3 - Maximum Likelihood Estimation for Large Interacting Stochastic Systems

Justin Sirignano, Stanford University, 3 Gibbs Court, Irvine, CA, United States of America, jasirign@stanford.edu, Kay Giesecke, Gustavo Schwenkler

Parameter estimation for a large system is facilitated by using the asymptotic SPDE to which the system weakly converges as well as a conditionally Gaussian first-order correction. We develop a particle filtering method for the asymptotic SPDEs. Theoretical convergence of the finite system's likelihood to the asymptotic likelihood is discussed. Important credit risk and mortgage applications motivate the method.

4 - Optimal Stopping and Early Exercise: An Eigenfunction Expansion Approach

Lingfei Li, Assistant Professor, The Chinese University of Hong Kong, Shatin, New Territories, Hong Kong-PRC, lingfeili2012@u.northwestern.edu, Vadim Linetsky

We propose an eigenfunction expansion approach to solve discrete time finite and infinite horizon optimal stopping problems for symmetric Markov processes, which cover many models used in practice. We illustrate this approach with some real option applications.

Monday, 11:00am - 12:30pm

■ MB01

01- West 101- CC

Computational Global Optimization

Sponsor: Optimization/Global Optimization

Sponsored Session

Chair: Andrew Trapp, Assistant Professor, Worcester Polytechnic Institute, School of Business, 100 Institute Rd., Worcester, MA, 01609, United States of America, atrapp@wpi.edu

1 - Parallel Global Optimization using an Improved Multi-points Expected Improvement Criterion

Peter Frazier, Assistant Professor, Cornell University, 106 Burleigh Dr, Ithaca, NY, 14850, United States of America, pf98@cornell.edu, Scott Clark

In the context of parallel global optimization with a Gaussian process prior, we consider the multi-points criterion proposed by Ginsbourger, Le Riche, and Carraro (2008). While this criterion is conceptually appealing, optimizing it to create an algorithm is difficult. Using stochastic approximation, we show how to optimize the multi-points criterion efficiently, and demonstrate that the resulting algorithm provides a speedup over the single-threaded expected improvement algorithm.

2 - Exploiting Convexity in Global Optimization

Aida Khajavirad, IBM T.J. Watson Research Center, Yorktown Heights, NY, United States of America, aida@cmu.edu, Nick Sahinidis

Many nonconvex optimization problems become convex once the domain of a small subset of their variables has been restricted. This situation arises frequently in the context of partitioning-based global optimization algorithms. We equip BARON with an advanced convexity detection tool that checks for convexity in every node of the search tree and utilizes local solvers and specialized algorithms when convexity conditions are met. Extensive computational results will be presented.

3 - Stochastic Control Optimization of a Binary Integer Program

Pengbo Zhang, PhD. Student, University of Washington, Industrial and Systems Engineering, Seattle, WA, 98195-2650, United States of America, pbzhang@u.washington.edu, Wolf Kohn, Zelda Zabinsky

We develop a discrete meta-control algorithm that provides a good approximation to large-scale binary integer programs with low polynomial time complexity. The key innovation to our optimal control approach is to map the vector of n binary decision variables into a scalar function defined over a discrete time interval [0, n]. We define a linear quadratic tracking problem and use the necessary conditions for optimality to develop a bang-bang type solution in our algorithmic approach.

4 - Comparing Value Function-Based Approaches to Solving Two-stage Integer Programs

Andrew Trapp, Assistant Professor, Worcester Polytechnic Institute, School of Business, 100 Institute Rd., Worcester, MA, 01609, United States of America, atrapp@wpi.edu

Two-stage integer programs with random right-hand sides can be solved via a value function reformulation. Explicit storage of the value function has both advantages and limitations. To overcome such limitations, we discuss theoretical and computational considerations of both level-set and constraint aggregation approaches, and elaborate on conditions under which each approach is effective.

■ MB02

02- West 102 A- CC

Aggregation of Probabilistic Judgments

Sponsor: Decision Analysis

Sponsored Session

Chair: Eric Bickel, Assistant Professor, The University of Texas at Austin, 1 University Station, C2200, Austin, TX, United States of America, ebickel@mail.utexas.edu

1 - Median Aggregation of Expert Distribution Functions

Stephen Hora, University of Southern California, Department of Industrial and Systems Eng, 3710 McClintock Avenue, RTH 314, Los Angeles, CA, 90089, United States of America, hora@price.usc.edu, Benjamin R. Fransen, Natasha Hawkins, Irv Susel

We discuss an approach to aggregating expert judgments when those judgments are given in the form of a distribution function. The method is based on a median filter, is reasonably simple to apply, and has some good properties. For example, both aggregation of probabilities and fractile values are equivalent. The method also has consensus preservation properties. Finally, we examine the impact of the method on calibration and derive an aggregation rule that preserves calibration in certain cases.

2 - Quantifying Two Effects of the Crowds: Size of the Crowd and Individual Contributions

David Budescu, Professor of Psychology, Fordham University, 441 East Fordham Road, Dealy Hall, Bronx, NY, 10458, United States of America, budescu@fordham.edu, Eva Chen, James Marcus

We present new methods designed to measure meaningfully the effects observed in the process of aggregating probabilistic forecasts from multiple judges (the ``wisdom of the crowd''). We derive measures of the size of the crowd and the contributions of the various individuals to the crowd. We illustrate them by analyzing responses from the Aggregative Contingent Estimation System (ACES), a forecasting website in which over 2000 judges have provided forecasts for more than 200 events.

3 - Is It Better to Average Probabilities or Quantiles?

Casey Lichtendahl, Assistant Professor, University of Virginia, Darden School of Business, 100 Darden Blvd, Charlottesville, VA, 22903, United States of America, lichtendahlc@darden.virginia.edu, Yael Grushka-Cockayne, Robert L. Winkler

We consider two ways to aggregate expert opinions: the average probability forecast and the average quantile forecast. We examine several analytical properties of these forecasts and compare their ability to harness the wisdom of the crowd. We show that the two average forecasts have the same mean and that the average quantile forecast always has lower variance. We present empirical evidence that the average quantile forecast outperforms the average probability forecast on four scoring rules.

4 - Trimmed and Winsorized Means for Aggregating Probability Forecasts

Victor Richmond Jose, Assitant Professor, Georgetown University, McDonough School of Business, 37th and O Sts NW, Washington, DC, 20057, United States of America, vrj2@georgetown.edu, Yael Grushka-Cockayne, Casey Lichtendahl

The literature on aggregating point forecasts has shown that trimmed & Winsorized means can offer some improvements to the simple mean. Here, we extend this notion to the case of prob forecasts by introducing two simple methods for trimming & Winsorizing. Using data from the SPF, we compare these robust means to the mean and find that therobust means outperform the simple mean when it exhibits underconfidence. We also propose a novel interior approach to deal with the case of overconfidence.

■ MB03

03- West 102 B- CC

Behavioral Responses to Low Probability Events and Near Misses

Sponsor: Decision Analysis

Sponsored Session

Chair: Matthias Seifert, Assistant Professor, IE Business School, Operations & Technology Area, Maria de Molina 12, 5th floor, Madrid, 28006, Spain, Matthias.Seifert@ie.edu

1 - Do Near Misses Impact Reference Points to Produce Risk Seeking Behavioral Responses to Warnings?

Richard John, Associate Professor of Psychology, University of Southern California, Los Angeles, CA, United States of America, richardj@usc.edu, Robin Dillon, Heather Rosoff

We examine how framing of past experiences, in particular near-misses, alters decision makers' reference point. We report behavioral experiments comparing reference points before and after one or more near misses. Results suggest that decision makers are more risk seeking following a near-miss and the related shift in reference point.

2 - Promoters versus Preventers: Near-miss Events and Subsequent Risk Perception

Florian Federspiel, PhD Candidate, IE Business School, Calle Maria de Molina 12, bajo, Madrid, 28006, Spain, ffederspiel.phd2014@Student.ie.edu, Jill Waymire Paine, Matthias Seifert

Our experimental study focuses on changes in perceived risk after having experienced a near-miss event. We distinguish between different kinds of near-misses (salient versus non-salient; small loss versus no loss) and we measure perceived risk using different measures (a direct one and two kinds of utility assessments). We further focus on interaction effects between displaying a promotion versus prevention focus and the risk perception after experiencing the different kinds of near-miss events.

3 - Managing Uncertainty and the Control of Risks in Decision Analysis

Shweta Agarwal, PhD Candidate, LSE, London, United Kingdom, S.Agarwal@lse.ac.uk, Gilberto Montibeller

In Decision Analysis models uncertainties are traditionally treated as external and thus 'uncontrollable'. However, in practice, managers often have levers to manage uncertainty and hence control risks. We propose representing this in influence diagrams as stochastic interventions (changing the probability distribution of state variables) that represent causal influences and model the corresponding probability revision using stochastic matrices. This technique can be useful in risk management.

■ MB04

04- West 102 C- CC

Applied Decision Analysis I

Contributed Session

Chair: John Mamer, Professor, University of California-Los Angeles, Anderson School of Management, 110 Westwood Plaza, D518, Los Angeles, CA, 90064, United States of America, jmamer@anderson.ucla.edu

1 - Decision Analysis to Promote Offshore Wind Development in the United States

Andrea Staid, PhD. Student, Johns Hopkins University, 3400 N Charles St., 313 Ames Hall, Baltimore, MD, 21218, United States of America, staid@jhu.edu, Seth Guikema

The offshore wind industry in the United States is set to take off, and there are several proposed projects on the horizon. We present a framework to analyze the decisions that must be made to maximize the probability of offshore project reliability and success. Decisions regarding grid connection type, turbine type, and farm location are included in this analysis.

2 - Improving Prediction Market Forecasts for Policymaking

Christopher Karvetski, Assistant Professor, IC Fellow, George Mason University, 5400 Nguyen Engineering Bldg., 4400 University Drive, MSN 1G8, Fairfax, VA, 22030, United States of America, ckarvets@gmu.edu, Kenneth Olson

In the first year of an IARPA-funded forecasting challenge, the Daggre prediction market substantially outperformed baseline forecasts on real-world events, as measured by a time-series Brier scoring average. We show that post-processing models can further improve the performance of the Daggre prediction market by up to 15%, in out-of-sample testing. We compare both of Bayesian and classical statistical models for the post-processing or adjusting of forecast time-series.

3 - Optimizing Test Plans to Maximize Correct Selection

Dennis Leber, Mathematical Statistician, NIST, 100 Bureau Drive, MS 8980, Gaithersburg, MD, 20899, United States of America, dennis.leber@nist.gov, Jeffrey Herrmann

When experimental testing is limited, a decision-maker has only uncertain estimates of the true values of an alternative's consequences. This attribute value uncertainty influences the probability of selecting the best alternative. Given a multiattribute preference structure, the optimal allocation of test effort to the uncertain attributes can be determined. This talk will consider planning tests of detection systems for screening individuals and their baggage for radioactive materials.

4 - Making the Best of a Bad Situation: Declining Price Expectations and Resale Price Maintenance

John Mamer, Professor, University of California-Los Angeles, Anderson School of Management, 110 Westwood Plaza, D518, Los Angeles, CA, 90064, United States of America, jmamer@anderson.ucla.edu, Steven Lippman

Technology products markets are often characterized expectations of decreasing prices. We model a sequential sales process in a market wherein each transaction prices sets an upper bound on the next and use our model to analyze the selling strategy of a product distributor selling for a manufacturer. This model offers a rationale for price maintenance policies implemented by the manufacturer as a means of preventing premature exit by the distributor.

■ MB05

05- West 103 A- CC

Joint Session QSR/DM: Predictive Analytics Applications I

Sponsor: Quality, Statistics and Reliability & Data Mining

Sponsored Session

Chair: Irad Ben-Gal, Professor, Tel Aviv University, Department Industrial Eng Tel Aviv University, Tel Aviv, Israel, bengal@tau.ac.il

1 - Analytics of Faults

Irad Ben-Gal, Professor, Tel Aviv University, Ramat Aviv, Tel Aviv, 69978, Israel, bengal@eng.tau.ac.il

We consider a system which is inspected by a set of given sensors. The sensors' signature, which is prone to inspection error, enables to classify the system state and decide whether it is reliable, or needs certain preventive maintenance action. We study the performance of the analytics policy under different inspection and malfunctioning scenarios. We use both Rough Set Theory and Error Correcting Codes measures for this analysis.

2 - Learning Based Construction of Efficient Parallel Decision Trees

Chavatzelet Tryster, Tel Aviv University, Hankin 2/11, Ra'anana, 43213, Israel, cdatryster@gmail.com, Irad Ben-Gal

We propose an algorithm for the construction of efficient coding/decision trees with an objective function of minimizing the average code length. The algorithm has a number of positive points, namely, a non-increasing monotonous efficiency function, and the possibility of taking advantage of parallel processing.

3 - Condition-based Maintenance through Targeted Bayesian Networks

Aviv Gruber, Researcher, Tel Aviv University, 7 Hanotea St., P.O.B. 171, Hadar-Am, 42935, Israel, avivgrub@post.tau.ac.il

We present a failure prediction mechanism, based on a machine-learning application. This mechanism serves as the core of the decision-making step, enabling an efficient use of the existing operational data. This is achieved by accounting for the relations between the operational attributes that are most relevant for failure prediction, through measures from Information Theory. We demonstrate the impact of the proposed approach by presenting an application of freight wagon fleet life-cycle cost-analysis, using Monte Carlo simulation.

■ MB06

06- West 103 B- CC

Joint Session SIM/MSOM: Applications of Simulation and Optimization

Sponsor: Simulation & Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Alp Akcay, PhD Candidate, Carnegie Mellon University, 5000 Forbes Ave, Pittsburgh, PA, 15213, United States of America, aakcay@andrew.cmu.edu

1 - Inventory Optimization for Large-scale ATO Systems

Willem van Jaarsveld, PhD Student, Erasmus University Rotterdam, Burgemeester Oudlaan 50, Rotterdam, 3000 DR, Netherlands, vanjaarsveld@ese.eur.nl

We study spare parts inventory control at an aircraft component repair shop. Parts are used in multiple component types. Each component type has an availability target: the problem structure resembles an Assemble-To-Order system. We develop an algorithm to optimize inventory policies at the repair shop. Unlike existing algorithms, it can handle the large scale of the problem.

2 - Dynamic Demand Fulfillment in Spare Parts Networks with Multiple Customer Classes

Geert-Jan van Houtum, Full professor, Eindhoven University of Technology, P.O. Box 513, Eindhoven, 5600 MB, Netherlands, G.J.v.Houtum@tue.nl, Moritz Fleischmann, Harold Tiemessen, Eleni Pratsini

We consider heuristics for the real-time demand fulfillment for spare parts networks, where customers are classified by their delivery time constraints. Part requests can be fulfilled from multiple local warehouses via regular deliveries or from externally by an emergency shipment. We develop a dynamic heuristic via an approximate dynamic programming approach. This heuristic is close to optimal, has a low computational complexity, and significantly ourperforms a widely used, static rule.

3 - fl-Guaranteed Joint Service Levels

Alp Akcay, PhD Candidate, Carnegie Mellon University, 5000 Forbes Ave., Pittsburgh, PA, 15213, United States of America, aakcay@andrew.cmu.edu, Bahar Biller, Sridhar Tayur

We introduce a cost-minimizing, multi-product, joint service-level model that satisfies a target joint service level with a guaranteed probability of fl. We combine computationally tractable approximations for service-level constraints with simulation-based procedures that are easy to implement and obtain asymptotically inventory targets delivering beta-guaranteed joint service levels.

■ MB07

07- West 104 A- CC

Robust Optimization in Data Mining and Machine Learning

Sponsor: Data Mining

Sponsored Session

Chair: Theodore Trafalis, Professor, The University of Oklahoma, 202, West Boyd, Rm 124, Norman, OK, 73019, United States of America, ttrafalis@ou.edu

1 - Uniformly-optimal Stochastic Dual Averaging Methods with Double Projections

Xi Chen, PhD Student, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, xichen@cs.cmu.edu, Javier Peña, Qihang Lin

We propose a stochastic dual averaging method for solving convex regularized optimization. Our approaches adopt two proximal operators for each iteration and the final solution is directly obtained from the proximal operator without an averaging step. With this technique, we achieve a uniformly-optimal convergence rate in expectation for both general convex and strongly convex objective function. The variance for the objective and high probability bounds have also been established.

2 - A Unified Robust Classification Model as Financial Risk Measure Minimization

Akiko Takeda, Associate Professor, Department of Administration Engineering, 3-14-1 Hiyoshi, Kouhoku, Yokohama, Kanagawa, 223-8522, Japan, takeda@ae.keio.ac.jp, Takafumi Kanamori

Recently, we proposed a robust optimization formulation that unifies several machine learning classification models. In this talk, we show that our model, the robust classification model (RCM), is extendable to other learning methods such as regression, novelty detection, etc. The RCM can be regarded as financial risk measure minimization. Based on such interpretation, we show that some RCM has guaranteed generalization performance.

3 - Designing Multivariate Control Charts using Weighted Support Vector Machines

Talayeh Razzaghi, Graduate Student, University of Central Florida, Orlando, FL, United States of America, talayeh.razzaghi@gmail.com, Petros Xanthopoulos

In quality control, automated algorithms are useful for early detection of abnormal patterns and avoidance of system malfunctions. In this work we present an overview of the literature of machine learning techniques used for control chart inspection and propose a modified K chart based on weighted Support Vector Machines (SVM) for unbalanced dataset demonstrating its practical application through sensitivity and specificity analysis.

4 - Models and Algorithms for Distributionally Robust Least Squares Problem

He Zhang, PhD Candidate, & Management Sciences, Northwestern University, Department of Industrial Engineering, 2145 Sheridan Road, Room C210, Evanston, IL, 60208, United States of America, hezhang2012@u.northwestern.edu, Sanjay Mehrotra

We present different robust frameworks using probabilistic ambiguity descriptions of the input data in the least squares problems. The three probability ambiguity descriptions are given by: (1) confidence interval over the first two moments; (2) bounds on the probability measure with moments constraints; (3) Kantorovich probability distance from a given measure. We derive equivalent formulations and show that the resulting optimization problem can be solved efficiently.

■ MB08

08- West 104 B- CC

Joint Session SPPSN/MAS: Humanitarian Logistics and Disaster Response III

Sponsor: Public Programs, Service and Needs & Military Applications

Sponsored Session

Chair: John Coles, PhD Student, University at Buffalo, 435 Bell Hall, Buffalo, NY, 14260, United States of America, jbcoles@buffalo.edu

1 - Modeling the Dynamics of Agency-agency Partnerships Before and Following Extreme Events

John Coles, PhD Student, University at Buffalo, 435 Bell Hall, Buffalo, NY, 14260, United States of America, jbcoles@buffalo.edu, Jun Zhuang

The objective of our research is to model and analyze the process of partnership creation, length of partnership efficacy, and timing of partnerships conclusion in networks of agencies responding to crises. We plan to create models using game theory and simulation to explore how characteristics of partnerships could be used to predict dynamics in agency investment, commitment length, partnership selection, and exit timing from a crisis.

2 - Imperfect Protection of Multi-state Networks

Hugh Medal, Industrial and Systems Engineering, Mississippi State University, Mississippi State, MS, 39762, United States of America, hmedal@ise.msstate.edu, Ed Pohl, Manuel D. Rossetti

Two assumptions are often made in network protection models: 1) protected elements cannot fail, and 2) unprotected elements exposed to a hazard always fail completely. Challenging these assumptions, we study a problem in which hazards cause capacity degradation of network elements. The post-hazard capacity of an element is a random function of the amount of protection allocated to that element. We present a stochastic programming strategy for this problem.

3 - A Framework for Improving Humanitarian Operational Effectiveness

Christopher Zobel, Professor, Virginia Tech, Department of Business Information Technology, 1007 Pamplin Hall, Blacksburg, VA, 24061-0235, United States of America, czobel@vt.edu, Josey Chacko, Loren Rees

Humanitarian operations are often subject to severe resource and time constraints. In order to make the best use of these limited resources and to incorporate learning into subsequent disaster recovery efforts, the humanitarian efforts need to be evaluated along both quantitative and qualitative measures. This research effort seeks to contribute to the ability to tie together long-term decision-making and policy analysis to create more sustainable and disaster-resilient communities.

4 - An Analysis of Competition and Coalition Fundraising Strategies for Disaster Relief Operations

Fuminori Toyasaki, Assistant Professor, York University, 4700 Keele St., Toronto, ON, M3J 1P3, Canada, toyasaki@yorku.ca, Tina Wakolbinger

Aid agencies involved in disaster relief are currently facing challenges in their environment: increasing demand for disaster relief, increasing competition for donations, and donors who are more demanding in terms of accountability. Aid agencies employ different fundraising strategies to deal with these trends. We explore two prevalent fundraising models: competitive model and coalition model.

■ MB09

09- West 105 A- CC

Finding Efficient and Preferred Solutions in MCDM

Sponsor: Multiple Criteria Decision Making

Sponsored Session

Chair: Murat Köksalan, METU, IE Department, METU, Ankara, Turkey, koksalan@ie.metu.edu.tr

1 - Generating All Efficient Solutions for Bi-criteria Multi Resource Assignment Problem

Ozlem Karsu, PhD Student, London School of Economics and Political Science, Houghton Street, London, WC2A 2AE, United Kingdom, O.Karabulut@lse.ac.uk, Meral Azizoglu

In this study we consider a multi resource assignment problem. Our aim is to generate all efficient solutions with respect to two criteria: total assignment load and maximum assignment load over all agents. We propose several lower and upper bounds and use them in our optimization and approximation algorithms. The computational results show satisfactory behaviours of our approaches.

2 - Solving Multi-objective Integer Programs using Convex Preference Cones

Banu Lokman, Aalto University, School of Economics, Department of Information, and Service Economy, Helsinki, Finland, banu.lokman@aalto.fi, Murat Köksalan, Pekka Korhonen, Jyrki Wallenius

We develop an interactive algorithm for multi-objective integer programming for an underlying quasiconcave value function. We generate cones to eliminate inferior regions and guarantee to find the most preferred solution. Tests on multi-objective assignment, knapsack, and shortest path problems show that the required pairwise comparisons are reasonable.

3 - Dependencies Among Multiple Quality Responses: Characterization and Aggregation for Prediction

Leman Esra Dolgun, Anadolu University, Industrial Engineering Department, Eskisehir, 26555, Turkey, ledolgun@gmail.com, Gülser Köksal, Nimetullah Burnak

We present results of a structured survey with several quality control experts to characterize preferential and statistical dependencies among multiple quality responses. We then consider aggregation of these responses via Choquet integral for predictive modeling. The method is tested for different dependence situations identified through the survey. We elaborate on design of the reference alternatives to control the number of comparisons required to capture the expertise of the decision maker.

4 - Multiple Objective Picker Routing Problems with Turn Penalties

Melih Çelik, Georgia Institue of Technology, 765 Ferst Dr NW, Atlanta, GA, 30332, United States of America, melihcelik@gatech.edu, Haldun Sural

We consider the problem of routing order pickers in a warehouse with the objectives of travel time and turn minimization. First, we show that the turn minimization problem can be solved in polynomial time. We then go on to propose a polynomial time algorithm that generates the efficient frontier for the biobjective problem that minimizes travel times and the number of turns. Lastly, we treat U-turns as a separate objective and extend our algorithm to handle all three objectives.

■ MB10

10- West 105 B- CC

Multi-period Techniques

Sponsor: Optimization/Stochastic Programming

Sponsored Session

Chair: Alan King, IBM Research, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States of America, kingaj@us.ibm.com

1 - Extending Convex Approximation Schemes using Switching Times

Alan King, IBM Research, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States of America, kingaj@us.ibm.com

Optimization of decision problems under uncertainty faces the curse of dimensionality. A frequently used approach (for example in neuro-dynamic programming) is to optimize over a low-dimensional "policy space". The problem is how to extend this policy region to incorporate new directions of solution progress. We discuss a method revise the solution based on the selection of a switching time and show how this can be reduced to a tractable two-stage stochastic programming sub-problem.

2 - An Approximate Solution Method for Large Risk-Averse Markov Decision Processes

Dharmashankar Subramanian, IBM Research, 1101 Kitchawan Rd, Yorktown, NY, 10598, United States of America, dharmash@us.ibm.com, Marek Petrik

Stochastic domains often involve decision makers that are risk averse. We propose and analyze a method for solving large risk-averse MDPs with hybrid continuous-discrete state spaces and continuous action spaces. The proposed method iteratively improves a bound on the value function using the linearity structure of the MDP. We demonstrate the use of the method on a portfolio optimization problem.

3 - Robust Optimal Stopping

Andy Sun, Postdoctoral Researcher, IBM Thomas J Watson Research Center, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States of America, andysun@us.ibm.com, Bo Zhang

The optimal stopping problem is a classic problem in applied probability and stochastic control with many applications. We consider a distribution-free approach to this traditional problem in situations where probability transition information is not available or probability models are not appropriate. We propose models that describe state-transition behaviors in the robust setting and characterize optimal and sub-optimal policies for single-choice and multiple-choice optimal stopping problems.

4 - Managing Uncertain Data at Scale

Robin Lougee, Manager, IBM Research, 1101 Kitchawan Road, Yorktown Heights NY 10598, United State of America,rlougee@us.ibm.com

The IBM Global Technology Outlook explores high-impact, disruptive technologies that will lead to industry-changing products and services over the next three- to ten-year period. This year's study highlighted how making revolutionary use of big data and analytics requires a paradigm shift to manage uncertain data at scale.

■ MB11

11- West 105 C- CC

Theory and Applications of Robust Optimization

Sponsor: Optimization/Stochastic Programming

Sponsored Session

Chair: Nikos Trichakis, Assistant Professor, Harvard Business School, Boston, MA, United States of America, ntrichakis@hbs.edu

1 - Robust Transient Queueing Theory

Nataly Youssef, Graduate Student, Massachusetts Institute of Technology, 143 Albany St., Apt. 014C, Cambridge, MA, 02139, United States of America, youssefn@mit.edu, Chaithanya Bandi, Dimitris Bertsimas

We study the transient behavior of queueing systems by employing robust optimization as opposed to stochastic analysis by modeling queue primitives using uncertainty sets. We provide closed form solutions for the transient behavior of the departure process, waiting and relaxation times for multi-server and tandem queues under possibly heavy tailed arrivals and services. Our results agree with simulation results while providing qualitative insights lacking from traditional queueing models.

2 - Optimal Mechanism Design for Multi-item Auctions: A Robust Optimization Approach

Chaithanya Bandi, PhD Student, Massachusetts Institute of Technology, 02139, United States of America, cbandi@mit.edu, Dimitris Bertsimas

We propose a robust optimization approach to the problem of auction design for multi-item auctions with budget constrained buyers. We model the unknown valuations using uncertainty sets, constructed using historical information and limit laws of probability theory. In this setting, we characterize the optimal auction extending the work of Myerson to auctions with budgets and correlated valuations. This approach is numerically tractable and is robust to distribution misspecifications.

■ MB12

12- West 106 A- CC

Cutting Planes for Mixed-Integer Programming

Sponsor: Optimization/Integer Programming

Sponsored Session

Chair: Simge Kucukyavuz, The Ohio State University, 1971 Neil Ave, 210 Baker Systems Building, Columbus, OH, 43210, United States of America, kucukyavuz.2@osu.edu

1 - Minimum Concave Cost Network Flow over a Grid Network

Qie He, Georgia Tech ISyE, 765 Ferst Dr NW, Atlanta, GA, 30332, United States of America, qie.he@gatech.edu, Shabbir Ahmed, George Nemhauser

We study the minimum cost flow problem over a grid network with a general nonnegative separable concave cost function, which generalizes the lot-sizing problem by allowing multiple sources in the network. We show that the problem is polynomially solvable with one echelon of sources and two echelons of sinks. The analysis relies on an inflow formula of any node under all extreme points of the feasible set, which generalizes Zangwill's result (1969) for the multi-echelon lot-sizing problem.

2 - Semi-continuous Network Flow Problems

Gustavo Angulo, 922 Myrtle St NE, Apt 2, Atlanta, GA, 30309, United States of America, gangulo@gatech.edu, Shabbir Ahmed, Santanu Dey

We consider network flow problems where some of the variables are restricted to be semi-continuous. We introduce the single-node semi-continuous flow set with variable upper bounds as a relaxation. Two particular cases of this set are considered, for which we present complete descriptions of the convex hull in terms of linear inequalities and extended formulations. We study the efficacy of the polyhedral results on a class of semi-continuous transportation problems.

3 - Multicommodity Variable Upper Bound Flow Models

Deon Burchett, PhD Student, University of Florida, 406-A Weil Hall, Gainesville, FL, 32608, United States of America, deonlb@hotmail.com, Jean-Philippe Richard

Variable upper bound flow models are well studied in the mixed-integer programming literature, and their study has yielded inequalities that are useful in computation. We consider a multi-commodity generalization of variable upper bound flow models. We perform a polyhedral study of this extended model, investigating novel aspects of its structure while also examining its relationship to the single-commodity case.

4 - Valid Inequalities for Some Generalizations of the Continuous Mixing Set

Manish Bansal, PhD Student, Texas A&M University, Emerging Technologies Building, 3131 TAMU, College Station, TX, 77840, United States of America, bans1571@neo.tamu.edu, Kiavash Kianfar

We present our progress in studying some interesting generalizations of the continuous mixing set previously studied by Van Vyve (2005). We present new valid inequalities for these sets and discuss their facet-defining properties.

■ MB13

13- West 106 B- CC

Gradient Methods for Large-scale Optimization

Sponsor: Optimization/Linear Programming and Complementarity

Sponsored Session

Chair: Peter Richtarik, University of Edinburgh, 6317 JCMB, King's Buildings, Edinburgh, EH93JZ, United Kingdom, peter.richtarik@ed.ac.uk

1 - Parallel Block Coordinate Descent Methods for Huge-scale Partially Separable Problems

Peter Richtarik, University of Edinburgh, 6317 JCMB, King's Buildings, Edinburgh, EH93JZ, United Kingdom, peter.richtarik@ed.ac.uk, Martin Takac

We show that randomized block coordinate descent methods can be accelerated by parallelization when applied to the problem of minimizing the sum of a partially block separable smooth convex function and a simple block separable convex function. The speedup increases with the number of processors and with the degree of partial separability of the smooth component of the objective function. We conclude with some encouraging computational results on huge-scale LASSO instances.

2 - Intermediate Gradient Methods for Smooth Convex Optimization Problems with Inexact Oracle

Olivier Devolder, Université Catholique de Louvain (UCL), 34 Voie du Roman Pays, Louvain-la-Neuve, 1348, Belgium, olivier.devolder@uclouvain.be, FranÁois Glineur, Yurii Nesterov

Between the slow but robust gradient method and the fast but sensitive to errors fast gradient method, we develop new intermediate gradient methods for smooth convex optimization problems. We show, theoretically and on numerical experiments, that these new intermediate first-order methods can be used in order to accelerate the minimization of a smooth convex function when only inexact first-order information is available.

3 - Distributed Block Coordinate Descent Method: Iteration Complexity and Efficient Hybrid Implementation

Martin Takac, University of Edinburgh, Edinburgh, EH93JZ, United Kingdom, M.Takac@sms.ed.ac.uk, Peter Richtarik

In this work we propose solving huge-scale instances of regularized convex minimization problems using a distributed block coordinate descent method. We analyze the iteration complexity of the algorithm and show how it depends on the way the problem data is partitioned to the nodes. Several variations of the basic method are obtained based on the way updates are handled. We report encouraging numerical results for an efficient hybrid MPI + Open MP implementation applied to sparse SVM.

4 - Stochastic First- and Zeroth-order Methods for Nonconvex Stochastic Programming

Guanghui Lan, University of Florida, P.O. Box 210020, Gainesville, FL, 32603, United States of America, glan@ise.ufl.edu, Saeed Ghadimi

We present a new stochastic approximation type algorithm, namely the randomized stochastic gradient method, for solving a class of nonlinear (possibly nonconvex) stochastic programming problems. We establish the rate of convergence of the method for computing an approximate stationary point of a nonlinear programming problem. This method is then specialized for solving a class of simulation-based optimization problems in which only stochastic zeroth-order information is available.

■ MB14

14- West 106 C- CC

Supply Chain Optimization

Cluster: Scheduling and Project Management

Invited Session

Chair: Lei Lei, Professor, Rutgers University, 1 Washington Park, Room 968, Newark, NJ, 07102, United States of America, llei@business.rutgers.edu

1 - A Demand Distribution-free Analysis of Process Flexibility Design

Tianhu Deng, University of California-Berkeley, Berkeley, CA, 94720, United States of America, dthacyj@gmail.com, Z. Max Shen

We discuss a distribution-free analysis of flexibility design problems. We investigate the worst-case performance among all demand distributions that have the given mean and variance. The analysis draws implications about the first and second order effects of plant capacity, demand mean and standard deviation.

2 - Inventory Optimization in Clinical Trial Supply Chains
Yao Zhao, Associate Professor, Rutgers Business School, 1 Washington Park, Newark, NJ, 07102, United States of America, yaozhao@andromeda.rutgers.edu, Anh Ninh, Adam Fleischhacker

One bottleneck in clinical trials is the slow patient recruitment. Companies typically address this issue by recruiting patients globally, which, however, resulted in significant overages of clinical supplies. In this study, we introduce a class of mathematic models to capture the unique attributes of clinical trial supply chains. We show how to optimally position inventory in such supply chains, and test the effectiveness of the model in a real-world example.

3 - Managing Engineering Design for Competitive Sourcing in Closed-loop Supply Chains
Tolga Aydinliyim, Lundquist College of Business, University of Oregon, Eugene, OR, 97403, United States of America, tolga@uoregon.edu

We study the design (integral vs. partitioned) and procurement decisions of a buyer and its suppliers' pricing decisions. The integral design requires more virgin materials and eliminates yield loss due to final joining. However, the simpler partitioned design allows a more competitive supplier base to rely less on reverse flows.

4 - Supply Chain Scheduling with Renewable and Non-renewable Resources
Michael Pinedo, Professor and Chair, New York University, Stern School of Business, 44 West 4th Street, New York, NY, 10012, United States of America, mpinedo@stern.nyu.edu, Lei Lei, Shengbin Wang, Kangbok Lee

When supply chain operations scheduling is subject to both renewable and nonrenewable resource constraints, solving the resulting problems to optimality, especially those involving additional constraints, becomes very difficult. We present three polynomial-time solvable cases, and also a heuristic algorithm for the general case.

■ MB15

15- West 202- CC

Software Demonstration

Invited Session

1 – Gurobi Optimizer for Client-Server Applications
Greg Glockner, Gurobi Optimization, Inc., Box 1001, 3733-1 Westheimer Road, Houston TX 77027, United States of America, glockner@gurobi.com

Client-server, multi-tier and cloud computing are popular methods in software engineering for high-volume or high-availability applications. We will discuss how this applies to optimization and see some optimization applications that can benefit from these architectures. Finally, we'll preview upcoming Gurobi features for client-server software applications.

2 - AIMMS- From Desktop to Network: Rolling Out AIMMS-Based Optimization Models
Peter Nieuwesteeg, AIMMS (Paragon Decision Technology), 500 108th Avenue NE, Sutie 1085, Bellevue WA 98004, United States of America, Peter.Nieuwesteeg@aimms.com, Deanne Zhang

AIMMS already makes it easy for you to build your optimization models and create a versatile user interface. With our just-released AIMMS PRO framework, you can now publish your AIMMS application in your own "App Store," allowing end-users to start the client application anywhere on the network, while the heavy lifting is done on the server. We will show how this client-server setup - combined with automated queuing - allows for efficient what-if analysis. Seeing is believing–come see for yourself!

■ MB16

16- West 207- CC

Clearing Functions, Variable Lead Times and Delay Equations in Production Planning

Cluster: Tutorials

Invited Session

Chair: Dieter Armbruster, Professor, Arizona State University, Tempe, AZ, United States of America, armbruster@asu.edu

1 - Clearing Functions, Variable Lead Times and Delay Equations in Production Planning
Dieter Armbruster, Professor, Arizona State University, Tempe AZ, United States of America, armbruster@asu.edu, Reza Uzsoy

We consider the problem of representing the capabilities of production systems to convert inputs into outputs over time in the face of deterministic demand. The fact that planning models generally operate in discrete-time while the factory being modeled operates in continuous time suggests the use of multimodel methods combining an optimization model that plans the releases into the plant over time with a simulation model that assesses the impacts of these releases on performance. We discuss several such schemes that have been implemented using discrete-event simulation, present recent computational results, and discuss their strengths and weaknesses. We then consider two alternative approaches that have emerged in the recent literature: the use of discrete-time linear programming models based on nonlinear clearing functions, and methods using systems of coupled partial differential equations based on transport phenomena. We identify the relationships between queueing models, clearing functions, and transport model-based methods, and discuss future research directions.

■ MB17

17- West 207 –CC

INFORMS Strategic Initiatives in Analytics

Cluster: Analytics

Invited Session

Chair: Anne Robinson, Director, Supply Chain Strategy and Analytics, Verizon Wireless, Basking Ridge NJ, United States of America, Anne.Robinson@VerizonWireless.com, Jack Levis

1 – Strategic Intiatitives in Analytics
Anne Robinson, Director, Supply Chain Strategy and Analytics, Verizon Wireless, Basking Ridge, NJ, United States of America, Anne.Robinson@VerizonWireless.com

Anne Robinson, President-Elect of INFORMS, and other committee members will provide information about multiple INFORMS analytics-related strategic priorities and goals in this talk. Topics such as certification, continuing education, and outreach will be covered.

■ MB18

18- West 208 A- CC

Advances in Simulation

Contributed Session

Thomas Kirschenmann, Graduate Research Assistant, University of Texas at Austin, 5217 Old Spicewood Springs Rd, Apt 501, Austin TX 78731, United States of America, thk3421@ices.utexas.edu

1 - Improving the Asmussen-Kroese Type Simulation Estimators
Samim Ghamami, University of Southern California, Los Angeles, CA, United States of America, ghamami@usc.edu, Sheldon Ross

Asmussen-Kroese (2006) Monte Carlo estimators of P(S_n > u) and P(S_N > u) are known to work well in rare event settings when S_n is the sum of n i.i.d heavy-tailed random variables, and N is a non-negative integer-valued random variable independent of the X_i. In this paper we show how to improve the Asmussen-Kroese estimators of both probabilities when the X_i are non-negative.

2 - Modeling and Simulating Nonstationary Point Processes having a Constant Variance-to-mean Ratio
Ran Liu, North Carolina State University, 2500 Stinson Drive, Burling Lab, Raleigh, NC, 27695, United States of America, rliu3@ncsu.edu, James Wilson

We survey various methods for modeling and simulating nonstationary point processes having a constant variance-to-mean ratio including nonhomogeneous Poisson processes and recent research on inversion and thinning methods for modeling and simulating nonstationary non-Poisson arrival processes. We propose a Combined Inversion-And-Thinning method for simulating these processes that avoids the disadvantages while retaining the advantages of each method.

3 - A Complete Bayesian Analysis of the Modified and Exponentiated Weibull Distributions
Thomas Kirschenmann, Graduate Research Assistant, University of Texas at Austin, 5217 Old Spicewood Springs Rd, Apt 501, Austin, TX, 78731, United States of America, thk3421@ices.utexas.edu, Elmira Popova, Paul Damien, Stephen Walker

This project provides the first complete Bayesian analysis of the exponentiated and modified Weibull distributions which are useful largely due to flexible hazard rate functions. For both models, a slice sampling method is employed to create a Gibbs sampler that intelligently slices the parameter space to sample only from posterior densities that have the desired hazard shape. These methods are tested with artificial data as well as real-world data from a nuclear power plant in Texas.

4 - Solving Large-scale Random Linear Programs via Sequential Statistical Approximation

Kuo-Hao Chang, Assistant Professor, National Tsing Hua University, No. 101, Section 2, Kuang-Fu Road, Hsinchu, Taiwan-ROC, chang@mx.nthu.edu.tw

We develop efficient methods for handling large-scale random linear programs, in which the technology coefficients are random variables, and can be estimated by stochastic simulation. We prove that the developed methodology can achieve any desired level of optimality gap and feasibility confidence. Numerical experiments show the developed method is much computational efficient than existing approaches.

■ MB19

19- West 211 A- CC

Simulation in Health Care

Contributed Session

Chair: R. Logen Logendran, Professor, Oregon State University, School of Mech, Indust, and Mfgr Engr., 204 Rogers Hall, Corvallis, OR, 97331-6001, United States of America, Logen.Logendran@oregonstate.edu

1 - Exploring Workflow Patterns in Emergency Departments

Mustafa Ozkaynak, Postdoctoral Fellow, Worcester Polytechnic Institute, 100 Institute Road, Worcester, MA, United States of America, mozkaynak@wpi.edu, Patricia Brennan

Emergency Departments (ED) in the US are facing a national crisis. Relevant research suggests looking at ED care processes and modifying them as needed to improve their efficiency and effectiveness. We conducted a field study in three hospital EDs and captured early stages of 108 patient care episodes. We identified six patterns. These patterns may inform the design, implementation and evaluation of systematic engineering interventions that will lead to lower cost and higher quality of care.

2 - Use of Discrete Event Simulation in Redesign of Internal Medicine Outpatient Clinic

Tarun Mohan Lal, Health Systems Engineering Analyst, Mayo Clinic, 155 First Avenue SW, Centerplace Building, Floor 6, Room 04, Rochester, MN, 55901, United States of America, mohanlal.tarun@mayo.edu

General Internal Medicine at Mayo Clinic was considering moving from a regular exam room to Jack and Jill/Suites (combination of 2 consult rooms and 1 exam room) layout based on patient feedback. This change would potentially impact the capacity needs, processes and efficiencies of the clinic. Purpose of this presentation will be to discuss how simulation modeling was used to study the operational impacts of the change and in developing new processes for successful implementation.

3 - Using Operations Research to Predict and Reduce Deteriorating Patients in Hospitals

Todd Huschka, Master Health Systems Analyst III, Mayo Clinic, 200 1st St. SW, Rochester, MN, 55905, United States of America, huschka.todd@mayo.edu, Thomas Rohleder, Jeanne Huddleston, Bruce Morlan, Matthew Johnson

Understanding the health path a patient takes during a hospitalization is important to reduce serious events, including death. Using operations research we will look at the possibility of predicting a deteriorating patient before the patient has a serious event, including death. Simulation of the process will evaluate how predicted increased monitoring of patients will affect overall hospital resource needs.

4 - Discrete Event Generation from the Dynamic Model of Deformable Organs for Laparoscopic Simulation

Seyoun Park, Research Professor, University of Ulsan College of Medicine, Asan Medical Center, Pungnap2-dong, Songpa-gu, Seoul, Korea, Republic of, Seyoun.Park@gmail.com, Joohoe Kong, Byung K. Choi, Hayong Shin, JoonChul Park

In general, deformation, physical state change of organs by surgery instruments is a continuous model such as a differential equation while surgical procedures are discrete event models. To interoperate two different models in one simulation system, we use an timer embedded FSM for modeling of scenarios and an rule-based event generator to check conditions and generate events from organ states. A simulation engine advances time steps of two models, generates events and passes them as messages.

5 - Joint Optimization of Allocation and Release Policy Decisions for Surgical Block Time

Mina Loghavi, University of Tennessee, The College of Business Administration, Knoxville, TN, 37996, United States of America, mloghavi@utk.edu, Charles Noon

In practice, block time is usually allocated without considering the stochastic nature of case demand and duration. Once allocated, the release policies (if used) are often less-than-optimal simple rules. Although previous research has examined these decisions individually, we consider them jointly using a multi-objective model. Financial, temporal, & clinical measures are embedded within a sim/opt framework to evaluate current practices and identify improved, yet practicable, approaches.

■ MB20

20- West 211 B- CC

George B. Dantzig Dissertation Prize II

Cluster: George B. Dantzig Dissertation Prize

Invited Session

Chair: Aliza R. Heching, IBM TJ Watson Research Center, Mathematical Sciences, Yorktown Heights, NY, 10598, United States of America, ahechi@us.ibm.com

1 - George B. Dantzig Dissertation Prize

Aliza R. Heching, IBM TJ Watson Research Center, Mathematical Sciences, Yorktown Heights, NY, 10598, United States of America, ahechi@us.ibm.com

The George B. Dantzig Disseration Award recognizes dissertations that are relevant to the practice of operations research and the management sciences. The award is designed to support greater interaction between academia and the world of practice by awarding research that combines development of novel methodology and new techniques with creative application in a practical real-world setting. Problem scope and potential magnitude of impact of research are considered. In this session, the award finalists will present their research.

■ MB21

21- West 212 A- CC

Network Optimization I

Sponsor: Optimization/Networks

Sponsored Session

Chair: R. Ravi, Carnegie Bosch Professor, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, ravi@andrew.cmu.edu

1 - A Branch and Bound Algorithm based on Approximate Binary Decision Diagrams

Andre Cire, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, United States of America, acire@andrew.cmu.edu, David Bergman, Willem-Jan van Hoeve, J.N. Hooker

In this talk we discuss a novel branch and bound algorithm based on approximate Binary Decision Diagrams (BDDs). We discuss how approximate BDDs can be used to generate upper and lower bounds for combinatorial optimization problems in the form of relaxation and restriction BDDs. We apply the ideas to the well-studied Maximum Independent Set Problem. Experiments show that the proposed branch and bound algorithm outperforms state-of-the-art integer programming technology on this problem domain.

2 - Bounds from Multiple Binary Decision Diagrams

David Bergman, Carnegie Mellon University, 5000 Forbes Ave., Pittsburgh, PA, 15213, United States of America, dbergman@andrew.cmu.edu, Willem-Jan van Hoeve, J.N. Hooker, Andre Cire

In this talk we discuss the use of multiple Binary Decision Diagrams (BDDs) for the purpose of generating bounds to discrete optimization problems. Individual BDDs are used to generate relaxations for different portions of the problem. From each BDD we derive a flow polytope and then link the BDDs via variables associated with the layers of the individual BDDs. We apply the technique to the Maximum Independent Set and Vertex Coloring problems.

3 - Approximation Algorithms for Generalized Hypergraph Matching Problems

Ojas Parekh, Senior Member Technical Staff, Sandia National Laboratories, MS 1326, Albuquerque, NM, 87185, United States of America, odparek@sandia.gov, Dave Pritchard

We examine two generalizations of the matching problem on hypergraphs with sets of size at most k. Our first result is a (k-1+1/k)-approximation for b-matching on k-hypergraphs, settling the integrality gap of the natural LP relaxation. Our second result is for demand matching on k-hypergraphs. Previously a 2k-approximation was known via iterative packing, and we show that a much simpler and faster local ratio algorithm gives the same result.

4 - Science and Engineering of Co-evolving Networks: Population Dynamics, Epidemics and Crisis Response

Madhav Marathe, Professor, Virgnia Tech, Virginia Bio-Informatics Inst., 1880 Pratt Drive Building XV, Blacksburg, VA, 24061, United States of America, mmarathe@vbi.vt.edu, Stephen Eubank, Anil Vullikanti

Complex Networks are pervasive in our society. Recent quantitative changes in high performance and pervasive computing have created new opportunities for collecting, integrating, and analyzing information related to such networks. The talk will a high performance computing based crises management system called Comprehensive National Incident Management System (CNIMS). Applications to pandemic planning and other large scale human-initiated crisis will be discussed.

■ MB22

22- West 212 B- CC

COIN-OR Technology Forum

Sponsor: Computing Society

Sponsored Session

Chair: Matthew Saltzman, Associate Professor, Clemson University, Mathematical Sciences Department, Martin Hall, Box 340975, Clemson, SC, 29634, United States of America, mjs@clemson.edu

1 - Panel: COIN-OR Technology Forum

Matthew Saltzman, Associate Professor, Clemson University, Mathematical Sciences Department, Martin Hall, Box 340975, Clemson, SC, 29634, United States of America, mjs@clemson.edu, Bradley Bell, William E. Hart, Kipp Martin, Ted Ralphs

COIN-OR software users, developers, and other interested people are invited to join members of the COIN-OR board of directors and technical council and project managers for an opportunity to discuss recent and future developments within COIN-OR. If you want to get involved, provide feedback, or just learn about COIN-OR, please join us!

■ MB23

23- West 212 C- CC

Joint Session Wagner/CPMS: Daniel H. Wagner Prize for Excellence in Operations Research

Cluster: Daniel H. Wagner Prize for Excellence in Operations Research & CPMS, The Practice Section

Invited Session

Chair: Allen Butler, Daniel H. Wagner Associates, 2 Eaton Street, Suite 500, Hampton, VA, 23669, United States of America, allen.butler@va.wagner.com

1 - Improving Patient Access to Chemotherapy Treatment at Duke Cancer Institute

Brian Denton, Associate Professor, University of Michigan, 2893 IOE Building, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States of America, btdenton@umich.edu, Tracy Gosselin, Amy Boswell, Johnathan Woodall, Edward P. Fitts

We describe how discrete event simulation and optimization methods were used to improve patient flow within a large cancer center. First, we show results from the simulation model that indicate nurses in the chemotherapy infusion center are a significant bottleneck. Next, we describe a mixed integer program that was used to optimize weekly nurse shift scheduling, and how a simulation optimization model was further used to optimize nurse shift start times to minimize average patient waiting time. Finally we summarize the recommendations that were implemented at Duke Cancer Institute.

2 - Automated Bed Assignments in a Complex and Dynamic Hospital Environment

Bex G. Thomas, Researcher, General Electric Global Research Center, 1 Research Center, Niskayuna, NY, 12309, United States of America, thomasb@ge.com, Srinivas Bollapragada, Kunter S. Akbay, David S. Toledano, Peter L. Katlic, Onur I. Dulgeroglu, Dan Yang

Bed management is an important function of any hospital with a big impact on patient care, patient flow and ultimately the hospital operating margin. A key challenge in bed management is optimizing the bed assignments in a complex and dynamic operating environment. We have developed innovative decision support tools with embedded mathematical models to periodically and automatically recommend bed assignments. We have hosted our prototype bed assignment solution as a cloud based application for Mount Sinai Medical Center (MSMC) in New York and improved their hospital operations.

■ MB24

24- West 213 A- CC

Analytical Approaches for Improving Access to Care

Sponsor: Health Applications Society

Sponsored Session

Chair: Beste Kucukyazici, Assistant Professor, McGill University, 1001 Sherbrooke St W, Montreal, QC, H3A 1G5, Canada, bkucukya@mit.edu

1 - The Bed Manager's Dilemma: A Dynamic Bed Assignment Problem

Jacqueline Griffin, Georgia Institute of Technology, Atlanta, GA, United States of America, jackie.griffin@gatech.edu, Pinar Keskinocak

A bed manager balances available capacity with competing requests for beds, accounting for clinical characteristics of the patients and expectations about future supply and demand. We identify structural properties of the bed assignment problem, by modeling the hospital system as a tandem queueing network with multiple customer classes and cross-trained server pools. We develop algorithms for dynamic assignments and test the performance against current hospital practices through simulation.

2 - Fully Adaptive Designs for Clinical Trials: Simultaneous Learning from Multiple Patients

Vishal Ahuja, PhD Candidate, University of Chicago, Booth Business School, Chicago, IL, 60637, United States of America, vahuja@chicagobooth.edu, John Birge

Traditional clinical trials are randomized and the goal is to maximize learning. Adaptive designs, however, use information accrued during the trial. An ideal adaptive design maximizes patient health outcomes without sacrificing any potential learning. We propose such a design, one that fully exploits learning from multiple patients simultaneously. We demonstrate our design's effectiveness on a recent trial. Our design is general and applicable to any MDP setting where learning takes place.

3 - The Primary Care Physician Shortage: Averting a Disaster

Linda Green, Armand G. Erpf Professor, Columbia Business School, 3022 Broadway, 423 Uris Hall, New York, NY, 10027, United States of America, lvg1@columbia.edu, Sergei Savin, Yina Lu

A severe U.S. primary care physician shortage has been forecast for the coming years. However, estimates are based on simple ratios and do not consider patients' ability to get timely access to care. They also do not quantify the impact of emerging new methods of delivering care. We show that implementation of some increasingly popular operational changes can completely offset the projected increase in demand for physician services while increasing access to care.

4 - Stroke Network Design: A Location-allocation Problem

Beste Kucukyazici, Assistant Professor, McGill University, 1001 Sherbrooke St W, Montreal, QC, H3A 1G5, Canada, bkucukya@mit.edu, Mozart Menezes

This study focuses on a design problem of stroke networks that represents the potential trade-off between minimizing transportation time to the hospital and increasing congestion in that hospital, in order to offer an optimized infrastructure that maximizes the overall efficiency of the stroke system. The developed model also allows to study: (i) value of relocating the primary stroke hospitals, and (ii) value of online information flow between hospitals and EMS.

■ MB25

25- West 213 B- CC

Chronic Disease Management

Sponsor: Health Applications Society

Sponsored Session

Chair: M. Reza Skandari, University of British Columbia, 2111 Lower Mall, #2052, Vancouver, BC, V6T1Z4, Canada, reza.skandari@sauder.ubc.ca

1 - Using Analytics to Improve U.S. Prostate Cancer Detection

John Silberholz, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Bldg. E40-149, Cambridge, MA, 02139, United States of America, josilber@mit.edu, Dimitris Bertsimas

American men spend more than $1 billion per year screening for prostate cancer using the Prostate-Specific Antigen (PSA) exam and then performing follow-up diagnostic testing. We use optimization-based decision analysis to improve screening policies, trading off quality-adjusted life years (QALYs) and screening and diagnostic costs. Our policies significantly decrease QALYs lost at no additional screening cost, or alternately maintain health outcomes at much lower cost.

2 - Community-based Chronic Care for Diabetic Patients through Intervention and Prevention

Alireza Boloori, PhD Student of Industrial Engineering, Wayne State University, 4815 Fourth Street, Department of Industrial & Systems Eng, Detroit, MI, 48202, United States of America, alireza.boloori@wayne.edu, Alper Murat, Ratna Babu Chinnam

Existing studies on chronic disease management in community-based health care services does not consider joint effects of intervention and prevention. By jointly considering intervention and prevention activities, we propose a novel approach to improve health outcome and operational efficiency. We develop a finite horizon MDP model for scheduling diabetic patient visits and composition of prevention and intervention activities. We present results for improving quality of care and efficiency.

3 - Merging Prediction Models and Optimization for Optimal Prevention Policy

Leila Zia, Stanford University, 450 Serra Mall, Stanford, CA, 94305, United States of America, leilaz@stanford.edu

This research merges risk prediction and cost-effectiveness analysis to optimally apply an intervention or prevention to the "right" sub-group of patients while considering the potential benefit to each patient and the cost and operating characteristics of the intervention/prevention. In particular, the cost of applying the intervention is assumed non-linear. Using a functional approximation to the ROC curve we can apply optimization methods to maximize the benefit of the intervention policy.

4 - Dynamic Timing of Arteriovenous Fistula (AVF) Creation for Chronic Kidney Disease (CKD) Patients

M. Reza Skandari, University of British Columbia, 2111 Lower Mall, #2052, Vancouver, BC, V6T1Z4, Canada, reza.skandari@sauder.ubc.ca, Nadia Zalunardo, Steven Shechter

Periodic laboratory tests help nephrologists measure the progression of CKD and forecast when hemodialysis (HD) is needed. The superior quality access for HD is via AVF, which needs to be first created and reach maturity before use. We present a decision model that decides if and when to start creating AVF by dynamically updating our understanding of patient's CKD progression based on observations. We then compare this dynamic approach with the best static policy.

■ MB26

26- North 221 A- CC

New Researchers in OM

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Erica Plambeck, Professor, Stanford Graduate School of Business, 655 Knight Way, Stanford, CA, 94305, United States of America, plambeck_erica@gsb.stanford.edu

1 - Greenhouse Gas Emissions Accounting: Allocating Emissions from Processes to Co-Products

Nur Sunar, PhD Candidate, Stanford University, Graduate School of Business, Stanford, CA, United States of America, nsunar@stanford.edu, Erica Plambeck

To implement border adjustment on imports or to evaluate the carbon footprint of a supply chain, one must specify how to allocate the emissions from a process among its co-products. For example, emissions could be allocated in proportion to the economic value or in proportion to the mass of co-products. We investigate the implications of the allocation rule (and flexibility therein) for GHG emissions, firms' profits, and social welfare.

2 - Does Inventory Increase Sales? The Billboard and Scarcity Effect in U.S. Automobile Dealerships

Santiago Gallino, The Wharton School, 3720 Walnut St., Philadelphia, 19104, United States of America, sgallino@wharton.upenn.edu, Gerard Cachon, Marcelo Olivares

Estimating the relationship between inventory and sales is complex for several reasons. One of the main challenges is that inventories are endogenously chosen: inventory levels are chosen by a decision maker in anticipation of sales. To tackle these difficulties we apply a novel procedure to estimate the impact of inventory on sales: We use weather shocks to dealer's inventories, which are exogenous of managerial decisions, to estimate the impact of inventory on sales.

3 - Demand for Durable Goods and Warranties with Possible Product Failures

Jingqi Wang, jingqi-wang@kellogg.northwestern.edu, Ozge Islegen, Baris Ata

We empirically estimate the demand for televisions and warranties considering that products may fail.

4 - Measurement and Improvement of Environmental Performance under Voluntary versus Mandatory Eco-labels

Basak Kalkanci, Massachusetts Insitute of Technology, Cambridge, MA, United States of America, kalkanci@mit.edu, Erica Plambeck, Erjie Ang

When a firm exerts effort to evaluate its social & environmental impacts, it finds opportunities to reduce them (and hence its risks associated with future regulation). We investigate when a firm should learn and disclose its impact (accounting for the response from consumers and investors) and whether policy makers should mandate disclosure. Experimentally, we show that voluntary disclosure can boost sales.

■ MB27

27- North 221 B- CC

Empirical Research in Supply Chain Management and Retail Operations

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Saravanan Kesavan, University of North Carolina-Chapel Hill, McColl Building, Chapel Hill, NC, 27519, United States of America, skesavan@unc.edu

1 - Operational Performance: Does Supplier Network Position Matter?

Serguei Netessine, Professor, INSEAD, Boulevard de Constance, Fountainbleau, 77305, France, Serguei.Netessine@insead.edu, Nitish Jain, Karan Girotra

We study the impact of a supplier network position in the buyer-supplier bipartite network on the operational performance of the buyer firm. We construct these networks using a novel data-set of over 25 million import transactions by U.S. firms from global suppliers.

2 - Demand Forecasting with Stockout and Substitution in Textbook Business

Vishal Gaur, Professor, Cornell University, Johnson School, Ithaca, NY, 14853, United States of America, vg77@cornell.edu, Joonkyum Lee, Suresh Muthulingam

We investigate demand forecasting and inventory planning for the textbook business in the presence of stockout and substitution. We use a utility-based choice model to incorporate stockout and substitution behavior based on the sales data for new and used textbooks from the Cornell Store. Our demand forecasting and inventory planning approach outperforms alternative methods. We implement our model as a controlled field experiment at the Cornell Store and find significant operational improvement.

3 - Labor-mix and Flexible Response to Demand Spikes

Saravanan Kesavan, University of North Carolina-Chapel Hill, McColl Building, Chapel Hill, NC, 27519, United States of America, skesavan@unc.edu, Bradley Staats, Wendell Gilland

In this paper, we investigate how labor-mix affects financial performance and service quality. Using data from 451 stores over two years of a large U.S. retailer, we show that the labor-mix of temporary workers exhibits an inverted U-shaped relationship with store profitability and temporary labor-mix is related to lower values of service quality. We also find that employee engagement positively moderates the negative relationship between temporary labor mix and service quality.

4 - Black Friday Pricing and Inventory Managment in Retail

Nikolay Osadchiy, Emory University, Atlanta, GA, United States of America, nikolay.osadchiy@emory.edu, Vishal Gaur

Black Friday sales are used by retailers to generate revenue through selling at discount prices as well as gauge demand for the remainder of the holiday season. Using Bayesian framework we decouple effects of price elasticity and demand signaling and study their implications for inventory and pricing decisions.

■ MB28

28- North 221 C- CC

Supply Chain Optimization

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Retsef Levi, Massachusetts Institute of Technology, 100 Main Street, Building E62-562, Cambridge, MA, United States of America, retsef@mit.edu

1 - Supply Chain Management with Online Customer Selection

Adam Elmachtoub, Massachusetts Institute of Technology, 77 Massachusetts Ave., Cambridge, MA, 02139, United States of America, ane@mit.edu, Retsef Levi

We consider a general class of supply chain and logistics problems where customers arrive sequentially, and one has to decide upon arrival whether to accept or reject each customer. The goal is to minimize the total production costs for the accepted customers plus the rejection costs for the rejected customers. We provide several online algorithms for these problems that are provably near optimal. Our algorithms are based on novel uses of re-optimization and cooperative game theory techniques.

2 - Efficiency Analysis for Service Industries with Nonlinear Demand and Congestion Effects

Wei Sun, Massachusetts Institute of Technology, Cambridge, MA, United States of America, sunwei@mit.edu, Georgia Perakis

This work focuses on efficiency analysis of an asymmetric oligopoly with nonlinear demand and nonlinear congestion cost. We derive tight upper and lower bounds on the welfare loss of an oligopoly with respect to its social optimum. We show that the loss depends on the nonlinearity of the demand and cost functions. In addition, it depends on whether one's congestion cost could be influenced by others' output level.

3 - Dynamic Model of Quality-based Competition between Suppliers

Joline Uichanco, Massachusetts Institute of Technology, Cambridge, MA, United States of America, uichanco@mit.edu, Retsef Levi, Georgia Perakis

In many industries, it is critical that suppliers provide components that meet a quality standard. We study two suppliers that use quality to compete for a contract over a time horizon. The contract is awarded based on the relative quality offered by the suppliers. The more contracts the supplier wins, the more likely it will produce components at a low cost at the next period. We model this problem as a stochastic game and suggest allocation schemes that will result in high quality components.

■ MB29

29- North 222 A- CC

Panel Discussion: Bringing O.R. into the 21st Century with Social Networking and Web 2.0 Tools

Sponsor: Computing Society

Sponsored Session

Chair: Bjarni Kristjansson, President, Maximal Software, Inc., 933 N. Kenmore Street, Suite 218, Arlington, VA, 22201, United States of America, bjarni@maximalsoftware.com

1 - Bringing O.R. into the 21st Century with Social Networking and Web 2.0 Tools

Moderator: Bjarni Kristjansson, President, Maximal Software, Inc., 933 N. Kenmore Street, Suite 218, Arlington, VA, 22201, United States of America, bjarni@maximalsoftware.com, Panelists: Paul Rubin, Michael Trick, Laura McLay, Timothy Hopper, Mary Leszczynski

After a brief "who, what, where, how, and why" on major social networking sites for operations researchers, and a synopsis of activity by INFORMS in the social media, the panel will address questions on the current state and future of social media in our field, including how best to use it for personal and professional advancement.

■ MB30

30- North 222 B- CC

OM-Finance Interface

Sponsor: Manufacturing & Service Oper Mgmt/iFORM

Sponsored Session

Chair: Fehmi Tanrisever, Eindhoven University of Technology, Den Dolech 2, Eindhoven, 5612, Netherlands, f.tanrisever@tue.nl

1 - How Inventory Is (Should Be) Financed: Trade Credit in Supply Chains

Song Alex Yang, Assistant Professor, London Business School, Sussex Place, London, NW1 4SA, United Kingdom, sayang@london.edu, John Birge

As an integrated part of a supply contract, trade credit has intrinsic connections with supply chain contracting and inventory management. Using a model that explicitly captures the interaction of firms' operations decisions and financial risks, this paper attempts to develop a deeper understanding of trade credit from an operational perspective. Using a sample of firm-level data from Compustat, we find that the inventory financing pattern our model predicts exists in a wide range of firms.

2 - The Value of Supply Chain Finance for the Supplier – the Interplay of Two Stochastic Credit Lines

Robert Grueter, EBS University, Konrad-Adenauer-Ring 15, Wiesbaden, Germany, Robert.Grueter@ebs.edu, Margarita Protopappa-Sieke, David Wuttke

Supply chain finance (SCF) is increasingly valued by managers not only because it lowers financing costs of supply chains, but also because it offers financial flexibility to suppliers. In our continuous-time stochastic model we introduce SCF as cost-less stochastic credit line for suppliers. Sensitivity analyses carried out on closed form solutions characterize formally the flexibility value of SCF, providing an explanation for suppliers adopting SCF even in absence of interest rate arbitrage.

3 - Hedging and Sharing Exchange-Rate Risk in a Global Supply Chain

Kun Soo Park, Assistant Professor, KAIST Graduate School of Management, 85 Hoegiro, Dongdaemun-gu, Seoul, 130-722, Korea, Republic of, kunsoo@business.kaist.ac.kr, Kyoung-Kuk Kim

Hedging exchange-rate risk with currency-options contracts and sharing risk with risk-sharing contracts have been popularly used in practice to manage the risk of exchange rate uncertainty in a global supply chain. In this paper, we consider a supply chain with one retailer and one supplier under different currency units and analyze their decisions on hedging and sharing contracts under exchange-rate uncertainty.

4 - Startup Risk Management: An Operational Hedging Perspective

Fehmi Tanrisever, Eindhoven University of Technology, Den Dolech 2, Eindhoven, 5612, Netherlands, f.tanrisever@tue.nl, Sinan Erzurumlu, Nitin Joglekar

We present a framework where SMEs may create an operational hedge against future under-investment problems through their early stage business expansion decisions. We show that, by operational hedging, SMEs may mitigate capital market frictions, enhance their financing options, and create additional value. The decision for creation of such hedges, however, ought to weigh the benefits of reduced marginal cost of capital and the cost of reduced future growth potential against a status quo.

■ MB31

31- North 222 C- CC

Mitigating Supply Chain Risks

Cluster: Managing Disruptions in Supply Chains

Invited Session

Chair: Yehua Wei, Massachusetts Institute of Technology, 60 Wadsworth,10B, Cambridge, MA, 02142, United States of America, y4wei@mit.edu

1 - Improving Supplier Yield with Spillover Risk

Yixuan Xiao, Washington University in St. Louis, St. Louis, MO, 63130, United States of America, xiaoy@wustl.edu, Nan Yang, Yimin Wang

We study manufacturers' supplier improvement efforts with spillover risk. We consider two manufacturers compete in the same market and share a common supplier, which has a production process that is subject to random yield. We model the competition between manufacturers as a two-stage game, and characterize its equilibrium.

2 - Increasing Supply Chain Robustness through Process Flexibility and Strategic Inventory

He Wang, Massachusetts Institute of Techonology, 77 Massachusetts Ave., Rm 1-249, Cambridge, MA, 02139, United States of America, Wanghe@mit.edu, David Simchi-Levi, Yehua Wei

We consider a supply chain with multiple plants producing multiple products, and a plant may fail because of disruptions. The firm can invest in process flexibility and strategic inventory. The robustness is measured by the time that elapses before the strategic inventory is used up. When demand is deterministic, we show that a little process flexibility is very effective in mitigating disruptions. However, the effectiveness decreases with demand uncertainty.

3 - Bullwhip and Reverse Bullwhip Effects under the Rationing Game

Ying Rong, Assistant Professor, Antai College of Economics & Management,Shanghai Jiao Tong University, 535 Fahuazhen Road, Shanghai, 200052, China, yrong@sjtu.edu.cn, Larry Snyder, Z. Max Shen

Under the risk of scarce supply, retailers may compete with each other by increasing their order sizes in the hope of getting a larger portion of the available inventory. We show that the reverse bullwhip effect, in which the retailers' order variance is higher than the capacity variance, occurs between the supplier and the retailers. This result indicates that demand uncertainty can be amplified upstream, while supply uncertainty can propagate downstream.

■ MB32

32- North 223- CC

Bargaining and Trust in Supply Chains

Sponsor: Manufacturing & Service Oper Mgmt/Supply Chain

Sponsored Session

Chair: Lauren Xiaoyuan Lu, Assistant Professor, Kenan-Flagler Business School, University of North Carolina at Chapel Hill, Campus Box 3490, Chapel Hill, NC, United States of America, lauren_lu@unc.edu

1 - Supply Chain Contracting under Competition: Bilateral Bargaining vs. Stackelberg

Lauren Xiaoyuan Lu, Assistant Professor, Kenan-Flagler Business School, University of North Carolina at Chapel Hill, Campus Box 3490, Chapel Hill, NC, United States of America, lauren_lu@unc.edu, Qi Feng

We analyze a two-tier supply chain system consisting of two competing manufacturers selling to two competing retailers. We contrast the firms' contracting behaviors in a Stackelberg game, in which a manufacturer offers a take-it-or-leave-it contract to a retailer, with those in a bargaining game, in which the firms bilaterally negotiate contract terms via a process of alternating offers.

2 - Dynamic Bargaining in a Supply Chain with Asymmetric Demand Information

Guoming Lai, University of Texas at Austin, 1 University Station, Austin, TN, United States of America, guoming.lai@mccombs.utexas.edu, Qi Feng, Lauren Xiaoyuan Lu

We study supply contracting with dynamic bargaining under asymmetric information. The buyer knows the demand state (either high or low), while the seller knows only the prior. We characterize a unique equilibrium for a seller-initiating game, where either both buyer types accept the offer immediately, or only one type accepts immediately while the other rejects and counteroffers an acceptable contract. We apply our model to study the effect of demand forecasting accuracy on firm profitability.

3 - Signaling Reciprocity in Supply Chains

Ruth Beer, Phd Candidate, University of Michigan, Ross School of Business, 701 Tappan, Ann Arbor, MI, 48105, United States of America, ruthbeer@umich.edu, Stephen Leider, Hyun-Soo Ahn

The relationship between a buyer and its suppliers is important and often goes beyond the monetary exchange resulted from transactions. We develop a theoretical model that captures acts of reciprocity and reciprocal gains. We show, theoretically and experimentally, that generous acts (e.g., a costly investment that is not required by the buyer) can serve as a signal of reciprocity to the other party and promote more collaborative relationships.

4 - Price Matching Negotiation versus Simultaneous Negotiation

Gangshu Cai, Associate Professor, Santa Clara University, Department of OMIS, Santa Clara, CA, United States of America, Gangshu@gmail.com, Weixin Shang

Price matching negotiation has been seen in practice; however, no theoretical analysis has been yet dedicated to this phenomenon. This article investigates the impact of negotiation schemes on firms via comparing price matching negotiation and simultaneous negotiation in a variety of situations. We find price matching negotiation can outperform simultaneous negotiation for all firms. We also discuss the impact of ownership, asymmetric bargaining power, and the firms' merger incentives.

■ MB33

33- North 224 A- CC

Topics in Sustainable Operations Management

Sponsor: Manufacturing & Service Oper Mgmt/Sustainable Operations

Sponsored Session

Chair: Chonnikarn Fern Jira, Doctoral Candidate, Harvard Business School, Wyss House, Soldiers Field Road, Boston, United States of America, cjira@hbs.edu

1 - The Supply Chain Impact of Environmental Labeling Design

Chonnikarn Fern Jira, Doctoral Candidate, Harvard Business School, Wyss House, Soldiers Field Road, Boston, United States of America, cjira@hbs.edu, David Simchi-Levi

We explore two designs of environmental labels: one where a fixed level of environmental performance is chosen by the retailer and the other where the supplier chooses his environmental performance, which the retailer communicates to consumers. We analyze the optimal levels of environmental performance in these two models under deterministic and stochastic demand. We show that while the two models are equivalent under deterministic demand, they can differ under stochastic demand.

2 - Got Local Food?

Mustafa Tongarlak, Northwestern University, 2001 Sheridan Road, Jacobs Center 550, Evanston, IL, 60208, United States of America, mtongarlak@gmail.com, Deishin Lee, Baris Ata

We study the sourcing tradeoffs of a retailer selling fresh produce. We derive the optimal ordering policy of a retailer from two types of suppliers: 1) mainstream farm with large, stable supply that is located far from the retail store, and 2) local farm with small, uncertain capacity that is located close to the retail store. We show how the retailer's ordering policy affect the utilization of the local farms.

3 - A Comparison of Type I and Type III Eco-labels for Product Carbon Footprints

Tony Craig, Post Doctoral Research Associate, Massachusetts Institute of Technology, 77 Massachusetts Ave., E40-220, Cambridge, MA, 02139, United States of America, tcraig@mit.edu, Edgar Blanco, Yossi Sheffi

Product carbon labels that communicate the carbon footprint of a product have emerged as a popular type of eco-label. However, initial consumer feedback has indicated confusion at this type of label. In this paper we present two models of carbon labels, one based on a Type III eco-label declaring the product's exact carbon footprint and the other on a standard Type I certification-style eco-label. We compare the results of the models on firm profits, emissions reductions, and social welfare.

4 - Heuristic Approaches for the Disassemble-to-order Problem under Binomial Yields

Karl Inderfurth, Professor, University of Magdeburg, Faculty of Economics and Management, Universitaetsplatz 2, Magdeburg, 39106, Germany, inderfurth@ww.uni-magdeburg.de, Sandra Transchel, Ian Langella, Stephanie Vogelgesang

In disassemble-to-order (DTO) systems it is typically assumed that yields from disassembly are either stochastically proportional (SP) or follow a binomial (BI) process. Yield misspecification results in a lower penalty if BI yield is assumed compared to SP assumption. To support BI yield modeling, heuristic approaches are developed and compared that facilitate DTO problem solving for complex real-world product structures.

■ MB34

34- North 224 B- CC

Technology Entrepreneurship

Cluster: New Product Development

Invited Session

Chair: Henry Sauermann, Georgia Institute of Technology, 800 W Peachtree St., Atlanta, GA, United States of America, henry.sauermann@mgt.gatech.edu

1 - The Entrepreneurial Intentions of Founders and Joiners
Henry Sauermann, Georgia Institute of Technology, 800 W Peachtree St., Atlanta, GA, United States of America, henry.sauermann@mgt.gatech.edu, Michael Roach

Using a sample of over 4,000 science and engineering PhD students close to graduation, we provide descriptive insights into founder and joiner intentions and explore similarities as well as differences with respect to three sets of potential antecedents: individual characteristics such as preferences for freedom or risk aversion, characteristics of the social environment, as well as perceived commercial opportunities.

2 - Information Analogies and the Initiation of Product Markets
Jon Eckhardt, Associate Professor, University of Wisconsin School of Business, 5252 Grainger Hall, 975 University Avenue, Madison, WI, 53706, United States of America, jeckhardt@bus.wisc.edu, Joseph Raffiee

In this paper, we test ex ante predictions regarding information conditions that are likely to stimulate the formation of markets in technological niches. We predict that producers are more likely to introduce products in response to proximate or analogous information when available. Using a monthly longitudinal database that captures the software ecosystem that developed for the Palm Handled computer we test and find partial support for our hypotheses.

■ MB35

35- North 225 A- CC

Pricing and Decentralized Management

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Cathy Xia, Professor, Ohio State University, 210 Baker, 1971 Neil Ave, Columbus, OH, 43210, United States of America, xia.52@osu.edu

1 - Stochastic Knapsack Problem in a Competitive Environment
Yingdong Lu, IBM T.J. Watson Research Center, 1101 Kitchawan Rd, Yorktown Heights, NY, United States of America, yingdong@us.ibm.com

Multiple sellers competes for the same demand stream over time. Each seller makes pricing decision based on a stochastic knapsack problem incorporated with competitive information. We investigate the monotonicity behavior of each seller's revenue function, as well as its relation with the seller's market position.

2 - Energy Cost Aware Pricing and Resource Management in Cloud
Parijat Dube, IBM, TJ Watson Research Center, Hawthorne, NY, United States of America, pdube@us.ibm.com, Munish Goyal

We consider a competitive model with M application providers each demanding certain slice of resources from the cloud. They obtain base resource slice on long term lease whereas configurable peak resource slice can be purchased on spot. Cloud auctions residual resource capacity at regularly space time intervals thus offering an opportunity for the application owners to monitor application workload and modulate the resource slice dynamically to balance service quality and energy cost.

3 - Decentralized Control Policies for Large-Scale Vehicle Sharing Systems
David George, Operations Research Analyst, Monsanto Company, Maryland Heights, MO, 63146, United States of America, david.k.george@monsanto.com, Cathy Xia

With the increasing scale and complexity of today's vehicle sharing systems, centralized approaches for their management tend to be impractical. In this research, we present a decentralized approach, based on a closed queueing network model, for maintaining balanced vehicle inventories across the network. In addition to decisions of vehicle repositioning and customer admission, our decentralized solution suggests a mechanism for the dynamic pricing of vehicle rentals based on network congestion.

4 - Robust Multi-Arm Bandit Problems
Michael Jong Kim, Postdoctoral Researcher, University of California Berkeley, 4141 Etcheverry Hall, Mail Code 1777, Berkeley, CA, 94720, United States of America, kimmi@ieor.berkeley.edu, Andrew Lim

We propose a robust formulation of the classic multi-armed bandit problem of Whittle. We show that arms are no longer independent under the worst case model, even if they are independent under the nominal. Robust versions of the Bellman (dynamic programming) equations are derived, and the optimality of a so-called project-by-project retirement (PPR) policy is established. Using the properties of the PPR policy, we show how performance bounds for suboptimal robust policies can be obtained.

■ MB36

36- North 225 B- CC

Industrial Applications of Price Management

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Andrew Vakhutinsky, Senior Principal Scientist, Oracle Retail Science Group, 10 Van de Graaff Drive, Burlington, MA, 01803, United States of America, andrew.vakhutinsky@oracle.com

1 - Revenue Model: A Hedonic Pricing Method to Estimate the Values of Customer-driven Attributes
Yimin Liu, Technical Expert, Ford Motor Company, 2101 Village Road, Research Center, Dearborn, MI, 48121, United States of America, yliu59@ford.com, Peggy Whalen

With stricter fuel economy regulations and volatility of gasoline prices, it is important for automakers to assess the revenue potential for fuel-efficiency and performance improvements. Consumers in different segments value fuel economy, performance, and size differently. Using a hedonic pricing methodology, this revenue model estimates the value of key customer-driven attributes, such as fuel economy, performance, and size on vehicle pricing in the US market under different gasoline prices.

2 - Multi-period Price Optimization for Grocery Retailers
Maxime Cohen, Massachusetts Institute of Technology, Cambridge, MA, United States of America, maxcohen@mit.edu, Georgia Perakis, Zachary Leung, Andrew Vakhutinsky

Product line pricing is an important business problem faced by retailers. We formulate a time-dependent price optimization problem for merchandise items in a product category, where demand for each item is a nonlinear function of all the prices. We require the prices to lie in a given price ladder and to satisfy business requirements such as sales target, inter-item constraints and store image preservation. We illustrate that the problem is hard and propose and compare various solution methods.

3 - Solving Large Non-linear, Non-convex Discrete Pricing Problems using Randomized Search Algorithm
Kresimir Mihic, Oracle Labs, 500 Oracle Parkway, 5IP2053, Redwood Shores, CA, 94065, United States of America, kresimir.mihic@oracle.com, Paraskevas Yiapanis, Andrew Vakhutinsky, David Vengerov

Randomized Search (RS) is a solution technique that takes advantage of the finite nature of the decision variables to solve currently intractable or hard to solve problems. Because of its intrinsically parallel nature, RS leverages multi-threaded microprocessors and scales almost linearly as thread count is increased. In our current testing, RS has provided a higher quality solution in less time than the leading commercial solver.

4 - Multi-product Markdown Optimization
Anahita Hassanzadeh, Doctoral Student, Lehigh University, 200 West Packer Avenue, Bethlehem, PA, 18015, United States of America, anh509@lehigh.edu, Andrew Vakhutinsky, Kiran Panchamgam

We focus on markdown optimization problem for multiple products with substitutable demands subject to markdown budget and sell-through constraints. We present a mixed integer linear optimization model based on approximation of the underlying demand function and propose a solution approach that runs sufficiently fast for practical applications. We demonstrate how various business rules are addressed and report the results of our computational experiments.

■ MB37

37- North 226 A- CC

Alternative Fuels, Stations, and Vehicles II

Sponsor: Location Analysis

Sponsored Session

Chair: Michael Kuby, Professor, Arizona State University, Tempe, AZ, 85287-5302, United States of America, mikekuby@asu.edu

1 - Spatial Refueling Patterns of Compressed Natural Gas (CNG) Drivers in Southern California

Scott Kelley, PhD Student, Arizona State University, Sch of Geog Sciences & Urban Planning, 975 S. Myrtle Ave., Coor Hall, Tempe, AZ, 85287, United States of America, sbkelley55@gmail.com, Michael Kuby

This study surveyed 259 drivers of compressed natural gas (CNG) vehicles at five stations in greater Los Angeles, and 261 respondents refueling at five nearby gasoline stations. Using GIS, we calculate deviations from shortest paths necessitated by refueling, station service areas, and proximity to home. When faced with a choice, CNG drivers select stations on their way rather than closest to home by a 10:1 margin, an important implication for developing early alt-fuel station networks.

2 - Finding Shortest Paths for Alternative Fuel Vehicles on a Real Road Network

Ozgur Araz, Assistant Professor, University of Nebraska Medical Center, Nebraska Medical Center, Omaha, NE, 68198-4365, United States of America, ozgur.araz@unmc.edu, Michael Kuby, John Fowler, Ismail Capar

We present a solution method to the problem of finding shortest feasible paths for Alternative Fuel Vehicles (AFVs) on a real road network. The proposed solution algorithm first preprocesses the original road network and stores the routes connecting the stations as the edges of the new network. Then, algorithm generates a new feasible network. Lastly, on this feasible network, for any given origin-destination pairs, the well known Floyd's algorithm is applied to find shortest feasible paths.

3 - A Heuristic Approach for the Flow Refueling Location Model Allowing Driver Deviations

Michael Kuby, Professor, Arizona State University, Tempe, AZ, 85287-5302, United States of America, mikekuby@asu.edu, Jong-Geun Kim

The Deviation-Flow Refueling Location Model (DFRLM) locates p stations to maximize covered flows given a driving range of alt-fuel vehicles and ability to detour from shortest paths. Our greedy algorithms build an artificial feasible network in which arcs represent feasible paths between stations, origins, and destinations and then solve a shortest path algorithm on the feasible network. Experiments show the computational efficiency and effect on optimal locations and objective function values.

4 - Planning the Alternative-fuel Station Infrastructure under Demand Uncertainty

Yu-jiun (June) Tsai, Texas A&M University, College Station, TX, United States of America, yjt2009@neo.tamu.edu, Ismail Capar, Jorge Leon

Flow refueling location model (FRLM), which is used to locate a fixed number of fuel stations on a road network , assumes the traffic flow between origin and destination (O-D) pairs known in advance and the fixed traffic flow is estimated. In this work, we propose a new model to address traffic flow uncertainty in the input data instead of point estimates. We utilize a scenario based approach with the objective of maximizing the traffic flow under the worst case scenario.

■ MB38

38- North 226 B- CC

Variability and Quality of Service Processes II

Sponsor: Service Science

Sponsored Session

Chair: Genady Ya Grabarnik, St. John's University, Queens, NY, United States of America, grabarng@stjohns.edu

Co-Chair: Arjun Natarajan, IBM TJ Watson Research, United States of America, arjunn@us.ibm.com

1 - Empowering Decision Makers through Process Data Analysis

Anca Chandra, Research Staff Member, T.J. Watson Research Center, IBM, 650 Harry Rd, San Jose, CA, 95120, United States of America, anca@us.ibm.com, Neil Boyette

Once a client company and a service provider sign a high deal spanning many years, the client creates a large number of small TCV short term deals. These deals are short term and the service provider must quickly react. Often, deal managers are not able to react fast because there are multiple organizations working on the deal. This paper describes a system built to assist managers when making daily decisions by exposing the current status of a deal though data aggregation and analysis.

2 - Multiple QoS in Service Composition

Soundar Kumara, Pearce Professor of Industrial Engineering, Pennsylvania State University, 310 Leonhard Building, University Park, PA, 16802, United States of America, u1o@engr.psu.edu, LiYing Cui

A service network is a graph consisting of services and semantic concepts. Service composition is to form a compound workflow of services so that this compound workflow can execute complex tasks which cannot be done by an individual service. This research deals with multiple criteria of QoS (quality of services) in service composition. It compares six different scenarios.

3 - On Quantitative Estimate of Service Pilot Parameters

Genady Ya Grabarnik, St. John's University, Queens, NY, United States of America, grabarng@stjohns.edu, Laura Shwartz, Yefim Haim Michlin

Before we showed robustness of the pilot test and service process parameters for the processes with large team of servers (SA). This paper gives quantitative estimate of the service process parameters and tests OC, ASN for teams of any size. 1. Michlin, Y. H., Grabarnik, G., Search boundaries of truncated discrete sequential test, J. App. Stat., (37)5, 2010,707-724. 2. Grabarnik,G.Ya., Michlin,Y.H., Shwartz,L. Designing Pilot for Operational Innovation in IT Service Delivery, BDIM 2012.

■ MB39

39- North 226 C- CC

Applications in the Service Industry

Contributed Session

Chair: Sahar Talebi, PhD Student, North Carolina State University, Raleigh, NC, 27606, United States of America, stalebi@ncsu.edu

1 - Optimizing a Cloud-based Service Design using Social Media

Amir Zadeh, Oklahoma State University, 101 Hanner Hall Stillwater Campus, Stillwater, 74075, United States of America, amir.zadeh@okstate.edu, Ramesh Sharda

Today, service providers offer a number of computing services on clouds and each of these services has different characteristics as regards price, security, compliance and competition, quality issues. On the other hand, individual and social influences play an important role in a consumer's service choice. In this paper, a cloud-based service design problem affected by peer influence is developed to optimize the service provider's profit and to incorporate social interactions.

2 - Services in Manufacturing Companies – From the Backyard to the Forefront

Thomas Meiren, Fraunhofer IAO, Nobelstr. 12, Stuttgart, Germany, thomas.meiren@gmx.de, Ilyas Khan

Product-related services play an increasing role in manufacturing companies. The presentation discusses how these firms describe and structure their service portfolios and communicate them to customers. Moreover, it includes the results of an empirical study among 100 manufacturing companies.

3 - Developing the Optimization Program for Assigning the Field Service Person in the Gas Utility

Hiroshi Kashio, Tokyo Gas Co., Ltd., 1-5-20 Kaigan Minato, Tokyo, Japan, kashio@tokyo-gas.co.jp, Shinnosuke Kimura

Tokyo Gas opens and closes about 2.5 million gas meters and repairs more than 5 million gas appliances annually. The local service centers assign their field service person to these jobs by hand every day. We developed the auto-assignment program for minimizing their travelling distances and the rate of missing the appointed time. And we trialed it at a center and confirmed its effect quantitatively.

4 - An ILP Formulation for RWA in Elastic Optical Networking

Sahar Talebi, PhD Student, North Carolina State University, Raleigh, NC, 27606, United States of America, stalebi@ncsu.edu

Service providers are using higher bit rates, like 40 Gb/s and 100 Gb/s per wavelength. However, it is likely that bit rates greater than 100 Gb/s will not fit into this scheme. Besides, the 10-year-old division of the optical spectrum of fixed "wavelength grid" will no longer work for 400 Gb/s and above. We tried to develop a new ILP formulation for routing and wavelength assignment (RWA) while we also consider the flexibility of the gird in this formulation.

■ MB40

40- North 227 A- CC

Empirical Research in Environmental Operations

Sponsor: Energy, Natural Res & the Envi/ Environment and Sustainability

Sponsored Session

Chair: Brian Jacobs, Assistant Professor, Michigan State University, 632 Bogue St. Rm N370, East Lansing, MI, 48824, United States of America, jacobsb@bus.msu.edu

1 - Environmental Certification and its Impact on Supply Chain Members: An Event Study

Myung Kyo Kim, Doctoral Candidate, Michigan State University, North Business College Complex, 632 Bogue St. Rm N461, East Lansing, MI, 48824, United States of America, myungkyo@bus.msu.edu, Tobias Schoenherr, Brian Jacobs, Ram Narasimhan

Increasingly, firms are utilizing external accreditation agencies to document environmental initiatives to consumers. While ISO 14000 certification has been relatively widespread, one certification on the rise is the certification offered by the Forest Stewardship Council (FSC), guaranteeing a credible link between responsible production and consumption of wood products. The present research focuses on this FSC certification and investigates its financial impact for adopting firms.

2 - Customer Satisfaction with New and Remanufactured Products

Ravi Subramanian, Associate Professor, Georgia Institute of Technology, Scheller College of Business, 800 West Peachtree St. NW, Atlanta, GA, 30308, United States of America, Ravi.Subramanian@mgt.gatech.edu, Ramanath Subramanyam

Customer satisfaction with remanufactured products relative to their new counterparts is of key concern to OEMs and Third Parties offering them. Using field data, we compare customer satisfaction levels for remanufactured and new products.

3 - Relationship between Appointments of Sustainability Officers and Performance

Manpreet Hora, Assistant Professor, Georgia Institute of Technology, College of Management, 800 West Peachtree St. NW, Atlanta, GA, 30332, United States of America, Manpreet.Hora@mgt.gatech.edu, Ravi Subramanian

In recent years, firms have been creating and staffing senior-level environmental and sustainability positions. We investigate the association between announcements pertaining to appointments of senior-level environmental or sustainability officers and firm performance.

4 - Persistence of Sustainability Capabilities: An Empirical Analysis

Brian Jacobs, Assistant Professor, Michigan State University, 632 Bogue St. Rm N370, East Lansing, MI, 48824, United States of America, jacobsb@bus.msu.edu, Sriram Narayanan

In this study, we examine the persistence of sustainability capabilities and draw implications for how sustainability capabilities of firms change over time. We examine how the "ecosystem" of internal capabilities and those of industry counterparts influence the persistence of firms' sustainability capabilities.

■ MB41

41- North 227 B- CC

Joint Session ENRE-Env & Sustainability/Energy: Biofuel Production and Supply Chain Management

Sponsor: Energy, Natural Res & the Envi/ Environment and Sustainability & Energy, Natural Res & the Environment/Energy

Sponsored Session

Chair: Guiping Hu, Iowa State University, 3004 Black Engineering, Ames, IA, 50010, United States of America, gphu@iastate.edu

1 - A Mixed Integer Programming Model and Analysis of Biofuel Production

Halil Ibrahim Cobuloglu, Graduate Research Assistant, Wichita State University, 1845 N Fairmount, Office 208A, Ind. & Manuf. Engineering Department, Wichita, KS, 67260, United States of America, hicobuloglu@wichita.edu, Esra Buyuktahtakin

In this study, we propose a multi-objective mixed integer programming model for biofuel production using switchgrass in US. This mathematical model maximizes the yield from switchgrass during its expected life span while considering its potential economical and environmental impacts under various production and harvesting scenarios.

2 - Biomass/Biofuel Logistics Network Design

Gokhan Memisoglu, PhD Student, Texas A&M University, Industrial and Systems Engineering Department, Emerging Technologies Building 3131 TAMU, College Station, TX, 77843-3131, United States of America, gmemis@tamu.edu, Halit Uster

This research is about logistic and supply chain of biomass and biofuel. We constructed the supply chain for biofuel starting from farms and to the blending facilities where the biofuel is blended with the regular fuel. In our model we assumed that demand and supply are known and deterministic. Our objective is to determine the location of the collection facilities and biorefineries to be opened and also to determine the production, inventory and logistic (transportation) decisions.

3 - Contracting for Cellulosic Biomass: Effects of Contract Structure and Yield Variability on Supply

Adaora Okwo, Georgia Institute of Technology, Atlanta, GA, United States of America, aokwo@gatech.edu

We model land allocation to perennial energy crop production and estimate the cellulosic biomass supply under different contract payment options. Biomass supply under each option varies according to the quality of land used to grow the biomass. Using switchgrass production in Tennessee as a case study, we show that pay-per-unit biomass contracts are more effective for premium lands and short-term contracts while pay-per-acre contracts are more effective for marginal lands and longer terms.

4 - Optimization Models for Biofuel Supply Chain under Uncertainty

Guiping Hu, Iowa State University, 3004 Black Engineering, Ames, IA, 50010, United States of America, gphu@iastate.edu, Narges Kazemzadeh

This study aims to determine the optimal design of biofuel supply chain to maximize annual profit considering uncertainty in feedstock yield, fuel market price and logistic costs. To deal with the stochastic nature of parameters, we develop two-stage stochastic programming models in which Conditional Value at Risk is considered as a risk measure to control shortage of demand. A case study in the state of Iowa is conducted to demonstrate the applicability and efficiency of the models.

■ MB42

42- North 227 C- CC

Transportation Networks and Plug-in Electric Vehicles I

Sponsor: Transportation Science & Logistics/ Urban Transportation

Sponsored Session

Chair: Chi Xie, Research Associate, The University of Texas at Austin, 1616 Guadalupe St, UTA 4.403, Austin, TX, 78701, United States of America, chi.xie@mail.utexas.edu

1 - Plug-in Electric Vehicular Flows in Equilibrium Networks

Chi Xie, Research Associate, The University of Texas at Austin, 1616 Guadalupe St., UTA 4.403, Austin, TX, 78701, United States of America, chi.xie@mail.utexas.edu

This presentation discusses a set of new network equilibrium models and methods that incorporate alternative travel restrictions and cost compositions of battery electric vehicles and plug-in hybrid electric vehicles into the traditional urban transportation network modeling paradigm.

2 - Locating Replenishment Stations for Electric Vehicles: Application to Danish Traffic Data

Oli Madsen, Professor, Technical University of Denmark, DTU Transport Bygningstorvet 115, Kgs. Lyngby, 2800, Denmark, ogm@transport.dtu.dk, Anders Norrelund, Min Wen, Allan Olsen, Gilbert Laporte

This paper considers the problem of locating electronic replenishment stations for electric vehicles on a traffic network with flow-based demand. The objective is to optimize the network performance, e.g. to maximize the flow covered by a prefixed number of stations, or to minimize the number of stations needed to cover traffic flows. Two mixed integer linear programming formulations are proposed to model the problem. These models are tested on real-life traffic data collected in Denmark.

3 - Stochastic Network Equilibrium of PEVs: Impacts of Electricity-charging Price and Speed

Ti Zhang, University of Texas-Austin, Austin, TX, United States of America, tizhang@utexas.edu, Chi Xie, Travis Waller

The purpose of the research is to develop a stochastic network equilibrium model that can take into account for (i) charging cost and (ii) the charging time for BEV drivers. This research result contains initiative insights of an equilibrium route choice model for BEV motorists impacted by the charging price and speed. Two logit-based stochastic traffic assignment models are built to study the route choice behavior of BEV drivers in a network and a solution algorithm is proposed.

■ MB43

43- North 228 A- CC

Railway Models under Uncertainties

Sponsor: Railway Applications

Sponsored Session

Chair: Rapik Saat, Research Assistant Professor, University of Illinois at Urbana-Champaign, 205 N Mathews, Urbana, IL, 61801, United States of America, mohdsaat@illinois.edu

1 - Railroad Hazardous Materials Transportation Risk Analysis under Uncertainty

Xiang Liu, University of Illinois at Urbana-Champaign, liu94@illinois.edu, Christopher Barkan, Rapik Saat

There are various sources of input uncertainty in the risk analysis of hazardous materials transportation by rail. In this research, we develop a stochastic model to quantify the effect of parameter uncertainty in the risk analysis. The statistical distribution of risk estimates is developed using probabilistic models and Monte Carlo simulation methods.

2 - Terminal Health and Solution Path

Brian Blevins, Sr Manager Service Design, BNSF, 2600 Lou Menk Dr., Fort Worth, TX, 76131, United States of America, Brian.Blevins@BNSF.com

Railroads are constantly struggled to identify where they are experiencing problems on their network. In an attempt to improve design efficiency I created a Terminal Health System that analyzes 3 dwell measurements and compares the current performance to historic percentiles. The struggling terminal is put on a list and emailed to our design staff on a daily basis. While this system is very basic, we have been able to track its ability to find issues and offer solutions.

3 - A Framework for Track Geometry Defect Risk Prediction and Maintenance Schedule Optimization

Qing He, IBM Watson Research Center, 1101 Kitchawan Rd, Yorktown Heights, NY, 10598, United States of America, qhe@us.ibm.com, Dhaivat Parikh, Debarun Bhattacharjya, Arun Hampapur, Hongfei Li

Track geometry defects, including align, gage, cant, surface, crosslevel, warp and so on, can be categorized as red and yellow tickets by severity. Red tickets are mandatory to be fixed by law but not yellow tickets. We proposed a risk model to prioritize yellow tickets by estimating its derailment risk. Given the inputs from risk model and other constraints, a repair schedule optimization model was developed to further reduce total cost on potential derailment and maintenance.

4 - Train Dispatching Model with Stochastic Capacity Breakdowns on an N-tracked Rail Network

Lingyun Meng, School of Traffic and Transportation, 8507D, No.8 Teaching Building, No.3 ShangYuanCun, HaiDian District, China, lymeng@bjtu.edu.cn, Xuesong Zhou

This paper presents an integer programming formulation for the networked train dispatching problem. A Lagrangian relaxation solution approach is used to dualize complicating capacity constraints and decompose the original complex problem into a sequence of sub problems. The sub problems are solved by a shortest path algorithm. A priority rule-based algorithm is used to deduce dual solutions to feasible solutions. Numerical experiments are used to demonstrate the performance of this approach.

■ MB44

44- North 228 B- CC

Supply Chain: Issues in Green Supply Chain Management

Contributed Session

Chair: Karca Aral, PhD Student, INSEAD, Technology and Operations Management, Boulevard de Constance, Fontainebleau, 77300, France, karca.aral@insead.edu

1 - Sustainability Efforts in Supply Networks

Alvaro Mendoza, PhD Student, Duke University, The Fuqua School of Business, 100 Fuqua Drive, Box 90120, Durham, NC, 27708, United States of America, alvaro.mendoza@duke.edu, Robert Clemen

We consider brand buyers competing on the sustainability performance of their supply chains. Only suppliers are able to exert sustainability efforts, while buyers can provide economic and technical support to their suppliers. We study the impact of various characteristics of buyers, suppliers, and stakeholders on the effort and support decisions under two different structures of the supply network: one where buyers share suppliers and the other where buyers have separate suppliers.

2 - Sustainable Supply Chain Network Design

Ali HajiAghaBozorgi, University of Central Florida, 4136 Guadalupe Ct, Orlando, Fl, 32817, United States of America, alililihozak@yahoo.com, Jennifer Pazour, Dima Nazzal

We study multi-objective inventory control for perishable items considering economic and environmental objectives. We will present our results to date on analyzing the structure of the economic inventory holding and transportation cost and the environmental impacts, which will guide our inventory control policies.

3 - Strategic Management of Remanufacturing in Closed-loop Supply Chains

Sung Hoon Chung, Visiting Assistant Professor, The College of William and Mary, P.O. Box 8795, Williamsburg, VA, United States of America, sxc447@gmail.com, Robert Weaver, Terry Friesz

We consider a sustainable remanufacturing model of firms embedded in a dynamic supply chain. The profitability of remanufacturing has been extensively studied. The environmental aspects of remanufacturing has also been widely investigated. The models that consider both perspectives are much rare due to complexity. We propose a differential variational inequality framework that enables us to tackle two such important aspects simultaneously while maintaining computational tractability.

4 - The Implications of Carbon Management on Supply Chain Design Issues

Yi-Fen Chen, University of California-Berkeley, 1115 Etcheverry Hall, Berkeley, CA, 94720, United States of America, yifenchen@berkeley.edu, Z. Max Shen, David Dornfeld

Companies normally focus on transportation tactics to reduce carbon emissions of their supply chains. However, this may lead to suboptimal decisions due to the lack of considerations of other supply chain activities, such as warehouse operations. An integrated supply chain design model was constructed to investigate the trade-offs between warehouse and transportation carbon emissions. We also investigate an multi-objective problem that minimizes both cost and carbon emissions.

5 - Optimal Supplier Retention Policies under Sustainability Default Risk

Karca Aral, PhD Student, INSEAD, Technology and Operations Management, Boulevard de Constance, Fontainebleau, 77300, France, karca.aral@insead.edu, Luk Van Wassenhove

For large multinationals, environmental and social risks associated with its suppliers are critical issues. The complexity of regulations, as well as rapidly evolving environmental and social standards, makes responsible procurement a very important part of Corporate Social Responsibility agendas. In this study, we present an analytical model for responsible procurement for a firm facing green demand, and discuss optimal interaction and retention policies regarding its suppliers.

■ MB45

45- North 229 A- CC

Panel Discussion: Academic Job Search

Cluster: Job Placement Services

Invited Session

Chair: Bala Shetty, Professor, Texas A&M University, College Station, TX, United States of America, b-shetty@tamu.edu

1 - Panel Academic Search

Moderator: Bala Shetty, Professor, Texas A&M University, College Station, TX, United States of America, b-shetty@tamu.edu, Panelists: Neil Geismar, Eva Lee

The panel will discuss the academic interview process and do's and don'ts associated with the job search. In addition to comments by current and former search chairs, time will be provided for questions and answers.

■ MB46

46- North 229 B- CC

Joint Session Amazon/CPMS: Amazon- Operations Research Decisions are Implemented in Practice

Cluster: Amazon & CPMS, The Practice Section

Invited Session

Chair: Stephen Graves, Massachusetts Institute of Technology, Sloan School of Management, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, sgraves@mit.edu

1 - Making Better Replenishment Decisions in Online Retail

Jason Acimovic, Assistant Professor, Pennsylvania State Smeal College of Business, 5 Carlisle St., Unit 3, Cambridge, MA, 02139, United States of America, acimovic@mit.edu, Stephen Graves

Online retailers operate multiple warehouses with centralized order fulfillment and inventory management. When an individual warehouse stocks out, demand spills over to another warehouse. We show the pitfalls of the local base-stock policy – popular in practice. This kind of replenishment policy can lead to undesirable dynamics and high outbound shipping costs. We show evidence on data from a large online retailer. We propose a new replenishment policy that performs better.

■ MB47

47- North 230- CC

Traffic Modeling using Mobile Sensors

Sponsor: Transportation Science & Logistics/ Intelligent Transportation Systems (ITS)

Sponsored Session

Chair: David Kim, Associate Professor, Oregon State University, 204 Rogers Hall, Corvallis, OR, 97331, United States of America, david.kim@orst.edu

1 - Utilizing Wireless Roadside Sensors as Vehicle Point Detectors

David Kim, Associate Professor, Oregon State University, 204 Rogers Hall, Corvallis, OR, 97331, United States of America, david.kim@orst.edu, SeJoon Park, Amirali Saeedu, David Porter

This research examines additional data collection capabilities of wireless roadside sensors for transportation applications. Experience with Bluetooth wireless roadside sensors show that enabled devices are typically detected multiple times as a vehicle moves through the sensor antenna coverage area, which may extend 200 to 300 yards from the roadside sensor. In this research signal strength data from Bluetooth devices is obtained at the same time that the enabled devices are detected. The signal strength data is used to identify when the vehicle is close to passing the sensor. Tests in both controlled and real world environments show the resulting accuracy is sufficient to extend the use of wireless technology to other transportation data collection applications.

2 - Vehicle Classification using Mobile Sensors

Zhanbo Sun, Rensselaer Polytechnic Institute, 2162, 14th Street, 2nd Floor, Troy, NY, 12180, United States of America, sunz2@rpi.edu, Jeff Ban

We consider staffing agents in which an initial forecast of the call volume is given at the beginning of the day. After an initial observation period, the manager has the ability to update the staffing level based on a revised forecast. The manager operates under QoS constraints which can be very general. The resulting problem is formulated as a two-stage stochastic program. When utilization is the metric, the resulting solution can be written in a closed form analogous to a newsvendor solution.

3 - Estimation of Long Queues using Mobile Sensors for Traffic Signals

Peng Hao, Rensselaer Polytechnic Institute, 108 8th Street, Troy, NY, 12180, United States of America, haop@rpi.edu, Jeff Ban

We develop methods to estimate queue lengths of signalized intersections using mobile data when the queue exceeds the upstream data collection location. The proposed method is based on LWR theory which is reformulated for this particular scenario.

4 - Mesoscopic Traffic State Estimation using GPS and Bluetooth Data

Hao Lei, Phd Student, University of Utah, 110 Central Campus Dr, MCE 2000, Salt Lake City, UT, 84112, United States of America, hao.lei@utah.edu, Xuesong Zhou, Wen Deng

This talk discusses how to use multiple data sources, including loop detector counts, AVI Bluetooth travel time readings and GPS location samples, to estimate mesoscropic traffic states on a homogeneous freeway segment. We extend Newell's three-detector method to approximate stochastic cumulative flow counts, by using a multinomial probit model and Clark's approximation method.

■ MB48

48- North 231 A- CC

VRP and Applications I

Sponsor: Transportation Science & Logistics/ Freight Transportation & Logistics

Sponsored Session

Chair: Johan Oppen, Associate Professor, Högskolen i Molde, Britvegen 2, Molde, 6410, Norway, johan.oppen@himolde.no

1 - Toll Enforcement Planning by Integer Programming

Elmar Swarat, Konrad-Zuse-Zentrum für Informationstechnik Berlin, Berlin, Germany, swarat@zib.de

We present an Integer Programming model for an optimization of toll enforcements on German motorways. The goal is to find a set of vehicle tours over the entire motorway network. They are planned according to spatial and temporal traffic distributions. In addition, a duty roster plan is generated for each crew member that is assigned to the tours. We will show that many practical requirements can be modeled. Computational results demonstrate that real-world instances can be solved.

2 - Snow Control and Winter Maintenance Scheduling

Leila Hajibabai, University of Illinois at Urbana-Champaign, 205 N Mathews Avenue, Room 3142, Urbana, IL, 61801, United States of America, leila.hajibabai@gmail.com, Seyed Mohammad Nourbakhsh, Yanfeng Ouyang

Snow control is a key component of winter maintenance for many urban/regional agencies, especially in case of heavy snowfall. In this paper, a mixed integer linear program (MILP) was proposed to simultaneously minimize total travel time of snowplow trucks and their longest individual cycle time. To solve this problem, a set of meta-heuristic methods were developed and applied to an empirical case study with realistic data.

3 - Scheduling and Transportation in the Construction Industry

Johan Oppen, Associate Professor, H¯gskolen i Molde, Britvegen 2, Molde, 6410, Norway, johan.oppen@himolde.no, Anastasia Rubasheuskaya

We present a real-world planning problem faced by many companies in the construction industry. Given a number of jobs or projects, where each job has a known location, estimated duration and demand of materials, the problem is to assign projects to teams of workers, schedule the projects for each team, and construct a transportation plan for how to supply the projects with the needed materials. We use asphalt spreading as an example, and show that the problem can be modelled as a combined scheduling and routing problem. Possible solution approaches are discussed.

4 - A Vessel Routing Problem with Time Windows for Steel-raw Materials Delivery

Byung-In Kim, POSTECH, San 31, Hyoja, Namgu, Pohang, 790-784, Korea, Republic of, bkim@postech.ac.kr, Juyoung Wy, Jongsung Lee

This research considers a vessel routing problem with time windows, in which loads can be split or can be combined and be loaded into ships, and the ships can visit multiple ports to load or unload materials in each trip. We want to find routes of a fleet of ships which provide smooth supply of raw materials with less cost. A mathematical model and a large neighborhood search algorithm are developed for the problem. Computational experiments demonstrate the effectiveness of the proposed algorithm.

5 - Two Commodities Pickup and Delivery Heuristic to Solve the Containership Routing Problem with Time Windows

Satish Ukkusuri, Associate Professor, Purdue University, 550 Stadium Mall Drive, G175F, West Lafayette, IN, 47906, United States of America, sukkusur@purdue.edu, Binh Luong, Rodrigo Mesa-Arango, Matthew Karlaftis

This paper considers the containership routing problem for pickups and deliveries of products between a hub and a set of ports. The products are perishable and they need to be collected and delivered in specific time windows. A heuristic approach is proposed and tested using data from a real world ship routing problem. The numerical results demonstrate a good approximation to the optimal solution with considerable computational savings.

■ MB49

49- North 231 B- CC

Transportation Infrastructure Management II

Sponsor: Transportation Science & Logistics

Sponsored Session

Chair: Wei Fan, Associate Professor, The University of Texas at Tyler, Department of Civil Engineering, 3900 University Blvd, Tyler, TX, 75799, United States of America, wfan@uttyler.edu

1 - Bus Fleet Replacement Optimization Framework with Real World Fleet Data

Miguel Figliozzi, Associate Professor, Portland State University, P.O. Box 751 CEE, OR 97207-075, Portland, OR, United States of America, figliozzi@pdx.edu, Wei Feng

We present a bus fleet replacement optimization framework that incorporates real-world bus fleet utilization, fuel economy, maintenance cost data and optimization models. Both an integer programming model and a stochastic dynamic programming model are formulated to provide optimal fleet replacement decisions under heterogeneous and homogeneous fleet assumptions.

2 - Equipment Replacement Optimization: Algorithms, Implementations, and Numerical Results

Wei Fan, Associate Professor, The University of Texas at Tyler, Department of Civil Engineering, 3900 University Blvd, Tyler, TX, 75799, United States of America, wfan@uttyler.edu, Randy Machemehl, Mason Gemar

The primary function of equipment managers is to replace the right equipment at the right time and at the lowest overall cost. First, both deterministic and stochastic dynamic programing models are formulated for the equipment replacement optimization (ERO) problem. Second, both Bellman's and wagner's approaches are developed to solving the ERO. Finally, the implementation techniques are presented. Comprehensive ERO numerical results are also discussed.

3 - The Design and Optimization of Modules in Total Efficiency Maintenance Mode for Urban Mass Transit

Yongneng Xu, The Design and Optimization of Modules in Total Efficiency Maintenance Mode for Urban Mass Transit, Department of Transportation Engineering at Nanjing University of Science & Technology, 200 Xiaolingwei Street, Nanjing, JS, 210094, China, x780906yn@163.com, Yu Zhang

To alleviate the imbalance between traffic demand and capacity in Nanjing Metro, we propose Total Efficiency Maintenance Mode (TEM). The objective of the proposed mode is to improve the productivity of maintenance crew and utilization of rolling stocks while ensuring the reliability of core components of rolling stocks. This presentation presents the methodology of rearranging maintenance modules and optimizing the combination of base and variable modules in proposed mode.

4 - Accounting for Equity in Infrastructure Maintenance

Stephen Boyles, Assistant Professor, The University of Texas, Austin, 1 University Station C1761, Austin, TX, United States of America, sboyles@mail.utexas.edu

Equity issues often arise in budget allocation, whether between rural and urban areas, or among specific districts or regions. Simply allocating projects in a geographically diverse area may not be enough, because the equity issue is based on the users who benefit, not the infrastructure itself. This presentation introduces several methods for incorporating equity constraints or metrics into maintenance optimization formulations, and provides initial discussion of their merits and limitations.

■ MB50

50- North 231 C- CC

Military Vehicle Routing II

Sponsor: Military Applications

Sponsored Session

Chair: Chase Murray, Assistant Professor, Industrial & Systems Engineering, Auburn University, Auburn, AL, United States of America, ccm0022@auburn.edu

1 - Multi-perspective Optimization of Unmanned Vehicles Routes for Information Gain

Hector Ortiz-Pena, CUBRC Inc., 4455 Genesee St., Buffalo, NY, 14225, United States of America, Hector.Ortiz-Pena@cubrc.org, Mark Karwan, Moises Sudit

We develop a mixed integer linear program to maximize the information gain from a team of autonomous unmanned vehicles (UxVs).Vehicles are operating in a decentralized framework. The mathematical formulation considers each UxV's perspective of the environment and mission, as information is only exchanged when UxVs are part of the same communication network. Area of operation is represented by a set of grid cells; each cell characterized by a value representing the potential information gain.

2 - UAV Path Selection Metric using the Particle Filter Framework in an Urban Environment

Emily Doucette, Air Force Research Laboratory, 101 W. Eglin Blvd., Eglin AFB, FL, United States of America, douceea@tigermail.auburn.edu

A constant velocity UAV is to intercept a target ground vehicle of unknown position, velocity, and destination within an urban setting. A particle filter with a traffic motion model is used to represent the target state. Binary measurements of subsections of the urban environment are corrupted by false reports. Particle weight along a path is used as a novel path selection metric and is compared to an existing entropy reduction metric by means of intercept and computation time.

3 - Dynamic Decentralized Cooperative Control for UAVs

Michael Hirsch, Raytheon Company, Orlando, FL, United States of America, mjh8787@ufl.edu, Daniel Schroeder

In this research, we discuss recent results related to dynamic decentralized cooperative control for autonomous unmanned vehicles. The vehicles operate in an urban domain, and are tasked with searching and tracking targets of interest. We also highlight some new metrics for analyzing our results.

■ MB51

51- North 232 A- CC

DIME/PMESII Modeling I

Sponsor: Military Applications

Sponsored Session

Chair: Dean Hartley, Principal, Hartley Consulting, 106 Windsong Ln, Oak Ridge, TN, 37830, United States of America, DSHartley3@comcast.net

1 - DEXES-II: An Alternative to Agent-Based Spatial Modeling of Societal Response

Loren Cobb, Associate Research Professor, University of Colorado Denver, Dept. of Mathematics, Campus Box 170, P.O. Box 173364, Denver, CO, 80217-3364, United States of America, cobb@Aetheling.com

DEXES-II is a simulation model developed for large-scale civil-military exercises in peacekeeping, disaster relief, and complex humanitarian emergencies. Since 1994, DEXES models have employed spatially-distributed variables for social, economic, political, and health conditions, including refugee dynamics, public opinion, ethnic conflict, and pandemic disease. Unlike DEXES-I, the current DEXES-II version is completely free of agents. The DEXES model approach and its pros and cons are discussed.

2 - Validating DEXES-II

Dean Hartley, Principal, Hartley Consulting, 106 Windsong Ln, Oak Ridge, TN, 37830, United States of America, DSHartley3@comcast.net

The Deployable Exercise System II (DEXES-II) is a new social model being developed by Dr. Loren Cobb for USSOUTHCOM. I describe the validation of the DEXES-II conceptual model with The DIME/PMESII VV&A Tool, which uses the Total Irregular warfare Ontology as the basis for linking the model to the social theories supporting the model. I describe both the process and the results.

3 - Optimizing Counterinsurgency Operations

Marvin King, Major, USA, United States Army, Student Detachment, Fort Jackson, SC, 29207, United States of America, marvin.king1@us.army.mil, Alexandra Newman, Amanda Hering

We present a model that uses historic casualty information on counterinsurgents and insurgents, allied military force strengths, and economic data with modern counterinsurgency theories to aid in the estimate of force requirements for ongoing and future counterinsurgency campaigns. Our mathematical optimization model provides insights that allow the military and government to make more informed decisions regarding the number of forces to deploy in future conflicts.

■ MB52

52- North 232 B- CC

Modeling Energy Markets

Sponsor: Energy, Natural Res & the Environment/Energy

Sponsored Session

Chair: Steven Gabriel, University of Maryland, College Park, MD, United States of America, sgabriel@umd.edu

1 - Equilibrium Prices from MIPs: Applications to Unit Commitment and Electric Capacity Expansion

David Fuller, Professor, University of Waterloo, Department of Management Sciences, Waterloo, N2L 3G1, Canada, dfuller@uwaterloo.ca

Market equilibrium models with continuous and binary variables may have no solution if prices are only for continuous variable commodities. O'Neill et al. proposed prices for continuous commodities and binary variables, but their proposal has shortcomings: the possibility that some prices are negative; possibly unfair price discrimination; and an incomplete treatment of the fact that all revenues paid to producers must be collected from consumers. Resolutions of these shortcomings are discussed.

2 - A Decomposition Method for Solving Equilibrium Programs with Equilibrium Constraints

Sauleh Siddiqui, Assistant Professor, Johns Hopkins University, 2122 Massachusetts Ave., NW, Apt 208, Washington, DC, 20008, United States of America, sauleh.siddiqui@gmail.com, Steven Gabriel

Equilibrium Programs with Equilibrium Constraints (EPECs) are a type of two-level optimization problem that are computationally expensive to solve. In this talk, we provide a solution technique based on decomposition to tackle this class of problems. Theoretical support of our method will be provided as well as an application to the US Natural Gas market.

3 - A Stochastic Optimization Model with Varying Objectives for Renewable Energy Investment at AWTP

Chalida U-tapao, PhD Candidate, University of Maryland, Department of Civil & Env. Eng., College Park, MD, 20742, United States of America, cutapao@umd.edu, Steven Gabriel

We present a stochastic optimization model with varying objectives for an advanced wastewater treatment plant (AWTP) that considers renewable energy investment and operational decisions under uncertainty. Examples of the uncertainty include: natural gas and electric power prices and carbon dioxide credits. These decisions involve converting uncertain amounts of biosolids into biogas and/or electricity for internal or external purposes. We also consider investment other clean energy sources.

4 - The Impact of Carbon Costs on the Global Natural Gas Market

Hakob Avetisyan, PhD Candidate, University of Maryland, 1173 Glenn L. Martin Hall, College Park, MD, 20742, United States of America, havetisy@umd.edu, Steven Gabriel

World Gas Model (WGM) developed in the University of Maryland is expanded to capture the effects of carbon costs on the natural gas market prices, production/consumption levels and export volumes from the U.S. The impact on the market is analyzed for cases where carbon costs are imposed on: suppliers, consumers, suppliers and consumers. The game theoretic structure of WGM allows for detailed analyses of carbon cost effects on the natural gas market in contrast to economic intuition.

■ MB53

53- North 232 C- CC

Optimization Models for Smart Grids

Sponsor: Energy, Natural Res & the Environment/Energy

Sponsored Session

Chair: Lawrence V. Snyder, Associate Professor, Lehigh University, 200 West Packer Ave., Mohler Lab, Department of Industrial and Systems Engr, Bethlehem, PA, 18015, United States of America, larry.snyder@lehigh.edu

1 - Integrating Short-term Unit Commitment Constraints into Transmission Planning

Saamrat Kasina, Student, Johns Hopkins University, 3400 North Charles Street, Ames Hall 319, Baltimore, MD, 21218, United States of America, k.saamrat@gmail.com, Francisco Munoz, Benjamin Hobbs

Transmission planning studies for renewable integration usually apply heuristic methods to decide which transmission lines to build, but optimization has been proposed. We ask whether operational constraints such as plant ramp-rates, zonal reserve requirements, and start-up decisions would significantly affect investments chosen by a two-stage stochastic transmission optimal expansion model. The value of integrating these features (in terms of improved expected performance) is also estimated.

2 - Electricity Market Operations

Alberto Lamadrid, Graduate Student, Cornell University, 419 Warren Hall, Ithaca, NY, 14850, United States of America, ajl259@cornell.edu, Tim Mount, Ray Zimmerman, Robert Thomas, Carlos Murillo

This paper analyzes the effect of the initial conditions for a stochastic program combining unit-commitment and AC optimal power flow problem for an electricity system with high penetration of renewable energy sources. The uncertainty sources are divided by their ontological characteristics, as bounds on the knowledge of the state of nature, and as low probability events. The modeling of Energy Storage Systems (ESS) and deferrable demand is explicitly included in a secure (n - 1) framework.

3 - A Bilevel Model for Retail Electricity Pricing with Flexible Loads

Lin He, PhD Candidate, Lehigh University, H.S. Mohler Laboratory, 200 West Packer Ave., Bethlehem, PA, 18015, United States of America, lih308@Lehigh.EDU, Larry Snyder

We consider an electricity service provider that wishes to set prices for a large customer with flexible loads so that the resulting load profile matches a predetermined profile as closely as possible. Assuming the customer minimizes its electricity and delay costs, we model this as a bilevel problem in which the provider sets prices and the customer responds by shifting loads forward in time. We derive optimality conditions for the lower-level problem to obtain a single-level problem.

4 - A Roadmap for Formulating a Generation Expansion Planning Model to Minimize Healthcare Costs

Mark Rodgers, PhD Student/Graduate Fellow, Rutgers University, 96 Frelinghuysen Road, CoRE Building, Room 201, Piscataway, NJ, 08854, United States of America, mdrodgers07@gmail.com, Frank Felder, Saltuk Selcuklu, David Coit

The framework for formulating a long-term power generation expansion planning model to minimize healthcare costs is described. We extend the typical least-cost GEP algorithm to consider societal healthcare costs incurred due to unfavorable implications resulting from power plant emissions. Methods of quantifying these costs will be evaluated, and a mathematical framework for this particular GEP model will be presented. Various surrogate based optimization techniques will also be assessed.

■ MB55

55- Regency Ballroom B - Hyatt

Joint Session OR in Emerging Econ/ENRE-Energy: OR Applications in the Energy Sector of Emerging Markets

Cluster: Operations Research in Emerging Economies & Energy, Natural Res & the Environment/Energy

Invited Session

Chair: Thiago Serra, Operations Research Analyst, PETROBRAS, Avenida Paulista, 901, São Paulo, SP, 01311-100, Brazil, thiago.serra@petrobras.com.br

1 - Planning Investments and Operation of a Natural Gas Network under Uncertainty

Leonardo A.M. Moraes, Operations Research Analyst, PETROBRAS, Av Nilo Pecanha, 151, 7 andar-Centro, Rio de Janeiro, RJ, 20020-100, Brazil, leonardo.moraes@petrobras.com.br, Julien P.C.B. Jonqua, Larissa F.T.F. Reis, Carolina C.L.B. Vielmond

This work considers the problem of planning investments and operation of a Natural Gas (NG) network for a horizon of twenty years. NG market comprises several usages of this commodity, as energy generation and supplying contracts. Moreover, in an integrated company, all activities are interconnected, from gas extraction to its distribution and decision must take into account uncertainties on the demand level and gas prices. We model and solve this problem as a two-stage stochastic program.

2 - Evaluation of Choices for Rural Electrification in Emerging Economies: A Multi-criteria Approach

Md Mizanur Rahman, Researcher, Aalto University School of Engineering, Department of Energy Technology, Otakaari 4, Espoo, FI-02150, Finland, mdmizanur.rahman@aalto.fi, Jukka Paatero

Making decisions concerning rural electrification is rather complex and it is limited by economic and technical constraints, socio-cultural dynamics, and environmental consequences. Here a multi-criteria approach that utilizes a stochastic multi-criteria acceptability analysis tool is presented to support decision makers concerning the extension of electricity services to rural areas.

■ MB56

56- Curtis A- Hyatt

Joint Session TMS/NPD/ORG SCI: Meet the Editors and Ask Them Questions

Sponsor: Technology Management, New Product Development & Organization Science

Sponsored Session

Chair: Leonardo Santiago, Federal University of Minas Gerais, Escola de Engenharia da UFMG, Av. Antonio Carlos, 6627. Pampulha, Belo Horizonte, MG, 31270-901, Brazil, lsantiago@ufmg.br

1 - Panel Discussion: Meet the Editors and Ask Them Questions

Moderator: Leonardo Santiago, Federal University of Minas Gerais, Escola de Engenharia da UFMG, Av. Antonio Carlos, 6627. Pampulha, Belo Horizonte, MG, 31270-901, Brazil, lsantiago@ufmg.br, Panelist: Andreas Schwab

Meet the Editors and Departmental Editors of Technology, Innovation and Entrepreneurship Journals and ask them questions.

■ MB57

57- Curtis B- Hyatt

Stochastic Optimization

Sponsor: Applied Probability

Sponsored Session

Chair: Bo Zhang, Research Staff Member, IBM Thomas J Watson Research Center, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States of America, zhangbo@us.ibm.com

1 - Online Stochastic Bin Packing

Varun Gupta, Booth School of Business, University of Chicago, Chicago, IL, 60637, United States of America, varun.gupta@chicagobooth.edu, Ana Radovanovic

In one-dimensional online stochastic bin packing, n items with sizes sampled i.i.d. from an unknown distribution arrive as a stream and must be packed on arrival to minimize the number of non-empty bins. We present the first truly distribution-agnostic bin packing heuristic that achieves additive O(sqrt(n)) waste compared to OPT for all discrete distributions. We also present some preliminary results on stochastic online bin packing with item departures.

2 - Stochastic Sequential Assignment Problem with Threshold Criteria

Golshid Baharian, University of Illinois, Urbana, IL, United States of America, gbahari2@illinois.edu, Sheldon Jacobson

A class of problems is presented where available distinct resources are allocated to sequentially arriving tasks with stochastic parameters so as to minimize the probability of the total reward failing to achieve a target value. Sufficient conditions for the existence of a deterministic Markov optimal policy are derived. Moreover, an algorithm to approximate the optimal value function and the optimal policy is presented, and convergence results are established.

3 - Near-optimal Online Algorithms for Dynamic Resource Allocations

Xin Lu, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, luxin@mit.edu, Patrick Jaillet

In this paper, we study a general online linear programming problem whose formulation encompasses many dynamic resource allocation problems. We propose a stochastic model, which under mild assumptions, allow near-optimal learning-based online algorithms without prior knowledge on the total number of requests to come, a first of its kind.

4 - Optimal Production Management when Demand Depends on the Business Cycle

Abel Cadenillas, University of Alberta, Edmonton, AB, Canada, acadenil@math.ualberta.ca, Michael Pinedo, Peter Lakner

We assume that consumer demand for an item follows a Brownian motion with drift that is modulated by a continuous-time Markov chain that represents the regime of the economy. The economy may be in either one of two regimes. Management of the company would like to maintain the inventory level of the item as close as possible to a target inventory level and would also like to produce the items at a rate that is as close as possible to a target production rate. The company is penalized by the deviations from the target levels and the objective is to minimize the total discounted penalty costs over the long term. We consider two models. In the first model the management of the company observes the regime of the economy at all times, whereas in the second model the management does not observe the regime of the economy. We solve both problems and obtain the optimal production policy as well as the minimal total expected discounted cost. We also study the case in which the consumer demand for an item follows a geometric Brownian motion modulated by a continuous-time Markov chain that represents the regime of the economy.

■ MB58

58- Phoenix East- Hyatt

Statistical Learning Methods and Applications

Sponsor: Applied Probability

Sponsored Session

Chair: Mohsen Bayati, Stanford University, Stanford, CA, United States of America, bayati@stanford.edu

1 - Ordered Rules for Classification

Cynthia Rudin, Assistant Professor, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, United States of America, rudin@mit.edu, Allison Chang, Dimitris Bertsimas

We aim to design classifiers that have the interpretability of association rules yet match the predictive power of top machine learning algorithms. We propose a novel mixed integer optimization (MIO) approach for this task. Our algorithm builds decision list classifiers that are both simple and insightful.

2 - Mining Medical Discussion Board Data

Shawndra Hill, Assistant Professor, The Wharton School, University of Pennsylvania, 3730 Walnut Street, Suite 500, Philadelphia, PA, 19103, United States of America, shawndra@wharton.upenn.edu, Lyle Ungar, John Holmes, Adrian Benton

We discuss medpie a tool to extract drugs and side effects from user generated content about medical conditions.

3 - Iterative Ranking from Pair-wise Comparisons

Sahand Negahban, Postdoc, Massachusetts Institute of Technology, Room D780, LIDS 77 Massachusetts Ave., Cambridge, MA, 02139, United States of America, sahandn@mit.edu, Sewoong Oh, Devavrat Shah

Aggregating pairwise comparisons to obtain a global ranking over a collection of objects has been of interest for a very long time: be it aggregating social opinions or deciding product suggestions. In most settings finding `scores' for each object is of interest to estimate the intensity of a preference. We propose a novel iterative rank aggregation algorithm for discovering scores for objects from pairwise comparisons and present has both theoretical and experimental justification for its use.

■ MB59

59- Phoenix West- Hyatt

Stochastic Decision Analysis with Applications

Sponsor: Applied Probability

Sponsored Session

Chair: Katsunori Ano, Professor, Department of Mathematical Sciences, Shibaura Institute of Technology, 307 Fukasaku, Minuma-ku, Saitama, 337-8570, Japan, k-ano@shibaura-it.ac.jp

1 - MDP Approach for Optimization in Closed Loop Supply Chains

Kenichi Nakashima, Professor, Kanagawa University, 3-27-1 Rokkakubashi, Kanawawa-ku, Yokohama, 2218686, Japan, nakasima@kanagawa-u.ac.jp, Arvinder Loomba

This paper deals with a remanufacturing problem with stochastic variability in closed loop supply chain system. We model the system as a time average Markov Decision Process (MDP) with production/ordering quantity considerations. The cost function is assumed to be composed of cost factors such as holding, backlog, manufacturing costs etc. We obtain optimal production and ordering policy that minimizes expected average cost per period. Numerical results show implementation of the methodology.

2 - A Competitive Inventory Model under Customers' Strategies

Hitoshi Hohjo, Associate Professor, Osaka Prefecture University, 1-1, Gakuen-cho, Naka-ku, Sakai, Osaka, 599-8531, Japan, hojo@mi.s.osakafu-u.ac.jp

We consider a competitive inventory model with two retailers and their customers, and analyze it in the game theory. Each retailer decides ordering strategy so as to maximize his profit. And customers decide the first visiting retailer under the minimization of total cost with respect to moving and purchasing a product at the beginning of planning period. Our goal is to investigate the influence of strategies between retailers and customers.

3 - Optimal Threshold Probability in Markov Decision Processes with a Target and an Extinction

Masahiko Sakaguchi, Kochi University, Kochi, Japan, sakaguchi@kochi-u.ac.jp

We maximize a down-side chance probability of total costs until attaining a target set before hitting a cemetery set in undiscounted Markov decision processes. We formulate the process as infinite horizon case with a recurrent class. We show that an optimal value function is a unique solution to an optimality equation and there exists an stationary optimal policy. Also we give a policy improvement method.

■ MB60

60- Remington- Hyatt

NextGen Performance Metrics Part I

Sponsor: Aviation Applications

Sponsored Session

Ricardo Parra, Engineer, Federal Aviation Administration, 800 Independence Avenue SW, Washington DC 20591, United States of America, ricardo.parra@faa.gov

1 - Measuring Access: An Application of Poisson Regression

Tony Diana, Division Manager, NextGen Performance, Federal Aviation Administration, 800 Independence Avenue SW, Washington, DC, 20591, United States of America, Tony.Diana@faa.gov, Ricardo Parra

Access is the level of utilization achieved by a set of users authorized to use a NAS asset or service such as the airspace, airport, approach, runway, etc). It can also represent the level of diversity in defined user categories such as capability, performance during a defined period of time. The presentation discusses the application of Poisson regression techniques to the measurement of access.

2 - Joint Planning and Development Office Metrics for Evaluating NextGen Performance

Jerry Creedon, Professor, Old Dominion University, 3750 Elkhorn Avenue, Norfolk, VA, 23529, United States of America, jcreedon@odu.edu, Yuri Gawdiak, George Price

This paper summarizes a set of metrics for use in assessing projected performance of the Next Generation Air Transportation System (NextGen). The effort, guided by the six goals established in the 2004 Integrated National Plan for NextGen, formulated a concise set of metrics to assess the projected benefits of NextGen for each of several NextGen stakeholder groups.

3 - Evaluation of the Incremental Effects of NextGen Programs

Yu Zhang, University of South Florida, Civil and Environmental Engineering Dept, 4202 East Fowler Ave., Tampa FL 33620, United States of America, yuzhang@usf.edu

The benefits of NextGen programs, such as continuous descending approach, area navigation, have been extensively studied. Nevertheless, the incremental impacts of the programs and their mutual effects have not been investigated yet. This study scrutinizes the portfolio of NextGen programs at one representative airport and answers the questions by applying econometrics methods, e.g. Vector Autoregression Model.

4 – FY11 NextGen Performance Assessment

Almira Ramadani, FAA, NextGen, Systems Analysis and Modeling, 800 Independence Ave SW, Washington DC 20591, United States of America, almira.ramadani@faa.gov, E.J. Spear

This presentation summarizes operational performance impacts of a subset of NextGen capabilities fielded in FY11, for which the required empirical data was available, and enough time has passed since the implementation for a meaningful analysis to be possible. For each of the NextGen capabilities, we explain our methodology for identifying key performance metrics, present operational and performance impacts we expected to observe, and elaborate actual outcomes we observed post-deployment.

■ MB61

61- Russell- Hyatt

Routes, Slots, and Storms: Contemporary Issues in Managing Four-dimensional Trajectories in Air Traffic Management

Sponsor: Aviation Applications

Sponsored Session

Chair: Mark Hansen, University of California at Berkeley, 114 McLaughlin Hall, Berkeley, CA, 94720, United States of America, mhansen@ce.berkeley.edu

1 - Value of Perfect Weather Information in the Probabilistic Air Traffic Management

Yoonjin Yoon, Assistant Professor, Korea Advanced Institute of Science and Technology, Dept. of CEE, 291 Daehak-ro, Yuseong gu, Daejeon, Korea, Republic of, yoonjin@kaist.ac.kr, Mark Hansen

In our previous study, we modeled a stochastic optimization of single-aircraft routing decision problem as a Geometric Recourse Model (GRM) during a weather disruption. In this paper, we utilize the same geometric setup to assess of the value of perfect weather information in probabilistic routing decision problem by solving both the stochastic GRM and the GRM with known clearance time. The results show that improvement with better weather information is limited with maximum saving of 10%.

2 - Equitable Resource Allocation Mechanisms during Reduced Airspace Capacity

Kleoniki Vlachou, University of Maryland, 1173 Glenn L. Martin Hall, College Park, MD, 20742, United States of America, kvlachou@umd.edu, David Lovell, Michael Ball

Part of the Airspace Flow Programs is the Collaborative Trajectory Options Program, where customers are allowed to submit cost-weighted sets of alternative trajectory options for their flights. In this research we propose a meaningful way for carriers to express some preference structure during AFP. We also propose a resource mechanism allocation that will improve the system efficiency and at the same time will take into account the preferences of the airlines.

3 - Algorithms for Dynamic Resequencing of En Route Flights to Relieve Terminal Congestion

James Jones, University of Maryland, Department of Civil and Environmental En, College Park, MD, United States of America, jonesjc1@umd.edu, David Lovell, Michael Ball

We present a set of algorithms designed to dynamically resequence flight arrival times of en route flights to both transfer and eliminate terminal delay. We also propose a strategy for transferring data between the systems and command centers and develop a process for assigning Controlled Times of Arrivals to flights en route. Analysis suggests that RBS-based algorithms provide strong throughput performance. This improvement is likely achieved, however, at the expense of fuel usage.

■ MB62

62- Borein A- Hyatt

Auction Theory

Cluster: Auctions

Invited Session

Chair: Thayer Morrill, North Carolina State University, Raleigh, NC, United States of America, thayer_morrill@ncsu.edu

1 - Stability and Competitive Equilibrium in Trading Networks

John Hatfield, Professor, Stanford Graduate School of Business, 655 Knight Way, Faculty Building East 313, Stanford, CA, 94305, United States of America, hatfield_john@gsb.stanford.edu, Scott Duke Kominers, Alexandru Nichifor, Michael Ostrovsky, Alexander Westkamp

We introduce a model in which agents in a network can trade via bilateral contracts. We find that when continuous transfers are allowed and utilities are quasilinear, the full substitutability of preferences is sufficient to guarantee the existence of stable outcomes for any underlying network structure. Furthermore, the set of stable outcomes is essentially equivalent to the set of competitive equilibria, and all stable outcomes are in the core and are efficient.

2 - Decentralized Auctions for Uniformly Semimodular Bidders
Mahyar Salek, Post-Doc Researcher, Microsoft Research Cambridge, 7 J J Thomson Avenue, Cambridge, CB30FB, United Kingdom, mahyar@microsoft.com, Richard Steinberg

Kelly and Steinberg (2000) introduced PAUSE, as a decentralized combinatorial auction for bidders with supermodular valuations. In this work, we extend their result to bidders with submodular valuations. We first define an abstract framework in which we generalize some bounds on the revenue of PAUSE. As a concrete instance of this abstraction, we define subPAUSE for submodular bidders. We demonstrate desirable properties of subPAUSE as compared with popular auctions in theory and practice.

3 - Design Issues for Combinatorial Clock Auctions
Lawrence Ausubel, Professor, University of Maryland, Department of Economics, Tydings Hall, College Park, MD, 20742, United States of America, ausubel@econ.umd.edu

The combinatorial clock auction (CCA) is a recent innovation in market design. It has been adopted for spectrum auctions in the UK, Denmark, Netherlands, Ireland, Canada and Australia. This paper explores some critical design issues. It considers features intended to limit strategic manipulation. It shows deficiencies in points-based activity rules and advantages in revealed-preference rules. It assesses implementation issues involving reserve prices and with large numbers of regional licenses.

4 - Optimal Auctions for Spiteful Bidders
Pingzhong Tang, Carnegie Mellon University, Computer Science Dept, Pittsburgh, PA, United States of America, kenshin@cs.cmu.edu, Tuomas Sandholm

We derive the optimal auction for spiteful (and altruistic) bidders. It chooses an allocation that maximizes bidders' generalized virtual valuations. The payment rule is less intuitive. It takes each bidder's own report into consideration. Bidders pay even if the seller keeps the item. The auction sometimes subsidizes losers when another bidder wins. We derive a revenue equivalence and present a template for comparing the revenues of any auctions that have the same allocation rule for the prior.

■ MB63

63- Borein B- Hyatt

Decision Analysis and Behavioral Operations

Sponsor: Behavioral Operations

Sponsored Session

Chair: Yael Grushka-Cockayne, Assistant Professor, University of Virginia, Darden School of Business, 100 Darden Blvd, Charlottesville, VA, 22903, United States of America, GrushkaY@darden.virginia.edu

1 - Distributed Choices in Networks: Routing of Splittable Flow
Eyran Gisches, University of Arizona, 1130 E. Helen Street, Tucson, AZ, 85721, United States of America, eyran@email.arizona.edu, Amnon Rapoport

The Braess Paradox is a counterintuitive finding that upgrading a network may increase users' cost. Our goal is to determine theoretically and empirically if users may benefit when the population consists of groups that operate as unitary players. We have players choose routes in a network game under two conditions. In one, each user controls a single unit. In the second, users control multiple units which may be split. Our results show that in both conditions behavior converges to equilibrium.

2 - Buyback versus Revenue Sharing Contracts: Influence of Loss Aversion
Yinghao Zhang, University of Minnesota, Suite 3-150, 321 19th Ave., S, Minneapolis, MN, 55108, United States of America, zhang786@umn.edu, Karen Donohue, Tony Cui

We investigate how suppliers set contract terms for buyback and revenue sharing contracts, and how their decisions influence profit. Using a combination of theory and lab experiments, we find that in low critical ratio, the results are similar to the channel coordination case while in high critical ratio, both contracts yield a lower profit with revenue sharing slightly better than buyback. These results are consistent with loss aversion and a desire to minimize ex post inventory error.

3 - Learning to Price from Bounded Rational Competitors
Kay-Yut Chen, Principal Scientist, HP Labs, 1U-2, HP Labs, 1501 Page Mill Road, Palo Alto, CA, 94304, United States of America, kay-yut.chen@hp.com, Shelen Jain, Guillermo Gallego, Jay Wang, Jose Beltran

We propose a new pricing method in markets where observed prices may be near, but not on equilibrium. A firm can "learn" from the limited intelligence in the market place. Simulated results show that the level of benefits depends on relative levels of intelligence between the firm, and the market.

4 - Bargaining in Supply Chains
Stephen Leider, Assistant Professor, University of Michigan Ross School of Business, 701 Tappan Street, Ann Arbor, MI, 48109, United States of America, leider@umich.edu, William Lovejoy

We study experimentally bargaining in a multiple-tier supply chain with sequential bargaining between tiers. Our treatments vary the cost difference between firms in tiers 1 and 2, with larger cost differences reflecting increased bargaining power. We measure how these underlying costs influence the efficiency and profit distribution with the supply chain, and the extent to which bargaining power and fairness concerns influence the negotiated prices.

5 - The Wisdom of Competitive Crowds
Yael Grushka-Cockayne, Assistant Professor, University of Virginia, Darden School of Business, 100 Darden Blvd, Charlottesville, VA, 22903, United States of America, GrushkaY@darden.virginia.edu, Casey Lichtendahl, Phil Pfeifer

We analyze a forecasting competition in which a prize is awarded to the forecaster whose point forecast is closest to an outcome. In a set of equilibrium results, we characterize the strategic forecasting. We find that the competitive crowd's forecast is more accurate than the average of truthful forecasts.

■ MB66

66- Ellis West- Hyatt

Knowledge Transfer and Classifier Selection

Sponsor: Data Mining

Sponsored Session

Chair: Si-Chi Chin, The University of Iowa, 3087 LIB, Iowa City, IA, 52242, United States of America, si-chi-chin@uiowa.edu

1 - Knowledge Development and Knowledge Transfer in New Product Development Projects
Wenli Xiao, University of San Diego, School of Business Administration, Olin Hall 335, 5998 Alcala Park, San Diego, CA, 92110, United States of America, wenlixiao@sandiego.edu, Cheryl Gaimon, Janice Carrillo

We introduce a dynamic model that characterizes linkages among three stages of engineering activities in an NPD project: prototyping, pilot line testing, and production ramp-up. The manager pursues knowledge development and transfer over time. Through knowledge transfer from a source to recipient stage, the manager enhances the recipient's knowledge development capabilities. We examine how the effectiveness of knowledge development, prior knowledge, and feedback impact the manager's strategies.

2 - Organizational Learning and Knowledge Transfer in a Multi-product Offshore Manufacturing Environment
Carolyn Denomme, Carnegie Mellon University, 5000 Forbes Avenue, 129 Baker Hall, Pittsburgh, PA, 15213, United States of America, cdenomme@cmu.edu, Linda Argote, Erica Fuchs, Dennis Epple

This work explores the significance of a multi-product environment on organizational learning & knowledge transfer by studying a US-owned overseas high tech manufacturing facility that produces variants of 4 focal products plus other miscellaneous products. We draw on 10 years of firm archival data and qualitative data collected to shed insights into why knowledge transfers across some products and not others by examining technological and organizational differences in these product transitions.

3 - Enhancing Knowledge Base with Knowledge Transfer
Si-Chi Chin, The University of Iowa, 3087 LIB, Iowa City, IA, 52242, United States of America, si-chi-chin@uiowa.edu, W. Nick Street

This presentation motivates the problem of Knowledge Base Enhancement (KBE), discusses the research methodology and proposes knowledge transfer network to describe the dynamic process of knowledge transfer. This interdisciplinary research crosses the study area of information filtering, machine learning, knowledge representation, and network analysis. It aims to explore and identify knowledge transfer methods to address the challenge of incomplete labelled data.

4 - A Classifier-Based Distance Metric for Ensemble Prediction
Senay Yasar Saglam, PhD Candidate, The University of Iowa Department of Management Sciences, S210 John Pappajohn Business Building, Iowa City, IA, 52242-1000, United States of America, senay-yasarsaglam@uiowa.edu, W. Nick Street

We propose methods of ensemble classification based on a new measure of distance between points. We map data points into a new space defined by the class probability estimates from a pool of two-class classifiers. Then, we use the Euclidean distance to measure the distance between data points in this space. We integrate this method with k-nearest neighbor procedures and KNORA in our experiments. Our findings show that our proposed method improves accuracy.

■ MB67

67- Ellis East- Hyatt

Advances in Bayesian Reliability Modeling and Risk Analysis

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Refik Soyer, Professor of Decision Sciences, George Washington University, 2201 G Street, Washington, DC, United States of America, soyer@gwu.edu

1 - Utility of Dependence, Departure from Independence, and Bayesian Reliability

Ehsan Soofi, Distinguished Professor, University of Wisconsin-Milwaukee, Lubar School of Business, P.O. Box 742, Milwaukee, WI, 53201, United States of America, esoofi@uwm.edu, Nima Jalali, Nader Ebrahimi

We formulate dependence in terms of the utility of predicting a variable from other variables. This approach integrates ideas from classic literature on dependence, the Bayesian expected utility in terms of uncertainty reduction, and measuring departure of a dependent model from the independence. We present applications to lifetime models such as Bayesian predictive joint distribution of components of a system and shock models, and Bayesian test of equality of parameters of lifetime models.

2 - Bayesian Variable Reliability Growth Modelling

Thomas Mazzuchi, Professor, George Washington University, 1776 G St. NW, Washington, DC, 20052, United States of America, mazzu@gwu.edu

In this talk, we present an overview of Bayesian Reliability Growth Modelling. Further, we develop a new model for Bayesian Reliability Growth Modeling which can account for various a priori growth patterns. The posterior distributions for all quantities of interest must be obtained via MCMC methods. We illustrate our methodology with real and simulated data.

3 - Modeling Heavy-Tailed, Skewed and Peaked Uncertainty Phenomena with Bounded Support

Johan van Dorp, Professor, George Washington University, 1776 G St., NW, #135, Washington, DC, 29952, United States of America, dorpjr@gwu.edu

A prevalence of heavy-tailed, peaked and skewed uncertainty phenomena have been cited in literature dealing with economic, physics, and engineering data. Herein, the family of Elevated Two-Sided Power (ETSP) distributions shall be presented. We demonstrate that the ETSP family allows for a remarkable flexibility when modeling bounded heavy-tailed and peaked, but skewed, uncertainty phenomena. We present an illustrative example utilizing 2008 US income data.

4 - Multivariate Distributions Induced by Dynamic Environments

Refik Soyer, Professor of Decision Sciences, George Washington University, 2201 G Street, Washington, DC, United States of America, soyer@gwu.edu

We consider multivariate distributions that arise as a results of components sharing a common operating environment. The operating environment follows a discrete time stochastic process and modulates failure characteristics of individual components. We discuss characteristics of the resulting multivariate models and develop Bayesian inference for their analysis.

■ MB68

68- Suite 312- Hyatt

Financial Services Section Best Student Research Paper Competition

Sponsor: Financial Services Section

Sponsored Session

Chair: Aparna Gupta, Associate Professor of Quantitative Finance, Rensselaer Polytechnic Inst., 110 8th Street, Troy, NY, 12180, United States of America, guptaa@rpi.edu

1 - Market-reaction-adjusted Optimal Central Bank Intervention Policy in a FX Market

Sandun C. Perera, University of Texas-Dallas, Dallas, TX, United States of America, sandun.perera@utdallas.edu

Motivated by empirical observations, we study a central bank intervention problem in the foreign exchange market when the market observes and reacts to the bank's interventions. Impulse control theory is used to solve the problem of finding the optimal times, types and amounts of interventions. For this, we first model an impulse control problem when the controller's action affects the state as well as the dynamics of the state process for a random amount of time. We then apply our model to solve the central bank intervention problem. Our results suggest that the central bank would intervene less frequently (more frequently) and the optimal policy is more (less) expensive than its corresponding value without the market reactions if the market reactions increase (decrease) the exchange rate volatility.

2 - Optimal Order Routing in a Fragmented Market

Hua Zheng, PhD Candidate, Columbia University, 3022 Broadway, New York, NY, 10027, United States of America, hzheng14@gsb.columbia.edu

In modern equity markets, participants have a choice of many exchanges at which to trade. Exchanges typically operate as electronic limit order books operating under the "price-time" priority rule. Taking into account the effect of investors' order routing decisions, we find that the equilibrium of this decentralized market exhibits a certain state space collapse property, whereby (a) the states at different exchanges are coupled in a fairly intuitive manner, (b) the behavior of the market is captured through a one-dimensional process that can be viewed as a weighted aggregate depth of the market at the best bid and offer, and (c) the behavior of the various exchanges is inferred through a set of simple mappings from that of the aggregated market depth process. This predicted dimension reduction is the result of high-frequency order routing decisions that essentially couple the dynamics across exchanges. We derive a characterization of the market equilibrium and the associated aggregated depth process. Analyzing a TAQ dataset for a sample of stocks over a one month period, we find strong support for the predicted state space collapse property.

3 - Dynamic Valuation of Delinquent Credit-card Accounts

Naveed Chehrazi, Stanford University, Stanford, CA, United States of America, nchehrazi@gmail.com

This paper introduces a dynamic model of consumers' repayment behavior on overdue (delinquent) credit-card loans placed in collections using a self-exciting point process. The models used to construct a probability measure for the collectability of a delinquent account. The resulting account-speci c dynamic collectability score (DCS) estimates, at any given time in the collections process, the probability of collecting a given percentage of the outstanding balance over a desired time horizon. The method is tested using a large set of account-level repayment data. The improvements in classi cation and prediction performance compared to standard bank-internal scoring methods are significant.

4 - The Valuation of Natural Gas-fired Power Plants by Integrating Spark Spread and Weather Options

Reaz-us Salam Elias, Ryerson University, Toronto, ON, Canada, m3elias@ryerson.ca

Spark spread based valuation of a natural gas-fired power plant addresses only the price risks emerging from the uncertainties of natural gas and electricity prices. A power plant, however, is also exposed to weather related risks. If the winter is mild, lower electricity generation leads to lower profit. Temperature fluctuations affect the profitability of the plant. In order to hedge the downside profitability, power plants can transfer weather related risks using temperature-based weather options. This research focuses on the integration of spark spread options with weather options in valuing a natural gas-fired power plant in a real options framework. This study addresses the financial risk issues of a natural gas-fired power plant and determines whether it is viable to integrate weather options with spark spread options; and how many options to long or short to minimize the variance of the total profit.

5 - Optimal Trade Execution with Dynamic Risk Measure and Primal-dual First-order Methods

Qihang Lin, PhD Student, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, qihangl@andrew.cmu.edu

We study the optimal trade execution problem in an illiquid market by minimizing the coherent dynamic risk of the sequential transaction costs. The prices of the assets are modeled as a discrete random walk perturbed by both temporal and permanent impacts related to the trading volume. We show that, when the dynamic risk measure is Markovian, the optimal strategy is time-consistent and static. Formulating the optimal execution problem as a saddle point problem, we proposed specialized primal and dual first-order methods to compute the the optimal strategy. The efficiency and scalability of our approaches are demonstrated by numerical experiments.

■ MB69

69- Suite 314- Hyatt

Quantitative Methods in Portfolio Optimization

Cluster: Optimization in Finance

Invited Session

Chair: Ciamac Moallemi, Associate Professor, Columbia Business School, 3022 Broadway, Uris 416, New York, NY, 10025, United States of America, ciamac@gsb.columbia.edu

1 - Dynamic Portfolio Choice with Common Factor Shocks
Mehmet Saglam, Columbia University, New York, NY, United States of America, MSaglam13@gsb.columbia.edu, Ciamac Moallemi, Pierre Collin-Dufresne, Kent Daniel

We propose a factor-based model that incorporates common factor shocks for the security returns. Under these realistic factor dynamics, we solve for the dynamic trading policy in the class of linear policies analytically. Our model can accommodate stochastic volatility and liquidity costs as a function of factor exposures. Calibrating our model with empirical data, we show that our trading policy achieves superior performance in the presence of common factor shocks.

2 - On the Control of Diffusions via Linear Programming
Andrew Ahn, Columbia University, Department of IE&OR, 500 West 120th Street, New York, NY, United States of America, aja2133@columbia.edu, Martin Haugh

Han and Van Roy (2011) proposed a linear programming approach for the approximate control of diffusion processes. We extend that approach and apply it to a class of dynamic portfolio optimization problems with no short-sales and no-borrowing constraints. We also use portfolio optimization duality techniques to establish that the LP approach is capable of essentially solving these problems.

3 - Stress Scenario Selection by Empirical Likelihood
Wanmo Kang, Assistant Professor, KAIST, 291 Daehak-ro, Yuseong-gu, Daejeon, Korea, Republic of, Wanmo.kang@kaist.edu, Paul Glasserman, Chulmin Kang

We present the selection and analysis of stress scenarios for financial risk assessment, with particular emphasis on identifying sensible combinations of stresses to multiple variables. We consider reverse stress testing - finding the most likely scenarios - using a nonparametric empirical likelihood estimator. We apply the results to marginal expected shortfall, macro stress scenarios, and scenario sampling method. This is a joint work with Paul Glasserman and Chulmin Kang.

4 - Optimizing Portfolios with Non-normal Distributions
John Birge, Professor, University of Chicago, Chicago, IL, United States of America, john.birge@chicagobooth.edu, Luis Chavez-Bedoya

Return distributions are well-known to have characteristics such as negative skewness and heavy tails that are not captured by normal distributions. We describe the characteristics of optimal portfolios with returns following a generalized hyperbolic (GH) distribution that accommodates many of the observed features absent from the normal distribution.

■ MB70

70- Suite 316- Hyatt

Digital and Social Networks II

Sponsor: Information Systems

Sponsored Session

Chair: Jui Ramaprasad, Assistant Professor, McGill University, 1001 Sherbrooke West, Montreal, QC, H3H2V1, Canada, jui.ramaprasad@mcgill.ca

1 - Towards an Ecosystem Theory of Information Technology Collaboration Networks
Ali Tafti, University of Illinois at Urbana-Champaign, 1206 S. Sixth Street, 350 Wohlers Hall, Champaign, IL, 61820, United States of America, atafti@illinois.edu

The production of information technology products and services involves a highly elaborate ecosystem of customers, collaborators, and competitors. In this study, I use a set of predictive statistical techniques to explore the determinants of positioning in an extended network alliances among IT-producing firms, as a means to develop more useful theories about how such IT ecosystems evolve.

2 - Maximizing the Potential of LinkedIn for Job Search
Rajiv Garg, Carnegie Mellon University, 4800 Forbes Ave., HBH 3030, Pittsburgh, PA, 15213, United States of America, rgarg@andrew.cmu.edu, Rahul Telang

Online professional networks (like LinkedIn) have been gaining popularity and are more frequently used by both job seekers and employers. This raises an important and unanswered question about the value of the building blocks of these networks for job search. In this paper we address these questions and present empirical findings that would allow job seekers to maximize the potential of these online professional networks.

3 - An Empirical Analysis of Digital Visibility
Lauren Rhue, New York University, Stern School of Business, 44 West 4th St., New York, NY, 10012, United States of America, lrhue@stern.nyu.edu

Increasingly, human interactions are either augmented or mediated by technologies, generating "digital visibility" in human behavior and introducing a social externality rooted in the anticipation of others' reactions. Variation among ties in friendship and reaction networks is leveraged to separate social influence from the influence of a digital audience.

4 - Value Co-creation in Crowdsourcing: The Effects of Social Networks on Product Co-Development Success
Hyelim Oh, McGill University, 1001 Sherbrook Street West, Montreal QC, Canada, hyelim.oh@mail.mcgill.ca, AnimeshAnimeshm, Alain Pinsonneault

Despite the popularity of diverse forms of crowdsourcing enabled by social media platforms, our understanding of performance drivers remains limited. Our study investigates how inventors' networks affect crowdsourcing performance. Our preliminary results suggest that inventors' structural position in the network and the composition of collaborators impact the success of product co-development.

■ MB71

71- Suite 318- Hyatt

Issues in Information Security, Fraud, and Location Awareness

Sponsor: eBusiness

Sponsored Session

Chair: Matthew Hashim, Assistant Professor of MIS, Eller College of Management, The University of Arizona, 1130 E. Helen St., McClelland Hall, Room 430, Tucson, AZ, 85721, United States of America, mhashim@email.arizona.edu

1 - Algorithmic Approaches to Fraud Prevention and Investigation
Dmitry Zhdanov, University of Connecticut, 2100 Hillside Rd, Storrs, CT, 06269, United States of America, dmitry.zhdanov@business.uconn.edu, Ram Gopal, Raymond Patterson, Erik Rolland

In this paper, we analyze a variety of algorithmic methods that can be used by the investigators of different fraud scenarios. We argue that the use of various social network overlays, coupled with graph theoretic concepts, is helpful in fraud investigation, particularly when fraud involves multiple perpetrators who may be insiders of the victim organization. We also present a set of consistent metrics that could be used to select and calibrate particular investigative techniques.

2 - E-Coupons Delivery Problems: A Dynamic and Stochastic Optimization Approach
Keumseok Kang, Florida International University, 11200 SW 8th Street, Miami, FL, 33199, United States of America, kskang@fiu.edu, Kemal Altinkemer, George Shanthikumar

Location based advertisement (LBA) enables advertisers to attract customers more effectively than ever, by sending location-aware advertisements, which we call e-coupons, through mobile devices. We consider a push-based LBA system and study a profit maximization problem of the advertiser, which we call the e-coupons delivery problem. We formulate this problem as a dynamic and stochastic programming model and find the structural properties of the optimal policy.

3 - A Dynamic Model of Emotions, Attitudes, and IS Security Policy Violations
John D'Arcy, University of Delaware, Newark, DE, United States of America, jdarcy@udel.edu

Research suggests that emotions play a prominent role in explaining employee deviance. In this study, we explore the dynamic nature of workplace events, emotions, and attitudes in predicting employees' deliberate IS security policy violations. The study is rooted in affective events theory and utilizes an experience-sampling methodology to assess within-individual variation in several of the study variables, including emotions.

4 - Collaboration, Interdependency, and Transfer Pricing
Matthew Hashim, Assistant Professor of MIS, Eller College of Management, The University of Arizona, 1130 E. Helen St., McClelland Hall, Room 430, Tucson, AZ, 85721, United States of America, mhashim@email.arizona.edu

Entities often engage in interdependent activities that may have an effect on other entities (e.g., airport security, health information exchanges). Using an experimental setting, we design several treatments using either endogenous or exogenous transfer pricing, and draw conclusions about the ability for subjects to achieve the optimal level of collaboration.

■ MB72

72- Suite 322- Hyatt

Advances in Optimization Modeling Languages and Systems III

Cluster: ICS-Advances in Optimization Modeling Languages and Systems

Invited Session

Chair: Robert Fourer, President, AMPL Optimization, Inc, 2145 Sheridan Road, Evanston, IL, United States of America, 4er@ampl.com

1 - Stochastic Programming in GAMS
Lutz Westermann, GAMS Development Corporation, 1217 Potomac St. NW, Washington, DC, United States of America, lwestermann@gams.com, Michael Bussieck

Recently GAMS made a first cut at supporting stochastic programming. With a few changes uncertainty can be added to an existing deterministic model. For this, the Extended Mathematical Programming (EMP) framework is used to replace parameters in the model by random variables. This way multi-stage recourse problems and chance constraint models can be formulated.

2 - Designing a User Friendly System for Planning under Uncertainty with Stochastic Programming (SP)
Linus Schrage, University of Chicago, 5807 S. Woodlawn, Chicago, IL, United States of America, linus.schrage@chicagobooth.edu, Mustafa Atlihan, Kevin Cunningham, Gautier Laude

Perhaps the most daunting challenge of SP is providing a user interface that is not daunting to the user. We describe the approach we have used in the SP component of the LINDO API optimization library. The two major tasks are eliciting from the user: 1) sequencing of decisions and random events, and 2) distributions of random variables, including dependencies. This library is accessible via the spreadsheet add-in What'sBest! and the modelling languages GAMS and LINGO.

3 - Network Optimization and Beyond in SAS/OR® Software
Leo Lopes, Advanced Analytics Specialist, SAS Institute, SAS Campus Drive, Cary, NC, 27513, United States of America, Leo.Lopes@sas.com

This talk demonstrates new features in the OPTMODEL procedure for network and combinatorial optimization. With PROC OPTMODEL, you can access a variety of network-based solvers by using only problem definitions instead of explicit formulations, greatly enhancing performance and scalability. You can also access most of the functionality of the SAS System by merging invocations of other SAS procedures with mathematical programming constructs that are built into the PROC OPTMODEL modeling language.

4 - GDXRRW: Exchanging Data between GAMS and R
Steven Dirkse, GAMS Development, 1217 Potomac St NW, Washington, DC, 20007-3212, United States of America, sdirkse@gams.com, Michael Ferris, Renger van Nieuwkoop

We discuss GDXRRW (GDX-R Read/Write), a tool for moving data between GAMS and R. This data exchange benefits both user communities. It gives R users the capability to use the superior modeling and optimization capabilities of GAMS, and it allows for visualization and analysis of GAMS data directly within R to take advantage of R's wide range of functionality. The freely available tool is based on GDX (GAMS Data eXchange), a well-established and public API for sharing data.

■ MB73

73- Suite 324- Hyatt

Default and Systemic Risk

Cluster: Quantitative Finance

Invited Session

Chair: Agostino Capponi, Assistant Professor, Purdue University, 315 North Grant Street, West Lafayette, IN, 47906, United States of America, capponi@purdue.edu

1 - Default Swap Games Driven by Spectrally Negative Levy Processes
Kazutoshi Yamazaki, Osaka University, CSFI, Osaka, Japan, k-yamazaki@sigmath.es.osaka-u.ac.jp, Tim Siu-Tang Leung

This paper studies game-type credit default swaps that allow the protection buyer and seller to raise or reduce their respective positions once prior to default. Under a structural credit risk model based on spectrally negative Levy processes, we apply the principles of smooth and continuous fit to identify the equilibrium exercise strategies for the buyer and the seller. We then rigorously prove the existence of the Nash equilibrium and compute the contract value at equilibrium.

2 - Filtered Likelihood for Point Processes
Gustavo Schwenkler, Stanford University, 1045 Alma St., Palo Alto, CA, 94301, United States of America, gschwenk@stanford.edu, Kay Giesecke

We develop likelihood estimators of the parameters of a marked point process and of incompletely observed explanatory factors that influence the arrival intensity. The factors follow arbitrary jump-diffusions. We provide conditions for consistency and asymptotic normality as the sample period grows. We also establish an approximation to the likelihood and analyze the convergence and asymptotic properties of the associated estimators. Numerical results illustrate our approach.

3 - The Topology of Central Counterparty Clearing Networks and Network Stability
Richard Sowers, University of Illinois at Urbana-Champaign, Urbana, IL, United States of America, r-sowers@illinois.edu, Rui Song, Jonathan Jones

We study a simple model of a trading network with central counterparties and Gaussian exposures. We are interested in the structure of rare events (Maximum Exposure at Risk). We identify a large-deviations-type result which captures some of the structure of rare events.

4 - Liquidity Impact of a Ban on Naked Credit-default Swaps
Agostino Capponi, Assistant Professor, Purdue University, 315 North Grant Street, West Lafayette IN 47906, United States of America, capponi@purdue.edu

We develop a dynamic search model to study the impact on market liquidity and credit risk of banning naked credit default swap (CDS) positions. In equilibrium, investors trade bonds and CDS protection directly and on over-the-counter markets (OTC). When OTC markets are well functioning, banning naked CDS positions raises market illiquidity and does not necessarily lower credit spreads. Bid-ask spreads increase proportionally to the benefits derived from using CDS as proxy hedging instruments. Such findings suggests that regulators should consider other measures to reduce instability from excessive speculation in derivatives market.

Monday, 12:30pm - 2:30pm

■ Interactive Session

West Ballroom Foyer, Level 300

Interactive Session

Cluster: Interactive Poster Session

Invited Session

Chair: Young-Jun Son, The University of Arizona, Systems and Industrial Engineering, Phoenix, AZ, United States of America, son@sie.arizona.edu

Co-Chair: Burcu Keskin, University of Alabama, Huntsville, AL, United States of America, bkeskin@cba.ua.edu

Co-Chair: Jian Liu, University of Arizona, Tempe, AZ, United States of America, jianliu@sie.arizona.edu

1 - A Research on Supply Chain Coordination in Unconventional Emergencies

Guwen Shen, School of Management,Huazhong University of Science and Technology, No.1037,Luoyu Road, Wuhan, China, sgwforever@gmail.com, Xianhao Xu

In this paper,we research the supply chain coordination under intervening measures by the government in unconventional emergencies,hoping to getting the government's optimal intervention mechanism in unconventional emergency and get the optimal coordination mechanism under the government's intervention measures in unconventional emergency.

2 - On Optimal Design of Multi-survey Internet Campaigns

Bogumil Kaminski, Assistant Professor, Warsaw School of Economics, Al. Niepodleglosci 162, Warsaw, 02-544, Poland, bkamins@sgh.waw.pl, Mariusz Kozakiewicz, Wit Jakuczun

We model a problem of optimal assignment of respondents to internet surveys. Respondents are invited online to participate in one of many surveys that are run in parallel. Each survey has a unique inclusion criteria based on respondent socio-demographic data and target number of times it has to be filled. We design a method that dynamically assigns respondents to surveys so as to minimize number of respondents questioned. The solution is implemented for a leading online survey company in CEE.

3 - A Better Ranking of National Soccer Teams via Optimization-based Method

Atsushi Takemasa, Chuo University, 13-27 Kasuga 1-chome,Bunkyoku,Tokyo JAPAN, Tokyo, Japan, atstakemasa@gmail.com, Jun-ya Gotoh

Ranking methods based on partial comparisons have been studied in various fields. In this study, we employ the Hodge ranking, an optimization-based ranking method, for grading more than 200 national soccer teams affiliated with FIFA. We first discuss how to measure the quality of ranking in the context of sports ranking and compare the results of the proposed method with the FIFA/Coca-Cola World Ranking. Several ways for modification will also be presented so as to improve the ranking quality.

4 - Measuring the Efficiency of the Libraries of a Public Institution of Higher Education in Brazil

Lasara Rodrigues, UFOP/BRAZIL, Campus Morro do Cruzeiro, Ouro Preto, MG, 35400000, Brazil, lasara@em.ufop.br, Marcella Pinto, Irce Guimarães

This paper present an approach based on Data Envelopment Analysis (DEA) used to investigate the efficency of 12 libraries from the Library Integrated System of a Public Institution of Higher Education in Brazil. BCC models driven to output were used due to the different sizes of DMUs analyzed. As result, the benchmark libraries as well as the efficiencies for each DMU, its scale factor and the targets for each inefficient DMU were obtained.

5 - Solving Nonlinear Multicommodity Network Flow Problem by Penalty Function Methods

Ali Darroudi, PhD Student, FIU, 10555 W. Flagler Street,, EC, Room 3730, Miami, FL, 33174, United States of America, ali_a_darroudi@yahoo.com, Hedayat Z. Aashtiani

Penalty-based algorithm is presented for solving the Multicommodity network flow problem (MNFL) with a nonlinear objective function and considering the side constraints. Side constraints will be relaxed, and a penalty term will be added for the violation of it to the objective function. This algorithm uses Hyperbolic, Liu and Dynamic penalty functions to eliminate side constraints. Frank-Wolf method is subsequently used to decompose the convex problem into a sequence of linear problems.

6 - Interpersonal Relationships and Inventors' Network Positions

Sebastiano Massaro, UCL & Boston University, Gower Street, London, United Kingdom, s.massaro@ucl.ac.uk, Daniele Rotolo

The structural perspective on networks disregards the role of actors' interpersonal dynamics in favor of topological configurations, to explain actors' behavior. Yet, different types of interpersonal relationships may favor (or not) actors' actions in building their network positions. Drawing on a mixed methods study in the nanotechnology sector, we argue that inventors who establish 'affective' relationships build stronger brokerage positions than those relying on 'instrumental' ties.

7 - Application of ELECTRE III for Personnel Selection Problem

Zülal Güngör, Prof, Gazi University, Engineering Faculty, Industrial Engineering Department, Ankara, Turkey, zulalg@gazi.edu.tr

The present work presents is an application of multi-criteria decision analysis (MCDA) for decisions in the area of personnel selection. MCDA is a general term for methods providing a systematic quantitative approach to support decision making in problems involving multiple criteria.This can be achieved only by employing potentially adequate personnel. The purpose of this paper is to provide methodologies for personnel selection problem, which are based on Electre III method.

8 - Performance Evaluation of Collaborative Healthcare Systems using Simulation

John Jung-Woon Yoo, Assistant Professor, Bradley University, 1501 W. Bradley Ave., Peoria, IL, 61625, United States of America, jyoo@bradley.edu, Krishnaveni Gnanasekaran

In our earlier research, we have proposed a collaborative medical service framework. We claim that through the proposed collaboration framework, healthcare service providers can have higher utilization of their resources, and the patients can reduce lead time for their treatments. To validate the performance of the proposed framework, a simulation study is conducted and the simulation results are discussed in this talk.

9 - Modeling for Equitable Allocation of Food Distribution in North Carolina under Capacity Constraints

Irem Sengul, North Carolina State University, 1010 Avent Hill, Apt. B8, Raleigh, NC, 27606, United States of America, isengul@ncsu.edu, Julie Ivy, Reha Uzsoy

In partnership with the Food Bank of Central & Eastern North Carolina, which works on a 34-county service area, this research focuses on determining the equitable distribution of donated food among people at risk for hunger. The factors that influence the solution are capacity, supply and demand. This poster presents deterministic, linear programming models used to derive structural properties and optimal policy for allocating additional storage capacity to the counties in the service region.

10 - An Approach to Approximating Contributions Received through Food Bank Collections at Grocery Stores

Luther Brock, North Carolina A&T State University, 1601 East Market Street, Greensboro, United States of America, lgbrockiii@hotmail.com, Lauren Davis

This research addresses the need to approximate how much food is received by food banks through collections at grocery store. Such forecasts are the basis for more cost-effective vehicle scheduling. A feed-forward artificial neural network (FF-ANN) is used to estimate the amounts of different in-kind goods received through isolated store collections. The FF-ANN is trained using donation records provided by a food bank in the southeastern United States and compared with linear regression.

11 - Activity-based Costing or Lean Accounting: Choices of Chinese Enterprises in the Transition

Danxia Guo, Associate Professor, Xiamen University, Longhunan 4th Lane, Apt 13-302, Xiamen, FJ, 361000, China, dxguo6204@163.com

As the investment-based development model among Chinese enterprises has lost its sustainability, enterprises are eager for a transformation to an efficient cost-orientated business model in order to maintain rapid growth. By analyzing differences between activity-based costing and lean accounting, this article demonstrates criteria and principles in selection, forecasts obstacles in application, and makes assumptions for lean accounting research, which point out a direction for empirical study.

12 - The Role of Trust in University-Industry Collaborative Research Partnership Performance

Lynette Wilcox, Doctoral Candidate, Virginia Tech, 565 Whittemore Hall, Blacksburg, VA, United States of America, lywilcox@vt.edu

Empirical studies on the roles of interpersonal and inter-organizational trust in university-industry collaborative research partnership performance may provide external validation to current findings which are contextually dominated by supply chain relations. Considering the cultural differences between academe and industry, combined with inherent uncertainty and risk associated with research and technology development, the role of trust could be more evident in this emergent context.

13 - Capacity Planning in the Departmant of Corporate Resource Planning at Turkish Aerospace Industries
Gözde Arslan, Master Student, Gazi Universitesi Mühendislik Fakültesi, Maltepe/Ankara, Turkey, gzdcn@hotmail.com

The management of capacity planning systems are becoming more and more important for manufacturing firms in this ever-increasing competitive marketplace.In this study,we examine special test machine which was determined bottlenecks in this study.To eliminate bottlenecks were prepared the addressing design matrix which was tested. In addition, a parametric method has been developed for the determination of the duration of the test machine parts.

14 - Difficulties Mitigating Cybercrime in the Banking Sector
Michael Mitchell, Programming Analyst, Sandia National Laboratories, P.O. Box 5800, MS 1138, Albuquerque, NM, 87185-1138, United States of America, micmitc@sandia.gov, Walter Beyeler

Cybercrime against retail payment systems is increasing. This study analyzes the factors which make cybercrime mitigation in the retail payment system difficult. Some of the factors considered for this study include how much money is stolen by cybercriminals, its impact on consumers, which stakeholders bear the burden of risk, and cost implications for combating cybercrime.

15 - Zigzag Search for Multiple Objective Optimization
Honggang Wang, Rutgers University, 96 Frelinghuysen Road, CoRE Building, Room 212, Piscataway, NJ, 08854, United States of America, honggang.w@rutgers.edu

We propose a new method, using a gradient-based zigzag search approach, for multi-objective optimization (MOO) or vector optimization problems. The key idea of this method is searching around the Pareto front by applying an efficient local-search procedure using the gradients of the objective functions. A simple implementation of this method, z-algorithm, is presented particularly for continuous bi-objective optimization (BOO) problems with well-connected Pareto optimal solutions.

16 - Value of Perfect Information in Containership Load Planning
Masoud Hamedi, Assistant Research Scientist, University of Maryland, 1173 Glenn L. Martin Hall, Bldg #088, Dept. of Civil & Environmental Eng, College Park, MD, 20742, United States of America, masoud@umd.edu, Ali Haghani

This paper describes implications of having access to perfect container demand information while planning load and unload operations for a cellular containership. The optimization model in this study is different from traditional stowage planning, such that minimizing unnecessary container shifts and maximizing quay crane utilization are considered simultaneously. The model is used to analyze sample problems under different scenarios in a multi-port voyage.

17 - A Model of Platform Transition in Retail Payment Systems
Walter Beyeler, PMTS, Sandia National Laboratories, P.O. Box 5800, Albuquerque, NM, 87185-1138, United States of America, webeyel@sandia.gov, Angie Kelic, Michael Mitchell

Technological innovations are inspiring tremendous innovation in retail payments processes. Platform economics have been used to understand traditional systems for retail payments such as credit cards, explaining the structures of incentives among the various kinds of participants. We build on this analysis to understand the possible dynamics of transitions to novel payment systems, and to include the influence of the security of transactions and information on uptake.

18 - Planning for Integration of Wind Power Capacity in Power Generation using Stochastic Optimization
Yashar Aliari, PhD Candidate, UMD, Civil Eng. Dept., 4329 Rowalt Dr Apt 202, College Park, MD, 20740, United States of America, yaliyari@yahoo.com, Ali Haghani

Wind-generated power has a stochastic nature and it is generally used in combination with more reliable sources of energy. Therefore, it is important to investigate how much capacity from each available source of energy should be installed in order to meet electricity demand at the desired reliability level considering cost and environmental implications. For this purpose, a probabilistic optimization model is proposed which is capable of assigning optimal capacity levels for each energy source.

19 - Food Security is Associated with Dietary Diversity Scores of Small Households in Rural Area
Ru Feng, Dalian University of Technology, No. 2 Linggong Road,Ganjinzi, Dalian, LN, 116033, China, fengru719@gmail.com, Gang Song

Food security- an increasingly important issues in the whole world-makes a significant contribution for human's good nutrition and health. This paper provides an overview of recent studies and statistics on food security. It focuses on 9-item questions and dietary diversity scores to evaluate the food security status. By analyzing the data of Kamuli and comparing other five cities in Asia and Africa, it gives a measurable model to examine the contribution of food security.

20 - Time-cost Trade-off Analysis with Workload Buffers
Tomasz Blaszczyk, University of Economics, 1 Maja 50, Katowice, 40-287, Poland, tomasz.blaszczyk@ue.katowice.pl, Pawel Blaszczyk

In this paper we propose a new approach to project modeling for the application of time-cost analysis. We use the concept of project buffers for the estimation of the workload on the job. On the basis on the results of earlier work on the problem of modeling time and cost buffers, we propose the construction of multi-criteria model compiled on the basis of single objective buffers work.

21 - A Study of Relationship about Homogeneity and Differences among Internet Enterprises
Xiong Yingzi, Xiamen University, School of Management; Xiamen University, Xiamen, FJ, 361005, China, xyingzi@xmu.edu.cn, Zhiduan Xu

We intend to interpret the causes of homogenization among Internet enterprises through establishing the competition model of two enterprises. It shows that homogenization is the result of rational choice on the part of an enterprise. The characteristics of network technologies and network products/services constitute a sufficient condition under which homogenization can be fulfilled. The competitive advantages of large Internet enterprises come from the differentiation based on the homogeneity.

22 - Dividing a Territory with Obstacles
Raghuveer Devulapalli, University of MInnesota, 310 8th St SE #205, MInneapolis, MN, 55414, India, me.raghuveer@gmail.com, John Gunnar Carlsson

We consider the problem of dividing a simply connected polygon containing a set of simply connected obstacles into sub-regions so as to balance the workloads of a collection of n fixed facilities or vehicles over that territory. We give a fast analytic center cutting plane method that divides the territory into n compact, connected sub-regions, each of which contains a facility, such that the workloads in each sub-region are balanced.

23 - Considering a Firm's Tech. Strategy in the Link between Inventor Mobility & Interfirm Knowledge Flow
Erin McKinney, PhD. Student, Carnegie Mellon University, 5812 Howe St., #21, Pittsburgh, Pe, 15232, United States of America, emckinne@andrew.cmu.edu

Inventor mobility is recognized as related to the flow of knowledge across firms. This paper claims that when an inventor's background fits the technological strategy of the firm recruiting him, there will be an increase in the firm's use of the recruits' prior ideas but not if his background lacks this fit. We use patent data to look at mobility and identify inventors who fit their hiring firm's technological strategy.

24 - Predicting Client Appointment Adherence to Improve Utilization at a Large Mental Healthcare Provider
Nathan Nehrt, Data Analyst/Predictive Modeler, Centerstone Research Institute, 720 North Marr Road, Columbus, IN, 47201, United States of America, nathan.nehrt@centerstone.org, Jason Luellen, Russell Galyon

Low appointment adherence, i.e. clients not showing up for scheduled appointments, has been a major challenge for community mental healthcare providers. We evaluate predictive models for appointment adherence based on client clinical, demographic, and prior appointment data and treatment facility and appointment time characteristics. Several models demonstrate significant predictive improvement over baseline adherence rates and could improve appointment slot utilization and increase revenue.

25 - Primal-Dual Heuristic for Path Flow Estimation in Medium to Large Networks
Shikai Tang, The Institute of Transportation Studies at UC Davis, 2028 Academic Surge, Davis, Calif. 95616, Davis, CA, 95616, United States of America, skytang@ucdavis.edu

The Path Flow Estimator (PFE), an Origin-Destination (O-D) estimation algorithm that relies on the computation of path flows, can be slow when applied to medium large networks. We develop a primal-dual heuristic that can significantly improve the efficiency of the PFE algorithm, and enables its application in medium to large networks with considerably less computational time.

26 - Statistical Pattern Recognition for Real-time Ridesharing
Keivan Ghoseiri, University of Maryland, 1173 Glenn Martin Hall, College Park, MD, 20742, United States of America, kghoseir@umd.edu, Masoud Hamedi, Ali Haghani

In the face of increasing the transportation cost and worsening the effects of traffic congestion and environmental pollutions, an easy, safe and quick to respond real-time rideshare system is a wise usage of personal cars. This paper employs statistical pattern recognition tools such as Principal Component Analysis and Discriminant Analysis to extract hidden patterns of ridesharing from a data warehouse generated by a verified spatiotemporal and hierarchical matching strategy.

27 - A Logistic Regression Model for Prediction of Accidents Associated with Changeable Message Signs
Azadeh Norouzi, University of Maryland, 1173 Glenn L. Martin Hall, Bldg #088, College Park, MD, 20742, United States of America, norouzi@umd.edu, Ali Haghani, Masoud Hamedi

Recently, some concerns have been raised about the negative impacts of CMSs on road safety including drivers' distraction and accidents resulted from slowing down. This paper investigates the meaningful relationship between the frequency of accidents and their proximity to CMSs using the ground truth incidents data in Maryland. The paper presents a logistic regression model to predict accident frequencies depending on the visibility, contents and type of messages, and distance from CMS.

28 - Optimizing a Cloud-based Service Design using Social Media
Amir Zadeh, OSU, 101 Hanner Hall Stillwater Campus, Stillwater, Ok, 74075, United States of America, amir.zadeh@okstate.edu, Ramesh Sharda

Today, service providers offer a number of computing services on clouds and each of these services has different characteristics as regards price, security, compliance and competition, quality issues. On the other hand, individual and social influences play an important role in a consumer's service choice. In this paper, a cloud-based service design problem affected by peer influence is developed to the optimize service provider's profit and to incorporate social interactions.

29 - Dynamic Pricing and Delivery in Smart Grid with Strategic Consumers
Shaudi Mahdavi-hosseini, university of pennsylvania, 220 South 33rd Street, Philadelphia, PA, 19104, United States of America, shaudi@seas.upenn.edu, Yan Lee Shu

The digitally-enabled "smart" energy grid enables instantaneous adjustments in pricing and supply of electricity. However, the minute-by-minute record of customers' energy use enabled by the grid poses a threat to consumer privacy. Here we extend prior work by modeling a setting (and studying the game that emerges) in which customers are strategic, and the utility delivers/prices energy on the basis of energy usage information transmitted in a private way.

30 - Equilibrium Model for Analysis on Opening and Improving Transportation Routes
Kazuhiko Ishiguro, Associate Professor, Kobe University, 5-1-1, Fukaeminami, Higashinada, Kobe, 658-0022, Japan, ishiguro@maritime.kobe-u.ac.jp, Pitu Mirchandani

Transport cost reduction will trigger new transport demand. This study develops international trade model taking account of ocean carriers' behavior based on multi-regional computable general equilibrium framework. Trade amount is formulated as the demand of goods produced in other region. The model is applied to opening and improving transportation routes and the impacts on trade are discussed.

31 - An Optimal Lane-Based Signal Merge Control Model for Freeway Work Zone Operations
Yue Liu, Assistant Professor, University of Wisconsin-Milwaukee, P.O. Box 784, Milwaukee, 53201, United States of America, liu28@uwm.edu, Jing Mao

This paper presents a dynamic control model for optimizing lane-based signal merge (LBSM) operations at freeway work zones. The control objective is to maximize the throughput. GA is employed to solve the model. Results reveal that the proposed method yields much better performance than traditional merge strategies under heavy traffic conditions.

32 - Optimal Decision-making between Signalized and Uninterrupted Flow Strategies during Evacuation
Zhenke Luo, University of Wisconsin-Milwaukee, P.O. Box 784, Milwaukee, 53201, United States of America, zluosr@uwm.edu, Yue Liu

This paper presents a bi-level network optimization model to determine the optimal set of intersections in the evacuation network for implementing uninterrupted flow and signal control strategies, respectively, which can yield the maximum evacuation operational efficiency and the best use of available budgets. The proposed model is solved by a GA-based heuristic.

33 - Cluster-based Optimal Location Planning of Urban Transit Hubs
Jie Yu, Associate Professor, Shandong University, No. 17923 Jingshi Rd, Jinan, China, yujie1979@gmail.com, Yue Liu, Zhenke Luo

This paper presents an optimization model planning urban transit hub locations. The model features a bi-level structure with the upper-level determining the hub locations to minimize the total transportation and facility cost. The lower-level models the behavior of buses and passengers in choosing optimal hubs and transportation routes. GA is employed to yield meta-optimal solutions.

34 - Material Allocation, Routing and Dispatch System (MARDS)
Tanju Yurtsever, Maxim Integrated Products, 14900 Spillman Ranch Loop, Austin, TX, 78738, United States of America, tanju.yurtsever@maxim-ic.com, Jessica Brown, Michael Bates

In Semiconductor Manufacturing, assigning products to the right tool and having them to be moved to the right location and processing them in the right order is very important for productivity. In MAXIM San Antonio Fab, we designed, developed and implemented a system that will find the best allocation, routing and dispatch decisions in real time in a manufacturing environment with about 1000 product moves through 1000 equipment in an hour.

35 - Real-time Feedback Control for Home Care Crew Scheduling
Seokgi Lee, PhD. Candidate, The Pennsylvania State University, 310 Leonhard Building, University Park, PA, 16802, United States of America, seok.lee75@gmail.com, Vittal Prabhu, Yuncheol Kang

We develop dynamic models for the home care crew scheduling problem (HCCSP) with dynamic patient appointments based on the theory of the nonlinear and discontinuous differential equation, and explain dynamics that span from controlling crew work times to home-visit scheduling and off-time planning. Also, the real-time feedback control algorithm based on the discrete event simulation is presented to solve HCCSP in a distributed system environment.

36 - Rule-Based Production Planning and Scheduling using Decision Tree
Hassan Gholami Mazinan, Logistic Expert, SAIPA, 14 km, Ardestan Rd, SAIPA Kashan Co., Kashan, 87135/1488, Iran, mazinan.hassan@gmail.com, Maziar Davoodi, Erfan Khaji, Keivan Ghoseiri, Mahyar Hoseinzadeh

Production planning and scheduling may require the solution of a complex large-scale problem. This paper presents a rule-based plan to tackle associated complexities of the problem. The paper compares hidden production rules generated from data mining tools such as Decision Tree with judgmental production rules in SAIPA Kashan automaker. The classifier approach generates proper rules and removes weak rules. The implemented results show effectiveness of data mining methods in production planning.

37 - Echelon Inventory Model with Fuzzy Approach and Heuristic Solution for Supply Chain Management
Hoda Atef Yekta, University of Connecticut, 2100 Hillside Road, Unit 1041, Storrs, CT, 06269, United States of America, hoda.atefyekta@business.uconn.edu, Milad Avazbeigi, Mohammad Reza Akbari

This research proposed a nonlinear mixed integer model for Inventory management in an integrated Supply Chain with fuzzy inputs. The objective is minimizing the inventory costs of chain while considering the restriction of fill rate of final products and determine the review period time and order-up-to level of each inventory.

38 - Heuristic Algorithms for Locating the Alternative-Fuel Station Infrastructure on A Large-Scale Network
Yu-jiun (June) Tsai, Texas A&M University, Department of Industrial Engineering, College Station, TX, United States of America, yjt2009@tamu.edu

Flow refueling location model (FRLM) is used to locate a fixed number of fuel stations on a road network to maximize the roundtrips between origin and destination (O-D) pairs given the limited range of alternative-fuel vehicles. In this work, we propose a modified formulation, applying branch-and-bound, to solve the problem more efficiently. We also deploy heuristic approach to solve the problem for large-scale networks.

39 - A New Methodology to Model Construction Project Supply Chain
Kiavash Parvan, PhD Student, University of Maryland, 3405 Tulane Dr. Apt#14, Hyattsville, United States of America, kparvan@gmail.com, Hazhir Rahmandad, Ali Haghani

Uniqueness and complexity are two features that distinguish construction projects from many routine work processes. These two are the main sources of uncertainty in project prediction. The current project management tools are not able to consider change and project activities dependency. The proposed methodology introduces a new model to predict project outcomes in form of probability distributions, considering change and design-construction inter-relationship.

40 - Cycling Behavior, Self-Image, and Identity: Insights from Agent-Based Modeling
Michael Maness, University of Maryland, 1173 Glenn Martin Hall, Department of Civil and Env. Engineering, College Park, MD, 20742, United States of America, mmaness@umd.edu

This research incorporates the concept of social identity into the modeling of cycling behavior. To explore this, an agent-based model of cyclists-motorists interaction with a central infrastructure planner was created. Heterogeneous agents are given rules that balance their travel needs with their self-image by exploring and expressing their cyclist identity and interacting with others. A central planner oversees these actions and adjusts the infrastructure to the planner's and agents' goals.

41 - The Statistical Analysis of the Housing Bubble in the US Metro Areas
Hamed Ahangari, Research Assistant, University of Connecticut, 1 Northwood Rd., Apt 108, Storrs, CT, 06268, United States of America, hamed.ahangari@uconn.edu, Dennis Heffley, Norman Garrick

This paper focused on the housing bubble issue and measured it based on the statistical model. This measurement is based on the magnitude and scale of the bubble. Also, this study developed a model for categorization and location analysis of the bubble in US metro areas during 2000 - 2010.

42 - Modeling the Fuzzy Inventory Routing Problem with Backlogging
Ensieh Mohseni, Project Control Expert, Peyk Asa CO., No. 10, #4 Alley, Sadeghi Street, West corner of Sharif University, Azadi, Tehran, +98, Iran, e_mohseni@aut.ac.ir, Hoda Atef Yekta, Mohamad Hossein Fazel Zarandi

This paper presents a new fuzzy inventory routing problem with backlogging(FIRPB). In the proposed model, triangular fuzzy numbers are used for fuzzy demands, fuzzy unit shortage costs and fuzzy unit holding costs. Here, the developed model consists of multi periods and single depot. To solve such a model, a heuristic method is presented. Finally, results of the fuzzy heuristic method are analyzed.

43 - A Decision Support Framework for Healthcare Transition Programs to Reduce Hospital Readmissions
Sabrina Casucci, PhD. Candidate & Research Assistant, University at Buffalo, SUNY, Department of Industrial & Systems Eng., Amherst, NY, 14260, United States of America, scasucci@buffalo.edu, Li Lin, Alexander Nikolaev

High hospital readmissions signal poor quality of post-hospital care and unnecessarily increase healthcare costs. Intervention programs aim to reduce readmission rates; yet there is little support for understanding the effect of physician and patient care decisions on the program outcomes. This paper focuses on the complexities of transitional care and the design of informative stochastic models that can provide decision support to all the stakeholders.

44 - A Non-linear Correlation Metric
Ed Ramsden, Sensata Technologies, 529 Pleasant Street, Attleboro, MA, 02703, United States of America, earamsden@comcast.net

Pearson and Spearman correlation is useful for identifying linear or monotonic functional relationships between data variables, but are less useful for identifying the presence of non-linear relationships that would be apparent in a graphic plot. We propose a new correlation metric based on the ability to predict data from local neighbors that can identify the degree of linear and non-linear relationships that may exist between two variables in the presence of noise.

45 - A Markovian Inventory Model for Inventory Record Inaccuracy in Retail Stores
Amir Zadeh, OSU, 101 Hanner Hall Stillwater Campus, Stillwater, Ok, 74075, United States of America, amhnzadeh@gmail.com

This paper proposes a Markovian inventory model to study the impacts of inventory record inaccuracy stemming from theft error in retail stores on a continuous review lost sale (s, Q) inventory system. This model is analyzed across two scenarios depending on which technology is deployed to optimize replenishment decisions: (1) Barcode technology; (2) RFID.

46 - A Conceptual Design and Estimated Costing for CdTe PV Factory
Hershall Shelley, Graduate Student and Professor, Colorado State University and Solar Energy and Engineering Systems, 2401 Greenlee Drive, 2401 Greenlee Drive, Austin, US, 78703, United States of America, hshelley@engr.colostate.edu

The development of a procedure is critical to an emerging product. An interactive computer parametric modeling tool will help the decision making process. This study by Bonnet is used as the baseline for a modeling and analysis tool for analyzing defender and challenger factory costs. The model is used to estimate associated expenses for defender and challenger factories. An ABC method is also presented. Finally, a defender and challenger replacement analysis is presented.

47 - An Overview of Integrated Network Design and Scheduling Problems
Sarah Nurre, PhD Student, Rensselaer Polytechnic Institute, 110 8th Street CII 5015, Troy, NY, 12180, United States of America, nurres@rpi.edu, Thomas Sharkey

We discuss the new problem class denoted Integrated Network Design and Scheduling (INDS) Problems. A broad overview of INDS problems will be presented, including complexity results, solution methods, computational results, and their applications in infrastructure restoration and humanitarian logistics. INDS problem extensions are examined, specifically an online optimization framework.

48 - A New Flexible Distribution for Discrete Outcomes
Eugene Hahn, Associate Professor, Salisbury University, 1101 Camden Ave., Salisbury, MD, 21801, United States of America, edhahn@salisbury.edu

A new distribution is introduced for the modeling of discrete outcomes called the tilted beta rectangular binomial distribution. The distribution nests the beta binomial distribution as a special case while allowing greater overdispersion. Preliminary results and modeling applications are presented.

49 - Real Time Optimization of Emergency Response using Social Media Data
Christie Nelson, Rutgers University, 640 Bartholomew Rd, Piscataway, NJ, 08854, United States of America, cgrewe@eden.rutgers.edu, William M. Pottenger

During real emergencies, social media data can be leveraged to improve resource allocation and response. Results found from using Higher-Order Topic Modeling on social media data can help to gain valuable insight into what additional resources are needed and where they are needed during an emergency. The Topic Modeling results can then be used as resources in a Linear Programming optimization model. In particular, this project looks at text messages sent during the Haiti 2010 earthquake.

50 - GridPick: A High Density Dynamic Picking System
Onur Uludag, Auburn University, Industrial and System Engineering, Alabama, United States of America, ozu0001@tigermail.auburn.edu

We present a new approach for carton and piece picking operations in the distribution centers. The system has a decentralized control algorithm based on a message-passing protocol in which each cell com- municate with their local neighborhood for the movement of items. In the proposed system, a dynamically changing pick face provides high sku density and low worker travel. Analysis show that introduced sys- tem enables 20% to 50% more picks per unit time compared to a flow rack. We use Petri Nets tool to model system and show structural properties such as deadlock-freeness.

Monday, 1:30pm - 3:00pm

■ MC01

01- West 101- CC

New Relaxation/Convexification Techniques in Global Optimization

Sponsor: Optimization/Global Optimization

Sponsored Session

Chair: Jiming Peng, University of Illinois at Urbana-Champaign, 801 South Wright Street, Urbana, IL, 61801, United States of America, pengj@illinois.edu

1 - A Nonlinear Semidefinite Relaxation for the Worst-case Linear Optimization under Uncertainties
Tao Zhu, University of Illinois at Urbana-Champaign, 104 S. Mathews Ave., Room 117, Urbana, Il, 61801, United States of America, taozhu1@illinois.edu, Jiming Peng

In this paper, we consider the so-called worst-case linear optimization (WCLO) with uncertain constraints. Such a problem arises from numerous applications such as systemic risk estimate in finance and stochastic optimization. A tractable nonlinear semidefinite relaxation model is derived. Our preliminary experimental results illustrate that the nonlinear SDR can provide very tight bounds for the original WCLO and is able to locate the exact global solution in most cases.

2 - Solving Nonconvex NLPs and MINLPs with BARON
Nick Sahinidis, Swearingen Professor, Carnegie Mellon University, Department of Chemical Engineering, Pittsburgh, PA, United States of America, sahinidis@cmu.edu

We report recent developments in the global optimization software BARON. These include new simultaneous convexification techniques, a convexity detection facility, and new interfaces to a variety of modeling systems. Extensive computational results will be presented.

3 - Nonlinear Semidefite Programming Approach for Quadratically Constrained Quadratic Programming
Jiming Peng, University of Illinois at Urbana-Champaign, 801 South Wright Street, Urbana, IL, 61801, United States of America, pengj@illinois.edu

QCQP is a powerful model that arises from various applications and known to be NP-hard. In this talk, we introduce a new class of approximation algorithms based on nonlinear SDP via integrating semidefinite relaxation and a special kind of penalty method. The new NLSDP can provide tighter bound for QCQP than the standard SDP. A bi-section search algorithm is proposed to solve the NLSDP. The computational complexity of the algorithm is estimated and numerical results will be reported.

4 - Higher-rank Order Semidefinite Cuts for Quadratic and Polynomial Programming Problems
Jitamitra Desai, Assistant professor, Nanyang Technological University, 50 Nanyang Avenue, Singapore, Singapore, jdesai@ntu.edu.sg

Given an RLT-based LP relaxation, along with imposing nonnegativity on the RLT product variables, PSD constraints on suitable dyadic variable-product matrices can also be used to derive implied semidefinite cuts. Previously known cuts are generated using coefficient matrices of rank one. Here, we present a cut generation algorithm for higher-rank order semidefinite cuts based on a congruent transformation scheme. Numerical examples will be used to illustrate the proposed cutting plane strategy.

■ MC02

02- West 102 A- CC

Panel Discussion: The Role of Decision Professionals in the Analytics Movement

Sponsor: Decision Analysis

Sponsored Session

Chair: Carl Spetzler, CEO, Strategic Decisions Group, 745 Emerson Street, Palo Alto, CA, 94301, United States of America, cspetzler@sdg.com

1 - The Role of Decison Professionals in the Analytics Movement
Moderator: Carl Spetzler, CEO, Strategic Decisions Group, 745 Emerson Street, Palo Alto, CA, 94301, United States of America, cspetzler@sdg.com, Panelists: Vince Barabba, Robert Bordley, Don Kleinmuntz

The Analytics Movement is "hot". The movement marries big data and OR to create insight. In this session a panel of DA leaders will address questions, such as: Where does big data and the consultative role of a decision professionl meet? What is new for the decision professional? Is Business Analytics on top of big data naturally focused on near term and optimization of smaller decisions? How do we marry expert judgment with data based analytics?

■ MC03

03- West 102 B- CC

Group Utility, Change, and Multiple Attributes

Sponsor: Decision Analysis

Sponsored Session

Chair: Ali Abbas, Associate Professor, University of Illinois at Urbana-Champaign, 104 S. Mathews Ave, Urbana, IL, 61822, United States of America, aliabbas@illinois.edu

1 - A Solution to the Group Decision Problem
Ralph Keeney, Fuqua School of Business, 101 Lombard St., #704W, San Francisco, CA, 94111, United States of America, keeneyr@aol.com

All previous attempts to develop a decision analysis model for group decisions made the implicit assumption that group members had the same decision frame for their joint decision problem. Accounting for member's different frames, a general prescriptive model for group decisions is developed consistent with standard decision analysis assumptions.

2 - An MCDA Approach to Synthetic Route Selection
James Felli, Research Fellow, Eli Lilly and Company, Indianapolis, IN, United States of America, felli_james_c@lilly.com, Peter G. Houghton, Douglas P. Kjell

During the early stages of pharmaceutical process development, development teams need to make synthesis process selections quickly in order to meet demand for clinical trial materials. We will present an MCDA tool we developed to help chemists organize, present and differentiate among key criteria to select a synthetic route to a new active pharmaceutical ingredient.

3 - Valuing Changes in Investment Opportunities
Ali Abbas, Associate Professor, University of Illinois at Urbana-Champaign, 104 S. Mathews Ave., Urbana, IL, 61822, United States of America, aliabbas@illinois.edu

I introduce two new measures for characterizing changes in the valuation of uncertain lotteries when their outcomes are modified by a monotone transformation. The first is a characteristic transformation whose shape determines bounds on the certainty equivalent of the modified lottery. The second is a measure of change whose magnitude determines the change in value of a "small-risk" lottery when its outcomes are modified by a monotone transformation.

4 - State-dependent Hyperbolic Discounting
Casey Lichtendahl, Assistant Professor, University of Virginia, Darden School of Business, 100 Darden Blvd, Charlottesville, VA, 22903, United States of America, lichtendahlc@darden.virginia.edu, Yael Grushka-Cockayne, Daniel Read

We show that background risk and state-dependent choices can accommodate the two aspects of hyperbolic discounting: decreasing impatience and time inconsistency. We apply a multiattribute utility model and find that decreasing impatience and an apparent time inconsistency can arise as a natural consequence of state-dependent dynamic choices. In addition, we show that the same dynamic-programming framework can accommodate hypobolic discounting and other phenomena.

■ MC04

04- West 102 C- CC

Methodological and Applications Issues in MCDM Models

Sponsor: Multiple Criteria Decision Making

Sponsored Session

Chair: Adiel Almeida, Professor, Federal University of Pernambuco, Cx. Postal 7462, Recife, 50.630-970, Brazil, almeidaatd@gmail.com

1 - A MCDM Model for Popular Demands Priority Classification: The Campina Grande City Council Participatory
Adiel Almeida-Filho, Assistant Professor, UFPE, Cx Postal 7471, Recife, PE, 50.630-971, Brazil, atalmeidafilho@yahoo.com.br, Mayne Almeida

This work presents a model and a case study for one of the stages of Campina Grande City Council participatory budget. In this work was considered the first stage of the process where popular demands are obtained from the population. The proposed model deals with the secretary leve,l considering the government programs and government strategy, classifying the population requests (alternatives) into three priority classes through Promsort method.

2 - Decision Support System for Qualitative Intra-criteria Evaluation
Danielle Morais, Assistant Professor, Federal University of Pernambuco, R. Cons. Portela, 169/701., Recife, PE, 52020-030, Brazil, daniellemorais@yahoo.com.br, Adiel Almeida

In multicriteria problems, decision-makers (DM) normally feel difficult to evaluate alternatives under qualitative criteria. Commonly, the elicitation process uses a fixed nominal scale. This paper presents a decision support system which performs a 'playing cards' procedure, facilitating to rank alternatives and also introducing a cardinal notion. The system allows quantify the alternatives based on their rank position, without requires a fixed scale size.

3 - A Multicriteria Decision Model to Support Public Safety Planning
Caroline Mota, Assistant Professor, Universidade Federal de Pernambuco, Av. Prof. Morais Ramos s/n, Recife, Brazil, carol3m@gmail.com, Andrè Gurgel

Public safety planning is a subject of great interest in the modern society. This article proposes a multicriteria decision model that seeks to prioritize areas for a given region using demographic and socioeconomic issues. Consequently, it's possible to perform different strategies in a region according to a set of factors that can influence criminality. The model was applied in Brazilian city.

4 - MCDM Models in Project Portfolio Selection

Adiel Almeida, Professor, Federal University of Pernambuco, Cx. Postal 7462, Recife, 50.630-970, Brazil, almeidaatd@gmail.com

Selection of Project portfolio based on multicriteria decision making (MCDM) methods is analyzed. MCDM compensatory and non-compensatory methods are considered, with emphasis to outranking and additive methods. Problems related to scales used for intra-criteria evaluation are considered. Considerations are given to applications on Research and Development (R&D) project portfolio selection.

■ MC05

05- West 103 A- CC

Joint Session QSR/DM: Predictive Analytics Applications II

Sponsor: Quality, Statistics and Reliability & Data Mining

Sponsored Session

Chair: Paul Goethals, Department of Mathematical Sciences, United States Military Academy, West Point, NY, United States of America, paul.goethals@usma.edu

1 - The Effect of the Three-Point Shot on the Game of Basketball

Paul Goethals, Department of Mathematical Sciences, United States Military Academy, West Point, NY, United States of America, paul.goethals@usma.edu, Tina Hartley

In the 1979-1980 and 1986-1987 basketball seasons for the National Basketball Association and the National Collegiate Athletic Association, respectively, the three-point shot rule was enacted. The rule enables teams to receive three-points, rather than two, for each shot made beyond a designated arc surrounding the basket. This research examines the effect of this rule on the game of basketball at both the professional and collegiate-levels, using statistical analyses of trends in performance.

2 - Development of a Quality Evaluation Scheme for Smartphone Product Service Systems

Hyun-Jin Kim, Pohang University of Science and Technology, Nam-Gu Hyoja-Dong San 31, Pohang, Korea, Republic of, hj_kim@postech.ac.kr, Kwang-Jae Kim

A combination of smartphone hardware and its related services is a representative case of product service systems (PSS). In addition to the hardware, the services, which provide users with various contents by web or applications, are major sources of customer satisfaction. Hence, when evaluating quality of smartphone, the quality of its related services should be considered. In this talk, we present a scheme for evaluating the quality of smartphone PSS.

3 - Expanding an Expected Goals Model for Evaulating NHL Teams and Players

Nicholas Clark, Instructor, Math Department USMA, Thayer Hall, West Point, NY, 10996, United States of America, nicholas.clark@usma.edu, Derek Burt, Brian Macdonald, Michael Findlay

One difficulty with analyzing performance in hockey is the relatively low scoring rate. In this paper, we predict goals using non-traditional regression techniques. Our models outperform other models used in the sport with regard to L2 norm between actual goals vs predicted goals. We estimate a player's contribution to his team's expected goals per 60 minutes. The results for expected goals provide an additional means by which NHL analysts can measure how valuable a player is to his team.

4 - Realignment in the NHL as a Quadratic Assignment Problem

Brian Macdonald, Assistant Professor, Math Department USMA, Thayer Hall, West Point, NY, 10996, United States of America, brian.macdonald@usma.edu, William Pulleyblank

The NHL has been planning realignment since the Atlanta Thrashers moved to Winnipeg, becoming the Jets. The Jets remained in the Southeast Division, creating an excessive amount of travel for those teams. We ask the question: Which teams should be in which divisions in order to minimize a weighted sum of the distances between each pair of cities? This optimization problem can be framed as a quadratic assignment problem. We report on ``good" league structures under a variety of conditions.

■ MC06

06- West 103 B- CC

Joint Session Sim/QSR: Design of Experiments and Statistical Analysis for Simulation

Sponsor: Simulation & Quality, Statistics and Reliability

Sponsored Session

Chair: Feng Yang, Assistant Professor, West Virginia University, P.O. Box 6070, Morgantown, WV, 26506, United States of America, feng.yang@mail.wvu.edu

Co-Chair: Hong Wan, Associate Professor, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47907, United States of America, hwan@purdue.edu

1 - Quoting Customer Lead Time via Simulation-based Statistical Methods

Minqi Li, PhD Student, West Virginia University, 777 Chestnut Ridge Road, Morgantown, WV, 26505, United States of America, mli6@mix.wvu.edu, John Fowler, Feng Yang, Hong Wan

A comprehensive framework is developed to model the lead time distribution of a new order as a function of the shop status characteristics. An experimental design methodology is developed to investigate the dependence of lead time upon a complete and non-redundant set of shop status factors. Statistical models are estimated from well-designed simulation experiments for lead time quotation.

2 - Sliced Full Factorial-based LHDs as a Framework for a Batch Sequential Design Algorithm

Weitao Duan, Graduate Student, Northwestern University, Department of Industrial Engineering, 2145 Sheridan Rd., Evanston, IL, 60208, United States of America, WeitaoDuan2013@u.northwestern.edu, Bruce Ankenman

Sequential design strategies allow experimenters to collect data only until prediction precision is sufficient. We present a batch sequential experiment design algorithm that is based on sliced Full Factorial-Based Latin Hypercube Designs, an extension OA-based LHDs. The structure of the FF-based LHD produces good projectivity and orthogonality throughout the stages of the design. We then demonstrate the sampling and fitting properties through both empirical studies and theoretical arguments.

3 - Using Discrete Optimization via Simulation to Improve Semiconductor Manufacturing Production Planning

Jie Xu, Assistant Professor, George Mason University, 4400 University Dr, MS 4A6, GMU Engr Bldg RM2100, Fairfax, VA, 22030, United States of America, jxu13@gmu.edu, Feng Yang

Production planning is a very challenging problem in a semiconductor manufacturing system due to the variability in the manufacturing system and the uncertainty in demand. No existing analytic model can realistically capture both effects and design an optimal production plan accordingly. We propose to use a discrete-event simulation model to realistically describe the variability and uncertainty and develop an optimization via simulation algorithm to solve the production planning problem.

4 - The Incentive Effect of Acceptance Sampling Plans in a Supply Chain with Endogenous Product Quality

Tian Ni, PhD Student, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47907, United States of America, ni10@purdue.edu, Hong Wan, Xiaowei Xu

This paper studies a firm that procures a product from a supplier with endogenous product quality. The firm determines the acceptance sampling plan and the supplier determines the quality effort level in either a simultaneous or a Stackelberg leadership game. We identify the Nash equilibriums, and show the firm's and the supplier's optimal strategies are sensitive to both the recall loss sharing ratio and the game format.

■ MC07

07- West 104 A- CC

Machine Learning II

Sponsor: Data Mining

Sponsored Session

Chair: Cynthia Rudin, Assistant Professor, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, United States of America, rudin@mit.edu

1 - Analyzing the Effect of Comorbidities on Delay in Discharge among Breast Cancer Inpatients

Shengfan Zhang, Assistant Professor, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, shengfan@mail.uark.edu, Hui Wang, Wei Bao

It is estimated that by 2030, there will be more than 70 million persons 65 years and older in the U.S., which is expected to be approximately 19% of the population by then. When admitted to a hospital, older patients usually have more than one comorbid conditions in addition to their primary diagnosis. This study seeks to explore the effect of comorbidities on the discrepancies between actual hospitalization charges and the Medicare reimbursement rates among breast cancer inpatients.

2 - Relaxed Support Vector Machines and Extensions

Onur Seref, Assistant Professor, Virginia Tech, 1007 Pamplin Hall, Blacksburg, VA, 24061, United States of America, seref@vt.edu

Relaxed support vector machines (RSVM) are variations of support vector machines, which feature a restricted budget for penalty-free slack, which is usually consumed by samples that would otherwise incur high penalty. RSVM have previously been proposed for binary classification and multiple instance classification. We propose extensions of RSVM to one-class and multi-class cases, and to support vector regression. We compare results on synthetic data and public benchmark datasets.

3 - Empirical Dynamic Complex Network Model of Genetic Expression Processes

Hoang Tran, Oklahoma State University, 322 Engineering North, Stillwater, OK, United States of America, hoangmt@ostatemail.okstate.edu, Satish Bukkapatnam

Abstract In this paper, we present an approach to reconstruct the nonlinear dynamics of a complex network from a high-dimensional vector time-series based on causality analysis. It overcomes the challenges associated with sparse time samples, large parameter space, and the need for accurate priors with previous Bayesian network models. Our method is applied to study the data set on genetic expression of Drosophila melanogaster using a sequence of DNA microarray data.

■ MC08

08- West 104 B- CC

Nonprofit Supply Chains

Sponsor: Public Programs, Service and Needs

Sponsored Session

Chair: Gemma Berenguer, Purdue University, Krannert School of Management, West Lafayette, IN, United States of America, gemmabf@purdue.edu

1 - Nonprofit Supply Chain Design: The Solar Cooking Case

Gemma Berenguer, Purdue University, Krannert School of Management, West Lafayette, IN, United States of America, gemmabf@purdue.edu, Z. Max Shen

The research community is paying increasing attention to the analysis of nonprofit practices that can differ from for-profit ones. In this talk we discuss the particularities of the private nonprofit organization (NPO) and, by extension, its supply chain. We illustrate this analysis with a case study of an NPO that introduces solar cooking to low-income countries with the objectives of improving social, economic, and environmental conditions. We focus on this NPO's supply chain design problems.

2 - The Effect of Earmarked Funding on Fleet Management for Relief and Development

Maria Besiou, Kuehne Logistics University-THE KLU, Brooktorkai 20, Hamburg, 20457, Germany, Maria.Besiou@the-klu.org, Luk Van Wassenhove, Alfonso Pedraza Martinez

International Humanitarian Organizations (IHO) often implement relief and development programs simultaneously, their operations can be decentralized and their funding can be earmarked. Using system dynamics we find that due to the interaction of dual mission and earmarked funding, a system with local procurement and a short lead time may consistently take longer to supply transportation for disaster response than a system with global procurement and high lead time.

3 - Multiproduct Humanitarian Healthcare Supply Chains: A Network Modeling and Computational Framework

Min Yu, University of Portland, 5000 N Willamette Blvd., Portland, OR, 97203, United States of America, myu@som.umass.edu, Anna Nagurney, Patrick Qiang

We develop a model for supply chain network design/redesign in the case of multiple products, with particular relevance to humanitarian healthcare. The model can be utilized for the determination of the optimal allocation of resources for multiple vaccine and medicine production, storage, and distribution to points of need in the case of disasters or epidemics. It may also be used by organizations to quantify the humanitarian healthcare supply chain costs in a transparent way to stakeholders.

4 - Fleet Management Coordination in Decentralized Humanitarian Operations

Alfonso Pedraza Martinez, Indiana University, Kelley School of Business, Bloomington, IN, United States of America, alpedraz@indiana.edu, Sameer Hasija, Luk Van Wassenhove

Motivated by extensive field research we study incentive alignment to coordinate humanitarian operations. In large international humanitarian organizations efficiency/equity balancing headquarters assign operational capacity to equity-oriented programs. This creates a misalignment of incentives complicated by earmarked funding of vehicles. We propose an operational mechanism design for system coordination.

■ MC09

09- West 105 A- CC

Behavioral Issues in MCDM

Sponsor: Multiple Criteria Decision Making

Sponsored Session

Chair: Hannele Wallenius, Professor, Aalto University, Otaniementie 17, Espoo, Finland, hannele.wallenius@aalto.fi

1 - Can A Linear Value Function Explain Choices? An Experimental Study

Jyrki Wallenius, Professor, Aalto University School of Economics, Runeberginkatu 22-24, Helsinki, 00100, Finland, jyrki.wallenius@aalto.fi, Pekka Korhonen, Kari Silvennoinen, Anssi Öörni

We investigate in a simple bi-criteria experimental study, whether subjects are consistent with a linear value function while making binary choices. Many inconsistencies appeared in our experiment. However, the impact of inconsistencies on the linearity vs. non-linearity of the value function was minor. Moreover, a linear value function seems to predict choices for bi-criteria problems quite well. This ability to predict is independent of whether the value function is diagnosed linear or not.

2 - Constructing a Strict Total Order for Alternatives Characterized by Multiple Criteria

Akram Dehnokhalaji, Assistant Professor, Kharazmi University (Tehran) and Aalto University School of Economics, Department of Mathematics, Tehran, Iran, akramdehnokhalaji@gmail.com, Pekka Korhonen, Murat Köksalan, Jyrki Wallenius, Nasim Nasrabadi

The problem of finding a strict total order for a finite set of multiple criteria alternatives is considered. We extend previous work by us to find a partial order for a finite set of alternatives. The preference information from the preference cones and polyhedral sets and pairwise comparisons yields a preference matrix. The resulting binary relation may not be transitive. We construct an integer programming model resulting a strict total order to rank alternatives.

3 - A Careful Look at Criterion Importance and Weights
Pekka Korhonen, Professor, Aalto University, School of Economics, Helsinki, 00100, Finland, pekka.korhonen@aalto.fi, Jyrki Wallenius, Kari Silvennoinen, Anssi Öörni

We study the connection between announced importance of criteria and weights, when a linear value function is assumed to represent DM's preferences. Based on an experimental setting, we use the subjects' responses to estimate the weights for the criteria in the linear value function. The value function explains choices very well, but our results imply that there is a reason to question the common belief that the values of the weights would reflect the importance of criteria.

4 - Consumer Preferences for Sustainability and their Impact on SCM: The Case of Mobile Phones
Markku Kuula, Professor, Aalto University School of Economics, Runeberginkatu 22-24, Helsinki, Finland, markku.kuula@aalto.fi, Anu Bask, Merja Halme, Markku Kallio

The consumers are interested in sustainable development. In the case of mobile phones we identify and assess the value of relevant product features related to sustainability in supply chains. Focus-group discussions identified the potential attributes that might affect the product choice. Choice-based conjoint analysis was used to assess the importance of the attributes. We found that, there are consumers who are willing to pay a premium for features that promote sustainable development.

■ MC10

10- West 105 B- CC

Advances in Stochastic and Robust Utility Optimization

Sponsor: Optimization/Stochastic Programming

Sponsored Session

Chair: Sanjay Mehrotra, Professor, Northwestern University, 2145 Sheridan Rd., Evanston, IL, United States of America, mehrotra@iems.northwestern.edu

1 - New Results in Scenario Generation for Stochastic Optimization Problems via the Sparse Grid Method
David Papp, Postdoctoral Fellow, Northwestern University, IE/MS, 2145 Sheridan Rd C210, Evanston, IL, 60208, United States of America, dpapp@iems.northwestern.edu, Sanjay Mehrotra, Shenyuan Chen

We present a sparse grid method for scenario generation when the uncertainty is modeled using a continuous multivariate distribution. The sequence of optimal solutions of the approximations converges to the true optimum. An improvement is presented when the uncertainty is given by a linear transform of a product of univariate distributions. Experiments show that the sparse grid method is very efficient for smooth integrands, and that it is potentially scalable to thousands of random variables.

2 - Robust Sparse Regression and Orthogonal Matching Pursuit
Yudong Chen, The University of Texas at Austin, 1 University Station, Austin, TX, 78712, United States of America, ydchen@utexas.edu

We consider support recovery in sparse regression, when a subset of the covariate/response pairs is arbitrarily corrupted. All existing tractable methods fail to provide any guarantees. Surprisingly, the natural brute force algorithm is also remarkably poor. In contrast, we provide a simple algorithm that gives stronger performance guarantees. Moreover, we compare our formulation with robust optimization, and demonstrate interesting connection and difference between them.

3 - Robust Decision Making using a Risk-averse Utility Set
Jian Hu, Assistant Professor, University of Michigan-Dearborn, 4901 Evergreen Rd., IMSE Department, Dearborn, MI, 48128, United States of America, jianhu2010@u.northwestern.edu, Sanjay Mehrotra

We develop a flexible decision making framework using the concept of utility robustness to address the problem of ambiguity and inconsistency in utility assessments. Boundary and auxiliary conditions are used to describe a utility set that characterizes a decision maker's risk attitude. Reformulation and convergence results are given for the discrete and continuous specifications of the utility set. A portfolio investment decision problem is used to illustrate the basic ideas.

4 - Robust Decision Making using a General Utility Set
Sanjay Mehrotra, Professor, Northwestern University, 2145 Sheridan Rd., Evanston, IL, United States of America, mehrotra@iems.northwestern.edu, Jian Hu

A robust decision-making framework is built on a general utility set which characterizes a decision maker's risk attitude described by certain boundary and auxiliary conditions. This framework is studied using the Sample Average Approximation (SAA) approach. We shows the asymptomatic convergence and give a mixed-integer reformulation. An application of this framework is illustrated using a portfolio investment decision problem.

■ MC11

11- West 105 C- CC

Robust Optimization and Applications

Sponsor: Optimization/Stochastic Programming

Sponsored Session

Chair: Muhong Zhang, Assistant Professor, Arizona State University, 699 S. Mill Ave., Brickyard Engineering (BYENG) 553, Tempe, AZ, 85281, United States of America, Muhong.Zhang@asu.edu

1 - Robust Optimization Method for Combined Chemo/Radiation Treatment Planning
Omid Nohadani, Assistant Professor, Purdue University, 315 N. Grant, West Lafayette, IN, 47907, United States of America, nohadani@purdue.edu

The treatment of cancerous tumors with external radiation is planned based on initial data and independent of other modalities, resulting in strategies that do not vary over the course of the treatment. However, the sensitivity of the tissue to radiation changes over time, particularly when chemotherapeutic agents are combined. Based on clinical cases, we demonstrate that robust plans account for temporal changes and are intrinsically insensitive to deviations from the assumed temporal path.

2 - Two-stage Minimax Regret Robust Uncapacitated Lot-Sizing
Muhong Zhang, Assistant Professor, Arizona State University, 699 S. Mill Ave., Brickyard Engineering (BYENG) 553, Tempe, AZ, 85281, United States of America, Muhong.Zhang@asu.edu

In this talk, we consider the two-stage minimax robust uncapacitated lot-sizing problem with interval uncertain demands. A mixed integer programming formulation is proposed. Even though the robust uncapacitated lot-sizing problem with discrete scenarios is an NP-hard problem, we show that it is polynomial solvable under the interval uncertain demand set.

3 - Routing Optimization with Deadlines under Uncertainty
Jin Qi, National University of Singapore, Mochtar Riady Building, BIZ1-8-76, 15 Kent Ridge Drive, Singapore 119245, Singapore, qijin@nus.edu.sg, Melvyn Sim, Patrick Jaillet

We study a routing problem with deadlines imposed at a given subset of nodes, and uncertain arc travel times characterized by distributional information set. By introducing a new measure named Lateness Index to evaluate the performance of meeting deadlines, we show that the special case, in which only one node has a deadline requirement, is polynomially solvable. Moreover, for the general case, we could find exact optimal routing policy by only solving a series of deterministic routing problems.

■ MC12

12- West 106 A- CC

Convex Relaxations for Mixed-integer Nonlinear Programs

Sponsor: Optimization/Integer Programming

Sponsored Session

Chair: James Luedtke, University of Wisconsin-Madison, 1513 University Ave, Madison, WI, 53706, United States of America, jrluedt1@wisc.edu

1 - Stronger Relaxations using Optimality Constraints for Global Optimization of Unconstrained NLPs
Yash Puranik, Carnegie Mellon University, Department of Chemical Engineering, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, ypp@andrew.cmu.edu, Nick Sahinidis

We discuss a methodology for obtaining tighter convex relations using first order optimality conditions, in the context of the lower bounding step for a spatial branch and bound framework for global optimization. We demonstrate a speed up in convergence in a test set of 200 problems using our framework

2 - New Linearization Strategies for Mixed Integer Nonlinear Programs

Mahdi Hamzeei, Research Assistant, University of Wisconsin-Madison, 3241 Mechanical Engineering Building, 1513 University Avenue, Madison, WI, 53706, United States of America, hamzeei@wisc.edu, James Luedtke

We introduce new strategies to add linearizations in linearization-based algorithms to MINLPs where only the convexity of feasible region is assumed. Existing algorithms derive linearizations over the solution of certain sub-problems. We show how, using line-search methods, we obtain other points to take more efficient linearizations. Furthermore, we investigate using other sub-problems. Finally in numerical results, we compare the performance of new strategies against the existing algorithms.

3 - A Branch-and-Cut Algorithm for Convex MINLPs

Serdar Yildiz, PhD Candidate, Lehigh University, 200 West Packer Ave., Bethlehem, PA, 18015, United States of America, sey309@Lehigh.edu, Ashutosh Mahajan

We present a branch-and-cut algorithm for solving convex mixed-integer nonlinear optimization (MINLP) problems. In contrast to the linearization-based approach of adding cutting planes to a linear relaxation of the MINLP, we add cuts directly to the continuous nonlinear-relaxation. We describe methods used to derive cuts from special combinatorial structures and nonlinear functions. Results obtained from computational experiments performed using the open source MINOTAUR toolkit are presented.

4 - Lifted Cuts for Box Constrained Quadratic Programming with Indicators

Hongbo Dong, Postdoc, University of Wisconsin-Madison, 330 North Orchard Street, Madison, WI, 53705, United States of America, hdong6@wisc.edu, Jeff Linderoth, Hyemin Jeon

We study the box constrained quadratic programs with binary indicators that act as "on/off" switch for each continuous variable. This structure appears in many MINLPs. We show how PSD cuts for box constrained quadratic programs can be lifted to include binary indicators. Further we show the separation problem for the related class of lifted concave QPB cuts can be solved via Semidefinite Programming. Finally we explore strategies to use these cuts in practice.

■ MC13

13- West 106 B- CC

Advanced Methods in Linear Programming

Sponsor: Optimization/Linear Programming and Complementarity

Sponsored Session

Chair: Dan Li, Lehigh University, 200 West Packer Ave, Bethlehem, PA, 18015, United States of America, dal207@Lehigh.EDU

1 - The Duality between the Perceptron Algorithm and the von Neumann Algorithm

Dan Li, Lehigh University, 200 West Packer Ave., Bethlehem, PA, 18015, United States of America, dal207@Lehigh.EDU, Tamás Terlaky

We investigate and reveal the duality relationship between the perceptron and the von Neumann algorithms. We interpret variants of the perceptron algorithm as variants of the von Neumann algorithm, and vice-versa; as well as transit the complexity results from one family to the other. Further, an Approximate Farkas Lemma enables us to derive bounds for the distance to the feasibility or infeasibility from approximate solutions of the alternative systems.

2 - A Smooth Perceptron - von Neumann Algorithm

Negar Soheili, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Ave., Pittsburgh, PA, 15213, United States of America, nsoheili@andrew.cmu.edu, Javier Pena

The perceptron and von Neumann algorithms for solving linear programming feasibility problems have attracted attention due to their simplicity and popularity in machine learning. A major limitation of these algorithms is that they exhibit slow convergence. We overcome this limitation by developing a procedure that combines smooth versions of these algorithms and retains their original simplicity. Further, we generalize it to solve conic systems.

3 - Sparse Grid Interpolation in Linear Programming

Emanuele Borgonovo, Professor, Bocconi University, Via Roentgen 1, Milan, Italy, emanuele.borgonovo@unibocconi.it, Richard Wendell, Greg Buzzard

In this work, we propose the utilization of sparse grid interpolation in linear programming. We show that this approach, when coupled with functional ANOVA, allows decision-makers to broaden the range of managerial insights obtained by sensitivity analysis. The connection with the tolerance sensitivity approach is discussed.

■ MC14

14- West 106 C- CC

Modern Scheduling Applications and Theory

Cluster: Scheduling and Project Management

Invited Session

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

1 - Dynamic Programming Based Mechanism for Energy Aware Scheduling

Rodrigo Carrasco, Columbia University, 500 West 120th Street, 313A S. W. Mudd Building, New York City, NY, 10027, United States of America, rac2159@columbia.edu, Garud Iyengar, Cliff Stein

Controlling power consumption in the context of scheduling is fast becoming a very important research problem. Here we present new dynamic programming based mechanisms for energy aware scheduling in which our objective is to minimize the sum of the total weighted completion time and the total energy consumption of the jobs processed.

2 - Scheduling Cluster Tools in Semiconductor Manufacturing

Emrah Cimren, Industrial Engineer, Micron Technology, 9600 Godwin Drive, Manassas, VA, 20110, United States of America, ecimren@micron.com, Marc Posner, DJ Kim

Cluster tools, which consist of several processing modules and transport robots, are one of the expensive equipments used in semiconductor manufacturing. We develop a methodology to determine optimal schedules for cluster tools. The proposed approach provides route of products in the tool with the minimum cycle time. We provide properties of optimal solution and a characterization of the optimal schedule. Computational results show the effectiveness of the methodology in practice.

3 - Online Production Planning and Information Purchase to Maximize On-Time Orders

Nicholas Hall, Professor, Ohio State University, 2100 Neil Avenue, Columbus, OH, United States of America, hall.33@osu.edu, Chris Potts, Marc Posner

We consider a two period production planning problem. In the first period full information is known; new orders are available in the second period. The objective is to maximize the proportion of on-time orders. We describe an efficient algorithm with asymptotically best possible performance that depends on the relative period lengths. We study the sensitivity of performance to the decision maker's choices. We describe an algorithm that makes asymptotically optimal use of purchased information.

4 - Parallel Machine Scheduling to Minimize Overtime and Waste Costs

Nickolas Freeman, PhD Student, University of Alabama, Box 870226, Tuscaloosa, AL, United States of America, nkfreeman@cba.ua.edu, John Mittenthal, Sharif Melouk

We consider a parallel machine scheduling problem with sequence dependent setup times and costs, where production waste and processing times depend on machine assignments. We use an MIP formulation to minimize overtime and waste costs which captures trade-offs between these cost components. We also develop two heuristic solution approaches and bounds on their solution quality. Experiments show our approach outperforms more traditional scheduling objectives with respect to the costs considered.

■ MC15

15- West 202- CC

Software Demonstration

Invited Session

1 - FICO - Introducing Xpress-Insight: Quick Visual Interaction with Optimization Models

Oliver Bastert, oliverbastert@fico.com

This demo will show you how to turn an optimization model into a full optimization application in minutes. Using the new FICO Xpress-Insight, you can start with an optimization model, create optimization scenarios, and compare and visually analyze the execution results. We'll explain how to customize Xpress-Insight and how to embed advanced custom user interfaces. In addition, we will give an overview of FICO's array of mathematical modeling and optimization tools, including FICO® Xpress Optimization Suite and FICO® Decision Optimizer.

2 - Imagine That, Inc.- ExtendSim Simulation Software
Dave Krahl, Technology Evangelist, Imagine That, Inc., 6830 Via Del Oro, #230, San Jose CA 95119, United States of America, davek@extendsim.com

Experience for yourself the ease of use, flexibility, and power of a professional simulation tool – ExtendSim. Use custom interactive model interfaces and hierarchical submodels to rapidly explore simulation concepts and design options. Realize why ExtendSim is the power tool of choice in the simulation industry. Don't miss this demo!

■ MC16

16- West 207- CC

Regenerative Medicine Manufacturing– A Systems Engineering Perspective

Cluster: Tutorials

Invited Session

Chair: Richard A. Wysk, Dopaco Distinguished Professor, North Carolina State University, Department of ISE, Raleigh, NC, United States of America, rawysk@ncsu.edu

1 - Regenerative Medicine Manufacturing– A Systems Engineering Perspective
Richard A. Wysk, Dopaco Distinguished Professor, North Carolina State University, Department of ISE, Raleigh, NC, United States of America, rawysk@ncsu.edu, Molly Purser, Paul Cohen, Rohan Shirwaiker, Ola Harrysson

This tutorial introduces the basic concepts associated with a regenerative medicine manufacturing (RMM) system. A background of regenerative medicine, the critical factors involved in its scale-up translation, and an overview of a systems engineering approach for RMM system design are presented.

■ MC17

17- West 208 B- CC

Mentoring Undergraduate Research

Sponsor: INFORM-ED

Sponsored Session

Chair: Janet McLeavey, Professor, United States Coast Guard Academy, 15 Mohegan Ave, New London, CT, 06320, United States of America, Janet.A.McLeavey@uscga.edu

1 - Managing Student Collaboration on Multi-disciplinary Projects
Melinda McGurer, Captain, U.S. Coast Guard Academy, 15 Mohegan Ave., New London, CT, 06320, United States of America, Melinda.D.McGurer@uscg.mil, Katherine B. Krystinik, Ian D. Frommer

A discussion of ideas and methods for approaching the incorporation of students from different disciplines on research projects with examples from Operations Research / Government and Operations Research / Engineering. An ideal outcome of an interdisciplinary project is that students learn about a field other than their own, and how the disciplines interact. In so doing, they gain a deeper understanding of their own discipline. How can this outcome be fostered? Should each discipline have pipeline work that feeds into the overarching structure of the project? Is it effective to blend the inter-disciplinary work throughout the project? How do we develop and encourage all members of the team to feel a sense of ownership in their roles as team members and leaders as they perform different aspects of the research?

2 - What are the Expected Outcomes of Undergraduate Research and/or Consulting Project?
Janet McLeavey, Professor, United States Coast Guard Academy, 15 Mohegan Ave., New London, CT, 06320, United States of America, Janet.A.McLeavey@uscga.edu

Should students be expected to produce results that will be useful to the sponsor? Should results affect grades? Or, is this an opportunity to explore different techniques even if they prove ineffective? Will this affect willingness of sponsors to participate? Will this affect the reputation of the mentor and/or department? How does a mentor weight the importance of students' confidence while still helping them to construct an approach that gives them a sense of accomplishment?

3 - Incorporating Undergraduates in Multidisciplinary Research Teams
Amy Cohn, University of Michigan, Ann Arbor, MI, United States of America, amycohn@umich.edu

One of the key challenges of training undergraduate engineering students is to prepare them for facing open-ended problems. Another challenge is to train them to communicate with non-engineers. We discuss our work with research teams that combine engineering undergraduates with medical students, residents, and clinicians.

■ MC18

18- West 208 A- CC

Copula and Kriging Techniques

Contributed Session

Chair: Ning Zhang, Northwestern University, 2145 Sheridan Road, Room C210, Evanston, IL, 60208, United States of America, ningzhang@u.northwestern.edu

1 - Copula based Synthetic Population Generation
Byungduk Jeong, PhD Candidate, KAIST, 291 Daehar-ro, Yuseong-gu, Daejeon, Korea, Republic of, jbd@kaist.ac.kr, Hayong Shin, Deok-Soo Kim, Won Jun Lee

Generating synthetic populations is a fundamental step of agent based microsimulations. The iterative proportional fitting (IPF) has been widely used to create the joint distribution of individuals by fitting the reference joint distribution to the target margins. In this paper, a novel method is proposed based on the copula concept. In most test cases, the proposed method performed significantly better in preserving the dependence structure of the reference joint distribution.

2 - Efficient Experimental Design for Kriging's Use in Simulation Metamodeling
Michael Hosking, North Carolina State University, 436 Summerwalk Circle, Chapel Hill, NC, 27517, United States of America, mrhoskin@ncsu.edu

One of the techniques for simulation metamodeling which has recently come into favor is Kriging. However, OR problems frequently have much higher dimension than those in spatial statistics (Kriging's origin). The prior research into efficient experimental design for Kriging focuses on 1, 2 or 3 dimensional situations. I will present some of the past work in efficient design with emphasis on higher dimensional results and present my own findings using a test bed of OR specific problems.

3 - Filtered Brownian Fields for Engineering Response Surface Metamodeling
Ning Zhang, Northwestern University, 2145 Sheridan Road, Room C210, Evanston, IL, 60208, United States of America, ningzhang@u.northwestern.edu, Daniel Apley

In kriging-based metamodeling of computer simulations, a stationary Gaussian process is the most common choice of underlying random field model. Despite its popularity, this choice of model has several undesirable characteristics when used for engineering response surface metamodeling. We investigate filtered Brownian fields, a form of non-stationary Gaussian process, as an alternative random field model and show that they are overall very attractive models.

■ MC19

19- West 211 A- CC

Optimization Society Prizes

Sponsor: Optimization

Sponsored Session

Chair: Jon Lee, University of Michigan, IOE Department, 1205 Beal Ave, Ann Arbor, MI, United States of America, jonxlee@umich.edu

1 - Optimization Society Student Paper Prize
Katya Scheinberg, Associate Professor, Lehigh University, 200 W Packer Avenue, Bethlehem, PA, 18015, United States of America, katyas@lehigh.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

Endre Boros, Professor, Rutgers University, 640 Bartholomew Road, Piscataway, NJ, 08854, United States of America, Endre.Boros@rutcor.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

David Shmoys, Cornell University, 231 Rhodes Hall, Ithaca, NY, United States of America, shmoys@cs.cornell.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

Kurt Anstreicher, Professor, University of Iowa, Department of Management Sciences, S210 PBB, Iowa City, IA, 52242, United States of America, kurt-anstreicher@uiowa.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.

■ MC20

20- West 211 B- CC

Lean in Health Care

Contributed Session

Chair: Yang Sun, Assistant Professor and Liaison, Decision Sciences, California State University, Sacramento, College of Business, 6000 J St, Sacramento, CA, United States of America, suny@csus.edu

1 - Optimal Levels of Standardization in Professional Organizations?- Evidence from German Hospitals

Roman Mennicken, RWI, Essen, Essen, Germany, roman.mennicken@rwi-essen.de, Desdemona Möller, Ludwig Kuntz

We discuss the non-linear structure of the impact of standardization on service quality in hospitals. We derive our hypotheses by combining operations management and a human behavioral perspective. We empirically test the hypotheses using a mortality-sensitive patient population.

2 - Empirical Study of Business Process Management and Applications in Healthcare Systems

He Zhang, PhD Candidate, & Management Sciences, Northwestern University, Department of Industrial Engineering, 2145 Sheridan Road, Room C210, Evanston, IL, 60208, United States of America, hezhang2012@u.northwestern.edu, David Liebovitz, Bradley Malin, Carl Gunter, Sanjay Mehrotra

Business process management is to use methods and techniques to support the administration and analysis of business processes. In this paper, we introduce an large data set of event logs from an hospital and show how to empirically construct a business process model. We further use this process model to study access control problem in healthcare systems.

3 - Clinical Quality, Experiential Quality and Financial Performance: Are All Hospitals Equal?

Claire Senot, The Ohio State University, Fisher Hall 600, 2100 Neil Avenue, Columbus, OH, United States of America, senot.1@osu.edu, Aravind Chandrasekaran, Peter Ward, Anita Tucker

Hospitals are expected to deliver high levels of clinical quality (i.e. follow standardized guidelines) and experiential quality (i.e. customize care to the individual patient) in each interaction with the patient. We expose the challenges and investigate the financial benefits of this dual focus for hospitals. Findings show that, despite improving experiential quality being a challenge for small hospitals, combining clinical and experiential quality leads to superior financial performance.

4 - The Impact of Lean Principles Implementation on Quality and Efficiency of US Hospitals

Yong Taek Min, PhD Candidate, Boston University School of Management, 595 Commonwealth Avenue, Boston, MA, 02215, United States of America, ytmin@bu.edu, Joseph Restuccia, Michael Shwartz, Jay Kim

Utilizing the data from a survey of 470 hospitals on quality improvement activity and another data set from the Center for Medicare & Medicaid Services, we empirically evaluate the extent of lean principles implementation in US hospitals and its impact on healthcare efficiency and quality. Preliminary analysis shows there is significant correlation between lean implementation and healthcare efficiency and quality.

5 - Reengineering a Service Process at a Medical Diagnostic Center

Yang Sun, Assistant Professor and Liaison, Decision Sciences, California State University, Sacramento, College of Business, 6000 J St., Sacramento, CA, United States of America, suny@csus.edu

The healthcare industry has faced continuous demand growth in recent years. A DMAIC procedure was followed to help a major medical diagnostic facility streamline its front-end, labor intensive process. Simulation models were used to show potential improvements in on-time delivery as well as savings on operational cost under higher demand. The facility was remodeled and results have shown actual improvements in operational performances.

■ MC21

21- West 212 A- CC

Network Optimization II

Sponsor: Optimization/Networks

Sponsored Session

Chair: Kelly Sullivan, University of Arkansas, 4207 Bell Engineering Center, 1 University of Arkansas, Fayetteville, AR, 72701, United States of America, kmsullivan@ufl.edu

1 - The TSP Race Problem

Bahar Cavdar, PhD Student, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30332, United States of America, baharca@gatech.edu, Joel Sokol

A traveling salesman is given a set of cities to visit. How long does it take to complete his tour, from the time he gets the data to the time he returns home? That depends not only on travel time, but also on how long it takes him to compute his route. We study the TSP Race problem, where it is sometimes optimal to sacrifice tour minimization in order to decrease decision time.

2 - Algorithms for a Multicommodity Network Flow Problem having Node Reliability Considerations

Bita Tadayon, Research Assistant, University of Florida, 406 Weil Hall, University of Florida, Gainesville, FL, 32608, United States of America, bitanhj@ufl.edu, J. Cole Smith

We consider the problem of sending a set of messages from origin to destination nodes via intermediate hubs. Given the amount of demand between each origin-destination pair, the problem is to find minimum-cost paths to transmit all messages while assuring that each message is relayed with a sufficiently large probability. This probability depends on the reliability of hubs on the message path, and those reliabilities are functions of the amount of information flow across the hub.

3 - Extreme Tornados

Paul Brooks, Assistant Professor, Department of Statistical Sciences and Operations Research, Virginia Commonwealth University, P.O. Box 843083, Richmond, VA, 23284, United States of America, jpbrooks@vcu.edu

Konig's Theorem states that in a bipartite graph, the covering number equals the matching number. Ryser's conjecture asserts that for r-partite hypergraphs, the covering number is at most r-1 times the matching number. The conjecture is open for intersecting hypergraphs. An intersecting hypergraph with covering number r-1 must contain a structure called a tornado. Properties of extreme tornados, those with covering number r-1, are described.

4 - Geographical Interdiction of a Maximum Flow Network
Kelly Sullivan, University of Arkansas, 4207 Bell Engineering Center, 1 University of Arkansas, Fayetteville, AR, 72701, United States of America, kmsullivan@ufl.edu, J. Cole Smith

We consider a network that resides in Euclidean space and a defender whose goal is to maximize flow from a source node to a sink node in the network. The problem we examine takes the perspective of an attacker, who seeks to minimize the defender's maximum flow by locating attacks in the area surrounding the network. We develop a solution approach based on solving a sequence of lower-bounding integer programs and demonstrate the efficacy of our approach on a set of test instances.

■ MC22

22- West 212 B- CC

Tools and Techniques for Modeling with Python

Sponsor: Computing Society

Sponsored Session

Chair: Ted Ralphs, Associate Professor, Lehigh University, 200 West Packer Avenue, Bethlehem, PA, 18015, United States of America, ted@lehigh.edu

1 - GIMPy and GrUMPy: Visualization for Optimization in Python
Ted Ralphs, Associate Professor, Lehigh University, 200 West Packer Avenue, Bethlehem, PA, 18015, United States of America, ted@lehigh.edu, Osman Ozaltin, Michael O'Sullivan, Aykut Bulut

In this talk, we discuss two related libraries for visualizing a wide variety of optimization algorithms. The first is for visualizing standard graph algorithms, while the second is for visualizing tree search algorithms, such as branch and bound. We'll discuss the use of these two libraries both in teaching and research.

2 - Advanced Modeling Techniques in Python
William E. Hart, Sandia National Laboratories, P.O. Box 5800, Albuquerque, NM, 87185, United States of America, wehart@sandia.gov, Jean-Paul Watson, Carl Laird, John D. Siirola, David L. Woodruff

Recently, a variety of algebraic modeling tools have been created within high-level programming languages, including C++, Java, Python and Ruby. We have previously argued that this allows modelers to leverage sophisticated language constructs and standard libraries, and that this enables a more expressive modeling environment. But is this claim true? This presentation critiques examples of modeling with the Pyomo software, which is built in Python.

3 - A Comparison of Optimization Modeling Software for Python
Bjarni Kristjansson, President, Maximal Software, Inc., 933 N. Kenmore Street, Suite 218, Arlington VA 22201, United States of America, bjarni@maximalsoftware.com, Sandip Pindoria

We start with a quick overview, to demonstrate the many features of Python that make it good language for optimization and scientific computing, comparing it with other programming languages such as C/C++, Java and C#. Then we demonstrate a few examples of how to build and deploy optimization applications, using some of the component libraries currently available in Python, such as MPLPY, GUROBI, CPLEX, GAMS, LPSolve, PYOMO, and PULP-OR, while pointing out the main differences between them.

■ MC23

23- West 212 C- CC

Joint Session Wagner/CPMS: Daniel H. Wagner Prize for Excellence in Operations Research

Cluster: Daniel H. Wagner Prize for Excellence in Operations Research & CPMS, The Practice Section

Invited Session

Chair: Allen Butler, Daniel H. Wagner Associates, 2 Eaton Street, Suite 500, Hampton, VA, 23669, United States of America, allen.butler@va.wagner.com

1 - Incorporating Stochastic Lead Times into the Guaranteed Service Model of Safety Stock Optimization
Salal Humair, Harvard School of Public Health, Boston MA, United States of America, shumair@hsph.harvard.edu, John Ruark, Brian Tomlin, Sean P. Willems

Variability, in its various forms, makes supply chain management hard. Most supply chain models incorporate demand variability but fewer models account for lead time variability, particularly in multi-echelon networks. We extend the guaranteed service model of safety stock placement to allow stochastic lead times. The main methodological contribution is the creation of closed form equations for the expected safety stock in the system. The main applied contributions are the demonstration of real stochastic lead times in practice and comparison to more traditional heuristics.

2 - Biological Planning for High-dose Rate Brachytherapy: Application to Cervical Cancer Treatment
Eva Lee, Professor and Director, Industrial and Systems Engineering Georgia Institute of Technology, Georgia Institute of Technology, Atlanta, GA, United States of America, eva.lee@gatech.edu, Fan Yuan, Jame CH Chu, Krystyna Liel, Alistair Templeton, Rui Yao

Cervical cancer is slow-growing and in early stages may not have any symptoms. Successful treatment remains challenging and the mortality rate in the U.S. is high at about 35%. We describe novel biological treatment planning designs that incorporate functional PET information for targeted escalated dose delivery. Our study reveals improvement both in local tumor control and organs-at-risk toxicity, two competing and desirable goals that were previously thought to be unachievable simultaneously.

■ MC24

24- West 213 A- CC

Healthcare Operations: Emergency Departments and Beyond

Sponsor: Health Applications Society

Sponsored Session

Chair: Soroush Saghafian, Arizona State University, Tempe, AZ, United States of America, soroush.saghafian@asu.edu

1 - Effect of Busyness in Hospital Care
Jillian Berry, Doctoral Candidate, Harvard University, Soldiers Field, Boston, MA, 02478, United States of America, jberry@hbs.edu, Anita Tucker

We examine how the Emergency Department (ED) is used as a buffer when a hospital is busy. We find that this behavior leads to greater overall resource utilization in the hospital. In particular, patients in the ED have a delayed admission, and this delay results in a change in length of stay (LOS) that is greater than the delay.

2 - Prioritizing Burn-injured Patients during a Disaster
Yina Lu, Columbia Business School, 3022 Broadway, 423 Uris Hall, New York, NY, 10027, ylu13@gsb.columbia.edu, Linda Green, Carri Chan

The US government has mandated that, in a catastrophic event, NYC areas need to be capable of caring for 400 burn patients. The current surged capacity is only 210. We develop a new system to prioritize patients for transfer to burn beds and demonstrate its superiority over several other methods. Based on data from previous burn disasters, we find that this is unlikely to meet federal guidelines. This work has implications for how disaster plans in other metropolitan areas should be developed.

3 - Emergency Department Simulation for Tackling Overcrowding
Vedat Verter, Professor, McGill University, 1001 Sherbrooke St. W., Montreal, QC, H3A 1G5, Canada, vedat.verter@mcgill.ca, Dr. Alrx Guttman, Antoinette Colacone, Dr. Eli Segal, Dr. Marc Afilalo

We have developed a comprehensive simulation model of a large emergency department in a tertiary hospital. The model has been verified based on extensive data concerning the patient flows as well as the direct and indirect activities of the physicians and nurses. This framework enables us to better understand the internal and external determinants of overcrowding and design interventions accordingly.

4 - An Enhanced Triage System for Emergency Departments
Soroush Saghafian, Arizona State University, Tempe, AZ, United States of America, soroush.saghafian@asu.edu, Mark Van Oyen, Jeffrey Desmond, Steven Kronick, Wallace Hopp

We propose a new triage system for hospital emergency departments that incorporates patient complexity as well as urgency. Using a combination of analytic and simulation models calibrated with hospital data, we demonstrate that the new triage system can substantially improve both patient safety and operational efficiency in emergency departments. We also investigate new patient flow designs as well as priority systems that can further improve the performance of Emergency Departments.

■ MC25

25- West 213 B- CC

Resource Allocation for Dynamical Health Systems

Sponsor: Health Applications Society

Sponsored Session

Chair: Stephen Chick, Professor, INSEAD, Technology and Operations Management, Boulevard de Constance, Fontainebleau, 77300, France, stephen.chick@insead.edu

1 - REACH: A Practical HIV Resource Allocation Tool for Decision Makers

Sabina Alistar, Stanford University, P.O. Box 17244, Stanford, CA, 94309, United States of America, ssabina@stanford.edu, Eduard Beck, Margaret Brandeau

Efficient allocation of HIV prevention and treatment funds is crucial but decision makers do not have good tools to support such decision making. We developed the Resource Allocation for Control of HIV (REACH) model, a planning tool for use by regional and country-level decision makers in evaluating potential resource allocations. We describe the model, present example analyses for three different settings, and describe our ongoing work in further developing and applying the model.

2 - Optimal Preventive Care Policies on Type 2 Diabetes Mellitus

Karca Aral, PhD Student, INSEAD, Technology and Operations Management, Boulevard de Constance, Fontainebleau, 77300, France, karca.aral@insead.edu

Type 2 Diabetes (T2D) is a chronic condition that affects over 285 million people worldwide. However, T2D and its related complications are preventable through healthier lifestyle and dietary choices. In this study, we introduce a population level progression model of T2D. We detail our findings on optimal preventive policies for resource allocation decisions regarding screening, public awareness and patient education programs for self-management around T2D.

3 - Sequential Monitoring of Glaucoma Patients

Mariel Lavieri, Assistant Professor, University of Michigan, 1205 Beal Ave., 2783 IOE, Ann Arbor, MI, 48109, United States of America, lavieri@umich.edu, Gregg Schell, Mark Van Oyen, Joshua Stein, MD, Jonathan Helm, David Musch

We develop novel algorithms to determine the best Time to Next Test based on each patient's individual disease trajectory. Our algorithms integrate a dynamic linear Gaussian systems model of disease progression with optimization approaches to predict the likelihood of glaucoma progression. We will present our closed form solutions and discuss the structural properties of the algorithms. Our work has been validated using patient data from a large–scale glaucoma clinical trial.

4 - Optimal Timing of the "Adoption with Research" Period for Conditional Reimbursement of Drugs

Leyla Mohseninejad, University Medical Center Groningen, Hanzeplein 1, Groningen, Gr, 9713 GZ, Netherlands, leymohnezh@gmail.com, Talitha Feenstra, Kuno Huisman, Maarten Postma, Cornelis Boersma, Erik Buskens

In the Dutch healthcare system, new inpatient drugs are conditionally reimbursed while additional research is undertaken to support a final decision. We present a framework to find the suitable time point for making a definite decision on a conditionally reimbursed drug. We consider the costs and benefits of extending the research period. Deriving the expected value of the additional information, and trading it off against the costs of delay, the expected net gains can be found and optimized.

■ MC26

26- North 221 A- CC

Retail Operations I

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Stephen Smith, Professor, Santa Clara University, 500 El Camino Real, Santa Clara, CA, 95070, United States of America, SSmith@scu.edu

1 - The Retail Planning Problem under Demand Uncertainty

George Georgiadis, University of California-Los Angeles, Anderson School of Management, 110 Westwood Plaza, Los Angeles, CA, United States of America, georgiadis@ucla.edu, Kumar Rajaram

We consider the Retail Planning Problem in which a retailer chooses suppliers, and determines production, distribution and inventory planning for products with uncertain demand to minimize total expected costs. This problem is faced by retail chains that carry private label products. We formulate it as a convex MIP, which is NP-hard, and we construct bounding procedures. Our computational results indicate that the feasible solutions are close to optimal. Finally, we develop managerial insights.

2 - Multi-retailer Supply Chains with Nonlinear Production Costs: Centralized and Decentralized

Yigal Gerchak, Professor, Tel Aviv University, Ramat Aviv 69978, Israel, yigal@post.tau.ac.il, Gilad Schwartz

Several industries, such as the gasoline and apparel industries, that face nonlinear production costs in the short term, are undergoing spin-offs of retail operations. We study centralized and decentralized supply chains with multiple retailers and one manufacturer under uncertain demand, with both exogenous and endogenous prices. Our goal is to shed light on how nonlinear production costs combined with decentralization affect production quantities, prices and profits.

3 - Big Box Retailers in Emerging Markets: Boon or Bane?

Aditya Jain, Assistant Professor, Indian School of Business, Gachibowli, Hyderabad, India, aditya_Jain@isb.edu, Sameer Mathur, Saibal Ray

We study changing retailing environment in emerging market (India). In recent years several big retailing firms have entered the market traditionally dominated by small mom-and-pop stores. We consider asymmetric competition between a small (budget constraint) and large (capitalized) retailer in a market comprising of multiple segments (poor and rich). Using simple model we illustrate how presence of large retailer impacts pricing and assortment decisions, and consumer welfare.

4 - Optimal Inventory Allocation and Pricing with Non-Identical Stores

Stephen Smith, Professor, Santa Clara University, 500 El Camino Real, Santa Clara, CA, 95070, United States of America, SSmith@scu.edu, Naren Agrawal

Retail chains must make decisions about allocation of inventory and clearance prices. Inventory decisions are often made before clearance prices are set, by which point, more precise demand information is available. We consider joint inventory allocation and clearance pricing decisions for retail chains with non-identical stores.

■ MC27

27- North 221 B- CC

Supply Risk, Pricing and Competition

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Yimin Wang, Arizona State University, W. P. Carey School of Business, Department of Supply Chain Management, Tempe, AZ, 85287, United States of America, Yimin_Wang@asu.edu

1 - To Share or Not to Share? Contract Structures for Capacity Investments in Shared Suppliers

Anyan Qi, University of Michigan, 701 Tappan St., Ann Arbor, MI, 48109, United States of America, anyqi@umich.edu, Hyun-Soo Ahn, Amitabh Sinha

We study contracts governing capacity investment in shared suppliers. Two types of contract are considered: exclusive, where unused capacity cannot be used for others, and flexible, where it can. We find that firms generally pursue exclusive contracts, resulting in a prisoners' dilemma, and in equilibrium it is possible that only one firm invests in flexible capacity, and allows others to free-ride. Our work suggests an opportunity for the firms to co-operate to achieve a pareto-optimal outcome.

2 - Horizontal Capacity Coordination for Risk Management and Flexibility

Xiaole Wu, Assistant Professor, Fudan University, Room 513, Siyuan Building, 670 Guoshun Road, Shanghai, 200433, China, wuxiaole@fudan.edu.cn, Panos Kouvelis, Hirofumi Matsuo

Motivated by the dual sourcing and contracting practices in the semiconductor industry, we study two prevailing types of contracts that deal with horizontal capacity coordination issues between two possible sources: an integrated device manufacturer (IDM) and a foundry. Our analysis provides insights on horizontal capacity coordination beyond the semiconductor industry.

3 - Sourcing for Quality: Pricing, Inspection, and Cooperation

Cuihong Li, University of Connecticut, Storrs, CT, 06269, United States of America, cli@business.uconn.edu, Hsiao-Hui Lee

A buyer can provide price incentive for the supplier to exert quality improvement effort, use inspection to screen out defective units, or spend her own resource on cooperating with the supplier to improve incoming quality. We investigate the use of the three instruments to manage quality. We consider complementary and substitutable relationships between buyer cooperation and supplier effort on quality improvement, and compare the results with observable and unobservable supplier effort.

4 - Sourcing Strategy under Endogenous Pricing and Spillover Risk
Yixuan Xiao, Washington University in St. Louis, St. Louis, MO, 63130, United States of America, xiaoy@wustl.edu, Nan Yang, Yimin Wang

We study a buying firm's sourcing strategy when its proprietary design and technology may be misappropriated by its supplier. We characterize the buying firm's optimal strategy under both endogenous and exogenous spillovers, and provide managerial insights on how the buying firm's pricing strategy influences its spillover risk.

■ MC28

28- North 221 C- CC

Competitive Models in Operations/Marketing

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Hamed Mamani, University of Washington, Foster School of Business, Seattle, WA, United States of America, hmamani@uw.edu

Co-Chair: Foaad Iravani, PhD Candidate, University of California-Los Angeles, Anderson School of Management, 110 Westwood Plaza, Los Angeles, CA, 90066, United States of America, foad.iravani.2012@anderson.ucla.edu

1 - Environmental Implications of Online vs. Brick-and-Mortar Retailing
Canan Savaskan-Ebert, Associate Professor, Cox Scghool of Business, P.O. Box 750333, Dallas, United States of America, csavaskan@mail.cox.smu.edu, Aydin Alptekinoglu, Ami Basu

In a competitive retailing model, in this paper, we explore environmental consequences of online and physical distribution channels. We develope insights with regards to the environmental implications of the sales tax policies for online channels.

2 - Competitive Aspects in Assortment Planning
Victor Martinez de Albeniz, Associate Professor, IESE Business School, Av. Pearson 21, Barcelona, 08034, Spain, valbeniz@iese.edu, Sebastian Heese

We present a model where different assortment planning strategies are compared. We find that it is usually best to pre-announce the assortment size but not declare which suppliers are included. Furthermore, we show that the best assortment size is typically smaller than the one that a centralized system would choose. Hence, artificially limiting the assortment size seems an effective strategy to drive supplier competition.

3 - Combating Child Labor: Incentives and Information Transparency in Global Supply Chains
Soo-Haeng Cho, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, soohaeng@andrew.cmu.edu, Sridhar Tayur, Ying Xu

An estimated 158 million children aged 5-14 are engaged in child labor. Besides poverty in underdeveloped countries, extensive outsourcing has slowed child labor reform by encouraging firms to seek low labor costs. This paper examines the incentive of a multinational firm to induce or combat child labor via its supply contract and internal monitoring. We then investigate the potential effects of the new legislation in the U.S. that requires disclosures on corporate efforts to combat child labor.

4 - Coping with Gray Markets: The Impact of Market Conditions and Product Characteristics
Foaad Iravani, PhD Candidate, University of California-Los Angeles, Anderson School of Management, 110 Westwood Plaza, Los Angeles, CA, 90066, United States of America, foad.iravani.2012@anderson.ucla.edu, Reza Ahmadi, Hamed Mamani

The diversion of products from authorized distribution channels to gray markets has created fierce competition for many manufacturers. We analyze the optimal strategy of a price-setting manufacturer who operates in two markets with uncertain demand and faces a gray market. We explore the impact of market conditions and product characteristics and provide insights about the viability of the uniform pricing policy that has been used by some companies to eliminate gray markets.

■ MC29

29- North 222 A- CC

Managing Delays in Access to Healthcare

Sponsor: Manufacturing & Service Oper Mgmt/ Healthcare Operations/SIG

Sponsored Session

Chair: Mor Armony, Stern School of Business, NYU, New York, United States of America, marmony@stern.nyu.edu

1 - Discharge Planning to Mitigate Bed Block and ER Overcrowding
Rene Bekker, VU University Amsterdam, De Boelelaan 1081a, Amsterdam, Netherlands, r.bekker@vu.nl, Jonathan Helm, Mark Van Oyen

Bed block in hospitals leads to long waits in Emergency Department, patients being placed in the hallways on stretchers, poor quality of care, high costs and mortalities. The timing of discharges from inpatient beds significantly impacts bed block, as the mismatch between arrivals and discharges over the day typically leads to a mid-day spike. This research models the intra-day census process and discharge timing and investigates how hospital characteristics impact bed blocking.

2 - Balancing between Timely Access to Medical Appointments and In-clinic Waits
Christos Zacharias, New York University, Stern School of Business, New York, United States of America, czachari@stern.nyu.edu, Mor Armony

We study the joint problem of determining the panel size of a medical practice and the number of offered appointments per day, so that patients do not face long backlogs, and the medical facility is not overcrowded. We consider the two separate time scales involved in patients' access to medical care: out-of-clinic waits for an appointment and in-clinic waits to see a physician, under state dependent partial backlogging. We provide system sizing guidelines based on heavy-traffic approximations.

3 - Step-Down Units in Hospitals: Benefits and Pitfalls
Mor Armony, Stern School of Business, NYU, New York, United States of America, marmony@stern.nyu.edu, Carri Chan, Bo Zhu

The use of Step-Down units (SDUs) in hospitals has been a matter of controversy in the medical community. On one hand, an SDU alleviates ICU congestion by providing a safe care environment for post-ICU patients before they can be transferred to the general wards. On the other hand, SDUs can take capacity away from the already over-congested ICU. We propose a queueing model that provides SDU sizing guidelines, noting that under some circumstances this optimal size is zero.

4 - Empirical Investigation into the Network Effects of Ambulance Diversion
Sarang Deo, Assistant Professor, Indian School of Business, Gachibowli, Hyderabad, 500032, India, Sarang_Deo@isb.edu, Eric Park, Itai Gurvich

We use operations management theory to study the effects of change in ambulance diversion policy in LA County, CA. We utilize a unique dataset obtained by combining ambulance dispatch data and hospital diversion status data over a period of 9 years from a network of seven closely located hospitals. We find that extent of time on diversion reduced significantly after the policy change but the number of diversions did not. We build empirical models provide possible explanations for these effects.

■ MC30

30- North 222 B- CC

Commodity Risk Management

Sponsor: Manufacturing & Service Oper Mgmt/iFORM

Sponsored Session

Chair: Lingxiu Dong, Associate Professor, Olin Business School, Washington University, One Brookings Drive, Saint Louis, MO, United States of America, dong@wustl.edu

1 - Capacity Investment, Production Scheduling and Financing Choice
Derek Wang, University of Michigan, Wangdd@umich.edu, Owen Wu, Hyun-Soo Ahn

Mining/energy projects usually require huge initial investment beyond the firm's working capital. We study the capacity investment and production decisions of a capital-constrained firm that can finance through either debt or joint venture in a multi-period model. We show how financing schemes influence the operational policies and describe the conditions under which the firm chooses debt financing

over joint venture.

2 - Commodity Processing and Financial Hedging: Under Correlated Price and Demand
Ankur Goel, Case Western Reserve University, Cleveland, Cleveland, United States of America, axg312@case.edu, Fehmi Tanrisever

We consider a publicly traded commodity processor, under perfect financial market, with an objective to maximize the value of its stakeholders when demand of output is correlated with its price. In a multi-period model, we develop optimal hedging and procurement policies in the presence of yield uncertainty and correlation between input and output price of the commodity.

3 - Dynamic Financial Hedging Strategies for a Storable Commodity with Demand Uncertainty
Zhan Pang, Lancaster University Management School, Department of Management Science, Lancaster, LA1 4YX, United Kingdom, z.pang@lancaster.ac.uk, Panos Kouvelis, Qing Ding

We consider a firm that is managing a storable commodity in the presence of demand uncertainty, a volatile spot market and associated financial derivatives. The objective is to coordinate the replenishment and financial hedging decisions to maximize the mean-variance utility of the terminal wealth over a finite horizon. We characterize the structure of optimal time-consistent policies. Our results shed new light into the interface between corporate risk management and operations management.

■ MC31

31- North 222 C- CC

Improved Inventory Policies and Supply Chain Coordination under Uncertainty

Cluster: Managing Disruptions in Supply Chains

Invited Session

Chair: Chase Rainwater, Assistant Professor, INEG Department, University of Arkansas, Fayetteville, AR, 72701, United States of America, cer@uark.edu

1 - Supplier Selection and Order Allocation under Supply Risks and Order Size Constraints
Yingying Wang, North Carolina State University, 400 Daniels Hall, College of Engineering, Raleigh, NC, 27695, United States of America, yywang1985@gmail.com, Donald Warsing, Russell E. King, Anita Vila-Parrish, Semra Ahiska

We consider a single-period, single-item, single-site inventory system with multiple suppliers, some of which are not perfectly reliable (delivery probability less than 1). The suppliers also may exhibit different fixed costs, item costs, and restrictions on minimum and maximum order sizes. Orders are allocated among suppliers to satisfy uncertain demand and minimize total costs. We develop and compare several algorithms to solve the problem under both continuous and discrete demand settings.

2 - Mitigating the Impact of National Drug Shortages for a Healthcare Facility
Samira Saedi, University of Houston, E209 Engineering Building, Houston, TX, 77204, United States of America, ssaedi@uh.edu, Erhun Kundakcioglu, Andrea Henry

A significant portion of public procurement spending is lost due to poor practices in pharmaceutical market such as inefficient inventory management. Along with national shortages, it causes lack of medicines leading to patients suffering. In this study, a continuous time Markov chain is considered to find the optimal inventory policy for a healthcare facility under supply and demand uncertainty. Simulation results show increase in availability of drugs and reduction in costs.

3 - The Benefit/Detriment of Information in Coordinating Supply Chains
Michael Wagner, St Mary's College of CA, 380 Moraga Rd, Moraga, CA, United States of America, mrw2@stmarys-ca.edu

We study a simple supply chain with a supplier and retailer, where one player knows the probabilistic distribution of demand and the other only knows the mean and variance. We show that this informational asymmetry either reduces or exacerbates the double marginalization effect. We study how the direction of asymmetry, level of uncertainty, economics and game theoretic considerations affect supply chain, as well as individual firm, performance.

■ MC32

32- North 223- CC

Temporal Product Variety

Sponsor: Manufacturing & Service Oper Mgmt/Supply Chain

Sponsored Session

Chair: Aydin Alptekinoglu, SMU Cox School of Business, 6212 Bishop Blvd, Dallas, TX, 75205, United States of America, aalp@cox.smu.edu

1 - Product Updates in the Presence of Consumer Progression
Paulo Albuquerque, University of Rochester, Carol Simon Hall 3110R, Rochester, United States of America, paulo.albuquerque@simon.rochester.edu, Yulia Nevskaya

We propose a dynamic model to explain product usage in categories characterized by frequent updates and progression of consumer involvement. Examples of such categories include TV series, software, and books. Consumer utility depends on intrinsic preferences, social interaction and expectations about future content. We use data from the computer game "World of warcraft" to implement our model. We offer managerial recommendations to improve decisions on product innovation in these categories.

2 - Flexible Products for Dynamic Preferences
Aydin Alptekinoglu, SMU Cox School of Business, 6212 Bishop Blvd, Dallas, TX, 75205, United States of America, aalp@cox.smu.edu, Karthik Ramachandran

We address a product design dilemma in the face of dynamic consumer preferences that change randomly over time. Is it better from a firm's perspective to offer multiple standard products (a set of dumbbells each with a specific weight) or one flexible product (a weight-adjustable dumbbell)? We find that higher ideal-product utility, more stable consumer preferences, and reduced durability all favor flexible products.

3 - Supply/demand Synchronization through Demand Shaping and Customer Analytics
Roger Lederman, Postdoctoral Research Scientist, IBM, Yorktown Heights, NY, United States of America, rdlederm@us.ibm.com, Marek Petrik

Demand shaping is the ability to sense demand patterns, evaluate, and execute actions to "steer" demand to better integrate the supply chain horizontally. We present a suite of mathematical models that enable demand shaping through dynamic management of product availability, price discounts, and sales levers across a portfolio of partially substitutable products. We discuss sensing, computation of optimal shaping actions, and insights from a real-life server computer manufacturing environment.

4 - The Role of Modular Upgradability as a Green Design Strategy
Sezer Ulku, Georgetown University, su8@georgetown.edu, Vishal Agrawal

We study the efficacy of modular upgradability as a design-for-environment strategy. By endogenizing a firm's development and introduction decisions and by considering a product's entire life cycle, we identify when modular upgradable architecture leads to lower environmental impact and is also more profitable for a firm.

■ MC33

33- North 224 A- CC

Green Business Models and Initiatives

Sponsor: Manufacturing & Service Oper Mgmt/Sustainable Operations

Sponsored Session

Chair: Vishal Agrawal, Assistant Professor, Georgetown University, Georgetown, United States of America, va64@georgetown.edu

1 - Energy Efficiency: Picking up the Twenty Dollar Bill
Deishin Lee, Harvard Business School, Soldiers Field Road, Boston, MA, 02163, United States of America, dlee@hbs.edu, Chonnikarn Fern Jira

Although numerous studies have shown that energy efficiency can simultaneously reduce environmental impact and increase firm profitability, many firms have not seized the opportunity to improve energy efficiency. We examine the organizational process of implementing capital-intensive energy efficiency projects using industrial waste heat recovery as an example.

2 - Electric Vehicles with a Switching Station: Adoption and Environmental Impact
Karan Girotra, INSEAD, Boulevard de Constance, Fontainebleau, France, Karan.GIROTRA@insead.edu, Buket Avci

We analyze a novel switching-station based business model for the deployment of electric vehicles. The firm charges customers for the miles driven and establishes a network of battery swapping stations to enable rapid change of batteries. We compare this new service model to the traditional EV sales model in terms of market adoption and environmental impact. We also investigate how the advances in battery technology influence the adoption and environmental impact of the new model.

3 - Firm Collaboration to Eliminate the use of a Substance of Concern
Tim Kraft, University of Virginia, Darden School of Business, Charlottesville, VA, 22902, United States of America, kraftt@darden.virginia.edu, Gal Raz

In this paper we analyze the conditions under which it is optimal for firms to collaborate to remove a potentially hazardous substance from their products. We consider the impact of market structure, existing regulatory threat, and market sensitivity on the collaboration decision and how the collaboration costs should be shared.

4 - The Potential of Servicizing as a Green Business Model
Vishal Agrawal, Assistant Professor, Georgetown University, Georgetown, United States of America, va64@georgetown.edu, Yannis Bellos

In recent years, manufacturers from various industries have begun to orient their practices towards selling the service of a product as opposed to selling the product itself. Moreover, such servicizing models have been proposed to be environmentally superior. In this paper, we investigate the economic, design, and environmental implications of such models and identify when and how different operational elements lead to lower environmental impact.

■ MC34

34- North 224 B- CC

Patents: Analysis and Use

Cluster: New Product Development

Invited Session

Chair: Jurgen Mihm, Assistant Professor, INSEAD, Fontainebleau, 77300, France, jurgen.mihm@insead.edu

1 - Emergence and Decline of Design Gurus
Haibo Liu, INSEAD, 1 Ayer Rajah Avenue 138676, Singapore, Singapore, HAIBO.Liu@insead.edu, Jurgen Mihm, Manuel Sosa

This study examines the creative output of individual designers over time and disentangles knowledge and social factors that predict both the emergence and decline of design gurus. We define design gurus as top ranked designers based on the citations received by their design patents. We test our hypotheses by using Event History Analysis on the design patents filed in United States Patent and Trademark Office (USPTO). Practical and theoretical implications for design management are discussed.

2 - Software Patent Policy: What Does Academic Research Have to Say?
David Pingry, Professor, University of Arizona, 430L McClelland Hall, Management Info Systems, Tucson, AZ, 85721-0108, United States of America, pingry@email.arizona.edu, Matt Thatcher

Since the patentability of computer software was first affirmed in 1981 there has been an explosion of software patents and a vigorous, twofold debate about software patent policy: 1. Should there be software patents? 2. If so, what should the policy parameters be? The academic literatures have had little impact on this important policy debate. This paper examines the state of the academic literatures in addressing these questions and proposes future directions for software policy research.

3 - On the Effectiveness of Patenting Strategies
Fabian Sting, Rotterdam School of Management, Erasmus University, Burgemeester Oudlaan 50, Rotterdam, Netherlands, FSting@rsm.nl, Jurgen Mihm, Tan Wang

What patenting strategy should a company pursue? What factors should the choice of strategy depend on? We build a coherent inventory of patenting strategies and we integrate it into a common coherent framework. Through a simulation model, we identify competitive dynamics as the most crucial contingency and within our framework we characterize the optimal patenting choices. Our research makes a step towards a contingency theory of patenting strategies.

4 - Corporate R&D Allocations in Systems Industries
Markus Reitzig, Vienna University, Brünnerstrafle 72, Vienna, Austria, markus.reitzig@univie.ac.at, Ramon Lecuona Torras

The goal of this research project is to better understand how (and why) corporations allocate resource and development (R&D) investments across technological landscapes in so-called system industries (i.e. industries in which sets of inter-related components constitute final consumer products).

■ MC35

35- North 225 A- CC

Joint Session RMPS/AAS: Approximation Methods for Revenue Management and Pricing

Sponsor: Revenue Management & Pricing & Aviation Applications

Sponsored Session

Chair: Dan Zhang, University of Colorado at Boulder, 995 Regent Dr, Boulder, CO, United States of America, dan.zhang@colorado.edu

Co-Chair: Thomas Vossen, University of Colorado at Boulder, 995 Regent Dr, Boulder, CO, United States of America, vossen@colorado.edu

1 - Approximation Scheme for Robust Dynamic Pricing with Two Substitutable Products
Zhi-Long Chen, Professor, University of Maryland, Robert H. Smith School of Business, College Park, MD, 20742, United States of America, ZChen@RHSmith.umd.edu, Ming Chen

We consider a dynamic pricing problem with two substitutable products with a number of business rules. We formulate the problem as a max-min problem which maximizes the worst-case total sales revenue over all possible demand realizations in the demand uncertainty spaces subject to constraints induced by the given business rules and the nature of substitution between the two products. We give a DP algorithm and develop a FPTAS which guarantees a proven near optimal solution in a manageable time.

2 - Joint Stocking and Product Offer Decisions under the Multinomial Logit Model
Huseyin Topaloglu, Cornell University, 223 Rhodes Hall, Ithaca, NY, United States of America, ht88@cornell.edu

We study a stocking and product offer problem, where we need to decide which sets of products to offer over the selling horizon and how many units of each product to stock given that customers choose among the offered products according to the multinomial logit model. We give a formulation of the problem with a separable objective function, which allows solution via dynamic programming. We study the properties of the optimal assortment.

3 - A Dynamic Disaggregation Approach to Approximate Linear Programs for Network Revenue Management
Dan Zhang, University of Colorado at Boulder, 995 Regent Dr, Boulder, CO, United States of America, dan.zhang@colorado.edu, Thomas Vossen

We consider the approximate linear program (ALP) resulting from an affine functional approximation to the network revenue management problem. We show that the ALP can be reduced to an equivalent, albeit much smaller, linear program. Our proof exploits the relationship between the ALP and an appropriate Dantzig-Wolfe reformulation. We develop a novel dynamic disaggregation algorithm to solve the reduced program. We generalize our results to choice-based network revenue management.

4 - Equivalence of Piecewise-linear Approximation and Lagrangian Relaxation for NRM
Sumit Kunnumkal, Assistant Professor, Indian School of Business, Gachibowli, Hyderabad, A.P, AP, India, sumit_kunnumkal@isb.edu, Kalyan Talluri

The network RM problem can be formulated as a DP with an exponentially large state space. A number of heuristics have been proposed to approximate it. Notable amongst these are ADP methods that approximate the value function by basis functions and decomposition methods that relax the constraints of the DP to solve simpler DPs. We show that these two seemingly distinct approaches coincide, i.e., the piecewise-linear approximation method and the Lagrangian relaxation method are one and the same.

5 - Power Approximations for Network Revenue Management
Dan Adelman, Professor of Operations Management, University of Chicago Booth School of Business, 5807 South Woodlawn Ave., Chicago, United States of America, dan.adelman@chicagobooth.edu, Christiane Barz, Canan Uckun

We consider a new approximation architecture for the network revenue management problem using power functions to express concavity. We address a number of technical challenges in fitting parameters and demonstrate numerical performance compared against other approximations.

■ MC36

36- North 225 B- CC

Pricing and Supply Chain Management

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Tim Huh, University of British Columbia, Sauder School of Business, Vancouver, Canada, tim.huh@sauder.ubc.ca

1 - Price and Reorder Flexibility for Differentiated Short Lifecycle Products under Competition

Philipp Afeche, Rotman School of Management, University of Toronto, 105 St.George Street, Toronto, ON, M5S3E6, Canada, Philipp.Afeche@Rotman.Utoronto.Ca, Ming Hu, Yang Li

We study competing providers of differentiated short lifecycle products with uncertain demand. They place initial orders before, and choose prices and reorder quantities after observing demand. We (1) show that the expected profit functions may be bimodal and characterize the equilibrium order/reorder and pricing strategies; (2) quantify under what conditions reorder flexibility increases or hurts profitability; (3) discuss how the mode of competition affects the value of volume flexibility.

2 - Impact of Strategic Customer Behavior and Rollover Strategies on Product Innovation

Metin Cakanyildirim, Associate Professor of Operations Management, University of Texas at Dallas, P. O. Box 830688, Richardson, TX, 75080-0688, United States of America, metin@utdallas.edu, chao liang, Suresh Sethi

Innovation rate, orders, prices and profit are analyzed in four settings: myopic or strategic customers, and single or dual (product) rollover for product transitions. With myopic customers, single rollover hurts the profit but accelerates the innovation process, and the innovation rate and profit cannot be increased simultaneously with any rollover strategy. With strategic customers, a firm can provide a more innovative product, earn a higher profit with the appropriate rollover strategy.

3 - Analysis of Inventory Problems with Inventory-dependent Demand

Frank (Youhua) Chen, Professor, City University of Hong Kong, College of Business, Dept. of Management Science, Kowloonton, Hong Kong-PRC, youhchen@cityu.edu.hk, Yi Yang, Weili Xue

We attempt to address a set of problems in which underlying demand depends on the (displayed) inventory level. Generally, inventory as a demand determinant is just one of the many sales levers, such as pricing. Can the approaches developed in the literature of inventory-pricing be extended to analyze the current problems? In this talk we examine periodic-review systems where inventories may be displayed on shelf or stored in backroom and present structural results.

4 - A Call-Back Auction for Oversold Flights

Sean Zhou, CUHK, Shatin, N.T., Hong Kong, Hong Kong-PRC, zhoux@se.cuhk.edu.hk, Zhiheng Zhong

Overbooking has been a widely used strategy by airlines to increase their revenue. However, customers are upset when they were bumped at the gate, which may also affect the future revenue of the airline. We propose and analyze a call-back auction mechanism, in which the passengers are asked to submit a bid when they purchase the tickets, which indicates the compensation they would like to receive for giving up their tickets. Comparison is made between this mechanism and the existing ones.

■ MC37

37- North 226 A- CC

Location Modeling and Applications

Sponsor: Location Analysis

Sponsored Session

Chair: Erhan Kutanoglu, The University of Texas at Austin, 204 E Dean Keeton St. C2200, Austin, TX, 78712, United States of America, erhank@mail.utexas.edu

1 - Sequential Clustering for Police Districting

Christopher Rump, Associate Professor, Bowling Green State University, Applied Statistics & Operations Research, Bowling Green, OH, 43403, United States of America, cmrump@bgsu.edu

We consider the problem of designing police command districts and, at a more granular level, police patrol beats. In doing so, we consider a hierarchy of clustering objectives to measure the overall distance within each formed district. The districting design optimization problem is modeled heuristically as a sequential clustering problem that for most choices of clustering objective can be solved efficiently via its linear programming relaxation.

2 - Positional Uncertainty in Coverage Modeling

Alan Murray, Professor, Arizona State University, P.O. Box 875302, Tempe, AZ, 85287, United States of America, atmurray@asu.edu

Coverage models have proven to be both theoretically interesting and of great practical significance. This paper reviews aspects of positional uncertainty and how this may impact coverage modeling. Extensions to account for positional uncertainty as well as empirical applications are detailed.

3 - Dual-based Local Search for Deterministic, Stochastic, and Robust Variants of the ConFL Problem

Gisela Bardossy, Assistant Professor of Operations Research, University of Baltimore, 1420 N. Charles Street, Baltimore MD 21201, United States of America, mgbardossy@gmail.com

We study a family of network design problems that arise in settings ranging from telecommunications to data management. We investigate the use of heuristic search procedures coupled with lower bounding mechanisms to obtain high quality solutions for deterministic, stochastic and robust variants of these problems. We extend methods, such as sample average approximation for stochastic optimization and the Bertsimas and Sim approach for robust optimization with heuristics, and widen their usability.

4 - Protection Planning for Critical Infrastructure Systems in Location Analysis: Models and Algorithms

Federico Liberatore, University of Kent, Kent Business School, Kent, Canterbury, United Kingdom, federico.liberatore@urjc.es, Maria Paola Scaparra

The aim of this thesis is to contribute to the expansion and growth of the field of supply system reliability and facility protection. The main objective of this research is to formulate and solve optimization models that incorporate the characteristics of complex supply systems in order to mitigate the impact of destructions or malfunctionings of critical infrastructure.

■ MC38

38- North 226 B- CC

Panel Discussion: Meet the Editors of the INFORMS Service Science Journal

Sponsor: Service Science

Sponsored Session

Chair: Gregory Heim, Associate Professor, Mays Business School at Texas A&M University, 320 Wehner Building, 4217 TAMU, College Station, TX, 77843-4217, United States of America, gheim@mays.tamu.edu

1 - Service Science Editorial Board Q&A

Moderator: Cheng Hsu, Rensselaer Polytechnic Institute, Dept. of Industrial & Systems Engineering, Troy NY 12180, United States of America, hsuc@rpi.edu

Service Science Editorial Board welcomes questions and suggestions from the community. This interactive session also aims at assisting our readers in staying informed on the most important topics and the latest development in Service Science.

■ MC39

39- North 226 C- CC

IT in the Service Industry

Contributed Session

Chair: Rama Akkiraju, Distinguished Engineer, Service Solution Design, IBM Research, 650 Harry Road, Almaden Research Center, San Jose, CA, 95120, United States of America, akkiraju@us.ibm.com

1 - Dialog Manager for IT Service Management

Juhnyoung Lee, Research Staff Member, IBM, 19 Skyline Drive, Hawthorne, NY, 10598, United States of America, jyl@us.ibm.com, Rangachari Anand

The Dialog Manager is a web-based software tool for documenting and organizing procedural knowledge. It provides a Wiki-style tool for authoring knowledge for resolving issues as structured conversations. It provides the authored knowledge to support staff at call centers for resolving incidents. It offers the authored content searchable and provides conversation state management in reusing the content in the issue resolution process.

2 - IT Incident Diagnosis by Incident Relation Analysis
Rong Liu, IBM, 19 Skyline Drive, Hawthorne, NY, 10532, United States of America, rliu@us.ibm.com, Juhnyoung Lee

The objective of IT incident management is to maintain high level of service quality and to restore normal service operations as quickly as possible in case of IT failures. In this paper, we present a novel and reusable analytical platform that integrates events from different data sources and provides predictive analytical capabilities by utilizing relations among incidents. It provides a prediction model of IT failures that anticipates failures and offers prevention and resolution actions.

3 - Development of Service Concepts for Automobiles using a Data-driven Approach
Min Jun Kim, POSTECH, Hyoja-Dong. Nam-Gu.Pohang. Kyungbuk, Pohang, Korea, Republic of, minjun@postech.ac.kr, Hyun-Jin Kim, Chie-Hyeon Lim, Kwang-Jae Kim

Advanced IT technologies enable automobile companies to provide services based on the trip data collected from customers' vehicles. In this talk, we present a data-driven approach to developing vehicle-related service concepts. The approach identifies service opportunities by understanding how customers drive by analyzing the data. Some of the identified opportunities are elaborated to form service concepts. The approach is demonstrated through a case study on the automobile telematics service.

4 - Assessing the Competitiveness of an IT Outsourcing Solution
Rama Akkiraju, Distinguished Engineer, Service Solution Design, IBM Research, 650 Harry Road, Almaden Research Center, San Jose, CA, 95120, United States of America, akkiraju@us.ibm.com, Tobin Lehman

Assessing the competitiveness of an IT outsourcing solution is a non-trivial task. It involves comparing unit costs and unit prices of complex service solutions with comparable prior deals and market data. Complex financial factors, cost allocations and customizations make determining 'comparables' quite involved. We present a mechanism and an analysis tool to assess the competitiveness of IT outsourcing solutions.

■ MC40

40- North 227 A- CC

Use of Recycled and Renewable Materials in Production Planning

Sponsor: Energy, Natural Res & the Envi/ Environment and Sustainability

Sponsored Session

Chair: Randolph Kirchain, Principal Research Scientist, Massachusetts Institute of Technology, 77 Massachusetts Ave, E38-432, Cambridge, MA, 02139, United States of America, kirchain@mit.edu

1 - Coordination and Flexibility Tradeoffs in Aluminum Recycling
Elsa Olivetti, Research Scientist, Massachusetts Institute of Technology, 77 Massachusetts Ave., E38-434, Cambridge, MA, 02139, United States of America, elsao@MIT.EDU, Tracey Brommer, Randolph Kirchain

Recycling offers environmental and economic benefits to the aluminum industry, whose costs are driven by electricity use. This work explores models to improve recycling of aluminum including metal recovery from byproducts of production process. Models are developed to examine the value of operating coordinated recycling centers and aluminum remelting plants. The analysis quantifies the value of flexibility given the practical constraints of the operation and variation in product demand.

2 - Uncertainty Analysis of a Mass Flow and Economic Model of Electronics Recycling Systems
Jeremy Gregory, Research Scientist, Massachusetts Institute of Technology, 77 Massachusetts Ave., E38-424, Cambridge, MA, 02139, United States of America, jgregory@mit.edu, Boma Brown-West, Randolph Kirchain

As electronics recycling systems become more widespread, analyzing the performance of such systems is critical for the evaluation of existing systems and the design of new ones. This work involves performance analysis of electronics recycling systems using a mass flow and economic model that quantifies the variation in economic performance of a recycling system due to product, collection, and market uncertainties. The goal is to highlight scenarios that may lead to economic success.

3 - Take Back Costs and Product Durability
Michael Pangburn, Lundquist College of Business, University of Oregon, Eugene, OR, 97403, United States of America, pangburn@uoregon.edu, Euthemia Stavrulaki

Due to EPR programs a firm may take back a fraction of its failed products. Extending a classic 2-period durable goods framework, we analyze the impact of take back costs on a firm's product durability choice. We show that compared to selling, leasing provides an incentive to raise durability, and that it is possible for the optimal durability to decrease if take backs increase. Leasing implies higher durability and profit, yet we find selling yields higher surplus in some settings.

4 - Enabling Increased Recycling & Renewable Materials use through Explicit Consideration of Uncertainty
Randolph Kirchain, Principal Research Scientist, Massachusetts Institute of Technology, 77 Massachusetts Ave., E38-432, Cambridge, MA, 02139, United States of America, kirchain@mit.edu, Elsa Olivetti

Increasing the use of recycled and renewable resources can enable energy savings, forestall depletion and avoid the deleterious effects of extraction. We discuss methods for increasing use of these materials through control of incoming feedstock quality variation. Research has shown that explicit incorporation of uncertainty, robust long term batch planning, and informed final product design through the use of stochastic programming can increase the use of recycled and renewable materials.

■ MC41

41- North 227 B- CC

Energy Generation

Contributed Session

Chair: Carlos Ruiz, École Centrale Paris and Supélec, Grande Voie des Vignes, Châtenay-Malabry, 92295, France, carlosruizmora@gmail.com

1 - Evaluating the Impacts of EU ETS on the Italian Electricity Market
Giorgia Oggioni, Assistant Professor, University of Brescia, Contrada Santa Chiara, 50, Brescia, 25122, Italy, oggioni@eco.unibs.it, Francesca Bonenti, Giacomo Marangoni, Elisabetta Allevi

We investigate the economic impacts of the European Union Emissions Trading Scheme (EU ETS)on the Italian electricity market by a power generation expansion model where generators behave either as Cournot or perfectly competitive players. The developed models are used to measure the effects of the EU ETS on electricity prices and demand, investments and generators' profits. Models are formulated as complementarity problems with endogenous energy and CO2 prices and are implemented in GAMS.

2 - Multi-objective Generation Expansion Planning (GEP) Optimization using Pareto Uncertainty Index
Saltuk Selcuklu, Rutgers University, 96 Frelinghuysen Road, CORE Building, Room 201, Piscataway, NJ, 08854, United States of America, bugrasel@gmail.com, Mark Rodgers, Frank Felder, David Coit

The GEP problem is a stochastic multi-objective optimization problem. For multi-objective optimization problems, a common solution methodology is to determine a Pareto optimal set. However, the Pareto optimal set gives deterministic results. Our research aims to introduce Pareto Uncertainty Index which can reflect the stochastic nature of the problem to the results. The proposed method will be applied to the GEP to find solutions which are likely to be less risky to the decision maker.

3 - Distributed Energy Scheduler
Mohammadjavad Feizollahi, PhD Student, Georgia Institute of Technology, 755 Ferst Dr.NW, Atlanta, GA, 30332, United States of America, feizollahi@gatech.edu, Shabbir Ahmed, Santiago Grijalva

In this study, we propose a Distributed Energy Scheduler model capable of determining the optimal schedule of power generation, consumption, storage and transmission with maximum total utility of power prosumers (producer-customers), satisfying physical limits of utilities and transmission systems, power balance and demand constraints in a multi-stage and flat configuration framework. We study performance and convergence of the algorithm and analyze the quality and sensitivity of the solutions.

4 - A Multi-criteria and Multi-year Planning for Distributed Generation with Renewable Power
Tongdan Jin, Assistant Professor, Texas State University, 601 University Drive, San Marcos, TX, United States of America, tj17@txstate.edu, Clara Novoa

Distributed generation planning aims to determine the generator type, capacity, placement, and maintenance such that the cost is minimized, and the loss-of-load probability is minimized. Power intermittency and load uncertainty are the key issues caused by increased penetration of wind, solar, and electric vehicles. We formulate the planning problem as a mixed-integer stochastic decision model which is solved by simulation-based optimization algorithms.

5 - Simulation and Optimization of Renewable Generators Allocation in a Distribution Network

Rodrigo Mena, École Centrale Paris and Supèlec, Grande Voie des Vignes, Châtenay-Malabry, 9225, France, rodrigo.mena@ecp.fr, Carlos Ruiz, Enrico Zio, Yanfu Li

We propose a framework for the simulation and multi-objective optimization framework of an electrical distribution network with the installation of multiple renewable generators and storage devices. The framework allows accounting for the uncertainties in the renewable resources, network components failures and repairs, variability of loads and grid power supply. The objectives of the optimization are minimizing the overall system cost and maximizing the reliability in power supply.

■ MC42

42- North 227 C- CC

Transportation Networks and Plug-in Electric Vehicles II

Sponsor: Transportation Science & Logistics/ Urban Transportation

Sponsored Session

Chair: Chi Xie, Research Associate, The University of Texas at Austin, 1616 Guadalupe St, UTA 4.403, Austin, TX, 78701, United States of America, chi.xie@mail.utexas.edu

1 - Electric Vehicles Routing: Shortest Path Problem with Recharging

Nan Jiang, The University of Texas at Austin, 301 E. Dean Keeton St., Stop C1761, Austin, TX, 78712, United States of America, jiang@utexas.edu, Chi Xie, Jennifer Duthie, Travis Waller

A special constrained shortest path problem considering electric vehicles' en route recharging requirements is studied. An integer programming formulation is developed. Three solution algorithms are proposed and their computational performance is compared.

2 - Accommodating Electric Vehicle Charging in California's Power Sector: Regional Impacts on Emissions

Julia Sohnen, University of California, Institute of Transportation Studies, Davis, CA, 95616, United States of America, jmsohnen@ucdavis.edu, Christopher Yang, Yueyue Fan, Joan Ogden

The carbon intensity of electricity generation depends on the available resource mix and current demand, which vary by time-of-day, season and location. We present a least-cost dispatch model of the California grid to assess temporal and spatial impacts on emissions due to electric vehicle charging. Dispatch decisions depend on price, location, resource mix, and transmission capacity. Emissions assigned to vehicle charging are assigned by looking at marginal generation required at each location.

3 - Localized Charging Policies for Greener Transportation Electrification

Mahdi Kefayati, Research Assistant, The University of Texas at Austin, 2501 Speedway Stop C0803 ENS 541, Austin, TX, 78712, United States of America, kefayati@utexas.edu, Ross Baldick

By analyzing PEV charging demand based on empirical traffic data, we first show that there is substantial flexibility in controlling charging rate, without sacrificing users' comfort. Then, we show that the aggregate load of PEVs, if charged like conventional loads, exacerbates the diurnal variability of electricity demand. Finally, we propose a localized charge rate control policy that reduces PEV load coincidence with conventional demand and increases its correlation with wind energy.

■ MC43

43- North 228 A- CC

Recent Advances in Yard and Shop Optimization and Analytics

Sponsor: Railway Applications

Sponsored Session

Chair: Krishna Jha, Vice President (R&D), Innovative Scheduling, 2153 SE Hawtorne Road, Gainesville, FL, 32641, United States of America, krishna@innovativescheduling.com

1 - Applying AnyLogic Simulation Software to Flat Yard Analysis

Roger Baugher, Director, BNSF Railway, 2600 Lou Menk Drive, Fort Worth, TX, 76131, United Kingdom, Roger.Baugher@BNSF.com

AnyLogic is a general purpose simulation tool enabling development of agent-based, system dynamics, and discrete-event models, in any combination. Among the specialized libraries is the Rail Library that understands the railroad environment – track, switches, trains, cars, coupling, routing, etc. The software exploits the object-oriented framework provided by Java. Using the tool, replay of activity at a flat yard will be demonstrated, and the features of the AnyLogic system discussed.

2 - Delivering Value from Hump Yard Simulation Models

Jeremiah Dirnberger, Manager-Operations Planning, CSX Transportation, 500 Water St. J315, Jacksonville, FL, 32202, United States of America, Jeremiah_Dirnberger@csx.com, Krishna Jha

Although building and validating simulation models of complex systems is no easy task, the real value of the models comes from their use and acceptance after validation is complete. While continuing to build additional hump yard models with Innovative Scheduling, CSX has worked to create processes that derive value from the existing models. This presentation will show how CSX has used the Hump Yard Simulation System to make better decisions in tactical, strategic and conceptual scenarios.

3 - Optimal Locomotive Shop Location and Capacity Planning

Kamalesh Somani, Manager Operations Research, CSX Transportation, 500 Water St., Jacksonville, FL, 32202, Kamalesh_Somani@csx.com, Weijun Xie, Yanfeng Ouyang

Multiple levels of locomotive maintenance and repair are done by Locomotive Shops with various capabilities located at some major yards in the railroad network. Strategically, it is of interest to find the optimal location of locomotive shops and the capacity of these facilities. We have designed a MIP formulation to solve this problem. Numerical study is conducted to verify the model.

4 - Analysis of Railroad Terminal Operational Decision Making

Edward Lin, Manager Operations Research, Norfolk Southern Corporation, 1200 Peachtree St NE, MS 12-117, Atlanta, GA, 30309-3579, United States of America, edward.lin@nscorp.com, Clark Cheng

Rail classification yards sort and regroup railcars to their next destinations in the rail network. A number of decisions are made in each process to ensure that cars are handled efficiently and safely to meet performance measures and resources are fully utilized. Proper analysis of activities can provide valuable insights that help OR modelers improve algorithms as well as help yard personnel improve operations.

■ MC44

44- North 228 B- CC

Supply Chain Optimization

Contributed Session

Chair: Avi Giloni, Sy Syms School of Business Yeshiva University, 500 West 185th Street, BH 428, New York, NY, 10033, United States of America, agiloni@yu.edu

1 - Analysis of the Best Double Frequency Policy in the Single Link Problem with Discrete Shipping Times

Luca Bertazzi, Professor, University of Brescia, Contrada Santa Chiara 50, Brescia, 25122, Italy, bertazzi@eco.unibs.it, Lap Mui Ann Chan

We study the problem of shipping products from an origin to a destination. The problem is to decide when to make the shipments and the quantity to send in order to minimize the sum of the transportation and the inventory costs. We show the worst-case performance bound of the Best Double Frequency policy. Moreover, we show that it is not possible to improve this bound by allowing more shipping frequencies. Finally, we show that the Best Double Frequency policy is very effective on average.

2 - Determining the Optimal Supply Chain Policies for the Dairy Industry in Puerto Rico

Lourdes Fernandez, University of Puerto Rico, Mayaguez Campus, Call Box 9000, Mayaguez, PR, 00680, Puerto Rico, lourdes.fernandez@upr.edu, Betzabè Rodrìguez

The Dairy Industry of Puerto Rico has a Milk's Price Stabilization Program to ensure a fair and proportionate price for producers and farmers. Furthermore, a maximum fresh milk production volume was established and excess milk produced has traditionally being sold to a privately own company or discarded. The objective of this research is to develop a model to find the best operational policies to ensure the optimal performance of the supply chain.

3 - A Solution Approach for Capacitated Multi-echelon Supply Chain Network Problem

Kangbok Lee, Research Associate Professor, Rutgers University, 1 Washington Park Room 906, Newark, NJ, 07102, United States of America, kangblee@business.rutgers.edu, Hui Dong, Lei Lei

We consider a capacitated multi-echelon supply chain network problem with batching production and delivery at manufacturers, unit packaging process at packaging centers. For a special case with one packaging center and an identical order size, we propose a strongly polynomial time algorithm by decomposition approach. For a general case, we present an approximation algorithm along with experimental result.

4 - Assessing the Difference Between Shock Sharing and Demand Sharing in Supply Chains

Avi Giloni, Sy Syms School of Business Yeshiva University, 500 West 185th Street, BH 428, New York, NY, 10033, United States of America, agiloni@yu.edu, Vladmir Kovtun, Cliff Hurvich

We consider the problem of assessing value of demand sharing in a multi-stage supply chain in which the retailer observes stationary ARMA demand. We provide conditions under which demand sharing is (i) equivalent to no sharing, (ii) equivalent to full information shock sharing, and (iii) intermediate in value to the two previously described arrangements. We then show that under these three possible sharing arrangements, demand propagates through a supply chain as QUARMA-in-QUARMA-out.

■ MC45

45- North 229 A- CC

Panel Discussion: Industry Job Search

Cluster: Job Placement Services

Invited Session

Chair: Bala Shetty, Professor, Texas A & M University, College Station, TX, United States of America, b-shetty@tamu.edu

1 - Panel Discussion: Industry Job Search

Moderator: Bala Shetty, Professor, Texas A & M University, College Station, TX, United States of America, b-shetty@tamu.edu, Panelists: Hossam Zaki, Bruce Patty, Irv Lustig

The panel will discuss the industry interview process and do's and don'ts associated with the job search. In addition to comments from current and former recruiters, time will be provided for questions and answers.

■ MC46

46- North 229 B- CC

Organizational and Industry Renewal (IV): Consortia, Alliances and Collaborations

Sponsor: Organization Science

Sponsored Session

Chair: Andreas Schwab, Associate Professor, Iowa State University, 3315 Gerdin, Ames, IA, 50011, United States of America, aschwab@iastate.edu

1 - SME Relationships with Non-Academic Research Institutes

Benjamin Weber, EBS Business School Strascheg Institute for Innovation and Entrepreneurship, Burgstr. 4, Oestrich-Winkel, 65375, Germany, benjamin.weber@ebs.edu, Florian Taeube, Friedemann Polzin

Innovation is a growth driver SMEs cannot ignore for their long term survival strategy. However, few SMEs can master the innovation process alone because research capabilities are scarce. Cooperations are seen as a solution for this obstacle. We surveyed 150 SMEs regarding innovation cooperations with other firms and research institutes. The aim of our study is to find out how innovation can emerge from cooperations and how to foster this process.

2 - Financing Eco-innovation– The Determinants of Cooperation to Bridge the Valley of Death

Friedemann Polzin, EBS Business School Strascheg Institute for Innovation and Entrepreneurship, Rheingaustr. 1, Oestrich-Winkel, 65375, Germany, polzin@instoec.de, Paschen von Flotow, Florian Taeube, Benjamin Weber

A main obstacle to effective commercialization and diffusion of clean technologies lies in the absent cooperation between financiers and innovators. I conduct expert interviews among project managers and survey stakeholders of government supported cooperative research projects (CRP) to explore this phenomenon. As results I expect a framework for the management of CRP and complementary industrial regulations to reduce information asymmetries in order to mitigate this innovation system failure.

3 - The Value of Process Development Alliances under Demand Uncertainty

Hiroki Sano, University of Texas McCombs School of Business, 1 University Station B6500, Austin, TX, 78712, United States of America, Hiroki.Sano@phd.mccombs.utexas.edu, Edward Anderson

Semiconductor manufacturers are forming alliances to develop common design rules that enable them to easily pool their capacities to manage demand uncertainty. We develop a game-theoretic model to study the benefits of this arrangement when the member firms' markets can be substitutes or complements.

■ MC47

47- North 230- CC

Advances on V2V and V2I Communications

Sponsor: Transportation Science & Logistics/ Intelligent Transportation Systems (ITS)

Sponsored Session

Chair: Bruce Wang, Professor, Texas A & M University, College Station, TX, United States of America, bwang@tamu.edu

1 - A Mathematical Modeling for the Temporal and Geographic Propagation of Information in Vehicle-to-Vehicle Communications

Yong Hoon Kim, Purdue University, 3000 Kent Ave, West Lafayette IN 47906, United States of America, kim523@purdue.edu, Srinivas Peeta

This study proposes a mathematical model for the dynamics of information propagation in large-scale vehicle-to-vehicle (V2V) communications based traffic networks. The proposed model aims to obtain a better understanding of the interacting processes of information propagation and the dynamics of traffic flow. Insights will be illustrated using the results obtained through the mathematical modeling and the simulated data.

2 - Social Network Analysis for Information Networks under V2V Communication Based Traffic Systems

Choungryeol Lee, Purdue University, West Lafayette, IN, United States of America, lee1210@purdue.edu, Srinivas Peeta

We proposes a graph-theoretical approach to model the information network which results from wireless connections of equipped vehicles in a traffic network through Vehicle-to-Vehicle (V2V) communications. This study presents metrics based on social network analysis to understand structural characteristics and dynamics of the information network. Further, based on simulation experiments, we discuss the results and an approach to explore the structural evolution of the information network over time.

3 - Vehicle-to-Vehicle Connectivity on Two Parallel Roadways with a General Headway Distribution

Bruce Wang, Professor, Texas A&M University, College Station, TX, United States of America, bwang@tamu.edu, Kai Yin, Yunglong Zhang

In this paper, we propose analytical models for the vehicle connectivity on two parallel roadways, assuming general distributions for vehicle headways. Models are derived for the expectation, variance and probability distribution of information propagation distance. Closed form approximation to the expectation is obtained and is numerically shown to agree well with the exact models. In addition, we discuss the effects of signal interference on the information propagation. Monte Carlo simulation results further validate the proposed models. Through simulations, the developed models are also shown to have overcome the deficiencies associated with the commonly used one-roadway models and models with the Poisson assumption for vehicle distribution.

4 - Using Dynamic Congestion Tolling and V2I Communication for Decentralized Optimal Routing

Hao Zhou, University of Michigan, 1205 Beal Ave., IOE Building, Ann Arbor, MI, 48109, United States of America, haozhou@umich.edu, Romesh Saigal

In this research, we consider a traffic network with dynamic congestion toll on each link, and vehicles capable of communicating with central controller. Each vehicle receives real-time toll prices and traffic information of all links, and tries to optimize its route choice based on its own preference. We developed a model to dynamically update toll prices on each link to minimize overall delay of vehicles.

5 - Predictive Speed Harmonization and Control of Flow Breakdown in a Connected Vehicle Environment

Alireza Talebpour, Northwestern University, Evanston, IL, 60208, United States of America, AlirezaTalebpour2014@u.northwestern.edu, Hani S. Mahmassani

Microscopic simulation is used to evaluate the effectiveness of speed harmonization strategies intended to avoid or delay the onset of breakdown and shock wave formation on freeways. Implementation in a connected vehicle environment is discussed.

■ MC48

48- North 231 A- CC

Dynamic Routing

Sponsor: Transportation Science & Logistics/ Freight Transportation & Logistics

Sponsored Session

Chair: Irina Dolinskaya, Assistant Professor, Northwestern University, Technological Institute M235, 2145 Sheridan Road, Evanston, IL, 60208, United States of America, dolira@northwestern.edu

1 - Real-Time Orienteering Problem with Stochastic Travel Times

Irina Dolinskaya, Assistant Professor, Northwestern University, Technological Institute M235, 2145 Sheridan Road, Evanston, IL, 60208, United States of America, dolira@northwestern.edu, Karen Smilowitz, Zhenyu (Edwin) Shi

We study an extension of the orienteering problem (OP) with stochastic travel times where network information is updated in real-time. Furthermore, the decisions regarding customer sequence and path choice affect the information gathered, requiring exploration vs. exploitation analysis. We present adaptive path planning methods to take advantage of this data, combining OP and optimal path finding. Application to search-and-rescue operations in a disaster affected region is also presented.

2 - Dynamic Fleet Routing via Tabu Search

Doug Popken, Systems View, 2127 Mountain Maple Avenue, Highlands Ranch, CO, United States of America, dpopken@systemsview.com

Systems View is upgrading the intranet based route management system of an auto shipper client to include a dynamic route optimization capability. Routes have complex capacity and timing constraints, with pickup and dropoff locations throughout the United States. A prototype, using a series of insertion based heuristics, generated enthusiasm for more advanced algorithms. This talk describes the development and deployment of a classic tabu search meta algorithm that guides the heuristics to producing sets of high-quality routes.

3 - Policy Evaluation and Cyclic-order Search for the Multi-compartment VRP with Stochastic Demands

Justin Goodson, Saint Louis University, 3674 Lindell Blvd., St. Louis, MO, 63108, United States of America, goodson@slu.edu

We develop methods to estimate and exactly calculate the expected cost of a priori policies for the multi-compartment vehicle routing problem with stochastic demands. We incorporate our estimation procedure into a cyclic-order-based simulated annealing algorithm, significantly improving the best-known solution values for a set of benchmark problems. We also extend the updating procedure for a cyclic order's candidate route set to duration-constrained a priori policies.

4 - Finding Eco Routes in a Time-dependent Traffic Network

Hao Lei, Phd Student, University of Utah, 110 Central Campus Dr, MCE 2000, Salt Lake City, UT, 84112, United States of America, hao.lei@utah.edu

This talk presents algorithms for estimating and finding the time-dependent eco-friendly route in a transportation network. A cross-resolution traffic model is first adapted to provide accurate traffic state and emission forecasts. A dynamic least cost path-finding algorithm with reduced search space is developed to efficiently compute route solutions with the least emissions.

5 - Routing for Customer Relationship

Shu Zhang, University of Iowa, Iowa City, IA, United States of America, shu-zhang-1@uiowa.edu, Jeffrey W. Ohlmann, Barrett W. Thomas

This problem is motivated by the decision making that salespeople face in their daily work. We focus on a priori routing of representatives in health care industry such that the expected sales to doctors can be maximized. We investigate a series of formulations with increasing modeling detail of the stochastic elements. Our computational experiments identify the value of modeling stochasticity.

■ MC49

49- North 231 B- CC

Integrated Models for City Logistics

Sponsor: Transportation Science & Logistics

Sponsored Session

Chair: Tom van Woensel, Professor of Freight Transport and Logistics, Eindhoven University of Technology, P.O. 513, Eindhoven, Netherlands, t.v.woensel@tue.nl

1 - Cyclic Distribution Strategies for an Inventory Routing Problem

Orsan Ozener, Ozyegin University, Department of Industrial Engineering, Istanbul, Turkey, orsan.ozener@ozyegin.edu.tr, Ali Ekici, Gultekin Kuyzu

We study a variant of inventory routing problem where a set of customers with deterministic and continuous demand is replenished from a central depot by routing a fleet of capacitated delivery vehicles. Assuming a cyclic distribution policy where the proposed delivery schedule is repeated with a given frequency, we propose three solution approaches and test them on a set of randomly generated instances in terms of solution quality and solution time.

2 - An Integrated Supply Chain Network Design Model with Expedited Delivery Options

Xiaopeng Li, Mississippi State University, P.O. Box 9546, 235L Walker Hall, 501 Hardy Road, Mississippi State, MS, 39762, United States of America, xli@cee.msstate.edu

We propose a network design model that integrates decisions in supplier location selection, customer assignments, transportation configurations, and inventory operations. This model particularly addresses tradeoffs between inventory expenses and expedited delivery usage and their dependence of location planning. A customized solution approach based on Lagrangian relaxation is proposed to efficiently solve this integer programming model with high nonlinearity.

3 - Developments and Challenges in City Logistics

Teodor Crainic, Professor, ESG UQAM and CIRRELT, Pavillon Andrè-Aisenstadt, 2920, chemin de la Tour, Montreal, QC, H3T 1J4, Canada, TeodorGabriel.Crainic@cirrelt.ca

We review recent developments and trends in the organization and business models for City Logistics as well as in models and methods proposed to address them. While significant progress may be observed, many challenging areas are still scarcely explored from an operations research perspective. We thus identify a number of research areas of major interest offering both significant scientific challenges and important impact potential.

4 - Integrating Freight and People in City Logistics

Tom van Woensel, Professor of Freight Transport and Logistics, Eindhoven University of Technology, P.O. 513, Eindhoven, Netherlands, t.v.woensel@tue.nl

Combining people and freight flows creates attractive business opportunities because the same transportation needs can be met with fewer vehicles and drivers. This paper will discuss the design of integrated people and freight transportation networks and the related coordination, planning and scheduling policies to enable efficient and reliable delivery of both persons and small- to medium-sized freight volumes.

■ MC50

50- North 231 C- CC

Military Decision Making

Sponsor: Military Applications

Sponsored Session

Chair: Chase Murray, Assistant Professor, Industrial & Systems Engineering, Auburn University, Auburn, AL, United States of America, ccm0022@auburn.edu

1 - Optimizing the Army's Aerial Reconnaissance and Surveillance Asset Mix

Jessica Tabacca, US Army TRADOC Analysis Center, White Sands Missile Range, Martin Luther King Drive, White Sands MR, NM, United States of America, emcrapar@nps.edu, Kirstin Smead, Emily Craparo

In an effort to preserve the Army's unmatched capabilities in aerial reconnaissance and surveillance (R&S), the Integrated Capabilities Development Team (ICDT) is supporting a large-scale study to determine in which R&S platforms and sensors the Army should invest. This presentation will discuss the Army's Joint Platform Allocation Tool (JPAT) methodology; key constraints, limitations, and assumptions; and the challenges overcome in developing the JPAT.

2 - Locating Monitors using Continuous- and Discrete-space Optimization Models

Andrew Romich, University of Florida, P.O. Box 210020, Gainesville, FL, 32611, United States of America, aromich222@gmail.com, J. Cole Smith, Guanghui Lan

The potential for an adversary to transport illicit material through an area of interest is a prevalent risk. In response to this threat, we examine the problem of placing stationary monitors in a continuous space to minimize an adversary's maximum probability of evasion. We first construct a two-stage MINLP. Then, we provide an algorithm to optimally locate the monitors in a continuous space and a heuristic that achieves a near-optimal bound utilizing a discretized set of monitor locations.

3 - A Nonconvex Nonlinear Assignment Problem for Multi-sensor Data Fusion

Dimitri Papageorgiou, PhD Candidate, Georgia Tech, 765 Ferst Ave., Atlanta, GA, 30332, United States of America, djpapag@gatech.edu

Multi-sensor data fusion hinges on the solution of a track-to-track association problem to determine the pairing of sensor-level tracks that correspond to the same true target from which the sensor-level tracks originated. After casting this problem as a MINLP, we use submodularity properties to solve this problem exactly within a branch-and-cut framework. Computational results illustrate the remarkable effectiveness of this approach.

■ MC51

51- North 232 A- CC

DIME/PMESII Modeling II

Sponsor: Military Applications

Sponsored Session

Chair: Dean Hartley, Principal, Hartley Consulting, 106 Windsong Ln, Oak Ridge, TN, 37830, United States of America, DSHartley3@comcast.net

1 - The Challenges Associated with Assessing Cyber Issues

Stuart Starr, Institute for Defense Analyses, 4850 Mark Center Drive, Alexandria, VA, 22311, United States of America, stuartstarr@cox.net, Dean Hartley

Recent cyber attacks have shown the challenges associated with assessing cyber issues. The assessment community is having a difficult time characterizing our current ability to assess cyber issues and prioritizing actions to improve that capability. We explore the state-of-the-art in our ability to assess cyber issues by decomposing the problem and identifying candidate cyber policy issues that warrant further analyses and identifies and illustrates candidate Measures of Merit (MoMs).

2 - A Methodology for Exploring Force Composition using the Peace Support Operations Model

Alejandro Hernandez, Associate Professor, Naval Postgraduate School, 777 Dyer Road, Monterey, CA, 93943, United States of America, ahernand@nps.edu, Mary McDonald, Julian Ouellet

We demonstrate a robust, repeatable methodology that addresses questions of force sufficiency (size, structure, capability). Though model-agnostic, this application employed the Peace Support Operations Model, recently used to support real-time planning in Afghanistan. We demonstrate a post-game analysis methodology that expands knowledge gained in a wargame, by evaluating additional courses of action as well as the robustness of decisions made given variations in the operational environment.

3 - The Foundations of Irregular Warfare (IW)

Dean Hartley, Principal, Hartley Consulting, 106 Windsong Ln, Oak Ridge, TN, 37830, United States of America, DSHartley3@comcast.net, Lee Lacy

IW operations are hard: they connect to the human domain, where our knowledge is weak. Recent conflicts have produced demands for models of IW. Ontologies provide a tool for representing IW. They specify vocabularies & semantic relationships. We show ontologies of IW actor, action, & environment concepts and state variables. They come from several sources. The semantics permit programmatic inferencing. The ontologies are useful for modeling, data interchange, interoperability, and V&V.

■ MC52

52- North 232 B- CC

Models for Clean Electricity Systems

Sponsor: Energy, Natural Res & the Environment/Energy

Sponsored Session

Chair: Pedro Linares, Comillas P. University, Alberto Aguilera 25, Madrid, 28015, Spain, pedro.linares@upcomillas.es

1 - Influence of CO2 Cap and Trade Policy Parameters on Deregulated Electricity Networks

Felipe Feijoo, University of South Florida, 4202 E. Fowler Avenue, ENB118, Tampa, Fl, 33620, United States of America, felipefeijoo@mail.usf.edu, Tapas Das

Our game theoretic model analyzes the impact of design parameters of CO2 cap and trade policies on the performance of deregulated electricity networks. The performances include emissions, LMPs, consumption, generation and allowances allocation, and profits. We formulate the allowance and electricity markets as a bi-level continuous optimization problem and solve it using a MPEC/EPEC approach.

2 - Robust Wind Farm Layout Optimization with Mixed Integer Programming

Peter Y. Zhang, University of Toronto, 164 College Street, Toronto, ON, M5S 3G9, Canada, peteryun.zhang@mail.utoronto.ca, David Romero, Timothy Chan, Cristina Amon

Wind farm layout optimization aims to find the most profitable layout, given the site condition and the wind regime. However, the latter is inherently uncertain due to errors in measurement, correlation, and forecasting. Previous studies on wind farm optimization assumed wind data to be perfectly accurate, which could lead to lower investor confidence and higher financial risk. This study presents a novel Robust MIP model to address such gap.

3 - Generation and Storage Dispatch in Stochastic Electricity Networks

Lawrence V. Snyder, Associate Professor, Lehigh University, 200 West Packer Ave., Mohler Lab, Department of Industrial and Systems Engr, Bethlehem, PA, 18015, United States of America, larry.snyder@lehigh.edu, Mohammadmohsen Moarefdoost, Gengyang Sun

We optimize generation and storage decisions in an electricity network with multiple generators, storage units, and loads under power flow constraints. The system faces either stochastic loads or supply disruptions. We solve the problems heuristically by decomposing them into several single-generator, single-battery, multi-load systems and solving them optimally using dynamic programming. We discuss our heuristic's computational performance as well as insights gained from the models.

4 - CGE Model for Clean Electricity Standards: Impacts on the U.S. Electric Power Sector

Ekundayo Shittu, Assistant Professor, Tulane University, 7 McAlister Dr., New Orleans, LA, 70118, United States of America, eshittu@tulane.edu, Ian Sue Wing

We develop a technology-detailed bottom-up CGE capacity expansion model with a macro-consistent calibration of activities via column disaggregation of the social accounting matrix. We address the congruency of technology substitution elasticity with clean electricity standards given a hybrid setting and EIA's generator pool mapping.

■ MC53

53- North 232 C- CC

Optimization Methods for Energy Efficiency and Risk Management

Sponsor: Energy, Natural Res & the Environment/Energy

Sponsored Session

Chair: Emilio L. Cano, University Rey Juan Carlos, Camino del Molino s/n, Edificio Biblioteca D007, Fuenlabrada, 28943, Spain, emilio.lopez@urjc.es

1 - Microgrid Modeling using the Stochastic Distributed Energy Resources Customer Adoption Model DER-CAM

Michael Stadler, Scientist, Lawrence Berkeley National Laboratory(USA), Center for Energy & Innovation(Austria), One Cyclotron Road, Berkeley (for Berkeley Lab), CA, United States of America, MStadler@lbl.gov, Mohammad Bozchalui, Afzal Siddiqui, Chris Marnay, Goncalo Cardoso, Markus Groissböck, Ratnesh Sharma

The Distributed Energy Resources Customer Adoption Model (DER-CAM) is a mixed integer linear optimization tool that has been designed by Berkeley Lab., USA and used in Australia, Austria, Germany, Portugal, Japan, and in China. It is also considered as basis for the European project Energy Efficiency and Risk Management in Public Buildings (EnRiMa). This presentation deals with the new stochastic programming features within DER-CAM, e.g. fuel cells or driving patterns for electric vehicles.

2 - Scenario Generation for Building Operations and Investment

Kjetil Midthun, SINTEF, Trondheim, Norway, Kjetil.Midthun@sintef.no, Adrian Tobias Werner, Michal Kaut

In a modern setting, consumers can take a more active role in controlling their energy usage. It is challenging to find efficient solutions in terms of economy and energy given the substantial uncertainty that are present both on the short-term and the long-term. Some of these uncertain parameters can be represented in scenario trees. We propose a scenario tree with a hybrid structure that address both long and short term uncertainty within the same framework.

3 - Analysis and Prediction of Aggregate Demand for Electricity

John Hobby, Alcatel-Lucent Bell Labs, 600 Mountain Avenue, Murray Hill, NJ, 07974, United States of America, hobby@research.bell-labs.com, Gabriel Tucci, Mustafa Dogru

We analyze the aggregate electricity consumption of many consumers, and extract components for weather and natural illumination. Least-squares fits for Steadman apparent temperature and log-scale illumination proceed independently for each hour of the day. We use cubic polynomials and spline surfaces, with FFT spectral analysis for residual consumption. We do a full comparison with simpler methods based on exponential smoothing.

4 - A Symbolic Model Specification for Energy Efficiency Models

Emilio L. Cano, University Rey Juan Carlos, Camino del Molino s/n, Edificio Biblioteca D007, Fuenlabrada, 28943, Spain, emilio.lopez@urjc.es, Javier M. Moguerza

Within the framework of a Decision Support System for energy-efficient buildings, the dynamic generation of optimization models is advisable. The aim is to allow reproducibility and scalability, in order to cover a wide range of building configurations. In this work, an integrated model specification framework is presented. Within this scheme data structures comprising the model objects, and mathematical and digital representations are generated for both, human and machine interpretation.

■ MC54

54- Regency Ballroom A- Hyatt

Publishing in the INFORMS Journal on Computing

Cluster: INFORMS Journals Cluster

Invited Session

Chair: John Chinneck, Carleton University, Systems and Computer Engineering, Ottawa, On, K1S 5B6, Canada, chinneck@sce.carleton.ca

1 - How to Publish Your Paper in the INFORMS Journal on Computing

John Chinneck, Carleton University, Systems and Computer Engineering, Ottawa, On, K1S 5B6, Canada, chinneck@sce.carleton.ca, David L. Woodruff, Allen Holder, Edward Wasil, Karen Aardal, Subramanian Raghavan, Robert Fourer

What do we look for in evaluating a paper for publication in the INFORMS Journal on Computing? What are the characteristics of successful papers? How can you increase your chances of acceptance? What are the up-and-coming topics of interest? The Editor-in-Chief and senior editors will address these issues and answer your questions.

■ MC55

55- Regency Ballroom B - Hyatt

Joint Session OR in Emerging Econ/ENRE-Energy: OR Applications in the Energy Sector of Emerging Markets

Cluster: Operations Research in Emerging Economies & Energy, Natural Res & the Environment/Energy

Invited Session

Chair: Thiago Serra, Operations Research Analyst, PETROBRAS, Avenida Paulista, 901, Sao Paulo, SP, 01311-100, Brazil, thiago.serra@petrobras.com.br

1 - The Stochasticity of Brazilian Electric Sector

Fernando Luiz Cyrino Oliveira, Pontical Catholic University of Rio de Janeiro, Rua Marques São Vicente, 225, Gávea, Rio de Janeiro, RJ, 22451041, Brazil, fcyrino@ele.puc-rio.br, Pedro Guilherme Costa Ferreira, Reinaldo Castro Souza

This article aims at presenting a broad perspective of the Brazilian Electric sector, identifying the process of transformation through which it underwent during the last decades arriving at the Brazilian Electric Sector (BES) New Model. With this model it's shown how a good modeling of the stochastic variable is determinant to the good functioning of the BES' three fundamental pillars: planning, operation, and accounting and settlement process of the energy transactions in the short term market.

2 - Optimal Integration of Wind with Pumped Hydro Storage: Case Study of Kenya

Maureen Murage, Graduate Student, Cornell University, 321 Riley Robb Hall, Ithaca, NY, 14853, United States of America, mwm88@cornell.edu, Lindsay Anderson

Kenya is largely hydro-based, but has a growing interest in wind energy to meet the growing demand for electricity. Our objective is to develop an optimal control strategy to deploy paired wind and hydro resources to maximize generation reliability in the Kenyan power system. The benefits of this methodology will be illustrated using a case study based on Kenyan wind data.

3 - Macro-level Hybrid Energy Planning Model with Intermittent Renewable Sources -India Case Study

Ayse Selin Kocaman, Graduate Research Assistant, Columbia University, 500 West 120th Street, 918 S. W. Mudd Hall, New York, NY, 10027, United States of America, ask2170@columbia.edu, Tim Huh, Vijay Modi

Fast depleting fossils fuels and their environmental hazards increase the importance of renewable sources for sustainable energy planning. However, renewables are intermittent and heavily dependent on spatial location. Here, we address the problem of modeling hydro and solar energy production and allocation, including storage and long-term investments, capturing the uncertainty in the hourly supply and demand data. Model is applied to India which has significant solar and hydropower potential.

4 - How to Improve the Energy Sector in Developing Countries

Syed Shahabuddin, Professor, Central Michigan University, Smith 203C, Mt Pleasant, MI, 48858, United States of America, shaha1s@cmich.edu

A country continual economic development requires energy. If a county is unable to provide enough, cheap energy, it could jeopardize its economic future. Operations Research has many techniques that can help develop efficient processes to improve productivity and reduce cost. The question is: does the availability of energy and cost effect economic growth and how can OR help? My paper will evaluate this question in the context of a few developing countries.

■ MC56

56- Curtis A- Hyatt

Joint Session TMS/ORG: Knowledge, Learning and Intellectual Capital

Sponsor: Technology Management & Organization Science

Sponsored Session

Chair: Charles Weber, Associate Professor of Eng & Tech Mgmnt, Portland State University, P.O. Box 751 ETM, Portland, OR, 97207, United States of America, webercm@gmail.com

1 - Knowledge Creation and Integration in Radical Product Innovation

Paulo Gomes, Visiting Assistant Professor, Babson College, TOIM, Babson Park, MA, United States of America, pgomes@babson.edu

We approach the product development process from a knowledge management perspective and examine practices at the product and process level that drive cohesiveness and integration. In particular, we try to understand how these practices facilitate or hinder new problems frames and product mental models for radical innovation. The paper reports on the results of an empirical study.

2 - Intellectual Property and Technology Start-ups: Size Matters

Kelvin Willoughby, Professor of Entrepreneurship & Intellectual Property, School of Electrical Engineering & Computing, Curtin University, GP.O. Box U1987, Perth, Wa, 6845, Australia, k.willoughby@curtin.edu.au

Intellectual property features more prominently in the business of small entrepreneurial technology firms than it does in the business of large mature technology firms. Results of an empirical study of bioscience-technology firms in the US reveal that the strategies of entrepreneurial technology firms incorporate a distinctive intellectual property portfolio management approach, rather than a crude patent administration approach, to appropriating value from their technology.

3 - Knowledge Work in Supply Chain Innovation Alliances: Technological Uncertainty as Inhibitor?

Ricarda Bouncken, Prof., University of Bayreuth, Prieserstr. 2, Bayreuth, 95444, Germany, bouncken@uni-bayreuth.de, Robin Pesch

Supply chain innovation alliances originally set up to improve effectiveness are today increasingly used for idea generation and new product creation. This study based on a sample of 418 firms delivers insights on how knowledge transfer and knowledge combination affect the joint knowledge creation and new product superiority in supply chain innovation alliances. We further provide insights how the knowledge work across supply chain partners is influenced by growing technological uncertainty.

4 - Synchronizing Knowledge Creation in a High Tech Manufacturing Ecosystem

Charles Weber, Associate Professor of Eng & Tech Mgmnt, Portland State University, P.O. Box 751 ETM, Portland, OR, 97207, United States of America, webercm@gmail.com, Jiting Yang

A qualitative empircal study of a high tech manufacturing ecosystem shows that the keystone of the ecosystem gains competitive advantage by entraining the whole ecosystem. Knowledge creation activities are synchronized on a global scale.

■ MC57

57- Curtis B- Hyatt

Markov Lecture (Keynote)

Sponsor: Applied Probability

Sponsored Session

Chair: Assaf Zeevi, Columbia Business School, New York, NY, United States of America, assaf@gsb.columbia.edu

1 - Stochastic Network Models for Hospital Inpatient Flow Management

J.G. "Jim" Dai, Professor, School of ORIE, Cornell University (on leave from Georgia Institute of Technology), 221 Rhodes Hall, 136 Hoy Road, Ithaca, NY, 14853, United States of America, jim.dai@cornell.edu

After being treated in ED, a patient's waiting time for admission to inpatient wards depends on time of the day, and can be excessively long when the patient's bed-request is in the morning. I will promote stochastic network models that are based on an extensive empirical study and present a two-time-scale approach to analyze these models. These analyses allow one to evaluate strategies such as inpatient discharge timing to flatten out the waiting time statistics throughout the day.

■ MC58

58- Phoenix East- Hyatt

New Directions in Game Theory and its Applications

Sponsor: Applied Probability

Sponsored Session

Chair: Gabriel Weintraub, Columbia Business School, 3022 Broadway, New York, NY, 10027, United States of America, gyw2105@columbia.edu

Co-Chair: Omar Besbes, Columbia Business School, 3022 Broadway, New York, NY, 10027, United States of America, ob2105@columbia.edu

1 - Delaying the Revelation of Information in a Social Learning Model

Kostas Bimpikis, Stanford University, Stanford, CA, United States of America, kostasb@stanford.edu, Kimon Drakopoulos

We study a model of strategic experimentation motivated by collective decision making with costly information acquisition or R&D and the innovation process. When the outcomes of experimentation are observable, free-riding results in inefficiently low experimentation. When an information aggregator holds all information and commits when to reveal it, efficiency increases.

2 - Equilibrium and Approximations for Repeated Auctions with Budgets Constraints

Santiago Balseiro, Columbia Business School, 3022 Broadway, New York, NY, 10027, United States of America, srb2155@columbia.edu, Omar Besbes, Gabriel Weintraub

We introduce the notion of a Fluid Mean Field Equilibrium (FMFE) to study the dynamic bidding strategies of budget-constrained agents in repeated second-price auctions. This concept combines a mean field approximation to relax the agents' informational requirements, with a fluid approximation to handle the dynamics of the agents' control problems. We show that a FMFE is computationally tractable, and that it approximates the rational behavior of agents in large markets.

3 - Mean Field Equilibria in Dynamic Auctions

Krishnamurthy Iyer, Stanford University, Stanford, CA, United States of America, kriyer@stanford.edu, Ramesh Johari

Recently, motivated by applications in electronic commerce, there has been a significant interest in the modeling and analysis of repetitions of simple auctions. Although standard techniques have not seemed promising, a large market approximation known as mean field equilibrium has been successful in characterizing bidder behavior and in market design. In this talk, we present an overview of the current results, and discuss new results for repeated common value auctions.

4 - An Internet Experiment on Bargaining in Networks

Yashodhan Kanoria, PhD Candidate, Stanford University, 350 Serra Mall, Stanford, CA, 94305, United States of America, ykanoria@stanford.edu, Cindy Chang, Andrea Montanari, Madison White

Exchange networks model the behavior of a set of players who need to reach pairwise agreements for mutual benefit, as in the labor market, the housing market and the 'market' for social relationships. We describe internet-based experiments on bargaining in networks, that are the largest such experiments to date. Our results include some of the first insights into the dynamics of bargaining.

■ MC59

59- Phoenix West- Hyatt

Multiclass Networks

Sponsor: Applied Probability

Sponsored Session

Chair: Erjen Lefeber, Technische Universiteit Eindhoven, Eindhoven, 5600MB, Netherlands, A.A.J.Lefeber@tue.nl

1 - Transport Equation Models for Transient Production Flows

Dieter Armbruster, Professor, Arizona State University, Tempe, AZ, United States of America, armbruster@asu.edu, Matthew Wienke

Transient production flows, like e.g. recovery from failure, require to determine ensemble averages instead of time averages typical for stationary production. We show that coupled transport equation models for describing the time evolution and flow of work in progress and production speed along a production line are an effective way to study transient behavior. It is shown that the boundary conditions are the crucial modeling step connecting transient queueing theory and continuum models.

2 - Control of Multi-class Queueing Networks with Infinite Virtual Queues
Erjen Lefeber, Technische Universiteit Eindhoven, Eindhoven, 5600MB, Netherlands, A.A.J.Lefeber@tue.nl

We consider a generalization of the standard multi-class queueing network model by allowing both standard queues and infinite virtual queues which have infinite supply of work. We present a possible solution to the problem of finding policies which allow some of the nodes of the network to work with full utilization, and yet keep all the standard queues in the system stable.

3 - A Queue with Skill Based Service under FCFS-ALIS
Ivo Adan, Eindhoven University of Technology, Den Dolech 2, Eindhoven, Netherlands, iadan@tue.nl, Gideon Weiss

We consider a queueing system with multi-type customers and multi-type servers, under FCFS-ALIS policy: A server always picks the first, longest waiting compatible customer, a customer is always assigned to the longest idle compatible server. We derive an explicit product-form expression for the steady state distribution, when service capacity is sufficient, and we also analyze the system under overload.

■ MC61

61- Russell- Hyatt

Joint Session AA/ SPPSN: Airline Scheduling under Competition and Collaboration

Sponsor: Aviation Applications & Public Programs, Service and Needs

Sponsored Session

Chair: Luis Cadarso, Technical University of Madrid, Aeronautics School, Pza. Cardenal Cisneros, 3, Madrid, 28040, Spain, luis.cadarso@upm.es

1 - Revenue and Operational Impacts of Depeaking Flights at Hub Airports
Laurie Garrow, Associate Professor, Georgia Institute of Technology, School of Civil Engineering, 790 Atlantic Drive, Atlanta, GA, 30332, United States of America, laurie.garrow@ce.gatech.edu, Donald Katz

Many US airlines have converted their hub airport schedules from having several flight banks a day to a depeaked continuous schedule. This study assess revenue and operational impacts associated with depeaking flights. By recreating airline schedules and determining how much each airline depeaked and which flights were shifted away from the banks, the lost connections will be assessed as to whether the depeaking strategy was beneficial for the airline and airport.

2 - A Consensus-building Mechanism for Setting Service Expectations in Air Traffic Flow Management
Prem Swaroop, PhD Candidate, Robert H Smith School of Business, University of Maryland, 3330C, Van Munching Hall, University of Maryland, College Park, MD, 20742, United States of America, pswaroop@rhsmith.umd.edu, Michael Ball

We develop a voting-based mechanism for airlines to provide strategic input to the Air Navigation Service Provider. This involves some interesting problems and technologies — largely: voting, optimization models, integer programming and column-generation, multi-attribute valuation models. Through large experiments, we have shown that the proposed mechanism is fairly robust and has promise in addressing the stated problem.

3 - Codesharing Types and Liberalization Agreements: Effects on Frequency and Pricing
Nicole Adler, Hebrew University of Jerusalem, Mount Scopus, Jerusalem, 91905, Israel, msnic@huji.ac.il, Benny Mantin

Governments sign liberalization agreements to regulate the airborne traffic between two countries, whereas airlines engage in codeshare contracts to set the level of coordination and pooling of resources. Empirically studying their effects on international non-stop routes, we find that the level of liberalization has a significant impact on frequency, and that 'free sale' contracts decrease airfares whereas 'block' codeshares have the opposite effect.

4 - Airline Scheduling in Competitive Markets
Luis Cadarso, Technical University of Madrid, Aeronautics School, Pza. Cardenal Cisneros, 3, Madrid, 28040, Spain, luis.cadarso@upm.es, Cynthia Barnhart, Virot Chiraphadhanakul, Angel Marín, Vikrant Vaze

We define competitive markets as those where more than one operator such as airlines and high speed trains operate. We develop a mixed-integer linear optimization model in order to determine an optimal flight schedule and fleet assignment for an airline operating in competitive markets. The market share is estimated by a piecewise linear approximation of the logistic curve. The objective is to maximize airline profitability. We assume that the strategy from the rest of operators is known. An application of the model for a simplified IBERIA (the major Spanish airline) network is shown.

■ MC62

62- Borein A- Hyatt

Market Mechanisms and their Applications

Cluster: Auctions

Invited Session

Chair: Tunay Tunca, Associate Professor, University of Maryland, Robert H. Smith School of Business, College Park, MD, 20742, United States of America, ttunca@rhsmith.umd.edu

1 - The Use of Optimization to Assist the FCC in a Reverse Auction to Buy Back TV Spectrum
Karla Hoffman, Professor, George Mason University, Mail Stop 4A6, 4400 University Drive, Fairfax, VA, 22030, United States of America, khoffman@gmu.edu, Tony Coudert, Dinesh Menon, Rudy Sultana

This reverse auction is completely voluntary and the broadcasters who do not participate or whose bids are not accepted will be repacked into the remaining reduced TV channels. Bidding options include giving up a license to broadcast over-the-air, sharing the 6-MHz channel with another station, or going from a UHF channel to a VHF channel. This talk will describe the optimization modeling that seeks to minimize the buy-back costs while satisfying interference restrictions.

2 - Optimal Allocation of Local Exclusivity Rights
Changrong Deng, Duke University, Fuqua School of Business, 100 Fuqua Drive, Durham, NC, United States of America, changrong.deng@duke.edu, Sasa Pekec

Multiple identical items are being sold to unit-demand buyers in a network. Buyers are willing to pay a premium if they obtain the item exclusively in their neighborhood. We solve the revenue maximizing mechanism design problem for locally linear exclusivity valuations. We discuss the complexity of the problem and the non-monotonicity of the optimal seller revenues in buyers' valuations. We also present an ascending auction implementation of the optimal mechanism for the clique.

3 - Managing Air Traffic Disruptions through Strategic Prioritization
Ian Kash, Microsoft Research, 7 J J Thomson Ave., Cambridge, CB3 0FB, United Kingdom, iankash@microsoft.com, Douglas Fearing

The current approach for allocating air traffic delays treats flights equivalently regardless of aircraft size, passenger load, etc. We show that significant benefits can be achieved by allowing prioritization. We develop a non-monetary, auction-based scheme for allocating flight priorities which allows airlines to trade-off priorities across airports. In addition to having nice equilibrium properties, our bidding scheme is capable of achieving some of the benefits of congestion pricing.

4 - Optimizing Kidney Exchange with Transplant Chains: Theory and Reality
John Dickerson, Carnegie Mellon University, Computer Science Dept, Pittsburgh, PA, United States of America, dickerson@cs.cmu.edu, Tuomas Sandholm, Ariel Procaccia

Chains, sequences of transplants initiated by an altruistic donor, have shown marked success in kidney exchanges. We prove that chains beyond length 3 do not help in the large. Yet our results from running the UNOS nationwide exchange show improvement with caps up to 13. We analyze reasons for this. We augment the standard model to include various real-world features. Experiments support the theory and help determine what is "in the large". In the dynamic setting, a cap of 4 is better than 5.

■ MC63

63- Borein B- Hyatt

Behavioral Issues in Supply Chain and Channel Management

Sponsor: Behavioral Operations

Sponsored Session

Chair: Kay-Yut Chen, Principal Scientist, HP Labs, 1U-2, HP Labs, 1501 Page Mill Road, Palo Alto, CA, 94304, United States of America, kay-yut.chen@hp.com

1 - Repeated Distributive Negotiations: How Expectations of Future Transactions Impact Present Behaviors

Haresh Gurnani, Professor, University of Miami, Dept. of Management, Coral Gables, FL, 33124, United States of America, hgurnani@bus.miami.edu, Rajesh Bagchi, Shweta Oza, Mahesh Nagarajan

We study repeat distributive negotiations to analyze how negotiator's role (buyer vs. seller) and expectation of role reversal in future affects current negotiation. Implications for supply chains are discussed. In three studies we find that with role reversal, transactions are coupled with greater concessions now in anticipation of future recovery. With role reversal, negotiators believe that opponents will make larger concessions in future as they feel that the negotiator would do the same.

2 - From Clicks to Bricks and Back Again

Julie Niederhoff, Syracuse University, Syracuse, NY, United States of America, jniederh@syr.edu, Almula Camdereli, Dennis Yu

In this paper we propose a model where stores offer to order the item into the local brick-and-mortar store for customer preview at no risk to the customer with a demand-based preview stocking policy. In this behavioral study, subjects are presented with a small choice set but they can incur some waiting time to see the larger set. The measures of satisfaction, willingness to pay for their ideal item, and commitment to the ideal item provide insight into the new online/in-store hybrid option.

3 - Decision Makings under Economic Order Quantity Settings

Diana Wu, University of Kansas, Lawrence, KS, United States of America, dianawu@ku.edu, Kay-Yut Chen

In this paper, we study ordering behavior under the EOQ setting. We find subjects error even under deterministic demand. Moreover, we find how demand and cost information is "framed" to subjects affects their decisions. A behavioral model that considers bounded rationality and framing effect is proposed to explain the observations.

4 - Complexity as a Contract Design Factor: A Human-to-human Experimental Study

Feryal Erhun, Stanford University, Stanford, CA, United States of America, ferhun@stanford.edu, Basak Kalkanci, Kay-Yut Chen

Our goal is to identify why simpler contracts may be preferred in practice despite being theoretically suboptimal using a human supplier-human buyer (H2H) experimental setting. We extend Kalkanci, Chen, and Erhun's (2011) (KCE) human supplier-computerized buyer results and show H2H interactions strengthen suppliers' preference for simpler contracts. KCE identified reinforcement and bounded rationality as key decision biases. In H2H experiments, we find evidence for social preference effects.

■ MC66

66- Ellis West- Hyatt

Decision Making and Planning: Methods and Applications

Sponsor: Data Mining

Sponsored Session

Chair: Shouyi Wang, University of Washington, 3311 NE 65TH Street, Seattle, WA, 98115, United States of America, shouyi@uw.edu

1 - Product Assortment Decisions for a Network of Retail Stores using Data Mining with Optimization

Fidan Boylu, University of Connecticut, One University Pl, Stamford, CT, 07020, United States of America, fidan.boylu@business.uconn.edu

We present a model for product assortment optimization for a network of retail stores operating in various locations. We combine local information captured from each retail store and deploy a global frequent itemset analysis based on association rule mining. We solve a network optimization model to find which products to include in a store's assortment and which stores to ship from. We use the transactional level data from a leading plastics manufacturer and retailer in the United States.

2 - ERP and the Myth of Collaboration in Supply Chains: A Cloud Based Planning Alternative

Suri Gurumurthi, Visiting Assistant Professor, University of Illinois, Urbana-Champaign, 350 Wohlers Hall, 1206 South Sixth Street, Champaign, IL, 61820, United States of America, surig@illinois.edu

Enterprise planning frameworks reveal several shortcomings when used for collaborative planning in product development, or production planning contexts. Current day planning algorithms – designed for integrated databases, and to centralize key decision-making, provide limited visibility and risk management capabilities when coordinating decision-making across firms. We provide a cloud based framework and associated algorithms for collaborative planning of capacity in a supply chain.

3 - Generalizing Sequential Sampling Experiments

Dashi Singham, Naval Postgraduate School, 1411 Cunningham Road, Monterey, CA, United States of America, dsingham@nps.edu

The sampling decision is crucial to the success of any simulation experiment. More samples imply better confidence and precision in the results, but require higher costs. A sequential confidence interval procedure can be used to determine when to stop collecting samples. We present a general framework for analyzing sequential rules and assessing their quality. Solutions for managing the tradeoff between improved coverage and replications costs are provided.

4 - Online Monitoring and Prediction of Complex Time Series Events

Shouyi Wang, University of Washington, 3311 NE 65TH Street, Seattle, WA, 98115, United States of America, shouyi@uw.edu, Art Chaovalitwongse

This talk presents a new general framework for online monitoring and prediction of complex time series events from nonstationary and chaotic time series data. The proposed prediction approach adapts and innovates data mining and adaptive learning concepts to analyze time series data, and creates a set of innovative analysis methods to reveal hidden temporal patterns that are characteristic and predictive of time series events.

■ MC67

67- Ellis East- Hyatt

Joint Session QSR/ENRE: Panel Discussion: Reliability and Stochasticity in Renewable Power Systems

Sponsor: Quality, Statistics and Reliability & Energy, Natural Res & the Environment/Forestry

Sponsored Session

Chair: Eunshin Byon, Assistant Professor, University of Michigan, 1205 Beal Ave., Ann Arbor, MI, 48109-2117, United States of America, ebyon@umich.edu

1 - Panel Discussion: Reliability and Stochasticity in Renewable Power Systems

Moderator: Eunshin Byon, Assistant Professor, University of Michigan, 1205 Beal Ave., Ann Arbor, MI, 48109-2117, United States of America, ebyon@umich.edu, Panelists: Shmuel Oren, David Coit, Yu Ding, Nagi Gebraeel, Shuangwen Sheng

Renewable energy systems pose significant challenges for planning and operations due to the stochastic nature. In this panel discussion, the panelists will share their experiences and highlight research problems that need to be addressed in future. The panelists are: Dr. Oren at University of California at Berkeley; Dr. Coit at Rutgers University; Dr. Ding at Texas A&M University; Dr. Gebraeel at Georgia Institute of Technology, Senior Engineer Dr. Sheng at National Renewable Energy Laboratory.

■ MC68

68- Suite 312- Hyatt

Tutorials in Financial Services

Sponsor: Financial Services Section

Sponsored Session

Chair: Jim Bander, National Manager, Decision Sciences/Risk Management, Toyota Financial Services, 3200 W Ray Rd, Chandler, AZ, 85226, United States of America, jim.bander@gmail.com

1 - Risk Management for Pension Funds

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

This tutorial outlines the Risk Management practice for a typical Pension Fund manager. Topics discussed include Composition Analysis, Benchmarks, Exposure Buckets, Marginal and Component Risk, Return and Risk Contribution, Tracking Error, Ex-ante and Ex-post measures, Duration and Convexity, Value at Risk, Brinson Method for return based attribution, multi-factor Risk and Return attribution, and Stress Tests. Sample Reports that are used for Risk Management will be illustrated.

2 - Tutorial: Analytics in Consumer Credit

Jim Bander, National Manager, Decision Sciences/Risk Management, Toyota Financial Services, 3200 W Ray Rd, Chandler, AZ, 85226, United States of America, jim.bander@gmail.com

A practitioner discusses current issues in consumer lending with the objective of sparking research ideas that can be applied in the field. The talk will review the state of the practice in credit, collateral, and fraud risk analytics. Specific applications including pricing, servicing, and collections optimization.

■ MC69

69- Suite 314- Hyatt

Financial Optimization Methods in Energy Markets

Cluster: Optimization in Finance

Invited Session

Chair: Kumar Muthuraman, University of Texas at Austin, 2110 Speedway Stop B6500, Austin, TX, United States of America, kumar@austin.utexas.edu

1 - Commodity Storage Valuation

Kumar Muthuraman, University of Texas at Austin, 2110 Speedway Stop B6500, Austin, TX, United States of America, kumar@austin.utexas.edu, Stathis Tompaidis

We present a general valuation framework for commodity storage facilities, for non-perishable commodities. We consider the case of a storage facility small enough so that injections and withdrawals do not influence the price of the underlying commodity. We allow for mean-reversion and seasonality in the price of the commodity, and allow for injection and withdrawal costs. To find the optimal actions for the storage owner we present an iterative numerical algorithm and prove its convergence.

2 - Generation Capacity Expansion in Electricity Markets under Rivalry and Uncertainty

Michail Chronopoulos, University College London, Gower Street, London, United Kingdom, m.chronopoulos@ucl.ac.uk, Derek Bunn, Bert De Reyck, Afzal Siddiqui

We explore electricity capacity expansion by accounting for not only dependency between the cash flows of competing technologies but also competition. Although market equilibrium can be determined analytically in stylised real options models, in a more general setting with asymmetric costs and capacity restrictions, analytical solution of a system of equations is not possible. Since a convex programming approach cannot be implemented, complementarity problems provide a viable modelling approach.

3 - Electricity Price Spike Prediction via Boosting Trees and Wavelet Analysis

Shijie Deng, Associate Professor, Georgia Institute of Technology, 755 Ferst Drive, Atlanta, GA, United States of America, deng@gatech.edu, Xiaoming Huo, Yibiao Lu

We present a novel approach, which combines nondecimated wavelet transform with the boosting trees method, to model energy prices for detecting and predicting price spikes. Intuitive and mathematical description of the methodology is provided. The case studies on Australia electricity markets (both Queenland and New South wales) show enhanced prediction accuracy and lowered false alarm rate than those of existing methods in the literature.

■ MC70

70- Suite 316- Hyatt

Optimizing Release Strategies for Open Source Software, Coordinating Online Marketplaces, and Designing for the Cloud

Sponsor: Information Systems

Sponsored Session

Chair: Terrence August, University of California-San Diego, Rady School of Management, 9500 Gilman Dr, MC 0553, La Jolla, CA, United States of America, taugust@ucsd.edu

1 - "Release Early, Release Often"? An Empirical Analysis of Release Strategy in Open Source Software

Wei Chen, University of California, San Diego, Rady School of Management, 9500 Gilman Drive, La Jolla, CA, 92093, United States of America, wei.chen@rady.ucsd.edu, Vish Krishnan, Kevin Zhu

"Release early, release often" has become a mantra in open source software (OSS). We study the impact of release strategies on the download performance of OSS projects. Using a panel data collected from Sourceforge.net, we find that release frequency has a curvilinear relationship with download performance. We also find that adoption cost and community contribution moderate the effect of release strategy. We explore the implications of our findings for the theory and practice of OSS management.

2 - Not all Cloud Users are Equal: Who Benefits from Technical Support?

German Retana, PhD Candidate, Georgia Institute of Technology, 800 West Peachtree NW, Atlanta, GA, 30308, United States of America, german.retana@mgt.gatech.edu, Chris Forman, Sridhar Narasimhan, Marius Florin Niculescu, D.J. Wu

Based on an analysis of firm-level data on cloud infrastructure services usage, we examine how customer-level attributes moderate the effects of support on customer demand for the service. We find, for example, that the younger customers are, the stronger the positive effect that adopting higher levels of support has on their demand for IT capacity and on their ability to employ the advanced features of the cloud.

3 - Competition and Coordination in Online Marketplaces

Daewon Sun, University of Notre Dame, 359 MCOB, Notre Dame, IN, United States of America, dsun@nd.edu, Jennifer Ryan, Xuying Zhao

Online market places, such as those operated by Amazon, eBay and Google, serve as an intermediary, providing the service of matching buyers with sellers, while control of the good is left to the seller. We study a new form of channel conflict caused by online marketplace systems.

4 - Cloud Computing: Implications on Software Network Structure and Security Risks

Terrence August, University of California-San Diego, Rady School of Management, 9500 Gilman Dr, MC 0553, La Jolla, CA, United States of America, taugust@ucsd.edu, Marius Florin Niculescu, Hyo duk Shin

By software vendors offering, via the cloud, software as a service (SaaS) versions of traditionally on-premises products, security risks associated with software usage become more diversified which can greatly increase the value associated with network software. In an environment where negative security externalities are present and users make complex consumption and patching decisions, we construct a model that clarifies whether and how SaaS versions should be offered by vendors.

■ MC71

71- Suite 318- Hyatt

eServices

Sponsor: eBusiness

Sponsored Session

Chair: Atanu Lahiri, University of Washington, Box 353226, Seattle, WA, United States of America, lahiria@uw.edu

1 - Competition Dynamics in Cloud Computing Market

Hossein Ghasemkhani, PhD Candidate, University of Washington, Foster School of Business, Seattle, WA, United States of America, hossein@uw.edu, Yong Tan

We analyze the dynamic competition of forward-looking cloud computing providers using a differential game model with rate of capacity provision as the control variable. We derive the long-run stationary equilibrium and analyze the short-run strategies of the firms. We posit that although initial market shares do not affect the steady-state outcomes, initial capacities, budgets and cost of capacity provision are all important in determining the steady-state market structure and long-run profits.

2 - How Keen are the Payers in Promoting Telemedicine – Incentives for the Insurers

Balaraman Rajan, Simon School of Business, University of Rochester, CS 4-339, Carol Simon, Rochester, NY, 14627, United States of America, balaraman.rajan@Simon.Rochester.edu

The adoption of telemedicine especially for the case of chronic disease management has been surprisingly slow. We use a markovian model to analyze the incentives for the payers in promoting telemedicine. While continuous disease management could reduce complications and help in preventive care, for the payor what might matter is the cumulative lifetime cost of a patient. The key to telemedicine is in an innovative payment system where the actual beneficiaries pay for the innovative practice.

3 - Allocating Shared Resources Optimally for Call Center Operations and Knowledge Management Activities

Abhijeet Ghosal, University of Minnesota, Minneapolis, MN, United States of America, abhijeet@umn.edu, Mani Subramani, Alok Gupta

We study a problem where a call center should optimally allocate available resources to call handling and document creation tasks. The call center resolves on phone problems that engineers face in the field. Often when an engineer calls, he/she has to wait in a queue. To avoid this situation, documents discussing commonly occurring problems are published at a knowledge repository. The allocation of resources should be determined so that the average waiting time in the queue is minimized.

■ MC72

72- Suite 322- Hyatt

Approximate Dynamic Programming in Resource Allocation

Sponsor: Computational Stochastic Optimization

Sponsored Session

Chair: Marek Petrik, Research Staff Member, IBM Research, 1101 Kitchawan Rd, Rte 134, Yorktown Heights, NY, 10598, United States of America, mpetrik@us.ibm.com

1 - A Joint Location-inventory-Transshipment Problem

Oleksandr Shlakhter, University of Toronto, Joseph L. Rotman School of Management, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, alex.shlakhter@Rotman.Utoronto.Ca, Oded Berman, Dmitry Krass

We consider a location-inventory-transshipment problem in a supply chain, which consists of one supplier, multiple retailers and multiple customers. The chain is coordinated through replenishment, customers allocation, and transshipments between retailers. The problem is to determine location of retailers, replenishment and transshipment policies, and allocation of customers to minimize the expected average cost. We show that the problem can be solved using a sample-path-based algorithm.

2 - An Approximate Dynamic Programming Method for Scheduling of a Chemotherapy Infusion Center

Timothy Hopper, North Carolina State University, 400 Daniels Hall, College of Engineering, Raleigh, NC, 27695, United States of America, tdhopper@ncsu.edu

Chemotherapy infusion clinics can have fifty or more chairs where patients come to receive one-to-eight hour treatments. Uncertainty in treatment durations, and nurse availability, makes real time appointment scheduling decisions a challenge. We formulate a stochastic dynamic programming model for this problem and we compare approximate dynamic programming methods for solving this problem. Results are presented based on empirical data from a large cancer hospital.

3 - Scheduling Capacitated Re-entrant Lines through Approximate Dynamic Programming

Spyros Reveliotis, Professor, Georgia Institute of Technology, ISyE, 765 Ferst Dr., Atlanta, GA, 30332, United States of America, spyros.reveliotis@isye.gatech.edu

We consider the problem of throughput maximization of re-entrant lines with finite buffering capacity at the line workstations. The presence of finite buffers gives rise to blocking effects that negate well known results concerning the throughput-optimal scheduling of re-entrant lines with infinite buffering capacity. We will present an approximate policy iteration scheme for the resulting scheduling problem that is based on a feature-based aggregation of the underlying state space.

4 - Demand Shaping by Approximate Dynamic Programming

Marek Petrik, Research Staff Member, IBM Research, 1101 Kitchawan Rd, Rte 134, Yorktown Heights, NY, 10598, United States of America, mpetrik@us.ibm.com, Dharmashankar Subramanian

We propose a method for balancing supply and demand using customer incentives to buy alternative products. The inventory is computed using approximate dynamic programming given the uncertain future demands. It is common to approximate the value function using piecewise linear separable functions, but this approach fails to capture inter-product dependence. We propose and analyze a new method for constructing features using problem structure and demonstrate its utility in this domain.

■ MC73

73- Suite 324- Hyatt

Portfolio Credit Risk

Cluster: Quantitative Finance

Invited Session

Chair: Rafael Mendoza, Assistant Professor, McCombs School of Business, 1 University Station, CBA 5.202, B6500, Austin, TX, 78712, United States of America, rafael.mendoza-arriaga@mccombs.utexas.edu

1 - Risk Premia and Optimal Liquidation of Defaultable Securities

Tim Siu-Tang Leung, Columbia University, New York, NY, United States of America, leung@ieor.columbia.edu, Peng Liu

We study the optimal timing to liquidate defaultable securities in a general intensity-based credit risk model under stochastic interest rate. The model incorporates the potential price discrepancy between the market and investors under different default risk premia specifications. We introduce the delayed liquidation premium and analyze the optimal liquidation policy for various credit derivatives.

2 - Dynamic Modeling of Portfolio Credit Risk with Common Shocks

Tomasz Bielecki, Professor, Applied Mathematics Department, Illinois Institute of Technology, 10 W 32nd Street, E1 Bldg, Chicago, IL, 60616, United States of America, bielecki@iit.edu, Stephane Crepey, Areski Cousin, Alexander Herbertsson

We consider a bottom-up Markovian copula model of portfolio credit risk where dependence among credit names stems from the possibility of simultaneous defaults. Calibration of marginals and dependence parameters can be performed separately using a two-steps procedure, much like in a standard static copula set-up. As a result this model allows us to hedge CDO tranches using single-name CDS-s in a theoretically sound and practically convenient way.

3 - Positive Subordinate Jump-CIR Processes with Two-Sided Mean-Reverting Jumps

Rafael Mendoza, Assistant Professor, McCombs School of Business, 1 University Station, CBA 5.202, B6500, Austin, TX, 78712, United States of America, rafael.mendoza-arriaga@mccombs.utexas.edu

In this paper we present the SubJCIR jump-diffusion process. The SubJCIR's jump component includes two-sided mean-reverting (state-dependent) jumps. The process remains strictly positive if the CIR process satisfies Feller's condition. The analytical tractability of the SubJCIR process makes it a richer extension to the JCIR process (compared to previous models) and it is also a natural alternative for interest rates and credit models.

4 - Variance Swaps on Levy Subordinated Diffusions

Matthew Lorig, Postdoctoral Researcher, Department of Operations Research and Financial Engineering, Princeton University, Sherrerd Hall, Charlton Street, Princeton, NJ, 08544, United States of America, mlorig@princeton.edu, Rafael Mendoza

We compute the value of a variance swap when the underlying is modeled as a Levy subordinated diffusion process. The underlying in this framework may exhibit jumps with a state-dependent Levy measure, as well as local stochastic volatility and default intensity. Moreover, the Levy subordinator can be obtained directly from European call/put prices.

Monday, 4:30pm - 6:00pm

■ MD01

01- West 101- CC

Convexification Techniques in MINLP

Sponsor: Optimization/Global Optimization

Sponsored Session

Chair: Jean-Philippe Richard, Associate Professor, University of Florida, Department of Industrial and Systems, Engineering 303 Weil Hall, Gainesville, FL, 32608, United States of America, richard@ise.ufl.edu

1 - Solving Mixed Integer Polynomial Optimization Problems with MINOTAUR

Jeff Linderoth, Professor, University of Wisconsin-Madison, 3270 Mechanical Engineering, 1513 University Avenue, Madison, WI, 53715, United States of America, linderoth@wisc.edu, James Luedtke, Ashutosh Mahajan, Mahdi Namazifar

We study methods for building polyhedral relaxations of multilinear terms that arise in nonconvex mixed integer optimization problems. We present computational results for an approach based on grouping the variables into subsets that cover all multilinear terms in the problem. The approach is combined with additional reformulation techniques and spatial branching in the software framework MINOTAUR to produce a solver for mixed integer polynomial optimization problems.

2 - Representability of Disjunctive Cuts for Mixed-integer Nonlinear Programming

Sina Modaresi, University of Pittsburgh, 3700 O'Hara Street, Pittsburgh, United States of America, sim23@pitt.edu, Mustafa Kilinc, Juan Pablo Vielma

Consider the problem of finding the convex hull of the union of disjunctive nonlinear sets. In many cases there are extended formulations for the convex hull; however, it is not clear if the projection of such formulations belongs to the same class as the original sets. We show that for some classes of sets, the convex hull of the union of two disjunctive nonlinear sets belongs to the same class as the original sets.

3 - Global Optimization of Nonconvex Problems with Multilinear Intermediates

Aida Khajavirad, IBM T.J. Watson Research Center, Yorktown Heights, NY, United States of America, aida@cmu.edu, Nick Sahinidis, Mohit Tawarmalani, Xiaowie Bao

We consider global optimization of problems containing multilinears. It is known that the facets of the convex hull of a multilinear on a box can be obtained by solving an LP. However, the size of this LP grows exponentially with the number of variables. We propose a decomposition scheme to decompose a multilinear to low dimensional components, for which this LP can be solved efficiently. We embed this cut generation strategy at every node of BARON, and present results on variety of problems.

4 - RLT-POS: Reformulation-Linearization Technique-based Optimization Software for Polynomial Programs

Evrim Dalkiran, Assistant Professor, Wayne State University, 4815 4th St Manufacturing Eng., Detroit Mi 48202, United States of America, evrimd@wayne.edu, Hanif D. Sherali

And the abstract is as follows: "We introduce a Reformulation-Linearization Technique (RLT)-based open-source optimization software for solving polynomial programs (RLT-POS). We start with presenting algorithms that form the backbone of RLT-POS. Next, we discuss the coordination between (a) bound-grid-factor constraints and semidefinite cuts and (b) constraint filtering techniques and reduced RLT representations. Finally, we compare the performances of the software packages BARON, SparsePOP, and Couenne with RLT-POS.

■ MD02

02- West 102 A- CC

Decision Analysis Society Awards

Sponsor: Decision Analysis

Sponsored Session

Chair: Vicki Bier, Professor, University of Wisconsin, 1513 University Avenue, Room 3270A, Madison, WI, 53706, United States of America, bier@engr.wisc.edu

1 - 2012 Decision Analysis Student Paper Award

Jun Zhuang, Assistant Professor, University at Buffalo, SUNY, 403 Bell Hall, Buffalo, NY, 14260, United States of America, jzhuang@buffalo.edu, Lea Deleris

We will announce the winner and the finalist of the 2012 Decision Analysis Student Paper Award. The winner will provide a short presentation. Everyone is welcome to attend!!

2 - 2012 DAS Practice Award

Gregory Parnell, United States Military Academy, West Point, NY, 10996, United States of America, gregory.parnell@usma.edu

The DAS Publications Award will be presented for the best paper published in 2010. This year's winners are Samuel Bond, Kurt Carlson, and Ralph Keeney, authors of "Improving the Generation of Decision Objectives", Decision Analysis, vol. 7, pp. 238-55, September 2010.

3 - Ramsey Medal Award

Detlof von Winterfeldt, Professor, University of Souther California, RTH 312, 3710 McClintock Ave., Los Angeles, CA, 92651, United States of America, detlof@aol.com

The Ramsey Medal of the Decision Analysis Society is awarded for distinguished contributions in decision analysis. Distinguished contributions can be internal, such as theoretical and procedural advances in decision analysis, or external, such as developing or spreading decision analysis in new fields. We will introduce the 2012 Ramsey Medal winner, followed by a presentation by the winner. This year's winner is Robert Clemen, Professor Emeritus of Decision Sciences at Duke University.

4 - Decision Analysis Publication Award

Jason Merrick, Professor, Virginia Commonwealth University, Statistics & Operations Research, P.O. Box 843083, Richmond, VA, 23284, United States of America, jrmerric@vcu.edu, Ali Abbas, Robin Keller

This award is given annually to the best decision analysis article or book published in the second preceding calendar year (i.e. calendar year 2010 for consideration in 2012). The intent of the award is to recognize the best publication in "decision analysis, broadly defined." This includes, but is not limited to, theoretical work on decision analysis methodology (including behavioral decision making and non-expected utility theory), descriptions of applications, and experimental studies.

■ MD03

03- West 102 B- CC

Applied Decision Analysis II

Contributed Session

Chair: Baichun Feng, The University of Memphis, 4510 N Wilson Dr Apt 1, Shorewood, WI, 53211, United States of America, flemns@hotmail.com

1 - A Decision on Increasing Recycling Rate of Waste Desktops in Taiwan by Bi-Level Programming

Ya-Ju Hsu, Grad. Inst. of Manag. Sci., Tamkang University, 151 Yingzhuan Rd., New Taipei, 25137, Taiwan-ROC, 600620081@s00.tku.edu.tw, Hsu-Shih Shih, Po-Hsien Hsu

This study analyzes the means of increasing the recycling rate of waste PCs in Taiwan through bilevel programming. The upper-level is the social welfare system; the lower-level is the recycling industries. The traditional and fuzzy approaches are used to solve the problem. The result shows the collecting fee being significant.

2 - Multiple Criteria Supplier Selection based on Artificial Intelligence

Baichun Feng, The University of Memphis, 4510 N Wilson Dr., Apt. 1, Shorewood, WI, 53211, United States of America, flemns@hotmail.com

This research proposes an approach to solve the multiple criteria supplier selection problem. This approach can take the advantage of the past supplier selection data and adapt itself in a way that it learn the decision maker's nonlinear preference information from the past data. A numerical example is used to demonstrate that this approach is very effective in handling the multiple criteria supplier selection problem.

3 - An Examination of Evolved Behavior in Two Reinforcement Learning Systems

Ram Pakath, Professor, University of Kentucky, Decision Science & Information Systems, 425 C.M. Gatton College of Business & Ec, Lexington, KY, 40506-0034, United States of America, pakath@gmail.com, David Gaines

We assess the relative performance of two reinforcement learning paradigms – the Learning Classifier System and the Extended Classifier System – in the context of playing the Iterated Prisoner's Dilemma game. The XCS is a considerably stronger performer in previous experimental settings. Our application allows us to assess their abilities to: (a) evolve irrational behavior, (b) cope with a multi-step test environment, (c) handle uncertainty, and (d) cope with asymmetric knowledge-base updates.

■ MD04

04- West 102 C- CC

Applications of the Analytical Network Process (ANP)

Sponsor: Multiple Criteria Decision Making

Sponsored Session

Chair: Orrin Cooper, Assistant Professor, University of Memphis, Fogelman College of Business & Economics, Memphis, TN, United States of America, olcooper@memphis.edu

1 - Applying the Analytic Hierarchy Process to Ethical Decision Making

Donald Adolphson, Professor, Brigham Young University, Romney Institute of Public Management, 764 TNRB, Provo, UT, 84602, United States of America, donald_adolphson@byu.edu, Orrin Cooper, Jared Harris

An often overlooked arena for OR tools is in moral & ethical decision making. The use of relative scales in Saaty's AHP is especially useful in this regard, because it provides a way to quantify things which cannot be easily measured. The fundamental concept in ethical decision making is Stakeholder Analysis. We will argue in this paper that the AHP can serve a vital role in gaining the understanding of stakeholder interests required to find the sought after joint interests.

2 - Does the Analytic Hierarchy Process (AHP) Measure Intensity of Preferences?

Gabriela M. Sava, PhD Student, Joseph M. Katz Graduate School of Business, University of Pittsburgh, 241 Mervis Hall, Pittsburgh, PA, 15260, United States of America, mgsava@katz.pitt.edu, Luis G. Vargas

The AHP is a decision-making method based on pairwise comparisons from an absolute scale. In this paper we construct two experiments to compare consumers' preferences for a good described by a single stimulus-response function. The results show that the AHP and the trade-offs made using the stimulus-response function are in agreement on how strongly consumers prefer the good. This provides support for the hypothesis that the AHP measures intensity of preferences.

3 - A Hybrid Performance Analysis Approach to Grafting Process Design using Simulation and Fuzzy AHP

Chao Meng, The University of Arizona, 1127 E James E Rogers Way, P.O. Box 210020, Tucson, AZ, 85721, United States of America, meng5656@gmail.com, Dong Xu, Young-Jun Son

A hybrid performance analysis approach integrating discrete event simulation, system dynamics and fuzzy analytic hierarchy process (AHP) is proposed to evaluate grafting process designs. Grafting process and grafted seedling supply chain are simulated to assess the performance of grafting process designs in terms of profit, production flexibility and resource utilization. Fuzzy AHP addresses a multi-objective problem given the performance results and determines the best grafting process designs.

4 - Cluster Comparison Weights in ANP Models that are Dependent on the Alternatives

Orrin Cooper, Assistant Professor, University of Memphis, Fogelman College of Business & Economics, Memphis, TN, United States of America, olcooper@memphis.edu, Guoqing Liu

The criteria weights or influence in an ANP model can be either independent of the alternatives like for school admissions or dependent on the alternatives like in a market share model. When the criteria are dependent on the alternatives the cluster comparisons are also dependent on the alternatives and must be made individually for each alternative in order to avoid bogus results. These results hold for both tangibles and intangibles. A simple example with the solution is presented herein.

■ MD05

05- West 103 A- CC

Advance in Modeling Massive Data

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Xinwei Deng, Assistant Professor, Virginia Tech, 406 Hutcheson Hall, Blacksburg, VA, 24061, United States of America, xdeng@vt.edu

1 - Bayesian Variable Selection for Computer Experiments

Ying Hung, Assistant Professor, Department of Statistics, Rutgers University, 110 Frelinghuysen Road, Piscataway, NJ, 08854, United States of America, yhung@stat.rutgers.edu, Xinwei Deng

Identifying inputs that significantly impact a complex system is a critical step in computer experiments. Such active factors can be further used to improve model accuracy. In this work, we propose a new and unified Bayesian framework to identify active factors. This framework is based on a widely used Gaussian process model and a novel approximation to simplify the computation. The performance of the proposed approach is demonstrated via simulations and real examples.

2 - Probabilistic Hashing Methods for Fitting Massive Logistic Regressions and SVM with Billions of Variables

Ping Li, Assistant Professor, Department of Statistical Science, Cornell University, 1192 Comstock Hall, Ithaca, NY, 14853-3801, United States of America, pingli@cornell.edu

Modern statistics tasks often encounter extremely high-dimensional massive data. In the context of search, certain industry applications have used datasets in 2^64 (square of billion) dimensions. We introduce a probabilistic method called b-bit minwise hashing, which can be seamlessly integrated with statistical learning algorithms such as logistic regression or SVM to solve extremely large-scale prediction problems. Experimental results on 200GB data (in billion dimensions) will be presented.

■ MD06

06- West 103 B- CC

Simulation Optimization and its Applications

Sponsor: Simulation

Sponsored Session

Chair: Demet Batur, Assistant Professor, University of Nebraska-Lincoln, CBA 209, Lincoln, NE, 68588, United States of America, dbatur2@unlnotes.unl.edu

1 - Optimal Computing Budget Allocation for a Single Design by using Regression with Sequential Sampling

Douglas Morrice, Professor, The University of Texas at Austin, Red McCombs School of Business, 2110 Speedway Stop B6500, Austin, TX, 78712-1750, United States of America, Douglas.Morrice@mccombs.utexas.edu, Xiang Hu, Loo Hay Lee, Chun-Hung Chen, Ek Peng Chew

In this paper, we develop an efficient single design budget allocation procedure using regression for a transient mean performance measure that follows a certain underlying function form. A sequential sampling constraint is imposed. We formulate the problem as a c-optimal design. The procedure provides the optimal number of simulation replications and simulation run lengths given a certain computing budget. Numerical experimentation confirms the efficiency of the procedure.

2 - Detecting Structure from Noisy Function Evaluations
Susan Hunter, Cornell University, School of ORIE, 282 Rhodes Hall, Ithaca, NY, United States of America, hunter@cornell.edu, Shane Henderson

We explore methods for detecting structure in functions that can only be observed as output from a stochastic simulation. Since simulation optimization algorithms often exploit some known structure of the underlying function, such as convexity, our methods may be considered a preprocessor that informs the selection of an appropriate simulation optimization algorithm.

3 - Reliability Analysis of Complex Systems based on the Stochastic Order
Demet Batur, University of Nebraska-Lincoln, CBA 209, Lincoln, NE, 68588, United States of America, dbatur@unl.edu, Fred Choobineh

Survival functions provide an indication about the likelihood of survival beyond a specific time. The reliability of system designs, such as designs for telecommunication and electrical power systems, are compared based on their survival functions. The survival functions are often tractable only via simulation. Here a statistical sequential selection procedure is presented to compare the survival functions of simulated stochastic systems based on the stochastic order dominance.

■ MD07

07- West 104 A- CC

Temporal Data Mining for Business Applications

Sponsor: Data Mining

Sponsored Session

Chair: W. Nick Street, The University of Iowa, S232 Pappajohn Business Building, Iowa City, IA, 52242, United States of America, nick-street@uiowa.edu

1 - Stock Chatter: Using Stock Sentiment to Predict Price Direction
Michael Rechenthin, The University of Iowa, S232 Pappajohn Business Building, Iowa City, IA, 52242, United States of America, michael-rechenthin@uiowa.edu, W. Nick Street, Padmini Srinivasan

This paper examines a popular stock message board and finds that only 17.3 percent of posts include a user-provided sentiment of "strong buy", "buy", "hold", "sell", or "strong sell", but many of the remaining include sentiment only within the context of the post. Supervised learning methods were used to infer the sentiment from these posts' text and this predicted sentiment is found to be more predictive of the underlying stock's price directional change than the user-provided sentiment.

2 - Consistency in Vehicle Routing using Clustering
Fahrettin Cakir, The University of Iowa, Tippie Business College, Iowa City, IA, 52242, United States of America, fahrettin-cakir@uiowa.edu

Consistent service in vehicle routing is a valuable aspect for parcel delivery firms. This is due to driver familiarity and learning which enables drivers to serve neighborhoods quicker. We formulate a two stage vehicle routing decision problem in which the first stage puts emphasis on assigning customers to those drivers that have served the most via an auxiliary expression in the objective function in order to build consistent routing solutions.

3 - Regulating Greed over Time for Yahoo! Front Page News Article Recommendations
Cynthia Rudin, Assistant Professor, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, United States of America, rudin@mit.edu, Virot Chiraphadhanakul, Ed Su

I will describe our second prize entry in the ICML Exploration and Exploitation 3 Challenge, which is a recommender system for Yahoo! News Article recommendations, involving multi-armed bandits and time series techniques.

4 - Click Logs Analysis for e-Commerce
Si-Chi Chin, The University of Iowa, 3087 LIB, W. Nick Street, Iowa City, IA, 52242, United States of America, si-chi-chin@uiowa.edu,

Click logs from e-Commerce sites provide a rich opportunity to acquire implicit feedback from users. Patterns derived from the time between a posted query and a click provide information on the ranking quality, reflecting the perceived relevance of a retrieved URL. This presentation applies the Kaplan-Meier estimator to study click patterns. The observed results demonstrate the potential of using click curves to predict the quality of the top-ranked results.

■ MD08

08- West 104 B- CC

Joint Session SPPSN/MIF: Managing Operations in Non-profit Food Distribution

Sponsor: Public Programs, Service and Needs & Minority Issues

Sponsored Session

Chair: Lauren Davis, North Carolina A&T State University, 1601 E. Market St., Greensboro, CA, United States of America, lbdavis@ncat.edu

1 - Modeling for Equitable Food Distribution in North Carolina under Capacity Constraints
Irem Sengul, North Carolina State University, 2101 Hillsborough St., Raleigh, NC, United States of America, isengul@ncsu.edu, Julie S. Ivy, Reha Uzsoy

We model the trade-off between equity and effectiveness with respect to the distribution of food donations in a specific region under capacity constraints. We work with the Food Bank of Central & Eastern North Carolina which serves as a hub and branch for distributing food to four branches in a 34-county service area. This presentation focuses on deterministic, capacity-constrained network flow models for this problem and the effect of distribution capacities on the optimal policy.

2 - An Approach to Approximating in-kind Donations Received by Food Banks through Supermarket Collection
Luther Brock, Doctoral Candidate, North Carolina A&T State University, 1601 East Market Street, Greensboro, NC, 27411, United States of America, lgbrockiii@hotmail.com, Lauren Davis

This research addresses the challenge of approximating the commodity-specific amount of in-kind food items received through an isolated food bank collection at supporting supermarkets. An artificial neural network (ANN) is developed based on past collection records maintained for a food bank in the southeastern United States. The accuracy of this ANN is compared to linear regression. The impact of improved forecast accuracy on transportation costs is demonstrated.

3 - Food Banks Can Improve their Operations with OR Tools
Canan Corlu, Assistant Professor, Bilkent University, Industrial Engineering Dept, Ankara, Turkey, canan.corlu@bilkent.edu.tr, Willem-Jan van Hoeve, Sridhar Tayur

In this study we work with Pittsburgh Community Food Bank (GPCFB) to improve their operations. We particularly focus on GPCFB's VRP, which has not been studied before, and evaluate three different approaches to solve this problem: MIP-based column generation, exact CP-based model and heuristic CP-based model. Our computational results indicate that the heuristic CP-based model can yield substantial savings even when a small number of changes (locations) are considered.

■ MD09

09- West 105 A- CC

Preference Learning I

Sponsor: Multiple Criteria Decision Making

Sponsored Session

Chair: Roman Slowinski, Professor, Poznan University of Technology, 60-965 Poznan, Poznan, Poland, roman.slowinski@cs.put.poznan.pl

1 - Multiple Criteria Hierarchy Process in Robust Ordinal Regression: a New Way of Preference Learning
Salvatore Greco, Professor, University of Catania, Corso Italia 55, Catania, 95129, Italy, salgreco@unict.it, Salvatore Corrente, Roman Slowinski

To learn about preferences of a Decision Maker (DM) in multiple criteria decision problems involving hierarchical criteria, we propose a combination of Robust Ordinal Regression (ROR) and a method called Multiple Criteria Hierarchy Process. It permits learning of preference relations with respect to a subset of criteria at any level of the hierarchy. ROR takes into account all sets of parameters of an assumed preference model, which are compatible with preference information elicited by a DM.

2 - Preference Learning using Dominance-based Rough Set Approach

Roman Slowinski, Professor, Poznan University of Technology, 60-965 Poznan, Poznan, Poland, roman.slowinski@cs.put.poznan.pl, Salvatore Greco, Benedetto Matarazzo

Dominance-based Rough Set Approach permits inductive learning of a preference model from ordinal data consisting of exemplary decisions (classifications or pairwise comparisons of objects). The model is a set of easily understandable "if, then…" decision rules. It can be used to either justify past decisions, or predict future decisions, or develop a strategy of intervention. The rule model can represent more complex interactions among attributes than any utility function or binary relation.

3 - Indirect Elicitation of MCDA Sorting Models using Valued Assignment Examples

Olivier Cailloux, École Centrale Paris, Grande Voie des Vignes, Châtenay-Malabry, 92295, France, olivier.cailloux@ecp.fr, Brice Mayag, Vincent Mousseau, Luis Dias

We propose an elicitation method for learning MCDA sorting functions. Such a function assigns each alternative from a set of alternatives, evaluated on multiple criteria, to a category in a set of preference ordered categories. Our input is a set of assignment examples where each example contains several possible destination categories for an alternative, each associated with a credibility. We deduce several sorting functions whose precision depend on the chosen credibility level.

■ MD10

10- West 105 B- CC

Modeling Uncertainty in Optimization

Sponsor: Optimization/Stochastic Programming

Sponsored Session

Chair: Vishal Gupta, Massachusetts Institute of Technology, 77 Massachusetts Ave, E40-135, Operations Research Center, Cambridge, MA, 02139, United States of America, vgupta1@mit.edu

1 - Optimization with Spectral Risk Measures

Garud Iyengar, Professor, Columbia University, New York, NY, United States of America, garud@ieor.columbia.edu, Carlos Abad

In this talk we will describe a fast-first order algorithm for optimization with several spectral risk measures.

2 - Appointment Scheduling with Limited Distributional Information

Jiawei Zhang, Stern School of Business, New York University, New York, NY, United States of America, jzhang@stern.nyu.edu, Ho-Yin Mak, Ying Rong

In this paper, we develop distribution-free models that solve the appointment scheduling and sequencing problems by assuming only moments information. In the special case where the first two marginal moments are given, the problem can be reformulated as a second-order cone program. Based on the structural properties of the two-moment model, we prove that, under a mild condition, it is optimal to sequence jobs in increasing order of duration variance.

3 - Constructing Uncertainty Sets from Data

Vishal Gupta, Massachusetts Institute of Technology, 77 Massachusetts Ave., E40-135, Operations Research Center, Cambridge, MA, 02139, United States of America, vgupta1@mit.edu

Modeling uncertainty via uncertainty sets and using robust optimization has become increasingly popular in recent years. In many applications, however, it is not clear how to construct an appropriate set. In this work we consider a nonparametric, data-driven approach to constructing uncertainty sets directly from historical samples of the uncertainty. Robust optimization problems using these sets remain tractable and enjoy strong probabilistic guarantees.

■ MD11

11- West 105 C- CC

Stochastic Programming Applications in Energy and Nonprofit

Sponsor: Optimization/Stochastic Programming

Sponsored Session

Chair: Armagan Bayram, University of Massachusetts, Isenberg School of Management, Amherst, MA, United States of America, abayram@som.umass.edu

1 - Estimating the Operating Cost at Pumped-Storage Plants with Stochastic Optimization

Goran Vojvodic, PhD Student, George Washington University, 2201 G St. NW, Funger Hall 415, Washington, DC, 20037, United States of America, goranv@gwu.edu

A precise estimation of the operating cost for pumped-storage power plants is needed. A novel approach is presented based on a structural parallel between two-settlement energy markets and the two-stage stochastic optimization modeling paradigm in order to estimate the operating cost at a plant. The results differ from the deterministic approach and we believe they are more accurate because they were obtained using an approach that is structurally similar to the operation of energy markets.

2 - Stochastic Programming Based Resource Allocation Models for Nonprofit Foreclosed Housing Acquisition

Armagan Bayram, University of Massachusetts, Isenberg School of Management, Amherst, MA, United States of America, abayram@som.umass.edu, Senay Solak

We consider strategic resource allocation decisions for nonprofit community organizations that acquire and redevelop foreclosed properties as part of the societal response to foreclosures. We develop different multistage stochastic integer programming models for the problem, and discuss the efficiency of exact and heuristic solution approaches for these models.

■ MD12

12- West 106 A- CC

MIP Techniques for Solving Stochastic Programs

Sponsor: Optimization/Integer Programming

Sponsored Session

Chair: Siqian Shen, Assistant Professor, University of Michigan, 2793 IOE Building, 1205 Beal Avenue, Ann Arbor, MI, 48103, United States of America, siqian@umich.edu

1 - Integrated Staffing and Scheduling for Service Systems via Stochastic Integer Programming

James Luedtke, University of Wisconsin-Madison, 1513 University Ave., Madison, WI, 53706, United States of America, jrluedt1@wisc.edu, Merve Bodur

We consider the joint problem of staffing (determining how many servers of each type should be available in each time period) and scheduling (assigning servers to feasible schedules) in a service system having multiple server types and multiple customer classes. We introduce a stochastic integer programming formulation and study solution methods for this problem class.

2 - Valid Inequalities and Formulations for a Dynamic Optimization Problem under a Chance Constraint

Minjiao Zhang, Graduate Research Associate, The Ohio State University, Integrated Systems Engineering, 1971 Neil Ave., Columbus, OH, 43210, United States of America, zhang.769@osu.edu, Simge Kucukyavuz

We consider a dynamic decision-making problem under uncertainty with a service level constraint. We formulate this problem as a joint chance-constrained program, and propose a branch-and-cut algorithm utilizing its cardinality-constrained continuous mixing substructure. We also compare the joint chance-constrained model with a risk-averse model and a robust optimization model on a dynamic probabilistic lot-sizing problem.

3 - Risk Optimization in Probabilistic Programs with Single or Multiple Chance Constraints
Siqian Shen, Assistant Professor, University of Michigan, 2793 IOE Building, 1205 Beal Avenue, Ann Arbor, MI, 48103, United States of America, siqian@umich.edu

This paper considers discretely distributed CCP, and trades off risk and cost by treating risk tolerances as decision variables. We first consider a problem with a single chance constraint, show that only finite risk thresholds affect optimum, and interpret the risk tolerance as SOS1 binary variables. We then optimize risk variables in multiple joint chance constraints. Our computations demonstrate that an enumeration takes longer CPU time than the MIP reformulation with SOS1 constraints.

■ MD13

13- West 106 B- CC

Recent Developments in Linear and Conic Optimization

Sponsor: Optimization/Linear Programming and Complementarity

Sponsored Session

Chair: Murat Mut, PhD Student, Lehigh University, 200 W. Packer Ave, Bethlehem, 18015, United States of America, mhm309@Lehigh.EDU

1 - The Simplex Method and the Diameter of a 0-1 Polytope
Tomonari Kitahara, Tokyo Institute of Technology, W9-62, 2-12-1, Ookayama, Meguro-Ward, Tokyo, Japan, kitahara.t.ab@m.titech.ac.jp, Shinji Mizuno

We will derive two main results related to the primal simplex method for an LP on a 0-1 polytope. First we show a well-known result that the diameter of any 0-1 polytope is bounded by its dimension by a simple argument using the simplex method. Next we show that the upper bound obtained by the authors for the number of distinct solutions generated by the simplex method is tight by constructing an LP instance on a 0-1 polytope.

2 - On the Total Curvature of the Central Path
Murat Mut, PhD Student, Lehigh University, 200 W. Packer Ave., Bethlehem, 18015, United States of America, mhm309@Lehigh.EDU, Tamás Terlaky

We highlight the relevance of two different curvature measures for the complexity of interior-point methods in Linear Optimization. Motivated by the d-step conjecture for the total geometric curvature of the central path by Deza, Terlaky and Zinchenko (2008), we prove a similar result for the local curvature measure first introduced by Sonnevend et al. in 1990.

3 - Improved Simplex Algorithm for Nonstationary Markov Decision Processes and its Applications
Ilbin Lee, PhD Student, The University of Michigan, Industrial and Operations Engineering, 1205 Beal Ave., Ann Arbor, MI, 48109-2117, United States of America, ilbinlee@umich.edu, Marina Epelman, Edwin Romeijn, Robert Smith

Nonstationary Markov decision processes (MDPs) are infinite-horizon MDPs with time-varying problem data. They can be modeled as countably infinite linear programs (CILP's) but there is no general solution method for CILP's. Recently, a simplex-type algorithm for nonstationary MDPs was suggested. We improved this algorithm while still guaranteeing its convergence to an optimal solution, applied it to a production planning problem, and compared it to a planning horizon approach.

■ MD14

14- West 106 C- CC

Adversaries and Tradeoffs

Cluster: Scheduling and Project Management

Invited Session

Chair: Nicholas Hall, Professor, Ohio State University, 2100 Neil Avenue, Columbus, OH, United States of America, hall.33@osu.edu

1 - Approximate Characteristic Functions for Intractable Cooperative Games in Operations Planning
Zhixin Liu, Assistant Professor, University of Michigan-Dearborn, zhixin@umd.umich.edu, Nicholas Hall

We design approximate characteristic functions for intractable operations planning games. An algorithm is proposed to specify solution procedure, solution space of coalitions' optimization problems, dependence of coalition value on outside decisions, and effective coalition structure. Applications include the knapsack problem, facility location, capacity allocation, the k-median problem, and flowshop sequencing.

2 - Dynamic Pricing with Minmax Regret
Zhi-Long Chen, Professor, University of Maryland, Robert H. Smith School of Business, College Park, MD, 20742, United States of America, ZChen@RHSmith.umd.edu, Nicholas Hall

We consider a two-period dynamic pricing problem where the decision maker has little demand information available and only knows lower and upper bounds of the demand functions. The objective is to minimize maximum regret. We propose two modeling approaches and solve the underlying problem efficiently in each case.

3 - Online Scheduling for Energy Minimization with a Constrained Adversary
Tulia Herrera, Columbia University, 500 West 120th Street, Rm. 313, New York, NY, 10027, United States of America, tjh2128@columbia.edu, Cliff Stein

We consider the problem of online scheduling to meet deadlines while minimizing energy in a two power state consumption system with a transition penalty. In general, no online algorithm can minimize energy and meet all deadlines. We propose using a constrained adversary and develop an algorithm that meets all deadlines and has small energy consumption. We bound the competitive ratio of the energy consumption and the total number of idle periods.

4 - Scheduling Two Chains on m Machines
Alessandro Agnetis, Professor, Universita di Siena, Dipartimento Ingegneria Informazione, via Roma 56, Siena, 53034, Italy, agnetis@dii.unisi.it, Hans Kellerer, Gaia Nicosia, Andrea Pacifici

A set of n tasks and m processing machines are given. Each task must be performed by one given machine, which can process only one task at a time. Precedence constraints exist among the tasks. We want to minimize a regular objective function of all task completion times. We address the case in which precedences take the form of two chains. We give complexity results for various special cases, including the weighted sum of task completion times and tardiness-related objectives.

■ MD15

15- West 202- CC

Software Demonstration

1 - Responsive Learning Technologies, Inc.- Online Games to Teach Operations and Supply Chain Management
Sam Wood, Responsive Learning Technologies, 4546 El Camino Real, #243, Los Altos CA 95014, United States of America, wood@responsive.net

Learn about online competitive exercises that are used in operations management courses and supply chain management courses to teach topics like capacity management, lead time management, inventory control, supply chain design and logistics. These games are typically used as graded assignments.

2 . Clear and Simple High Performance Technical Computing with Julia
Michael Bean, President, Forio Online Simulations, 1159 Bryant Street, San Francisco CA 94107, United States of America, mbean@forio.com

Julia is a new, high-performance dynamic programming language for technical computing that provides a sophisticated compiler, distributed parallel execution, numerical accuracy, and an extensive mathematical function library. Forio will demo its IDE for Julia that allows users to read, write, edit, and execute their Julia code and includes syntax-highlighting and code-completion.

■ MD16

16- West 207- CC

Teaching Dynamic Programming and Duality Insights using Games, Interdiction, and Robust Optimization

Cluster: Tutorials

Invited Session

Chair: J. Cole Smith, Professor, University of Florida, P.O. Box 210020, Gainesville, FL, 32611, United States of America, cole@ise.ufl.edu

1 - Teaching Dynamic Programming and Duality Insights using Games, Interdiction, and Robust Optimization
J. Cole Smith, Professor, University of Florida, P.O. Box 210020, Gainesville, FL, 32611, United States of America, cole@ise.ufl.edu

This tutorial discusses two aspects that often prove formidable to students: Dynamic programming (DP) and duality. We first discuss games that help teach DP concepts to undergraduate students in an entertaining and accessible manner. This background permits an application-oriented discussion of duality, which can in turn be used to teach emerging topics in interdiction and robust optimization. As a result, students may better understand the scope and limitations of modern optimization topics.

■ MD17

17- West 208 B- CC

Business Analytics Curriculum in Higher Education

Sponsor: INFORM-ED

Sponsored Session

Chair: Curt Hinrichs, JMP Academic Programs, SAS Institute, 100 SAS Campus Drive, Cary, NC, 27513, United States of America, Curt.Hinrichs@jmp.com

1 - Positioning Analytics in Business Intelligence (BI) Curricula

Susan Palocsay, Professor, James Madison University, Computer Info Sys & Business Analytics, MSC 0202, Harrisonburg, VA, 22807, United States of America, palocssw@jmu.edu, Michel Mitri

The growth of BI technology has garnered a great deal of attention, and information systems (IS) curriculum guidelines recognize BI as a specific knowledge area within data/information management. Combined with the surging interest in business analytics, this presents an opportunity for introducing extended coverage of statistical analysis and OR/MS modeling skills into undergraduate IS programs. We will discuss alternative designs for BI curricula that incorporate varying levels of analytics.

2 - What Our MBA Students Tell Us About Analytics

Vijay Mehrotra, University of San Francisco, School of Management, 2130 Fulton Street, San Francisco, CA, United States of America, vmehrotra@usfca.edu, Thomas Grossman, Mouwafac Sidaouoi

We have been teaching a core MBA course in Spreadsheet Modeling and Business Analytics for the past several years. This class has been enthusiastically received by both full-time and part-time students, and has led to the creation of student-driven electives. In this talk, we will describe the innovative aspects of our core class and discuss what we have learned from our students in recent years.

3 - UConn's Masters Program in Business Analytics and Project Management

Sudip Bhattacharjee, Associate Professor, University of Connecticut, Storrs, CT, United States of America, sbhattacharjee@business.uconn.edu, Ram Gopal, James Marsden

The Operations and Information Management department of UConn's School of Business launched a MS in Business Analytics and Project Management in Fall 2011. We detail our motivation and vision for the program, the structure and interdependencies of analytics courses we deliver, and the skills and value that students gain. We highlight the importance of analytics and our faculty expertise working in several corporate analytics research projects using SAS tools and various methodologies.

4 - Experiences with Developing an Advanced Business Analytics Course

Jerry Oglesby, Senior Director, SAS, SAS Campus Drive, Cary, NC, 27513, United States of America, jerry.oglesby@sas.com

A survey course on Business analytics was developed by SAS for masters level instruction. We describe the market forces and rationale for key topics included in the course and the challenges in balancing depth with breadth of coverage. We will discuss feedback and evolution of the course over the past 2 years and insights on where the survey course is heading.

■ MD18

18- West 208 A- CC

Optimization with Surrogates

Sponsor: Optimization/ICS- Derivative-free and Surrogate Optimization

Sponsored Session

Chair: Nick Sahinidis, Swearingen Professor, Carnegie Mellon University, Department of Chemical Engineering, Pittsburgh, PA, United States of America, sahinidis@cmu.edu

1 - Derivative-free Optimization Enhanced-surrogate Model Development for Optimization

Nick Sahinidis, Swearingen Professor, Carnegie Mellon University, Department of Chemical Engineering, Pittsburgh, PA, United States of America, sahinidis@cmu.edu, Alison Cozad, David Miller

We propose a model generation method that uses derivative-based and derivative-free optimization alongside machine learning and statistical techniques to learn algebraic models of detailed simulations. Once a candidate set of models is defined, they are tested, exploited, and improved through the use of derivative-free solvers to adaptively sample new points. We provide extensive computational experience with ALAMO, a code that we have developed to implement this strategy.

2 - Large-scale Expensive Black-box Function Optimization using an Adaptive Radial Basis Function Method

Kashif Rashid, Principal Research Scientist, Schlumberger-Doll Research, 1 Hampshire Street, Cambridge, MA, 02139, United States of America, krashid@slb.com, Benoit Couet, William Bailey

Optimization of a computationally expensive black-box reservoir simulation model of many variables is demonstrated using an adaptive radial basis function method. The iterative proxy-based scheme is used to tune the control variables, distributed for finer control over a varying number of intervals covering the total simulation period, to maximize asset NPV. The method shows that large-scale simulation-based function optimization of several hundred variables is practical and effective.

3 - Using Surrogates to Calculate Sensitivity Analysis While Optimizing

Genetha Gray, Sandia National Labs, P.O. Box 969, MS 9159, Livermore, CA, 94551-0969, United States of America, gagray@sandia.gov, John D. Siirola, Ethan Chan

In this talk, we will describe how hybridization can be used incorporate sensitivity analysis into optimization procedures. Specifically, by dynamically incorporating Bayesian sensitivity techniques into the minimization process, we will show how the usefulness of computational models can be drastically improved. We will review the basic hybridization algorithm and resulting software. We will also give some ideas for useful hybrids and show some results for a real world problem.

4 - Locally-Biased Efficient Global Optimization for Black-Box Optimization using Kriging Surrogates

Rommel Regis, Assistant Professor, Saint Joseph's University, Department of Mathematics, 5600 City Avenue, Philadelphia, PA, 19131, United States of America, rregis@sju.edu

The Efficient Global Optimization (EGO) algorithm by Jones et al. (1998) is a popular surrogate-based method that works well on many problems. However, its performance on high-dimensional problems and low-dimensional problems with deep and narrow basins tends to be relatively poor. This talk presents locally-biased forms of EGO that address this issue and that yield dramatic improvements over EGO on a 14-D watershed model calibration problem and on several test problems with up to 30 dimensions.

5 - Asynchronous Parallelization of Surrogate Response Surface Methods for Global Optimization

Christine Shoemaker, cas12@cornell.edu, Tipaluck Krityakierne, Taimoor Akhtar

Response surfaces reduce effort for computationally expensive Black-Box Simulation Optimization for multimodal continuous variable problems. This effort can be further reduced through algorithm changes to facilitate asynchronous parallelism. Methods will be discussed. The major issue is selecting the next points in decision space at which simulations will be done when multiple processors are available to accept new jobs at different times because of heterogeneity in processor speeds.

■ MD19

19- West 211 A- CC

Topics in Appointment Scheduling

Contributed Session

Chair: Carter Browning, University of Oklahoma, 1315 Northcrest Dr., Ada, OK, 74820, United States of America, cbrowning@ou.edu

1 - Designing Appointment Schedules in Health Care: Dealing with Walk-in Patients

Ingrid Vliegen, Assistant Professor, University of Twente, P.O. Box 217, Enschede, 7500 AE, Netherlands, i.m.h.vliegen@utwente.nl, Joost Veldwijk, Aleida Braaksma, Nelly Litvak

Traditionally diagnostic facilities schedule appointments for all patients. Allowing patients to walk in without an appointment, however, speeds up the process and reduces access times. We develop an algorithm that generates appointments schedules in which both patients with an appointment and walk-in patients can be served. Our study shows promising results with respect to the fraction of walk-in patients served, the access time of patients with an appointment and the computation time needed.

2 - Forecasting Binary Outcomes with Order-constrained Coefficients

Shannon Harris, Katz Graduate School of Business, 241 Mervis Hall, Pittsburgh, PA, 15213, United States of America, sharris@katz.pitt.edu, Jerry May

We consider the problem of forecasting the probabilities for binary outcomes using historical data with the impact of historical behavior decreasing over time. The work is motivated by trying to model patient no-show probability in an outpatient clinic. Future no-show behavior is a function of past behavior, but patients change their habits over time. We illustrate our approach using data from VA outpatient clinics.

3 - Reducing Patient Wait Times in Emergency Departments
Shanshan Qiu, Wayne State University, Industrial & Systems Engineering Department, Detroit, MI, 48202, United States of America, shanshan@wayne.edu, Ratna Babu Chinnam, Alper Murat, Evrim Dalkiran, Qingyu William Yang

Emergency Departments (EDs) in hospitals are experiencing a trend of severe crowding and prolonged patient waiting times. Some of these delays can be attributed to delays in identifying and readying beds for patients to be transferred to admit wards. We propose effective models to predict patient admission likelihood early on during ED triage so that necessary preparation steps can be taken early to reduce transfer delays. We also present results from Detroit VA Medical Center.

4 - Physician Dual Practice, Public Waiting Time and Patient Welfare
Qu (Alex) Qian, Assistant Professor, Shanghai University of Finance and Economics, 777 Guoding Road, School of International Business Adm, Shanghai, 200433, China, qian.qu@mail.shufe.edu.cn, Anming Zhang, Hong Chen

We use a stylized model to investigate the waiting time difference between dual-practice physicians and public-only physicians. We study the impact of physician dual practice on patient's waiting time and welfare. Although patients with lowest time costs have to endure a longer waiting time if physician dual practice is allowed, some of these patients may benefit as they could self-select dual-practice physicians and enjoy a service of higher quality.

5 - The Analysis of a Hospital Clinic Based on Support Vector Regression
Carter Browning, University of Oklahoma, 1315 Northcrest Dr., Ada, OK, 74820, United States of America, cbrowning@ou.edu

The shift from inpatient to outpatient services is becoming increasingly popular. With this shift, arrival and service times have become a greater problem for administrators. Evaluating queue performances requires the knowledge of these arrival and service density functions beforehand. Using support vector regression we can solve for the density function and evaluate outpatient services.

■ MD20

20- West 211 B- CC

The Business of Health Care

Contributed Session

Chair: Cigdem Gurgur, Purdue University, 2101 East Coliseum Blvd., Fort Wayne, IN, 46805, United States of America, gurgurc@ipfw.edu

1 - Panel Related Factors of Healthcare Bundled Payments
Wei Liu, Graduate Research Assistant, Purdue University, Gerald D. and Edna E. Mann Hall, Suite22, 203 Martin Jischke Drive, West Lafayette, IN, 47907, United States of America, liu317@purdue.edu, Ping Huang

The Bundled Payments for Care Improvement Initiative is considered to be an effective way to improve care coordination among multiple healthcare providers. In this research, several data analyses have been conducted to explore the panel related factors (e.g., patient's comorbidities, available panel resources, interaction between multiple facilities and providers etc) that may cause the variations of utilizations in a defined episode of care.

2 - Value-based Competition in Health Care Delivery
Tannaz Mahootchi, PhD Candidate, Wilfrid Laurier University, 75 University Ave. W, Waterloo, ON, N2L3C5, Canada, tmahootchi@wlu.ca, Ignacio Castillo

Reforming health care delivery to value-based competition requires building Integrated Practice Units (IPU) on medical conditions over full cycle of care. Changing the nature of competition based on results will require different performance measures and payment systems. Challenges include pricing for care cycles and deploying mechanisms to facilitate collaboration among specialties in an IPU. This study explores the challenges and provides some insights on effective mechanisms.

3 - Competing on Quality: Evidence from Award Winning Hospitals in California
Wei Wu, University of Tennessee Knoxville, 916 Volunteer Blvd., Knoxville, TN, 37996, United States of America, wwu3@utk.edu, Randy Bradley, Bogdan Bichescu

Healthcare is a highly competitive environment in which hospitals compete against one another to both provide services to patients and attract indispensable resources (i.e., nurses and physicians) to deliver their services. We investigate the marketing, operational, and financial benefits associated with winning quality awards, by performing a matching study that compares quality award-winning hospitals to comparable hospitals without quality awards during the period of our study.

4 - Tradeoffs in Bundling Decisions for Healthcare Products
Cigdem Gurgur, Purdue University, 2101 East Coliseum Blvd., Fort Wayne, IN, 46805, United States of America, gurgurc@ipfw.edu

In this study we consider supplier selection and quantity allocation decisions for a health care organization that may purchase a number of unbundled products and refurbished products under stochastic demand. We use data from a large healthcare provider in Indiana to test the implications of our study.

■ MD21

21- West 212 A- CC

Network Games and Interdiction

Sponsor: Optimization/Networks

Sponsored Session

Chair: Kelly Sullivan, University of Arkansas, 4207 Bell Engineering Center, 1 University of Arkansas, Fayetteville, AR, 72701, United States of America, kmsullivan@ufl.edu

1 - Geometric Interdiction of Multi-State Networks with Stochastic Interdiction Effect
Hugh Medal, Industrial and Systems Engineering, Mississippi State University, Mississippi State, MS, 39762, United States of America, hmedal@ise.msstate.edu

We study a network interdiction problem in which the interdictor, seeking to maximally disrupt the flow of an adversary, stages attacks at points within a geographic area containing the network. These attacks expose surrounding network elements to hazards with intensity proportional to hazard magnitude and distance to the center of the hazard. The post-disruption element capacity is a random function of the hazard intensity. We present a stochastic programming strategy to solve the problem.

2 - Deception Tactics for Network Interdiction: A Multi-Objective Approach
Javier Salmerón, Associate Professor, Naval Postgraduate School, jsalmero@nps.edu

This work develops defender-attacker network interdiction models with deception, i.e., where the defender is allowed to use interdiction assets and decoys that are not realized by the attacker. We develop a mixed-integer programming formulation as a generalized network, and its Benders decomposition. We also show a multi-objective extension to accommodate several attacker behaviors. Our computational tests show the difficulty in solving these problems optimally.

3 - Locating Direction Finders to Maximize Detection Effectiveness
Wilbert Wilhelm, Professor, Texas A&M University, Department of Industrial and Sytems Engineering, TAMU3131, College Station, TX, 77843-3131, United States of America, wilhelm@tamu.edu, Suhwan Kim

A set of electronic direction finders is used by the military to locate the source of radio frequencies emitted on the battlefield by enemy forces. In modern warfare, it is crucial to detect the enemy as early as possible to gain advantage. This paper describes a new formulation to prescribe the deployment (i.e., location) of direction finders that maximizes the effectiveness with which emitters can be detected using a resource-constrained shortest path model.

4 - Convex Hull Representation of the Bipartite Max-Reliability Path Interdiction Problem
Kelly Sullivan, University of Arkansas, 4207 Bell Engineering Center, 1 University of Arkansas, Fayetteville, AR, 72701, United States of America, kmsullivan@ufl.edu, David Morton, J. Cole Smith

We consider the problem of installing sensors on arcs in a network in order to minimize a smuggler's maximum probability of traversing from a known origin to a known destination without being detected. We develop an class of inequalities that produces the convex hull for the case when sensor installations are restricted to arcs in a predefined cut-set. These inequalities may be useful in solving a generalized version of this problem in which the smuggler's origin and destination are unknown.

■ MD22

22- West 212 B- CC

What's New in Coopr

Sponsor: Computing Society

Sponsored Session

Chair: David L. Woodruff, University of California-Davis, Graduate School of Management, Davis, CA, 95616, United States of America, dlwoodruff@ucdavis.edu

1 - What's New in Coopr I

John D. Siirola, Sandia National Laboratories, P.O. Box 5800 MS 1326, Albuquerque, NM, 87185, United States of America, jdsiiro@sandia.gov, David L. Woodruff, William E. Hart, Jean-Paul Watson

We describe new features in the open-source software for modeling and optimization called Coopr. The Python-based algebraic modeling language Pyomo is being extended in many ways including the provision of user-defined workflows, more efficiency, and model blocks for specifying aggregations of model components. The PySP stochastic programming package has expanded support for chance constraints, automatic computation of the expected value of a stochastic solution, and numerous other extensions.

2 - What's New in Coopr III

Jean-Paul Watson, Principal Member of Technical Staff, Sandia National Laboratories, P.O. Box 5800, MS 1326, Albuquerque, NM, 87113, United States of America, jwatson@sandia.gov, David L. Woodruff, William E. Hart, John D. Siirola

We describe new features in the open-source software package for modeling and optimization called Coopr. The Python-based algebraic modeling language Pyomo is being extended in many ways including the provision of user-defined workflows, more efficiency, and model blocks for specifying aggregations of model components. The PySP stochastic programming package has expanded support for chance constraints and automatic computation of the expected value of a stochastic solution.

3 - What's New in Coopr IV

David L. Woodruff, University of California-Davis, Graduate School of Management, Davis, CA, 95616, United States of America, dlwoodruff@ucdavis.edu, Jean-Paul Watson, John D. Siirola, William E. Hart

We describe new features in the open-source software for modeling and optimization called Coopr. The Python-based algebraic modeling language Pyomo is being extended in many ways including the provision of user-defined workflows, more efficiency, and model blocks for specifying aggregations of model components. The PySP stochastic programming package has expanded support for chance constraints, automatic computation of the expected value of a stochastic solution, and numerous other extensions.

■ MD23

23- West 212 C- CC

Issues in the Semiconductor Industry

Contributed Session

Chair: Zhufeng Gao, The University of Texas, 2004 E. Dean Keeton, Street C2200, Austin, TX, 78712-1591, United States of America, gaozhufeng@utexas.edu

1 - Approximating the Yield in Wafer to Wafer Integration Problem

Trivikram Dokka, Katholieke Universitiet Leuven, Naamsestraat 69, Leuven, 3000, Belgium, Trivikram.Dokka@econ.kuleuven.be, Frits Spieksma

We consider the yield maximization problem in wafer to wafer 3D integration. We formulate the wafer to wafer integration prob- lem as a multidimensional assignment problem. We settle its complexity status and study the problem from approximation point of view. We give simple algorithms for a special case and comment on the approximability of the general case.

2 - Real-time Decision Support for Assembly and Test Operations in Semiconductor Manufacturing

Zhufeng Gao, The University of Texas, 2004 E. Dean Keeton, Street C2200, Austin, TX, 78712-1591, United States of America, gaozhufeng@utexas.edu, Jonathan Bard

We will introduce an efficient procedure for prioritizing machine changeovers in a semiconductor assembly and test facility on a periodic basis. In daily planning, target machine-tooling combinations are derived based on work in process, due dates, and backlogs. As machines finish their current lots, they need to be reconfigured to match their target setups. The proposed algorithm is designed to achieve this objective and run in real time with high-quality solutions obtained in negligible time.

■ MD24

24- West 213 A- CC

Optimizing Patients Schedules for Improving Healthcare Delivery

Sponsor: Health Applications Society

Sponsored Session

Chair: Nadia Lahrichi, Professor, École Polytechnique de Montreal, C.P. 6079, Succ. Centre-ville, Montreal, QC, H3C3A7, Canada, Nadia.Lahrichi@polymtl.ca

1 - Towards Broad Appointment Scheduling Policies: Enriched Understanding from Simulation Optimization

Ken Klassen, Professor, Brock University, Dept. of Finance, Operations & IS, St Catharines, ON, L2S3A1, Canada, kklassen@brocku.ca, Reena Yoogalingam

The unique and highly variable characteristics of outpatient clinics make it challenging to develop broad policies for scheduling appointments. The presence of factors such as patient and doctor unpunctuality, interruptions and no-shows further complicates this process. This study uses a simulation-optimization framework based on empirical data to develop general insights into appointment system design.

2 - An Approximate Auction-based Coordination Mechanism for Dynamic Patient Scheduling under Uncertainty

Hadi Hosseini, University of Waterloo, 200 University Ave., West, Waterloo, ON, N2L3G1, Canada, h5hosseini@uwaterloo.ca, Jesse Hoey, Robin Cohen

Computing an optimal solution for the problem of stochastic healthcare scheduling is computationally intractable. We propose an approximate multiagent resource allocation technique to find possible alternatives that maximize a social welfare function. Each patient formulates its internal preferences, success model, and temporal dependencies between resources as a single MDP. An auction-based coordination mechanism is then applied to find a close-to-optimal allocation of the aggregated MDPs.

3 - Setting Surgical Schedules to Optimize Downstream Resource Utilization

Patrick Jonathan, Professor, University of Ottawa, 55 Laurier Avenue, Ottawa, ON, K2G 3A6, Canada, patrick@telfer.uottawa.ca, Davood Astaraky

Determining an appropriate surgical schedule is a tough decision process that requires the administrator to assess competing priority classes and surgical types, variable surgical times and lengths of stay post-surgery. We seek to develop a model that optimally allocates surgeries into pre-determined surgical blocks in order to maximize utilization of operating room time and post-op beds while meeting priority specific wait time targets using an approximate dynamic programming approach.

4 - Online Optimization of Radiotherapy Patient Scheduling

Antoine Legrain, PhD Candidate, École Polytechnique Montreal, Pavillon André-Aisenstadt, Bureau 3520, 2920, Chemin de la Tour, Montrèal, QC, H3T 1J4, Canada, antoine.legrain@polymtl.ca, Nadia Lahrichi

An efficient radiotherapy patient scheduling on the linear accelerators is crucial to ensure the delivery of the treatment respecting all delays. Different contradictory objectives and constraints have to be taken into account. We propose a hybrid algorithm using online and stochastic optimization. Online methods allow scheduling a patient whenever according to the preference of the user and stochastic tools authorize to infer the future in order to take into account prospective patients.

■ MD25

25- West 213 B- CC

Simulation Optimization in Healthcare

Sponsor: Health Applications Society

Sponsored Session

Chair: Daniel Underwood, North Carolina State University, 111 Lampe Drive, 373 Daniels Hall, Campus Box 7906, Raleigh, NC, 27695, United States of America, daniel.underwood@ncsu.edu

1 - Scheduling Patient Transports for an Air Ambulance Service

Shane Henderson, Professor, Cornell University, School of ORIE, 230 Rhodes Hall, Ithaca, NY, 14850, United States of America, sgh9@cornell.edu, Timothy Carnes, Russell Macdonald, Mahvareh Ahghari, David Shmoys

Ornge is a not-for-profit company that provides air-ambulance services to Ontario. A major part of their operations involves transporting patients between health facilities using a collection of fixed-wing aircraft stationed around the province. The requests are received a day in advance, and scheduled overnight. I will describe our work in using set partitioning to perform the scheduling, and its impact on Ornge's operations.

2 - Mitigating the Operational Effects Patient Isolation Requirements in Hospital Bed Assignments

Ruben Proano, Assistant Professor, Rochester Institute of Technology, 81 Lomb Memorial Drive, KGCOE-1593, Rochester, NY, 14623, United States of America, rpmeie@rit.edu

We present an optimization model that suggests how to accommodate admitted and incoming patients in a hospital unit in order to satisfy all isolation requirements, while simultaneously ensuring the unit is used by the most critical patients, and minimizing the number of internal movements (i.e., patient shuffles). The model is then integrated into a Monte Carlo simulation experiment to determine how many single- and double-patient rooms are necessary to minimize the number of internal movements.

3 - Optimizing Pandemic Control Strategies using Simulation Meta-modeling

Michael Beeler, University of Toronto, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, mfbeeler@gmail.com, Michael Carter, Dionne Aleman

Pandemic simulations can be so high-dimensional that it is difficult for conventional designed experiments to explore the full space of possible disease parameters, population characteristics, and simulated pandemic responses. Stochastic kriging, an alternative simulation meta-modeling technique, is used to search the simulation design space for good pandemic control strategies and construct a response surface covering a range of possible future scenarios.

4 - The Impact of Flexibility and Capacity Allocation on the Performance of Primary Care Practices

Hari Balasubramanian, Assistant Professor, University of Massachusetts, 160 Governors Drive, Amherst, MA, 01003, United States of America, hbalasubraman@ecs.umass.edu, Xiaoling Gao, Ana Muriel

We adapt ideas of manufacturing process flexibility to the management of continuity and timely access in primary care practices. Timely access focuses on the ability of a patient to get access to a physician. Continuity refers to building a strong relationship between patient and physician by maximizing patient visits. We develop a two-stage stochastic integer program to investigate optimal capacity allocation for prescheduled and same-day patients, and the value of different flexible policies.

■ MD26

26- North 221 A- CC

Retail Operations II

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Dorothee Honhon, Technische Universiteit Eindhoven, P.O. Box 513, 5600 MB, Eindhoven, Netherlands, d.b.l.p.honhon@tue.nl

Co-Chair: Xiajun Amy Pan, University of Florida, United States of America, amypan@ufl.edu

1 - Integrated, Multi-Category, Pricing, Assortment and Inventory Decisions under Cross Selling

Bacel Maddah, Associate Professor, American University of Beirut, Bliss Street, Beirut, Lebanon, bm05@aub.edu.lb, Ahmed Ghoniem, Ameera Ibrahim

We formulate a nonlinear integer program that jointly optimizes retail decisions on assortment, pricing, and inventory for two complementary categories, primary (e.g. toys) and secondary (e.g. batteries). We model asymmetric cross-selling, where some customers who purchase from the primary category (e.g. a toy) also buy from the secondary category (e.g. a battery). We develop an exact linear reformulation, which is efficiently solved to optimality on CPLEX.

2 - Assortment Planning with Vertically and Horizontally Differentiated Products

Lei Xie, Assistant Prof., Shanghai Jiaotong University, 1954 Huashan road, shanghai, P.R.China, Shanghai, China, leixie@sjtu.edu.cn, Yulan Wang, Xiaofeng Shao

Companies always design product lines by segmenting their markets on quality and taste attributes. Existing operations management literature mainly focuses on either vertically or horizontally differentiated products. In our paper, we consider such a scenario where a monopoly firm designs the product line on both quality and taste attributes, and jointly optimize the assortment and pricing decisions. We also derive the structure of the optimal assortment policy.

3 - Assortment Planning and Customer Segmentation

Denis Saure, Assistant Professor, University of Pittsburgh, 1042 Benedum Hall, 3700 O'Hare Street, Pittsburgh, PA, United States of America, dsaure@pitt.edu

We study the problem of a retailer facing heterogeneous consumers with initially unknown preferences. The retailer might customize offerings based on available profile information. However, users with different profiles might behave identically, suggesting that no all information is relevant. Thus, the retailer might benefit from pooling customers with similar behavior. We propose policies that dynamically adjust customer segmentation to maximize cumulative revenue.

4 - Bundling Strategies for Vertically Differentiated Products

Xiajun Amy Pan, University of Florida, United States of America, amypan@ufl.edu, Dorothee Honhon

In this paper, we study how to choose the optimal bundling strategy for a retailer offering vertically differentiated products. We characterize conditions under which different bundling strategies are optimal respectively and provide efficient methods to identify optimal prices for offered products in order to maximize the retailer's profit.

■ MD27

27- North 221 B- CC

Strategies in Retail

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Achal Bassamboo, Northwestern University, 2001 Sheridan Rd, Evanston, IL, United States of America, a-bassamboo@kellogg.northwestern.edu

1 - Impact of Delay Announcement: An Empirical Study

Qiuping Yu, Student, Northwestern University, 2145 Sheridon, Evanston, IL, 60201, United States of America, yqp2009@gmail.com, Gad Allon, Achal Bassamboo

Many service systems announce anticipated delay to the customers. In this paper, we explore the impact of such announcement. We study the data from a medium size call center where the customers are provided announcement concerning their delay. The data provides information about how long the customer stayed in system before they decided to abandon or entered service, whichever occurred first.

2 - Online-offline Strategies in Retail
Santiago Gallino, The Wharton School, 3720 Walnut St., Philadelphia, 19104, United States of America, sgallino@wharton.upenn.edu, Antonio Moreno-Garcia

Using a dataset from a leading retailer, we study the effect on customer behavior of online-offline integration strategies, such as showing inventory information online and store pickup of online orders.

3 - Who Are My Competitors? Let the Customer Tell
Jun Li, lijun1@wharton.upenn.edu, Serguei Netessine

Identifying competitor set is critical yet challenging in hotel industry. Based on click-stream data from a major Online Travel Agent, we develop an approach to construct hotel competition network. Furthermore, according to hotelier competitive pricing behavior, we find that there is a mismatch between hoteliers' and customers' perspective of competitor sets.

4 - Service Competition and Product Quality in the U.S. Automobile Industry
Jose Guajardo, josegu@wharton.upenn.edu, Morris Cohen, Serguei Netessine

We formulate and estimate a structural econometric model to study the role of services in the U.S. automobile industry. We analyze the impact of service attributes on demand, and test whether the effects of service attributes and product quality are independent, complementary or substitutes. Our findings indicate that service attributes act as complements in the demand function, and conversely, that service attributes play the role of substitutes with respect to product quality.

■ MD28

28- North 221 C- CC

Choice Models in Operations and Revenue Management

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Yuri Levin, Professor, Queen's School of Business, 143 Union St., Kingston, Canada, ylevin@business.queensu.ca

1 - A New Approach to Hotel Pricing
Dan Zhang, University of Colorado at Boulder, 995 Regent Dr, Boulder, CO, United States of America, dan.zhang@colorado.edu, Lawrence Weatherford

We show that a non-linear non-separable approximation architecture proposed in the recent work of Zhang (2011) can be generalized to dynamic pricing for network revenue management. This generalization leads to tighter bounds and better heuristic policies than widely used DAVN type approaches. We provide a case study with data from a major US hotel.

2 - Intermediation in Salvage Markets with Strategic Consumers
Pnina Feldman, Haas School of Business, UC Berkeley, 545 Student Services Bldg #1900, Berkeley, CA, 94720, United States of America, feldman@haas.berkeley.edu, Kate Ashley

Motivated by the proliferation of third-party salvage firms such as Overstock.com, we consider the operational benefits that such firms can provide to sellers. The setting is a variation on the classic newsvendor: a seller can either sell surplus units directly to customers, or sell to an intermediary at a lower price. We find that if customers are strategic, the longer supply chain may perform better, even if the intermediary has no cost or marketing advantages.

3 - Equilibrium in Queues under Unknown Service Rates and Service Value
Senthil Veeraraghavan, Associate Professor, The Wharton School, 3730 Walnut Street Suite 550, Philadelphia, PA, 19104, United States of America, senthilv@wharton.upenn.edu, Laurens Debo

We study queue joining equilibrium when there is uncertainty on service rates and service value. We show that equilibrium may not be a simple threshold policy, and a "sputtering equilibrium" might exist. In the sputtering equilibrium, the joining behavior is non-monotone. Consumers balk from a queue at some queue length following a randomized decision, but will always join when the queue gets longer.

4 - Dynamic Pricing of Flight Passes
Yuri Levin, Professor, Queen's School of Business, 143 Union St., Kingston, Canada, ylevin@business.queensu.ca, Mikhail Nediak, Huseyin Topaloglu

Many airlines have recently introduced a "flight pass" which targets customers in a frequent traveler segment. This product permits its holder to obtain a seat on a specified number of flights at a fixed price. Dynamic pricing of passes is contingent upon pricing of individual flights and how forward-looking customers choose between passes and individual bookings. We present a stochastic dynamic programming formulation for this problem and analyze the properties of the pricing policy.

■ MD29

29- North 222 A- CC

Resource Allocation in Healthcare Systems

Sponsor: Manufacturing & Service Oper Mgmt/ Healthcare Operations/SIG

Sponsored Session

Chair: Carri Chan, Columbia Business School, 3022 Broadway, Uris 410, New York, NY, United States of America, cwchan@columbia.edu

1 - Decomposing the Impact of Workload on Patient Outcomes
Michael Freeman, Judge Business School, University of Cambridge, Cambridge, United Kingdom, mef35@cam.ac.uk, Nicos Savva, Stefan Scholtes

Previous work has shown that in-patient outcomes deteriorate at high workloads. In this paper we use a detailed dataset from the Delivery Unit of a large UK hospital to investigate the operational factors that drive this this deterioration. We discuss findings and implications for hospitals.

2 - Optimizing the Flow of Short-Stay Patients in the Intensive Care Unit: A Simulation Model
Elisa Long, Assistant Professor, Yale School of Management, New Haven, CT, 06520, United States of America, elisa.long@yale.edu, Kusum Mathews

As demand for intensive care unit (ICU) beds increases, optimizing patient throughput is needed. Using 9-months of data for Yale-New Haven Hospital, we characterized "short-stay" patients (<24 hours), who account for 35% of ICU patients. Approximately 50% of short-stay patients were lower-acuity and could be treated in a step-down unit (SDU). We developed a simulation model with priority queuing to determine the optimal allocation of ICU and SDU beds.

3 - A Mixed Integer Programming Approach to Improve Operational Scheduling of Radiation Therapists
Vincent Chow, Operations Research Analyst, British Columbia Cancer Agency, 600 West 10th Ave., Vancouver, BC, V5Z4E6, Canada, vchow@bccancer.bc.ca, Pablo Santibanez, Travis Nordin, John French, Martin Puterman, Scott Tyldesley

Radiation therapists (RTs) are integral to cancer care, performing tasks such as imaging, treatment planning and delivery. We present a mixed integer programming model to create RT schedules with daily assignments. Results from implementation at a mid-size center in Western Canada show 30% to 40% improvement in a range of quality metrics. The model is packaged into a customized web-based scheduling platform and used by the RT manager on a regular basis.

4 - ICU Admission Control: An Empirical Study of Capacity Allocation and Patient Outcomes
Song-Hee Kim, Columbia University, 500 W 120th Street, New York, NY, United States of America, sk3116@columbia.edu, Marcelo Olivares, Carri Chan

We examine how congestion in the ICU can impact the care pathway of patients and, ultimately, patient outcomes. We develop a stylized model for ICU admission and use the insights gained to develop an empirical framework, in which instrumental variable approach is used to identify the effect of the endogenous admission decision. We estimate these models using a large data set from an integrated healthcare delivery system and discuss the results' substantial health and financial implications.

■ MD30

30- North 222 B- CC

Impact of Credit on Operations

Sponsor: Manufacturing & Service Oper Mgmt/iFORM

Sponsored Session

Chair: Sridhar Seshari, Professor, University of Texas at Austin, McCombs School of Business, Austin, TX, 78712, United States of America, Sridhar.seshadri@mccombs.utexas.edu

1 - The Effect of Trade Credit in Supply Chains

John Birge, Professor, University of Chicago, Chicago, IL, United States of America, john.birge@chicagobooth.edu, Song Alex Yang

Trade credit is the dominant source of short-term credit for most firms. In previous work, we described a model of firm interactions in which trade credit serves as a risk-sharing mechanism that improves chain efficiency. This talk discusses predictions from this model and empirical evidence.

2 - Operational Investment and Capital Structure under Asset Based Lending

Vishal Gaur, Professor, Cornell University, Johnson School, Ithaca, NY, 14853, United States of America, vg77@cornell.edu, Yasin Alan

We study the implications of asset based lending for operational investment, probability of bankruptcy, and capital structure for a newsvendor firm. Using a single-period game between a business owner and a bank, we show how asset based lending helps the bank mitigate adverse selection under information asymmetry. We derive the collateral value of inventory, which contrasts with simple rules of thumb used by banks in practice.

3 - An Analysis of Inventory Financing Cost and Performance

Sridhar Seshari, Professor, University of Texas at Austin, McCombs School of Business, Austin, TX, 78712, United States of America, Sridhar.seshadri@mccombs.utexas.edu, Qi Wu, Kumar Muthuraman

In this paper, we study the inventory performance of publicly listed firms between 1985 and 2010 and show how the effect of cost of capital should be accounted for in inventory decisions. We also examine how financing and inventory decisions jointly impact one another after controlling for various operational and financial factors.

4 - Working Capital Constraints and Inventory

Yale T. Herer, Technion-Israel Institute of Technology, Israel, yale@technion.ac.il, Enver Yücesan, Illana Bendavid

Curiously absent from the inventory operations literature are models that consider financial constraints imposed by working capital requirements (WCR). In practice, however, many firms are self-financing, i.e., their ability to replenish their own inventories is directly affected not only by their current inventory levels, but also by their receivables and payables. In this paper, we analyze the materials management practices of a self-financing firm whose replenishment decisions are constrained by cash flows. In particular, we investigate the interaction between the financial and operational parameters as well as the impact of WCR constraints on the long-run average cost.

■ MD31

31- North 222 C- CC

Service Quality, Staffing and Marketing for Congestion-prone Services

Sponsor: Manufacturing & Service Oper Mgmt/Service Operations

Sponsored Session

Chair: Philipp Afeche, Rotman School of Management, University of Toronto, 105 St.George Street, Toronto, ON, M5S3E6, Canada, Philipp.Afeche@Rotman.Utoronto.Ca

1 - Design of an Aggregated Marketplace under Congestion Effects: Asymptotic Analysis and Equilibrium Characterization

Ying-Ju Chen, UC Berkeley, Berkeley, United States of America, chen@ieor.berkeley.edu, Gustavo Vulcano, Costis Maglaras

We study an aggregated marketplace where potential buyers arrive and submit requests-for-quotes (RFQs). We characterize the asymptotic performance of this system, and subsequently extract insights about the equilibrium behavior of the suppliers. We show that supplier competition results into a mixed-strategy equilibrium phenomenon and is significantly different from the centralized solution. We propose a compensation-while-idling mechanism that coordinates the system.

2 - Asymptotic Stability of AR(1)-Driven Workforce Scheduling Models

Yong-Pin Zhou, Associate Professor, University of Washington and University of Hong Kong, Box 353226, Seattle, WA, 98195-3226, United States of America, yongpin@u.washington.edu, Noah Gans, Haipeng Shen, Han Ye

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.

3 - Formulation Choice in Call Centers: Service-level Differentiation Revisited

Itai Gurvich, Northwestern University-Kellogg School of Management, Evanston, IL, United States of America, i-gurvich@kellogg.northwestern.edu, Seung Bum Soh

We study formulation choice for call-center staffing. We formalize an intuitive notion of Service-Level Differentiation and show how the staffing and prioritization rules depend on the choice of differentiation-degree. We prove the convexity of the staffing cost as a function of the differentiation degree. We also prove that monotone-index policies that are appealing and widely used in practice are, in fact, optimal under the appropriate formalization of service-level differentiation.

4 - Demand and Capacity Management for a Call Center: Optimal Priorities, Promotions and Staffing

Mojtaba Araghi, Rotman School of Management, University of Toronto, 105 St. George Street, Toronto, Canada, mojtaba.araghi08@rotman.utoronto.ca, Philipp Afeche, Opher Baron

We study the problem of maximizing the profit of an inbound call center that controls promotions, staffing and priorities to new vs. base customers. We develop a deterministic fluid model that links these controls to customer flows, the size of the customer base and key performance measures. We generate analytical prescriptions on the optimal decisions for the fluid model, and we show via simulation that these prescriptions yield near-optimal performance for the underlying stochastic system.

■ MD32

32- North 223- CC

Supply Chain Management for Environmental Sustainability

Sponsor: Manufacturing & Service Oper Mgmt/Supply Chain

Sponsored Session

Chair: Greys Sosic, University of Southern California, Marshall School of Business, Los Angeles, CA, United States of America, sosic@marshall.usc.edu

1 - Complying with Take-back Legislation: A Comparison of Compliance Schemes

Eda Kemahlioglu Ziya, Professor, Kenan Flagler Business School, University of North Carolina, Chapel Hill, NC, 27599, United States of America, Eda_KemahliogluZiya@unc.edu, Gokce Esenduran

Under take-back legislation, manufacturers finance the collection and treatment of their end-of-use products. The most common compliance schemes are by individual manufacturer and collectively with cost allocation by market share. We compare these two schemes, based on cost the manufacturer and on environmental benefits.

2 - Design Incentives, Fairness and Cost Efficiency: A Network Perspective on EPR

Luyi Gui, Georgia Institute of Technology, Atlanta, GA, United States of America, luyi.gui@gatech.edu, Atalay Atasu, Beril Toktay, Ozlem Ergun

Extended Producer Responsibility (EPR) is a policy tool that stipulates the financial responsibility of producers for post-use handling of their products. In this research, we provide an analytical assessment of the potential of the widely-adopted collective EPR implementations for providing design incentives and generating economic benefits for the involved stakeholders via designing cost allocation mechanisms, using a network model of e-waste collection and recycling operations.

3 - Designing Consumer Subsidies with Industry Response for Green Technology Adoption
Maxime Cohen, Massachusetts Institute of Technology, Cambridge, MA, United States of America, maxcohen@mit.edu, Ruben Lobel, Georgia Perakis

We study the problem of designing consumer subsidies for adopting green technologies. We introduce a model where the government sets subsidies to achieve an adoption target level while minimizing its expenditures whereas industry decides production and price to optimize its profit. We derive insights on the impact of demand uncertainty by comparing the optimal policies for stochastic demand to an average case approximation. Finally, we analyze the supply-chain efficiency.

4 - A Stochastic Inventory System with an Emission Constraint
Rowan Wang, University of Minnesota, 111 Church St. SE, Minneapolis, MN, 55455, United States of America, Wang1075@umn.edu, David Chen, Saif Benjaafar

We consider a stochastic inventory problem with a horizon-based emission constraint. We formulate the problem as a stochastic dynamic program and characterize the structure of the optimal policy. We provide managerial insights into the effect of the emission constraint under a variety of settings.

■ MD33

33- North 224 A- CC

Inventory in Manufacturing

Contributed Session

Chair: Rainer Kleber, Otto-von-Guericke University Magdeburg, Faculty of Economics and Management, Universitatsplatz 2, Magdeburg, 39106, Germany, rainer.kleber@ovgu.de

1 - Industry Clockspeed and Manufacturing Inventory
Barin Nag, Professor, Towson University, E-Business & Technology Management, Towson, MD, 21252, United States of America, bnag@towson.edu, Chaodong Han, Dongqing Yao

There is a view that industry clockspeed drives internal operations. We examine Manufacturing inventory levels at different stages, raw material, work-in-process, and finished goods, using operational data for 3-digit NAICS manufacturing industries. Industry clockspeed is linked to manufacturing inventories using multidimensional measures. Results show that clockspeed rates impact manufacturing inventories.

2 - Optimal Replenishment Policy for a Inventory System with One-way Substitution and Fixed Order Costs
Yannick Deflem, KU Leuven, Naamsestraat 69, Leuven, 3000, Belgium, yannick.deflem@econ.kuleuven.be, Inneke Van Nieuwenhuyse

We consider a two-product inventory system with one-way substitution, in which the flexible product is used as a backup of the regular product when it stocks out. We analyze the optimal replenishment policy, assuming periodic review and joint fixed order costs.

3 - Inventory Control in Hybrid Manufacturing System with Fixed Set-up Costs
S. Phil Kim, Purdue University, 315 N. Grant St., West Lafayette, IN, 47907, United States of America, ksphil@purdue.edu, George Shanthikumar, Seokcheon Lee

In this paper, the inventory problems in a closed-loop hybrid manufacturing and remanufacturing systems with set-up costs are studied. The set-up costs make it difficult to analyze the optimal structural properties. Recently, Ahiska & King provided practical policy characterizations in separate set-up cost cases. We expand the the problem by including joint & swithing set-up costs and provide integrated approximate policy structures for each type of set-up costs.

4 - Inventory Management in China: An Empirical Study
Jun Shan, Assistant Professor, Nankai University, Business School, Nankai University, 94 Weijin Road, Tianjin, 300071, China, jshan@nankai.edu.cn

In the presence of increased competition from both inside and outside of China, many Chinese manufacturers have turned to scientific management approaches and implemented various enterprise systems. In this study, we apply an econometrical method to investigate the inventories of 1286 firms listed in China. We find that on average the inventory levels have declined over time and that the firm-level data is consistent with several implications derived from classical inventory models.

5 - The Impact of Stock-keeping on Dual-sourcing Strategies with Capacity Reservation and Spot Markets
Rainer Kleber, Otto-von-Guericke University Magdeburg, Faculty of Economics and Management, Universitatsplatz 2, Magdeburg, 39106, Germany, rainer.kleber@ovgu.de, Karl Inderfurth, Peter Kelle

We address a procurement problem of an item used for producing finished goods in a make-to-stock environment under stochastic demand. We consider two sourcing options: the spot market showing stochastic prices and a capacity reservation contract. The contract fixes for a long time the procurement price, a maximum order quantity, and a reservation price. In a numerical study we assess the advantage drawn from dual sourcing compared to single strategies in the context of stock-keeping of material.

■ MD34

34- North 224 B- CC

Feedback, Learning and Innovation

Cluster: New Product Development

Invited Session

Chair: Enno Siemsen, University of Minnesota, 321 19th Ave. S, Minneapolis, MN, United States of America, siems017@umn.edu

1 - Different Feedbacks Different Benefits: Customers and Product Development Process
Bilal Gokpinar, Assistant Professor, University College London, Management Science and Innovation, London, United Kingdom, b.gokpinar@ucl.ac.uk

Companies receive a substantial amount of feedback and learn a lot about their products from the customers after their products are on the market. In this empirical study, we examine the effects of different feedbacks on organizational learning and subsequent design and development efforts.

2 - Patients as Health Care Innovators and Developers of New Treatments, Therapies or Medical Devices
Pedro Oliveira, Professor, Catolica-Lisbon School of Business and Economics, Palma de Cima, Lisboa, 1649-023, Portugal, poliveira@ucp.pt

We empirically investigate the role of patients of chronic diseases in the development of new treatments, therapies or medical devices (TT&DM). We studied a sub-set of diseases (Cystic Fibrosis, Asthma, Sleep Apnea and Diabetes) and found that patients, or their families, have developed about 50% of all TT&DM available. However, the main health-care players have resisted integrating them in their development cycles. Our empirical findings have important policy and managerial implications.

3 - Does Pre-market Approval of Medical Devices Benefit Patients?
Cheryl Druehl, George Mason University, Fairfax, VA, United States of America, cdruehl@gmu.edu, Zhili Tian

We examine whether the FDA Pre-Market Approval (PMA) and 510(K) processes benefit patients using two types of medical devices: spinal implants and stents. In PMA, applicants provide scientific evidence to assure that the device is safe and effective for its intended uses. To quickly get to market, firms often go through 510(K) notification. Without scientific evidence, physicians may either ignore the innovative devices or adopt potentially unsafe devices. In either case, patients suffer.

4 - Collocation Matters:The Interdependence of R&D and Manufacturing
Enno Siemsen, University of Minnesota, 321 19th Ave., S, Minneapolis, MN, United States of America, siems017@umn.edu, John Gray, Gurneeta Vasudeva

Does the collocation of manufacturing and research and development (R&D) activities improve or hurt manufacturing performance? We empirically show that the conformance-quality-related benefits from collocating manufacturing and R&D in the pharmaceutical industry generally dominate the drawbacks, and thus, collocated sites have superior manufacturing quality performance.

■ MD35

35- North 225 A- CC

Pricing Policies and Social Media

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Benny Mantin, University of Waterloo, Waterloo, ON, Canada, bmantin@uwaterloo.ca

1 - Selling to Strategic Consumers: on the Benefits of Valuation Uncertainty and Targeting Capabilities

Dror Hermel, 1004 West Cordova Street, Vancouver, BC, V6E 3T3, Canada, Dror.Hermel@sauder.ubc.ca, Benny Mantin, Yossi Aviv

We study a 2 period model. In the first setting a revenue maximizing seller encounters consumers who are faced with valuation uncertainty. We show that the seller may benefit from encountering strategic rather than myopic consumers. Also, offering a return option can be beneficial. In the second setting the consumers' valuation is certain. The seller can target certain consumers with a discount coupon. In this case we show the adverse effects of strategic consumers can be eliminated.

2 - Customer Revenue Sharing Program in Online Social Media

Fredrik Odegaard, Assistant Professor, Richard Ivey School of Business, 1151 Richmond St. N, London, On, N6G4X3, Canada, fodegaard@ivey.uwo.ca, Fouad H. Mirzaei, Xinghao Yan

Online social media (OSMs) have become a popular and growing phenomenon on the Internet. Given high competition over the Internet to attract users, a question that arises is whether OSMs should reward their contributing users. We model this competition by a duopoly game where users are either active or passive with respect to each OSM. We show this game has a unique Nash equilibrium in pure strategies and specify how OSMs derive the optimal reward payments.

3 - Dynamic Pricing under Demand Uncertainty in the Presence of Patient Consumers

Benny Mantin, University of Waterloo, Waterloo, ON, Canada, bmantin@uwaterloo.ca, Yinhan Meng

We study the effect of consumers' patience on pricing, inventory decisions, and inventory release policies of a monopoly retailer selling a single product over two periods facing uncertain demand. We characterize situations in which the retailer may benefit from the presence of patient consumers; we find the optimal release policy for a given capacity; and we numerically demonstrate capacity decisions to maximize profit.

4 - Social Network Effects on Strategic Customer Behavior: A Laboratory Investigation

Yang Zhang, PhD Student, Pennsylvania State University, 479 Business Building, University Park, PA, 16802, United States of America, yangzhang@psu.edu, Gary Bolton

We examine a coordination game in which each player engages with players directly connected to her in a social network. We identify effects from both global and local network on coordination. Specifically, pooling and separating equilibrium are respectively observed in high and low density networks. Coordination increases with network density and individual connectivity. The observed equilibrium selection pattern can be explained by argument on coordination robustness against strategic risk.

■ MD36

36- North 225 B- CC

On-Demand Dynamic Pricing of Perishable Items in Food and Chemical Industries

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Heping Liu, Senior Science Analyst, SignalDemand Inc., 101 California Street, Suite 1950, San Francisco, CA, 94121, United States of America, hepingliu@yahoo.com

1 - Exploring Research on Methods of Forecasting Product Price of Food Industries

Heping Liu, Senior Science Analyst, SignalDemand Inc., 101 California Street, Suite 1950, San Francisco, CA, 94121, United States of America, hepingliu@yahoo.com

This research made an exploring investigating on the methods of forecasting product prices of food industries. The crucial results are summarized and presented.

2 - A Supply Chain Oligopoly Model for Pharmaceuticals under Brand Differentiation and Perishability

Anna Nagurney, Professor, Univerity of Massachusetts-Amherst, 121 Presidents Drive, Amherst, MA, 01003, United States of America, nagurney@isenberg.umass.edu, Amir H. Masoumi, Min Yu

We propose a generalized network oligopoly model for supply chains of pharmaceutical products. The model captures the Cournot competition among the manufacturers where the consumers differentiate among the products of firms, and the firms take into consideration the discarding costs of perished / wasted products. We investigate the complex challenge faced by the pharmaceutical industry, where an expensive brand loses its dominant market share as a consequence of patent rights expiration.

3 - On the Design of Group Buying Mechanisms

David Yang, The Chinese University of Hong Kong, RM615, M. W. Mong Engineering Building, The Chinese University of Hong Kong, Hong Kong, Hong Kong-PRC, yyyang@se.cuhk.edu.hk

Group buying has gained wide acceptance in recent years. In this talk we try to address the following questions. For a seller, how to choose group buying parameters, such as prices, quantity limits, and time deadlines? When the seller also engages in regular sales, the design of parameters needs to coordinate with the direct channel.

4 - A Prescription for Healthcare Sustainability Focusing on Capability and Affordability

Dennis Mathaisel, Professor, Babson College, Babson Hall, Babson Park, MA, 02457-0310, United States of America, Mathaisel@Babson.edu, Clare Comm

Sustainability is the ability to remain productive long term while minimizing waste and creating value. To be sustainable, the entity or enterprise must possess five "abilities": availability; dependability; capability; affordability; and marketability. This paper focuses on sustainability in the U.S. healthcare industry with an emphasis on its capability and affordability.

■ MD37

37- North 226 A- CC

Competitive Location

Sponsor: Location Analysis

Sponsored Session

Chair: Tammy Drezner, Professor, California State University, Department of ISDS, Fullerton, CA, 92834, United States of America, tdrezner@fullerton.edu

1 - L-SOUP: Location of Socially Undesirable Premises

Vladimir Marianov, Department of Electrical Engineering, The Catholic University of Chile, Santiago, Chile, marianov@ing.puc.cl, H. A. Eiselt

We locate capacitated landfills and transfer stations. waste from any origin can go to a landfill either directly or through a transfer station, where it is compacted and loaded on larger trucks. All garbage disposal needs of a region are fulfilled, while pollution effects over the population are constrained. Pollution from a landfill reaches a distance that depends on its capacity. We present preliminary computational tests.

2 - Issues in Competitive Location Analysis

H.A. Eiselt, University of New Brunswick, P.O. Box 4400, Fredericton, NB E3B 5A3, New Brunswick, Canada, haeiselt@unb.ca, Vladimir Marianov

The presentation considers von Stackelberg solutions of a variety of Hotelling models on a linear market. In particular, we investigate the case of delivered pricing, an asymmetric scenario, in which the duopolists have different objectives, and finally the case of two firms that maximize their respective return on investment.

3 - The p-dispersion Problem: A Unifying Theory

Rick Church, Professor, University of California-Santa Barbara, Santa Barbara, CA, 93106-4060, United States of America, church@geog.ucsb.edu

Erkut and Neuman (1991) proposed a class of four different p-dispersion models. These models covered all of the forms that had appeared in the literature prior to 1991. Since that time much of the work has been concentrated on the refinement of these four model forms. In this paper we present a unifying approach and show that all four models can be formulated as special cases of this unifying model. Computational experience is provided for this general problem and future research is proposed.

4 - A Simulation Based Location of Acoustic Sensors in a Data Fusion Capable Environment

Rajan Batta, University at Buffalo (SUNY), Dept. of Industrial & Systems Engg, Buffalo, NY, 14260, United States of America, batta@buffalo.edu, Alan Blatt, Kevin Majka, Marie Flanigan, Tejswaroop Geetla

In an advanced road system filled with intelligent sensors, we believe that a distributed network of acoustic sensors plays a major role in incident detection and accident characterization. This work looks at the placement of acoustic sensors in a data fusion capable environment to better characterize an incident.

■ MD38

38- North 226 B- CC

Modeling Service Systems

Sponsor: Service Science

Sponsored Session

Chair: Ralph Badinelli, Professor, Virginia Tech, Department of Business Information Technology, Virginia Tech, Blacksburg, VA, 24061, United States of America, ralphb@vt.edu

1 - How Exactly Does Value Creation Happen in Services? On the Way of Operationalizing SDL

Christoph Heitz, Zurich University of Applied Sciences/Swiss Institute of Service Science, Postfach, Winterthur, 8401, Switzerland, heit@zhaw.ch

Service Dominant Logic (SDL) has become an important paradigm for explaining value creation in services. While the theory seems to be valuable to analyze services, it is still in a very conceptual stage. When viewed with an operational perspective, many questions are not yet solved. In particular it is unclear how value is created over time which, in turn, is relevant for many important decision problems for both firms and clients. We present some thoughts on how SDL can be operationalized.

2 - Abductive and Inductive Reasoning in Service-system Decision Making

Ralph Badinelli, Professor, Virginia Tech, Department of Business Information Technology, Virginia Tech, Blacksburg, VA, 24061, United States of America, ralphb@vt.edu

This paper begins with a description of the Viable Systems Approach (VSA) as a framework for modeling service systems. The process of abductive/inductive reasoning guides the epistemology and decision-making of agents in a viable service system. We investigate the use of fuzzy logic and fuzzy control systems to model abductive/inductive reasoning. We define different forms of viability and establish conditions for viability based on the performance of fuzzy controls.

■ MD39

39- North 226 C- CC

Strategy in Retail Management

Contributed Session

Chair: Heleno Pioner, Assistant Professor, USP, Av. Prof. Luciano Gualberto, 908, São Paulo, SP, 05508900, Brazil, pioner@usp.br

1 - Assortment Planning for Configurable Products

Ali Taghavi, PhD Candidate, Wayne State University, 4815 Fourth Street, Industrial and System Engineerig Department, Detroit, MI, 48202, United States of America, dz3738@wayne.edu, Ratna Babu Chinnam, Evrim Dalkiran

We develop a framework to find optimal assortment for a manufacturer of configurable products dealing with stock-out substitutions. We suggest a branch and bound approach to solve the mixed-integer nonlinear program, the procedure can solve problems optimally with up to 100 configurations and is being tested by a major automotive OEM.

2 - The Strategic Implications of Seasonal Shopping Queues

Chun Qiu, Assistant Professor, McGill University, 1001 Sherbrooke Street West, Montreal, QC, J4Y3G9, Canada, chun.qiu@mcgill.ca, Wenqing Zhang

We investigate two strategic implications of queues in seasonal shopping. We show that, first, a long queue helps retailers effectively segment customers, and target those with lower time costs. Second, a long queue prompts shoppers who decide to join the queue to purchase more. Depending on the trade-off of long term vs. short term profits, a retailer can optimize the queue through operational and promotional decisions.

3 - Retail Staffing in a Competitive Environment

Emre Demirezen, PhD Candidate, Mays Business School, Texas A&M University, College Station, TX, 77843, United States of America, edemirezen@mays.tamu.edu, Subodha Kumar, Natarajan Gautam, Olga Perdikaki

Two retailers compete to capture a market where relative staffing levels affect store traffic. A customer leaves a retailer if she is not served after some time, and may visit the other retailer instead. Each retailer considers revenues from converted traffic, loss of goodwill from reneged customers, and labor cost. We derive the equilibrium staffing levels and analyze the effects of different demand and labor market settings as well as service rates on the staffing levels and profits.

4 - The Effect of Online and Traditional Advertising on Traffic of Retail Stores

Heleno Pioner, Assistant Professor, USP, Av. Prof. Luciano Gualberto, 908, Sao Paulo, SP, 05508900, Brazil, pioner@usp.br, Craig Stacey

We develop a Panel Vector Autoregressive Model to measure the effects of online and traditional media on store traffic. The model addresses the endogeneity of advertising and allows for heterogeneity in effects across markets. Using proprietary data from a large retailer we show that traditional marketing actions have impact on Google searches, store traffic and online store traffic. Moreover, traditional marketing actions appear to have longer effects on store traffic than online advertising.

5 - Strategic Optimization of Split Orders via Assortment Allocation

Andres Catalan, PhD Candidate, The Wharton School, 3730 Walnut St., 500 Jon M. Huntsman Hall, Philadelphia, PA, 19104, United States of America, andresc@wharton.upenn.edu, Marshall Fisher

Split orders occur when a customer order has to be fulfilled from more than one distribution center. They can drain an online retailer's profit, especially when pursuing a volume strategy. We study the impact of proactively allocating SKUs to distribution centers and develop and evaluate several heuristics to tackle the problem by using transaction data from one of the leading online retailers in China.

■ MD40

40- North 227 A- CC

Sustainability and Human Factors

Sponsor: Energy, Natural Res & the Envi/ Environment and Sustainability

Sponsored Session

Chair: Xu (Cissy) Yang, Postdoctoral Associate, Massachusetts Institute of Technology, 1 Amherst Street, E40-211, Cambridge, MA, 02142, United States of America, xu_yang@mit.edu

1 - Offering New and Remanufactured Products to Strategic Consumers

Ravi Subramanian, Associate Professor, Georgia Institute of Technology, Scheller College of Business, 800 West Peachtree St. NW, Atlanta, GA, 30308, United States of America, Ravi.Subramanian@mgt.gatech.edu, Narendra Singh

Using a two-period model, we consider a firm that offers new and remanufactured products to strategic consumers. The firm offers a new product 1 in the first period, and an improved new product 2 and a remanufactured version of product 1 in the second period. We analyze profit-maximizing strategies for the firm under different scenarios.

2 - Take Responsibility of Building an Ethical Supply Chain and the Influence

Yu Xia, Associate Professor, Northeastern University, 214 Hayden Hall, 360 Huntington Ave., Boston, MA, 02115, United States of America, Y.Xia@neu.edu, Xingxing Zu

Manufacturers in the global supply chain is facing tremendous challenge-on one hand, intensified competition and compelling drive for cost containment; and on the other hand, the ever increasing demand of corporate social/ethical responsibility that isn't constrained by geographic and political border. This research proposes a framework to discuss the influence of building an ethical supply chain to a manufacturer's competitive advantage in the global market.

3 - Supply Chain Environmental and Social Sustainability: Determinants and Outcomes

Vincent Hargaden, University College Dublin, School of Mech & Materials Eng, Belfield, Dublin 4, Ireland, vincent.hargaden@ucd.ie, Laoise NicCharthaigh, Donna Marshall

In this paper, we empirically investigate the determinants of environmental and social sustainability in supply chains, such as institutional effects, senior management orientation and uncertainty. Using a path model, we explore the impact that these have on supply chain practices and performance.

4 - Human Factors Study on Sustainable Transportation Technologies and Solutions

Xu (Cissy) Yang, Postdoctoral Associate, Massachusetts Institute of Technology, 1 Amherst Street, E40-211, Cambridge, MA, 02142, United States of America, xu_yang@mit.edu, Ying Wang

We mainly study selected new sustainable transportation technology and informative solution which are driven by users' participation (purchase or adoption). The proposed methodology includes a series of studies on the concept layer, application layer, market layer and effectiveness layer across both macroscopic and microscopic views.

■ MD41

41- North 227 B- CC

Forestry Session I

Sponsor: Energy, Natural Res & the Environment/Forestry

Sponsored Session

Chair: Marc McDill, Associate Professor, Pennsylvania State School of Forest Resources, 310 Forest Resources Building, University Park, PA, 16802, United States of America, mem14@psu.edu

1 - Development and Field-testing of a Forest Fire Detection Decision Support System

David Martell, University of Toronto, 33 Willcocks Street, Faculty of Forestry, Toronto, ON, M5S 1A1, Canada, david.martell@utoronto.ca, Colin McFayden, Douglas Woolford

Forest fire managers seek to find fires while they are small to increase the chance that they will be contained by the initial attack system while they remain small. We describe how subjective assessments of the probability of daily people and lightning-caused fire occurrence and statistical analyses of historical fire occurrence and weather data were combined to develop a fire detection DSS and report on the results of our 2012 field test of the system.

2 - Addressing Adjacency Concerns while Managing Flammable Forest Landscapes

Andres Weintraub, University of Chile, Santiago, Chile, aweintra@dii.uchile.cl, David Martell, Juan Jose Troncoso

We consider problems where uncertain fires can disrupt the satisfaction of adjacency constraints. One cannot harvest stands adjacent to burned stands. Our heuristic accelerates the harvesting of high risk stands. Application of the heuristic to a hypothetical forest increased the value of the harvest while satisfying the adjacency constraints.

3 - A Stochastic, Cellular Multi-objective Forest Harvesting Model with the Risk of Fire

Susete Marques, Technical University of Lisbon, School of Agriculture, Lisbon, Portugal, smarques@isa.utl.pt, Marc McDill, Jose G Borges

Understanding a disturbance like a fire on forest landscapes is a challenge because of complex interactions over a range of temporal and spatial scales. We present a stochastic, cellular multi-objective forest harvest scheduling model incorporating a mechanistic model of fire risk probability based on the state of a cell and the fire risk in neighboring cells.

4 - Finding the Efficient Frontier of a Multiple Criteria Planning Problem in Cork and Holm Oak Forest

Jordi Garcia-Gonzalo, Technical University of Lisbon, School of Agriculture, Forest Research Centre, Lisbon, Portugal, jordigarcia@isa.utl.pt, Vladimir. A Bushenkov, Marc McDill, Jose G Borges

This paper focuses on the use of a decision support system for oak ecosystems' scenario analysis including multiple objectives (e.g.cork production, carbon stocks, protection). The Feasible Goals Method/Interactive Decision Maps (FGM/IDM) technique (applying the Estimation Refinement method) was used to approximate and visualize the Pareto frontier of this multi-criteria optimization problem. Results are discussed for a large-scale application on a cork and holm oak forest in Southern Portugal.

■ MD42

42- North 227 C- CC

Public Transit Modeling

Sponsor: Transportation Science & Logistics/ Urban Transportation

Sponsored Session

Chair: Nicholas Lownes, Assistant Professor, University of Connecticut, 261 Glenbrook Rd., U-2037, Storrs, CT, 06269, United States of America, nlownes@engr.uconn.edu

1 - Estimating the Optimal Cycle Length for Feeder Transit Services

Luca Quadrifoglio, Assistant Professor, Texas A&M University, CE/TTI Bldg.-Room 301-I, 3136 TAMU, College Station, TX, 77843, United States of America, quadrifo@tamu.edu

An increase of "livability" depends on solutions to the issue of first/last mile access to transit. We aim to identify the feeder's optimal cycle to maximize LOS. A case study in El Cenizo, TX has been conducted. We are now developing a handy analytical model to obtain results, without relying on extensive simulation analyses. Experiments appear to validate our model, which would allow decision makers to identify the best feeder transit operating design of any given residential area.

2 - Schedule-based Transit Assignment using a Bush-based Approach

Mark Hickman, Associate Professor, University of Arizona, 1209 E. Second Street, Tucson, AZ, 85721-0072, United States of America, mhickman@email.arizona.edu, Hyunsoo Noh

Considering a congested transit network with passenger boarding priority, we propose a schedule-based transit assignment using bush-based approach. The proposed model is applied on a link-based transit schedule network, assuming either deterministic or stochastic passenger behavior. Stochastic behavior is represented with the entropy term for each path. For the solution, an algorithm using a diagonalization technique is utilized.

3 - Enabling Transit Solutions – A Case for Open Data

Kari Watkins, Assistant Professor, Georgia Technology Institute, 790 Atlantic Dr, Atlanta, GA, 30332-0355, United States of America, kari.watkins@ce.gatech.edu

The supply of websites, mobile apps and dynamic displays for transit traveler information has proliferated in the past few years. There are two primary enablers of this trend. This presentation first discusses the impacts of real-time information on riders. It then discusses how open data formatted according to the General Transit Feed Specification as allowed agencies to tap into a growing field of developers who create innovative applications at little cost to the agency.

■ MD43

43- North 228 A- CC

GIS-based Analytical Tools in Railroad

Sponsor: Railway Applications

Sponsored Session

Chair: Clark Cheng, Director Operations Research, Norfolk Southern Corporation, 1200 Peachtree St NE, MS 12-117, Atlanta, GA, 30309, United States of America, clark.cheng@nscorp.com

1 - Map-Based Data Visualization and Business Intelligence Solutions for Transportation

Ravindra Ahuja, President & CEO, Innovative Scheduling, GTEC, 2153 Hawthorne Road, Suite 128, Gainesville, FL, 32641, United States of America, ravi@InnovativeScheduling.com, Jason Montgomery

Visualization of shipment movements and the assets used in these movements on a map is very useful for planning and scheduling activities for transportation carriers. In this talk, we will give demonstrations of several web-based map-based data visualization and business intelligence solutions for railroads which can be easily adapted for other modes of transportation, such as trucking, airlines, and shipping lines.

2 - An Open-architecture GIS Component for Creating Multiband Traffic Density Maps

David Hunt, Oliver Wyman, One University Square, Suite 100, Princeton, NJ, 08540, United States of America, David.Hunt@oliverwyman.com

We will present the architecture behind a GIS mapping component, which was built to generate multiband traffic density maps. Utilizing a web-based, open-architecture design allows this component to be called from nearly any software system that can provide a traffic file and access to a network.

3 - Network Planning Workbench, An Analytical Tool for Monitoring and Improving Operating Performance
Viraj Karnik, Manager Operations Research, Norfolk Southern Corporation, 1200 Peachtree St NE, MS 12-117, Atlanta, GA, 30309, United States of America, viraj.karnik@nscorp.com, Ilya Lavrik

Business analytics improves decision making, it helps to optimize performance by providing new insights. In this talk we present NPW – an analytical tool developed by NS Operations Research for Transportation Planners. NPW provides historical, real time, plan vs. actual comparison information. It is highly interactive, visual and provides user with ability to drill down and perform root cause analysis and decide on corrective actions.

4 - Estimating Customer Service Times using GIS Information
Shantih Spanton, University of Florida, Gainesville, FL, 32611, United States of America, sspanton@ufl.edu, Jagadish Jampani, Joseph Geunes

Currently customer service times are reported manually by crews, leading to potential data entry errors. This project automates the estimation of service times by utilizing onboard GIS data and the customer service sequence. The close proximity of sequentially serviced customers and lack of a precise work location for large industrial customers adds complexity. The derived service times can then be used to optimize local train work load balancing.

■ MD44

44- North 228 B- CC

Supply Chain, Competition

Contributed Session

Chair: Pei-Cheng Liao, Associate Professor, National Taiwan University, No. 1, Sec. 4, Roosevelt Rd., Taipei, 10617, Taiwan - ROC, pcliao@ntu.edu.tw

1 - Cooperative Game for Multi-Product Assembly Systems with a Common Component
Cheng-Bang Chen, Department of Industrial and Manufacturing Engineering, The Pennsylvania State University, 424 Waupelani Dr., Apt. N33, State College, PA, 16801, United States of America, czc184@psu.edu, Chia-Wei Kuo

This paper studies cooperative game structures for a single-period multi-product assembly system with a common component. We analyze different forms of coalition that consist of some or all of the suppliers in the channel. We depict the optimal pricing decisions of the suppliers and propose possible coalition structures in the supply chain. Our results document that coalition structures and the manufacturing costs of the suppliers have a profound impact on the optimal wholesale price decisions.

2 - Beyond Price Mechanisms: How Much Can Service Help Manage the Competition from Gray Markets?
Foaad Iravani, PhD Candidate, University of California-Los Angeles, Anderson School of Management, 110 Westwood Plaza, Los Angeles, CA, 90066, United States of America, foad.iravani.2012@anderson.ucla.edu, Reza Ahmadi, Sriram Dasu

Many companies are challenged by the resale of their products in unauthorized gray markets. Using a game model, we analyze the price and service competition between a manufacturer who operates in two markets and a gray market. We show that the manufacturer uses service to differentiate herself from the gray market and that a little service can go a long way in helping the manufacturer manage the competition from the gray market.

3 - Optimal Order Splitting Ratios for a Two Supplier Case in a Supply Chain Configuration Problem
Gangaraju Vanteddu, Southeast Missouri State University, Cape Girardeau, MO, 63701, United States of America, gvanteddu@semo.edu

By considering order splitting issue as a supply chain configuration problem and cost and responsiveness as the primary order-winners, some very interesting managerial insights are offered with respect to the effect of cost efficient operations and/or location and cost of volume related flexibility at a stage on the optimal ratios of order splitting between two competing suppliers.

4 - Resolving the Knowledge Sharing Dilemma In Supply Chain Innovation Projects: A Game Theory Approach
Eman Nasr, Wilfrid Laurier University, 75 University Avenue West, Waterloo, L5N3C5, Canada, nasr7080@mylaurier.ca, Hamid Noori

Supply chain innovation projects pose a risk of horizontal leakage from vertical sharing of knowledge. Sharing more knowledge increases both innovation-success and knowledge-leakage chances. This presentation addresses this dilemma using a game theoretic approach modeling joint innovation projects in a supply chain linkage (i.e. buyer-supplier) where partners get access to each others knowledge that they can use in other (competing) linkages.

5 - Input Prices as Signals of Uncompetitiveness
Pei-Cheng Liao, Associate Professor, National Taiwan University, No. 1, Sec. 4, Roosevelt Rd., Taipei, 10617, Taiwan-ROC, pcliao@ntu.edu.tw

We consider a dual distribution channel in which a vertically integrated manufacturer competes with a downstream rival in a retail market and also the former sells input to the latter. We use a signaling model with a continuum of types to study the case where the manufacturer has private information on its cost. In the separating equilibrium, we show that the manufacturer signals the uncompetitiveness of its firm by charging a smaller input price than the optimal one under complete information.

■ MD45

45- North 229 A- CC

Best of WORMS

Sponsor: Women in OR/MS

Sponsored Session

Chair: Eva Regnier, Naval Postgraduate School, 699 Dyer Road, Monterey, CA, 93943, United States of America, eregnier@nps.edu

Co-Chair: Banafsheh Behzad, PhD Candidate, University of Illinois at Urbana-Champaign, 117 Transportation Building, 104 S. Mathews Ave., Urbana, IL, 61801, United States of America, behzad1@illinois.edu

1 - Quantitative Comparison of Approximate Solution Sets for Multicriteria Optimization Problems
Esma Gel, Arizona State University, Department of Industrial Engineering, Tempe, AZ, 85287, United States of America, esma.gel@asu.edu, Murat Köksalan, John Fowler, Jyrki Wallenius

We consider evaluating the quality of solution sets generated by heuristics for multiple-objective combinatorial optimization problems. We present and demonstrate the use of the integrated preference functional (IPF), which assigns a scalar value to a given discrete set of nondominated points. We present an exact calculation method for the IPF measure for an arbitrary number of criteria and demonstrate the use of IPF with two- and three-criteria numerical examples.

2 - Optimal Supply Diversification under General Supply Risks
Nan Yang, Assistant Professor of Operations and Manufacturing Management, Olin Business School, Washington University in St. Louis, Campus Box 1133, One Brookings Drive, St. Louis, MO, 63130, United States of America, yangn@wustl.edu, Awi Federgruen

We analyze a planning model for a firm or public organization which needs to cover uncertain demand for a given item by procuring supplies from multiple unreliable sources. The planning model determines which of the potential suppliers are to be retained and what size order is to be placed with each. The model considers single-period, multiple-period and infinite horizon settings.

3 - On the Relationship between Risk Preferences and Uncertainty Sets in Robust Optimization
Dessislava Pachamanova, Associate Professor, Babson College, Babson Park, MA, United States of America, dpachamanova@babson.edu

We illustrate the correspondence between uncertainty sets in robust optimization and some popular risk measures in finance and show how robust optimization can be used to generalize the concepts of these risk measures. We show that by using properly defined uncertainty sets in robust optimization models, one can construct coherent risk measures and address the issue of the computational tractability of the resulting formulations. We also review extensions and recent related work in this area.

■ MD46

46- North 229 B- CC

Structural Estimation in Operations Management

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Marcelo Olivares, Columbia Business School, 3022 Broadway, Uris Hall 417, New York, NY, 10027, United States of America, molivares@columbia.edu

Co-Chair: Gabriel Weintraub, Columbia Business School, 3022 Broadway, New York, NY, 10027, United States of America, gyw2105@columbia.edu

1 - What's on the Table: Revenue Management and the Welfare Gap in the US Airline Industry

Vivek Farias, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, United States of America, vivekf@mit.edu, Yiwei Chen

We present a status quo estimate of total welfare in the US airline industry along with what we believe is the first operationally relevant benchmark for optimal welfare. Our estimates leverage a unique data set on ticket purchases. We show that the welfare gap is surprisingly large, raising the possibility that, moving forward, a combination of innovative selling mechanisms and legislation can make a dramatic difference to airline profitability and consumer satisfaction alike.

2 - Structural Estimation of Callers' Delay Sensitivity in Call Centers

Seyedmorteza Emadi, PhD Student, Kellogg School of Management, 2001 Sheridan Road, Evanston, IL, 60208, United States of America, s-emadi@kellogg.northwestern.edu, Baris Ata, Zeynep Aksin, Che-Lin Su

We model callers' decision making process in call centers as an optimal stopping problem. After each period of waiting a caller decides whether to abandon or to continue to wait. The utility of a caller is modeled as a function of his waiting cost and reward for service. We use random coefficient model to capture the heterogeneity of the callers. Using the data of individual calls made to an Israeli call center, we estimate the cost and reward parameters of the callers.

3 - Estimating the Impact of Understaffing on Sales and Profitability in Retail Stores

Saravanan Kesavan, University of North Carolina-Chapel Hill, McColl Building, Chapel Hill, NC, 27519, United States of America, skesavan@unc.edu, Vidya Mani, Jayashankar M. Swaminathan

In this paper we use micro-level data on store traffic, sales and labor from 41 stores of a large retail chain to identify the extent of understaffing in retail stores and quantify its impact on sales and profitability using structural estimation. Aligning staffing levels with changing traffic patterns can result in a 6.15% savings in lost sales and a 5.74% improvement in profitability.

4 - Measuring the Performance of Large-Scale Combinatorial Auctions: A Structural Estimation Approach

Sang Won Kim, Columbia Business School, 3022 Broadway, New York, NY, 10027, United States of America, skim14@gsb.columbia.edu, Marcelo Olivares, Gabriel Weintraub

We develop a structural estimation method to uncover bidders' costs from bidding data in large-scale combinatorial auctions (CAs). We apply the method to the Chilean auction for school meals in which the government procures half a billion dollars worth of meal services every year. Based on the cost estimates, we measure the performance of the CA in terms of cost efficiency and payments to the bidders. We also perform counterfactuals to evaluate alternative mechanisms such as VCG.

■ MD47

47- North 230- CC

Vehicle Trajectory Estimation and Applications

Sponsor: Transportation Science & Logistics/ Intelligent Transportation Systems (ITS)

Sponsored Session

Chair: Zhanbo Sun, Rensselaer Polytechnic Institute, 2162, 14th Street, 2nd Floor, Troy, NY, 12180, United States of America, sunz2@rpi.edu

1 - Computational Methods for Investigating Intradriver Heterogeneity using Vehicle Trajectory Data

Jeffrey Taylor, University of Utah, 5966 West 3500 South, Salt Lake City, UT, United States of America, jeff.d.taylor@utah.edu, Xuesong Zhou

We extend Newell's car-following model to incorporate time-dependent parameters, and use the Dynamic Time warping (DTW) algorithm for model calibration. By synthesizing NGSIM driver trajectory data, we will examine driver heterogeneity in car-following behavior, as well as the driver's heterogeneous situation-dependent behavior within a trip.

2 - Enhancing Vehicle Trajectory Estimation using Airborne Image Data

Zhuoyang Zhou, Arizona State University, 699 S Mill Ave., BYENG MailRoom 523, Tempe, AZ, 85281, United States of America, zhuoyang.zhou@asu.edu, Pitu Mirchandani

The problem that we are addressing is follows: Given macro data (speeds, densities and volumes) on a freeway segment, given some precise data from airborne data, can we reconstruct trajectories of vehicles on the segment. We use the cell transmission model to first develop approximate trajectories which are refined using the image data and a least square estimation model.

3 - Vehicle Trajectory Estimation using Mobile Sensor Data

Zhanbo Sun, Rensselaer Polytechnic Institute, 2162, 14th Street, 2nd Floor, Troy, NY, 12180, United States of America, sunz2@rpi.edu, Jeff Ban

We aim to estimate trajectories of unsampled vehicles from those sample vehicle trajectories around a signalized intersection. The estimated trajectories together with the sample trajectories can provide a more complete picture of the intersection traffic flow. The proposed method is based on the variational formulation for traffic flow.

■ MD48

48- North 231 A- CC

VRP and Applications II

Sponsor: Transportation Science & Logistics/ Freight Transportation & Logistics

Sponsored Session

Chair: Joseph Y.J. Chow. Assistant Professor, Ryerson University, 350 Victoria Street, Toronto, ON, M5B 2K3, Canada, joseph.chow@ryerson.ca

1 - Activity-based Travel Scenario Analysis with Routing Problem Reoptimization

Joseph Y.J. Chow, Assistant Professor, Ryerson University, 350 Victoria Street, Toronto, ON, M5B 2K3, Canada, joseph.chow@ryerson.ca

A shared issue with the HAPP and generalized VRP is the computational cost of scenario analysis. Two reoptimization algorithms (solving with prior optimum) are proposed and tested in a computational experiment with 100 zones and 500 synthesized households. Two scenarios are evaluated: a major work destination closes down, and a freeway is added. Results demonstrate effectiveness of reoptimization and ability to re-allocate activities and schedules with respect to spatio-temporal changes.

2 - Local Freight Truck Delivery Planning under Congestion and Emission Considerations

Taesung Hwang, University of Illinois at Urbana-Champaign, Newmark Civil Engineering Lab., MC-250, 205 N. Mathews Ave., Urbana, IL, 61801, United States of America, hwang7@illinois.edu, Yanfeng Ouyang

It is assumed that a congestion state of each highway segment follows a known probability distribution while local road has identical congestion state. This study deals with the problem of truck driver who decides whether to use highway or local road at each decision point to minimize expected total cost including carbon emission. Dynamic programming approach is adopted.

3 - Hybrid Parallel Metaheuristics for Traveling Salesman Problems with Precedence Constraints
Amelia Regan, University of California, Irvine, CA, United States of America, aregan@uci.edu, Dmitri Arkhipov, Ross Wagoner

Our work studies the effectiveness of implementations of several hybrid metaheuristics implemented on GPUs.

4 - A General-purpose Solver for Multi-attribute Vehicle Routing Problems
Thibaut Vidal, Universitè de Montrèal, Montrèal, QC, Canada, Thibaut.Vidal@cirrelt.ca, Teodor Crainic, Michel Gendreau, Christian Prins

A unified hybrid genetic search is proposed to address multi-attribute vehicle routing problems. This meta-heuristic relies on problem specific route evaluation and assignment components, along with generic implementations of Split procedures, local-search improvement methods, and genetic operators. In addition, a bi-criteria evaluation of individuals, driven by the contribution to the diversity of the population and the solution quality, enables to enhance exploration capabilities and reduce the risks of premature convergence. High-quality results are reported for a wide range of vehicle routing variants.

■ MD49

49- North 231 B- CC

Joint Session TSL/SPPSN: Emergency Preparedness, Disaster Cleanup and Relief

Sponsor: Transportation Science & Logistics & Public Programs, Service and Needs

Sponsored Session

Chair: Irina Dolinskaya, Assistant Professor, Northwestern University, Technological Institute M235, 2145 Sheridan Road, Evanston, IL, 60208, United States of America, dolira@northwestern.edu

1 - Post-disaster Debris Clearance Problem with Information Updates
Melih Çelik, Georgia Institue of Technology, 765 Ferst Dr NW, Atlanta, GA, 30332, United States of America, melihcelik@gatech.edu, Pinar Keskinocak, Ozlem Ergun

The post-disaster debris clearance problem aims to find a sequence for clearance of debris-covered roads under limited capacity so that demand for relief is satisfied in a timely manner. We consider the problem under limited information about debris amounts and assume information is updated as clearance proceeds. We propose heuristic procedures taking into account the trade-off between learning and optimizing, and derive structural results for different learning schemes on structured graphs.

2 - A Two-stage Stochastic Program for Coordination of Disaster Relief Organizations
Luis de la Torre, PhD Candidate, Northwestern University, Technological Institute C236, 2145 Sheridan Road, Evanston, IL, 60208-3119, United States of America, ledelatorre@u.northwestern.edu, Karen Smilowitz, Irina Dolinskaya

Studies of humanitarian operations have found that coordination between relief organizations is challenging to execute but critical for effective assistance. We present a stochastic program for distribution of goods with uncertainty in the accessibility of demand locations. Collaborations are formed in the first stage and multi-day operational decisions are made in the second stage. We discuss insights on the benefits to effective distribution under various limited types of collaboration.

3 - Conditional Value-at-risk for Hazardous Materials Transportation on Time-dependent Networks
Changhyun Kwon, Assistant Professor, University at Buffalo, SUNY, 400 Bell Hall, Buffalo, NY, 14260, United States of America, chkwon@buffalo.edu, Iakovos Toumazis

We propose new methods for mitigating risk in hazardous materials (hazmat) transportation, based on conditional value-at-risk (CVaR) measure, on time-dependent vehicular networks. While the CVaR risk measure has been popularly used in financial portfolio optimization problems, its application in hazmat transportation has been very recently proposed. The CVaR models are shown to be flexible and general routing models for hazmat transportation, and be solved efficiently.

4 - Network Redesign with Contra-flow in Hurricane Evacuation
Binh Luong, Purdue University, 550 Stadium Mall Drive, G175F, West Lafayette, IN, 47906, United States of America, lthbinhhnvn@gmail.com, Satish Ukkusuri

Given the increasing frequency and severity of hurricanes, it is important to develop efficient strategies for evacuating evacuees. In this work, we present a heuristic approach to redesign the network with limited budget. Both temporal and spatial variations of the contraflow design will be considered. Different scenarios will be tested and compared using an agent based simulation tool.

5 - A Change-point Approach to Estimate Post-disaster Built Environment Recovery
Henry Lester, PhD Candidate, The University of Alabama, Box 870205, Tuscaloosa, AL, United States of America, leste019@crimson.ua.edu

Construction increases in disaster-prone areas dictate disaster planning to safeguard at risk populations during the recovery phase of the disaster life cycle and this planning necessitates a temporal recovery metric. This paper presents a change-point approach to estimating post-disaster built environment recovery. The approach examines spatiotemporal residential construction variability to determine built environment rapidity providing a temporal metric for operative disaster planning.

TSL Poster Session

North Building Foyer

Cluster: TSL Poster

Invited Session

Chair: Elise Miller-Hooks, University of Maryland, College Park, MD, United States of America, elisemh@umd.edu

1 - A Milk Run Model in the Inflow Logistics of Iranian Automobile Manufacturer (Case study)
Ramez Kian, PhD Student, Bilkent University, Bilkent, Central Campus, Cankaya, Ankara, Turkey, ramezk@bilkent.edu.tr, AlirezaHashemi

Automobile manufacturing includes some main production plants and several smaller suppliers where causes to have a sophisticated form of supplying operations in this industry. Moreover, transportation part of the supply chain encompasses massive volume of logistical operations which in turn include large portion of operational costs. Here, a successful experience of implementing Milk-Run concept in the inflow logistics of IKCO, its cost benefits and difficulties will be discussed.

2 - Freight Network Design with Pricing and Economies of Scale
Panagiotis Ypsilantis, PhD. Candidate, RSM, Erasmus University, BurgemeesterOudlaan 50 (Office T9-15), Rotterdam, 3078HB, Netherlands, pypsilantis@rsm.nl, Rob Zuidwijk

The freight service network design in a strategic level is formulated as a bi-level mathematical program; the pricing, design and economies of scale are considered in a competitive environment. The net revenues of a TOC that operates barge and train connections to inland terminals according to the extended gate concept are maximized while the total costs faced by the users of the network are minimized. A solution approach for this problem and some numerical results are presented and discussed.

3 - Integrating Supply Chain Network Model for Auto Industry in Midwest using GIS
Yasaman Kazemi, North Dakota State University, PO box 6050, NDSU UGPTI Dept. 2880, Fargo, ND, 58108, United States of America, yasaman.kazemi@ndsu.edu, Eunsu Lee

This study develops a model for domestic automobile supply chain in the Midwest area based on minimum cost and integrates the cost into highway transportation network. The proposed GIS spatial interaction predicts the optimized flow from origins to destinations by choosing an optimal sequence of routes in order to minimize the total supply chain network cost.

4 - Modelling and Forecasting Maryland Freight Demand
Xiaoyu Zhu, Faculty Research Associate, National Center for Smart Growth, 1226C Preinkert Field House, College Park, MD, 20742, United States of America, xyzhu@umd.edu, Chao Liu

Considering the issues of increase in freight demand because of Panama Canal expansion, opening of Northwest Passage, construction of freight alone corridor and addition of new freight rail tracks, this paper discusses how freight mode and route choice is made to analyse travel behaviour of shippers for a varying range of commodities, dollar value and weight of shipment. Freight Analysis Framework (FAF) data is used to analyze existing shipment.

5 - Offline Share-a-Ride Problem: Taxi Sharing between Passenger and Package

Baoxiang Li, TechnischeUniversiteit Eindhoven, Pav. E.09a, OPAC, Department of IE&IS, Eindhoven, Netherlands, B.Li@tue.nl, Tom Van Woensel, HajoReijers

We propose a multi-commodity sharing system referred to Share-a-Ride problem, mainly design vehicle routes and schedules for a multi-commodity requests. The application of multi-commodity sharing system can raise benefit, reduce cost, and alleviate urban congestion and environment pollution. In this paper, we build an offline model using taxis for both passenger and freight service. The objective function is to minimize a combination of distance saving and convenience fee paid to passengers.

6 - Resource Allocation Model for the Dynamic Control of Material Convergence after Catastrophic Events

Miguel Jaller, Rensselaer Polytechnic Institute, 110 8th St JEC 4037, Troy, NY, 12180, United States of America, jallem@rpi.edu, José Holguín-Veras

We develop a mathematical formulation for the control of material convergence (i.e., flow of supplies and equipment) as to maximize the net benefits extracted from the different flows reaching the impacted area by optimally allocating resources for the tasks of control, handling and processing. This is a multistage access control system that considers the dynamic effects of supply and demand to determine the priority of different items, in order to grant or deny them access to the system.

7 - Using Dynamic Congestion Tolling and V2I Communication for Decentralized Routing

Hao Zhou, University of Michigan, 1205 Beal Ave., Ann Arbor, MI, 48109, United States of America, haozhou@umich.edu

In this research, we consider a traffic network with dynamic congestion toll on each link, and vehicles capable of communicating with central controller. Each vehicle receives real-time toll prices and traffic information of all links, and tries to optimize its route choice based on its own preference. We developed a model to dynamically update toll prices on each link to minimize overall delay of vehicles.

■ MD50

50- North 231 C- CC

Air Force Inventory Delivery

Sponsor: Military Applications

Sponsored Session

Chair: Alan Johnson, Air Force Institute of Technology, AFIT/ENS, 2950 Hobson Way, Bldg 641, Wright-Patterson AFB, OH, 45433, United States of America, alan.johnson@afit.edu

1 - Estimating Cargo Airdrop Collateral Damage Risk

Jeffery Cochran, Professor of Operations Research, Air Force Institute of Technology, 2950 Hobson Way, Wright-Patterson AFB, OH, 45433, United States of America, jeffery.cochran@afit.edu, Vincent Cammarano

From real world airdrop scoring data we determine critical factors that affect supply airdrop error and find that bivariate normal distributions characterize cargo airdrop error patterns. Collateral damage risk is estimated by combining numerical integrations of fit bivariate normal distributions across rectangular representations of drop field objects impacted by bundled airdrops as they fall along a linear path.

2 - The Use of Framing in Inventory Decisions

Ken Schultz, Air Force Institute of Technology, Wright-Patterson AFB, OH, 45433, United States of America, kenneth.schultz@afit.edu

People make newsvendor decisions in consistent, sub-optimal ways. Part of this is a reaction to increasing risk with order quantity. We investigate how people respond to framing in the newsvendor problem.

3 - Improving the Robustness of Demand Over Lead-time Calculations

Darryl Ahner, Air Force Institute of Technology, 2905 Hobson Way, WPAFB, OH, 45433, United States of America, darryl.ahner@afit.edu

Demand over lead time calculation using the assumption of normality is well know. Unfortunately, the normality assumption is often violated. This talk discusses a simple yet effective variation of determining point estimates of the mean and variance that increase the robustness of the calculation.

4 - Precision Airdrop: C-5M vs C-17

Alan Johnson, Air Force Institute of Technology, AFIT/ENS, 2950 Hobson Way, Bldg 641, Wright-Patterson AFB, OH, 45433, United States of America, alan.johnson@afit.edu

We compare the costs of using the Joint Precision Airdrop System with the C-5M aircraft versus the C-17 platform currently used. Our research question is that the C-5M's greater range and payload capacity renders it a more cost-effective overall delivery platform. To test this hypothesis, we created a spreadsheet-based model that combines planning factors and optimization to estimate the cost associated with a wide range of payloads and mission distances.

■ MD51

51- North 232 A- CC

DIME/PMESII Modeling III

Sponsor: Military Applications

Sponsored Session

Chair: Dean Hartley, Principal, Hartley Consulting, 106 Windsong Ln, Oak Ridge, TN, 37830, United States of America, DSHartley3@comcast.net

1 - Value Focused Metrics

David Davis, Co-Director, Peace Operations Policy Program, George Mason University, 3351 Fairfax Dr, Arlington, VA, 22201, United States of America, ddavis@gmu.edu, Daniel Maxwell

Value Focused Metrics (VFM) was developed based upon Ralph Keeney's book, Value Focused Thinking. VFM uses Fundamental Objectives Hierarchies supported by Means Ends Objective Networks as in Keeney's work. Networks are represented as Bayesian and the metrics are identified for outcomes, outputs and inputs thus giving a complete system. The result is an Influence Diagram that can be used to integrate metrics across the levels of the process or as an analytic tool for what if analysis.

2 - Reconciling Multi-strategy Game Theoretic Simulations with Cognitive Dissonance

Jordan Willcox, HSCB Modeling Analyst, System of Systems Analytics, Inc., 11250 Waples Mill Road, Ste 300, Fairfax, VA, 22030, United States of America, jwillcox@sosacorp.com

Game theory is sometimes used to model strategic equilibria for multiple agents, but often the behavior of the agents is dissimilar to human behavior. One example is the contrast between goal maximization and interest in relative agent status. Another is the human bias towards consistent strategies, as captured by the theory of cognitive dissonance. The author considers modifications that address these issues, and discusses integrating a cognitive dissonance model into a game-theoretic model.

3 - Understanding the Instruments of National Power through a System of Differential Equations

Cade Saie, Air Force Institute of Technology, 2950 Hobson Way, WPAFB, OH, 45433, United States of America, Cade.Saie@afit.edu, Darryl Ahner

Motivated by the modeling of attrition warfare using Lanchester equations, we develop of a functional form of a system of differential equations; describe the methodology which populates and solves this system; and demonstrate the results obtained through an application of the process using open source data from Iraq. This system captures the changes in measures of merit used to evaluate the effects of leveraging the instruments of national power in nation-building operations.

4 - Epidemiological Modeling in Sparse Data Environments: An Approach to Data Collection and Analysis

Joel Alejandre, Naval Research Laboratory, 4555 Overlook Ave., SW, Washington, DC, 20375, United States of America, joel.alejandre@nrl.navy.mil, Roger Hillson

In austere environments with limited network-coverage and poor medical record systems, a platform is needed for collecting and geographically contextualizing health data to assist pathogenic outbreak detection. A Sierra Leone use-case illustrates data collection (demographic, health, and physical features); utilization of population estimation products for data-normalization; and health reporting over mobile networks. This analysis will facilitate the judicious deployment of medical resources.

■ MD52

52- North 232 B- CC

Reserve Requirements and Zone Partitioning in Electric Power Systems

Sponsor: Energy, Natural Res & the Environment/Energy

Sponsored Session

Chair: Kory Hedman, Assistant Professor, Arizona State University, P.O. Box 875706, GWC 206 School of ECEE, Tempe, AZ, 85287-5706, United States of America, kory.hedman@asu.edu

1 - Power Network Partitioning via Electrical Distance

Seth Blumsack, Pennsylvania State University, 124 Hosler Building, University Park, PA, 16802, United States of America, sethb@psu.edu

We outline a method for partitioning electrical networks based on a measure of electrical coheseiveness as our primary measure of partition quality. The method can be implemented easily on large systems using a novel genetic algorithm, and we illustrate our partitioning method on a small test network and a representation of the Polish transmission grid. We also present a power-flow based example application of the usefulness of our proposed method for defining analysis zones in a power system.

2 - A Mathematical Program to Determine Reserve Zone Partitions

Joshua Lyon, PhD Student, Arizona State University, 31000 N Silver Bullet Trl, San Tan Valley, AZ, 85143, United States of America, joshua.lyon@asu.edu, Kory Hedman, Muhong Zhang

Reserve requirements are used to ensure reliability in electric power systems since endogenously modeling all N-1 contingencies is too computationally burdensome. Reserve zones ensure that reserves are dispersed across the network in order to ensure deliverability. This research develops a mathematical program to determine zone partitions for day-ahead unit commitment models while considering the impact on market economics and reliability. Results based on IEEE test cases will be presented.

3 - Determining Reserve Zone Requirements from the Energy and Ancillary Service Co-optimization

Yonghong Chen, Consulting Engineer, MISO, 720 City Center Drive, Carmel, IN, 46077, United States of America, ychen@misoenergy.org, Paul Gribik

A new approach was proposed and implemented at MISO to address the reserve deliverability issue. MISO enhanced the co-optimization process so that it can evaluate the impact that deploying cleared reserves on a zonal basis would have on specified transmission constraints. Reserve zone requirements are solved to meet both market-wide reserve requirements and deliverability requirements. MISO is looking at a more comprehensive solution in which procurement of reserves is modeled on a nodal basis.

4 - Contingency-based Zonal Reserve Modeling and Pricing in a Co-optimized Energy and Reserve Market

Tongxin Zheng, Technical Manager, ISO New England, 1 Sullivan Road, Holyoke, MA, 01106, United States of America, tzheng@iso-ne.com, Eugene Litvinov

This paper presents the market clearing framework for the co-optimized real-time energy-reserve market implemented in the ISO New England. In this co-optimized market clearing model, reserve products are procured on a zonal basis based on system and local contingency protection criteria. The zonal reserve model is derived from the worst contingency event in the reserve zone and ensures reserve deliverability among reserve zones.

■ MD53

53- North 232 C- CC

Integration of Uncertainty Modeling and Stochastic Optimization for Energy Applications

Sponsor: Energy, Natural Res & the Environment/Energy

Sponsored Session

Chair: Victor Zavala, Argonne National Laboratory, Mathematics & Computer Science Division, Chicago, IL, 60439, United States of America, vzavala@mcs.anl.gov

1 - Higher-order Confidence Intervals for Stochastic Programming using Bootstrapping

Cosmin Petra, Argonne National Laboratory, 9700 S. Cass Avenue, Argonne, Il, 60439, United States of America, petra@mcs.anl.gov, Mihai Anitescu

Traditional methods for the statistical inference of stochastic optimization problems require a large number of samples to obtain accurate uncertainty estimates on the solution. For complex energy systems incorporating weather-related uncertainty, an extensive weather sampling becomes prohibitive due to the associated high cost. In this talk, we present a novel high-order bootstrapping method that provides reliable confidence regions in the presence of a small number of samples.

2 - Gaussian Process Modeling for Measurement and Verification of Building Energy Savings

Yeonsook Heo, Argonne National Laboratory, 9700 S. Cass Avenue, Argonne, IL, United States of America, yheo@anl.gov, Diane Graziano, Victor Zavala

Measurement and verification (M&V) can add significant cost to building energy efficiency projects and often produce energy savings evaluations that lack credibility. We introduce an improved M&V method applying Gaussian Process (GP) modeling that can, using less measured data, capture nonlinear energy behavior and quantify prediction uncertainty. A case study demonstrates the strengths of GP models for M&V and further explores their potential for analyzing different time resolution data.

3 - Multi-scale Stochastic Optimization for Integrating Wind Simulation

Suvrajeet Sen, Professor, University of Southern California, Epstein Department of ISE, Los Angeles, CA, United States of America, sen.22@osu.edu, Victor Zavala, Harsha Gangammanavar

We present a stochastic optimization model in which decisions for wind generation are implemented at a far greater pace than those for thermal units. This multi-scale model adopts a combination of approximate dynamic programming and stochastic decomposition (ADP/SD) to accommodate the different time-scales. Our computational results are based on injecting wind simulations into the ADP/SD algorithm.

4 - Calibration of Building Energy Model under Uncertainty

Huafen Hu, Assistant Professor, Portland State University, 1930 SW 4th Ave., Room 400, Portland, OR, 97201, United States of America, hu@cecs.pdx.edu

Calibrated building model is playing a more significant role in building retrofit and control but yet remains to be an art rather than a science due to the inherent nonlinearity and uncertainty in building behavior. This study presents a simple but effective Monte Carlo approach that delivers calibrated building models by a walk-through audit. A university building is used to demonstrate the strength and robustness of the approach to unavoidable noise/disturbance in building model calibration.

■ MD54

54- Regency Ballroom A- Hyatt

Panel Discussion: Town Hall Meeting with the Editorial Board of Operations Research

Cluster: INFORMS Journals Cluster

Invited Session

Chair: Stefanos Zenios, Professor, Stanford Graduate School of Business, 655 Knight Way, Stanford, United States of America, stefzen@GSB.Stanford.Edu

1 - Town Hall Meeting with the Editorial Board of Operations Research

Moderator: Stefanos Zenios, Professor, Stanford Graduate School of Business, 655 Knight Way, Stanford, United States of America, stefzen@GSB.Stanford.Edu, Panelists: Beril Toktay, Edieal Pinker

Members of the editorial board of Operations Research will discuss both the areas that are historically covered by the journal, as well as initiatives to cover new "growth" areas. The audience will have the opportunity to learn about Special Issues and ask questions about the journal, its strategy, and the process of reviewing and revising papers.

■ MD55

55- Regency Ballroom B - Hyatt

Joint Session OR in Emerging Econ/Enre-Energy: OR Applications in the Energy Sector of Emerging Markets

Cluster: Operations Research in Emerging Economies & Energy, Natural Res & the Environment/Energy

Invited Session

Chair: Thiago Serra, Operations Research Analyst, PETROBRAS, Avenida Paulista, 901, São Paulo, SP, 01311-100, Brazil, thiago.serra@petrobras.com.br

1 - On Approaching Upstream and Downstream Logistic Problems at Petrobras

Thiago Serra, Operations Research Analyst, PETROBRAS, Avenida Paulista, 901, São Paulo, SP, 01311-100, Brazil, thiago.serra@petrobras.com.br, Daniel F. Ferber, Daniel G. E. Trovo

We present two operations research applications in logistic problems faced by Petrobras. The first concerns the scheduling of rigs and vessels to develop offshore oil wells. It involves the assignment and scheduling of resources to developments, resource maintenance and loading of inventory. The second is related to the transference planning of oil refined commodities on a pipeline network. It comprises tactical aspects such as capacity for in-transit inventory, transit time and flow reversal.

2 - Optimizing Crude Oil Supply Chain Decisions with Policy Impact: A Case Study of Ghana

Iddrisu Awudu, North Dakota State University, 26 University Village, Fargo, ND, 58102, United States of America, Iddrisu.Awudu@my.ndsu.edu, Jun Zhang

This study will integrate supply chain decisions optimization and governmental policies. Challenges such economic and political issues within a newly discovered oil well under production are crucial to all parties involved. This stud analyzes a crude oil production company using chance constraint programming to measure the level of satisfaction the firm places on its profit margin, while fulfilling governmental policies. The results conclude a firm can combine both and have a solid outlook.

3 - An Economic Analysis of Brazil Fuel Policies, Consumption and Choice of Fuel, and Emission Impacts

Hector Nunez, Universtiy of Illinois, nunez5@illinois.edu, Hayri Onal

We use an economic equilibrium model to analyze the impacts of recent changes in Brazil fuel policies and strong demand in world sugar markets. We simulate consumers' driving demand and fuel choices in response to the reduced blend rate and taxes, and determine land use changes, GHG emissions, and welfare implications. Our results show that despite the reduction in driving demand, GHG emission from Brazil would increase significantly due to the consumption of a more carbon intensive fuel blend.

4 - Low-Carbon Development of the Nigerian Power Sector: The Role of Off-Grid Generation in Leapfrogging

Surya Swamy, Consulting Decision Analyst, Lumina Decision Systems, 26010 Highland Way, Los Gatos, Ca, 94117, United States of America, surya@lumina.com, Max Henrion

Nigeria's Power Sector has grappled with electricity shortages and unreliability of supply over the last two decades, which have prevented the country from realizing its full economic growth potential. In this World Bank funded study, we explore how Nigeria could leapfrog traditional development pathways by embracing an alternative model for low-carbon development in which distributed generation and renewables play a major role.

■ MD56

56- Curtis A- Hyatt

Joint Session TMS/NPD: TMS Distinguished Speaker

Sponsor: Technology Management & New Product Development

Sponsored Session

Chair: Juliana Hsuan, Professor, Copenhagen Business School, Department of Operations Management, Solbjerg Plads 3, Frederiksberg, DK-2000, Denmark, jh.om@cbs.dk

1 - An Ecology of Innovation

James Utterback, Massachusetts Institute of Technology, Cambridge, MA, United States of America, jmu@mit.edu

Amid an increasingly diverse and chaotic scene of changing markets and widening competition, I will argue for thinking of innovation and firm formation as a process of experimentation in the market. Rather than seeking to reduce uncertainty and to optimize, we should seek to increase possibilities for experimentation and for broader search and synthesis.

■ MD57

57- Curtis B- Hyatt

Advances in Stochastic Optimal Control and Learning I

Sponsor: Applied Probability

Sponsored Session

Chair: Ciamac Moallemi, Associate Professor, Columbia Business School, 3022 Broadway, Uris 416, New York, NY, 10025, United States of America, ciamac@gsb.columbia.edu

Co-Chair: Vivek Farias, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, United States of America, vivekf@mit.edu

1 - New Sampling Schemes for Simulation-based Approximate Dynamic Programming

Dimitri Bertsekas, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, United States of America, dimitrib@mit.edu, Huizhen Yu

Existing multistep methods in temporal difference (TD) learning often use a single long trajectory. We propose much more flexible sampling schemes. They are connected with weighted Bellman equations, which broadly generalize the TD(lambda) approximation framework. We provide a convergence analysis, and we review a variety of useful schemes in the context of policy evaluation and policy iteration with exploration enhancements.

2 - Q-Learning Algorithms and their Convergence in Total Cost Problems of Stochastic Shortest Path Type

Huizhen Yu, Massachusetts Institute of Technology, Laboratory for Information and Decision, 77 Massachusetts Avenue, 32-D558, Cambridge, MA, United States of America, janey_yu@mit.edu, Dimitri Bertsekas

Q-learning is an asynchronous stochastic iterative algorithm for solving Markov decision processes (MDP) or two-player zero-sum stochastic games. Its convergence in the total cost case was known earlier under restrictive conditions that ensure boundedness of iterates. We show that such conditions can be removed for MDP and stochastic games of the stochastic shortest path (SSP) type. This convergence result applies also to a new policy iteration-like Q-learning algorithm for SSP problems.

3 - A Brownian Model of Dynamic Pricing with Demand Model Uncertainty

N. Bora Keskin, University of Chicago Booth School of Business, 5807 South Woodlawn Avenue, Chicago, IL, 60637, United States of America, bora.keskin@chicagobooth.edu

We propose a Brownian formulation to address the tradeoff between learning and earning in a dynamic pricing problem that involves demand model uncertainty. We characterize the optimal solution of the Brownian formulation to provide guidelines to implement price experimentation in practice.

■ MD58

58- Phoenix East- Hyatt

Queueing and Pricing

Sponsor: Applied Probability

Sponsored Session

Chair: Mor Harchol-Balter, Associate Professor, Carnegie Mellon University, 5000, Forbes Avenue, Computer Science Department, Pittsburgh, PA, 15213, United States of America, harchol@cs.cmu.edu

Co-Chair: Mustafa Akan, Assistant Professor of Operations Management Tepper School of Business Carnegie Mellon University, Pittsburgh, PA, 152123, United States of America, akan@cmu.edu

1 - The Optimal Admission Threshold in Observable Queues with State Dependent Pricing

Sherwin Doroudi, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Ave., Pittsburgh, PA, 15213, United States of America, sdoroudi@andrew.cmu.edu, Christian Borgs, Jennifer Chayes, Mor Harchol-Balter, Kuang Xu

We consider a model where delay sensitive customers seek service from a server with an observable queue. It is known that in this setting revenue is maximized by a state dependent pricing policy with a threshold, whereby customers are barred from entry once the queue reaches a certain length. We are the first to find the optimal threshold in closed form. Our closed form uses the Lambert W function and leads to a very simple formula for optimal revenue.

2 - Provisioning of Large Scale Systems: The Role of Network Effects and Anarchy in the User Base

Jayakrishnan Nair, Caltech, 1200 E. California Blvd., Pasadena, CA, 91125, United States of America, ujk@caltech.edu, Adam Wierman, Bert Zwart

We consider the problem of capacity provisioning for an advertising-supported online service by analyzing the strategic interaction between the service provider and the user base. We show that stronger positive network effects and non-cooperation in the user base drive the service into a more congested state, leading to increased profit for the service provider. However, the impact of non-cooperation, or `anarchy' in the user base strongly dominates the impact of network effects.

3 - Fixed and Market Pricing for Cloud Services

Ian Kash, Microsoft Research, 7 JJ Thomson Ave., Cambridge, CB3 0FB, United Kingdom, iankash@microsoft.com, Vineet Abhishek, Peter Key

This paper considers two simple pricing schemes for selling cloud instances and studies the trade-off between them. We characterize the equilibrium for the hybrid system where arriving jobs can choose between fixed or the market based pricing. We provide theoretical and simulation based evidence suggesting that fixed price generates a higher expected revenue than the hybrid system.

■ MD59

59- Phoenix West- Hyatt

Stochastic Impulse/Singular Control Models and Methods

Sponsor: Applied Probability

Sponsored Session

Chair: Kumar Muthuraman, University of Texas at Austin, 2110 Speedway Stop B6500, Austin, TX, United States of America, kumar@austin.utexas.edu

1 - Inventory Control with a Cash Register: Sales Recorded but Not Demand or Shrinkage

Metin Cakanyildirim, Associate Professor of Operations Management, University of Texas at Dallas, P. O. Box 830688, Richardson, TX, 75080-0688, United States of America, metin@utdallas.edu, Meng Li, Suresh Sethi, Alain Bensoussan

Inventory is subject to unobserved shrinkages happening both before and after the demand realization and it is inaccurate. Our objective is to minimize the expected discounted cost related to inventory holdings and shortages over an infinite horizon. We obtain a lower bound on the cost analytically and develop an iterative algorithm, and compare its solution to a myopic solution.

2 - Short Rate Control and Implied Yield Curves

Haolin Feng, Assistant Professor, Sun Yat-sen University, 135 Xing Gang Xi Road, Lingnan College, Guangzhou, 510275, China, FengHaoL@mail.sysu.edu.cn, Kumar Muthuraman, Daniel Mitchell

We consider a problem where the central bank has a target short rate level. Running costs are incurred as the short rate deviates from the target level. Each intervention of the central bank incurs some costs which have a fixed and a variable component. The objective of the central bank is to minimize the total expected costs. We solve the resulting impulse control problem for various short rate dynamics and study how the yield curves of different models are impacted under impulse control.

3 - Impulse Controls on Jump Diffusions

Xin Guo, University of California-Berkeley, Berkeley, CA, United States of America, xinguo@ieor.berkeley.edu

We discuss the general DPP for impulse control problems of jump diffusions, as well as the regularities of the value functions for the control problems.

■ MD60

60- Remington- Hyatt

Airline Pricing and Customer Choice

Sponsor: Aviation Applications

Sponsored Session

Chair: Laurie Garrow, Associate Professor, Georgia Institute of Technology, School of Civil Engineering, 790 Atlantic Drive, Atlanta, GA, 30332, United States of America, laurie.garrow@ce.gatech.edu

1 - The Effect of Advanced Purchase Deadlines on Airline Customer Behavior

Susan Hotle, Graduate Research Assistant, Georgia Institute of Technology, 790 Atlantic Drive, Atlanta, GA, 30332, United States of America, slhotle2@yahoo.com, Laurie Garrow, Matt Higgins

It has become critically important for airlines to understand how shopping on the internet allows consumers to search for information and what factors influence their purchase decisions. Most literature assumes that customers can search for an infinite amount of time and fails to account for the presence of advanced purchased deadlines which signal price increases. This research looks at the how advanced purchase deadlines affect the online search and purchase behavior of airline customers.

2 - Controlling for Price Endogeneity in Airline Passenger Itinerary Choice Models

Stacey Mumbower, Graduate Research Assistant, Georgia Institute of Technology, Atlanta, GA, United States of America, stacey.mumbower@gatech.edu, Laurie Garrow

Although price endogeneity can lead to unrealistic and misleading model coefficient estimates, few studies have explored endogenous airline prices. A unique set of data collected from airline websites is used to build airline passenger itinerary choice models. An instrumented variable approach is used to control for factors that influence price (such as prices of other competitors and presence of a low cost carrier), allowing models to estimate the unbiased effect of price on consumer decisions.

3 - An Optimum Pricing Policy for a Multiclass Problem in the Airline Industry

Daniel Felipe Otero Leon, Lecturer, Universidad de los Andes, Cra 1 Este #19A -40, Bogota, 00, 1111, Colombia, df.otero128@uniandes.edu.co, Raha Akhavan-Tabatabaei

In the airline industry, deciding the price of a ticket directly affects the future demand to buy that ticket. Depending on the willingness to pay of the customers, seats could remain empty or sold at a lower price at the departure date. We propose a stochastic dynamic pricing model to optimize the revenue of a given flight, applying phase type distributions and renewal processes to estimate the inter-arrival process and the probability that a customer buys a ticket.

■ MD61

61- Russell- Hyatt

Analyzing Security Against Adaptive Adversaries

Cluster: Applications in Emergency Management and Terrorism Security

Invited Session

Chair: Henry Willis, RAND Corporation, 4570 Fifth Avenue, Suite 600, Pittsburgh, PA, 15213, United States of America, hwillis@rand.org

1 - Using Pattern Analysis and Systematic Randomness to Allocate Border Security Resources

Henry Willis, RAND Corporation, 4570 Fifth Avenue, Suite 600, Pittsburgh, PA, 15213, United States of America, hwillis@rand.org, Joel Predd

The U.S. Office of Border Patrol is investigating how pattern and trend analysis and systematic randomness can be used to position border security resources. This study examined how approaches that combine these two techniques yield higher interdiction rates than approaches using either technique alone, and it identifies circumstances in which combined approaches are competitive with perfect surveillance.

2 - Has Terror Gone to Ground?

Arnold Barnett, Professor, Massachusetts Institute of Technology, E62-568, MIT, Cambridge, MA, 02478, United States of America, abarnett@mit.edu

Since 9/11, efforts to thwart terror against transportation systems have focused on airplanes. Recently, however, the vast majority of successful attacks on transportation have victimized subways, commuter trains, and long-distance rail services. We discuss the recent data and their implications.

3 - Games and Risks: Some National Security Issues and Comparison of Analytic Frameworks

Elizabeth Pate-Cornell, Stanford University, Palo Alto, CA, United States of America, mep@stanford.edu

An overview of studies in the Stanford engineering risk research group on the use of game analysis in risk assessment with applications to national security problems involving counter-terrorism, nuclear non-proliferation startegies and warnings from the intelligence community.

4 - Attacker-defender Games and Decisions

Detlof von Winterfeldt, University of Southern California, Los Angeles, CA, United States of America, detlof@sppd.usc.edu

Using game and decision theory to model attacker defender interactions has been an important recent development to assess terrorism risks. I will give a brief overview of alternative attacker-defender models and provide examples from nuclear detection and surface-to-air missile defenses.

■ MD62

62- Borein A- Hyatt

Competition in Network Markets

Cluster: Auctions

Invited Session

Chair: Thanh Nguyen, Northwestern University, Kellogg School of Management, 2001 Sheridan Rd, Evanston, IL, United States of America, t-nguyen@kellogg.northwestern.edu

1 - Energy Procurement Strategies in the Presence of Intermittent Sources

Sachin Adlakha, Caltech, 1200 E. California Blvd., Pasadena, CA, 91125, United States of America, adlakha@caltech.edu, Adam Wierman, Jayakrishnan Nair

The increasing penetration of renewable energy sources, such as wind energy, pose significant challenges for utility companies. In this talk, we discuss inventory management issues that arise in the presence of renewable resources. A key insight from our work is a separation between the impact of the structure of electricity markets and the impact of increased penetration.

2 - Investment and Competition in Unlicensed Spectrum

Randall Berry, Professor, Northwestern University, 2145 Sheridan Rd., Evanston, IL, 60208, United States of America, rberry@eecs.northwestern.edu

Increasing the amount of unlicensed spectrum for wireless services, such as the recent opening of the television white spaces in the US, has the potential to benefit customers by increasing competition, but may also increase congestion. We give a model for studying such trade-offs and consider the implications of adding such spectrum in terms of the investment and pricing decisions of wireless service providers.

3 - The Cost of Free Spectrum

Thanh Nguyen, Northwestern University, Kellogg School of Management, 2001 Sheridan Rd, Evanston, IL, United States of America, t-nguyen@kellogg.northwestern.edu

The FCC has recently increased the amount of spectrum available for wireless services by permitting unlicensed access to television whitespaces. While this additional unlicensed spectrum allows for market expansion, it also influences competition among providers and increase congestion among consumers of wireless services. We find that the social and consumer welfare depends on the amount of additional unlicensed spectrum, can actually decrease over a significant range of unlicensed bandwidths.

4 - Mechanism Design Approach to Electricity Markets

Luciano De Castro, Northwestern University, 2001 Sheridon Road, Evanston, IL, United States of America, l-decastro@kellogg.northwestern.edu

The standard framework to electricity markets is that of competitive markets, somehow adjusted to take in account eventual market power. In this framework, electric energy is just a homogenous good, to be negotiated in a spot market. Although contracts could be written for future delivery, this is just a consequence of the risk aversion of the players, since price variance can be significant. We propose a different way of looking at electricity markets: one given by mechanism design.

■ MD63

63- Borein B- Hyatt

Behavioral Operations Management

Sponsor: Behavioral Operations

Sponsored Session

Chair: Yaozhong Wu, National University of Singapore Business School, 15 Kent Ridge Dr., Singapore, Singapore, yaozhong.wu@nus.edu.sg

1 - Behavioral Project Management: Motivating Workers to Meet Project Deadlines

Fabian Sting, Rotterdam School of Management, Erasmus University, Burgemeester Oudlaan 50, Rotterdam, Netherlands, FSting@rsm.nl, Dirk Stempfhuber, Christoph Loch

A fundamental problem in project management is meeting deadlines under uncertainty and project workers with private information. We present a case study of a company that has developed a project management system that addresses human behavior. Resulting from this evolution into a "behavioral project management system", the company's project performance improved. Our findings demonstrate the importance behavior in project management and suggest approaches to effectively guide behavior.

2 - On a Queueing System with State-dependent Service Rate

Xiaobo Zhao, Professor, Tsinghua University, IE Department, Qinghuayuan, Beijing, 100084, China, xbzhao@tsinghua.edu.cn, Hao Zhang, Qi-Ming He

We conduct a laboratory experimental study on some service systems. Results indicate that the service rate of a server (i.e., a subject) depends on the number of customers in the queue, which is typically non-monotone. Taking such state-dependent service into consideration, we introduce an M/M/1 type queueing model and analyze the effect of the state-dependent service on system performance.

3 - Distributional and Peer-induced Fairness in Supply Chains

Yaozhong Wu, National University of Singapore Business School, 15 Kent Ridge Dr., Singapore, Singapore, yaozhong.wu@nus.edu.sg, Xuanming Su, Teck-Hua Ho

We study how different forms of fairness concerns affect pricing decisions in supply chains whose members exhibit distributional fairness between upstream suppliers and downstream retailers as well as peer-induced fairness among retailers. We analyze how the supplier should make price offers to retailers in the presence of both types of fairness concerns. We also conduct an experimental study and provide evidence of the impact of both fairness concerns.

4 - Contingent Pricing in the Presence of Loss Averse Consumers with Stochastic Reference Points

Sami Najafi-Asadolahi, Rotman School of Management, University of Toronto, Toronto, Canada, Sami.Najafi@rotman.utoronto.ca, Opher Baron, Ming Hu

We study a setting in which over repeated sales horizon a firm sells a product to a market with two types of consumers: regular consumers, who have a given valuation for the product and whose market size is uncertain; and bargain hunters, who have a lower valuation and are abundant. The regular consumers are loss-averse with stochastic reference points that reflect their experiences with historic prices. We show that the firm's optimal policy is a contingent pricing policy in a threshold form.

■ MD66

66- Ellis West- Hyatt

Topics in Data Mining

Sponsor: Data Mining

Sponsored Session

Chair: Haibing Lu, Assistant Professor, Santa Clara University, 500 El Camino Real, Santa Clara, CA, 95050, United States of America, hlu@scu.edu

1 - Community Discovery and Profiling with Social Messages

Wenjun Zhou, Assistant Professor, University of Tennessee, 247 Stokely Management Center, 916 Volunteer Blvd, Knoxville, TN, 37996, United States of America, wzhou4@utk.edu, Hongxia Jin, Yan Liu

With the popularity of social media, it is of great interest to discover communities and utilize them for effective social communications and collaborations. Existing work has shown prospects of modeling contents and social links. Nonetheless, the definition of a community varies. We believe that a community depends not only on people, but also the topics they are communicating about. In this paper, we automatically find and profile users' communities with a model based on Bayesian modeling.

2 - Accurate and Efficient Query Clustering via Top-K Search Results

Yuan Hong, PhD Candidate, Rutgers University, 1 Washington Park, Newark, NJ, 07102, United States of America, yhong@cimic.rutgers.edu, Jaideep Vaidya, Haibing Lu

Search engine query clustering has attracted significant attention recently. Since they are usually incomplete, ambiguous and diverse, most clustering methods cannot guarantee good performance. We propose an efficient and accurate approach to cluster diverse queries based on their ranked top-k URLs returned by the search engine. The experimental results show that our method can generate more precise clusters, with remarkably improved efficiency/scalability and robust parameter tuning.

3 - Cost-aware Collaborative Filtering for Travel Tour Recommendations

Yong Ge, PhD. Student, Rutgers University, 1 Washington Street, Newark, NJ, 71012, United States of America, yongge@pegasus.rutgers.edu, Hui Xiong

Advances in tourism economics have enabled us to collect massive amounts of travel tour data. If properly analyzed, this data can be a source of rich intelligence for the provision of travel tour recommendations. However, tour recommendation is quite different from traditional recommendations, because the tourist's choice is directly affected by the travel cost, which includes the financial cost and the time. In this paper, we provide a focused study of cost-aware tour recommendation.

4 - Unfixed Clusterwise Linear Regression

Haibing Lu, Assistant Professor, Santa Clara University, 500 El Camino Real, Santa Clara, CA, 95050, United States of America, hlu@scu.edu

Clusterwise linear regression (CLR) considers data points are generated by multiple linear models. Most CLR approaches simply assume that multiple linear models to be discovered have the same explanatory variables and differ only in coefficients. However, it is often the case that different clusters have different exploratory variable sets. How to effectively and efficiently identify clusters with their respective explanatory variable sets from large scale observations is our interest.

■ MD67

67- Ellis East- Hyatt

Reliability in Integrated Manufacturing and Service Systems

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Tongdan Jin, Assistant Professor, Texas State University, 601 University Drive, San Marcos, TX, United States of America, tj17@txstate.edu

Co-Chair: Haitao Liao, Associate Professor, University of Arizona, Tucson, AZ, 85721, United States of America, hliao@email.arizona.edu

1 - Performance-based Maintenance and Logistics Service: Parts Availability or Operational Availability?

Tongdan Jin, Assistant Professor, Texas State University, 601 University Drive, San Marcos, TX, United States of America, tj17@txstate.edu

Performance-based contracting is envisioned to produce the necessary levels of reliability at the reduced cost. We study a multi-echelon and multi-item service delivery network. We present a unified operational availability model comprehending eight drivers, including reliability, usage, spares, maintenance, fleet size, touch labor, repair and reconditioning turn-around times. Contradictory to the common belief, high operational availability can be sustained under near-zero spares inventory.

2 - Prediction of Warranty Repair Demand Considering New Sales and Failed-but-not-reported Phenomena

Haitao Liao, Associate Professor, University of Arizona, Tucson, AZ, 85721, United States of America, hliao@email.arizona.edu, Wei Xie

In this paper, we present a mathematical model for predicting warranty repair demands for a new product covered by a non-renewable free minimal-repair warranty policy. We consider that the installed base of the product varies with time due to both new sales and units being taken out of service. In particular, failed-but-not-reported phenomena with time-dependent warranty claim probability are considered.

3 - A Method for Reliability Analysis and Optimization of Hybrid Energy Systems

Zhigang Tian, Concordia University, 1515 Ste-Catherine Street West, Montreal, Canada, tian@ciise.concordia.ca, AmirAhmad Seifi

A hybrid energy system integrates renewable energy sources like wind, solar, micro-hydro and biomass, fossil fuel power generators and energy storage. In this work, we develop a method to analyze reliability of hybrid energy systems considering uncertainties and time-varying characteristics in various power sources and the demand, and to optimize the system design to minimize the system cost and improve system reliability.

4 - An Efficient Method for Fatigue and Fracture Analysis with Uncertainity Quantification

Qingyu William Yang, Assistant Professor, Wayne State University, 4815 Fourth Street, Rm 2167, Detroit, MI, 48335, United States of America, qyang@wayne.edu, Nailong Zhang

Fatigue damage is defined as material fails due to repeated application of loads that are not large enough to cause failure in one single application. We developed an efficient statistical model to capture the model uncertainty for fatigue and fracture analysis. A case study is conducted to verify the proposed method.

5 - A POMDP for Maintenance Optimization with a Heterogeneous Population of Spare Components

C.D van Oosterom, PhD Student, Eindhoven University of Technology, P.O. Box 513, Opwettensemolen 62, Eindhoven, 5600MB, Netherlands, C.D.v.Oosterom@tue.nl, Geert-Jan van Houtum, Hao Peng

We develop a partially observable Markov decision process (POMDP) model that incorporates component heterogeneity in adaptively scheduling inspections and replacements for deteriorating systems. As the likelihood of observing a certain sequence of degradation levels will be affected by the component type (strong or weak), inspections and replacements can be adapted to the belief about the component type. We evaluate the according reduction in total expected discounted costs in a numerical study.

■ MD68

68- Suite 312- Hyatt

Market Crashes

Sponsor: Financial Services Section

Sponsored Session

Chair: Olympia Hadjiliadis, Associate Professor, Brooklyn College and the Graduate Center, CUNY, 2900 Bedford Ave, Brooklyn, NY, 11209, United States of America, ohadjiliadis@brooklyn.cuny.edu

1 - Modeling Stochastic, State-Dependent Correlations

Adam Metzler, Assistant Professor, University of Western Ontario, London, ON, Canada, ametzle@uwo.ca

Empirical evidence indicates that financial assets tend to be most sensitive to systematic risk factors when these factors take on adverse values. Unfortunately this relationship is not accounted for in many standard approaches to modeling stochastic correlation, most notably in simple mixture models. In this talk we introduce a novel family of correlation models that explicitly accounts for this type of state-dependence, and contains both the simple mixture and RFL models as extreme cases.

2 - Optimal Stopping to Prevent a Catastrophic Event
H. Dharma Kwon, University of Illinois at Urbana-Champaign, 1206 South Sixth Street, Champaign, IL, 61820, United States of America, dhkwon@illinois.edu

We consider the stopping problem of a decision-maker facing a catastrophic event with weak forewarning signals. We are particularly interested in the case the event is extremely rare and the occurrence of the event is extremely costly. The optimal policy is to stop when the posterior probability of the event exceeds an optimally chosen threshold. We also comment on stopping problems under risk-sensitivity of the decision-maker.

3 - A Study of Rare Events in Finance
Ionut Florescu, Assistant Professor, Stevens Institute of Technology, Castle Point on The Hudson, Hoboken, NJ, 07030, United States of America, ifloresc@stevens.edu

In this work we investigate financial events where the price shows large changes with relatively small volume. These event are detected in real time and the methodology is compared with two other ways to detect extrema of multivariate distributions: p-efficient points and ziggurat method. We also investigate the relationship between these events and lack of liquidity on the market which is measured using the aggressor indicator available in certain exchange data.

4 - Trailing Stops and Early Liquidation Premium
Hongzhong Zhang, Assistant Professor, Columbia University, New York, NY, 10027, United States of America, hz2244@columbia.edu, Tim Leung

We analyze the optimal timing to liquidate a risky asset subject to a trailing stop order. This leads to an optimal stopping problem with stochastic timing constraint described by a moving barrier. Modeling price dynamics by a time-homogeneous diffusion, we express the optimal timing in terms of the associated drawdown process. We also compare our results to the liquidation problem under a fixed stop-loss barrier.

5 - Trends and Trades
Olympia Hadjiliadis, Associate Professor, Brooklyn College and the Graduate Center, CUNY, 2900 Bedford Ave., Brooklyn, NY, 11209, United States of America, ohadjiliadis@brooklyn.cuny.edu

We build trend following algorithms based on the sequential statistics rules such as the Cumulative sum and the Sequential probability ratio test. We draw the connections between these algorithms and the well-known path dependent statistics used to capture sudden market drops/crashes and upward trends, the maximum drawdown and the maximum draw-ups. In fact the algorithms introduced are trend following algorithms and are seen to be most profitable during times of market instability.

■ MD69

69- Suite 314- Hyatt

New Perspectives on Portfolio Optimization

Cluster: Optimization in Finance

Invited Session

Chair: Daniel Kuhn, Imperial College London, 180 Queen's Gate, London, United Kingdom, d.kuhn@imperial.ac.uk

1 - Efficiency-based Quantitative Asset Selection
Irene Song, Columbia University, Columbia University, 120th Street, New York, NY, 10027, United States of America, is2306@columbia.edu, Soulaymane Kachani, Iraj Kani

In this talk, we propose an efficiency-based asset selection methodology that combines data envelopment analysis (DEA), a non-parametric productivity analysis of relative efficiencies of economic entities, with fundamental analysis in a disciplined manner. We test our strategy in both equity and currency markets and evaluate its performance relative to market benchmarks and widely used regression-based techniques.

2 - Robustifying Convex Risk Measures: A Non-Parametric Approach
David Wozabal, Technische Universitat München, TUM School of Management, Arcisstr. 21, München, 80333, Germany, david.wozabal@tum.de

We robustify convex, version independent risk measures. The robustified measures are defined as the worst case portfolio risk over a neighborhood of a reference distribution. The problem of finding the worst case risk is solved analytically and closed form expressions for the robust risk measures are obtained. Using these results robustified versions for several examples of risk measures are derived and the resulting robust risk measures are tested in rolling-window out-of-sample evaluations.

3 - Hedging Year-End Downside Risk in Global Tactical Asset Allocation
Gerd Infanger, Stanford University, Management Science and Engineering, 475 Via Ortega, Stanford, CA, 94305, United States of America, infanger@stanford.edu

Institutional investors are often concerned with controlling the downside risk at the end of a (fiscal) year as losses incurred at the end of a year determine the risk budget for investments in the following year. We show how dynamic asset allocation can be used to control the downside risk at year-end and analyze the cost and benefits of such management in the context of global tactical asset allocation.

4 - Worst-Case Value-at-Risk of Non-Linear Portfolios
Daniel Kuhn, Imperial College London, 180 Queen's Gate, London, United Kingdom, d.kuhn@imperial.ac.uk, Steve Zymler, Berc Rustem

Most portfolio optimization models involving Value-at-Risk (VaR) assume that the distribution of the risk factors is known exactly. When only partial distributional information is available, however, these models exhibit significant model risk. In this talk we discuss a Worst-Case VaR (WVaR) that is designed to mitigate model risk. We extend WVaR to portfolios that exhibit a polyhedral or quadratic dependence on the risk factors and show how it can be used to structure derivative portfolios.

■ MD70

70- Suite 316- Hyatt

Social Media and Online Opinions

Sponsor: Information Systems

Sponsored Session

Chair: Lu Yan, Indiana University, Kelley School of Business, Bloomington, IN, United States of America, lucyyan@uw.edu

1 - Matching Apps and Ads: An Investigation on Determinant of Ad Click-through Rate on Mobile Devices
Yichun Ho, PhD Student, University of Washington, 4141 Brooklyn Ave., NE, Seattle, WA, 98105, United States of America, chadho@uw.edu, Yong Tan

The work posits to examine how click-through rate of advertisement is affected by the characteristics of applications, developers, users, mobile devices, and advertisement itself. Interesting research questions to be investigated could be: how can we identify optimal matching patterns between apps and ads that can induce higher click-through rate? The data set to be examined is collected from an advertising company targeting in mobile device industry.

2 - Shared Minds: How Patients use Collaborative-Based Information Sharing
Lu Yan, Indiana University, Kelley School of Business, Bloomington, IN, United States of America, lucyyan@uw.edu, Yong Tan

Social media has changed patients' role in managing their health. In this study, we investigate how patients utilize and educate themselves by learning others' shared experiences in the online healthcare communities. The results provide evidence for the existence of social contagion on the Internet for health information seeking and knowledge creation. Implications of these findings in relation to both practitioners and researchers are also discussed.

3 - Rewards and User Behavior in Crowd-based Problem Solving
Mingfeng Lin, University of Arizona, 1130 E. Helen St., Tucson, AZ, 85721, United States of America, mingfeng@eller.arizona.edu, Paulo Goes, Chenhui Guo

We study user behavior in an online knowledge exchange market, in particular, how users respond to certifications schemes designed to encourage participation. Such "meritocracy" arrangements allow users to accumulate points to advance upward in the community hierarchy. We collected an extensive dataset from Experts-Exchange (EE) to examine the effect of user certification on the participation behavior of answerers as well as the choice of askers.

■ MD71

71- Suite 318- Hyatt

eBusiness Models, Business Strategy and Innovation

Sponsor: eBusiness

Sponsored Session

Chair: Harpreet Singh, University of Texas at Dallas, 800 West Campbell Road, Richardson, TX, 75080, United States of America, harpreet@utdallas.edu

1 - Impact of Promotions on Location-based Services: Evidence from Foursquare

Lei Wang, PhD Candidate, OPIM Department, University of Connecticut, 2100 Hillside Road Unit 1041, Storrs, CT, 06269, United States of America, Lei.Wang@business.uconn.edu, Ram Gopal, Joseph Pancras, Ramesh Sankaranarayanan

Foursquare, top 1 location-based services provider, provides a free platform for businesses to give promotions to customers. We propose a hierarchical linear model to examine the impact of offering promotions though location-based services on the growth rate of consumer traffic. We find (1) If more competitors offer specials through location-based services, the best strategy for a restaurant is to not offer specials; (2) the more competitors a restaurant has, the higher its growth rate will be.

2 - Inventory as a Driver of Demand

Yasin Ceran, University of Texas at Dallas, Richardson, TX, 75080, United States of America, ceran@utdallas.edu

In online retailing, inventory decisions can greatly impact sales for a product by affecting, among other things, availability (stock-outs) and word of mouth (WOM). In this study, we develop a model as an extension of similar structural models introduced in the literature. We investigate the impact of inventory on the amount of lost sales. We use Markov Chain Monte Carlo (MCMC) simulations to test our model with synthetically generated data and then provide an empirical application.

3 - Socio-economic Value of Online User Rating on Box Office Sales

Young Jin Lee, University of Wisconsin at Green Bay, Cofrin School of Business, Green Bay, WI, 54311, United States of America, leey@uwgb.edu

We examine the economic value of prior online user ratings as advertising effect on subsequent box office sales. To correctly identify the value, we use a instrumental variable (IV) estimation strategy with a unique data that includes reviewer and movie level information. Using reviewers' social characteristics in an online social network as IV for online user ratings, we directly compare the effect to weekly advertising spending to quantify the monetary value of online user ratings.

4 - The Online Retailer Fulfillment Service: Why Help Your In-store Competitor?

Wenjing Shen, Assistant Professor, Drexel University, 101 N. 33rd Street, 228A, Philadelphia, PA, 19380, United States of America, ws84@drexel.edu, Gangshu Cai

Online fulfillment program is a service offered to small retailers by large retailers such as Amazon, where large retailers handle shipping and service for the small retailer. We analyze a game between two retailers and find out the conditions under which fulfillment program is beneficial for the large retailer.

■ MD72

72- Suite 322- Hyatt

Computational Stochastic Optimization in Health

Sponsor: Computational Stochastic Optimization

Sponsored Session

Chair: Jennifer Mason, North Carolina State University, 111 Lampe Drive, Campus Box 7906, Raleigh, NC, 27695, United States of America, jemason2@ncsu.edu

1 - A Robust Markov Decision Process for Glycemic Control for Patients with Type 2 Diabetes

Yuanhui Zhang, PhD Student, North Carolina State University, 375 Daniels Hall, Campus Box 7906, Raleigh, NC, 27695, United States of America, yzhang29@ncsu.edu, Brian Denton, Jennifer Mason, Nilay Shah, Steven Smith

We present a Robust Markov Decision Process (MDP) for treatment decisions for glycemic control in patients with Type 2 Diabetes. We describe an approximate dynamic programming (ADP) method to find near optimal policies given uncertainty in transition probability matrix. Performance of the ADP method relative to the non-robust counterpart is discussed. Computational results based on a large clinical dataset are presented to illustrate the structure and influence factors of the optimal policy.

2 - Dynamic Matching via Weighted Myopia with Application to Kidney Exchange

John Dickerson, Carnegie Mellon University, Computer Science Dept, Pittsburgh, PA, United States of America, Ariel Procaccia, Tuomas Sandholm

We propose an approach to stochastic optimization that learns potentials of problem elements. Then, we run an offline algorithm at each time period, subtracting from the objective the potentials of the elements used up. Applied to kidney exchange, we analyze the power of potentials on vertices, edges, cycles, and the entire graph. Experimentally, by learning vertex potentials, we get better solution quality than the myopic practice and scale much better than sample-trajectory-based algorithms.

3 - Approximate Dynamic Programming Methods for Optimal Control of Cardiovascular Risk

Jennifer Mason, North Carolina State University, 111 Lampe Drive, Campus Box 7906, Raleigh, NC, 27695, United States of America, jemason2@ncsu.edu, Brian Denton, Nilay Shah, Steven Smith

We describe ADP methods to approximate the solution to a finite horizon, non-stationary MDP with a continuous state space defined by risk factors including blood pressure and cholesterol. We compare the performance of policies generated from three ADP methods: state aggregation, basis function approximation of the value function, and a new adaptive state aggregation approach. We present numerical results for the optimal control of blood pressure and cholesterol in patients with type 2 diabetes.

■ MD73

73- Suite 324- Hyatt

Systemic Risk

Cluster: Quantitative Finance

Invited Session

Chair: Konstantinos Spiliopoulos, Assistant Professor, Boston University, Department of Mathematics & Statistics, 111 Cummington Street, Boston, MA, 02215, United States of America, kspiliop@math.bu.edu

1 - Extremely Hard to Borrow (Bankrupt) Stocks

Richard Sowers, University of Illinois at Urbana-Champaign, Urbana, IL, United States of America, r-sowers@illinois.edu, Xiao Li, Michael Lipkin

We extend a model of Avellaneda and Lipkin to cover extremely hard-to-borrow (bankrupt) stocks. The only source in stochasticity is Poisson relaxations after short squeezes. We find asymptotic formulae and a risk-neutral model.

2 - Stability and Instability of Interbank-lending System

Tomoyuki Ichiba, University of California, South Hall 5617 A, Santa Barbara, CA, 93106, United States of America, ichiba@pstat.ucsb.edu

We study an interacting diffusion for a competitive interbank lending market where banks extend loans to one another at the interbank short-term rate, in addition to their long-term banking activities. Insufficient transaction in the interbank market triggers multiple defaults and then a financial instability. In our model the lending preferences are linked to the instability of system. We also discuss the role of a financial regulator who enhances the stability of the system under such model.

3 - A Mean-field Model of Systemic Risk and its Large Deviations

Tzu-Wei Yang, Stanford University, 419 Lagunita Dr., Apt. 19, Stanford, CA, 94305, United States of America, twyang@stanford.edu, George Papanicolaou, Josselin Garnier

We model a banking system as an interacting particle system and each component affects the others through their mean field. The system has two stable states that can be interpreted as the normal and failed states. The transition from the system's normal state to the failed state could happen with an exponentially small probability. We use large deviations to compute this small probability and argue that risk sharing may reduce the individual risk but at the same time increase the systemic risk.

4 - Large Portfolio Loss: Conditionally Gaussian Approximations

Justin Sirignano, Stanford University, 3 Gibbs Court, Irvine, CA, United States of America, jasirign@stanford.edu, Kay Giesecke, Konstantinos Spiliopoulos

We extend previous asymptotic results for the loss in a large credit portfolio by proving a first-order correction. This conditionally Gaussian approximation satisfies a stochastic partial differential equation and is shown to offer accurate approximations to the finite portfolio loss distribution. Numerical methods are developed to simulate the approximating loss.