behavioural OR
Raimo Hamalainen, Professor, Aalto University, Espoo, Espoo, 00076, Finland, raimo.hamalainen@aalto.fi

The new research area of Behavioural Operational Research(BOR) studies the behavioural aspects in OR based problem solving and decision support as well as the use of OR methods in the analysis of human behaviour. BOR aims to improve the practice of OR and to advance the use of OR models of social systems. Behavioural research exists in some areas of OR (e.g.decision analysis, behavioural operations ,system dynamics, game theory) but more studies are needed across the full spectrum of OR.

■ TD64

Parc- Cyril Magnin I

Rare Events, Sensitivity, and Exact Simulation

Sponsor: Applied Probability Society

Sponsored Session

Chair: Jose Blanchet, Associate Professor, Columbia University, Rm. 323, School of Engineering, 500 West 120th Street, New York, NY, 10027, United States of America, jose.blanchet@columbia.edu

1 - Sensitivity Analysis for Markov Chains
Chang-han Rhee, Georgia Tech, North Ave NW, Atlanta, GA, 30332, United States of America, rhee@gatech.edu, Peter Glynn

We introduce a general theory that provides sufficient conditions for differentiability of various types of performance measures including ones associated with random horizon expectations and stationary expectations, which are known to be notoriously difficult to deal with. The new theory is easy to apply on the basis of the model building blocks and requires weaker conditions than the ones provided by the existing literature. It also provides expressions useful for computation via simulation.

2 - Interplay of Insurance and Financial Risks
Qihe Tang, The University of Iowa, Iowa City, IA, United States of America, qihe-tang@uiowa.edu

Consider an insurance company exposed to a stochastic economic environment that contains two kinds of risks. The first kind is the insurance risk caused by traditional insurance claims, and the second kind is the financial risk resulting from investments. In this talk I will study the interplay of the two risks on the ruin probability for heavy-tailed cases.

3 - Rare-event Analysis for the Extreme Eigenvalues of the Beta-Laguerre Ensemble
Gongjun Xu, University of Minnesota, xuxxx360@umn.edu

We consider the tail behavior of the extreme eigenvalues coming from the Beta-Laguerre ensemble, which is a generalization of the Wishart matrix and plays an important role in multivariate analysis. We provide asymptotic approximations and bounds for the tail probabilities of the extreme eigenvalues. Moreover, we construct efficient Monte Carlo simulation algorithms to compute the tail probabilities. This is a joint work with Kevin Leder and Tiefeng Jiang.

4 - Exact Simulation of Multidimensional Reflected Brownian Motion
Karthyek Rajhaa Annaswamy Murthy, PhD Student, Tata Institute of Fundamental Research, Homi Bhabha Road,, Navy Nagar, Colaba, Mumbai, 400005, India, kamurthy@mailhost.tifr.res.in, Jose Blanchet

Using the recently developed tolerance enforced simulation techniques, we present the first exact simulation method for multidimensional reflected Brownian motion (RBM). The problem of obtaining samples from reflected diffusions is challenging because of the presence of correlated local-time-like terms in their definition. We obtain samples of RBM by first obtaining a piecewise linear approximation to the RBM, and then by applying a novel acceptance/rejection procedure to eliminate the error.

■ TD65

Parc- Cyril Magnin II

Stochastic Control Applications

Sponsor: Applied Probability Society

Sponsored Session

Chair: Bora Keskin, The University of Chicago Booth School of Business, 5807 S. Woodlawn Avenue, Chicago, IL, 60637, United States of America, bora.keskin@chicagobooth.edu

1 - Moment Conditions for Multi-Server Queues with Integral Load
Alan Scheller-Wolf, Professor, Carnegie Mellon University, Tepper School of Business, Carnegie Mellon University, Pittsburgh, PA, 15213, United States of America, awolf@andrew.cmu.edu, Michele Dufalla, Rein Vesilo

We provide a partial answer to the open question concerning the performance of multi-server queues with integral load. We do so by finding tighter necessary conditions for finite expected delay moments for these queues under power-law (i.e. Pareto) service times, using domain of attraction theory. This reduces, but does not close, the gap between necessary and sufficient conditions for these queues.

2 - Investment Timing with Incomplete Information and Multiple Means of Learning
Nur Sunar, University of North Carolina at Chapel Hill, Nur_Sunar@kenan-flagler.unc.edu, Michael Harrison

We consider a firm that can use one of several costly learning modes to dynamically reduce uncertainty about the unknown value of a project in a continuous-time setting. In addition to dynamic decisions about its learning mode, the firm must decide when to stop learning and either invest or abandon the project. We solve both the discounted and undiscounted versions of this problem, and extend our analysis to consider a firm that can choose multiple learning modes simultaneously.

3 - Queuing System Topologies with Limited Flexibility
Kuang Xu, MIT, 77 Massachusetts Ave., Cambridge, United States of America, kuangxu@mit.edu, John Tsitsiklis

We study a multi-server model where n flexible servers are connected to rn queues through a fixed connectivity graph, with average degree d. We show that as n tends to infinity, both a diminishing delay and a large capacity region are jointly achievable, even under limited flexibility (d << n): a family of random graphs are shown to stabilize all bounded admissible arrival rates, while simultaneously ensuring a diminishing queueing delay under a new class of matching-based scheduling algorithms.

4 - Server-Side Scheduling for Video Service: Earliest Progressive Deadline First
Kristen Gardner, Carnegie Mellon University, Computer Science Department, 5000 Forbes Ave., Pittsburgh, PA, 15213, United States of America, ksgardne@cs.cmu.edu, Sem Borst, Mor Harchol-Balter

Video servers must deliver content to clients on time. Each byte has a deadline by which it must be received by the client. We introduce a new server-side scheduling policy, Earliest Progressive Deadline First (EPDF), and prove that EPDF maximizes the fraction of bytes delivered on time. Like most server-side scheduling policies, EPDF is difficult to analyze exactly; we provide several bounds and approximations. Empirical results show that other policies, like GPS, perform similarly to EPDF.

■ TD66

Parc- Cyril Magnin III

Data Fusion for Prognostics

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Kaibo Liu, Assistant Professor, UW-Madison, 1513 University Avenue, Madison, United States of America, kliu8@wisc.edu

1 - Scalable Predictive Analytics for Multi-sensor Condition Monitoring Applications
Xiaolei Fang, Georgia Institute of Technology, 1207 Noble Creek Dr NW, Atlanta, GA, 30327, United States of America, xfang33@mail.gatech.edu, Kamran Paynabar, Nagi Gabraeel

We develop a multi-sensor prognostic model that utilizes multistream signals to predict residual lifetimes of partially degraded systems. We first fuse the multistream degradation signals via Multivariate Functional Principal Components Analysis (MFPCA). Next, the fused features are used for prognostics via adaptive functional regression. To address some of the Big Data challenges, a randomized low-rank matrix approximation technique is incorporated to speed up the MFPCA matrix decomposition.

2 - Reliability Analysis of a Surveillance System with Multifunctional Sensors

Yiwen Xu, United States of America, yiwen.xu6@gmail.com, Haitao Liao

In this paper, we study the reliability of a surveillance system with multifunctional sensors. Such multifunctional components provide another degree of flexibility for functional redundancy within the system. The analytic formulation of system reliability is provided and a redundancy allocation problem is formulated and solved through a heuristic-enhanced genetic algorithm.

3 - Iterative System Optimization Based on Condition Monitoring Data and Bayesian Updating

David Coit, Rutgers university, 96 Frelinghuysen Rd., Piscataway, NJ, 08854, United States of America, coit@rutgers.edu, Nida Chatwattansiri

This paper proposes a method to update model parameters of condition monitoring system with generalized series-parallel structure using Weibull distributions. We analyze actual system usages in future scenarios that take various uncertainties into consideration. In particular, our method uses Bayesian approach to update model parameters of the system reliability. The technique is illustrated by numerical examples of independent Weibull component lifetimes with scale parameters.

4 - Integration of Data Fusion Methodology and Degradation Modeling Process to Improve Prognostics

Kaibo Liu, Assistant Professor, UW-Madison, 1513 University Avenue, Madison, United States of America, kliu8@wisc.edu, Shuai Huang

This talk develops a systematic data-level fusion methodology that combines the degradation-based signals from multiple sensors to construct a health index for better characterizing the condition of a unit. The novelty of this methodology lies in integrating the fusion procedure and the degradation modeling in a unified manner. The methodology was tested and validated by using the degradation-based signals of aircraft gas turbine engine that was generated by C-MAPSS.

■ TD67

Parc- Balboa

Data Driven Scientific Discovery

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Chiwoo Park, Florida State University, 2525 Pottsdamer St., Tallahassee, Fl, 32310, United States of America, cpark5@fsu.edu

1 - Ensemble Data Assimilation: Combining Geophysical Models with Observational Data

Jeffrey Anderson, Senior Scientist, National Center for Atmospheric Research, P.O. Box 3000, Boulder, CO, 80307-3000, United States of America, jla@ucar.edu

Data assimilation (DA), originally developed for weather prediction, combines computer forecasts and observations to produce initial conditions for subsequent forecasts. Ensemble DA uses sample statistics from sets of forecasts to estimate the impact of observations on model state variables. This talk presents an introduction to state-of-the-art ensemble DA algorithms that use millions of observations per day, models with 100 million variables, and O(100) ensemble members.

2 - Scalability of Scientific Image Analysis

Daniela Ushizima, Research Scientist, Lawrence Berkeley National Lab., 1 Cyclotron, Berkeley, CA, 94720, United States of America, dushizima@lbl.gov

Research laboratories store images as part of experimental records. Limitations in scientific image analysis hamper ability to understand the acquired data. This talk will overview current research on fundamental and domain-specific pattern recognition methods that exploits mathematical and statistical image analysis techniques to bring knowledge about known structures as constraints, apply priors to find scientifically relevant constructs and allow fast software for use in everyday analysis.

3 - Robust Nanoparticles Detection by Fusing the Complementary Image Information

Yanjun Qian, Research Assistant, Texas A&M University, 1501 Holleman Dr, Apartment 82#, College Station, TX, 77840, United States of America, qianyanjun09@gmail.com, Xiaodong Li, Yu Ding, Jianhua Huang

This paper studies the problem of detecting nanoparticles in noisy transmission electron microscopic (TEM) images. In order to achieve robustness while handling low contrast and high noise, we propose an approach to fuse two kinds of complementary image information: the region information and the edge information. We apply our method to a set of TEM images taken under different resolutions and noise levels. It can process a TEM in a few minutes, and the processed outcomes appear rather robust.

4 - Data-Driven Study of Nanoparticle Growth

Chiwoo Park, Florida State University, 2525 Pottsdamer St., Tallahassee, Fl, 32310, United States of America, cpark5@fsu.edu, Nigel Browning, Taylor Woehl, James Evans

We present a data-driven approach for studying nanoparticle growth in a solution. Individual nanoparticles in a solution typically grow through a series of single atom attachments, but more importantly, when they reach to a critical size they can aggregate with other particles to form bigger particles. We exploit the realtime microscopic images of the growth process and our image sequence data analysis method for previously unexplained findings on aggregation-based particle growth.

■ TD68

Parc- Davidson

Emerging Topics in Simulation Analysis & Optimization

Sponsor: Simulation

Sponsored Session

Chair: Jie Xu, Assistant Professor, George Mason University, 4400 University Dr., MS 4A6, Fairfax, VA, 22030, United States of America, jxu13@gmu.edu

1 - Efficient Multi-fidelity Simulation Optimization

Jie Xu, Assistant Professor, George Mason University, 4400 University Dr., MS 4A6, Fairfax, VA, 22030, United States of America, jxu13@gmu.edu, Loo Hay Lee, Edward Huang, Nurcin Celik, Si Zhang, Chun-Hung Chen

There are often simulation models of different levels of fidelity for evaluating alternative solutions of a complex system, offering a trade-off between accuracy and speed. We propose a Multi-fidelity Optimization with Ordinal Transformation and Optimal Sampling framework to exploit the benefits of high- and low-fidelity simulation models to perform optimization efficiently. Through preliminary analysis and numerical experiments, we demonstrate the promising performance of the proposed method.

2 - Simulation Swarm Optimization

Lee Schruben, Berkeley University, Berkeley, CA, United States of America, lees@berkeley.edu, Raunak Bhinge, Eike Ebel

A swarm of simulation models can explore multi-dimensional feasible regions. The simulations can change their configurations (locations) as they run, guiding each other toward optimal solutions. The basic notion is akin to Particle Swarm Optimization where the particles are stochastic discrete-event simulation models running in parallel. The models can replicate themselves as they approach stochastic constraints or promising positions to balance exploration, exploitation, and estimation.

3 - Agent-Based Simulation of Financial Markets: Multifractal Analysis of Positive-Intelligence Models

James Thompson, Research Analyst, NC State University, Fitts Dept Indust & Sys Engr, Raleigh, NC, 27695-7906, United States of America, j7sthompson@gmail.com, James Wilson

To analyze the impact of intelligent traders on agent-based simulations of financial markets, we enhance the classic zero-intelligence model of financial markets with positive-intelligence agents using the MASON modeling framework. Exploiting multifractal detrended fluctuation analysis, we analyze the series of stock prices generated by the positive-intelligence simulation. We study the changes in this output process when altering the mix of agents with competing market philosophies.

4 - Simulation-based Continuous Optimization with Stochastic Constraints

Liujia Hu, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States of America, lhu9@gatech.edu, Sigrun Andradottir

We consider simulation optimization problems with stochastic constraints. We propose an Adaptive Search with Discarding and Penalization (ASDP) method for solving this problem. ASDP utilizes the penalty function approach to convert the original problem into a series of simulation optimization problems without stochastic constraints. We present conditions under which the ASDP algorithm converges almost surely, and conduct numerical studies aimed at assessing its efficiency.

■ TD69

Parc- Fillmore

Carbon-Considerate Operations Management

Sponsor: Energy Natural Resources and the Environment/ Sustainability and Environment

Sponsored Session

Chair: Tarkan Tan, Eindhoven University of Technology, Den Dolech 2, Eindhoven, 5612AZ, Netherlands, T.Tan@tue.nl

1 - Managerial Implications of Considering CO2 Emissions on Vehicle Routing Problems

Josue Velazquez-Martinez, Instituto Tecnológico y de Estudios Superiores de Monterrey, Campus Santa Fe, Mexico City, Mexico, josue.velazquez@itesm.mx, Jose Cohen, Jan C. Fransoo

We present a new model for the VRP that minimizes CO2 emissions. Our model is formulated based on the NTM methodology. Extensive numerical experiments show that substantial CO2 savings can be achieved when truck utilization increases or truck capacity is large. We present conditions in which minimizing distance is equivalent to minimizing CO2 emissions.

2 - Carbon Leakage: The Impact of Asymmetric Emission Regulations on Technology and Capacity Investments

Beril Toktay, Professor, Georgia Institute of Technology, 800 West Peachtree Street NW, Atlanta, GA, 30308, United States of America, beril.toktay@scheller.gatech.edu, Ximin (Natalie) Huang, Tarkan Tan, Kristel Hoen

We study the decisions for an energy-intensive good producer to choose between (1) investing in cleaner technology in an area where emissions are regulated and/or (2) expanding capacity in the unregulated area, under the uncertainty of future emission price. We also compare the impacts of different mitigation options of the policy maker numerically: grandfathering is preferable by companies while border tax is more effective in inducing lower total emission when the emission price is moderate.

3 - The Impact of Coordination on the Retail Chain Emissions

Yann Bouchery, Ecole de Management de Normandie, 30, Rue de Richelieu, Le Havre, 76087, France, y.bouchery@tue.nl, Zied Jemai, Tarkan Tan, Asma Ghaffari

This paper analyzes the impact of coordination on the retail chain emissions besides a cost analysis. We show that the supply chain carbon emissions can be greater under pure cost driven coordination. We also show how this effect could be mitigated. We argue that the objective of coordination needs to be clearly defined to ensure cost and carbon emissions reduction. Accordingly, we use multiobjective optimization to identify the solutions achievable when coordinating the supply chain.

4 - Where to Exert Abatement Effort for Sustainable Operations Considering Supply Chain Interactions?

Tarkan Tan, Eindhoven University of Technology, Den Dolech 2, Eindhoven, 5612AZ, Netherlands, T.Tan@tue.nl, Astrid Koomen

We consider the problem of how firms can take the dynamics of supply chain interactions into account when "greenifying" their operations. We introduce a framework which firms can use in defining the right optimization problem and boundaries when they want to exert abatement effort. Our framework, which is applied at a chemical company, can help firms in determining which impact certain decisions have on other firms' emissions in the supply chain and the resulting total footprint of the product.

■ TD71

Parc - Lombard

The Economics of Auction Markets

Cluster: Auctions

Invited Session

Chair: Brian Baisa, bhbaisa@gmail.com

1 - Reference-Dependent Bidding in Dynamic Auctions

Marion Ott, Lehrstuhl für Volkswirtschaftslehre, Templergraben, Germany, marion.ott@vwl1.rwth-aachen.de, Karl-Martin Ehrhart

Loss-averse bidders (a la K˝szegi and Rabin, 2006) with independent private values face different sensations as the price clock proceeds in English (EA) or Dutch auctions (DA). We solve for personal equilibrium profiles (PEP), which contain each bidder's best response given the others' strategies and the reference point induced by the strategies. If PEP exist in both auctions, the revenue in the DA exceeds that from the EA, mainly due to the aversion to losing the item in the DA.

2 - Revealed Preference in Bidding: Empirical Evidence from Recent Spectrum Auctions

Oleg Baranov, Colorado Technical University, CO, United States of America, Oleg.Baranov@Colorado.edu, Lawrence Ausubel

Activity rules are among the key innovations underlying modern dynamic multi-item auctions. In recent work, Ausubel and Baranov (2013, 2014) have advocated that the traditional activity rules may be both too weak and too strong, and instead have advocated activity rules based upon the Generalized Axiom of Revealed Preference (GARP). Detailed bidding data from two recent spectrum auctions provide unique opportunity to examine whether GARP-based activity rules are too restrictive to be viable.

3 - The Role of a Market Maker in Networked Cournot Competition

Subhonmesh Bose, California Institute of Technology, 1200 E. California Blvd, Pasadena, United States of America, boses@caltech.edu, Adam Wierman, Desmond Cai

We study the role of a market operator in a transmission constrained electricity market. We model the market as a one-shot networked Cournot competition. This mimics the operation of a spot market in a deregulated market structure. We focus on possible mechanisms employed by the market operator to balance demand and supply. We the characterize existence of Generalized Nash Equilibrium and show that market outcomes at equilibrium can be very different under different market operator mechanisms.

4 - Bid Behavior in the Uniform Price and Vickrey Auctions on a General Preference Domain

Brian Baisa, bhbaisa@gmail.com

I compare the Vickrey auction and the uniform-price auction in a setting where bidders have private values and multiunit demands. I remove the standard quasilinearity restriction and assume only that bidders have weakly positive wealth effects. I show that truth-telling is not a dominant strategy in the Vickrey auction and both auctions are generally inefficient. When the auction is large, both give approximately equal allocations and revenues, and both are approximately ex-post efficient.

■ TD72

Parc- Stockton

Energy IV

Contributed Session

Chair: Nikolaos Gatsis, Assistant Professor, The University of Texas at San Antonio, One UTSA Circle, BSE 1.500, San Antonio, TX, 78249, United States of America, nikolaos.gatsis@utsa.edu

1 - Nodal Pricing Applied to Feed-in RES in a Hybrid Pricing Context

Hong Cai, PhD Student, Norwegian School of Economics, Room 108, Helleveien 124, Bergen, -, 5043, Norway, hong.cai@nhh.no, Mette Björndal, Evangelos Panos, Endre Björndal

Using a large scale network, we mainly study in a joint market, whether nodal pricing (location marginal pricing) helps one pricing area (zone) to reduce the volatility within the grid caused by the increased share of feed-in wind generated power in other pricing areas where zonal pricing is applied.

2 - Peer Effects vs. Competitive Effects under Alternative Regulatory Regimes

Eun-Hee Kim, Assistant Professor, George Washington University, Funger Hall 615D, 2201 G Street, NW, Washington, DC, 20052, United States of America, eunheek@gwu.edu

This paper studies drivers of operating efficiency in the power sector under alternative regulatory regimes by making use of a unique dataset from the U.S. electric power industry. The dataset matches confidential tested data and publicly available observed data on power plant efficiency and is used to construct a disaggregated measure of efficiency based on self-benchmarking.

3 - Capacity Mechanisms and Generation Investments in Electricity Markets

Yuto Takano, Tokyo University of Science, 2641 Yamazaki Noda-shi, Chiba, Japan, 7414617@ed.tus.ac.jp, Ryuta Takashima

Recently a capacity mechanism has been introduced in various countries in order to recover an investment cost. It is necessary to discuss the design of the capacity mechanism due to the penetration of the renewable energy. In this paper we analyze an effect of the capacity market on investments under uncertainties by means of stochastic programming. Especially, we compare the outcome with that for energy-only market in order to extract the effect of the capacity market.

4 - Optimization of Energy Management in Large Scale Smart Grid Systems
Sunil Vuppala, IIITB, Electronics City, Bangalore, India, sunil.vuppala@iiitb.ac.in, GNS Prasanna

We present optimization techniques for near real time control in smart grids handling objectives of consumers and utility with price uncertainty in a rolling horizon approach. Our MILP handles fine grain constraints till the level of individually controllable appliances. Our results are compared with an ALL-OR-NONE heuristic that is scalable up to 100,000's of consumers. The results indicate 5-15% of energy bill reduction by using optimization methods, compared to heuristics, on area wide grids.

5 - Stochastic Programming Models for Power Flow Optimization in Electricity Distribution Networks
Nikolaos Gatsis, Assistant Professor, The University of Texas at San Antonio, One UTSA Circle, BSE 1.500, San Antonio, TX, 78249, United States of America, nikolaos.gatsis@utsa.edu, Mohammadhafez Bazrafshan

Stochastic programming models for real and reactive power management in distribution networks are introduced. Decisions include real power consumption from programmable loads, and reactive power consumption or generation from photovoltaic generation units, which is adaptive to the uncertain (random) generated solar power. The aim is to minimize expected thermal losses or maximize the user sum-utility, under risk-constrained voltage regulation. Decentralized solution algorithms are presented.

■ TD73

Parc- Mission I

Energy Planning and Uncertainty

Sponsor: Energy, Natural Res & the Environment/Energy

Sponsored Session

Chair: Soheil Shayegh, Georgia Institute of Technology, North Ave NW, Atlanta, GA, 30332, United States of America, soheilsh@gatech.edu

1 - Impact of Forecast Errors on Expansion Planning of Power Systems with a Renewables Target
Salvador Pineda, University of Copenhagen, Universitetsparken 5, Copenhagen, Denmark, spinedamorente@gmail.com, Juan Miguel Morales, Trine Krogh Boomsma

We present a model to determine the expansion plan that minimizes investment and operating costs, while ensuring a given share of renewable generation. This model includes both a day-ahead and a balancing market to capture the impact of both production forecasts and the associated prediction errors. Within this framework, we compare two paradigmatic market designs that differ in whether the day-ahead generation schedule and the subsequent balancing re-dispatch are co-optimized or not.

2 - Optimal Bidding Policies in the Electricity Market using Approximate Dynamic Programming
Daniel Jiang, Princeton University, Sherrerd Hall, Charlton St, Princeton, NJ, 08540, United States of America, drjiang@princeton.edu, Warren Powell

There is growing interest in the use of grid-level storage to smooth variations in supply that are likely to arise with increased use of wind and solar energy. Battery arbitrage is becoming an important way of paying for these expensive investments. The problem of optimal bidding in the presence of storage is complicated by the fact that bids need to be placed either day or hour-ahead. We propose the use of approximate dynamic programming (ADP) techniques to find profitable bidding policies.

3 - Quantitatively Exploring the Future of RPS in the Korean Electricity Sector via an Energy Model
Dong Gu Choi, Senior Researcher, Korea Institute of Energy Research, 152 Gajeong-ro Yuseong-gu, Daejeon, 305-343, Korea, Republic of, doonggus@gmail.com, Sang Yong Park, Jong Chul Hong

We investigate the Korean renewable portfolio standard (RPS) mechanism and develop a multi-regional bottom-up model (via TIMES model) to implement how the mechanism will work. Based on scenario-based analysis with model, we predict the possible future results of the mechanism under a national basic plan on electricity demand and supply. We indicate the disharmony between the plan and mechanism. In addition, we address some insights and suggestions on its continued application.

4 - Fuel Hedging Strategy for Electric Power Utilities
Jo Min, Associate Professor, Iowa State University, 3004 Black Engineering, Ames, 50011, United States of America, jomin@iastate.edu, Chung-Hsiao Wang

Electric power utility companies have used contracts to hedge against fuel price volatility for their coal generation units. With the recent popularity of natural gas combined cycle generation units, the fuel hedging strategy now needs to consider natural gas as well. As coal-based and natural gas-based generation units are competing for economic dispatch, for a utility owning both types of generation units, we show how fuel hedging strategy can be developed and analyzed.

■ TD74

Parc- Mission II

Stochastic Programming for Planning Electricity Supply

Sponsor: Energy, Natural Res & the Environment/Energy

Sponsored Session

Chair: Sarah M. Ryan, Professor, Iowa State University, 3004 Black Engineering Bldg., Ames, United States of America, smryan@iastate.edu

1 - Capacity Planning in Power Systems with High Solar Energy Penetration using Stochastic Programming
Cesar Silva-Monroy, Senior Member of Technical Staff, Sandia National Laboratories, PO Box 5800, Albuquerque, NM, 87185-1140, United States of America, casilv@sandia.gov, Jean-Paul Watson, Andrew Mills, Richard Li-Yang Chen, Ali Pinar, Francisco Munoz

Uncertainty such as fuel prices and load growth exists when selecting new generators. At current low penetration, the amount of solar energy available during high load periods (i.e., capacity value) is treated as deterministic. However, at levels set by renewable portfolio standard the above approach can result in suboptimal expansion plans. We present a stochastic programming formulation of this problem that includes treatment of solar capacity value as one of several sources of uncertainty.

2 - Solution Sensitivity Based Scenario Reduction for Stochastic Unit Commitment
Yonghan Feng, Iowa State University, 0076 Black Engineering Bldg, Ames, IA, 50010, United States of America, yhfeng@iastate.edu, Sarah M. Ryan

A two-stage stochastic program is formulated for day-ahead commitment of thermal units to minimize the total expected cost when uncertain load and variable generation resources are considered. A heuristic scenario reduction method that selects scenarios based on their cost and reliability impacts helps to alleviate the computational burden. In instances derived from a US system operator, the proposed method maintains solution quality even when the reduction is substantial.

3 - Economic Assessment of Energy Storage in Integration of High Levels of Renewable Generation
Nan Li, PhD Student, Arizona State University, 1151 South Forest Avenue, Tempe, AZ, 85287, United States of America, nan.li24@asu.edu, Audun Botterud, John Birge, Canan Uckun, Kory Hedman

The fast-growing expansion of renewable energy increases the complexities in balancing generation and demand in the power systems. The energy-shifting and fast-ramping capability of energy storage technologies has led to increasing interest in energy storage for grid integration of renewable energy. We present a stochastic programming framework to evaluate and investigate the potential value of energy storage in power systems with high renewable penetration levels.

4 - Robust Optimization or Stochastic Programming for Unit Commitment?
Sarah M. Ryan, Professor, Iowa State University, 3004 Black Engineering Bldg., Ames, United States of America, smryan@iastate.edu, Narges Kazemzadeh

We study stochastic programming and robust optimization in the unit commitment problem for a multi-bus power system under net load uncertainty. The stochastic programming model aims to minimize a combination of expected value and CVaR of the costs, while the robust model objective reflects the commitment cost and the worst case dispatch cost. We compare the performance of these approaches in different aspects including economic efficiency as well as the risk associated with the decisions.

■ TD75

Parc- Mission III

Reliability II

Contributed Session

Chair: Wei Xie, Adjunct Assistant Professor, University of Arizona, 1127 E. James E. Rogers Way, Tucson, AZ, 85721, United States of America, shallwe123@gmail.com

1 - Multi-phase Spare Parts Provisioning for Warranty Service Demand
Wei Xie, Adjunct Assistant Professor, University of Arizona, 1127 E. James E. Rogers Way, Tucson, AZ, 85721, United States of America, shallwe123@gmail.com

In this paper, we study spare parts inventory control for warranty repairs. This study is focused on a new product covered by a non-renewable free-replacement warranty policy. We consider time-varying warranty demand rate based on stochastic sales and out-of-service units. Specifically, a multi-phase inventory model is developed to provide an effective support for the warranty service.

2 - A Condition-Based Maintenance Policy for a Multi-Unit System with Aperiodic Inspections
Minou Olde Keizer, University of Groningen, Nettelbosje 2, Groningen, 9747 AE, Netherlands, m.c.a.olde.keizer@rug.nl, Ruud Teunter

In condition-based maintenance (CBM) a certain condition, e.g., vibration, is monitored to estimate the moment of failure. Maintenance is then performed right before that moment. We consider an advanced, existing, CBM optimization approach in which the aperiodic inspection moments and condition thresholds are jointly optimized for a two-unit series system. We analyze an adapted version of the system where two units operate in parallel, and provide new insights on CBM for systems with redundancy.

3 - Multi-stage Reliability Growth Planning Using Dynamic Programming
Zhaojun Li, Assistant Professor, Western New England University, 1215 Wilbraham Rd, Springfield, MA, 01119, United States of America, zhaojun.li@wne.edu

This research formulates the multi-stage reliability growth planning using dynamic programming. Product development usually experiences multiple stages and optimal resources allocation including testing time and units for each stage can lead to higher projected reliability. One stage's reliability growth depends on previous stages' reliability growth, which forms a sequential decision process. The approach for reliability growth planning is demonstrated through an engine development example.

■ TD76

Parc- Embarcadero

Revenue Management Applications for Non-Travel Industries

Sponsor: The Practice Track

Sponsored Session

Chair: Bruce Patty, Vice President, Veritec Solutions, 75 Lochinvar Road, San Rafael, Ca, 94901, United States of America, BPatty@veritecsolutions.com

1 - Revenue Management in the Self Storage Industry
Bruce Patty, Vice President, Veritec Solutions, 75 Lochinvar Road, San Rafael, Ca, 94901, United States of America, BPatty@veritecsolutions.com

The Self Storage industry presents several problems of interest from setting starting rates to making rate changes for existing customers. In this presentation, an overview of the decisions to be made will be provided as well as a detailed look into the existing customer rate change decision.

2 - Price and Revenue Optimization in the Rental Industry
Hossam Zaki, Vice President of Pricing Science, Zilliant, hossam_zaki@yahoo.com

This presentation will provide insights into and comparisons between two Price and Revenue Optimization (PRO) problems in the rental vertical. The first is PRO for the B2C One-Way Truck Rental industry. The second is PRO for the B2B Equipment Rental industry. We will contrast between the B2C aspects of the first and the B2B aspects of the second and how these aspects affect the solution design.

■ TD77

Parc- Market Street

Joint Session Analytics/SPPNS: Analytics in Government, Defense, and National Security

Sponsor: Analytics & Public Programs, Service and Needs

Sponsored Session

Chair: Natalie Scala, Assistant Professor, Towson University, Dept. of e-Business and Technology Manag, 8000 York Road, Towson, MD, 21252, United States of America, nscala@towson.edu

1 - Making the Case for Case Management: Identifying High Risk Diabetes Patients
David Anderson, Assistant Professor, Baruch College, Zicklin School of Business, 1 Bernard Baruch Way, New York, NY, 10010, United States of America, david.anderson@baruch.cuny.edu, Margrét Bjarnadöttir

In this paper we show that insurance claims data can be used to identify diabetes patients who are relatively healthy and low cost, but are at risk of having high costs in the following year. Using a mix of regression analysis and other data mining techniques, we are able to identify a patient cohort that has low costs in the observation year, but have high costs the next year. We identify a group of patients who go from an average cost of under $5,500 to over $12,000 in the following year.

2 - Simulating Carrier Strike Group Manning
Hoda Parvin, Research Analyst, CNA, 4825 Mark Center Dr, Alexandria, VA, 22311, United States of America, Parvinh@cna.org, Edward Schmitz, David Rodney

We present a discrete event simulation model to study the impact of enhanced carrier strike group (CSG) presence on Navy's personnel. We develop several manning policies to assess how enhancing CSG presence affect various aspects of Navy manpower. The model informs policy makers on optimal points of CSG manning without degrading other sea billets. We show the impact of changing manning priorities over the deployment cycle and produce both immediate and long-term estimates of the impacts.

3 - Fortification of Network Components against Intentional Disruptions
Gokhan Karakose, University of Missouri, Columbia, MO, United States of America, gkz7c@mail.missouri.edu, Ronald McGarvey, Mustafa Y. Sir

In this paper, a methodology to protect a transportation network components against interdictors (i.e. attacks) is proposed to minimize the economic impact of network disruption. Here, the cost of network disruption is defined as the number of users who are unable to reach their destinations because of the cut in the network. This cost is integrated to maintenance optimization models which are developed in a game theoretic perspective.

■ TD78

Parc- Mason

Decision Analysis 5

Contributed Session

Chair: Vijitashwa Pandey, Assistant Professor, Oakland University, 2200 N Squirrel Rd, Rochester, MI, 48309, United States of America, pandey2@oakland.edu

1 - Collaborative Decision Analysis for Stakeholder Agency Engagement in Resource Management
Matthew Wood, Research Psychologist, US Army Engineer Research & Development Center, USACE New England District, 696 Virginia Road, Concord, MA, 01742, United States of America, matthew.d.wood@usace.army.mil, Keith Rudie, Mandy Michalsen, Leah Wickstrom, Matthew Bates, Igor Linkov

Decision making in resource management contexts requires the coordinated effort of a variety of organizations tasked with different regulatory missions. We describe an effort using multi-criteria decision analysis to structure discussion and promote collaboration between these groups, and facilitate development of conceptual design alternatives for improving the Green River in Kent, WA to effectively balance concerns (e.g, flood risk, ecology) shared across these organizations.

2 - Heterogeneity Based Grading
Deokkyo Oh, Researach fellow, Korea Corporate Governance Service, 76 yeouinaru-ro, youngdeungpo-gu, Seoul, 150977, Korea, Republic of, deokkyo.oh@gmail.com

Conventional grading models generally follow the percentile rule but sometimes make a problem in interpreting the grading result as each grade is not so identically explanary. Therfore, in this research, heterogeneity based grading model will be developed with the cluster analysis. The number of grade suitalbe to data set will be found first and more specifically, two-stage cluster analysis shall be adopted in this research to identify the "good" and "bad" groups first and detailed grades.

3 - Experiment Design for Multiple Attribute Selection Problems
Dennis Leber, NIST, 100 Bureau Drive, Gaithersburg, MD, 20899, United States of America, dennis.leber@nist.gov, Jeffrey Herrmann

When collecting data to support a selection decision, the decision-maker must decide which data to collect. Ranking and Selection methods provide guidance on such experiment designs with focus on allocating data collection across the alternatives. We present work on allocating a fixed data collection budget across multiple attributes. We developed several allocation rules and tested their performance. The better allocation rules considerably increased the probability of correct selection.

4 - Antibiotic Stewardship: A Decision Analytic Approach
Vijitashwa Pandey, Assistant Professor, Oakland University, 2200 N Squirrel Rd, Rochester, MI, 48309, United States of America, pandey2@oakland.edu, Vipul Shukla

Antibiotic stewardship, a sequential decision-making process used to delineate and assess antibiotic treatment regimens, is an essential tool utilized in health-care. Evolving antibiotic resistance mechanisms and profiles of pathogenic microorganisms require alteration of treatment regimens. This presentation will discuss a decision theoretic framework for optimizing antibiotic stewardship.

■ TD79

Parc- Powell I

Forecasts and Judgments

Sponsor: Decision Analysis

Sponsored Session

Chair: Asa Palley, Duke University, The Fuqua School of Business, 100 Fuqua Drive, Box 90120, Durham, NC, 27708, United States of America, asa.palley@duke.edu

1 - The Benefits of Eliciting, Evaluating, and Aggregating Forecasters' Quantiles
Casey Lichtendahl, University of Virginia, 100 Darden Blvd, Charlottesville, United States of America, LichtendahlC@darden.virginia.edu, Yael Grushka-Cockayne, Robert Winkler

We present the benefits of eliciting, evaluating, and aggregating forecasters' quantiles, rather than their probabilities. We characterize the class of proper scoring rules for multiple quantiles. By applying the idea of bracketing to quantiles, we propose new measures for evaluating the quality of a crowd's forecasts. In aggregating quantiles, we show that averaging quantiles can be consistent with a Bayesian updating process.

2 - Measuring Advice Taking
Jack Soll, Associate Professor, Duke University: Fuqua School of Business, 100 Fuqua Drive, Box 90120, Durham, NC, 27708, United States of America, jsoll@duke.edu, Min Bang, Asa Palley, Christina Rader

We introduce a new measure of advice taking, IOA (influence of advice). IOA more completely measures influence compared to extant alternatives, because it applies to entire probability distributions and not just point estimates. We discuss the properties of IOA, and the new insights it reveals about behavior.

3 - Eliciting and Aggregating Forecasts when Information is Shared
Asa Palley, Duke University, The Fuqua School of Business, 100 Fuqua Drive, Box 90120, Durham, NC, 27708, United States of America, asa.palley@duke.edu, Jack Soll

Dependence in forecast errors greatly limits the ability of the wisdom of crowds to recover the truth. This dependence often emerges because information is shared: forecasters may draw on the same data when formulating their responses. We present an elicitation procedure in which forecasters also guess how others will respond. An assessor can aggregate these responses through a technique called pivoting. We discuss the results of several studies examining the accuracy of the aggregate forecasts.

■ TD80

Parc- Powell II

Graphical Models in Decision Analysis

Sponsor: Decision Analysis

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Chair: Wenhao Liu, PhD Candidate, Stanford University, 475 Via Ortega, Stanford, Ca, 94305, United States of America, owenliu@stanford.edu

1 - Facilitating the Construction of Bayesian Networks from the Literature
Lea Deleris, IBM, Dublin Research Lab, Dublin, Ireland lea.deleris@ie.ibm.com, Stephane Deparis, Bogdan Sacaleanu, Charles Jochim

We have built information extraction and aggregation algorithms to facilitate the construction of Bayesian networks (BNs) from information contained in the literature. Specifically, we extract probabilities and dependence/independence statements from a set of specified academic papers, aggregate the statements into a BN structure and make use of the probabilities to determine the parameters of the conditional probability tables. We illustrate our approach with papers related to breast cancer.

2 - Inference in Hybrid Influence Diagrams with Deterministic Conditionals
Prakash P. Shenoy, Ronald G. Harper Distinguished Professor of Artificial Intelligence, Univ. of Kansas Business School, 1300 Sunnyside Ave, Summerfield Hall, Lawrence, KS, 66045-7601, United States of America, pshenoy@ku.edu

We discuss some challenges associated with making inferences in hybrid influence diagrams with deterministic conditionals. For problems that can be solved without arc-reversals, these challenges can be overcome by approximating conditionals probability density and utility functions by mixtures of polynomials. A framework for making inferences is described and illustrated with examples.

3 - Extending Influence Diagram Graphics
Jim Matheson, Chairman, SmartOrg, Inc., 855 Oak Grove Ave, Ste 202, Menlo Park, CA, 94025, United States of America, jmatheson@smartorg.com

The original conceptualization of influence diagrams had only Decision and Chance Nodes (sometimes deterministic), and values were thought to be in another third dimension. Then explicit Value Nodes allowed automatic generation of complete decision models. An extension is to add "data analytic" nodes, which usually point into a chance node to be further evaluated and interpreted by human assessments. Human interpretation gives a view of where you are going: a "windshield" above the "dashboard.

4 - Efficient Observation Set Selection for Bayesian Networks, with Application in Petroleum Prospecting
Marie Lilleborge, PhD Student, Norwegian Computing Center, P.O. Box 114 Blindern, Oslo, NO-0314, Norway, lilleborge@nr.no

We try to speed up observation set selection for BNs, while still ensuring optimality of the information gathering. Probability updates must be calculated many times, so it is crucial to use fast routines such as the Junction Tree Algorithm even for small BNs. For larger BNs, we use upper and lower bounds inspired by JTA.

5 - Complexity of the Exact Solution to the Test Sequencing Problem
Wenhao Liu, PhD Candidate, Stanford University, 475 Via Ortega, Stanford, Ca, 94305, United States of America, owenliu@stanford.edu, Ross Shachter

We analyze the complexity of decision tree and influence diagram solutions to the test sequencing problem. We develop an MDP influence diagram formulation that scales better, and show how a decision circuit formulation improves on the decision tree solution through recursive coalescence. We prove that this decision circuit formulation achieves the lower bound complexity for the general test sequencing problem and renders this problem tractable for more tests than has been possible to date.

■ TD81

Parc- Divisadero

Time Series Data Mining

Sponsor: Data Mining

Sponsored Session

Chair: Mustafa Gökce Baydogan, Assistant Professor, Department of Industrial Engineering, Bogaziçi University, Bebek, Istanbul, 34342, Turkey, mustafa.baydogan@boun.edu.tr

1 - Regularization Methods for Virtual Metrology Modeling

Seoung Bum Kim, Associate Professor, Korea University, Anam-Dong, Seongbuk-Gu, Seoul 136-713, Seoul, Korea, Republic of, sbkim1@korea.ac.kr, Chan Hee Park

In this study, we present various regularization algorithms for virtual metrology modeling in semiconductor manufacturing processes. Advantages and disadvantages of each method are discussed.

2 - Clustering of Short Time-Course Gene Expression Data with Dissimilar Replicates

Cem Iyigün, Assistant Professor, Middle East Technical University, Endustri Muhendisligi, ODTU, ANKARA, 06800, Turkey, iyigun@metu.edu.tr, Ozlem Ilk Dag, Ozan Cinar

In this study, we propose a clustering method where every gene is considered as a collection of short time-series of replications by using a distance measure coupling the Euclidean distance and slope changes. The numerical experiments showed that the proposed approach can find the clusters very fast with a low percentage of misclassification. Furthermore, various criteria are proposed for finding the number of clusters.

3 - Ensemble Learning Strategies for Large-scale Time Series Analysis and Data Mining

Mustafa Gökçe Baydogan, Assistant Professor, Department of Industrial Engineering, Bogaziçi University, Bebek, Istanbul, 34342, Turkey, mustafa.baydogan@boun.edu.tr

We introduce a novel time series (TS) representation based on a tree-based ensemble learning strategy. Earlier, many high-level representations have been proposed for TS data mining but they require many parameters and have problems with generalizability. Our proposed approach is scalable, imposes no constraints and has only one parameter. Benefits of our approach are illustrated on 45 TS classification problems. The approach has promising extensions to clustering, anomaly detection etc.

■ TD82

Parc- Haight

Building MCDM Models: Practical and Methodological Issues

Sponsor: Multiple Criteria Decision Making

Sponsored Session

Chair: Danielle Morais, daniellemorais@yahoo.com.br

Co-Chair: Adiel Teixeira Almeida, Professor, Universidade Federal de Pernambuco, Recife, PE, Brazil, almeidaatd@gmail.com

1 - Resolving Evaluation of Criteria Weights by Interactive Flexible Elicitation

Adiel Teixeira Almeida, Professor, Universidade Federal de Pernambuco, Recife, PE, Brazil, almeidaatd@gmail.com, Ana Paula Costa, Adiel T. de Almeida Filho, Jonatas Almeida

The paper deals with the elicitation of weights of multicriteria additive models, which is one of the most relevant issues in additive models. The tradeoff elicitation procedure is one of the approaches with strongest theoretical foundation. This paper presents a method based on flexible elicitation for the tradeoff procedure so as to reduce the DM effort in the process. The use of the DSS is illustrated by an application.

2 - Selecting Suppliers with an Additive-veto Multicriteria Model

Luciana Hazin, UFPE, Av. Académico Hélio Ramos, Recife, Brazil, alencarlh@gmail.com, Adiel Teixeira Almeida

Organizations have taken an increasing interest in analyzing outsourcing, particularly with regard to selecting suppliers. Thus, this study puts forward a multicriteria decision aid model to assist companies to select suppliers, using an additive-veto model. An application for selecting contractors for a building site using this model is presented.

3 - A Multi Criteria Failure Mode Effects and Criticality Analysis Approach

Adiel T. de Almeida-Filho, Assistant Professor, Universidade Federal de Pernambuco, Caixa Postal 7471,cordeiro, Recife, PE, 50630971, Brazil, atalmeidafilho@yahoo.com.br, Marcelo Alencar, Adiel Teixeira Almeida

This work presents a multi criteria failure mode effects and criticality analysis (FMECA) approach. FMECA provides a critical and systematic evaluation of potential failure modes and its causes with respect to an industrial plant or a specific equipment by considering a risk priority number (RPN). The approach proposed can be used to rank potential causes from FMECA providing managerial information for resources allocation amongst failure prevention, inspections and preventive maintenance.

4 - A Multi-criteria Decision Model for Technology Readiness Assessment

Danielle Morais, Federal University of Pernambuco, Production Engineering Department, Brazil, daniellemorais@yahoo.com.br, Adiel Teixeira Almeida, Ceres Cavalcanti

The Brazilian energy production is traditionally generated by hydroelectricity. However, the actual challenge of the sector is to identify new technologies for supply energy for the country. This study deals with a multicriteria decision model for Technology Readiness Assessment in order to improve the decision making in this sector.

■ TD83

Parc- Sutro

Advances in Business Data Analytics

Sponsor: Data Mining

Sponsored Session

Chair: Nick Street, Professor and Departmental Executive Officer, The University of Iowa, S210 Pappajohn Business Building, Iowa City, IA, 52242, United States of America, nick-street@uiowa.edu

1 - The Effect of Diversity in Dynamic Class Prediction

Senay Yasar Saglam, Graduate Student, University of Iowa, S210 John Pappajohn Business Building, Iowa City, IA, 52242, United States of America, senay-yasarsaglam@uiowa.edu, Nick Street

Dynamic class prediction has taken great attention for the last couple of decades. Accuracy and prediction confidence are used to evaluate ensemble performance. In this study, we analyze the effect of diversity in three experimental settings. For each new point, we choose ensembles via: random assignment, heuristic search process, and a two-phase framework using probability-based distance measure. After accounting for certain features of the ensembles, we find that diversity remains useful.

2 - On Over-Specialization and Popularity Biases of Recommender Systems

Panagiotis Adamopoulos, PhD Candidate, New York University, 4 4 W 4th Street, New York, NY, 10012, United States of America, padamopo@stern.nyu.edu, Alexander Tuzhilin

Focusing on the problems of over-specialization and concentration bias in recommender systems, we propose a novel probabilistic method in the neighborhood-based collaborative filtering framework. We conduct an empirical study showing that the proposed method increases the diversity, dispersion, and mobility of recommendations by selecting diverse sets of neighbors. This performance improvement is in accordance with ensemble learning theory and the phenomenon of "hubness" in recommender systems.

3 - Building Interpretable Descriptive Patterns for Discrete Linear Classification

Tong Wang, Student, MIT, 70 Pacific St Apt 242a, Cambridge, Ma, 02139, United States of America, tongwang@mit.edu, Cynthia Rudin

Descriptive Pattern (DP) sets are a collection of rules used to characterize groups of objects in data. We present a MIP model to create accurate and interpretable DP sets. Our model penalizes the lengths of the rules, the number of features per rule, and the total number of features to create collections of rules that are more understandable to human experts. We show how DP rules can be used for classification, and introduce extensions to improve the predictive accuracy of these models.