

14th **POMS-HK** International Conference



*New Frontiers in
Operations Management--
Opportunities and
Challenges*

5-6 Jan 2024
Hong Kong

Welcome to the 14th POMS-HK International Conference

Welcome Message from the General Chair

We at The Hong Kong University of Science and Technology (HKUST) are honoured to host the 14th POMS-HK International Conference and extend our warm welcome to you all.



The POMS-HK International Conference is an annual event organized by the POMS Hong Kong Chapter, and this year marks the third time for the Conference to be held at HKUST. With the dedication and support of colleagues in Hong Kong and beyond, the conference has become a successful platform

for scholars, students and practitioners around the globe to exchange ideas and share new development. The theme of this year's conference is "New Frontiers in Operations Management – Opportunities and Challenges". We welcome research that in the broad field of operations research and management, including that which crosses traditional boundaries. We are excited that four renowned scholars, Professor Shane Henderson from Cornell University, Professor Ming Hu from University of Toronto, Professor Peng Sun from Duke University, and Professor Assaf Zeevi from Columbia University will deliver keynote speeches at the conference.

I look forward to seeing you all at the conference and wish you a rewarding and inspiring experience.

Professor Rachel Quan ZHANG

General Chair of the 14th POMS-HK International Conference
Chair Professor
Department of Industrial Engineering and Decision Analytics
The Hong Kong University of Science and Technology

Welcome to the 14th POMS-HK International Conference

Welcome Message from the Department Head of Industrial Engineering and Decision Analytics

It is my pleasure to welcome each of you to the 14th POMS-HK International Conference. The IEDA Department at HKUST is honored to host this esteemed academic gathering. Our primary intent is to offer a vibrant platform for scholars, students, and practitioners to collaborate and discuss the most recent advancements in production and operations management.



Our field is constantly evolving and continually adapting to emerging challenges. Under the theme, “New Frontiers in Operations Management – Opportunities and Challenges”, we aspire to foster a space where experts in the field can convene to navigate the myriad emerging possibilities and challenges.

I look forward to your active participation in the conference. It is my genuine hope that your time here proves to be both invigorating and rewarding, further fueling your passion and dedication in your research pursuits.

Professor Jiheng ZHANG

Head and Professor

Department of Industrial Engineering and Decision Analytics

The Hong Kong University of Science and Technology

About the 14th POMS-HK International Conference

The 14th POMS-HK International Conference

The 14th POMS-HK International Conference will be held at The Hong Kong University of Science and Technology (HKUST) on 5 – 6 January 2024. Under the theme of “**New Frontiers in Operations Management – Opportunities and Challenges**”, the conference aims to provide a collaborative platform that brings together scholars and researchers in the field of operation management and related disciplines to exchange research ideas, industry practice, and managerial insights.

Conference Committee

General Chair

- Rachel Zhang, The Hong Kong University of Science and Technology

Organising Committee

Chair:

- Qian Liu, The Hong Kong University of Science and Technology

Programme Committee

Chair:

- Jin Qi, The Hong Kong University of Science and Technology
- Man Yu, The Hong Kong University of Science and Technology

Best Student Paper Competition Chairs:

- Xiangtong Qi, The Hong Kong University of Science and Technology
- Xuan Wang, The Hong Kong University of Science and Technology

Time	Event	Venue
08:00 - 17:00	Registration <i>(Refreshment will be provided)</i>	Foyer, Shaw Auditorium (08:00 - 13:00) Outside LT-A (13:00 - 17:00)
08:30 - 08:40	Welcome & Opening Ceremony	Main Hall, Shaw Auditorium
08:40 - 10:10	Keynote Speech (1) Prof. Shane G. Henderson Cornell University	
10:10 - 10:30	Refreshment Break & Networking	Foyer, Shaw Auditorium
10:30 - 12:00	Keynote Speech (2) Prof. Ming Hu University of Toronto	Main Hall, Shaw Auditorium
12:00 - 12:15	Group Photo Taking	
12:15 - 14:00	Lunch	G/F Chinese Restaurant 南北小廚
14:00 - 15:20	Best Student Paper Session I	Rm 1104 (Near LT-A)
	Parallel Session (A)	Classrooms in Academic Building (2/F, near Lift 19)
15:20 - 15:40	Refreshment Break & Networking	Academic Concourse outside LT-A/B
15:40 - 17:00	Best Student Paper Session II	Rm 1104 (Near LT-A)
	Parallel Session (B)	Classrooms in Academic Building (2/F, near Lift 19)
17:45	Shuttle Bus from HKUST Piazza to Banquet Venue	
18:45 - 21:45	Banquet at WM Hotel Address: 28 Wai Man Road, Sai Kung, New Territories, H.K.	
21:45	Shuttle Bus from Banquet Venue to HKUST / Tseung Kwan O MTR Station	

Time	Event	Venue
08:00 - 17:00	Registration <i>(Refreshment will be provided)</i>	Foyer, Shaw Auditorium (08:00 - 13:00) Outside LT-A (13:00 - 17:00)
08:30 - 10:00	Keynote Speech (3) Prof. Peng Sun Duke University	Main Hall, Shaw Auditorium
10:00 - 10:30	Refreshment Break & Networking	Foyer, Shaw Auditorium
10:30 - 12:00	Keynote Speech (4) Prof. Assaf Zeevi Columbia University	Main Hall, Shaw Auditorium
12:00 - 13:30	Lunch	G/F Chinese Restaurant 南北小廚
13:30 - 14:50	Parallel Session (C)	Classrooms in Academic Building (2/F, near Lift 19)
14:50 - 15:10	Refreshment Break & Networking	Academic Concourse outside LT-A/B
15:10 - 16:30	Parallel Session (D)	Classrooms in Academic Building (2/F, near Lift 19)
16:30 - 16:50	Refreshment Break & Networking	Academic Concourse outside LT-A/B
16:50 - 18:10	Parallel Session (E)	Classrooms in Academic Building (2/F, near Lift 19)

Day 1		
Room No.	14:00 - 15:20 Parallel Session (A)	15:40 - 17:00 Parallel Session (B)
2126D	A1 - Data-Driven Robust Optimization and Its Applications	B1 - Data-Driven Research on Emerging Topics
2126A	A2- Operations and Decision Analytics	B2 - Data-Driven Operations Management
2126B	A3 - Analytics and Operations Management	B3 - Frontiers in Data-Driven Decision-Making Algorithms
2126C	A4 - Prescriptive Analytics in Socially Responsible Operations	B4 - Machine Learning Methods in Supply Chain Management
2127A	A5 - Frontiers of Analytics with Applications	B5 - Learning with Humans in the Loop
2127B	A6 - Recent Development in Stochastic Simulation	B6 - Inventory Management and Pricing Analytics
2127C	A7 - Robust Choice Model and Pricing	B7 - Data-Driven Methods for Revenue and Supply Chain Management
2128A	A8 - Modern Optimization Algorithm	B8 - Competition and Operations Innovation
2128B	A9 - New Challenges and Opportunities in the Digital Era and Platform Economic	B9 - Learning Algorithms for Inventory and Revenue Management
2128C	A10 - Management of Online Platforms	B10 - Emerging Topics in Digital Business
2129A	A11 - Emerging Topics on Online Resource Allocation	B11 - Influencer and Live-Stream Marketing
2129B	A12 - Interface of OM and Marketing: Consumer Behaviour and Pricing	B12 - Interface between Operations and Marketing
2129C	A13 - Stochastic Processes and Their Applications	B13 - On-Demand Service Platforms
2130A	A14 - Emerging Topics in Service Operations Management	B14 - Retailing and Service Operations Management

Day 1 (Cont.)		
Room No.	14:00 - 15:20 Parallel Session (A)	15:40 - 17:00 Parallel Session (B)
2130B	A15 - Empirical Studies in Operations Management	B15 - Manufacturing and Production OM
2130C	A16 - Simulation Optimization and Learning	B16 - Stochastic Simulation in Complex Systems
2131A	A17 - Supply Chain Management under Platform Economy	B17 - Information Sharing and Design in Supply Chains
2131B	A18 - Contract and Information Design in Operations Management	B18 - Emerging Trends in Operations: Optimal Design and Policies
2131C	A19 - Online Healthcare Platforms and Systems	B19 - Empirical Studies in Healthcare Operations
2132A	A20 - Sustainable Operations Management	B20 - Socially Responsible, Green, and Analytics-Driven Operations
2132B	A21 - Decision Making in Sustainable Operation	B21 - Information Disclosure on Sustainable Operations
2132C	A22 - Addressing Behavioural Problems in Operations Management	B22 - Topics in Behavioral Operations

Parallel Session Programme / January 6 / 2024

Day 2			
Room No.	13:30 - 14:50 Parallel Session (C)	15:10 - 16:30 Parallel Session (D)	16:50 - 18:10 Parallel Session (E)
2126D	C1 - Emerging Topics of Decision-Making in Operations Management	D1 - Data-Driven Operations Management	E1 - Machine Learning and Operations Management
2126A	C2 - Data Driven Operations Management	D2 - Distributionally Robust Optimization and Its Applications	E2 - Advanced Topics in Robust Optimization
2126B	C3 - Sequential Learning Problems in Operations Management	D3 - Empirical Research on Retail Operations	E3 - Recent Developments in Decision Analytics
2126C	C4 - Empirical Operations Management	D4 - Empirical Research in Operations Management	E4 - Business Analytics and Operations
2127A	C5 - Advancing Operations: Innovations in Sequential Decision Making	D5 - Emerging Topics in Operations Management	E5 - Data Driven Supply Chain Management
2127B	C6 - Theory and Applications of Revenue Management	D6 - Platform Operations and Pricing Strategies	E6 - Assortment Optimization
2127C	C7 - Emerging Challenges in Pricing	D7 - New Frontiers in Revenue Management	E7 - Content and Advertising Management
2128A	C8 - Operations Management	D8 - Innovation OM	E8 - Supply Chain Analytics
2128B	C9 - Fairness in Operations Management	D9 - Consumer Privacy and Trust in E-Commerce	E9 - Advanced Topic in Revenue Management
2128C	C10 - New Topics in E-Commerce Platforms and Supply Chain	D10 - Reviews, Rebates, and Recommendations in E-Commerce	E10 - Fintech and Blockchain
2129A	C11 - OM-Marketing Interface	D11 - Operations-Marketing Interface	E11 - Operations Management Under Competition
2129B	C12 - Data Analysis in Quantitative Finance	D12 - Algorithmic Methods in OM- Finance Interface	E12 - Policy Development in OM- Finance Interface
2129C	C13 - Service Operations	D13 - Recent Topics in Service Operations	E13 - Operational Transparency and Visibility

Parallel Session Programme / January 6 / 2024

Day 2 (Cont.)			
Room No.	13:30 - 14:50 Parallel Session (C)	15:10 - 16:30 Parallel Session (D)	16:50 - 18:10 Parallel Session (E)
2130A	C14 - Information and Behaviors in Service Operations	D14 - On-Demand Services and Platforms	E14 - Recent Advances in Service Operations
2130B	C15 - Supply Contracting and Channel Coordination	D15 - Game-Theoretic Models in Operations Management	E15 - Scheduling and Design in Operations Management
2130C	C16 - Optimization in Transportation and Delivery	D16 - Drones and Urban Air Mobility	E16 - Vehicle Routing Problems
2131A	C17 - Supply Chain Risk Management	D17 - Resource Planning in Healthcare Operations	E17 - Humanitarian and Crisis Management
2131B	C18 - Optimization Models for Service Systems	D18 - New Topics in Healthcare Operations Management	E18 - Healthcare Information Systems and Provision
2131C	C19 - Incentive Structures and Behavioral Effects in Healthcare Operations	D19 - Advances in Healthcare Operations	E19 - Decision-Making in Healthcare Operations
2132A	C20 - Theoretical and Empirical Studies on Sustainable Operations	D20 - Integrated and Data-Driven Energy Systems	E20 - Sustainable Operations
2132B	C21 - Sustainability and Sharing Economy	D21 - On-Demand Delivery Platform	E21 - Behavioural Bias in Operations Management
2132C	C22 - Emerging Topics in Supply Chain Management I	D22 - Emerging Topics in Supply Chain Management II	E22 - Emerging Topics in Supply Chain Management III

Keynote Speech

Keynote 1 - Modeling the Impact of Community First Responders

Day 1 : 5th Jan (Fri) 08:40 - 10:10

Prof. Shane G. Henderson

Charles W. Lake, Jr. Professor in Productivity
School of Operations Research and
Information Engineering
Cornell University



Abstract:

Patient survival from out-of-hospital cardiac arrest (OHCA) can be improved by augmenting traditional ambulance response with the dispatch of community first responders (volunteers) who are alerted via an app. How many volunteers are needed, from where should volunteers be recruited, and how should they be dispatched? We use a combination of Poisson point process modeling and convex optimization to address the first two questions; the right areas from which to recruit are not always obvious, because volunteers recruited from one area may spend time in various areas across a city. To answer the third question we use a combination of dynamic programming and decision trees, balancing the goal of a fast response to the current patient with the need to avoid disengagement of volunteers that arises when multiple volunteers respond. A case study for Auckland, New Zealand demonstrates the ideas.

This is joint work with Pieter van den Berg, Océane Fourmentraux, Caroline Jagtenberg, and Hemeng (Maggie) Li

Keynote Speech

Biography:

Professor Shane G. Henderson holds the Charles W. Lake, Jr. Chair in Productivity in the School of Operations Research and Information Engineering (ORIE) at Cornell University. His research interests include discrete-event simulation, simulation optimization, emergency services planning and transportation. He is an INFORMS Fellow and a co-recipient of the INFORMS Wagner Prize for his work on bike-sharing programs. He has served as Director of the School of ORIE, as chair of the INFORMS Applied Probability Society, and as editor in chief of the journal Stochastic Systems. He likes cats, climbing walls, biking, Harry Potter and being a Dad.

Keynote Speech

Keynote 2 - Spatial Supply-Demand Matching

Day 1 : 5th Jan (Fri) 10:30 - 12:00

Prof. Ming Hu

Distinguished Professor of
Business Operations and Analytics
Rotman School of Management
University of Toronto



Abstract:

First, I will model recent applications in the on-demand economy as spatial queues to extend the scope of urban operations research and draw managerial insights. Second, I will develop theories on a transient spatial congestion system and general spatial resource allocation problems.

Biography:

Ming Hu is the University of Toronto Distinguished Professor of Business Operations and Analytics, a professor of operations management at the Rotman School of Management, and an Amazon Scholar. He received a master's degree in Applied Mathematics from Brown University in 2003 and a Ph.D. in Operations Research from Columbia University in 2009. For more about his research, please visit <http://individual.utoronto.ca/minghu/>

Keynote Speech

Keynote 3 - Equilibrium with Communication, Information Design, and Linear Programming

Day 2 : 6th Jan (Sat) 08:30 - 10:00

Prof. Peng Sun

J.B. Fuqua Professor

Fuqua School of Business

Duke University



Abstract:

Linear programming and its duality provide analytical tools to study games with communication and information design. After reviewing the basic concepts of equilibrium with communication, we study two applications. In the first application, we show that in simple environments, a bidding ring operating at a first price sealed-bid auction cannot achieve any gains relative to non-cooperative bidding if the ring is unable to control the bids that its members submit at the auction. In the second application, we study a Cournot competition model in which players are able to share information about the uncertain market potential. We show that there is no incentive for the players to fully share their information. On the other hand, whether we want to maximize the collective gain of the firms, or the social welfare, the non-cooperative equilibrium (no information sharing) can also substantially underperform, compared with upper bounds. When there is much room for improvement over no information sharing, we propose a mechanism which shares an information mediator's information as well as partially sharing each firm's information using a threshold approach.

Keynote Speech

Biography:

Peng Sun is a JB Fuqua Professor in the Decision Sciences area at the Fuqua School of Business, Duke University. He researches mathematical theories and models for resource allocation decisions under uncertainty, and incentive issues in dynamic environments. His work spans a range of applications areas, from operations management, economics, finance, marketing, to health care and sustainability. He serves as a Department Editor at Management Science, and an Associate Editor at Operations Research, two leading academic journals of the profession of Operations Research and Management Science. At the Fuqua School, Professor Sun has taught MBA core course Decision Models and elective course Strategic Modeling and Business Dynamics, and PhD course Dynamic Programming and Optimal Control.

Keynote Speech

Keynote 4 - Some Flavors of Statistical Learning in Operations

Day 2 : 6th Jan (Sat) 10:30 - 12:00

Prof. Assaf Zeevi

Kravis Professor of Business

School of Business,

Columbia University



Abstract:

Linear programming and its duality provide analytical tools to study games with communication and information design. After reviewing the basic concepts of equilibrium with communication, we study two applications. In the first application, we show that in simple environments, a bidding ring operating at a first price sealed-bid auction cannot achieve any gains relative to non-cooperative bidding if the ring is unable to control the bids that its members submit at the auction. In the second application, we study a Cournot competition model in which players are able to share information about the uncertain market potential. We show that there is no incentive for the players to fully share their information. On the other hand, whether we want to maximize the collective gain of the firms, or the social welfare, the non-cooperative equilibrium (no information sharing) can also substantially underperform, compared with upper bounds. When there is much room for improvement over no information sharing, we propose a mechanism which shares an information mediator's information as well as partially sharing each firm's information using a threshold approach.

Keynote Speech

Biography:

Assaf Zeevi is Professor and holder of the Kravis chair at the Graduate School of Business and the Data Science Institute (DSI), Columbia University. His research and teaching interests lie at the intersection of Data Science, Operations and Machine Learning, and Ai technologies more broadly. In particular, he has been developing theory and algorithms for reinforcement learning, Bandit problems, stochastic optimization, statistical learning and stochastic networks, and successfully implementing these in a variety of application domains such as online retail, healthcare analytics, dynamic pricing, recommender systems, and online marketplaces. Assaf is a founding member of the Columbia Center for Artificial Intelligence Technologies (CAIT), and serves on several scientific advisory boards for startup companies in the high technology sector. He received his B.Sc. and M.Sc. (Cum Laude) from the Technion - Israel Institute of Technology, and subsequently his Ph.D. from Stanford University in 2001. Assaf has held several visiting positions, including Stanford University, the Technion, and Tel Aviv University.

Best Student Paper Session I**Day 1: 5th Jan (Fri) 14:00-15:20 Venue: 1104****Session Chairs: Xiangtong Qi, The Hong Kong University of Science and Technology
Xuan Wang, The Hong Kong University of Science and Technology****Title: The (Surprising) Sample Optimality of Greedy Procedures for Large-Scale Ranking and Selection**

Presenter: Zaile Li, Fudan University

Co-author(s): L. Jeff Hong, Weiwei Fan

Abstract:

Ranking and selection (R&S), which aims to select the best alternative with the largest mean performance from a finite set of alternatives, is a classic research topic in simulation optimization. Statistical procedures (a.k.a. algorithms) developed to solve the R&S problem have been broadly applied in the optimization of healthcare, inventory, service, and transportation systems. Recently, considerable attention has turned towards the large-scale variant of the R&S problem which involves a large number of alternatives. Ideal large-scale R&S procedures should be sample optimal, i.e., the total sample size required to deliver an asymptotically non-zero probability of correct selection (PCS) grows at the minimal order (linear order) in the number of alternatives, but not many procedures in the literature are sample optimal. Surprisingly, we discover that the naïve greedy procedure, which keeps sampling the alternative with the largest running average, performs strikingly well and appears sample optimal. To understand this discovery, we develop a new boundary-crossing perspective and prove that the greedy procedure is indeed sample optimal. We further show that the derived PCS lower bound is asymptotically tight for the slippage configuration of means with a common variance. Moreover, we propose the explore-first greedy (EFG) procedure and its enhanced version (EFG+ procedure) by adding an exploration phase to the naïve greedy procedure. Both procedures are proven to be sample optimal and consistent. Last, we conduct extensive numerical experiments to empirically understand the performance of our greedy procedures in solving large-scale R&S problems.

Title: Managing Perishable Inventory Systems with Positive Lead Times: Inventory Position vs. Projected Inventory Level

Presenter: Huanyu Yin, The Chinese University of Hong Kong

Co-author(s): Jinzhi Bu, Xiting Gong

Abstract:

We consider periodic-review perishable inventory systems with a fixed product lifetime and positive replenishment lead times. Demands are satisfied by on-hand inventories of different ages following a general issuance policy. Unsatisfied demand is either backlogged or lost. The objective is to minimize the long-run average holding, penalty, and outdated costs. The optimal replenishment policy for these systems is notoriously complex and intractable in computation because of the curse of dimensionality. It has been shown in the literature that the class of base-stock policies, which maintains a constant inventory position in each period, performs poorly when the unit penalty cost is large. In this paper, we propose a more appealing class of projected inventory level (PIL) policies that maintains a constant expected on-hand inventory level at the time of each order arrival. For both backlogging and lost-sales systems under a general issuance policy, we prove that under a large class of demand distributions, the relative optimality gap of the best PIL policy goes to zero as the unit penalty cost goes to infinity. For the backlogging system, we further prove that the absolute optimality gap of the best PIL policy decays to zero exponentially fast in the product lifetime and in the demand population size under a large class of issuance policies. Our numerical study shows that the best PIL policy performs close to optimal and much better than the best base-stock policy.

Title: Taylor Approximation of Inventory Policies for One-Warehouse, Multi-Retailer Systems with Demand Feature Information

Presenter: Jingkai Huang, Zhejiang University

Co-author(s): Kevin Shang, Yi Yang, Weihua Zhou, Yuan Li

Abstract:

We consider a distribution system in which retailers replenish perishable goods from a warehouse, which, in turn, replenishes from an outside source. Demand at each retailer depends on exogenous features and a random shock, and unfulfilled demand is lost. The objective is to obtain a data-driven replenishment and allocation policy that minimizes the average inventory cost per time period. The extant data-driven methods either cannot guarantee a feasible solution for out-of-sample feature observations or generate one with excessive computational time. We propose a policy that resolves these issues in two steps. In the first step, we assume that the distributions of features and random shocks are known. We develop an effective heuristic policy by using Taylor expansion to approximate the retailer's inventory cost. The resulting solution is closed-form, referred to as Taylor Approximation (TA) policy. We show that the TA policy is asymptotically optimal in the number of retailers. In the second step, we apply the linear quantile regression and kernel density estimation to the TA solution to obtain the data-driven policy called Data-Driven Taylor Approximation (DDTA) Policy. We prove that the DDTA policy is consistent with the TA policy. A numerical study shows that the DDTA policy is very effective. Using a real data set provided by Fresh Hema, we show that the DDTA policy reduces the average cost by 11.0% compared to Hema's policy. Finally, we show that the main results still hold in the cases of correlated demand features, positive lead times, and censored demand.

Title: Stochastic Multi-Armed Bandits: Optimal Trade-off among Optimality, Consistency, and Tail Risk

Presenter: Feng Zhu, Massachusetts Institute of Technology

Co-author(s): David Simchi-Levi, Zeyu Zheng

Abstract:

We study the trade-off between expectation and tail risk for regret distribution in the stochastic multi-armed bandit problem. We fully characterize the interplay among three properties for policy design: worst-case optimality, instancedependent consistency, and light-tailed risk. We show how the order of expected regret affects the decaying rate of regret tail probability for both the worst-case and instance-dependent scenario. Simple and novel policies are proposed to characterize the optimal regret tail probability for any regret threshold. Specifically, for any given $\alpha \in [1/2, 1)$ and $\beta \in [0, \alpha]$, each of our policies achieves a worst-case expected regret of $\tilde{O}(T^\alpha)$ (referred to as α -optimal) and an instance-dependent expected regret of $\tilde{O}(T^\beta)$ (referred to as β -consistent), while enjoys a probability of incurring an $\tilde{O}(T^\delta)$ regret ($\delta \geq \alpha$ in the worst-case scenario and $\delta \geq \beta$ in the instance-dependent scenario) that decays exponentially with a polynomial T term. Such decaying rate is proved to be best achievable. Moreover, we discover an intrinsic gap of the optimal regret tail rate under the instance-dependent scenario depending on whether the time horizon T is known a priori or not. Interestingly, when it comes to the worst-case scenario, this gap disappears. Finally, we extend our proposed policy design to (1) a stochastic multi-armed bandit setting with non-stationary baseline rewards, and (2) a stochastic linear bandit setting. Our results reveal insights on the trade-off between regret expectation and tail risk for both worst-case and instance-dependent scenarios, indicating that more sub-optimality and inconsistency lead to more light-tailed risk of incurring a large regret, and that knowing the planning horizon in advance can make a difference on alleviating tail risks.

Best Student Paper Award II**Day 1: 5th Jan (Fri) 15:40-17:00 Venue: 1104****Session Chairs: Xiangtong Qi, The Hong Kong University of Science and Technology
Xuan Wang, The Hong Kong University of Science and Technology****Title: Treatment Planning of Victims with Heterogeneous Time-Sensitivities in Mass Casualty Incidents**

Presenter Yunting Shi, Shanghai Jiao Tong University

Co-author(s): Nan Liu, Guohua Wan

Abstract:

The current emergency response guidelines suggest giving priority of treatment to those victims whose initial health conditions are more critical. While this makes intuitive sense, it does not consider potential deterioration of less critical victims. Deterioration may lead to longer treatment time and irrecoverable health damages, but could be avoided if these victims were to receive care in time. Informed by a unique timestamps dataset of surgeries operated in a field hospital set up in response to a large-scale earthquake, we develop scheduling models to aid treatment planning for mass casualty incidents (MCIs). A distinguishing feature of our modeling framework is to simultaneously consider victim health deterioration and wait-dependent service times in making decisions. We identify conditions under which victims with a less critical initial condition have higher or lower priority than their counterparts in an optimal schedule—the priority order depends on victim deterioration trajectories and the resource (i.e., treatment time) availability. A counterfactual analysis based on our data shows that adopting our model would significantly reduce the surgical makespan and the total numbers of overdue and deteriorated victims compared to using the then-implemented treatment plan; dynamic adjustment of treatment plans (if a second batch of victims arrive) and care coordination among surgical teams could further improve operational efficiency and health outcomes. By demonstrating the value of adopting data-driven approaches in MCI response, our research holds strong potentials to improve emergency response and to inform its policy making.

Title: On the Design of Consistent and Fair Allocation Policies for Resource Pooling Systems

Presenter: Piao Hu, The Hong Kong University of Science and Technology

Co-author(s): Guodong Lyu, Chung-Piaw Teo

Abstract:

A key challenge in many resource pooling systems is to find an “efficient” resource allocation policy that is “fair” to all involved. In this paper, we address this fundamental problem in which the operator uses a centralized pool of resources to serve multiple agents with stochastic demands, with efficiency measured by (minimizing) the total squared shortfalls (between demand and allocation) among the agents, while satisfying (i) the service level requirements of each agent to ensure individual allocation fairness, and (ii) the consistency requirement to ensure that the allocation will not be changed if only a subset of the agents participates in the pooling system. This notion is motivated by the stream of literature on the bankruptcy problem in game theory. Our model connects the extant literature in the latter to the resource pooling literature in supply chains.

We develop a class of interpretable optimal allocation policies – min-max shortfall policy – to fulfill efficiency, individual fairness, and consistency requirements. Moreover, the optimal allocation policy to our problem can be characterized in closed-form, in terms of randomized min-max shortfall policies. This allows us to solve stochastic resource allocation problems of considerable scale, using the tools of online convex optimization. Our approach compares favorably to the use of Shapley value in fair allocation problems, without the associated computational overheads.

We extend this technique to resource allocation problems in a two-sided setting (e.g., bipartite supply-demand networks), where individual fairness and consistency requirement is extended to the supply side (equitable resource utilization requirements). Extensive numerical experiments across various pooling systems, from classical bankruptcy problem to flexible manufacturing system, demonstrate the effectiveness of the proposed consistent and fair allocation policies.

Title: Multi-Armed Bandit Experimental Design: Online Decision-Making and Adaptive Inference

Presenter: Chonghuan Wang, Massachusetts Institute of Technology

Co-author(s): David Simchi-Levi

Abstract:

Multi-armed bandit has been well-known for its efficiency in online decision-making in terms of minimizing the loss of the participants' welfare during experiments (i.e., the regret). In clinical trials and many other scenarios, the statistical power of inferring the treatment effects (i.e., the gaps between the mean outcomes of different arms) is also crucial. Nevertheless, minimizing the regret entails harming the statistical power of estimating the treatment effect, since the observations from some arms can be limited. In this paper, we investigate the trade-off between efficiency and statistical power by casting the multi-armed bandit experimental design into a *minimax multi-objective optimization problem*. We introduce the concept of *Pareto optimality* to mathematically characterize the situation in which neither the statistical power nor the efficiency can be improved without degrading the other. We derive a useful *sufficient and necessary condition* for the Pareto optimal solutions to the minimax multi-objective optimization problem. Additionally, we design an effective Pareto optimal multi-armed bandit experiment that can be tailored to different levels of the trade-off between the two objectives. Moreover, we extend the design and analysis to the setting where the outcome of each arm consists of an adversarial baseline reward and a stochastic treatment effect, demonstrating the robustness of our design. Finally, motivated by clinical trials, we examine the setting where the employed experiment must split the experimental units into a small number of batches, and propose a flexible Pareto optimal design.

Title: When to Push Ads: Optimal Mobile Ad Campaign Strategy under Markov Customer Dynamics

Presenter: Guokai Li, The Chinese University of Hong Kong, Shenzhen

Co-author(s): Pin Gao, Zizhuo Wang

Abstract:

Problem Definition: We investigate a seller's optimal advertising campaign strategy targeting customers who interact with the seller over time. We model customers' engagement as a continuous-time Markov chain with two states, active and inactive. While in the active state, customers make purchases according to a Poisson process, with each purchase yielding a specific reward; in contrast, customers in the inactive state make no purchases. The seller aims to optimize the expected average profit by promptly activating customers through costly advertising campaigns contingent on their purchase histories.

Methodology/Results: For the unconstrained problem, we demonstrate the optimality of a threshold policy based on the elapsed time since the last purchase or ad campaign. When confronted with a budget constraint on the overall ad cost, we suggest first solving a static problem and then implementing a separate threshold policy for each customer with a specified budget. We establish the asymptotic optimality of this policy and show that the asymptotic loss order is $O(1/\sqrt{T})$. Furthermore, we explore two extensions: strategic customer reactions and probabilistic customer activation. Despite these additional complexities, our main findings remain robust, yielding additional insights into these scenarios.

Managerial Implication: Our findings reveal that the seller tends to push ads earlier to customers with high purchase rates and low recapture rates (i.e., low transition rates from an inactive state to an active state). Surprisingly, we also observe that the seller should push ads earlier to customers with intermediate churn rates (i.e., intermediate transition rates from an active state to an inactive state) compared to those with small or large churn rates. Moreover, we propose an easy-to-implement and asymptotically optimal policy under budget constraints.

Parallel Session (A1) - Data-Driven Robust Optimization and Its Applications**Day 1: 5th Jan (Fri) 14:00-15:20 Venue: 2126D****Session Chair: Qinshen Tang, Nanyang Technological University****Title: Robust Optimization with Moment-Dispersion Ambiguity**

Presenter: Li Chen, University of Sydney

Co-author(s): Chenyi Fu, Fan Si, Melvyn Sim, Peng Xiong

Abstract:

We introduce the moment-dispersion ambiguity set enabling independent characterization of a random variable's central location, dispersion, and support. We propose the dispersion characteristic function and devise a process for constructing and integrating ambiguity sets. We also introduce the independence propensity hyper-parameter to foster joint ambiguity set creation for multiple random variables, facilitating varying independence characterization without needing a correlation matrix. Consequently, we develop safe tractable approximations for assessing risks linked with affine and convex piecewise affine cost functions over moment-dispersion ambiguity sets, accommodating varying risk tolerances. We conduct two numerical experiments to show the modelling flexibility.

Title: A Robust Satisficing Multi-Objective Optimization Approach for Bike-Sharing Systems with Heterogeneous User Types

Presenter: Qingxin Chen, Tianjin University

Co-author(s): Shoufeng Ma, Chenyi Fu, Ning Zhu, Qiao-Chu He

Abstract:

We study the heterogeneous users in bike-sharing systems, i.e., subscribers and general customers. And the different features of heterogeneous users yield service level and profits objectives in the system. However, jointly optimizing these objectives is challenging,

especially when demand is highly uncertain. To address these issues, we present a robust satisficing optimization model that jointly optimizes the service level and profits in bike-sharing systems under demand uncertainty. We derive a novel satisficing measure defined based on a fragility-based probability distance to minimize the violation risk of the targets. In addition, numerical experiments test the performance of our model.

Title: Data-Driven Pricing Analytics: A Perspective on the Bias and Variance Tradeoff

Presenter: Xun Zhang, Shanghai Jiao Tong University

Co-author(s): Ying Rong, Huan Zheng

Abstract:

This study aims to explore strategies for mitigating endogeneity problems in the context of pricing decisions with the goal of maximizing a retailer's expected revenue. In addition to the two sequential approaches, we introduce robust pricing models with parameter uncertainty sets, constructed using ordinary least squares estimation and the generalized method of moments. Leveraging duality theory, we emphasize the close relationship between robust pricing models and matching problems, providing insights into the trade-off between bias and variance in the pricing problem. Our numerical experiments provide solid evidence that our robust methods outperform the sequential approaches.

Title: The Analytics of Robust Satisficing: Predict, Optimize, Satisfice, then Fortify

Presenter: Qinshen Tang, Nanyang Technological University

Co-author(s): Melvyn Sim, Minglong Zhou, Taozeng Zhu

Abstract:

We present a unique approach to prescriptive analytics using robust satisficing techniques for optimal decisions amid risk ambiguity and prediction uncertainty. Our model uses a reward function with uncertain parameters predicted through side information. The prediction model's accuracy hinges on data-derived regression coefficient estimates. We set

a predict-then-optimize target, then solve a robust model reducing estimation uncertainty's impact. Supported by statistical evidence, we offer models for scenarios like saddle functions and two-stage linear problems. Case studies, such as wine investment and product pricing with real data, show our method surpassing traditional approaches, especially with limited data.

Parallel Session (A2) - Operations and Decision Analytics

Day 1: 5th Jan (Fri) 14:00-15:20 Venue: 2126A

Session Chair: Shining Wu, The Hong Kong Polytechnic University

Title: Bridging Adversarial and Nonstationary Multi-Armed Bandit

Presenter: Hailun Zhang, The Chinese University of Hong Kong, Shenzhen

Co-author(s): Ningyuan Chen, Shuoguang Yang

Abstract:

In the multi-armed bandit framework, there are two formulations that are commonly employed to handle time-varying reward distributions: adversarial bandit and nonstationary bandit. Although their oracles, algorithms, and regret analysis differ significantly, we provide a unified formulation in this paper that smoothly bridges the two as special cases. The formulation uses an oracle that takes the best action sequences within a switch budget. Depending on the switch budget, it turns into the oracle in hindsight in the adversarial bandit and dynamic oracle in the nonstationary bandit. We provide algorithms that attain the optimal regret with the matching lower bound. The optimal regret displays distinct behavior in two regimes.

Title: Data-Driven Robust Network Revenue Management

Presenter: Tao Zhang, The Hong Kong Polytechnic University

Co-author(s): Miao Song

Abstract:

We consider the canonical quantity-based network revenue management problem in which the decision maker accepts or rejects each arriving customer request irrevocably with the goal of maximizing the total expected revenue over a finite selling horizon given limited resources. Assuming that the demand distribution is mostly unknown, except for the availability of limited historical data, we develop a data-driven distributionally robust optimization model where the ambiguity set is constructed based on Wasserstein metric with the given data. We then extend the robust model to account for time dynamics. The experimental results confirm the value of the distributionally robust approach.

Title: Learning-Based Scheduling Rules for Multi-Class, Multi-Server Pools Queues

Presenter: Zhihao Li, The Hong Kong University of Science and Technology

Co-author(s): Jiheng Zhang, Rachel Q. Zhang, Shining Wu

Abstract:

We consider a queueing system with multiple server pools and customer classes. For each customer served, there is a reward associated with her class (endowed with a known context vector) and the server type, together with an unknown parameter that can be learned over time. We model the firm's problem as a linear contextual bandit problem with queueing features where the goal to find scheduling rules that strike a balance between exploration and exploitation and maximize the average net gain (rewards minus the waiting costs). We develop learning algorithms that are asymptotically optimal with regrets in the order of $O(\log(T))$.

Title: Learning to Simulate: Generative Metamodeling via Quantile Regression

Presenter: Qingkai Zhang, Fudan University

Co-author(s): L. Jeff Hong, Yanxi Hou, Xiaowei Zhang

Abstract:

Stochastic simulation models that capture the dynamics of complex systems are often too slow to run for real-time decision makings. Metamodeling techniques are often used to learn the relationship between a summary statistic, e.g., the mean or quantile, of the output and the inputs of the simulator, so that they can be used in real time. However, this requires prior knowledge of what summary statistic to use and is not flexible for many practical situations. In this paper we propose a new metamodeling idea called generative metamodeling. The goal is to create “a fast simulator of the simulator”, which can generate random outputs with a similar conditional distribution as the original simulation outputs but much faster, when the inputs are given. Once a generative metamodel is built, we may use it to generate a large amount of random outputs almost instantaneously after the inputs are specified, so that any summary statistic can be easily calculated for real-time decision makings. We also propose a quantile-regression-based generative metamodeling (QRGMM) algorithm, study its convergence and rate of convergence. An extensive numerical study is conducted to understand the empirical performance of the QRGMM algorithm, to compare it with other state-of-the-art generative algorithms, and to demonstrate its usefulness in practical real-time decision makings.

Parallel Session (A3) - Analytics and Operations Management**Day 1: 5th Jan (Fri) 14:00-15:20 Venue: 2126B****Session Chair: Liang (Leon) Xu, Singapore Management University****Title: Data-Driven Shelf-Stock Allocation**

Presenter: Jia Zhao, University of Chinese Academy of Sciences

Co-author(s): Shuming Wang

Abstract:

We study a shelf-stock allocation problem under demand ambiguity, which decides the placement and stock-levels of commodities on shelves to maximize the expected profit. We develop a data-driven robust model leveraging a decision-dependent Wasserstein metric that incorporates the demand forecasts and captures the vertical-location effect. Given

locations, we develop a nested binary search for the shadow price and a closed-form optimal stock, leveraging a supergradient-based KKT condition. Furthermore, the optimal location can be determined by an improved L-shaped decomposition with a derived supergradient. Finally, impacts of ambiguity-aversion on the marginal expected profit, shadow price, and optimal stocking are presented.

Title: Appointment Scheduling with Same-day Patient Re-entrance

Presenter: Haolin Feng, Sun Yat-sen University

Co-author(s): Michelle Alvarado, Sailesh Konda, Mark Lawley

Abstract:

We study the problem of appointment scheduling in outpatient clinics with stochastic patient re-entrance, motivated by Mohs Micrographic Surgery (MMS) for skin cancers. Re-entrance occurs when a patient repeats upstream processes during a single-day outpatient appointment, typically after a medical test. The number of re-entrances for each patient is unknown and revealed over time, posing challenges to scheduling. We develop a stochastic slot model, SMART, that captures the key characteristics of the appointment processes and stochastic re-entrance. We then design a scheduling algorithm that balances patient waiting, clinic overtime, and patient throughput, while considering stochastic complications.

Title: Proactive Policing: A Resource Allocation Model for Crime Prevention with Deterrence Effect

Presenter: Yue Zhao, National University of Singapore

Co-author(s): Long He, Xiaobo Li

Abstract:

This study proposes a proactive, cost-minimizing model for police resource allocation that deters crime across various locations. Employing a multinomial logit model, we evaluate how police presence affects crime location choices, shedding lights on the concepts of crime control diffusion and crime displacement. The paper connects criminology and economics,

examines the model's structural aspects, and suggests practical solution methods using optimization software. The model's effectiveness is demonstrated through a case study on New York City's surveillance camera allocation.

Title: Auto-Replenishment with Human Oversight: Evidence from a Field Experiment

Presenter: Liang (Leon) Xu, Singapore Management University

Co-author(s): Shuming Wang, Meng Li

Abstract:

We conducted a randomized field experiment where an auto-replenishment system was implemented in 20 stores, with 20 others as controls. The system recommends orders but allows managers to override. Despite managers routinely deviates, the system improves service levels by 4.3% without raising overall inventory. While the system is believed to be more value-added for popular items as they account for 80% of sales, its value for these items is discounted due to managers' deviation. Instead, managers tend to adhere to the recommendations for non-popular items due to the challenging nature of managing inventory slow-moving items.

Parallel Session (A4) - Prescriptive Analytics in Socially Responsible Operations

Day 1: 5th Jan (Fri) 14:00-15:20 Venue: 2126C

Session Chair: Guodong Lyu, The Hong Kong University of Science and Technology

Title: Design for Human-Machine Complementarity: SKU Rationalization in Food Bank

Presenter: Hailong Sun, Shanghai Jiao Tong University

Co-author(s): Mabel Chou, Victor Fernandes, Peng Liu, Chung-Piaw Teo, Lu Zhou

Abstract:

We study how to rationalize the stock-keeping unit (SKU) of products in a local food bank to improve operational efficiency, and how this affects the magnitude of Human-Machine complementarity. We conduct experiments to evaluate the classification errors in the SKU recognition task performed by Human and Machine. We also employ a Bayesian model to combine the power of Human and Machine to improve performance. Our experimental results show that Human performs best under an intuitive and simple design, but the collaboration between the AI-based image recognition system and experiment participants reaps much more benefits under more complex designs.

Title: Cost-Effectiveness of a Network of Lethal Ovitrap for the Prevention and Control of Dengue Fever

Presenter: Yvonne Huijun Zhu, National University of Singapore

Co-author(s): Joel Goh, Joel Aik, Shuzhen Sim

Abstract:

We analyze the system-level cost-effectiveness of a network of lethal ovitraps for Dengue control. Benefits are modeled using an age-stratified multiple-infection epidemiological model and measured as reductions in disability-adjusted-life-years (DALYs). We estimate labor costs by modeling the workload needed for periodic maintenance of the traps via Traveling Salesmen Problems (TSPs).

Title: Process Flexibility: A Distribution-Free Approach to Long Chain Resilience

Presenter: Qinghe Sun, The Hong Kong Polytechnic University

Co-author(s): Li Chen, Mabel Chou

Abstract:

Process flexibility has been a well-established supply chain strategy in both theory and practice that enhances responsiveness to demand uncertainty. We extend its scope to supply disruption mitigation by analyzing a long chain. We investigate the effectiveness of

long chains in the face of random supply disruption under ambiguous demand and derive a closed-form, tight bound on the ratio of its expected sales relative to that of a fully flexible system. To comprehensively handle supply disruption and demand ambiguity, we introduce a moment decomposition approach that easily adapts to general piecewise polynomial performance metrics, such as the type-I service level.

Title: Closed-Form Robust Base-Stock Policy for Independent Demands

Presenter: Sheng Bi, Shanghai University of Finance and Economics

Co-author(s): Songchen Jiang, Zhaolin Li, Chung-Piaw Teo, Min Huang

Abstract:

We study the stationary base-stock policies for a multi-period inventory system with independent but non-identically distributed demands considering constant lead times. Given the unknown demand distributions, we explore the distributionally robust optimization model and introduce a distribution-free method involving a zero-sum game to derive a closed-form solution utilizing only the first two moments of demand. By characterizing the steady-state equilibrium, we establish the equal range property for non-identical distributions and show the influence of lead time on the robust stock policy adopted by the firm. The optimal solution enhances computational efficiency and renders it applicable to a diverse of inventory problems. Specifically, we apply the distribution-free method to the dual-sourcing inventory problem, deriving a closed-form solution for the robust tailored base-surge (TBS) policy. Our closed-form solution effectively explains how the TBS policy addresses uncertain demand by leveraging regular supplier tracking for mean values, while concurrently deploying emergency suppliers to mitigate volatility. Finally, we present empirical evidence using real data from a multinational food manufacturer, demonstrating the favorable performance of our proposed solution relative to other distribution-based or distribution-free benchmarks.

Parallel Session (A5) - Frontiers of Analytics with Applications**Day 1: 5th Jan (Fri) 14:00-15:20 Venue: 2127A****Session Chairs: Philip Renyu Zhang, The Chinese University of Hong Kong
Puping Jiang, Shanghai Jiao Tong University****Title: Gig or Employee? Platform's Joint Staffing and Pricing Decisions Under Hybrid Labor Mode**

Presenter: Xuyan Xin, Fudan University

Co-author(s): Jiayi Yu, Tianjun Feng

Abstract:

On-demand platforms are hiring both full-time employees and part-time gig workers to provide service in some novel settings. In order to understand operational strategies that platforms should adopt when managing hybrid labor force, we consider a two-period model where platform serves the uncertain consumer demand through the use of employees and gig workers. Our findings indicate that platform tend to opt for hybrid-staffing when both salary of employees and labor pool size of gig workers are at moderate level, and under hybrid-staffing, gig workers may be utilized as “top-off” in high demand state or “dual” in both demand states.

Title: Discount Signalling When Customers Search

Presenter: Yi Chen, The Hong Kong University of Science and Technology

Co-author(s): Jing Dong, Fanyin Zheng

Abstract:

Promotions are ubiquitous in online retailing and influence the markets profoundly. The platform can choose to either display the promotions at homepage directly or hide such information so that customers can only reveal them after clicking the links of specific products. We use a large-scale dataset that contains detailed individual level data to

estimate a simultaneous search model where customers search for promotions and we find that the search cost is considerable. In counterfactual analysis, we show that when no-purchase option and search behaviour exist, hiding promotions harms the total market shares of purchase. However, it is possible to increase the revenue by hiding the promotions of some low-profitable products. We also propose an easy-to-implement policy to determine which promotions should be hidden.

Title: Unintended Impact of Initial Prescribing in Hypnotics Abuse

Presenter: Manqi Li, Renmin University of China

Co-author(s): Xiang (Charlie) Cheng, Yan Huang

Abstract:

Hypnotics misuse is a severe global problem. We discover the causal impact of initial prescribing on long-term outcomes. We ask how physician's decision is affected by historical prescriptions and what are the underlying mechanisms. We propose three structural models representing physician decision behaviour, where physicians make decisions based on 1) solely the inferred health state, 2) a combination of previous dosage and the inferred state, or 3) a Bayesian updated inferred state. We then quantify the effect of prescribing additional dosage in the initial visit. We stress the need for careful decisions in the early stage of the treatment.

Title: When A Platform Competes with Third-Party Sellers in Networked Markets: A Revenue Management Perspective

Presenter: Hongfan (Kevin) Chen, The Chinese University of Hong Kong

Co-author(s): Hai Wang

Abstract:

We consider a platform marketplace with both third-party and first-party sellers. The platform charges commissions to third-party sellers and buyers for transactions in the marketplace. Meanwhile, it also directly determines transaction prices for first-party sellers

in their sales to buyers. Sellers and buyers are divided into different types with the compatibility captured by a bipartite network. Different types of sellers and buyers are heterogeneous in their cost and utility functions. Given the platform's decisions on prices and commissions, buyers/third-party sellers maximize their own payoffs from demanding/supplying products, and market-clearing conditions are satisfied in the networked market. Facing the complexity with non-convex equilibrium constraints in the networked market, we develop a convex optimization formulation for the platform's profit-optimal price-commission vector. Moreover, we characterize how the platform's profit-optimal price-commission decision depends on the network structure featured by complement and substitution of agents' trading relation in the marketplace. We also establish the impact of network structure on the equilibrium trading quantities in the platform's profit-optimal equilibrium implementation. Besides this, under fairness consideration between the platform and its market participants, we develop an efficient (1-epsilon)-approximation algorithm to obtain a price-commission profile under which a fair allocation of surplus between the platform and its market participants is guaranteed in the equilibrium trades. Lastly, we shed light on how the platform should optimally introduce additional first-party sellers into the networked market.

Parallel Session (A6) - Recent Development in Stochastic Simulation

Day 1: 5th Jan (Fri) 14:00-15:20 Venue: 2127B

Session Chair: Guo Liang, Renmin University of China

Title: First-stage Sampling in Ranking and Selection: Beyond Variance Estimation

Presenter: Xuewen Li, Tongji University

Co-author(s): Weiwei Fan, Jun Luo, Shing Chih Tsai

Abstract:

The ranking-and-selection (R&S) problem seeks to select the best system among a finite set of stochastic systems. The R&S procedure often conducts a first-stage sampling to estimate the unknown variances of systems. Emphasizing the impact of the first-stage sample size

n_0 beyond variance estimation, we depict the relationship between the achieved probability of incorrect selection and n_0 for indifference-zone-free (IZ-free) procedures, and successfully design the improved procedure. Furthermore, we extend our approach to a more universally applicable setting, incorporating multiple updating time points that are exogenously identified. We illustrate this enhancement through the example of new pharmaceutical development.

Title: A Unified Framework for Nested Estimation Based on Smoothing Approaches

Presenter: Nifei Lin, Fudan University

Co-author(s): Yingda Song, L. Jeff Hong

Abstract:

Nested estimation refers to the problem of estimating the expectation of a function of conditional expectation. In this research, we propose a unified framework for nested estimation when the conditional expectation is smooth. In particular, we propose to decouple the estimation task into an inner-level approximation stage and an out-level simulation stage, where the inner-level stage can accommodate commonly used smoothing techniques, including kernel smoothing, stochastic kriging, kernel ridge regression, and neural networks. Furthermore, we analyse the asymptotic properties of the proposed estimators, and demonstrate the superiority of our approach in estimating popular risk measures including VaR and CoVaR.

Title: A Double Sample-Recycling Approach to Finite Difference Method

Presenter: Guo Liang, Renmin University of China

Co-author(s): Guangwu Liu, Kun Zhang

Abstract:

The estimation of stochastic gradients plays a crucial role in fields such as service systems in operations research. The finite difference approximation is a classical method for this estimation, involving the generation of samples at perturbed inputs. However, determining

the perturbation and obtaining a finite difference estimator with an optimal convergence rate of its mean squared error remain challenging in practice. To tackle this problem, we propose a double sample-recycling approach in this paper. Firstly, pilot samples are recycled to derive the optimal perturbation. Secondly, recycling these pilot samples again and generating new samples based on this perturbation, lead to an efficient finite difference estimator. We also establish the asymptotic analyses of the perturbation and the proposed estimator, showing that the estimator's mean squared error can achieve its optimal convergence rate. In numerical experiments, we apply the estimator in several examples, and numerical results demonstrate its robustness, as well as coincidence with the theory presented.

Parallel Session (A7) - Robust Choice Model and Pricing

Day 1: 5th Jan (Fri) 14:00-15:20 Venue: 2127C

Session Chair: Zhi Chen, The Chinese University of Hong Kong

Title: Discrete Choice Models with Ambiguity Aversion: Product Line Pricing and Competition

Presenter: Qi Cheng, University of Science and Technology of China

Co-author(s): Jingwen Lin, Yimin Yu

Abstract:

We study the robust multiproduct pricing problem under a general utility-based discrete choice model. The customer preference is given as a multiplier preference with a relative entropy penalty. We show that an ambiguity-averse seller overestimates the purchasing probability of products with small profit margins compared with an ambiguity-neutral seller, leading to lower prices. Furthermore, we consider a multinomial logit model as a reference distribution. We provide an explicit solution for optimal prices, and our results recover the constant markup property. We also consider generalized extreme value models with constant price sensitivities and show that the adjusted markup is constant.

Title: Mitigating Misspecification for Approximate Incentive-Compatible Pricing

Presenter: Feng Liu, University of Chinese Academy of Sciences

Co-author(s): Zhi Chen, Shuming Wang

Abstract:

This paper delves into the monopolistic robust pricing problem, where we have access to both the mean and variance of buyer's valuation distribution. From the buyer's standpoint, we embrace the framework of approximate incentive-compatibility, allowing the buyer to be an imperfect optimizer. On the seller's side, we assume a misspecification-averse stance, acknowledging the potential inaccuracies in the estimated mean and variance. Focusing on the set of deterministic mechanisms, we derive a closed-form hence easily computable solution for the model. Through extensive simulation results, we illustrate the encouraging value of both approximate incentive-compatibility and misspecification.

Title: Learning Mixed Multinomial Logits with Provable Guarantees and its Applications in Multi-Product Pricing

Presenter: Limeng Liu, Nanyang Technological University

Co-author(s): Yiqun Hu, David Simchi-Levi, Zhenzhen Yan

Abstract:

A mixture of multinomial logits (MMNL) generalizes the multinomial logit model. Built on the Frank-Wolfe (FW) method, we propose a new algorithm that learns both mixture weights and component-specific logit parameters with provable convergence guarantees for an arbitrary number of mixtures. We further provide a sample complexity analysis to show that only a polynomial number of samples is required to secure the performance guarantee of our algorithm. Finally, we apply the learned MMNL to data-driven multi-product pricing problems.

Title: Randomized Assortment Optimization

Presenter: Zhengchao Wang, Imperial College Business School

Co-author(s): Heikki Peura, Wolfram Wiesemann

Abstract:

In this paper, we introduce the concept of randomization into the robust assortment optimization literature. We show that the standard approach of deterministically selecting a single assortment to offer is not always optimal in the robust assortment optimization problem. Instead, the firm can improve its worst-case expected revenues by selecting an assortment randomly according to a prudently designed probability distribution. We demonstrate this potential benefit of randomization both theoretically in an abstract problem formulation as well as empirically across three popular choice models: the multinomial logit model, the Markov chain model, and the preference ranking model.

Parallel Session (A8) - Modern Optimization Algorithm

Day 1: 5th Jan (Fri) 14:00-15:20 Venue: 2128A

Session Chair: Mingyang Fu, National University of Singapore

Title: Efficient Importance Scenario Generation for Optimization with Rare Events

Presenter: Anand Deo, Indian Institute of Management, Bangalore

Co-author(s): Karthyek Murthy

Abstract:

Scalable approaches for solving optimization formulations involving tail risks have remained elusive, due to the large number of samples needed to witness the relevant rare scenarios in the corresponding sample approximations. We exhibit a procedure for generating importance scenarios which overcomes these challenges by producing scenario approximations with low variance, applicable for a wide variety of optimization objectives, including those modelled with algorithmic feature-mapping tools. We demonstrate both in

theory and numerically, that the obtained variance reduction results in an exponential reduction in the the number of scenarios needed for approximating objectives formulated in terms of rare events.

Title: The Circular Balancing Problem

Presenter: Michael Pinedo, New York University

Co-author(s): Myungho Lee, Kangbok Lee

Abstract:

We consider a balancing problem with a minmax objective in a circular layout. This balancing problem involves the arrangement of an even number of items with different weights on a circle while minimizing the maximum total weight of items arranged on a half circle. Due to its generic structure it may have applications in a fair number of resource allocation schemes (e.g., workforce and shift scheduling). This problem is a generalization of the well-known cake cutting problem. We show the NP-Hardness of the problem and develop polynomial time algorithms when the number of distinct weights is a fixed constant. We also propose a tight $7/6$ approximation algorithm that is better than any existing one.

Title: Models and Algorithms for Cluster-Plus-Optimization

Presenter: Keliang Wang, University of Connecticut

Co-author(s): Leonardo Lozano, Mohsen Emadikhiav, David Bergman

Abstract:

Clustering analysis often guides a downstream decision-making problem. Traditionally, these two steps are processed independently, with a clustering algorithm (e.g., K-means) serving as a preliminary step which ignores how clustering results will be used in the downstream. We demonstrate that the isolated treatment leads to sub-optimal solution using one application in sports analytics: data-driven team formation in Daily Fantasy Sports. We introduce a Cluster-Plus-Optimization framework that enables joint clustering and solve of the ensuing optimization problems. We devise exact optimization algorithms

based on Benders' cuts which outperforms the baseline in terms of computational time and optimality gaps.

Title: Fourth-Order Marginal Moment Model: Reformulations and Applications

Presenter: Mingyang Fu, National University of Singapore

Co-author(s): Xiaobo Li

Abstract:

This paper studies the bounds on the expectation of combinatorial optimization, given moment information for each individual random variable. The conventional approach to solving this problem, known as the marginal moment model (MMM), is to reformulate it as a semidefinite program (SDP). In this paper, we further investigate the structure of MMM with up to fourth-order degree marginal moments and reframe them as second-order cone programs (SOCP). Moreover, we establish that this SOCP formulation is equivalent to a convex optimization problem on the convex hull of the feasible region of the original combinatorial optimization, presenting a closed-form expression for both the objective function and its derivative. These reformulations enable more efficient computation of the bounds and persistency value.

Building on this theoretical advancement, we explore two applications. First, we consider the project crashing problem, in which both the means and variances of activity durations can be controlled with effort. We demonstrate that the distributionally robust project crashing problem with up to fourth-order moment information can be reformulated as an SOCP or a convex minimization over a simple polytope. Numerical analysis reveals that MMM with fourth moment yields tighter bounds on expected delays and demands a significantly smaller budget than the 2-MMM model for a fixed delay guarantee. Second, we apply our reformulations to solve the distributionally robust newsvendor problem with moment information, extending the well-known Scarf's model. We derive several new closed-form solutions and numerically show that incorporating additional moment information can lead to better performance.

Parallel Session (A9) - New Challenges and Opportunities in the Digital Era and Platform Economic**Day 1: 5th Jan (Fri) 14:00-15:20 Venue: 2128B****Session Chair: Weihua Liu, Tianjin University****Yongtong Chen, Beijing Normal University****Title: Competition Between Two-Sided Logistics Platforms: Technology Investment in Service Providers**

Presenter: Shangsong Long, Tianjin University

Co-author(s): Weihua Liu, Tsan-Ming Choi, Chuanwen Dong

Abstract:

With advancements in information technology, smart logistics matching platforms have emerged. In addition to matching the needs of providers and consumers, many of these platforms enhance their competitiveness by supporting and investing in service providers (i.e., technology empowerment). Considering this special characteristic and based on a Hotelling model, this paper examines a two-sided duopoly market where the providers are multi-homing, and two smart logistics platforms, one of which has a higher smart level than the other, competes and makes strategic decisions on technology empowerment. We find platforms' technology empowerment decisions are related to their smart level and the commission ratio.

Title: Research on the Allocation of Carpooling Orders in Online Car-Hailing Platforms

Presenter: Qian Qiu, University of Science and Technology Beijing

Co-author(s): Rui Yan, Yuwen Chen, Baolong Liu, Yimiao Ni, Qiang Guo

Abstract:

Carpooling provides convenience and reduces emission, and also brings operational

challenges to car-hailing platforms in allocating orders and motivating drivers, car-hailing platforms usually need to subsidize drivers to participate in carpooling. We build G/M/1 queueing models to investigate the optimal operational decisions in order allocation and matching radius to ensure good experience for passengers and sufficient motivation for drivers. The platform includes two order dispatching systems: the assign and the inform system. The results show the structure of optimal carpooling orders allocations and the matching radius, and also demonstrate the equilibrium subsidy to balance the drivers' payoff in both systems.

Title: Data-Driven Optimal Deployment and Scheduling of Highway Emergency Rescue Resources

Presenter: Shuzhu Zhang, Zhejiang University of Finance and Economics

Co-author(s): Zhiyu Lu, Feng Qi

Abstract:

Highway emergency rescue is of critical importance to both the traffic smoothness and the road safety. The utilization of rescue resources could affect, even determine the performance of emergency rescue efficiency and responsiveness. In this research, we collect the practical traffic accident data in G60 highway, investigate the matching between traffic accident and rescue resources, and further formulate a mixed integer linear model aiming to determine optimal deployment and scheduling of rescue resources. The effectiveness of the proposed model is verified using Gurobi in small-scale instances. A new exact algorithm is further designed to handle the large-scale problems.

Title: Research on the Development Path of Government Public Data Open Platform from the Perspective of Data Asset

Presenter: Yongtong Chen, Beijing Normal University

Co-author(s): Wanqiang Wang, Huiyao Pan, Yuao Zhou

Abstract:

With the vigorous development of digital economy, the important role of data as the fifth production factor has gradually become more prominent. The process of data assetization continues to advance, among which the volume of public data is huge. The government public data open platform provides a practical basis for the assetization of public data. This article builds a public data open platform maturity evaluation model from the perspective of data asset, and conducts a comparative analysis and evaluation. Based on the results, a new path for the development of the public data open platform is proposed.

Title: Sustainable Supplier/Product Selection with Overlapping Criteria by Using CNLS Approaches

Presenter: William Chung, City University of Hong Kong

Co-author(s): Yong-Tong Chen

Abstract:

Sustainable supplier selection problems involve a set of sustainable criteria, which are classified into three sustainable development (SD) dimensions: environmental, social, and economic dimensions in a mutually exclusive way. In the selection process, one of the main tasks is assigning appropriate weighted scores to the criteria. However, several sustainable criteria are classified into different SD dimensions in the literature. For example, "green design" is classified into either the economic or environmental dimension, herein referred to as "overlapping criteria." In this study, we propose an approach to resolve this issue of overlapping criteria using the Convex Nonparametric Least Squares (CNLS) method.

Parallel Session (A10) - Management of Online Platforms

Day 1: 5th Jan (Fri) 14:00-15:20 Venue: 2128C

Session Chair: Jingqi Wang, The Chinese University of Hong Kong, Shenzhen

Title: Reducing Traffic Incidents in Meal Deliveries: Penalize the Platform or its Independent Drivers?

Presenter: Liu Ming, The Chinese University of Hong Kong, Shenzhen

Co-author(s): Yue Cheng, Wenchang Zhang, Christopher Tang

Abstract:

Traffic accidents related to meal deliveries are surging. This has led to ongoing debates about whether governments should hold platforms accountable for incidents that occur during deliveries and ensure driver safety. By analyzing a three-stage Stackelberg game, we establish the following results. (1) Imposing higher penalties on drivers for traffic incidents will lead drivers to travel faster and ultimately causing more accidents (2) Applying stricter penalties to the platform for traffic incidents will motivate drivers to travel at safer speeds. (3) The socially optimal policy penalizes only the platform for traffic violations and accidents, not the drivers.

Title: Navigating Live-streaming Commerce: A Tale of Two Strategies – Price Discounts and Short Videos

Presenter: Yue Cheng, Peking University HSBC Business School

Co-author(s): Chewei Liu, Wenchang Zhang

Abstract:

This study investigates the viewer engagement effects of price discounts and the use of non-pricing tools – short videos – in live-streaming commerce, aiming to provide valuable insights for brands and streamers seeking to optimize their marketing strategies. Utilizing a comprehensive dataset from TikTok (China), we underscore the importance of leveraging the power of short videos in terms of viewer engagement, since posting short videos can strengthen the connection with viewers and reduce their price sensitivity. Streamers also should be mindful of the potential drawbacks associated with excessive discounting in live-streaming commerce.

Title: Operating Three-sided Marketplace: Pricing, Spatial Staffing and Routing in Food Delivery Systems

Presenter: Yiwen Shen, The Hong Kong University of Science and Technology

Co-author(s): Zhe Liu, Yanwei Sun

Abstract:

We study a food delivery platform's joint pricing and staffing problem under endogenous participation of three sides: restaurants, customers and deliverers. Using a state-dependent queueing model, we study the system's equilibrium behaviors and obtain the platform's optimal pricing and spatial staffing decisions in an asymptotic regime. We show how optimal platform controls balance capacity utilization and service quality. We characterize the platform's impact on all three sides and show that the platform greatly improves the system efficiency. We find that it is important to account for the spatial effect as well as the participation decisions of all three sides.

Title: The Impact of Hospitals' Annual Award Display on Patient Consultations: Evidence from a Natural Experiment

Presenter: Jingqi Wang, The Chinese University of Hong Kong, Shenzhen

Co-author(s): Hao Wang, Yangzi Jiang

Abstract:

Leveraging an exogenous shock on Haodf, a prominent Chinese online medical platform, we design a natural experiment to explore how displaying the award sign influences the consultation volume in departments with different award status, including award-winning departments (AWD), non-awarded departments in hospitals with award (NAD), and departments in hospitals without any awards (NAH). To conduct a causal inference, we further obtain the consultation data from Chunyu to serve as the control group. Using the difference-in-differences approach, we find that after displaying the award sign, the consultation volume in AWD increases significantly, with no substantial change in NAD and NAH categories.

Parallel Session (A11) - Emerging Topics on Online Resource Allocation**Day 1: 5th Jan (Fri) 14:00-15:20 Venue: 2129A****Session Chair: Zhenzhen Yan, Nanyang Technological University****Title: Adaptive Neyman Allocation**

Presenter: Jinglong Zhao, Boston University

Abstract:

In this paper, we introduce a competitive analysis framework to study a multi-stage experimental design problem. We propose a simple adaptive Neyman allocation algorithm, which almost matches the information-theoretic limit of conducting experiments. Using online A/B testing data from a social media site, we demonstrate the effectiveness of our adaptive Neyman allocation algorithm, highlighting its practicality especially when applied with only a limited number of stages.

Title: Online Reusable Resource Assortment Planning with Customer-Dependent Usage Durations

Presenter: Tianming Huo, National University of Singapore

Co-author(s): Wang Chi Cheung

Abstract:

We study an adversarial online reusable resource assortment problem with customer-dependent usage durations. The decision maker offers assortments of the reusable resources to a sequence of online customers, with the aim to maximize the total revenue, subject to the respective resource constraints at all time. Our setting departs from existing works by allowing usage duration heterogeneity across customers. We propose a novel online algorithm featuring the notion of rejection durations, which serves to reserve capacities for future customers. We show that with large capacities, our algorithm achieves a competitive ratio within a constant factor of the best possible one.

Title: Sample-Based Online Generalized Assignment Problem with Unknown Poisson Arrivals

Presenter: Zihao Li, Nanyang Technological University

Co-author(s): Hao Wang, Zhenzhen Yan

Abstract:

We study an edge-weighted online stochastic Generalized Assignment Problem with unknown Poisson arrivals. We provide a sample-based multi-phase algorithm by utilizing both pre-existing offline data (named historical data) and sequentially revealed online data. We establish its parametric performance guarantee measured by a competitive ratio. We further provide a guideline on fine tuning the parameters under different sizes of historical data based on the established parametric form.

Title: Constant Approximation for Network Revenue Management with Markovian Correlated Customer Arrivals

Presenter: Jiashuo Jiang, The Hong Kong University of Science and Technology

Abstract:

We present a Markovian model for correlated customer arrivals in the NRM problem and provides a new LP approximation for solving the problem under this model. We use our LP to develop a new bid price policy, which computes bid prices for each system state and time period in a backward induction manner. The decision is then made by comparing the reward of the customer against the associated bid prices. Our policy guarantees to collect at least $1/(1+L)$ fraction of the total reward collected by the optimal policy, where L denotes the maximum number of resources required by a customer.

Parallel Session (A12) - Interface of OM and Marketing: Consumer Behaviour and Pricing**Day 1: 5th Jan (Fri) 14:00-15:20 Venue: 2129B****Session Chair: Yue Dai, Fudan University****Title: Dynamic Pricing and Service Fulfillment of Mobile Charging Systems with Stochastic Demands**

Presenter: Jie Yang, Tongji University

Co-author(s): Fang He, Zuo-Jun Max Shen, Xi Lin

Abstract:

This study investigates the joint pricing and service fulfillment of mobile charging systems. We model the platform-customer interaction with a Stackelberg game and explicitly characterize customers' optimal charging decisions under the platform's service plans. Leveraging the theoretical results, we design an augmented network to transform the platform's operations optimization into a variant of vehicle routing problems. To improve the framework's scalability, we explore a localized subproblem with concentrated demands. In this context, we propose a heuristic service strategy with performance guarantees. The analytical outcomes regarding the subproblem can be integrated into developing the general framework, boosting the presented algorithm's efficiency.

Title: Information Sharing and Personalized Pricing in Online Platforms

Presenter: Guo Li, Beijing Institute of Technology

Co-author(s): Yihong Hu, Mengqi Liu, Shengnan Qu

Abstract:

With the rise of big data technology, an online platform can easily gather customer information to engage in price discrimination and obtain additional profits. Whether to share information remains an unsolved strategy decision for the platform. We employ a

game-theoretic model to characterize the interplay of information sharing by the platform and the pricing strategies of two firms. We study scenarios where the two firms adopt either uniform or personalized pricing policies. We find that the seller always has incentives to acquire information, while the platform is not always willing to share information.

Title: Does Cost Increment Hurt the Supply Chain Members Facing the Consumer Fairness Concerns?

Presenter: Yuwen Du, Wuhan University

Co-author(s): Bin Dai, Yue Dai

Abstract:

The suppliers increase the retail prices to transfer the increment costs, however, it induces the inter-temporal fairness concerns among consumers. Whether to raise prices is still unknown in the multi-channel platform. Thus, we explore the interactions under agency selling (Strategy A), reselling (Strategy R) and Strategy AR. Results show that, consumer fairness concerns and increased cost harm both the supplier and platform under Strategy A. However, the increased product cost may benefit only the platform (supplier) under Strategy R (AR). Moreover, consumer fairness concerns could only benefit the supplier (both benefit the supplier and platform) under Strategy R (AR).

Title: Unifying or Discriminating: Competitive Pricing Strategies for Multi-Channel Retailers

Presenter: Yue Dai, Fudan University

Co-author(s): Kun Zhang, Gangshu (George) Cai

Abstract:

In a competitive environment with two multi-channel retailers, the pricing strategies are complicated by the heterogeneity of consumers and their crosschannel/cross-retailer purchasing behaviors. We construct a duopoly model with two multi-channel retailers for which consumers are heterogeneous in their brand preferences. We discover that retailers

tend to adopt the uniform pricing strategy at equilibrium when consumers' brand preferences are strong, while the dual pricing strategy is favored when the store assistance cost is high. The interaction of these two driving forces results in an asymmetric pricing equilibrium when brand heterogeneity is intermediate and the store assistance cost is relatively low.

Parallel Session (A13) - Stochastic Processes and Their Applications

Day 1: 5th Jan (Fri) 14:00-15:20 Venue: 2129C

Session Chair: Junfei Huang, The Chinese University of Hong Kong

Title: Staffing Multi-Server Queue with Hawkes Arrivals

Presenter: Kang Gong, The Chinese University of Hong Kong, Shenzhen

Co-author(s): Xinyun Chen

Abstract:

Motivated by clustering effect in arrivals to service systems, we investigate multi-server queues with Hawkes arrivals. We propose a novel asymptotic regime under which the limiting process is analytically attractive while captures the clustering effect in arrivals. In detail, we prove that when its base arrival rate and excitation kernel are properly scaled, the Hawkes process will converge to an Ornstein-Uhlenbeck process. Then, we derive diffusion approximation of the corresponding queueing process. As a direct application, the diffusion approximation leads to a new "safe" staffing rule for the queueing system in heavy-traffic. Our results show that the classic square-root rule is violated as the clustering effect leads to overdispersion in arrivals, and as a consequence, the safe staffing should follow the level of overdispersion. In addition to the theoretic analysis, we also carry out a set of numerical experiments to empirically verify the safe staffing rule for a variety of queueing models with Hawkes arrivals.

Title: Chance Constrained Program with Quadratic Randomness: A Unified Approach Based on Gaussian Mixture Distribution

Presenter: Zhaolin Hu, Tongji University

Co-author(s): Xiaochuan Pang, Shushang Zhu

Abstract:

This paper investigates the stochastic program with chance constraint on a quadratic form of random variables following multivariate Gaussian mixture distribution (GMD). It is proved that, under some mild conditions, the asymptotic distribution of this kind of quadratic randomness is a univariate GMD. It is further shown that by restricting the condition numbers of covariance matrices associated with the Gaussian components of the multivariate GMD, the underlying fitness error and the asymptotic approximation error can be reduced simultaneously. These findings help to translate a type of chance constrained program with quadratic randomness into a more tractable one, based on which an effective branch-and-bound (BB) algorithm that takes advantage of the special structure of the problem can be used to search an approximate global optimal solution. The rationality of the approximate global optimal solution and the complexity of the BB algorithm for searching it are explored, respectively. Some numerical simulations and an illustrative application are also conducted to verify the effectiveness of this unified approach.

Title: The Generalized c/μ Rule for Queues with Heterogeneous Server Pools

Presenter: Zhenghua Long, Nanjing University

Co-author(s): Hailun Zhang, Jiheng Zhang, Zhe George Zhang

Abstract:

We investigate optimal control in a queueing model with varied server pools, focusing on balancing queue holding and server operating costs. We introduce a target-allocation policy for general cost functions, proving its asymptotic optimality but noting complex implementation. For convex costs, a more concise Gc/μ dynamic priority policy is proposed, while concave costs favor a fixed priority approach. The research also develops hybrid routing policies, combining queue thresholds with server strategies, suitable for various

cost scenarios. These policies are validated through extensive simulations, demonstrating their effectiveness in practical applications.

Title: Maintaining Work-Life Balance While Completing A Task: A Stochastic Modelling Framework

Presenter: Zhengli Wang, The University of Hong Kong

Co-author(s): T. Li, J. Li

Abstract:

How should an individual maintain work-life balance while completing a task? This presentation provides a stochastic modelling framework to answer the above question. Specifically, we model an individual who wishes to complete a task. As the individual puts in more effort, the task becomes easier, but at the same time the individual becomes more fatigued, which may negatively impact performance. We characterize the optimal policy under certain interesting parameter regimes and illustrate how the individual can complete the task while maintaining work-life balance.

Parallel Session (A14) - Emerging Topics in Service Operations Management

Day 1: 5th Jan (Fri) 14:00-15:20 Venue: 2130A

Session Chair: Lijun Ma, Shenzhen University

Lianmin Zhang, Shenzhen Research Institute of Big Data

Title: The Value of Freedom-of-Pricing Strategy on Combating Deceptive Counterfeits under Dual-Channel

Presenter: Chaonan Zheng, Shanghai University of Finance and Economics

Co-author(s): Jing Chen, Hang Wei, Lei Xie

Abstract:

We use a hoteling model to study how a brand-name company utilizes the freedom-of-pricing strategy to combat deceptive counterfeits in a dual-channel game where the brand-name company sells a product through its direct channel and a licit retailer. We find that selling counterfeits provides the cost-saving force and the market-loss force which drive the retailer to increase and decrease the proportion of deceptive counterfeits respectively. The brand always gets a lower profit under the freedom-of-pricing strategy which implies the brand has no incentive to delegate the retailer the freedom of pricing in practice.

Title: Assortment Problem under MNL Choice Model

Presenter: Yajun Xiao, Shenzhen Research Institute of Big Data

Co-author(s): Kameng Nip, Lianmin Zhang

Abstract:

This study investigates the price distance effect on consumer choices in software-tiered pricing. It enhances our understanding of reference pricing, offering valuable insights for subscription-based businesses. The methodology uses unilateral and bilateral price distance formulations, and the findings provide practical implications for revenue maximization and consumer preference alignment in evolving markets.

Title: Alliance Formation in a Coproduct Supply Chain

Presenter: Yangyang Peng, Shenzhen Research Institute of Big Data

Co-author(s): Xiaoqiang Cai, Xiaolin Xu, Lianmin Zhang, Xin Wang

Abstract:

We study how the coproduct alliances are formed considering tradeoff between processing cost and mismatch ratio among heterogeneous retailers. We establish a stylized collaborative game model and study the existence of the core of the grand coalition. We find that when the processing cost is large and the market uncertainty is relatively small, or

when the processing cost is small and the market demand uncertainty is large, the centralized procurement is better for downstream retailers.

Title: Pricing and Quality Decisions for Standardized and Collaborative Services in a Home Health Care Service Platform

Presenter: Meiyang Lin, Shenzhen University
Co-author(s): Lijun Ma, Fanjie Yang, Weili Xue

Abstract:

Home health care service platforms (HHCSs) serve older consumers by gathering informal caregivers who offer standardized care services and/or collaborative care services. We develop an analytical model to study the service price and quality decisions given these four scenarios. We find that the HHCS and the informal caregiver's preferred scenarios align with which they can take the power of pricing. In most cases, the informal caregiver (HHCS) preferred scenario will more likely evolve from the $ICC(PLC)$ scenario to the $ICS(PLS)$ scenario as the informal caregiver becomes more efficient.

Parallel Session (A15) - Empirical Studies in Operations Management

Day 1: 5th Jan (Fri) 14:00-15:20 Venue: 2130B

Session Chair: Zhenyang Shi, BI Norwegian Business School

Title: Service Upgrade, Shopper Update: Implications of Adopting Third-Party Grocery Delivery on Inventory Management

Presenter: Jinjia Huang, National University of Singapore
Co-author(s): Stanley Frederick W. T. Lim, M. Serkan Akturk

Abstract:

Grocery delivery services provide consumers with the convenience to shop online without

the need to visit a local store. We use store-level transaction data from a U.S.-based grocery chain to examine the economic and operational implications for a traditionally offline grocery chain when it offers an online presence to its customers via a mobile app enabled by a third-party delivery platform. Employing a series of quasi-experiments that combine a difference-in-differences estimator with synthetic control approach, we document a significant sales dispersion effect at the grocery stores after the focal retailer launches an online presence. We explore implications on inventory management.

Title: The Impact of Collaboration Network Characteristics on High-Level Scholars' Research Performance in the Field of Quantum Information Technology

Presenter: Baohuan Zhou, University of Science and Technology of China

Co-author(s): Yundong Xie, Xiaoli Hu, Yaozong Zhu, Liang Liang

Abstract:

As a critical component of modern physics, quantum information technology represents a field with discernible thresholds. Evaluating the high-level scholars' research performance in this domain has emerged as a pivotal research focus. Unlike previous studies that examined the impact of collaboration networks on scholars' research performance from a single network perspective, this article explores how the characteristics of scholars' egocentric networks and team networks, within a two-tiered collaboration networks framework, influence the quantity and quality of research performance among high-level scholars. Our research methodology encompasses bibliometrics, social network analysis, and the machine learning infomap algorithm. Initially, we crawled 202,614 papers between 2000 and 2020 in the Web of Science Core Collection SCIE database as primary examples. Incorporating name disambiguation, 6,587 high-level scholars were gathered for collaborative network analysis. In the empirical analysis, we employed both linear regression models, and negative binomial regression models with fixed effects. To ensure the reliability of our results, we conducted a series of robustness tests. In terms of scholars' egocentric networks, occupying an intermediary or structural hole location positively affects scholars' research performance. From the team networks perspective, there is an inverted U-shaped relationship between team size and the quality of high-level scholars' research performance, with the tightness of the teams in which high-level scholars are

embedded contributing to the production of higher-quality research outputs. This new exploration of influencing factors relevant to scholars' collaboration networks and their research performance in this empirical analysis consolidates and broadens the findings of previous studies.

Title: Evaluating Delivery Service Impact on Retailer Engagement in E-Commerce Co-creation

Presenter: Yuxiao Liang, Josai University

Abstract:

This study investigates the impact of delivery service quality on retailer participation in value co-creation within China's EC market, focusing on Ali Group. Incorporating a mixed-methods approach, the research combines a survey of 100 diverse online retailers with in-depth case studies. Advanced statistical analysis through SPSS, supplemented by qualitative insights, highlights how logistics quality influences retailer engagement in e-commerce collaboration.

This work provides nuanced understanding of the delivery service-retailer interaction, revealing significant implications for fostering effective value co-creation in the dynamic landscape of the Chinese electronic commerce sector.

Title: The Spillover Effect of Cyberattacks Along Supply Chain

Presenter: Zhenyang Shi, BI Norwegian Business School

Co-author(s): Wenhong Ding, Wei Guan

Abstract:

Cyberattacks lead to firms' operation disruption, and data breach. We focus on the propagation of cyber risk along supply chain. Using a large sample of U.S. cyberattacks, we empirically document that cyberattacks on suppliers have a negative spillover effect on their major customers' financial performance. The influence is stronger when the customer is more dependent on the attacked supplier and when there are fewer substitutes of the

supplier. We also find that major customers are more likely to terminate the relationship with attacked suppliers, while the attacked suppliers tend to provide more trade credit to compensate for the customers.

Parallel Session (A16) - Simulation Optimization and Learning

Day 1: 5th Jan (Fri) 14:00-15:20 Venue: 2130C

Session Chair: Jun Luo, Shanghai Jiao Tong University

Weiwei Fan, Tongji University

Title: Steady-State Analysis and Online Learning for Queues with Hawkes Arrivals

Presenter: Xinyun Chen, The Chinese University of Hong Kong, Shenzhen

Co-author(s): Guiyu Hong

Abstract:

We investigate the long-run behavior of single-server queues with Hawkes arrivals and general service distributions and related optimization problems. In detail, utilizing novel coupling techniques, we establish finite moment bounds for the stationary distribution of the workload and busy period processes. In addition, we are able to show that, those queueing processes converge exponentially fast to their stationary distribution. Based on these theoretic results, we develop an efficient numerical algorithm to solve the optimal staffing problem for the Hawkes queues in a data-driven manner. Numerical results indicate a sharp difference in staffing for Hawkes queues, compared to the classic GI/GI/1 model, especially in the heavy-traffic regime.

Title: A Tree-based Continuous Simulation Optimization Procedure

Presenter: Jianzhong Du, University of Science and Technology of China

Co-author(s): L. Jeff Hong, Ying Zhong

Abstract:

In this work, tree-based procedures are proposed to solve continuous optimization via simulation (COvS) problems. The procedures search for the optimal solution by adaptively partitioning the design space and allocating more sampling efforts to the area where the optimal solution tends to lie. We establish different lower bounds on the minimax convergence rate for the optimization error when the objective function satisfies different local smoothness assumptions. Then we show that our procedures can solve these problems without necessarily knowing the objective function's smoothness condition and achieve the optimal minimax convergence rates. Numerical results show the procedures are efficient.

Title: Reinforcement Learning Algorithm for Reusable Resource Allocation with Time-Varying Reward

Presenter: Ziwei Wang, Peking University

Co-author(s): Jie Song, Jingtong Zhao, Yixuan Liu

Abstract:

We consider a problem where the platform must choose the price and type of resources for randomly arriving customers. During the rental period, the platform earns rewards from the rented product and aims to maximize its revenue over a finite horizon. Additionally, the expected reward varies throughout the rental time. Initially, the platform lacks knowledge about the distribution of reward and rental time and needs to learn them while making decisions. We first introduce an offline allocation method with a $1/2$ performance guarantee. Subsequently, we design a reinforcement learning algorithm to tackle the cold start problem, achieving sublinear regret against the offline benchmark.

Title: Reference Alternatives Based Knockout-Tournament Procedure for Ranking and Selection

Presenter: Ying Zhong, University of Electronic Science and Technology of China

Co-author(s): Jianzhong Du, Deng-Feng Li, Zhaolin Hu

Abstract:

The knockout-tournament procedure is an efficient procedure recently developed to solve large-scale ranking and selection problems. The procedure adopts a selection structure which is commonly used in many sports tournaments, and eliminates alternatives by conducting “matches” between paired alternatives round-by-round. To further improve the procedure’s performance, we propose a major modification of the procedure. In each round, before pairing the alternatives and conducting the matches, we first choose an alternative as the reference alternative and then add the reference alternative to each match. We compare our procedure with various procedures on different test examples and numerically justify our theoretical analysis.

Parallel Session (A17) - Supply Chain Management under Platform Economy**Day 1: 5th Jan (Fri) 14:00-15:20 Venue: 2131A****Session Chair: Jianbin Li, Huazhong University of Science and Technology****Title: Monotone Comparative Statics with Non-Lattice Structures and its Applications**

Presenter: Peng Hu, Huazhong University of Science and Technology

Abstract:

Comparative statics focus on how the optimal decisions or equilibrium outcomes vary with parameters such as income, wealth, labor efforts. It finds a number of applications in economics since Paul Samuelson, and recently gains more attentions in operations research. Nevertheless, these theoretic tools for deriving comparative statics predictions mainly rely on the lattice structure of the feasible set, which rules out even the budget constraint case, a simple and commonly used setting in microeconomic theory. To fill the gap, we in this study developed some new results on the monotone comparative statics when the feasible set is not a lattice in terms of decisions and parameters, and applied it to single resource allocation problems.

Title: Trade Credit and Bankruptcy Risk in Supply Chains: An Experimental Study

Presenter: Rihuan Huang, The Chinese University of Hong Kong, Shenzhen

Co-author(s): Andrew M. Davis, Kyle Hyndman

Abstract:

In practice, supply chain parties often have limited capital, requiring them to seek financing and bear bankruptcy risk. In this paper, we behaviorally investigate a trade credit contract between a supplier and a capital-constrained retailer, the latter of which may face bankruptcy risk. After the supplier proposes a wholesale price, the retailer purchases a quantity through trade credit if its initial capital is insufficient and repays the supplier after demand is realized. If demand is too low, the retailer goes bankrupt. Through a controlled-laboratory experiment with human participants, we investigate how a retailer's exposure to bankruptcy risk, which we vary through its initial capital, affects supply chain decisions and outcomes. We find that the presence of such bankruptcy risk leads to decisions that systematically differ when compared to a setting without bankruptcy risk. Our work demonstrates that the presence of bankruptcy risk for a retailer significantly alters supply chain decisions in systematic ways, which has direct consequences on profits.

Title: Cooperative Mechanism Design for a Gig Platform with Opportunity Cost Time Sensitivity

Presenter: Zhiying Tao, Wuhan Textile University

Abstract:

The gig economy enables a growing number of freelancers to participate in on-demand services, such as products delivered in the O2O takeout industry. Although most of the on-demand service platforms have developed their traditional employees, they rely strictly on freelancers to work as gig workers to complement their own delivery capacity. The platform should carefully design the order allocation mechanism between the traditional delivery capacity and the gig delivery capacity, as well as the traditional employee's salary strategy. We study how the platform encourages those heterogeneous delivery drivers to make the

"right choice" to match the platform's optimal profit under uncertain demand circumstances. We consider a newsvendor framework to model the uncertain demand and use the Expected Utility Theory to derive the heterogeneous drivers' choices. We derive the platform's optimal staffing policy which encourages the delivery drivers to make "the right choice" under two different order allocation mechanisms, the equal probability principle, and the fixed proportion principle. We also shed light on how the platform designs its order allocation mechanism under different market conditions.

Parallel Session (A18) - Contract and Information Design in Operations Management

Day 1: 5th Jan (Fri) 14:00-15:20 Venue: 2131B

Session Chair: Feng Tian, The University of Hong Kong

Title: Information Design for On-Demand Service Platform: A Queueing-Theoretic Approach

Presenter: Donghao Zhu, The Institute of Statistical Mathematics

Co-author(s): Stefan Minner, Martin Bichler

Abstract:

Information design in on-demand service platforms matters in applications such as taxi services, ride-hailing platforms, and freight exchanges. Displayed service delay information significantly affects platform revenues, leading users to balk or renege. User arrival rates depend on information policies and perceived matching probabilities in a model with multiple platforms. Queueing theory is applied to analyze information disclosure for revenue maximization in single- and double-sided queueing systems. Results reveal the preferred policy depends on arrival rate and system load. Considering long-term matching probability influence, information policy recommendations remain qualitatively the same, but revenue differences between policies increase.

Title: Paying for Long-Term Hospital Care: Contract Design under Dynamic Information Asymmetry

Presenter: Wei Zhang, Zhejiang University

Co-author(s): Youhua (Frank) Chen, Sergei Savin

Abstract:

Long-term care hospitals (LTCHs) serve post-acute patients for extended stays. The payment policy exhibits a sharp increase after a specific length-of-stay, "short-stay outlier" (SSO), is exceeded. As a result, LTCHs strategically retain the patients to pass the SSO to collect more reimbursement, causing a "magic day" effect. How should Medicare reform the contract to regulate LTCHs' strategic discharging behavior and optimize patient outcomes? We focus on designing such a new class of contract. We build a model where LTCHs can privately observe the patient's health condition process and control discharging decision responses to the Medicare's contract. (i) We characterize the optimal first-best and second-best contracts corresponding to the full information and asymmetric information regimes. The optimal second-best discharging policy belongs to a history-dependent cutoff type, and the optimal payment policy has a deferred payment structure. (ii) We offer managerial insights. The optimal second-best contract delays discharging patients, and such distortion persists even for the long-stayed patients. We construct a simple contract that depends on the patient's initial health condition and length of stay (LOS), implementing the second-best discharging policy when health condition follows the AR(1) process. (iii) We quantify the performance gaps between the optimal contract and three alternative contracts using real data. By highlighting role of the LTCHs' gaming behavior under dynamic information asymmetry, our work advances understanding of regulating LTCHs' strategic discharging.

Title: Will Spatial Pooling Solve Wild Goose Chase?

Presenter: Mingliu Chen, The University of Texas at Dallas

Co-author(s): Ming Hu

Abstract:

Wild Goose Chase is a phenomenon that may greatly hinder efficiencies in the ride-hailing context. A driver may drive a significant time for a pick-up but end up with a short ride. We propose implementing spatial pooling to improve operational efficiencies in such systems. In spatial pooling, drivers only pick up riders at certain locations instead of chasing them around the city. We show that the pooling mechanisms may greatly improve operational efficiencies. The benefits critically depends on the rider's disutility of traveling on foot, the service radius, and whether the platform can endogenize the demand.

Title: Information Design and Pay Mechanism in the Gig Economy

Presenter: Feng Tian, The University of Hong Kong

Co-author(s): Zhen Lian, Feifan Zhang

Abstract:

Conventional wisdom in ride-hailing suggests that disclosing trip details to drivers hurts the platform, as drivers become selective about trips ("cherry-picking"). Still, recent shifts in regulations and labor are nudging platforms towards more transparency for drivers. To understand its implications, we analyze a platform with two levers on drivers: the pay, and the transparency of this pay. The platform faces uncertain demand, characterized by multiple demand scenarios. We find that, surprisingly, revealing full information is optimal, providing that the pay is set properly in each scenario. However, if the platform cannot dynamically adjust the pay, then full information can backfire, worse than not sharing any information at all. Our results highlight the intricate relationship between the information policy and the driver pay in ride-hailing.

Parallel Session (A19) - Online Healthcare Platforms and Systems

Day 1: 5th Jan (Fri) 14:00-15:20 Venue: 2131C

Session Chair: Yixuan Liu, The Hong Kong Polytechnic University

Title: A Data-Driven Approach to Outpatient Appointment Scheduling with Heterogeneous Service Time

Presenter: Yiwu Jia, Sun Yat-sen University

Co-author(s): Haolin Feng, Siyi Zhou, Hongyi Chen, Teng Huang

Abstract:

Efficient appointment scheduling is crucial for outpatient clinics. The existing literature and practice involve classifying patients into pre-defined groups for appointment scheduling. However, extant classification rules fall short in accounting for the heterogeneous nature of the patients fully. We present a data-driven appointment scheduling framework, CPS (Cluster-Predict-Schedule), which leverages unsupervised and supervised machine learning. In the numerical experiments, we find a significant reduction in the cost of the clinic considering the patients' waiting time, physician idle time, and physician overtime. Our method can save about 15.0% compared to the baseline and 4.7% versus the best practices, ensuring fair access simultaneously.

Title: Foot in Both Camps: How Do Activities on Third-Party OHPs Affect Demand on Official OHPs?

Presenter: Heng Zhao, Tongji University

Co-author(s): Sijia Zhou

Abstract:

The purpose of this paper is to examine how doctors' service activities on third-party online healthcare platforms (OHPs) affect the number of their consultations on official OHPs. Utilizing empirical data obtained from a well-known third-party online consultation platform and a large comprehensive hospital (equipped with its official online healthcare platform), this study employs a two-stage Heckman selection model to validate the research hypotheses. Furthermore, the research findings are validated and enriched through robustness checks and following heterogeneity analysis. The results indicate that third-party OHPs should not be considered an obstacle to promoting official OHPs; instead,

doctors' activities on third-party OHPs increase the demand for doctors on official OHPs. In addition to the service quantity, the specific efforts, including the number of posts and medical summaries, and prescriptions on third-party OHPs, contribute to an increased number of their consultations on official OHPs. Besides, compared to less-trained doctors, the service efforts of higher-rank doctors on third-party platforms are expected to more effectively increase their consultations on official OHPs. In addition, we provide that this positive effect comes from a transfer mechanism instead of promotional mechanism. This contributes to policymakers and hospital administrators on how to promote and coordinate online services across multiple platforms and guide heterogeneous doctors in terms of job titles in their online service behaviors across these platforms. Additionally, it makes a theoretical contribution in the research on service providers' adoption and application of similar technologies across multiple platforms or channels.

Title: It Is Not for Advertising: The Impact of Medical Live Streaming on Online Medical Consultation

Presenter: Yixuan Liu, The Hong Kong Polytechnic University

Co-author(s): Mike Kee-Hung Lai, Xiaofei Zhang, Yixin Lu

Abstract:

Medical live streaming on online medical consultation (OMC) platforms bridges information gaps and addresses health disparities. While its impact on platform operations is ambiguous, it might clarify uncertainties for patients or encourage self-diagnosis. Our study in a quasi-natural experimental setting reveals that medical live streaming significantly increases patient consultations, primarily through match-up and knowledge-sharing effects. Contrasting with the typical advertising effect in standard live streaming, this influence is more subdued in a medical context. Further analysis explores the heterogeneity linked to live streaming characteristics and physician traits, enhancing understanding and providing insights for academics and practitioners.

Parallel Session (A20) - Sustainable Operations Management

Day 1: 5th Jan (Fri) 14:00-15:20 Venue: 2132A**Session Chair: Kai Pan, The Hong Kong Polytechnic University****Title: Sustainable Operations of Energy-Intensive Productions with Onsite Renewables**

Presenter: Neng Fan, University of Arizona

Abstract:

Energy resources are essential for the development of the human society in the industrialized world, while the energy-intensive productions account for a large portion of the total energy consumption. The renewable energy, such as wind and solar, is naturally replenished and has the potential to achieve net-zero emissions for production systems, although it is challenging because of its intermittencies. In this study, we develop sequential decision-making approaches under uncertainty, to operate production systems with onsite renewables integration. Several case studies will be discussed with the consideration of controllable loads, energy storage systems, grid islanding, and demand response programs.

Title: Data-Driven Chance-Constrained Planning for Distributed Generation: A Partial Sampling Approach

Presenter: Shiyi Jiang, The Hong Kong Polytechnic University

Co-author(s): Jianqiang Cheng, Kai Pan, Feng Qiu, Boshi Yang

Abstract:

The planning of distributed energy resources has been challenged by the significant uncertainties and complexities of distribution systems. One often employs chance-constrained programs to seek a feasible solution while minimizing certain costs. The traditional sample average approximation (SAA) is commonly used to represent uncertainties and reformulate a chance-constrained program into a deterministic optimization problem. However, the SAA introduces additional binary variables to indicate whether a scenario sample is satisfied and thus brings great computational complexity. In

this paper, we introduce a new paradigm, i.e., the partial sample average approximation (PSAA) using real data, to improve computational tractability. Our extensive experiments show that the PSAA approach performs better than the SAA because the former provides better solutions in a shorter time in in-sample tests and provides better guaranteed probability for system reliability in out-of-sample tests.

Title: A Computational Study on Power System Operations with a Single Type of Binary Variables

Presenter: Bin Tian, The Hong Kong Polytechnic University

Co-author(s): Kai Pan, Chung-Lun Li

Abstract:

The investigation of strong formulations with a single type of binary variables for unit commitment (UC) problems has been limited due to the difficulty of deriving strong valid inequalities to improve the tightness. This paper considers a compact formulation using a single type of binary variables and develops strong valid inequality families to enhance the tightness of the formulation. Conditions under which these strong valid inequalities serve as facet-defining inequalities for the UC polytope are provided. For those large-size valid inequality families, efficient separation algorithms for determining the most violated inequality are given.

Title: Carbon Tax vs. Carbon Cap-and-Trade: Implementation of Carbon Border Tax in Cross-Regional Production

Presenter: Jiawen Hua, Xi'an Jiaotong University

Co-author(s): Jun Lin, Kai Wang, Yanjun Qian

Abstract:

Carbon Tax and Carbon Cap-and-Trade policies, as the primary carbon pricing instruments, are designed to reduce greenhouse gas emissions. However, inconsistent global regulations for emissions may lead to emissions leakage, as firms strategically relocate production to

regions with less stringent controls. This study contributes to existing research by evaluating Carbon Tax and Carbon Cap-and-Trade policies in conjunction with the impending Carbon Border Tax (CBT), designed to mitigate emissions leakage from cross-regional production. Specifically, we examine a firm's equilibrium strategies in investment and production in both domestic and offshore regions under two different carbon pricing instruments while subject to the CBT. The analysis includes a comparative assessment of technology investment, total greenhouse gas emissions, and social welfare. Our findings indicate that the Carbon Tax policy can be associated with lower emission intensity, albeit generating greater total emissions compared to the Carbon Cap-and-Trade policy. Notably, the CBT can serve as an equivalent stimulant for technological investment and a reducer of aggregate emissions under both pricing instruments. Moreover, the Carbon Cap-and-Trade policy proves more beneficial in terms of social welfare when the firm's optimal strategy is confined to either domestic or offshore production. Conversely, the Carbon Tax policy yields higher social welfare in cases of high emission tax rates when the firm's optimal strategy is cross-regional production. The introduction of the CBT enlarges the set of conditions under which the Carbon Tax policy proves more advantageous for social welfare.

Parallel Session (A21) - Decision Making in Sustainable Operation

Day 1: 5th Jan (Fri) 14:00-15:20 Venue: 2132B

Session Chair: Ruijiu Mao, National University of Singapore

Title: Information Disclosure for Perishables: Profit and Food Waste Implications

Presenter: Fan Zhou, University of Michigan

Co-author(s): Ekaterina Astashkina, Ravi Anupindi

Abstract:

In online grocery retail, produce freshness varies and is often not visible to consumers. We build a game-theoretical model to examine the effects of freshness visibility on profitability and household waste. We show that visible freshness generally leads to increased household waste due to sellers' improved pricing flexibility, boosting sales. Profitability

from visible versus invisible freshness hinges on a trade-off: while visibility expands sales and profits, it also increases waste, reducing consumer valuation and potentially harming profits. The positive impact on profits is dominant when the product has a low cost-value ratio and/or a lower rate of food perishability.

Title: Data-Driven Demand Forecasting for Rush Repair Spare Parts of Power Equipment

Presenter: Minfang Huang, North China Electric Power University

Co-author(s): Xiangpei Hu, Yanxin Wang

Abstract:

Aiming at the characteristics of intermittence, urgency and randomness of rush repair spare parts demand for power equipment, we propose a data-driven demand forecasting method based on scenario analysis and adaptive-network-based fuzzy inference system. Firstly, we analyze the factors affecting the demand of rush repair spare parts. The decision scenario, including disaster-causing factors, disaster-bearing bodies, disaster-pregnant environment, is defined and the scenario evolution model is established. Then we combine the ANFIS with expert experience to realize the prediction of rush repair spare parts demand. Finally, numerical analysis is conducted by using the historical demand data from a power grid company.

Title: Regularized Convex Regression: A Data-Driven Method for Energy Regulation

Presenter: Zhiqiang Liao, Aalto University

Co-author(s): Sheng Dai, Eunji Lim, Timo Kuosmanen

Abstract:

Estimating unknown convex regression functions from data has been a topic of research in various fields, including operations research, economics, and statistical learning. In this paper, we focus on the overfitting problem in convex regression. We show that the estimator is inconsistent and its subgradients are unbounded at the boundary, hence

resulting in overfitting. We propose two regularized convex regression methods to reduce overfitting. We investigate the statistical properties of both methods. The proposed approaches are further applied to benchmark the operations efficiency of Finnish electricity distribution companies.

Title: From Curtailed Renewable Energy to Green Hydrogen: Infrastructure Planning for Hydrogen Fuel-Cell Vehicles

Presenter: Ruijiu Mao, National University of Singapore

Co-author(s): Long He, Nan Ke, Wei Qi, Hongcai Zhang

Abstract:

Hydrogen fuel-cell vehicles (HFVs) have been proposed as a promising green transportation alternative. For regions suffering renewable energy curtailment, promoting HFVs can achieve the dual benefit of reducing curtailment and developing sustainable transportation. However, promoting HFVs faces several major hurdles, including uncertain vehicle adoption, the lack of refueling infrastructure, the spatial mismatch between hydrogen demand and renewable sources for hydrogen production, and the strained power transmission infrastructure. In this paper, we address these challenges and study how to promote HFV adoption by deploying HFV infrastructure and utilizing renewable resources. We formulate a planning model that jointly determines the locations and capacities of hydrogen refueling stations and hydrogen plants, as well as electricity transmission and grid upgrade. Despite the complexity of explicitly considering drivers' HFV adoption behavior, the optimization model can be reformulated as a tractable mixed integer second-order cone program. We apply our model calibrated with real data to the case of Sichuan, a province in China with abundant hydro resources and a vast amount of hydropower curtailment. We obtain three findings: (i) The optimal deployment of hydrogen refueling stations displays vastly different spatial patterns depending on the HFV adoption target. The capital city, a transportation hub, should actually be excluded from the plan under a low target, but emerge as the center of HFV adoption under a high target. (ii) Promoting the HFV adoption can overall help reduce hydropower curtailment, but the effectiveness depends on factors such as the adoption target and the grid upgrade cost. (iii) Modeling the grid operations jointly brings significant cost savings by avoiding excessive ex-post remedial grid investment. Our findings

convey two messages to infrastructure planners: (i) The HFV adoption target should be carefully established before infrastructure investment. (ii) A cross-disciplinary modeling approach considering both transportation and power systems becomes imperative for planning our next-gen transportation/energy infrastructure.

Parallel Session (A22) - Addressing Behavioural Problems in Operations Management

Day 1: 5th Jan (Fri) 14:00-15:20 Venue: 2132C

Session Chair: Vivek Choudhary, Nanyang Technological University

Title: Don't Fake It If You Can't Make It: Driver Misconduct in Last Mile Delivery

Presenter: Srishti Arora, INSEAD

Co-author(s): Vivek Choudhary, Sameer Hasija

Abstract:

This study with an Indian delivery firm finds that agents' misconduct, particularly fake delivery remarks, affects same-day attempts and decreases next day's successful deliveries by 1.60%, with cascading effects. We recommend minimizing task complexity to enhance efficiency, as known levers such as familiarity might not work in these scenarios.

Title: How Uncertainty Reshaped Patient-Doctor Gender Concordance

Presenter: Vivek Choudhary, Nanyang Technological University

Co-author(s): Xiaodan Shao, Anandasivam Gopal

Abstract:

This study explores the impact of uncertainty on patient preference on healthcare provider's gender. Analysing 5.5 million prescriptions in India, our findings reveal that

female doctors experience an 11% decrease in gender concordance compared to male doctors' post-lockdown. This shift is primarily driven by male patients choosing female doctors and persists even after unlocking. We rule out alternative explanations, establishing that this change is tied to increased facetime for female doctors. This research underscores the critical need for more female doctors in times of uncertainty and poses significant capacity planning considerations in distressing circumstances.

Title: Selling to Time-Inconsistent Consumers in the Presence of Secondary Market

Presenter: Chen Pang, The Hong Kong Polytechnic University

Co-author(s): Li Jiang, Gang Li

Abstract:

The time difference between immediate payment and delayed payoff gives rise to time-inconsistent purchases and overestimation of current utilities by consumers. This paper investigates the effect of time inconsistency on the pricing strategy of a monopolist who sells different versions of new products with the existence of second-hand transactions intra-consumers.

Title: Consumer Surplus and Seller Profitability: Constrained Assortment Optimization with Satisficers

Presenter: Mina M Iravani, The Hong Kong University of Science and Technology

Co-author(s): Guillermo Gallego, Masoud Talebian

Abstract:

Numerous studies indicate that choice abundance can make decision-making challenging for consumers. Rather than maximizing utility, many consumers employ a satisficing decision-making approach, whereby they search for products sequentially until they find a satisfactory one. We challenge the notion that satisficing is a bounded rational strategy and show that it can be rational within a game-theoretic framework between the seller and consumers. We introduce the concept of Y-regularity and show that a seller prefers satisficers over maximizers for choice models with this property, making satisficing a

Pareto-dominant strategy. This leads to the less explored setting of assortment optimization, wherein consumers follow a satisficing approach. We first demonstrate that this problem can be solved optimally by offering all products in decreasing order of revenue. However, when the consumers are impatient and cardinality constraints apply, the problem becomes APX-hard. We demonstrate that the greedy algorithm provides an optimal $(1-1/e)$ -approximation within homogeneous consumers' patient levels. We also provide a constant factor approximation for the problem within heterogeneous consumers' patient levels. Furthermore, we demonstrate that the problem is NP-hard in the context of latent-class MNL. Nevertheless, we provide a fully polynomial-time approximation algorithm for homogeneous consumers and a quasi-polynomial-time approximation algorithm for heterogeneous consumers for this scenario.

Parallel Session (B1) - Data-Driven Research on Emerging Topics**Day 1: 5th Jan (Fri) 15:40-17:00 Venue: 2126D****Session Chair: Sidika Tunc Candogan, National University of Singapore****Title: Crowd-Judging on Two-Sided Platforms: An Analysis of In-Group Bias**

Presenter: S. Alex Yang, London Business School

Co-author(s): Alan P. Kwan, Angela Huyue Zhang

Abstract:

This paper studies crowd-judging, a novel crowd-sourcing mechanism whereby users (buyers and sellers) volunteer as jurors to decide disputes arising from the platform. Using a rich dataset from Taobao, this study focuses on the magnitude and impact of in-group bias (buyer jurors might favor buyers and vice versa for sellers). Findings show a seller juror is 10% more likely to side with sellers than a buyer juror. However, this bias drops rapidly as jurors gain experience. Despite individual biases, in-group bias affects only 2% of cases under the current voting system and can be further reduced through dynamic case allocation.

Title: Dynamic Pricing in the Airline Industry: Theory and Practice

Presenter: Hong Ming Tan, National University of Singapore

Co-author(s): Chung Khim Lae, Jussi Keppo, Bar Light

Abstract:

This paper introduces a dynamic pricing model for airlines, accounting for diverse traveler preferences and fluctuating demand. It considers various fare classes, ancillaries, and ticket conditions, proposing an optimal pricing policy formula based on marginal revenue and demand parameters. A novel dataset from an airline is used to estimate the model's parameters, demonstrating the model's reliability and robustness in capturing the

complexity of airline ticket pricing amidst diverse customer preferences and temporal demand changes.

Title: Unravelling the Implications of Driver Relocation in Food Delivery

Presenter: Srishti Arora, INSEAD

Co-author(s): Vivek Choudhary, Sameer Hasija

Abstract:

Exploring the efforts of food delivery workers in relocating to find orders, this study assesses its impact on driver efficiency. Collaborating with an Asian platform, we find relocation decreases drivers' hourly earnings by 16%. We explain this using conservation of resources theory, which confirms slower speeds and resource conservation. Familiarity bias significantly influences relocation decisions. Relocations addressing supply shortages, termed 'Balance-enhancing,' can improve efficiency. Results show that relocations not seeking familiarity and diminishing supply balance are most detrimental to earnings. This suggests that platforms can increase operational efficiency and driver earnings by facilitating balance enhancing relocations and reducing cluster affinity.

Title: Product Development in Crowdfunding: Theoretical and Empirical Analysis

Presenter: Sidika Tunc Candogan, National University of Singapore

Co-author(s): Philipp B. Cornelius, Bilal Gokpinar, Ersin Körpeoğlu, Christopher S. Tang

Abstract:

We study crowdfunding by focusing on entrepreneurs' product development decisions. We first construct a game-theoretical model, where an entrepreneur decides on both the initial development level of his product and whether to improve it further during his campaign. We then use a unique data set from Kickstarter to test our theoretical predictions. We show that entrepreneurs should avoid overdeveloping their products before crowdfunding campaigns because, as well as decreasing the chance of campaign success, this could hinder their ability to save development costs (e.g., market research costs) through involving customers in product development.

Parallel Session (B2) - Data-Driven Operations Management**Day 1: 5th Jan (Fri) 15:40-17:00 Venue: 2126A****Session Chair: Yi Chen, The Hong Kong University of Science and Technology****Title: Born to Wait? A Study on Allocation Rules in Booking Systems**

Presenter: Tracy Xiao Liu, Tsinghua University

Co-author(s): Lingbo Huang, Jun Zhang

Abstract:

When allocating scarce goods or services through booking systems, queue-based rules are often considered efficient, as queuing time could signal people's valuation. However, the externality of queuing on other tasks, especially the queuing time that could have been spent on other tasks, is frequently overlooked when people can multi-task. Through a laboratory experiment where participants engage in both a booking system and a production task, we compare a queue-based rule with a lottery-based rule and quantify different sources of efficiency losses under the two rules. Surprisingly, the queue rule does not exhibit higher allocative efficiency than the lottery rule, as participants display bimodal behavior---either fully engaging or not participating in the booking task. We further design a novel dual-track booking system, allowing participants to choose their preferred allocation rule, which partially restores the efficiency loss observed in the pure queue system.

Title: Design of Wait Time Interval in Virtual Queue

Presenter: Yiming Zhang, The Chinese University of Hong Kong, Shenzhen

Co-author(s): Qiuping Yu, Yong-Pin Zhou

Abstract:

In this project, we focus on the design of the wait time interval displayed to waiting customers. Specifically, we are interested in the impact of lower and upper bounds (LB and

UB) on abandonment rates. Collaborating with a ride-sharing platform, we conduct a field experiment involving standard, LB-extended (smaller lower bound with the same upper bound), and UB-extended (larger upper bound with the same lower bound) intervals displayed to waiting customers in virtual queues. Our exploration delves into the treatment effects' mechanisms, and we offer insights for firms aiming to optimize wait time intervals and manage customer abandonment behaviors effectively.

Title: The Effect of Intellectual Protection Policies on Online Retail Platforms

Presenter: Shuo Zhang, Shanghai Jiao Tong University

Co-author(s): Xiang Hui, Meng Liu, Tat Chan, Tianjun Feng, Fuqiang Zhang

Abstract:

Intellectual property (IP) protection is an important tool for promoting innovation and quality improvement on online retail platforms, yet stringent protection policies may not always benefit IP owners. By collaborating with an e-commerce platform, we study the effects of IP protection policies that fight against image plagiarism on the platform. We find that strict punishments on infringing sellers, such as deleting product links or removing product images, may lead to decreases in sales and user visits for the infringed sellers compared to other more lenient punishment. Our findings suggest that protecting IP is a complex issue, and strict punishments on infringing sellers may undermine the original purpose of such policies.

Title: Learning While Repositioning in On-Demand Vehicle Sharing Networks

Presenter: Hansheng Jiang, University of Toronto

Co-author(s): Shunan Jiang, Z.-J. Max Shen, Chunlin Sun

Abstract:

We consider the inventory repositioning problem in on-demand and one-way vehicle sharing networks. Due to uncertainty in both customer arriving and vehicle returning, the service provider needs to periodically reposition the vehicles to match the supply with the

demand while minimizing the total costs of repositioning labor and lost sales. The repositioning problem is critical in successful management of on-demand one-way vehicle sharing services, and it is challenging both analytically and computationally. We develop learning methods and algorithms to dynamically reposition vehicles without knowing the demand distribution in advance.

Parallel Session (B3) - Frontiers in Data-Driven Decision-Making Algorithms

Day 1: 5th Jan (Fri) 15:40-17:00 Venue: 2126B

Session Chair: Xiaojie Mao, Tsinghua University

Title: A Bayesian Optimization Model for Locating Emergency Service Units

Presenter: Cheng Hua, Shanghai Jiao Tong University

Co-author(s): Arthur J. Swersey, Wenqian Xing

Abstract:

This paper presents a new approach to solving the optimal unit location problem in a stochastic emergency service. The goal is to minimize the system-wide mean response time, which is formulated as a combinatorial optimization problem. We show that this problem is NP-hard and develop lower and upper bounds for the optimal solution using a special case of the classic p-median problem. To solve the problem, we develop a Bayesian optimization algorithm that we show always converges to the optimal solution with a sublinear regret rate. We evaluate our approach through numerical experiments and a constructed study using real data from the St. Paul, Minnesota emergency response system and show that our model consistently and quickly converges to the optimal solution.

Title: Data-Driven Asset Selling

Presenter: Puping Jiang, Shanghai Jiao Tong University

Co-author(s): Lingxiu Dong

Abstract:

Unique features and business requirements of the asset-selling platforms (e.g., used cars, real estate, etc.) make classical retailing models hard to meet practical needs. In this paper, we formulate a data-driven asset-selling infrequent dynamic pricing framework that utilizes platforms' access to customers' online behavioral data. Under mild assumptions on the demand model, we propose a deterministic approximation policy and show its regret bound. Later, in the scenario where an idiosyncratic latent value for each asset is unknown. We propose Thompson-Sampling-based and Maximum-A-Posterior-based pricing policies, and we also give the regret bounds of the policies.

Title: Learning in Lost-Sales Inventory Systems with Stochastic Lead Times and Random Supplies

Presenter: Jiameng Lyu, Tsinghua University

Co-author(s): Xin Chen, Shilin Yuan, Yuan Zhou

Abstract:

Supply uncertainty, characterized by stochastic lead times and random supply quantities, has gained prominence in academia and industry, particularly in the aftermath of the COVID-19 pandemic. In this paper, we consider managing the lost-sales inventory systems with general supply uncertainty: stochastic lead times and random supplies. Unlike the previous studies, we assume the demand distribution, supply distribution and any structural information of the random supplies are all unknown to the decision maker. We propose the first provably effective learning algorithm for inventory management problems with unknown demand and supply information under general supply uncertainty, and we establish a regret of $\tilde{O}(\sqrt{T})$ for this learning algorithm compared to the best constant-order policy.

Due to the complicated nature of the considered inventory systems, this problem exhibits three primary technical challenges: the non-convexity of cost function, the establishment of stability for inventory systems under constant-order policies, and the accurate estimation of long-run average costs. We overcome these challenges through innovative approaches, some of which are of independent interest. We also conduct numerical experiments to

demonstrate the effectiveness of our algorithm.

Title: Robust Actionable Prescriptive Analytics

Presenter: Minglong Zhou, Fudan University

Co-author(s): Li Chen, Melvyn Sim, Xun Zhang

Abstract:

We propose a robust actionable prescriptive analytics framework, leveraging the past realizations of the uncertain parameters and the side information that have some predictive power on those uncertainties. The framework solves for a response policy that transforms the side information to actionable here-and-now decisions. We adopt the data-driven robust satisficing framework to address the issue of overfitting when the empirical distribution is used for evaluating the risk-based objective function. We focus on tree-based static and affine response policies in the robust satisficing framework, and we propose safe approximations when addressing combinatorial and linear optimization models with recourse. We provide a case study in a portfolio optimization problem.

Parallel Session (B4) - Machine Learning Methods in Supply Chain Management

Day 1: 5th Jan (Fri) 15:40-17:00 Venue: 2126C

Session Chair: Shilin Yuan, Tsinghua University

Title: Managing Third-Party Risks in Supply Chain Data Security: The Differentially Private Newsvendor

Presenter: Du Chen, Nanyang Technological University

Co-author(s): A. Geoffrey Chua

Abstract:

Data is now unanimously considered a key firm asset for enabling better operational decisions. However, data-driven decisions can inadvertently expose private data, leaving firms vulnerable to unforeseen danger. How to manage third-party data security risks by protecting data from being inferred from observable decisions thus becomes an important question. In this paper, we focus on data security in supply chains due to their data-intensive nature and high connectivity to third parties. Specifically, we examine a data-driven contextual newsvendor problem. To ensure and quantify data security, we adopt the notion of differential privacy, a mathematically rigorous measure of data security that limits a third-party's inference accuracy. Employing convolution smoothing and noise injection, we propose several differentially private algorithms that provably guarantee both data security and asymptotic optimality with (near) optimal rates. In the non-asymptotic regime, we further identify three drivers of the cost of data security; namely, dataset size, context, and number of products. This finding suggests that gathering more data, collecting detailed context, and pooling data from multiple products can lower data security cost. Lastly, we examine the impact of a newsvendor's private algorithms on supply chain partners. We discover additional distortion to the demand signalling process and lower profit share for an upstream supplier.

Title: Deep Reinforcement Learning for an Inventory Problem with an All-or-Nothing Yield Pattern and Leadtimes

Presenter: Yuting Yan, Central South University & City University of Hong Kong

Co-author(s): Wenjie BI, Youhua (Frank) Chen, Zhe Fu

Abstract:

We consider a single-item, periodic-review inventory system with stochastic demand and all-or-nothing yield pattern. The firm's objective is to find an optimal ordering policy to minimize its expected total discounted cost. As the optimal policy remains unknown, we propose a model-free Deep Reinforcement Learning (DRL) algorithm based on a tailored neural network model. The algorithm developed combines the results of existing heuristics to improve performance and stabilize the training process. Moreover, the total cost to be computed is jointly convex in the state and decision variable, which facilitates the search. Experiments show that our DRL method significantly outperforms known heuristics.

Title: Data-Driven Reliable Facility Location Design

Presenter: Hao Shen, Renmin University of China

Co-author(s): Mengying Xue, Zuo-Jun Max Shen

Abstract:

We study the reliable (uncapacitated) facility location (RFL) problem in a data-driven environment where historical observations of random demands and disruptions are available. Owing to the combinatorial optimization nature of the RFL problem and the mixed-binary randomness of parameters therein, the state-of-the-art RFL models applied to the data-driven setting either suggest overly conservative solutions, or become computationally prohibitive for large- or even moderate-size problems. In this paper, we address the RFL problem by presenting an innovative prescriptive model aiming to balance solution conservatism with computational efficiency. In particular, our model selects facility locations to minimize the fixed costs plus the expected operating costs approximated by a tractable data-driven estimator, which equals to a probabilistic upper bound on the intractable Kolmogorov distributionally robust optimization estimator. The solution of our model is obtained by solving a mixed-integer linear program that does not scale in the training data size. Our approach is proved to be asymptotically optimal, and offers a theoretical guarantee for its out-of-sample performance in situations with limited data. In addition, we discuss the adaptation of our approach when facing data with covariate information. Numerical results demonstrate that our model significantly outperforms several important RFL models with respect to both in-sample and out-of-sample performances as well as computational efficiency.

Title: A Minibatch-SGD-Based Learning Meta-Policy for Inventory Systems with Myopic Optimal Policy

Presenter: Shilin Yuan, Tsinghua University

Co-author(s): Jiameng Lyu, Jinxing Xie, Yuan Zhou

Abstract:

Stochastic gradient descent (SGD) has proven effective in solving many inventory control problems with demand learning. However, it often faces the pitfall of an infeasible target inventory level that is lower than the current inventory level. Several recent works (e.g., (Huh and Rusmevichientong 2009, Shi et al. 2016)) are successful to resolve this issue in various inventory systems. However, their techniques are rather sophisticated and difficult to be applied to more complicated scenarios such as multi-product and multi-constraint inventory systems. In this paper, we address the infeasible-target-inventory-level issue from a new technical perspective – we propose a novel minibatch-SGD-based meta-policy. Our meta-policy is flexible enough to be applied to a general inventory systems framework covering a wide range of inventory management problems with myopic clairvoyant optimal policy. By devising the optimal mini-batch scheme, our meta-policy achieves a regret bound of $O_p(\sqrt{T})$ for the general convex case and $O(\log T)$ for the strongly convex case. To demonstrate the power and flexibility of our meta-policy, we apply it to three important inventory control problems: multi-product and multi-constraint systems, multi-echelon serial systems, and onewarehouse and multi-store systems by carefully designing application-specific subroutines. Numerical experiments on the multi-product multi-constraint systems show that our algorithm has low average costs and high computational efficiency.

Parallel Session (B5) - Learning with Humans in the Loop**Day 1: 5th Jan (Fri) 15:40-17:00 Venue: 2127A****Session Chair: Yifan Feng, National University of Singapore****Title: The Wisdom of Strategically Diverse Crowds**

Presenter: Jussi Keppo, National University of Singapore

Co-author(s): Yanwei Jia, Ville Satopaa

Abstract:

We investigate the effects of a new type of heterogeneity called strategic diversity.

Specifically, the agents receive public and private information and have varying external motivations, ranging from conformity to contrarianism. We find that the agents' strategic tendencies become more pronounced. Consequently, strategic diversity in crowd forecasting does not yield the same benefits as information diversity. We study a new weighted-by-deviation scheme that assigns greater weight to contrarian viewpoints. We show that this aggregator improves accuracy relative to a simple equally weighted average if the crowd is large.

Title: Understanding Labor Supply in Gig Economy: Evidence from a Logistics Platform

Presenter: Sixing Hu, National University of Singapore

Co-author(s): Jussi Keppo, Yifan Feng, Wu Hao

Abstract:

In this study, we analyze labor supply behavior on a logistics platform. On this platform, many jobs are pre-scheduled, and compensation offers for both participating and non-participating agents are directly observable. This distinctive feature helps eliminate common endogeneity issues in estimating the compensation elasticity for labor supply. Consistent with Camerer (1997), our findings suggest that agents set income targets, leading to negative compensation elasticities. Employing the Discounted Cumulative Shock model, we also investigate the impact of unexpected compensation changes on intraday labor supply based on granular time-series order information. We find that increased morning compensation enhances over-day participation but slightly diminishes afternoon and evening deliveries.

Title: Myopic Quantal Choice: Thompson Sampling Meets Behavioral Economics

Presenter: Ying Rong, Shanghai Jiao Tong University

Co-author(s): Jingying Ding, Yifan Feng

Abstract:

Motivated by the quantal choice theory, we study a novel family of behavioral policies for the multi-armed bandit (MAB) problem, termed Myopic Quantal Choice (MQC). MQC prescribes a simple way to randomize over arms according to historical rewards and a "shrinkage rate of exploration," which explicitly manages the exploration-exploitation trade-off. Based on a series of lab experiments, we use our methodology to estimate human behavior patterns when solving MAB problems.

Title: Simple Algorithms for Learning to Select and Rank from Choice-based Feedback

Presenter: Yifan Feng, National University of Singapore

Co-author(s): Junwen Yang

Abstract:

A company wishes to identify the most preferred item among a group of products or learn their full ranking based on customer feedback. The company sequentially presents display sets to customers and collects their choices, aiming to select/rank with minimal samples and high confidence. We introduce two simple policies, Nested Elimination (NE) and Nested Sort (NS), to tackle the item selection and full-ranking problems, respectively. Both are inspired by the nested structure implied by the information-theoretic lower bounds, simple in structure, easy to implement and offer robust theoretical guarantees concerning sample complexity.

Parallel Session (B6) - Inventory Management and Pricing Analytics**Day 1: 5th Jan (Fri) 15:40-17:00 Venue: 2127B****Session Chair: Jinzhi Bu, The Hong Kong Polytechnic University****Title: Approximation Algorithms for Lost-sales Inventory Systems with Remanufacturing**

Presenter: Suting Liu, The Chinese University of Hong Kong

Co-author(s): Xiting Gong

Abstract:

We develop approximation algorithms for two classes of lost-sales inventory systems with remanufacturing. For pure remanufacturing inventory systems, we develop a modified dual-balancing policy and show that it has a worst-case performance guarantee of two under mild conditions on demand processes and system parameters. For hybrid manufacturing/remanufacturing inventory systems with general identical lead times, we develop a dual-balancing policy and show that it has a worst-case performance guarantee of four under similar conditions. When lead time is zero, the dual-balancing policy has a worst-case performance guarantee of two under general demand and return processes.

Title: Pricing Analytics with Shape-Restricted Demands

Presenter: Jingren Liu, National University of Singapore

Co-author(s): Hanzhang Qin, Mabel C. Chou

Abstract:

We consider a fundamental problem in revenue management: feature-based pricing, where a firm needs to price a single product based on feature information. We assume that customer demand is linear in price, and the impact of covariates is captured through a shape-restricted function. We propose an algorithm to estimate the demand and foster provably near-optimal pricing decisions. We derive finite sample regret bounds, showcasing the efficacy of our algorithm even under model misspecification. The numerical results demonstrate that the decision performance of our algorithm is comparable to the Double Machine Learning method while significantly outperforming a naive iterative learning method.

Title: Dynamic Resource Allocation with Proactive Upgrades: The Value and Design of Fulfillment Flexibility

Presenter: Zheng Cui, Zhejiang University

Co-author(s): Lijian Lu, Daniel Zhuoyu Long

Abstract:

Product upgrading, where a customer may be served with an upgrade to a higher quality product or service, has been an increasingly popular practice. Despite its popularity, there is limited understanding of how resources should be managed dynamically and how much value is added by providing upgrades under a general upgrade structure. This work attempts to close this gap by considering dynamic network revenue management with multiple vertically differentiated products under a general upgrades structure. We develop computationally efficient heuristics and show that the heuristic is asymptotically optimal with a large demand. We find that the upgrading flexibility could improve revenue substantially (more than 20%) depending on the mismatch between supply and demand, the upgrading structure, the demand correlation, and the number of products.

Title: Waste Reduction of Perishable Products through Markdowns at Expiry Dates

Presenter: Jinglong Zhao, Boston University

Co-author(s): Arnoud V. den Boer, Hermanus M. Jansen

Abstract:

We study whether giving discounts for perishable products on their expiry dates can simultaneously reduce waste and increase profit. We consider a seller of a single perishable product who daily replenishes inventory up to a certain order-up-to level, and who serves customers whose purchase probabilities both depend on price and on the remaining shelf life of the product. Under a scaling limit, we derive explicit expressions for waste and profit. In a multinomial-logit demand setting, we show that a markdown pricing policy, which gives discounts to the expiring products, reduces waste compared to a fixed price policy.

Parallel Session (B7) - Data-Driven Methods for Revenue and Supply Chain Management**Day 1: 5th Jan (Fri) 15:40-17:00 Venue: 2127C****Session Chair: Hanzhang Qin, National University of Singapore****Title: Robust Mechanism Design under Nonlinear Utility**

Presenter: Zhen Wang, The Chinese University of Hong Kong, Shenzhen

Co-author(s): Yicheng Liu, Pin Gao, Shixin Wang, Zizhuo Wang

Abstract:

This paper studies a classic nonlinear pricing environment, where the seller has the first two moment information of the buyer's valuation distribution. We formulate the problem as a robust mechanism design problem. We fully characterize the optimal robust pricing mechanism, and demonstrate that how optimal profits vary with elasticity coefficient and ambiguity levels. Furthermore, we offer a precise depiction of the robust linear pricing approach due to its prevalence in practice. Interestingly, the linear pricing strategy achieves a provable performance bound relative to the optimal robust mechanism when the elasticity coefficient is less than 2. However, the performance bound fails when the elasticity coefficient exceeds 2.

Title: Pigeonhole Design: Balancing Sequential Experiments from an Online Matching Perspective

Presenter: Jinglong Zhao, Boston University

Co-author(s): Zijie Zhou

Abstract:

We study an online experimental design problem called "Online Blocking Problem." In this problem, experimental subjects with heterogeneous covariate information arrive sequentially and must be immediately assigned into either the control or the treated group.

The objective is to minimize the total discrepancy. To solve this problem, we propose a randomized design of experiment called "Pigeonhole Design." The pigeonhole design first partitions the covariate space into smaller spaces, which we refer to as pigeonholes, and then, when the experimental subjects arrive at each pigeonhole, balances the number of control and treated subjects for each pigeonhole.

Title: Myopic Policies for Periodic-Review Inventory System with Demand Covariates

Presenter: Jingkai Huang, Zhejiang University

Co-author(s): Kevin Shang, Yi Yang, Weihua Zhou

Abstract:

We investigate a multi-period inventory system influenced by external covariates and random fluctuations, aiming to develop data-driven policies for cost-effective inventory management. We introduce the Data-Driven Optimal (DDO) policy, delivering near-optimal results with a specific sample size but limited practicality. To enhance practicality, we explore the myopic policies, leading to the Data-Driven Myopic (DDM) policy, and provide with its performance guarantees. We extend the approach to consider future period costs, resulting in the practical semi-myopic policy. We also analyse correlated demand scenarios with time-series covariates, highlighting DDM's effectiveness.

Title: Feature Based Dynamic Matching

Presenter: Yilun Chen, The Chinese University of Hong Kong, Shenzhen

Abstract:

We consider a feature-based dynamic matching problem faced by centralized platforms in a highly heterogeneous market. Specifically, a set of heterogeneous supply units, each characterized by i.i.d. supply feature vector, is available initially. In each period, a customer arrives with an i.i.d. demand weight vector describing her type, and requests to consume a

supply unit. The platform seeks a dynamic matching policy that assigns supply units to customers to maximize the expected average matching utility. We propose and analyze a simple, simulation-based matching policy, dubbed Simulate-Optimize-Assign-Repeat (SOAR). We prove that SOAR enjoys a surprisingly universal (near) optimality guarantee, achieving the optimal regret scaling under various modelling assumptions. Extensive numerical simulations support the robustness of the performance of SOAR.

Parallel Session (B8) - Competition and Operations Innovation

Day 1: 5th Jan (Fri) 15:40-17:00 Venue: 2128A

Session Chair: Lin Tian, Fudan University

Title: Information Sharing and Manufacturer Rebate Competition

Presenter: Yunjie Wang, Renmin University of China

Co-author(s): Albert Y. Ha, Weixin Shang

Abstract:

We investigate the incentive for a retailer to share private demand information with two rebate-offering manufacturers who sell substitutable products through the retailer. We characterize how the information sharing equilibrium depends on key factors such as the proportion of rebate-sensitive consumers and competition intensity. When the retailer cannot charge a side payment, we show that the retailer will not voluntarily share information with a monopolistic manufacturer, but he may do so with none, one or both of the manufacturers when there is competition. When the retailer can charge a side payment, he always prefers concurrent contracting over sequential contracting.

Title: Upward Decentralization and Diagonal Partial Ownership: A Win-Win Outcome for Competition

Presenter: Yingchen Yan, Beihang University

Co-author(s): Jiong Sun

Abstract:

This paper proposes that by externalizing one's own input costs while simultaneously internalizing a fraction of the competitor's input costs, a positive synergy can be created, resulting in mutual benefits for competing firms involved. We demonstrate that diagonal passive ownership can function as such a mechanism that motivates upward decentralization, which also enhances the overall channel efficiency of the competing supply chains. In this framework, downstream firms strategically abstain from vertical control, allowing competing firms to profitably internalize the competition effect, leading to higher downstream prices. The effects are stronger when competition effect is strong and remain robust even in the presence of market expansion effects.

Title: Agri-Tech Products: Firm Strategy, Farmer Competition, and Government Subsidy

Presenter: Xiao Tan, East China University of Science and Technology

Co-author(s): Duo Shi, Fuqiang Zhang

Abstract:

We study the impact of agri-tech product adoption, like agricultural drones, on the traditional agriculture supply chain. Farmers' purchasing strategies, firm's pricing decisions and government's subsidy schemes are considered. Since it requires high capability of farmers to use the product properly. Apart from selling agri-tech products, the firm may also sell professional service to help farmers. We find the best pricing strategy for the firm is to achieve either complete bundle selling or sell products only. And firm can free-ride farmers' high capability and gain more profits.

Title: Advertising Format and Content Provision on Revenue-Sharing Content Platforms

Presenter: Yuansheng Wei, Shanghai University of Finance and Economics

Co-author(s): Lin Tian, Baojun Jiang

Abstract:

Many platforms show ads when consumers watch the content on their platforms, and they share ad revenue with content creators to incentivize them to create and share content. These platforms often adopt either uniform advertising (UA) (i.e., they display the same number of ads irrespective of content quality) or differentiated advertising (DA) (i.e., they display the number of ads based on content quality). We find that the platform's profit and the consumer surplus are lower under DA than under UA. However, depending on the level of creator substitutability, the creators' profits can be higher or lower under UA.

Parallel Session (B9) - Learning Algorithms for Inventory and Revenue Management**Day 1: 5th Jan (Fri) 15:40-17:00 Venue: 2128B****Session Chair: Xuefeng Gao, The Chinese University of Hong Kong****Title: Online Learning with Sample Average Approximation for a Multiechelon Inventory System with Expediting**

Presenter: Yufei Zhao, The Chinese University of Hong Kong

Co-author(s): Xiangyu Gao

Abstract:

We consider a serial multi-echelon inventory system with expediting shipping over a finite horizon. In this system, each echelon orders from the next upstream echelon by regular and expedited shipping, and the most downstream fulfills the stochastic demand from outside. The unsatisfied demands are fully backlogged. We assume the demand distribution is unknown, and demand learning needs to be done on the fly. We propose an SAA-based online learning algorithm and establish an upper bound of $O(\sqrt{T} \ln T)$ on the worst-case regret for this algorithm.

Title: Sampling-Based Approximation for Series Inventory Systems

Presenter: Sean Zhou, The Chinese University of Hong Kong

Co-author(s): Kairen Zhang, Zhanyue Wang, Xiangyu Gao

Abstract:

We study inventory management of an infinite-horizon, series system with multiple stages. Each stage orders from its immediate upstream stage and the most upstream stage orders from an external supplier. Random demand with unknown distribution occurs at the most downstream stage. Each stage incurs inventory holding cost while the most downstream stage also incurs demand backlogging cost when it experiences inventory shortage. The objective is to minimize the expected total discounted cost over the planning horizon. We apply the sample average approximation (SAA) method to obtain a heuristic policy (SAA policy) using the empirical distribution function constructed from a demand sample (of the underlying demand distribution). We derive an upper bound of sample size (viz., distribution-free bound) that guarantees the performance of the SAA policy be close (i.e., with arbitrarily small relative error) to the optimal policy under known demand distribution with high probability. This result is obtained by first deriving a separable and tight cost upper bound of the whole system that depends on (given) echelon base-stock levels and then showing the cost difference between the SAA and optimal policies can be measured by the distance between the empirical and the underlying demand distribution functions. We also provide a lower bound of sample size that matches the upper bound (in the order of relative error). Furthermore, when the demand distribution is continuous and has an increasing failure rate (IFR), we derive a tighter sample size upper bound (viz., distribution-dependent bound). Both distribution-free and distribution-dependent bounds for the newsvendor problem, a special case of our series system, improve the results by Levi et al. (2015). In addition, we show that both bounds increase polynomially as the number of stages increases. The performance of SAA policy and the sample size bounds are illustrated numerically. Finally, we extend the results to finite-horizon series systems.

Title: Reinforcement Learning for Intensity Control: An Application to Choice-Based Network Revenue Management

Presenter: Huiling Meng, The Chinese University of Hong Kong

Co-author(s): Xuefeng Gao, Ningyuan Chen

Abstract:

We study choice-based network revenue management (NRM) in continuous time, assuming that the arrival rates of customers and their choice probabilities are unknown. In contrast to the traditional discrete-time formulation, we formulate the NRM problem as a continuous-time Markov decision process without discretizing the time horizon, in order to remove the bias and overcome the computational challenge for a refined time discretization. This makes standard reinforcement learning algorithms inapplicable. We propose and theoretically analyze a modified data-driven Actor-Critic algorithm based on policy gradient, where the procedures of evaluating value functions and updating policies are alternately conducted. To evaluate the effectiveness of our approach, we implement our algorithm on multiple airline networks. With a proper choice of parameterized families for both value functions and policies, our algorithm can yield policies that outperform the heuristics from choice-based deterministic linear programming and approximate dynamic programming.

Title: Dynamic Pricing and Learning Under the Effect of Inventory Scarcity

Presenter: Mengyan Zhu, Zhejiang University

Co-author(s): Qingwei Jin

Abstract:

Revealing inventory scarcity messages to customers to trigger scarcity effect is an important and widely adopted way to promote sales in online platforms. Under such circumstances, the demand is affected by both price and scarcity messages. In this article, we study the joint dynamic pricing and learning problem under the inventory scarcity effect. Specifically, we consider three popular scarcity messages: partially revealed, fully revealed, and mixedly revealed inventory information, and we design passive learning algorithms with/without forced learning steps to learn unknown parameters in the demand function

with a planning horizon consisting of many independent selling seasons. The main challenge is that there is always a strictly positive probability of no learning in one selling season, since the change of inventory status is not fully under control. To balance the learning speed and regret in this setting, we introduce the idea of endogenous and forced learning cycles, and design indices to determine when to conduct forced learning steps. Furthermore, to increase the success learning probability, we design learning steps by grouping two selling seasons together based on the MDP structure for the optimal pricing policy, which is quite different from the scenario without inventory scarcity effect. As a result, our methods have $O(\log^2 T)$ regret bounds in all cases. Moreover, numerical experiments show that ignoring the scarcity effect will cause significant revenue loss. We also provide insights on when the seller should choose pure passive learning method or passive learning methods with forced learning steps. Our work sheds light on the practice of online retailing in the presence of inventory scarcity effect.

Parallel Session (B10) - Emerging Topics in Digital Business

Day 1: 5th Jan (Fri) 15:40-17:00 Venue: 2128C

Session Chair: Xin Fang, Singapore Management University

Title: Unlocking the Power of Joining a Virtual Team: The Heterogeneous Impacts of Team Signaling in Telehealth

Presenter: Shiyi Wang, Nanyang Technological University

Co-author(s): Jack Tong, John Dong

Abstract:

The recent proliferation of Telehealth platforms has engendered immense business potential in improving patients' welfare and facilitates doctors to expand services to geodistant locations. In particular, the development of communication and information technology empowers the formation of virtual teams. This study aims to empirically examine the business value of joining a virtual team on individual doctor's patient demands. Drawing upon signaling theory, we provide a theoretical explanation by which virtual team information could affect different types of doctors (e.g., job titles, tenure, popularity, and

region) and what types of virtual teams (e.g., specialty vs institution-based) benefit individual doctors most.

Title: Managing The Personalized Order-Holding Problem in Online Retailing

Presenter: Yun Fong Lim, Singapore Management University

Co-author(s): Shouchang Chen, Zhenzhen Yan

Abstract:

A significant percentage of online consumers place consecutive orders within a short duration. To reduce the total order arrangement cost, an online retailer may consolidate consecutive orders from the same consumer. We investigate how long the retailer should hold the consumer's orders before sending them to a third-party logistics provider (3PL) for processing. We optimize the holding time to balance the total order arrangement cost and the potential delay in delivery. Our research suggests that the holding threshold is higher for “plus” consumers, female consumers, and consumers in the age group of 16-25.

Title: Return or Not? Joint Pricing and Refund Optimization for Omni-channel Retailing

Presenter: Zhenzhen Yan, Nanyang Technological University

Co-author(s): Shouchang Chen, Yimeng Sun, Yun Fong Lim

Abstract:

We study a return problem of a retailer selling multiple substitutable products through an online channel and a physical store. We characterize a consumer's sequential decisions on making a purchase and returning the product using a generalized Markovian logit choice (MLC) model, which allows us to formulate a joint pricing and refund optimization problem. If no constraints on the prices and refund values are imposed, we obtain analytical expressions of its optimal solution. If constraints are imposed, we approximate it using a mixed-integer linear program. We further propose and evaluate an estimation-and-optimization framework based on this generalized MLC model.

Title: Partnerships Between Taxis and On-Demand Ride-Hailing Platforms: A Regulatory Perspective

Presenter: Xin Fang, Singapore Management University

Co-author(s): Liling Lu, Guiyun Feng, Sergei Savin

Abstract:

The arrival of on-demand ride-hailing platforms has posed challenges to local and national governments about regulating the relations between these newcomers and incumbent taxi services. The set of current regulatory approaches varies from strong encouragement of taxi drivers' participation in platform-based service delivery to equally strong drive to separate street-hailing and platform-based services. Given this variety of regulatory stances, we address a natural question about conditions that favor each particular approach by developing a parsimonious game-theoretical model of a government-regulated urban transportation system.

Parallel Session (B11) - Influencer and Live-Stream Marketing

Day 1: 5th Jan (Fri) 15:40-17:00 Venue: 2129A

Session Chair: Qianqian Chen, Zhejiang University

Title: The Strategies for E-retailer on Resorting to KOL Live Streaming Channel

Presenter: Yue Chen, Chongqing University

Co-author(s): Wang Yong, Duan Yu-lan, Zheng Jing

Abstract:

Brand self-built (BLSE) and KOL-based LSE (KLSE) live streaming e-commerce are two typical live streaming channels. We use consumer uncertainty and waiting costs to distinguish BLSE and KLSE, and research findings follow. (i) Within single-channel strategy, e-retailer can achieve "win-win" with KOL streamer under "pure commission rate" mode if

both waiting costs and commission rate are low. (ii) Within dual-channel strategy, “lose-lose” scenario will appearance under “pure commission rate” mode if consumer uncertainty is high, and both waiting costs and commission rate are low. Interestingly, the aforementioned “lose-lose” can become “win-win” by switching to “commission rate & slotting fees” mode.

Title: Pricing and Channel Selection Strategies in E-Commerce Supply Chain with Hybrid Channels and Live Streaming

Presenter: Jie Zhang, Guangdong University of Finance and Economics

Co-author(s): Xin Zhang

Abstract:

With consideration of two types of live streaming channels, we construct a model for the e-commerce supply chain and analyze the impacts of several key factors: the share of online celebrities' channel, the diversion effect and the commission rate. We find when the cross-price elasticity reaches a certain threshold, the optimal choice is to establish both self-broadcast and online celebrities' live streaming channels (i.e., hybrid mode). In the hybrid mode, the price in online celebrities' live streaming channel can be unimodal regarding its share. Furthermore, high commission rate does not necessarily bring high profits for online celebrities.

Title: A Bargaining Framework for Analyzing the Economic Value of Online Celebrity

Presenter: Qianqian Chen, Zhejiang University

Co-author(s): Shouchang Chen, Lin Liu, Yi Yang

Abstract:

This paper explores how a brand seller negotiates with a celebrity over the proportion of shared revenue of products sold through the live streaming channel. We build a game theoretical model to capture the bargaining process between the seller and the celebrity in which consumers can choose to be followers or non-followers of the celebrity. Our analysis

yields that the seller can achieve the coordination in the live streaming chain when consumer-stickiness is not intermediate. And a strategic live streaming platform may restrict consumer traffic to the celebrity when the consumer-stickiness is intermediate.

Title: Introducing New Products via Social Media Influencers

Presenter: Liping Liang, Lingnan University

Co-author(s): Zhenhao Li

Abstract:

We study a firm's strategy for introducing a new product via a social media influencer. The influencer exerts an effort in a promotional campaign to sell the product to her followers. The followers may spread the product information via word-of-mouth (WOM) to non-followers, who become aware the product and may buy it in the subsequent selling period. We derive the firm's pricing and commission contract decisions, and examine how influencer-related factors (e.g., follower size, followers' WOM) affect the firm's decisions. We find that the firm may not be better off employing an influencer with a larger follower base.

Parallel Session (B12) - Interface between Operations and Marketing

Day 1: 5th Jan (Fri) 15:40-17:00 Venue: 2129B

Session Chair: Quan Zheng, University of Science and Technology of China

Title: Impact of Government Subsidy and Consumer Heterogeneity on the Green Product Design

Presenter: Lingyun Chen, The Hong Kong Polytechnic University

Co-author(s): Xiaomeng Guo, Dan Tan, and Guang Xiao

Abstract:

This paper captures two key incentives for green technology innovation: subsidy and consumers' willingness to pay a premium. It studies how these incentives affect the firm's innovation decision to identify the optimal subsidy policy for the welfare-maximizing government. Our results offer the sufficient condition for the firm to innovate and reveal the differentiating effect of subsidy policies for various recipients on innovation. In addition, we find the optimal subsidy policy and demonstrate that there exists a portfolio of subsidy policies that can yield greater social welfare than a single subsidy policy.

Title: Channel Returns and Contract Unobservability

Presenter: Tao Tao, University of Science and Technology of China

Co-author(s): Quan Zheng, Honggang Hu

Abstract:

Manufacturers frequently provide retailers with the option to return unsold inventory for full refund. The traditional explanation for channel returns relies on demand uncertainty. In contrast, our paper proposes an alternative mechanism, i.e., contract unobservability. Specifically, with certain demand, a single upstream manufacturer distributes products through two downstream retailers, and more importantly, the contract terms between the manufacturer and each retailer are secret to the rival retailer. We show that a returns policy would arise as a commitment device, enabling the manufacturer to resolve the opportunism problem owing to contract unobservability and thus restore its monopoly power.

Title: The Impact of Opt-out Rights on Content Platforms

Presenter: Xuanqi Chen, Xi'an Jiaotong University & The Hong Kong Polytechnic University

Co-author(s): Gang Li, Yulan Wang

Abstract:

Consumers provide data on content platforms (CP), but CPs may share consumer data with the third party without consents (i.e., mandatory data sharing), triggering significant

privacy concerns. To alleviate this issue, regulations require opt-out rights. We build an analytical model and show that compared with mandatory data sharing, voluntary data sharing can increase or decrease the advertising intensity. Voluntary data sharing thus may backfire and hurt consumers but benefit the CP. Win-win and loss-loss outcomes are both identified.

Title: AI Interviews and Strategic Applicants

Presenter: Chaochao Huang, University of Science and Technology of China

Co-author(s): Quan Zheng

Abstract:

This paper analyzes the implications of AI-powered interviews for both firms and applicants. The competency of an applicant depends on his personality and expertise, where the personality can be manipulated at a cost. We reveal that a firm may strategically reduce AI precision to mitigate the manipulation behavior. The traditional HR-interviews perform better than AI only when both dimensions are relatively important for the competency and the cost of manipulation is high. Moreover, we identify conditions under which HR-interviews lead to extreme recruitment strategies and AI-interviews emerge as a win-win outcome.

Parallel Session (B13) - On-Demand Service Platforms

Day 1: 5th Jan (Fri) 15:40-17:00 Venue: 2129C

Session Chair: Yang Bo, The Chinese University of Hong Kong**Title: M/M/s On Demand: Queues with On-Demand and Reserved Servers**

Presenter: Zhichao Feng, The Hong Kong Polytechnic University

Co-author(s): Milind Dawande, Ganesh Janakiraman, Anyan Qi

Abstract:

We analyze a queueing system that employs both "reserved" and "on-demand" servers – the

number of reserved servers is decided at the beginning of the time horizon while the number of on-demand servers is decided dynamically. We study two problems. The first is that of minimizing the infinite-horizon discounted cost. The second is that of minimizing the long-run average cost. We show that the optimal on-demand capacity control is a threshold-based bang-bang policy: If the number of jobs is below a threshold, then no on-demand servers are employed. Otherwise, the number of on-demand servers is chosen such that no jobs wait.

Title: Waiting Matters: The Impact of Restaurant Wait Times on Food Delivery Performance

Presenter: Xiaotian Kang, The Chinese University of Hong Kong, Shenzhen
Co-author(s): Yiming Zhang, Jingqi Wang, Qin Zhou, Haipeng Shen

Abstract:

This project investigates the relationship between waiting time at restaurants and the delivery behavior of food deliverers. By partnering with a food-delivery platform, we collect detailed order information from around one thousand food deliverers in a major city during 2022. Specifically, we examine the effects of waiting time at restaurants on delivery performance for both individual orders and orders within the same delivery batch. Furthermore, we analyze how the waiting time at restaurants influences the working hours and productivity of food deliverers throughout a day. By gaining behavioral insights, we offer operational recommendations to both platform and food delivers.

Title: Operating Three-Sided Marketplace: Pricing and Spatial Staffing in Food Delivery Systems

Presenter: Yiwen Shen, The Hong Kong University of Science and Technology
Co-author(s): Zhe Liu, Yanwei Sun

Abstract:

We study a food delivery platform's joint pricing and staffing problem under endogenous

participation of three sides: restaurants, customers and deliverers. Using a state-dependent queueing model, we study the system's equilibrium behaviors and obtain the platform's optimal pricing and spatial staffing decisions in an asymptotic regime. We show how optimal platform controls balance capacity utilization and service quality. We characterize the platform's impact on all three sides and show that the platform greatly improves the system efficiency. We find that it is important to account for the spatial effect as well as the participation decisions of all three sides.

Title: Human in The Loop Automation: Ride-Hailing with Remote (Tele-) Drivers

Presenter: Xiaotang Yang, University of Toronto

Co-author(s): Saif Benjaafar, Zicheng Wang

Abstract:

By putting the human back "in the loop," tele-driving has emerged recently as a more viable alternative to fully automated vehicles, with ride-hailing (and other on-demand transportation-enabled services) being an important application. We examine the impact of tele-driving on the efficiency of ride-hailing. Using a spatial queueing model that captures the dynamics of both pick up and trip times, we show that, perhaps surprisingly, reducing the number of drivers relative to the number of vehicles can improve the system performance, or it can significantly reduce the number of drivers without significantly affecting the system performance.

Parallel Session (B14) - Retailing and Service Operations Management

Day 1: 5th Jan (Fri) 15:40-17:00 Venue: 2130A

Session Chair: Rowan Wang, Southern University of Science and Technology

Baolong Liu, ShanghaiTech University

Title: Coopetition in Omnichannel Operations

Presenter: Zhenyang Shi, Zhejiang University of Technology

Co-author(s): Lin Liu, Yi Yang, Ziyang Zhang, Quan Yuan

Abstract:

This paper studies the cooperation partnership in omnichannel operations between an e-tailer and multiple B&M retailers under the buy-online-ship-from-store (BOFS) strategy. The e-tailer's orders can be fulfilled by B&M retailers with their store inventory, and retailers earn additional profits through a revenue sharing scheme. We build a game-theoretic model to investigate when the e-tailer and B&M retailers have the incentives to form such a cooperation partnership and when all stakeholders in the market benefit from the BOFS strategy.

Title: Scheduling of Firm-Initiated Field Appointments with Customer Choice

Presenter: Yanlu Zhao, Durham University Business School

Co-author(s): Felix Papier

Abstract:

We study the scheduling of field appointments under uncertain customer choice for the timing of the visit. The objective is to maximize the number of visits by minimizing travel and idle times of the field agent. The problem is motivated by the sales force operations of a B2B payment services company, but is applicable to a wide range of appointment scheduling problems. We formulate the problem as a Markov decision process and analytically derive structural properties. Our developed policy outperforms significantly better than existing approaches, improving the number of visits by 15% compared to the benchmark policy.

Title: Flash Sales versus Traditional Sales: Price Optimization for an Online Retailer with Pre-planned Logistics

Presenter: Ruijie Zhang, ShanghaiTech University

Co-author(s): Yun Fong Lim, Zhenzhen Yan, Xiande Zhao

Abstract:

This paper examines a novel flash-sale model where customers first pay the down payment and then wait several days to make the final payment. The down payment provides a discount for customers and helps the retailer to better estimate demand and hence pre-plan the logistics, which greatly reduces the logistics cost. We propose a joint optimization model for the down payment and product price and analyze the value of introducing the flash-sale channel. Through analytical characterization and a real-world case study, we show that the model predicts demand well and the proposed pricing strategy dramatically improve the profit.

Title: In-queue Queueing: Gaining Utility through Ancillary Service while Waiting

Presenter: Baolong Liu, ShanghaiTech University

Co-author(s): Yang Li, Rowan Wang

Abstract:

We examine a queueing system with the primary service provider also offering an ancillary service. The customers are categorized into two groups: the ones who exclusively come to the primary service (Type-P) and the ones who are also interested in the ancillary service (Type-A). While both types come for the primary service, Type-A customers line up in an embedded queue for the ancillary service which attracts more demand but increases the expected waiting time. We show that not only does the ancillary service expand demand, but also improves welfare and profit under certain conditions.

Title: Managing Truck Driver Performance in Logistics Networks

Presenter: Xingliao Wan, Rice University

Co-author(s): Yiming Zhang, Ye Shi

Abstract:

In this work, we study how the truck drivers' scheduling and driving behaviors in logistics

networks. Particularly, we are interested in how truck drivers balance their working and rest time after receiving the order, and what factors are responsible for their unsafe driving behaviors such as over-speeding. This study is based on a large-scale dataset collected from a logistics platform, which contains more than 70k orders with detailed path information from around 20k active drivers. By analyzing the highly granular path information, we provide the managerial insights to improve truck drivers' operational performance.

Parallel Session (B15) - Manufacturing and Production OM

Day 1: 5th Jan (Fri) 15:40-17:00 Venue: 2130B

Session Chair: Xiting Gong, The Chinese University of Hong Kong

Title: Optimal Policies for a Stochastic Periodic-Review Inventory System with Free Shipping Option

Presenter: Shiyu Song, Nanjing University

Co-author(s): Hongqiao Chen, Houcai Shen

Abstract:

This paper studies the optimal policies for a stochastic periodic-review inventory system with free shipping option. We characterize the single-period optimal policy under convex single-period cost assumption. Then we introduce the concepts of Q -increasing functions and K -bounded functions, which enables us to characterize the structure of the finite-horizon optimal policy for both backordering case and lost sales case. Furthermore, we characterize the optimal stationary policy for infinite-horizon discounted cost model and average cost model by vanishing discount approach. Finally, we construct a sufficient condition for the optimal policy to be fully characterized and develop an effective heuristic policy.

Title: Online Learning for Multi-Product Production Planning with Emissions Trading

Presenter: Ziyang Zhou, Shanghai Jiao Tong University

Co-author(s): Tong Wang, Jingwei Zhang

Abstract:

We consider a T-period dynamic control problem where the manufacturer produces N products and satisfies random demands under a given total emission allowance. Meanwhile, the manufacturer participates in the carbon emission trading market through transactions. After proposing an insightful reformulation and deriving theoretical properties for the optimal policy, we establish, firstly, an easy-to-implement heuristic policy that achieves performance within $O(TN^{1/2})$ of optimal. Secondly, we consider the problem in an online version where the distributions of demand and the trading price are unknown, and develop an algorithm that achieves regret bounded by $O(T^{2/3}N + TN^{1/2})$.

Title: Learning to Order for Inventory Systems with Lost Sales and Uncertain Supplies

Presenter: Jiashuo Jiang, The Hong Kong University of Science and Technology

Co-author(s): Boxiao Chen, Jiawei Zhang, Zhengyuan Zhou

Abstract:

We consider a stochastic lost-sales inventory control system with a lead time L over a planning horizon T. Supply is a function of the order quantity (due to random yield/capacity, etc). We aim to minimize the T-period cost, a problem that is known to be computationally intractable even under known distributions of demand and supply. We assume that both the demand and supply distributions are unknown and develop a computationally efficient online learning algorithm. We show that our algorithm achieves a regret that is sublinear in T and depends linearly in L, which is new in the literature.

Title: Inventory Control Involving Opaque Selling

Presenter: Yuan Qu, The University of Hong Kong

Co-author(s): Jian Yang

Abstract:

We proposed a stylized model to help a firm practice opaque selling optimally. Rather than a given replenishment policy, we offer the best real-time decisions for both replenishment and rationing. Themes like contraction mapping, submodularity, diagonal dominance, concavity, and mild monotonicity all loom large in this study. Fitting the rationing aspect is a potentially new property of balance-inducing monotonicity. Key to the current joint rationing-replenishment control is the simultaneous preservation of all kinds of value-function properties, which has been verified. An immediate consequence is both rationing and production follow the balance-inducing principle even when the replenishment decision is jointly made.

Parallel Session (B16) - Stochastic Simulation in Complex Systems**Day 1: 5th Jan (Fri) 15:40-17:00 Venue: 2130C****Session Chair: Jun Luo, Shanghai Jiao Tong University****Kun Zhang, Renmin University of China****Title: High-Dimensional Simulation Optimization via Brownian Fields and Sparse Grids**

Presenter: Liang Ding, Fudan University

Co-author(s): Xiaowei Zhang

Abstract:

We propose a sampling algorithm that converges to a global optimal solution and suffers

minimally from the curse of dimensionality. Under mild conditions on the smoothness of the response surface and the simulation noise, we establish upper bounds on the convergence rate for both noise-free and noisy simulation samples. These upper bounds deteriorate only slightly in the dimension of the feasible set, and they can be improved if the objective function is known to be of a higher-order smoothness.

Title: Over-Conservativeness of Variance-based Efficiency Criteria and Probabilistic Efficiency in Rare-event Simulation

Presenter: Zhiyuan Huang, Tongji University

Co-author(s): Yuanlu Bai, Henry Lam, Ding Zhao

Abstract:

In rare-event simulation, an importance sampling (IS) estimator is regarded as efficient if its relative error, namely the ratio between its standard deviation and mean, is sufficiently controlled. It is widely known that when a rare-event set contains multiple "important regions" encoded by the dominating points, IS needs to account for all of them via mixing to achieve efficiency. We argue that missing less significant dominating points may not necessarily cause inefficiency, and the traditional analysis recipe could suffer from intrinsic looseness by using relative error, or in turn estimation variance, as an efficiency criterion. We propose a new efficiency notion called "probabilistic efficiency" to tighten this gap. The new notion is especially relevant in high-dimensional settings where the computational effort to locate all dominating points is enormous.

Title: Smooth Nested Simulation: Bridging Cubic and Square Root Convergence Rates in High Dimensions

Presenter: Wenjia Wang, The Hong Kong University of Science and Technology
(Guangzhou)

Co-author(s): Yanyuan Wang, Xiaowei Zhang

Abstract:

Nested simulation concerns estimating functionals of a conditional expectation via simulation. In this work, we propose a new method based on kernel ridge regression to exploit the smoothness of the conditional expectation as a function of the multidimensional conditioning variable. Asymptotic analysis shows that the proposed method can effectively alleviate the curse of dimensionality on the convergence rate as the simulation budget increases, provided that the conditional expectation is sufficiently smooth. We demonstrate the performance of the proposed method via numerical examples from portfolio risk management and input uncertainty quantification.

Title: Efficient Risk Quantification via a Nested Simulation Method

Presenter: Kun Zhang, Renmin University of China

Co-author(s): Guo Liang, Jun Luo

Abstract:

Risk quantification is pivotal in both portfolio risk measurement and input model uncertainty. This paper aims to quantify the risk by studying widely used risk measures, Value-at-Risk (VaR) and Conditional Value-at-Risk (CVaR). We introduce a jackknife-based nested simulation method to estimate these measures, providing point estimators, confidence intervals (CIs), and deriving their asymptotic properties. Furthermore, we propose an efficient algorithm that ensures the mean squared errors of the estimators and the widths of the CIs decay at their optimal rates in practice. Numerical results are consistent with the theory presented.

Parallel Session (B17) - Information Sharing and Design in Supply Chains

Day 1: 5th Jan (Fri) 15:40-17:00 Venue: 2131A

Session Chair: Yihong Hu, Tongji University

Title: Information Sharing, Information Quality and Competition in a Dual-Sourcing Supply Chain

Presenter: Jizhou Lu, Central University of Finance and Economics

Abstract:

This paper investigates the impact of information sharing and quality on supplier competition in a dual-supplier supply chain, with market demand modeled as a time series. Employing a state-dependent base-stock policy and minimum mean-squared error forecast method, we examine various information-sharing and quality scenarios. Findings reveal that a supplier's demand increases with competitive power, yet escalating power also brings higher inventory costs, mitigated by information sharing. Suppliers must balance these factors to identify an optimal competitiveness level. Information errors influence competition dynamics, with transmission errors providing a comparative advantage when information is shared with both suppliers. Differentiation, rooted in varied information statuses and qualities, underscores the significance of negotiating exclusive information-sharing collaborations and reinforcing information-quality management systems based on error types.

Title: Entry and Competition Strategy in a Neighborhood Fresh Product Retailing Market

Presenter: Qiuxia Chen, Huazhong University of Science and Technology

Co-author(s): Xuelian Qin, Zhixue Liu

Abstract:

We consider a competitive fresh product retailing market consisting of one pre-existing retailer (A) with the in-store (S) mode and one invasive retailer (B) with either the pre-warehouse (W) mode or the store-as-warehouse (H) mode, which both modes provide fresh product online ordering and instant delivery service to consumers, and the H mode additionally serves an offline channel to consumers than the W mode. We focus on the strategic mode choice of retailer B and investigate the optimal operating decisions of retailers, and further study the impact of retailer B's entry on retailer A.

Title: Competition in the Quality Award and Cooperation in the Product Quality in the Supply Chain: A Double-edged Sword for Product Quality Improvement

Presenter: Zizhuo Wang, Shandong University

Co-author(s): Xin Fang, Ying-Ju Chen, Mingzheng Wang

Abstract:

We compare the impacts of two types of product quality awards – the one with publicity license and that with publicity restriction – on the final product of a supply chain. The manufacturer develops one essential component and purchases the other one from the supplier. The final product quality is determined by both players' quality level decisions. The players compete in the quality award based on their quality levels. By comparing with the benchmark, we find that the quality award with publicity license may backfire which reduces the final product quality, and may even result in the supplier's free-riding behaviour; while, the one with publicity restriction is more likely to incentivize players to choose high quality levels. Our results provide some implications for the government and NGOs about product quality awards.

Title: Information Sharing and Personalized Pricing in Online Platforms

Presenter: Yihong Hu, Tongji University

Co-author(s): Guo Li, Mengqi Liu, Shengnan Qu

Abstract:

With the rise of big data technology, an online platform can easily gather customer information to engage in price discrimination and obtain additional profits. Sharing customer information with a third-party seller increases the platform's commission and information revenue, but the seller's personalized pricing using customer information intensifies the price competition, which may damage the profitability of the platform's own product. Whether to share information remains an unsolved strategy decision for the

platform. We employ a game-theoretic model to characterize the interplay of information sharing by the platform and the pricing strategies of two firms. We consequently study four basic scenarios where the two firms adopt either uniform or personalized pricing policies. In equilibrium, the seller does not always have incentives to acquire information, and the platform is not always willing to share information. Intriguingly, with different combinations of the commission rate and the new consumer ratio, the equilibrium of the overall system has four possible results where the information may not be used for price discrimination. With a relatively high commission rate and a low new consumer ratio, the platform no longer pursues a demand for its own product and lets the seller occupy the whole market, which leads to the lowest consumer surplus and social welfare. We finally show that in the event of a relatively high commission rate, prohibiting information sharing increases consumer surplus and social welfare, verifying the necessity of regulations. These results could provide useful guidelines for platform managers and regulators to better design information sharing and price discrimination policies.

Parallel Session (B18) - Emerging Trends in Operations: Optimal Design and Policies

Day 1: 5th Jan (Fri) 15:40-17:00 Venue: 2131B

Session Chair: Yong-Hong Kuo, The University of Hong Kong

Title: Dynamic Inventory Control with Covariates: Regularization and Time Inconsistency

Presenter: Shaochong Lin, The University of Hong Kong

Co-author(s): Frank Chen, Yanzhi Li, Max Shen

Abstract:

Starting with historical demand trajectories of similar products and their covariate information, we develop a data-driven approach to dynamic inventory planning for new products. We employ non-parametric machine learning methods to model the uncertain demand and incorporate the newly available demand information in a folding-horizon

manner. Our data-driven model with profit-risk constraints and information updates brings computational and analytical challenges, e.g., issues of time inconsistency. To analyze the performance of the proposed approach and address the challenge pertaining to time inconsistency, we develop a time-consistent folding-horizon model as a benchmark. We are able to establish the asymptotic optimality of the original model with respect to the sample size. To assess the real performance of our approach, we conduct extensive numerical experiments with real and synthetic data.

Title: Operating Policies for Robotic Cellular Warehousing Systems

Presenter: Benedict Jun Ma, The University of Hong Kong

Co-author(s): Yong-Hong Kuo, Shenle Pan, and George Q. Huang

Abstract:

The robotic cellular warehousing system is an innovative technology for e-commerce order fulfilment in which robots pick orders underneath a set of dispensers, called multi-robot parallel picking. By analysing real-world online customer order data, we found that single-line orders dominate the e-commerce market, which significantly affects the operating policies applied in warehouses. This paper studies and compares two picking strategies (pick-while-sort vs. pick-and-sort) and three robot-to-workstation assignment rules (random, closest, and dedicated). The single-class and multi-class closed queueing network (CQN) models are developed to estimate the maximum throughput capacity under different policies.

Title: Price Competition and Contract Design on Third-party Online Healthcare Platform and Offline Hospital under Information Asymmetry

Presenter: Fangyuan Cao, The University of Hong Kong

Co-author(s): Jie Wang, Yong-Hong Kuo, Feng Tian

Abstract:

Third-party online healthcare platforms, e.g., HealthTap, become popular in recent years.

However, the impacts of such platforms on different parties are unclear due to the unobservable abilities of online doctors. Therefore, we discuss: (1) what is the impact of an online healthcare platform on the welfare and decisions of offline hospitals, patients, and doctors? (2) how should the online platform design incentive contracts to motivate online doctors to offer better medical services? Will the platform acquire online doctors' private information actively, or online doctors reveal their abilities' information themselves? This paper studies the competition between different parties under information asymmetry.

Title: A Choice-Based Recommendation Model with Sequential Choice Behavior

Presenter: Chenbin Luo, City University of Hong Kong

Co-author(s): Weili Xue

Abstract:

Recommendation methods frequently encounter challenges related to data sparsity when reliant on implicit feedback. In contrast to conventional models, we adopt a discrete choice perspective for product recommendation. The Apriori algorithm is employed to construct a user behavior tree that encapsulates sequential behavior. Subsequently, the behavior structure is modeled through a multi-layer Nested Logit model, integrating matrix factorization to capture latent preference factors. By incorporating the consider-then-choose framework, our product assortment recommendation model demonstrably enhances expected revenue. Empirical numerical experiments demonstrate unbiased parameter estimates, while industry datasets exhibit superior predictive performance, particularly in scenarios involving sparse data.

Title: Deceptive Online Reviews in Competitive Markets: The Blockchain Solution and its Implications

Presenter: Boru Li, The University of Hong Kong

Co-author(s): Jie Wang, Yong-Hong Kuo

Abstract:

Blockchain technology leverages its traceability and tamper-proof records to integrate each stakeholder within the supply chain, ensuring complete and transparent information flow through upstream to downstream. Its gradual implementation in e-commerce additionally enhances the veracity of online reviews. Given that the distinct reviews environment influence consumer purchasing decisions in different level, this study delineates two scenarios: one platform with prevalent fake reviews and another where blockchain underpins accurate and verified reviews. Specifically, we investigate the effects of these review environments on the customers' behaviour, the platform's blockchain investment decision, and the firms' pricing strategy. Initially, our research conducts an empirical analysis of customers' credit and privacy sensitivity, which correlate with their attitudes toward blockchain adoption. Then, we consider a game-theoretical model to contrast the short-term and long-term profitability of firms and platforms, revealing insights of strategic recalibration in handling online reviews and blockchain's practical value across time horizons.

Parallel Session (B19) - Empirical Studies in Healthcare Operations

Day 1: 5th Jan (Fri) 15:40-17:00 Venue: 2131C

Session Chair: Sarah Yini Gao, Singapore Management University

Title: Rethinking Appointment Scheduling: Addressing Counsellor Burnout and Improving Patient Outcomes

Presenter: Yuchen Liang, National University of Singapore

Co-author(s): Sarah Yini Gao, Kejia Hu, Chung-Piaw Teo

Abstract:

The growing demand for mental health services has placed significant strain on psychological counsellors, posing unique challenges for counselling clinic operations. We study the impact of burnout on counsellor performance and clinic operations within the appointment scheduling context. Leveraging a data-set from a counselling clinic in a Singaporean university, we examine the effects of workload and task complexity on counsellor behaviours, and their subsequent impacts on patients. To improve clinic

operations, we propose a scheduling heuristic that integrates workload and task complexity considerations, and develop a discrete-event simulation model to compare the results.

Title: Screening Process Information Matters More Than Clinical Information: A Randomized Controlled Trial of Information Sharing on Cancer Screening Decision

Presenter: Xiaodong Wang, Singapore Management University

Co-author(s): Yongjian Zhu, Sarah Yini Gao, Zhichao Zheng

Abstract:

Information sharing is frequently used by policymakers to swing one's decision-making. Particularly in healthcare service systems, sharing "proper" information could induce desired behaviour from patients. However, literature reaches no consensus on the effective components of information to share. This paper focuses on information sharing in the context of cancer screening promotion. Leveraging data from a randomized controlled trial specifically related to colorectal cancer, we find sharing information on screening process significantly improves screening intention, whereas sharing clinical information does not. The impact of information awareness and heterogeneous effect of information content are investigated. Actionable insights are provided for healthcare policymakers.

Title: Small Area Estimation of Case Growths for Timely Covid-19 Outbreak Detection

Presenter: Zhaowei She, Singapore Management University

Co-author(s): Zilong Wang, Jagpreet Chhatwal, Turgay Ayer

Abstract:

Rapid and accurate detection of local outbreaks is critical to tackling resurgent waves of COVID-19. A fundamental challenge in case growth rate estimation, a key epidemiological parameter, is balancing the accuracy vs. speed tradeoff for small sample sizes of counties. We develop an algorithm, Transfer Learning Generalized Random Forest (TLGRF), that balances this tradeoff. Through transfer learning, TLGRF can accurately estimate case

growth rates for counties with small sample sizes based on relevant day and county-level features affecting the disease spread. TLGRF outperforms established growth rate estimation methods and demonstrated that it can greatly improve the timely detection of outbreaks.

Title: The Impact of Online Service Channels on Visit Demand and Sojourn Time

Presenter: Heng Zhao, Tongji University

Co-author(s): Chunyang Tong

Abstract:

This paper estimates the effectiveness of introducing online service channels, using panel data collected from a comprehensive public hospital equipped with both online and offline channels. Our study reveals that patient online channels adoption is associated with a decrease in offline visits but an increase in total visits. Although the sojourn time of offline visits has significantly decreased in tandem with offline visits, the overall sojourn time has not increased significantly along with the total visits. This implies that online channels enable increased interactions between patients and healthcare providers without a significant change in overall system sojourn time.

Parallel Session (B20) - Socially Responsible, Green, and Analytics-Driven Operations

Day 1: 5th Jan (Fri) 15:40-17:00 Venue: 2132A

Session Chair: Wei Zhang, The University of Hong Kong

Title: Mitigating Negative Externalities in Urban Services: Evidence from the Bike-Sharing Industry

Presenter: Weiming Zhu, The University of Hong Kong

Co-author(s): Victor Martínez-de-Albéniz, Qihang Yang, Jianfeng Lin, Zhaochen Dong, Jinglong Dai

Abstract:

Decentralized business models have emerged in recent years as a disruptive form of service provision. One popular variant of this new breed of firms are two-sided platforms which manage supply - either directly or indirectly - via economic mechanisms, and match supply-side producers with demand-side consumers. While supply decisions elevate platforms revenue, they may have a negative effect on the rest of the economy, as they remove available capacity from other usages. For example, ride-sharing drivers contribute to traffic congestion, while shared bikes occupy valuable sidewalk space. In this study, we collaborate with a leading bike-sharing platform to investigate how such platforms can minimize the negative externalities generated during service provision and the associated costs. Specifically, we propose a novel empirical strategy to (a) assess sidewalk congestion level, and (b) construct a link function to estimate the impact of bike supply on sidewalk congestion levels. We then validate our estimation results through a field experiment. Building on our estimations, we incorporate additional constraints to the current bike relocation algorithm to mitigate bike congestion, and evaluate the effectiveness of the proposed algorithm in reducing negative externalities and its impact on platform revenue via a field experiment.

Title: Fee-for-Battery or Fee-for-Mile? An Equilibrium Analysis of a Battery Swapping Station

Presenter: Tianyi Zhao, City University of Hong Kong

Co-author(s): Na Li, Zhankun Sun, Wei Zhang

Abstract:

The prolonged charging times pose a significant obstacle to the broader adoption of electric vehicles (EVs). Battery swapping is considered a promising complement to alleviate this issue. We study two pricing schemes for battery swapping stations: fee-for-mile, wherein users pay for the energy used for each exchanged battery according to a per-mile price, and fee-for-battery, which involves a fixed fee for each battery swap. We investigate the impact

of pricing scheme on customer behavior, firm profit, and EV adoption rate.

Title: A-B Testing with Strategic Agents

Presenter: Guoxing He, The University of Hong Kong

Co-author(s): Wei Zhang

Abstract:

Oftentimes, A-B tests must be conducted at the level of business unit (e.g., branch stores and regions) to evaluate the effectiveness of a strategic initiative. We consider two challenges for A-B tests in such circumstances. First, due to the limited population of business units, it is almost impossible to find a perfect control for the treatment group. Second, the manager, having better knowledge of a business unit, may hesitate to engage as the treatment group due to the risk of a negative impact or to share the knowledge. To reduce the estimation error and to address the participation issue, we study four different mechanisms for the firm and compare their cost effectiveness.

Title: Reducing Food Waste in Delivery Channels: Should We Regulate the Pricing Scheme?

Presenter: Wei Zhang, The University of Hong Kong

Co-author(s): Yuyang Ou

Abstract:

Spend-and-save pricing (SSP) schemes are frequently used in the food delivery channels and are blamed for causing a significant amount food waste. We use a stylized model to investigate the motivation for a monopolist restaurant to use the SSP scheme and study the levels of food waste and social welfare with and without SSP, respectively. We find that the restaurant's optimal SSP causes food waste only from consumers with high willingness to pay; in addition, it may not be necessary for a social planner to ban or restrict the SSP scheme to maximize the social welfare.

Parallel Session (B21) - Information Disclosure on Sustainable Operations

Day 1: 5th Jan (Fri) 15:40-17:00 Venue: 2132B

Session Chair: Jianyue Wang, The Hong Kong University of Science and Technology

Title: Mandatory Carbon Reporting and Firm Operational Efficiency: Empirical Evidence from the UK

Presenter: Hugo Lam, University of Liverpool

Co-author(s): Andy Yeung, Jeff Ng, Chris Tang

Abstract:

Regulators around the world have started to force firms to report carbon emissions, but it is unclear how such mandates may affect firms' operational efficiency. Our research tackles this important issue by conducting a quasi-natural experiment in the UK, in which firms listed on the London Stock Exchange have been required to report carbon emissions annually since 2013. Specifically, we quantify the impact of the new reporting requirement on the operational efficiency of the UK firms concerned. We also explore how the impact may vary across UK firms with different reporting behaviours and operating in different environments.

Title: Implications of SR Disclosure Strategies in Platform Retailing

Presenter: Yurong Liang, Wuhan University

Co-author(s): Bin Dai

Abstract:

Social responsibility (SR) disclosure is vital for retail platforms and suppliers due to

growing consumer social consciousness. In this study, we examine the optimal SR disclosure strategies under different modes. The results show low SR level leads to no disclosure, moderate SR level favors overstate disclosure, and high SR level opts for truthful disclosure. Interestingly, SR disclosure makes the supplier more likely to choose agency mode. The supplier in agency channel with low marginal selling cost and commission rate is more likely to overstate SR. SR overstate disclosure boosts the supplier's profit and consumer surplus but may decrease platform's profit.

Title: Common Ownership and Corporate Climate Risk Disclosure: Evidence from Chinese Listed Firms

Presenter: Chen Wang, Xi'an Jiaotong University

Co-author(s): Jianling Wang

Abstract:

Climate risk disclosure is an important channel for shareholders to understand corporate climate governance. We use textual analysis to construct climate risk disclosure variable and examine the impact of common ownership on firm's climate risk disclosure using data of Chinese listed firms from 2012 to 2020. We find that common ownership can increase corporate climate risk disclosure through information transmission and collaborative governance mechanisms. This effect is more pronounced for firms with higher EPU, higher managerial ability, and in industries sensitive to climate change. The results have implications for literature and practitioners to increase information transparency and promote sustainable development.

Title: Apparel Retail and Rental Business Models and Sustainability Implications

Presenter: Jianyue Wang, The Hong Kong University of Science and Technology

Co-author(s): Ki Ling Cheung, Albert Ha

Abstract:

We develop several game theoretical models in which an apparel manufacturer who sells

apparel products directly to consumers can consider introducing rental to its business with endogenous product quality. It is shown profitability and sustainability are not mutually exclusive. We also evaluate the impact of four commonly adopted public policies on product sustainability in our models.

Parallel Session (B22) - Topics in Behavioral Operations

Day 1: 5th Jan (Fri) 15:40-17:00 Venue: 2132C

Session Chair: Lei Xie, Shanghai University of Finance and Economics

Title: Efficient Frontier and Applications in Product Offering and Pricing

Presenter: Chenxu Ke, Shanghai University of Finance and Economics

Co-author(s): Lijian Lu, Ruxian Wang

Abstract:

The joint assortment and pricing problem is notoriously challenging to solve, especially for large problems under various operational constraints arising from business practices. In this paper, we consider joint optimization problems under the constrained logit choice models with product-differentiated price sensitivities in static, randomized and dynamic settings. We develop a unified optimization methodology that applies efficient frontier and dimensional reduction and transforms the joint optimization into a single-variable problem with the aggregate resource consumption rate. The efficient frontier is employed to transform the non-concave objective function equivalently into its concave counterpart.

Title: Temptation and Information Provision in Live-streaming Channel

Presenter: Liu Yang, Tsinghua University

Co-author(s): Tianwu Zhou, Laurens Debo, Shuo Huang

Abstract:

This paper examines an innovative business model, live-streaming e-commerce. A live-streaming channel provides information but tempts customers. We propose a stylized

model to study when it is profitable for the firm to introduce a live-streaming channel and its implications of the product return. We have shown that a firm can always achieve higher profit in a live-streaming channel by calibrating the temptation level. Our results also demonstrate that the production cost and return cost are critical parameters for determining the temptation level.

Title: Managing Emergency Supplies with Guaranteed Delivery Under Dynamic Government's Orders and Real-time Relief Supplier Response

Presenter: Linqiu Li, University of Science and Technology of China

Co-author(s): Minxuan He, Fang Liu, Arvind Sainathan

Abstract:

A government cooperates with a relief supplier to manage emergency supplies. Based on mutual agreement, the government can only order again after certain periods from its previous order. We formulate the two parties' interactions as a bargaining game followed by the government's ordering problem and the supplier's replenishment problem. We propose a novel time index to solve the supplier's cyclic dynamic programming problem. Through numerical studies, we find that pooled system is much better than dedicated system for less likely but more lethal disasters. We then conduct a case study to generate insights on the management of emergency supplies.

Title: Allocating Divisible Resources on Arms with Unknown and Random Rewards

Presenter: Wenhao Li, Shanghai University of Finance and Economics

Co-author(s): Ningyuan Chen

Abstract:

We consider a decision maker allocating one unit of renewable and divisible resource in each period on a number of arms. The arms have unknown and random rewards whose means are proportional to the allocated resource and whose variances are proportional to an order b of the allocated resource. When the order b ranges from 0 to 1, the framework

smoothly bridges the standard stochastic multi-armed bandit and online learning with full feedback. We design two algorithms that attain the optimal gap-dependent and independent regret bounds, and demonstrate a phase transition at $b=0.5$. The theoretical results hinge on a novel concentration inequality.

Parallel Session (C1) - Emerging Topics of Decision-Making in Operations Management**Day 2: 6th Jan (Sat) 13:30-14:50 Venue: 2126D****Session Chair: Jiashuo Jiang, The Hong Kong University of Science and Technology****Title: Online Resource Allocation: Bandits Feedback and Advice on Time-Varying Demands**

Presenter: Lixing Lyu, National University of Singapore

Co-author(s): Wang Chi Cheung

Abstract:

We consider a general online resource allocation model with bandit feedback and time-varying demands. Motivated by the recent online algorithms with advice framework, we incorporate online advice into policies for online resource allocation. We design a robust online algorithm, dubbed OA-UCB, that leverages online predictions on the total demand volume. Empowered with online advice, OA-UCB is theoretically shown to converge to the optimality when the online advice is sufficiently accurate. Finally, we adapt our model to a network revenue management problem, and numerically demonstrate that our algorithm can still perform competitively compared to existing baselines.

Title: Smart Coordinated Multi-Energy Intra-Scheduling Inter-sharing and Cost-saving Redistribution for Multiple Microgrids

Presenter: Yangbing Xu, Zhejiang University

Co-author(s): Xin Lin, Shengxuan Ye, Qianyun Wen, Weihua Zhou, Jiangtao Huangfu

Abstract:

This paper designs a two-stage decision framework for day-ahead operations of smart information center, where the first stage minimizes the total cost by the proposed multi-energy intra-scheduling and inter-sharing mode and the second stage implements the smart

cost-saving redistribution model to stimulate Microgrids in long-term joining of energy sharing. The extended alternating direction multipliers method algorithm is developed to protect the privacy of Microgrids' data while approximating the optimal solution of the first stage. The case study proves that the two-stage framework performs better with more heterogeneity of Microgrids.

Title: Distributionally Robust Discrete Choice Model and Assortment Optimization

Presenter: Daniel Zhuoyu Long, The Chinese University of Hong Kong

Co-author(s): Bin Hu, Qingwei Jin, Yu Sun

Abstract:

We consider an assortment optimization problem where the retailer needs to choose a set of products to offer to customers. We study the robust setting in the sense that we do not have exact knowledge of the distribution of customers' utility from each product. We show that the optimal assortments exhibit a revenue-ordered property. We derive the worst-case distribution, and construct worst-case choice model based on the worst-case distribution and provide insights on the effects of distributionally robust setting. When the assortment optimization problems have a cardinality constraint, we develop efficient methods to find optimal solutions.

Title: Target-Based Inventory Fulfillment Problem with Fairness Consideration

Presenter: Ziqi Liu, Zhejiang University & City University of Hong Kong

Co-author(s): Zheng Cui, Weihua Zhou

Abstract:

We study the two-stage inventory fulfillment problem with multiple suppliers and multiple retailers with uncertain demand and supply. The decision maker determines the production quantities of suppliers before knowing the actual demand and available supply, and the allocation quantities after the randomness is realized. We take a target-based distributional

robust optimization approach with a moment-based ambiguity set. Moreover, we propose a new decision criterion that considers the fairness of the allocation results and uniform risk measure of target violation as our objective. We analyse the pooling effect, scenario values, and the superiority of our uniform and fair risk measures numerically.

Parallel Session (C2) - Data Driven Operations Management

Day 2: 6th Jan (Sat) 13:30-14:50 Venue: 2126A

Session Chair: Fang Liu, Durham University

Yanlu Zhao, Durham University

Title: The Trade Credit Bullwhip Effect in Production Networks

Presenter: Chong Chen, Central University of Finance and Economics

Co-author(s): Fang Liu, Ziang Wang

Abstract:

We model and empirically test trade credit bullwhip effect (TC-BWE) along the production networks, indicating that the volatility of trade credit offered by more upstream firms is greater. Customer transparency, supplier opaqueness, and market competition positively influence the TC-BWE, while the supplier's external financing ability can mitigate the TC-BWE. Additionally, we show that customer portfolio management can effectively attenuate the TC-BWE. The results of our study demonstrate that the formation, dissolution, and replacement of the customer base can effectively smooth out the trade credit. This study extends prior research on order-based BWE and offers new insights into financial flow volatilities.

Title: Toward Climate Resilient Cities: Robust Planning Against Extreme Rainfalls

Presenter: Wei Qi, Tsinghua University

Co-author(s): Sheng Liu, Aiqi Zhang

Abstract:

We are experiencing prolonged and intensified rainfalls in our cities due to climate change. Urban stormwater infrastructure is typically planned based on empirically predetermined rainfall scenarios on the Intensity-duration-frequency (IDF) Curve, which fails to capture the worst scenario that should be planned against. Leveraging robust optimization techniques, this paper identifies the worst-case rainfall scenario that will cause the most severe flooding loss. Our analysis reveals that not all rainfalls on the same IDF curve are equal in terms of the incurred flooding loss. We demonstrate that cities should be savvy in balancing between their investments in stormwater retention flow rate and in stormwater retention capacity, as reflected in the composition of green and grey infrastructures. Finally, we show that the flooding loss will quickly ramp up as the climate change risk exacerbates, underscoring the urgency of taking the proposed integrated measures.

Title: Personalized Dynamic Pricing and Learning with Customer Feature and Limited Inventories

Presenter: Yifan Li, Shanghai University of Finance and Economics

Co-author(s): Yangyang Liu, Lei Xie, Fan Zhou

Abstract:

We consider a dynamic pricing and learning problem in the presence of customer feature and limited inventories. Customers sequentially arrive with his/her feature information with a d -dimensional vector. Product inventory perish after a finite horizon and would be replenished to a fixed capacity level. The company's goal is to maximize the total expected revenue by estimating demand parameters and value functions. We show that, the greedy pricing decision possesses a self-exploration property with high probability and reach an expected regret at $O(d \sqrt{\log T} + d^2 \log T)$ under certain assumptions. In addition, the expected regret of any admissible policy satisfies $\Omega(d \log T)$ when a self-exploration property is hold and otherwise satisfies $\Omega(d\sqrt{T})$.

Title: Optimal Pricing Strategies of Information Goods with Data-Enabled Learning

Presenter: Yu Tang, Shanghai University of Finance and Economics

Co-author(s): Fang Liu, Lei Xie

Abstract:

We consider a monopoly that sells information goods in a two-period model with data-enabled learning. The data-enabled learning consists of the across-user learning and within-user learning. We characterize the optimal pricing strategies and analyze how data-enabled learning affects the optimal decisions.

Parallel Session (C3) - Sequential Learning Problems in Operations Management

Day 2: 6th Jan (Sat) 13:30-14:50 Venue: 2126B

Session Chair: Dongwook Shin, The Hong Kong University of Science and Technology

Title: Online Reusable Resource Advance Booking with Multi-Class Arrivals

Presenter: Tianming Huo, National University of Singapore

Co-author(s): Wang Chi Cheung

Abstract:

We study an adversarial online reusable resource advance booking problem. The decision maker allocates a single type of reusable resource to sequentially arriving customers who are heterogeneous in terms of their willingness to pay, and their time spans between their arrival time and service starting time. This is the first work that allows the arbitrariness of the latter quantity. We propose a novel online algorithm featuring the notion of rejection price, which serves to reserve capacity for more profitable future customers. We show that with large capacities, our algorithm achieves at least half of the best possible competitive ratio.

Title: A Mallows-Type Model for Preference Learning from (Ranked) Choices

Presenter: Yuxuan Tang, National University of Singapore

Co-author(s): Yifan Feng

Abstract:

We consider a preference learning setting where participants' feedback consists of a list of top-k preferred items from different subsets. We developed a distance-based ranking model to capture this feedback structure. Our model offers closed-form expressions for ranked choice probabilities, makes model estimation relatively easy, and captures real-world data well. Using this model, we consider a sequential experiment design problem where a company adaptively displays menus of products and requests customers' top-k ranked choices to identify the top candidate. We study how the richness of feedback structure affects informational efficiency. We find that while a larger k always helps with informational efficiency, a small $k=2$ often achieves near or full optimality.

Title: Discovering Logic-Informed Intrinsic Rewards to Explain Human Policies

Presenter: Yinghao Fu, The Chinese University of Hong Kong, Shenzhen

Co-author(s): Shuang Li

Abstract:

In high-stakes systems such as healthcare, it is crucial to distill expert clinicians' knowledge into logical rules. Assuming rationality in expert decision-making, our proposed Inverse Reinforcement Learning (IRL) algorithm automatically extracts these rules through a neural logic tree generator. Trained to generate logical statements backward from the goal, the generator facilitates forward reasoning for optimal policy planning. The IRL-driven learning process uncovers effective strategic rules, demonstrating our method's prowess in extracting meaningful logical insights, notably in healthcare scenarios. Additionally, our algorithm enables the recovery of the underlying reward function, enhancing its interpretability and applicability.

Title: Feature Misspecification in Sequential Learning Problems

Presenter: Dongwook Shin, The Hong Kong University of Science and Technology

Co-author(s): Dohyun Ahn, Assaf Zeevi

Abstract:

In this paper, a decision maker must learn the unknown statistical characteristics of a finite set of alternatives using sequential sampling to ultimately select the best ones. System performance is governed by a set of features. The decision maker postulates the dependence on these features to be linear, but this model may not precisely represent the true underlying system structure. We show that this misspecification, if not managed properly, can lead to suboptimal performance due to a phenomenon identified as sample-selection endogeneity. We propose a prospective sampling principle that eliminates the adverse effects of misspecification in an asymptotic setting.

Parallel Session (C4) - Empirical Operations Management

Day 2: 6th Jan (Sat) 13:30-14:50 Venue: 2126C

Session Chair: Weiming Zhu, The University of Hong Kong

Title: Solving the Traffic Puzzle: Optimal Policies for Streamers in Live-Streaming Commerce

Presenter: Liu Ming, The Chinese University of Hong Kong, Shenzhen

Co-author(s): Feifan Zhang, Wenchang Zhang

Abstract:

Live-streaming commerce is a novel business model and its rise in China represents its successful promotion of matching consumer demand and supplier offerings in its way. The success of a live-streaming session, for both the streamers and brands, largely depends on the traffic in the live-streaming room. Streamers make great efforts during live streams, such as giving out bonuses, interactive engagements, promotions, or direct traffic driving, all in

an attempt to maintain the room's traffic. However, traffic changes over time aren't entirely controllable, and rules for traffic distribution are managed by the platform's algorithm. As a result, how to better manage and utilize traffic has become a common challenge for streamers and brands alike.

Our study aims to maximize sales in live-streaming rooms and, we have constructed a dynamic optimization model under continuous time. We find that the optimal traffic management strategies differ for streaming rooms with different initial states. For smaller streamers, their best strategy is to try to stay within their current traffic pool as much as possible; for medium and large streamers, they should strive to exceed their limits and enter a higher traffic pool as early as possible in the live broadcast. We collected data from TikTok (China) to validate and quantify our results. Our findings provide business insights and actionable suggestions for the current traffic dilemma, and offer perspectives for better control of traffic levels by the platforms.

Title: Dissecting the Learning Curve for Manufacturing Efficiency: An Empirical Analysis

Presenter: Menfei Li, Fudan University

Co-author(s): Yue Cheng, Liu Ming, Xiaole Wu, Wenchang Zhang,

Abstract:

Our study explores learning effects in the production processes of small/median sized manufacturing firms. We focus on the enhancement of four key operational stages - raw material procurement, material inventory turnover, production, and finished goods inventory turnover - through learning, and the impact of firm and personnel factors such as skill proficiency and workload on learning effectiveness. The research is grounded in a rich dataset from dozens of manufacturing firms, allowing for precise tracking of each production process's timeline and various pieces of information. We employ a range of empirical strategies to analyze how production efficiency evolves with experience and assess the influence of different factors on learning efficiency. Our findings reveal variations in learning efficiency across firms and products and identify key organizational and operational factors that bolster learning. These insights offer practical recommendations

for managerial optimization, leading to improved organizational effectiveness, and underscore the vital role of continuous learning in enhancing manufacturing efficiency, a critical determinant of the competitiveness of order-responsive enterprises.

Title: Data-Driven Real-Time Coupon Allocation in Online Platform: A Large-Scale Field Experiment

Presenter: Weiming Zhu, The University of Hong Kong

Co-author(s): Jinglong Dai, Hanwei Li, Jianfeng Lin,

Abstract:

Allocating coupons in online marketing campaigns poses significant challenges for platforms with extensive user bases and diverse product portfolios. These challenges encompass fractional and non-convex Return on Investment (ROI) constraints, as well as intricate data-generating processes arising from the platform running multiple campaigns concurrently. In this study, we partner with a leading platform to initially train an uplift model that predicts customer Conversion Rates (CVR) under various pricing schemes, using customer and product features along with purchase history. Furthermore, we employ isotonic regression to address the negative elasticity issue, which is commonly encountered by online platforms when data stems from complex campaigns designed by different departments within the platform. Subsequently, using the predicted CVR as input, we develop a Mixed Integer Programming (MIP) framework and apply a Lagrangian dual transformation to the non-convex ROI constraints, ensuring strict convexity and $O(N)$ computation time. This approach makes it suitable for large-scale distributed computing in industrial settings. Finally, we conduct a comprehensive field experiment to assess the effectiveness of our proposed coupon allocation algorithm.

Title: Selecting Creators to Sign on a Content-Sharing Platform: A Deep-DiD Approach

Presenter: Yan Cheng, Tsinghua University

Co-author(s): Jingbo Wang, Xinyu Cao, Zuo-Jun Max Shen, Yuhui Zhang

Abstract:

A large video-sharing platform introduced a “Creator Signing Program” aimed at signing creators and motivating them to generate more high-quality video content on the platform. Leveraging a matched dataset from the platform, we employ Difference-in-Difference (DiD) analyses to demonstrate the significant positive impact of the signing program on signed creators’ performance, measured by the number of uploaded videos as well as the total user time and user engagement contributed by the creators’ videos. More importantly, we propose a novel Deep-DiD model that combines deep neural networks with DiD to estimate the individual-level heterogeneous treatment effects of the signing program. Based on the estimated individual level treatment effects as a function of creators’ pre-treatment characteristics, the platform can optimize creator selection by selecting creators with the highest estimated treatment effects. Comparing creators selected using our Deep-DiD model to those selected by the platform, we show that the former have significantly higher estimated treatment effects and experience substantially larger actual performance jumps. Lastly, we demonstrate the importance of incorporating unstructured data (visual and audio features) in the model.

Parallel Session (C5) - Advancing Operations: Innovations in Sequential Decision Making**Day 2: 6th Jan (Sat) 13:30-14:50 Venue: 2127A****Session Chair: Ruohan Zhan, The Hong Kong University of Science and Technology****Title: Online Joint Assortment-Inventory Optimization under MNL Choices**

Presenter: Xiaojie Mao, Tsinghua University

Co-author(s): Yong Liang, Shiyuan Wang

Abstract:

We study an online joint assortment-inventory optimization problem where customers follow an MNL choice model with unknown attraction parameters. The retailer makes

periodic assortment and inventory decisions to dynamically learn the attraction parameters from realized demands while maximizing the expected total profit. We propose a novel algorithm that can effectively balance exploration and exploitation in decision-making. We prove a regret upper bound for our algorithm and establish its near optimality by a matching lower bound. We further incorporate practical approximate optimization oracles into our algorithm and bound the impact of optimization errors on the regret of our algorithm.

Title: Minimax-Optimal Multi-Agent RL in Markov Games With a Generative Model

Presenter: Gen Li, The Chinese University of Hong Kong

Co-author(s): Yuejie Chi, Yuting Wei, Yuxin Chen

Abstract:

Reinforcement learning (RL) is frequently modeled as learning and decision making in a Markov decision process (MDP). A core objective of RL is to search for a policy that approximately maximizes expected cumulative rewards in an MDP. In contemporary applications, it is increasingly more common to encounter environments with prohibitively large state and action space, thus exacerbating the challenge of collecting enough samples to learn the model. In this talk, we present a minimax optimal algorithm for multi-agent Markov game to break curse of multi-agents and the long horizon barrier at the same time. This result might shed light on the efficacy of this algorithm in more complicated scenarios.

Title: On the Value of Adaptivity in Sequential Experiments

Presenter: Yvonne Huijun Zhu, National University of Singapore

Co-author(s): Yifan Feng, Tu Ni

Abstract:

We consider a Bayesian active sequential hypothesis testing problem. The objective is to identify the most efficient policy that minimizes the combined cost of sampling and making an error. We explore different levels of adaptivity in sequential experiments: No Adaptivity

- determining the experiment at the beginning of the testing; Full Adaptivity - allowing to change experiments at any time during the testing; Limited Adaptivity - allowing to change experiments only limited times. There is a notable gap between No Adaptivity and Full Adaptivity. This gap can be notably alleviated using policies with Limited Adaptivity, such as nested policy.

Title: Switchback Experiments under Geometric Mixing

Presenter: Yuchen Hu, Stanford University

Co-author(s): Stefan Wager

Abstract:

The switchback is an experimental design that measures treatment effects by repeatedly turning an intervention on and off. While the switchback is a robust way to overcome cross-unit spillovers, it is vulnerable to bias from temporal carryovers. In this paper, we consider properties of switchback experiments in Markovian systems that mix at a geometric rate. We find that, in this setting, standard switchback designs suffer considerably from carryover bias: Their estimation error decays slowly in terms of the experiment horizon, whereas in the absence of carryovers a parametric rate would have been possible. We also show, however, that judicious use of burn-in periods considerably improves the situation.

Parallel Session (C6) - Theory and Applications of Revenue Management

Day 2: 6th Jan (Sat) 13:30-14:50 Venue: 2127B

Session Chair: Zizhuo Wang, The Chinese University of Hong Kong, Shenzhen

Title: The Optimization of Inbound Marketing: Assortment Planning, Pricing Management, and Paid Advertising

Presenter: Pin Gao, The Chinese University of Hong Kong, Shenzhen

Co-author(s): Shujie Luan, Ruxian Wang, Weili Xue

Abstract:

This study utilizes a modified multinomial logit model to investigate the impact of inbound marketing, wherein a consumer's purchase decision is contingent upon their initial attraction to a specific subset of the available products offered by the retailer. Empirical evidence supports the model's effectiveness. We then examine the optimization of inbound marketing strategies, including assortment planning, pricing management, and paid advertising. For each strategy, we determine optimal solutions or approximations. Furthermore, based on the proposed model, we explore a Stackelberg competition between two firms in terms of assortment planning and pricing management, respectively.

Title: Assortment Optimization in the Presence of Focal Effect: Operational Insights and Efficient Algorithms

Presenter: Chenyu Xue, Shanghai University of Finance and Economics

Co-author(s): Bo Jiang, Zizhuo Wang, Nanxi Zhang

Abstract:

This paper explores how a seller's assortment influences customers' evaluation of item utility. A possible consequence is the focal effect, where certain items become over-evaluated. Recently, the focal Luce model (FLM) is introduced to describe customers' choices in the presence of such effect, offering flexibility in capturing diverse customers' behaviour. Although the assortment optimization under the FLM is NP-hard in general, we still identify some structures of the optimal assortment that bring operational insights of the model. We also find some polynomial-time algorithms by imposing reasonable assumptions. Furthermore, this polynomial-solvability is reserved even for joint assortment and pricing optimization problem.

Title: Pricing and Auction Design for Digital Freight Transportation Marketplaces

Presenter: Xuan Wang, The Hong Kong University of Science and Technology

Co-author(s): Sungwoo Kim, He Wang

Abstract:

In recent years, digital freight marketplaces that provide automated brokerage services have started to reshape the freight industry. In this talk, we consider a digital freight platform that serves as an intermediary between shippers and carriers in a truckload transportation network. The platform offers shipper and carrier rates based on market dynamics. We analyze three types of mechanisms commonly used in practice: pricing, auction, and a dual-channel mechanism that offers pricing and auction simultaneously. We prove tight bounds between these mechanisms for varying market sizes. The findings are validated through a numerical simulation using U.S. freight market industry data.

Title: Simple is Enough: A Cascade Approximation for Attention-Based Satisficing Choice Models

Presenter: Yicheng Liu, The Chinese University of Hong Kong, Shenzhen

Co-author(s): Chenhao Wang, Pin Gao, Zizhuo Wang

Abstract:

Empirical evidence suggests that consumers commonly focus their attention on a subset of available products and evaluate them in batches to identify a satisfactory option. To capture this phenomenon, we introduce the Attention-Based Satisficing choice rule, which encompasses several classic choice models as special cases. Notwithstanding the NP-hardness of finding the revenue-maximizing assortment and estimating certain parameters for the proposed model, we demonstrate that it can be approximated by a simple Cascade model with substantially fewer parameters, and has a worst-case revenue guarantee of at least $3/8$ of that obtained from an optimized assortment under the best parameter configuration.

Parallel Session (C7) - Emerging Challenges in Pricing**Day 2: 6th Jan (Sat) 13:30-14:50 Venue: 2127C****Session Chair: Xiao Lei, The University of Hong Kong****Title: Online Learning and Pricing with Nonparametric Demand and Price Match Guarantee**

Presenter: Sheng Ji, Zhejiang University

Co-author(s): Cong Shi, Yi Yang

Abstract:

To alleviate customers' unpleasantness from frequent price changes, many retailers implement price match guarantee policy (i.e., customers will receive refunds if the product price drops during the guarantee period). We consider a joint pricing and guarantee length decision making problem with unknown nonparametric demand. We propose an online learning algorithm that integrates the inverse SGD and UCB algorithms. We prove the regret of the algorithm is upper bounded by $O(\sqrt{MT \log T})$, where T is the time horizon and M is the number of feasible guarantee length. The numerical experiments verify the robustness of our algorithm under various situations.

Title: Pricing Analytics for Primary and Ancillary Products using Conversion Rate Data

Presenter: Hailong Sun, Shanghai Jiao Tong University

Co-author(s): Changchun Liu, Chung Piaw Teo, Maoqi Liu

Abstract:

We consider a firm that sells both primary and ancillary products to customers, with the condition that customers can purchase the ancillary products only if they purchase the primary ones. Our goal is to jointly determine the prices for all the products to optimize profits to the firm. We use a class of additive perturbed utility model (APUM) to explicitly

capture the complex customer choice behaviour and extract values from conversion rate data. By utilizing piecewise linear approximation arguments, we demonstrate that the resulting data-driven pricing problem can be solved to within ϵ -optimality as a mixed integer program.

Title: Regulating Discriminatory Pricing in the Presence of Tacit Collusion

Presenter: Zongsen Yang, The Chinese University of Hong Kong, Shenzhen

Co-author(s): Xiao Lei, Pin Gao

Abstract:

Price-setting algorithms enable firms to discriminate prices based on customer information, leading to unethical behavior and increased regulation. However, fairness regulations can impact tacit collusion, another concern arising from pricing algorithms. Our analytical model explores the relationship between fairness regulation and tacit collusion, revealing that for homogeneous products, regulation weakens collusion, while for differentiated products, strict fairness may support collusion. To optimize welfare, mild fairness permitting moderate price differentiation can prevent market collusion. We propose a randomized policy to address fairness-induced collusion, emphasizing the importance of a nuanced approach to regulating discriminatory pricing.

Title: Optimal Production Contract Design under Multiple Moral Hazard

Presenter: Mingliu Chen, University of Texas at Dallas

Co-author(s): Feng Tian, Ruiting Zuo

Abstract:

We analyze a newsvendor production problem subject to agency issues. A principal provides funds/resources and contracts an agent for capacity planning. However, the agent may commit cash diversion after receiving the funds, which is unobservable to the principal. We derive the optimal contract under ex-ante and ex-post cash diversion scenarios. Optimal

contracts have simple forms and are easy to implement. Furthermore, we provide the optimal production quantity and price. In addition, we consider a scenario where the agent's pricing strategy is also unobservable and find that the principal can still use a simple debt contract to deter both moral hazards.

Parallel Session (C8) - Operations Management

Day 2: 6th Jan (Sat) 13:30-14:50 Venue: 2128A

Session Chair: Jiannan Ke, Wuhan University

Huan Zheng, Shanghai Jiao Tong University

Title: The Value of Flexible Response in Resource Allocation Competition

Presenter: Sarah Yini Gao, Singapore Management University

Co-author(s): Chung-Piaw Teo, Huan Zheng

Abstract:

This paper investigates the value of limited flexibility in a two-player resource allocation game with redeployment capabilities. Analyzing equilibrium strategies and payoffs, we address computational challenges by characterizing the game using conic programs. Closed form solutions of two special cases, a k-chain redeployment network with flow-maximizing and hinge-type payoffs, are obtained, which reveal nuanced results. Specifically, limited flexibility offers no advantages with flow-maximizing payoffs, contrasting classic process flexibility. Under hinge-type payoffs, limited flexibility displays more pronounced benefits, but less markedly than in stochastic settings, emphasizing the impact of an adversarial context on the value of limited flexibility.

Title: Data-Driven Remanufacturing Planning with Parameter Uncertainty

Presenter: Yue Shi, Wuhan University

Co-author(s): Zhicheng Zhu, Yisha Xiang, Ming Zhao

Abstract:

We consider the problem of remanufacturing planning in the presence of uncertain transition probabilities and formulate the problem as a data-driven robust Markov decision process with distance-based uncertainty sets. We further establish structural properties of optimal robust policies and provide insights for remanufacturing planning. A computational study on the NASA turbofan engine shows that our data-driven robust decision framework consistently yields better out-of-sample reward and higher reliability of the performance guarantee, compared to the nominal model that uses the maximum likelihood estimates of the transition probabilities without considering parameter uncertainty.

Title: Online Advertisement Allocation Under Customer Choices and Algorithmic Fairness

Presenter: Huan Zheng, Shanghai Jiao Tong University

Co-author(s): Xiaolong Li, Ying Rong, Renyu Zhang

Abstract:

Advertising is a crucial revenue source for e-commerce platforms and a vital online marketing tool for their sellers. In this paper, we explore dynamic ad allocation with limited slots upon each customer arrival for an e-commerce platform, where customers follow a choice model when clicking the ads. Motivated by the recent advocacy for the algorithmic fairness of online ad delivery, we adjust the value from advertising by a general fairness metric evaluated with the click-throughs of different ads and customer types. The original online ad-allocation problem is intractable, so we propose a novel stochastic program framework (called two-stage target-debt, TTD) that first decides the click-through targets then devises an ad-allocation policy to satisfy these targets in the second stage. We design a debt-weighted offer-set (DWO) algorithm and demonstrate that, as long as the problem size scales to infinity, this algorithm is (asymptotically) optimal under the optimal first-stage click-through target. Compared to the Fluid heuristic and its re-solving variants, our approach has better scalability and can deplete the ad budgets more smoothly throughout the horizon, which is highly desirable for the online advertising business in practice. Finally, our proposed model and algorithm help substantially improve the fairness of ad allocation

for an online e-commerce platform without significantly compromising efficiency.

Title: Counterfeit Competition with Strategic Consumers

Presenter: Jiannan Ke, Wuhan University

Co-author(s): Yucheng Ding, Xu Guan

Abstract:

This paper investigates deceptive counterfeit competition between a branded firm selling a durable good over two periods and a counterfeiter entering the market in the second period. The two firms engage in a price signaling game, in which the branded firm designs its price strategy over two periods against the counterfeiter, and consumers are strategic that decide whether to buy the authentic product upfront or wait till the second period. We find that the branded firm may benefit from the counterfeit competition if the quality gap between the two products is sufficiently large. The intuition is that the branded firm would charge a high second-period price to signal itself, which then induces more consumers to buy the authentic product up front. This allows the branded firm to increase its first-period price and demand simultaneously, mitigating the time-inconsistency problem effectively. Instead, if the quality gap is small, counterfeit competition would reduce the branded firm's profit. The results are robust in several extensions, including partially informed or naive consumers, asymmetric retail channels, post-purchase regret and endogenized quality.

Parallel Session (C9) - Fairness in Operations Management

Day 2: 6th Jan (Sat) 13:30-14:50 Venue: 2128B

Session Chair: Menghang Wang, University of Science and Technology of China

Title: Temporal Fairness in Learning and Earning: Price Protection Guarantee and Phase Transitions

Presenter: Qing Feng, Cornell University

Co-author(s): Ruihao Zhu, Stefanus Jasin

Abstract:

Motivated by the prevalence of “price protection guarantee”, which helps to promote temporal fairness in dynamic pricing, we study the impact of such policy on the design of online learning algorithm for data-driven dynamic pricing with initially unknown customer demand. Under the price protection guarantee, a customer who purchased a product in the past can receive a refund from the seller during the so-called price protection period (typically defined as a certain time window after the purchase date) in case the seller decides to lower the price. We consider a setting where a firm sells a product over a horizon of T time steps. For this setting, we characterize how the value of M , the length of price protection period, can affect the optimal regret of the learning process. We show that the optimal regret is $\sim \Theta(\sqrt{T} + \min\{M, T^{2/3}\})$ by first establishing a fundamental impossible regime with the novel refund-aware regret lower bound analysis. Then, we propose LEAP, a phased exploration type algorithm for Learning and EArning under Price Protection to match this lower bound up to logarithmic factors or even doubly logarithmic factors (when there are only two prices available to the seller). Our results reveal the surprising phase transitions of the optimal regret with respect to M . Specifically, when M is not too large, the optimal regret has no major difference when compared to that of the classic setting with no price protection guarantee. We also show that there exists an upper limit on how much the optimal regret can deteriorate when M grows large. Finally, we conduct extensive numerical simulations with both synthetic and real-world datasets to show the benefit of LEAP over other heuristic methods for this problem.

Title: Socially Responsible Pricing

Presenter: Jing Peng, University of Science and Technology of China

Co-author(s): Hongqiao Chen, Ming Hu

Abstract:

We examine three socially responsible pricing schemes. The social responsibility (S) scheme has a similar objective to partial privatization. The Nash bargaining (B) scheme follows a weighted proportional fairness notion. The Rawlsian fairness (R) scheme generalizes the max-min fairness notion. For a given customer valuation distribution and

CSR level, we show that B leads to a lower price than S and R. Moreover, when facing different valuation distributions, with the same CSR level, S is robustly preferred from the profit perspective, while B is robustly preferred from the consumer surplus and social welfare perspectives.

Title: Cost Allocation in a Cooperative Delivery Game: Fairness and Robustness

Presenter: Menghang Wang, University of Science and Technology of China

Co-author(s): Lindong Liu, Jie Wu, Lan Lu

Abstract:

This paper presents a cooperative delivery game with uncertain demand locations. To motivate players to join cooperation and maintain long-term stability, an effective cost allocation solution is crucial. However, the considerable uncertainty inherent in real-world situations would disrupt the coalitional stability constraints when using the traditional cost allocation methods. To address this challenge, we propose the robust optimal cost allocation problem (ROCAP) and introduce a novel concept of the robust core, which guarantees that the worst-case performance of the grand coalition is superior to the best-case performance of any subcoalition. This guarantees that every player is incentivized to participate in cooperation, ensuring fairness and robustness in the cooperative delivery game. Furthermore, we study the existence and several properties, i.e., monotonicity, subsethood, and robustness of the robust core to extend traditional core concepts to be applicable in uncertain scenarios. Additionally, even if the robust core does not exist, ROCAP can identify the gap to achieve robustness. This identification provides a foundation for implementing external treatments, such as potential government subsidies, to bridge the gap and enhance the overall robustness of the system. Technically, we derive tractable reformulations for the proposed ROCAP model and design several algorithms for seeking the robust core. Through extensive numerical experiments, we demonstrate the robust core in out-of-sample testing could elevate the robustness performance of traditional allocation methods from around 50% to 99%, ensuring stable cooperation within the coalition across various scenarios.

Parallel Session (C10) - New Topics in E-Commerce Platforms and Supply Chain**Day 2: 6th Jan (Sat) 13:30-14:50 Venue: 2128C****Session Chair: Xing Hu, The University of Hong Kong****Title: Learning to Rank under Strategic Manipulation in Small and Large Markets**

Presenter: Yifan Feng, National University of Singapore

Co-author(s): Qinzhen Li, Hongfan(Kevin) Chen

Abstract:

We consider a dynamic learning and ranking problem of a digital platform. Uninformed of the products' intrinsic qualities, the platform strives to design a ranking rule that learns from historical traffic data while accounting for sellers' potential manipulation through "brushing" activities, such as fake orders or sales. We study a simple Experiment-Then-Commit (ETC) policy framework and characterize the sellers' strategic responses as a "brushing war" game. We find that in the limit with a long time horizon and many sellers, there is a "self-reinforcing" market equilibrium. That is, the sellers' brushing amounts increase in the product's qualities, thus "reinforcing" the platform's complete learning.

Title: Livestream Selling with Online Influencers

Presenter: Jing Hou, Nanjing University

Co-author(s): Houcai Shen, Fasheng Xu

Abstract:

Livestream selling is an emerging trend in e-commerce. Influencers broadcast live to demonstrate products, and consumers can have a real time interaction with influencers and purchase products directly from livestreaming. We study a firm's optimal livestream adoption strategies and implementation tactics. We show that cooperating with a less professional influencer or selling products with a lower quality level can be more favourable

for the firm. It is also beneficial for the firm to allow the influencer to share more from livestream sales revenue to gain more pricing flexibility, but introducing a slot fee never has the same effect.

Title: Sourcing Contracts with Bilateral Efforts and Renegotiation

Presenter: Ning Chen, Chongqing University

Co-author(s): Hongyan Xu, He Huang, Liming Liu

Abstract:

Motivated by collaborative efforts from buyer and supplier for product cost reduction and renegotiation in practice, this paper studies the impacts of ex-ante contract and ex-post renegotiation on the effort incentives. We find that the buyer (supplier) has incentives to invest when the likelihood of renegotiation increases (decreases). Greater initial quantity and higher supplier's bargaining power incentivize supplier's effort but undermine buyer's. Counterintuitively, when two parties' effort costs are moderate and the cost of buyer (supplier) is higher than supplier (buyer), the buyer (supplier) with large bargaining power induces supplier (buyer) to take a strong free ride on him.

Title: Learning-by-Doing and Strategic Inventory under Inventory Commitment

Presenter: Juan Chen, Nanjing University

Co-author(s): Houcai Shen

Abstract:

This paper develops a two-period supply chain model with learning-by-doing effect under inventory commitment to investigate the strategic inventory behavior of the manufacturer and the retailer. The results show that the manufacturer holds strategic inventory only when both holding cost and learning rate are small and chooses not to produce any more in the second period. Second, it is found that when the manufacturer holds inventory, the manufacturer's profits instead decline as the learning effect increases, and that the learning-by-doing effect discourages the manufacturer from holding inventory but further

encourages the retailer's strategic inventory behavior.

Parallel Session (C11) - OM-Marketing Interface

Day 2: 6th Jan (Sat) 13:30-14:50 Venue: 2129A

Session Chair: Yan Liu, The Hong Kong Polytechnic University

Title: Simultaneous vs Sequential: Optimal Assortment Recommendation in Multi-Channel Retailing

Presenter: Yicheng Liu, The Chinese University of Hong Kong, Shenzhen

Co-author(s): Xiao Alison Chen, Yan Liu, Zizhuo Wang

Abstract:

We study a multi-channel assortment planning problem in which a seller centrally decides the assortment in each channel. Each channel is visited by a certain fraction of customers. Upon arrival, customers observe the products offered in the current channel. The seller can either 1) show products in other channels to customers simultaneously or 2) show products in other channels to customers if they decide not to purchase in the current channel. Customers may incur a disutility if they choose products from other channels. We study the assortment planning problem under each of these two strategies and compare their performance.

Title: Anticipated Wait and Its Effects on Consumer Choice, Pricing, and Assortment Management

Presenter: Chenxu Ke, Shanghai University of Finance and Economics

Co-author(s): Ruxian Wan, Zifeng Zhao

Abstract:

We investigate the effects of waiting time, mainly due to production in a make-to-batch-order (MTBO) system, on consumer choice behavior, pricing, assortment, and model

estimation.

Title: Supply Chain Transparency and Blockchain Design

Presenter: Jingchen Liu, Renmin University of China

Co-author(s): Yao Cui, Vishal Gaur

Abstract:

Companies that are investing in blockchain technology to enhance supply chain transparency face challenges in fostering collaborations with others and deciding what information to share. Transparency over the actions of supply chain partners can improve operational decisions, but sharing own data on the blockchain can put firms at a competitive disadvantage. In this paper, we investigate the resulting questions of when blockchain should be adopted in a supply chain and how it should be designed by analyzing two ways that it can enhance supply chain transparency: making the manufacturer's sourcing cost transparent to the buyers (i.e., vertical cost transparency), and making the ordering status of buyers transparent to each other (i.e., horizontal order transparency). Given such transparency, firms can design a smart contract that automates transactions contingent on the revealed information and enables them to realize better equilibrium outcomes.

Title: Is the More the Merrier for Coalition Loyalty Programs?

Presenter: Jingmai Wang, The Hong Kong Polytechnic University

Co-author(s): Yan Liu, Yulan Wang, Dan Zhang

Abstract:

Business practitioners have divergent views on the size of coalition loyalty programs (CLPs), which prompts us to study the optimal design focusing on the sizing decision. Our study reveals that the sizing decision of CLPs depends on the market composition of customers in terms of product valuation and shopping intensity. In a valuation-driven market, the more the merrier, while in an intensity-driven market, bigger is not always better. Notably, a properly-sized CLP can boost the participating firms' profit and customer surplus,

compared with either proprietary reward programs or no reward programs. Our results remain qualitatively intact in several model extensions.

Parallel Session (C12) - Data Analysis in Quantitative Finance

Day 2: 6th Jan (Sat) 13:30-14:50 Venue: 2129B

Session Chair: Wei Jiang, The Hong Kong University of Science and Technology

Shize Li, The Hong Kong University of Science and Technology

Title: Nonlinear Dependence and Households' Portfolio Decisions over the Life Cycle

Presenter: Shize Li, The Hong Kong University of Science and Technology

Co-author(s): Wei Jiang, Jialu Shen

Abstract:

Using data from the Panel Study of Income Dynamics and the Center for Research in Security Prices, we show that nonlinear dependence between earning risk and stock return exists. Incorporating nonlinear dependence measured by sufficient statistics “between-squares correlation” into a life-cycle model lowers households’ participation rate and generates moderate risky asset holdings. Our empirical studies reveal that households recognize such nonlinear dependence risks and adjust their portfolio decisions accordingly, supporting the model’s predictions. Moreover, we show that ignoring between-squares correlations leads to substantial welfare loss and increasing wealth inequality.

Title: From Hotelling to Nakamoto: The Economics of Bitcoin Mining

Presenter: Yu Long, The Hong Kong University of Science and Technology

Co-author(s): Min Dai, Wei Jiang, Steven Kou, Cong Qin

Abstract:

Inspired by the celebrated Hotelling model for exhaustible resources, we propose a unified

dynamic framework to study the economics of the supply side of bitcoin mining, such as endogenous transaction fees, the miners' liquidation policies, and endogenous inventory holdings, in the face of declining system block rewards and stochastic demand. The model offers an explanation for the observed co-movements of average transaction fees, average block sizes, and bitcoin prices. We also find that high jump risk and transaction fees income can drive miners to significantly reduce their inventory even when bitcoin prices are relatively low. Moreover, we collect a substantial number of miners' addresses and demonstrate that our calibrated model can generate inventory curves similar to the actual miners' inventory.

Title: Designing Structured Products on Traded Accounts

Presenter: Zihao Song, The Chinese University of Hong Kong

Co-author(s): Chen Yang

Abstract:

Structured products on traded accounts are financial products whose payoff depends on a trading account managed by the product buyer. In this paper, we study how to design these products from the perspectives of both buyers and sellers, and our proposed model features both the transaction costs in the trading account and the buyer's risk aversion. The buyer's problem is formulated as a singular stochastic control problem with a non-concave objective, and the seller's contract design strategy is characterized as a Stackelberg game. We design a numerical procedure to study this problem. We find that the price that the risk-averse buyer is willing to pay is much smaller than the risk-neutral price reported in the literature, and the buyer's optimal trading strategy is significantly more complicated. For the seller's perspective, it is optimal to offer a contract to less risk-averse buyers at a time with lower market volatility.

Title: Design Good Liquidity Pools on Automated Market Makers

Presenter: Yutian Zhou, The Chinese University of Hong Kong

Co-author(s): Xuedong He, Chen Yang

Abstract:

The automated market maker (AMM) is a popular type of decentralized exchanges where users trade assets directly following a fixed pricing function. The liquidity provider (LP) contributes to the liquidity pool by supplying assets and in return they earn transaction fees from traders. We derived the risk-averse LP's optimal strategy by dynamic programming and proved the existence and uniqueness of the solution. Also, the impact of the transaction fee and AMM pricing formula on the LP's optimal decision is studied. Additionally, we provide discussions on the AMM pools design when assets performance on the open market changes.

Parallel Session (C13) - Service Operations**Day 2: 6th Jan (Sat) 13:30-14:50 Venue: 2129C****Session Chair: Xiaole Chen, Sun Yat-sen University****Title: A Uniform Approach for Analyzing Queues with Correlated Interarrival and Service Times**

Presenter: Haoran Wu, Sun Yat-sen University

Co-author(s): Qi-Ming He, Li Xia

Abstract:

Using the Markov modulated fluid flow (MMFF) process, we introduce a framework to analyze queues with correlated interarrival and service times and explore the impact of the correlation coefficient of the interarrival and service times on queueing performance. An algorithm is developed for computing quantities such as the distributions of age, waiting\sojourn times, and queue length. A number of special cases are presented to demonstrate the versatility of the queueing model and the power of the solution approach.

Title: Capacity Allocation and Scheduling in Two-Stage Service Systems with Multi-Class Customers

Presenter: Zhiheng Zhong, South China University of Technology

Co-author(s): Ping Cao, Junfei Huang, Sean X. Zhou

Abstract:

This paper considers a tandem queueing system, in which stage 1 has one station serving multiple classes of arriving customers differing in their service requirements and related delay costs, and stage 2 has multiple parallel stations, each of which provides one type of service. The objective is to design a joint capacity allocation between the stages/stations and scheduling rule of different classes of customers to minimize the long-run average cost. We convert the stochastic problem into a fluid optimization problem and develop a procedure to solve it. Based on the solution to the fluid optimization problem, we propose a simple and easy-to-implement capacity allocation and scheduling policy, and establish its asymptotic optimality for the stochastic system. The policy has explicit index-based forms for two special system structures: the many-to-one and one-to-many systems. We further propose a grouping and pooling strategy to streamline the operations of the service system. Finally, we conduct numerical experiments to validate the accuracy of the fluid approximation, and quantify the effect of grouping and pooling based on fluid optimal solution.

Title: Equilibrium Analysis for the Seller's Fulfillment Channels

Presenter: Shu Hu, Southwest Jiaotong University

Co-author(s): Ke Fu

Abstract:

Sellers' products can be sold either through platform channels or through their own channels. Besides, sellers' orders can be fulfilled either by platforms (FBP) or by third-party merchants (FBM). We consider a platform and a representative seller compete in selling two substitutable products. We develop an analytical framework for identifying each firm's structure preference by comparing four modes: own channel with FBP, own channel with

FBM, platform channel with FBP, and platform channel with FBM. Our research establishes a few insights for the platform and the seller.

Title: Learning Decisions Offline from Censored Observations with ϵ -insensitive Operational Costs

Presenter: Teng Huang, Sun Yat-sen University

Co-author(s): Minxia Chen, Ke Fu, Miao Bai

Abstract:

Many important managerial decisions are made based on censored observations. Making decisions without adequately handling the censoring leads to inferior outcomes. We investigate the data-driven decision-making problem with an offline dataset containing the feature data and the censored historical data of the variable of interest without the censoring indicators. Without assuming the underlying distribution, we design and leverage ϵ -insensitive operational costs to deal with the unobserved censoring in an offline data-driven fashion. We demonstrate the customization of the ϵ -insensitive operational costs for a newsvendor problem and use such costs to train two representative machine learning models.

Parallel Session (C14) - Information and Behaviors in Service Operations

Day 2: 6th Jan (Sat) 13:30-14:50 Venue: 2130A

Session Chair: Qiao-Chu He, Southern University of Science and Technology

Title: Information Design of a Delegated Search

Presenter: Zhenyu Hu, National University of Singapore

Co-author(s): Yangge Xiao, Shouqiang Wang

Abstract:

A principal delegates a sequential search to an agent, who bears the search cost and controls when to terminate searching. Upon termination, the search payoff is split between the principal and agent. However, only the principal can evaluate each search outcome. The principal designs an information policy to strategically disclose private outcomes over time to the agent. We show the optimal policy is fully prescribed by a sequence of deterministic acceptance standards. The agent is recommended and voluntarily willing to continue the search if and only if the current termination payoff fails to meet that period's standard.

Title: Managing Consumer Search in Omnichannel Operations via Information Design

Presenter: Ailing Xu, The Hong Kong University of Science and Technology

Co-author(s): Qiao-Chu He, Ying-Ju Chen

Abstract:

This paper examines how firms manage consumer search and purchase behaviors in omnichannel operations via information design to increase sales. We demonstrate that the two channels can exhibit complementarity under the optimal signal structure, which can be either a threshold ("two-interval") policy or non-monotone ("three-interval") policy. By employing distinct signal realizations to guide heterogeneous consumers to behave divergently across channels, the firm can effectively coordinate different channels and enhance its demand. Our findings offer valuable insights into the optimal information design for effectively coordinating different channels and managing consumer search behaviors in omnichannel operations.

Title: Dine-in or Food Delivery: A Dilemma of Priority? The Optimal Service Mechanism for Restaurants

Presenter: Qian Zhang, Tianjin University

Co-author(s): Yongjian Li, Zhongbin Wang, Dongyuan Zhan

Abstract:

Recently, on-demand food delivery (OFD) has transformed restaurant dynamics, offering convenience to customers while diminishing dining quality due to long-distance delivery. This study establishes a congestion-prone service system to unprecedentedly investigate the impact of OFD quality on effectiveness of three common service policies: first-come-first-serve (FCFS), prioritizing dine-in (PI), and prioritizing OFD (PO). Findings indicate that OFD introduction is recommended at intermediate quality levels. Particularly, with improved OFD quality, it is advisable for restaurants to adopt the PO policy, FCFS policy and PI policy sequentially. Finally, a threshold-based partial priority policy outperforming all three common service policies, is proposed.

Title: Dual Pricing with Purchase Hassle

Presenter: Yifu Li, University of Science and Technology of China

Co-author(s): Xuelan Zhang, Jun Lin

Abstract:

Past study suggests that hassle cost reduces consumers' utility and hurts sellers' profits. However, counterintuitively, some sellers, especially those selling online, intentionally increase the hassle cost of buying their products. Our work examines how sellers effectively apply dual pricing with purchase hassle to improve their profit and how it affects consumers' purchasing decisions and utility. Different from past studies, we consider both the heterogeneities of consumers' product valuations and hassle costs. We find that when the consumer's hassle sensitivity is independent of their product valuations, and it decreases or concavely increases in the product valuation, dual pricing with purchase hassle reduces sellers' profits. When consumers' hassle costs are convex increasing in product valuation, if the relative increasing rate is high, sellers can obtain additional profit through the dual pricing strategy. Moreover, under the dual pricing strategy, consumers' utility is non-monotonic in their product valuation. Furthermore, we extend our model to the cases with the full-price maintained scenario and network effects. We find that the properties mentioned above still hold, considering the switching behaviour and network effects.

Title: Strategic Communications in Entry to a Joint Innovation Venture

Presenter: Zhenxiao Chen, Southern University of Science and Technology

Co-author(s): Kanglin Chen, Qiao-Chu He

Abstract:

This paper depicts a frenemy relationship between an incumbent and a potential entrant in developing an innovative product with uncertain market potential. The entrant contributes to the product development but encroaches on the monopoly of the incumbent. Regarding the market entry decision, we find that an entrant with a higher market power may be less inclined to encroach on the market. In cases where the entrant has already encroached on the market, the two parties jointly exert efforts only when the synergy efficiency is high and the two parties are comparable in terms of market power; otherwise, the party with a limited market power becomes a free-rider. To reconcile the conflicting interests between both parties, we explore how the incumbent can communicate the market potential with the entrant strategically under a framework of information design. The optimal information scheme features three different signal structures: a downplay policy that deters entry, a hype policy that facilitates entry, and a silent policy that carries no information. The specific signal structure's choice is contingent upon the value of the new entrant and the prior expectation about the market potential. From the overall market perspective, an entrant comparable in market power optimally benefits the incumbent and the entire market. In that case, the two parties are highly incentivized to develop the product by exerting considerable efforts, which fully exploits the complementary effect and reinforces the investment by the parties.

Parallel Session (C15) - Supply Contracting and Channel Coordination

Day 2: 6th Jan (Sat) 13:30-14:50 Venue: 2130B

Session Chair: Chen Yang, The Hong Kong University of Science and Technology

Title: Push vs. Pull Contracts in Retail Supply Chains: Risk Aversion, Information Asymmetry, and Outside Opportunity

Presenter: Chengfan Hou, University of Science and Technology of China

Abstract:

Recent global crises have caused unprecedented economic uncertainty and intensified retailers' concerns over inventory risks. Mitigating inventory risks and incentivizing retailer orders is critical to managing retail supply chains and restoring their norms after severe impacts.

Problem definition: We study the allocation of inventory risks using contracts in a retail supply chain with a risk-neutral manufacturer and a risk-averse retailer. We consider two factors that affect the effectiveness of contracting: (1) asymmetric risk aversion information---retailers' attitudes are typically diverse and unknown to the manufacturer, and (2) uncertain outside opportunity---retailers typically face a volatile external business environment.

Methodology: With a game-theoretic model that captures the interaction among risk aversion, information asymmetry, and outside opportunity, we derive the contracting equilibrium under two widely adopted risk allocation schemes---push (i.e., the retailer bears the inventory risk) and pull (i.e., the manufacturer bears the inventory risk) contracts.

Results: We show that---contrary to conventional wisdom that pull contracts are more effective in risk mitigation---push contracts may induce larger expected order quantities and achieve the highest supply chain efficiency due to the interaction of asymmetric risk aversion information and risky outside opportunities. We also find that the manufacturer may obtain higher profits with push contracts when both the heterogeneity in the retailer's risk attitude and the risk of the outside opportunity are sufficiently high. In addition, when the risk of the outside opportunity is in a medium range, the push contract allows the manufacturer to fully eliminate the information rent and achieve the supply chain's first-best outcomes. We further evaluate the effects of product profitability and demand uncertainty and generalize the retailer's risk measure to any coherent risk measure.

Managerial implications: Our analysis highlights the importance of modeling asymmetric risk aversion information and risky outside opportunities in analyzing supply chain contracting. When considering these practical factors, it may be better to allocate more inventory risks to a risk-averse retailer instead of a risk-neutral manufacturer. Our results provide novel insights into the selection of proper contract types for managing inventory risks in retail supply chains.

Title: The Bright Side of Price Volatility in Global Commodity Procurement

Presenter: Liming Liu, Southern University of Science and Technology

Abstract:

Firms' often face a choice between the contingent-price contract (CPC) and fixed-price contract (FPC) in global commodity procurement. Under both contracts, each firm determines its order quantity based on the updated belief about the market demand. The contract price is fixed under FPC, but is pegged to an underlying index and realized on the delivery date. The unrealized CPC price correlates with the market demand, allowing a firm to update its belief about the CPC price using demand information, thereby generating a price-learning effect. We find that, contrary to conventional wisdom, a larger price volatility could benefit the firms, and, under differentiated contracts, a firm might benefit from the improvement of forecast accuracy at its rival. We further show that the price-learning effect plays a critical role in the firms' contract choices. First, significant price volatility forces the firms to pursue the responsiveness of the CPC. Second, the firms may adopt differentiated contracts to enhance their responses to market changes and dampen competition, and a higher competition intensity more likely leads to contract differentiation. Third, the firms in a small market seek responsiveness and contract differentiation rather than cost efficiency. This study reveals the bright side of price volatility and takes a step toward understanding the effect of two-dimensional information updating.

Title: Developing a Store Brand or Collecting a Commission: Amazon's Choice and Quality Decision

Presenter: Hui Xiong, Huazhong University of Science and Technology

Co-author(s): Ying-Ju Chen, Lu Hsiao

Abstract:

Amazon, as one of the dominant online retailers (platforms), cooperates with manufacturers under wholesale contract to develop its store brands. Simultaneously, Amazon offers manufacturers with a marketplace and serves manufacturers in the agency

selling. In this paper, we build a model to investigate the platform and the manufacturers' choices on the cooperation modes (i.e., wholesale contract or agency selling) and their quality decisions when they serve consumers with heterogeneous willingness to pay for quality and the platform can dictate the quality under the wholesale contract. We find that the platform and the manufacturer are more likely to align their preferences on selling modes when consumers are homogenous enough. Moreover, when the commission rate is relatively low, both of them may prefer the agency selling. In this case, the manufacturer is willing to offer high quality in the agency selling. In contrast, when the commission rate is sufficiently high, they can only align their preferences on selling modes by choosing the wholesale contract. The product quality under the wholesale contract is higher than that in the agency selling. Finally, we provide three extensions: the platform decides the commission rate, the platform decides the wholesale price and the retail competition.

Title: Optimal Selling Channel in Online Platforms: The Roles of Network Structure

Presenter: Chen Yang, The Hong Kong University of Science and Technology

Co-author(s): Lijian Lu, Jin Qi

Abstract:

As E-commerce matures, competition has become increasingly important in the online market, highlighting the need to understand the interplay among selling channels, competition networks, and selling services. However, existing literature on the channel structure of online platforms typically focuses on only one or two concepts, which is unreasonable, as their underlying interactions can produce diverse outcomes. In this research, we develop a comprehensive Stackelberg game model for the two-sided market and simultaneously incorporates selling channels, competition networks, and selling services. We identify unique equilibria for each regime of selling channels and supply chain networks and conduct in-depth quantitative analysis from various perspectives, including efficiency, the value of selling services, channel preferences, and more. Our work reveals intriguing effects that competition can have on selling channels and services. For instance, competition combined with selling services can mitigate double marginalization. While duopoly competition incorporating selling services can be advantageous for platforms, it may harm the efficiency of the supply chain. Our analysis identifies specific conditions for

different outcomes and the primary parameters that drive them. Our research contributes to the literature and managerial society by offering comprehensive insights into the relationship among selling channels, competition networks, and selling services and by characterizing platform and seller behaviors under all-encompassing circumstances.

Parallel Session (C16) - Optimization in Transportation and Delivery

Day 2: 6th Jan (Sat) 13:30-14:50 Venue: 2130C

Session Chair: Hai Wang, Singapore Management University

Title: Learning for Guiding: A Framework for Unlocking Trust and Improving Performance in Last-Mile Delivery

Presenter: Genshen Fu, Tsinghua University

Co-author(s): Pujun Zhang, Dazhou Lei, Wei Qi, Zuo-Jun Max Shen

Abstract:

In last-mile delivery, drivers often deviate from the suggested routes given by the platform. These deviations decrease trust in the platform and compromise its performance. This paper proposes a "Learning for Guiding" framework that integrates drivers' preferences and experience to design a more acceptable delivery scheme. We validate the framework using real data from Amazon. Our approach saves completion time by 4.2% compared to drivers' actual trajectories and increases the likelihood of acceptance by 58.9% compared to optimal solutions. By implementing our framework, the platform can enhance interaction with drivers, establish trust, and improve the delivery system's overall performance.

Title: Efficient Construction of Arc-Based Transportation Network Models using Graph Attention Networks

Presenter: Keji Wei, Tongji University

Co-author(s): Vikrant Vaze

Abstract:

This paper introduces a novel method for constructing transportation network models, addressing a key challenge in problems with variable minimum connection times. Traditional network construction heuristics yield large, slow-to-solve models, while optimally constructed models are quick to solve but slow to construct. The proposed method, based on graph attention networks (GATs), accelerates network construction while maintaining optimality. Tested on large-scale real-world airline industry problems, it consistently outperformed benchmarks, solving all instances to optimality within three minutes—a significant improvement over existing methods. This demonstrates its potential for efficient, optimal decision-making in practical applications.

Title: Recursive Logit-Based Meta-Inverse Reinforcement Learning for Driver-Preferred Route Planning

Presenter: Pujun Zhang, Tsinghua University

Co-author(s): Dazhou Lei, Shan Liu, Hai Jiang

Abstract:

Driver-preferred route planning assesses routes based on how closely driver follows them. Inverse Reinforcement Learning (IRL) has gained considerable attention in this area. To address existing challenges in estimating expected state visitation frequencies (SVFs) and the issue of data sparsity, we propose a recursive logit-based meta-IRL approach. This approach employs the recursive logit model to analytically derive expected SVFs efficiently and applies meta-learning techniques to improve the learning on sparsely covered links using experiences from learning of popular ones. We have validated our approach using real GPS data from Chengdu, China.

Title: Short-Term Idle Vehicle Repositioning in the Ride-Hailing System

Presenter: Xian Lyu, The University of Hong Kong

Co-author(s): Zhengli Wang, Hai Wang

Abstract:

To alleviate supply-demand imbalance in the ride-hailing system, we model platform's guidance for idle vehicles through a short-term repositioning problem, considering uncertain future demand and complex city networks. We propose a two-stage repositioning policy for general networks, with a lower bound metric indicating both policy performance and service improvement space. For special linear and circular networks, another repositioning policy is derived via an approximation approach relaxing demand uncertainty, with a performance upper bound that can be tight under particular supply-demand status. Extensive numerical experiments based on real data validate the effectiveness of our policy, offering empirical insights.

Parallel Session (C17) - Supply Chain Risk Management**Day 2: 6th Jan (Sat) 13:30-14:50 Venue: 2131A****Session Chair: Guang Xiao, The Hong Kong Polytechnic University****Title: Sourcing Under Supply Uncertainty: Impact of International Commercial Terms**

Presenter: Jingwen Xu, The Hong Kong Polytechnic University

Co-author(s): Yulan Wang, Guang Xiao, Lei Chen

Abstract:

We consider a three-tier decentralized global supply chain that consists of a domestic buyer, a reliable supplier located outside a free trade area, an unreliable supplier situated within a free trade area, and a logistics service provider that transports products from overseas suppliers to the domestic buyer. First, based on who shall bear the tariff and shipping cost, the buyer and the supplier can undertake one of the following three trade agreements: Ex Works, Delivered at Place, or Delivered Duty Paid. Second, depending on the basis of the dutiable value on which the tariff is calculated, Free on Board and Cost Insurance Freight are considered.

Title: Flexibility Value of Reshoring Capacity under Import Cost Uncertainty and Domestic Competition

Presenter: Xiao Tan, East China University of Science and Technology

Co-author(s): Panos Kouvelis, Sammi Tang

Abstract:

Companies that operate global supply chains are facing increasing uncertainty in the cost of imported goods—both finished products as well as raw materials. This has prompted companies to rethink the need for a diversified global supply chain, particularly by adding an onshore/nearshore production location to the current offshore location. This paper adopts a game-theoretic model to analyze a global firm's reshoring capacity, output quantity, and production decisions in the presence of domestic market competition. We account for uncertainties around market demand and import costs at both the raw-material and finished-goods level.

Title: Vertical Information Sharing in the Presence of Investment Shocks: When May It Happen?

Presenter: Puping Jiang, Shanghai Jiao Tong University

Co-author(s): Panos Kouvelis

Abstract:

Vertical information-sharing literature in supply chains, either a bilateral chain or one supplier with multiple Cournot-competing buyers, has argued that voluntary (public) information sharing is not a Nash equilibrium. Our work argues that in some industrial settings with the presence of uncertain cash flows limiting operational investments, the revelation of accurate market demand information may influence the operational investment decisions of the supplier and alter their supply cost. Subsequently, resulting cost savings may be partially passed via wholesale prices to the buyers and overcome the harmful effects of information sharing.

Title: Crop Production in Emerging Economies: The Pricing Lever of Processing Plant

Presenter: Jian Li, Northeastern Illinois University

Co-author(s): Panos Kouvelis, Guang Xiao

Abstract:

We examine an agricultural supply chain for a particular crop, where farmers can choose to sell their product in a side market or to a processing plant. In addition, the government offers a minimum price guarantee for the crop. We explore various pricing strategies that the processing plant can use to engage with farmers regarding land and harvest allocation decisions. We develop two-stage stochastic program models to analyze these allocation and pricing decisions. And we develop analytic and numerical results guiding the decisions.

Parallel Session (C18) - Optimization Models for Service Systems

Day 2: 6th Jan (Sat) 13:30-14:50 Venue: 2131B

Session Chair: Zheng Zhang, Zhejiang University

Title: Daily Movie Scheduling Incorporating Customer Choice

Presenter: Ning Fang, Zhejiang University

Co-author(s): Zhou Xu, Weihua Zhou

Abstract:

Digital projection technology enables frequent changes in the movie showing on screens. The showtime can be adjusted in minutes, allowing for a more flexible screening schedule than traditional film-based projection. This study aims to determine which movie will be shown on which screens and at what times of the day at the cinema, with the estimated demand for all films at different times. The goal is to maximize the expected revenue of the screening schedule. This problem is challenging because competition exists when showings

of the same film open close to each other, also known as cannibalization. This means the revenue of showings depends not only on the expected demand but also on the adjacent showings. We first define the viewing utility of customers and illustrate the allocation of buying power among adjacent showings. Then, we start from the special case where the capacity of the screen is excessively larger than demand and transform it into a network flow problem. After that, we construct several simulation-based heuristic algorithms for the general case. Numerical experiments using synthetic and actual data document the advantage of our proposed algorithms on resource-allocation efficiency. We also discuss how customer choice impacts daily movie scheduling and provide managerial insights.

Title: Managing Appointments for A Multi-Stage-Multi-Server System

Presenter: Can Zhao, Zhejiang University

Co-author(s): Xuan Liao, Zheng Zhang

Abstract:

Appointments have been widely used in service systems to manage customer arrivals, aiming to smooth customer flow and improve service efficiency. This study considers managing customer appointments for a generic system consisting of multiple stages of the service and multiple servers in each stage. The problem is challenging because of the unfixed service order and random service times, which further cause discontinued cost function. We propose a simulation-based optimization framework to determine the customer arrival times of the first stage while assuming customer service follows a first-come-first-serve rule in the following stage. The goal is to minimize a weighted total expected cost associated with the customer's waiting and sojourning and the server's overtime work. By exploiting conditional Monte Carlo sampling, we smooth the originally discontinued sample path cost function and propose a tailored stochastic gradient algorithm for a good-performing approximate solution. We conduct a series of numerical experiments and results show that our approach significantly outperforms the benchmark strategies in lowering the expected cost. We also discuss the impact of capacity planning of servers among the stages and provide managerial insights about the facility design of the system.

Title: Design of Patient Visit Itineraries in Tandem Systems

Presenter: Shan Wang, Sun Yat-sen University

Co-author(s): Nan Liu, Guohua Wan

Abstract:

We develop the first optimization modeling framework to provide each patient a personalized visit itinerary in a tandem (healthcare) service system. To address technical challenges, we develop two original reformulations. One is directly amenable to off-the-shelf optimization software and the other is a concave minimization problem over a polyhedron shown to have neat structural properties, based on which we develop efficient solution algorithms. In addition to these exact solution approaches, we propose an approximation approach with a provable optimality bound and numerically validated performance to serve as an easy-to-implement heuristic.

Title: Helping the Captive Audience: Advance Notice of Diagnostic Service for Hospital Inpatients

Presenter: Zheng Zhang, Zhejiang University

Co-author(s): Miao Bai, Nan Liu

Abstract:

Inpatients are often treated as the “captive audience” on-demand for hospital diagnostic service. We propose an innovative scheduling approach called “advance notice” to manage hospital diagnostic practice. Patients are placed in a common queue waiting to be called for service, and they will be provided both a fixed preparation time and a guaranteed service time window in advance. It calls for two decisions: who to serve now and who to send advance notices to. We formulate a Markov Decision Process model to optimize these decisions dynamically. Via a novel variable transformation, we reveal the hidden antimultimodular structure of the problem and show how the optimal decisions should be adjusted in response to changes in the system load. Beyond solving the MDP model for daily operations, we further investigate how the service time window and preparation time

window, as system-level controls, can be used to manage system performance. Our numerical study, populated by real data from a large academic medical center in the United States, demonstrates significant improvement in operational efficiency by switching from the current practice to adopting our advance notice policy.

Parallel Session (C19) - Incentive Structures and Behavioral Effects in Healthcare Operations

Day 2: 6th Jan (Sat) 13:30-14:50 Venue: 2131C

Session Chair: Zhaowei She, Singapore Management University

Title: Decision Fatigue in Physicians

Presenter: Han Ye, Lingnan University

Co-author(s): Junjian Yi, Songfa Zhong

Abstract:

A recognized problem in administering medical care is physicians' excessive workload. We explore its behavioral consequences from the perspective of decision fatigue—the decline in decision quality due to an increased number of patients and treatment decisions. Using administrative data from over 250,000 visits to an emergency department, we find that an increased number of patients the physician had previously treated during a shift lowered the index patient's inpatient admission probability and increases subsequent revisit rates. These findings have important implications on the long-standing debate regarding regulations for healthcare professionals and excessive physician workload.

Title: From Black to Grey: Improving Access to Antimalarial Drugs in the Presence of Counterfeits

Presenter: Jiatao Ding, INSEAD

Co-author(s): Michael Freeman, Saša Zorc

Abstract:

We study how donors should allocate limited funds to subsidize antimalarial drugs via private-sector distribution channels in the presence of counterfeits. We also consider the potential effectiveness of other interventions to improve outcomes. To examine the supply chain of antimalarials, we develop a game-theoretic model in which the retailer has a choice to source legitimate drugs from a certified supplier, potentially counterfeit drugs from an uncertified supplier, or both. Our results indicate the need for regulators and donors to understand market characteristics to design effective subsidy schemes and select appropriate technologies and policies to improve access to life-saving medicines.

Title: The Theory and Practice of Shared Savings Programs

Presenter: Xinyue Fei, City University of Hong Kong

Co-author(s): Frank Chen, Wei Zhang, Long Gao

Abstract:

The Medicare Shared Savings Program (MSSP) has shown modest progress and an incentive-participation dilemma since its inception. This work redesigns a long-term MSSP contract, considering providers' heterogeneity, private information, random savings generation, and uncontractable efforts. We construct optimal and approximated contracts, justifying the current contract form while refining the sharing rates and benchmarks to resolve the incentive-participation dilemma. Our optimal benchmark policy also suggests appropriate targets in the pay-for-performance design to resolve the infamous ratchet effect while ensuring insurers' and the public's surplus. We estimate parameters using real data through inverse optimization and quantify the performances of different contracts.

Title: The "Netflix Model": A New Payment Model for Silent Diseases

Presenter: Huaiyang Zhong, Virginia Polytechnic and State University

Co-author(s): Zhaowei She, Yueran Zhuo, Jagpreet Chhatwal, Tugay Ayer

Abstract:

Tackling the diagnosis and management of asymptomatic diseases is vital, as many go unnoticed in early stages, leading to severe complications later. The high costs of screenings and treatments pose additional challenges. The "Netflix Model" offers a solution: government agencies pay pharmaceutical companies an upfront fee for unlimited access to treatments, mirroring a subscription system. We offer a theoretical mathematical framework to understand the conditions under which such Netflix-style contracts can be most beneficial, presenting a potential solution to the challenges of asymptomatic disease management.

Parallel Session (C20) - Theoretical and Empirical Studies on Sustainable Operations**Day 2: 6th Jan (Sat) 13:30-14:50 Venue: 2132A****Session Chair: Yihua He, The Hong Kong University of Science and Technology****Title: Female-Enhanced Operations: Relationships Between Female Workers and Safety Performance**

Presenter: Wenjun Shu, The Hong Kong Polytechnic University

Co-author(s): Di Fan

Abstract:

Operations management scholars have been dedicated to exploring the organizational antecedents of operational safety, but the impact of workforce gender composition has often been overlooked. Conventional wisdoms consider that female workers are vulnerable in the workplace, whereas theories suggest that female workers are generally more risk-averse and compliant with rules, making them less likely to breach safety procedures. Our two-way fixed effect regression analysis, sampling U.S.-listed firms, shows that firms with increased female workers see fewer time-lost injuries from workplace accidents. This relationship is more salient in firms with an OHSAS 18001 certification and those with high-turnover labor conditions.

Title: The Impact of Sustainability Management Practices on Firm Performance: Chinese Evidence

Presenter: Shuo Shan, BNU-HKBU United International College

Co-author(s): Lingjia Li, Yongyi Shou, Weihua Zhou

Abstract:

Research on the linkage between environmental/social sustainability practices and firm performance has been investigated extensively. On this basis, this study aims to reveal the differences between them and the underlying mechanisms. Moreover, the moderating effects of organizational (i.e., firm size and marketing spending) and environmental conditions (i.e., industry competition) are examined from an organizational visibility perspective. Based on the resource-based view (RBV), we test the overall hypotheses using a panel dataset of publicly listed Chinese manufacturing firms. This study adds knowledge to uncovering the performance effects of sustainability management practices and the corresponding boundary conditions.

Title: On the Heterogeneous Impacts of Green Manufacturing Adoption on Operational Efficiency

Presenter: Fuzhen Liu, The Hong Kong Polytechnic University

Co-author(s): Ni (Nina) Huang, Kee-Hung (Mike) Lai

Abstract:

With the incentives of “carbon peak & carbon neutrality” goals, many manufacturers have started to go green. However, scant literature empirically reveals the consequences of pro-environmental actions urged by policy regulations from an operations management perspective. This study investigates whether green manufacturing improves operational efficiency by using a staggered difference-in-differences approach. Drawing from a resource-based view, we also examine which factors may substitute or complement green manufacturing practices for achieving a firm’s operational excellence. Accordingly, this study can provide new insights into the knowledge regarding the relationship between

environmental friendliness and operational efficiency.

Title: A Cost-agnostic Model for Infrastructure Planning in Sustainable Water Development

Presenter: Yihua He, The Hong Kong University of Science of Technology

Co-author(s): Guillermo Gallego, Mengqian Lu, Jin Qi

Abstract:

An efficient water allocation system and improvement of water-related facilities are vital for rapid socioeconomic development and environmental sustainability. To evaluate the current system and identify promising improvements, we develop an aggregated rain-flow allocation model over a relevant time horizon to balance demand and supply. The model is infrastructure cost-agnostic and focuses on the potential value of changing storage capacity for reservoirs and improving network connectivity over rivers and cities. Specifically, we obtain two crucial statistics, marginal value and allowable range from linear optimization, to create a list of the most promising projects in terms of their ability to improve the matching of supply and demand. Specifically, we develop an evaluation loop to capture the change of marginal value with the improvement of each possible infrastructure project. This evaluation loop can help the decision maker to identify promising projects from these candidates and save significant time and effort compared to cost-based models that require obtaining cost data for many projects that will never be built. We apply our model to a case study in the Greater Bay area based on real data. We identify two drought cities, Guangzhou and Foshan, that can greatly benefit from infrastructure improvement and there is no need to enlarge the inventory capacity in Shenzhen, Huizhou and Dongguan.

Parallel Session (C21) - Sustainability and Sharing Economy**Day 2: 6th Jan (Sat) 13:30-14:50 Venue: 2132B****Session Chair: Ying Xu, Singapore University of Technology and Design****Title: When Trade-in Refurbishment Meets P2P Market: Product Design and Environmental Regulation**

Presenter: Xin Zhou, University of Science and Technology of China

Co-author(s): Fan Zhou, Ravi Anupindi, Feng Tian

Abstract:

This research investigates the relationship between sellers' trade-in programs, product refurbishment, and Peer-to-Peer (P2P) resale markets, focusing on their influence on product design and environmental regulations. P2P markets may enhance seller profits through faster product turnover, yet their environmental impact is mixed: beneficial initially, but potentially harmful as efficiency increases. Sellers strategically determine the quality difference between new and older products, with larger differences possibly benefiting environments. For environmental policies, refurbishment subsidy alone is optimal with sufficient funding, whereas P2P market investments alone is optimal with tight budgets and when the quality gap is substantial.

Title: Pricing Strategies in Dual-Channel Closed-Loop Supply Chains: Trade-In vs. Direct Purchase Customers

Presenter: Yang Xiao, Yokohama National University

Co-author(s): Hisashi Kurata

Abstract:

In the realm of dual-channel closed-loop supply chains (DCCLSCs), the formulation of pricing strategies tailored to two distinct customer types—direct purchasers and participants in Trade-In programs—is crucial. This study applies equilibrium analysis and

numerical simulation to evaluate pricing within three recycling models: manufacturer-led, retailer-led, and co-led. The results reveal a marked divergence in pricing frameworks for direct buyers versus Trade-In consumers, contingent upon the chosen recycling strategy. This research illuminates the complex interactions between customer heterogeneity, pricing, and recycling systems, offering insights for enhancing both profitability and sustainability in DCCLSCs.

Title: Escaping the “Black Holes”: Periodic Repair and Maintenance Problem of Shared Bikes

Presenter: Chengcheng Yu, University of Science and Technology of China

Co-author(s): Lindong Liu, Qiao-Chu He, Lan Lu

Abstract:

The first-order survival challenge for the bike-sharing industry is to reduce operational costs via well-planned repairs, as malfunctioning bicycles cause traffic congestion, parking problems as well as recycling nightmares. The status quo of bicycle repair relying on manual reporting systems is in desperate need of analytics enabled by data science. In this paper, we introduce a data-driven periodic repair framework to integrate the failure rates prediction and the repair operation of shared bikes. We introduce a novel prediction paradigm to estimate failure rates and conceptualize a physical landscape analogous to “black holes” in cosmology, representing locations with morbidly high failure rates. Based on the “black hole” phenomenon, we propose a periodic repair model for shared bikes and develop an efficient customized Lagrangian relaxation heuristic to address it. To further enhance repair operations, we introduce a robust optimization model to handle uncertainties in bike health prediction and employ a myopic method to solve the robust model, relying on the closed-form solution of the special single depot case. Additionally, a preventive maintenance model is proposed to mitigate the “black holes” phenomenon and reduce the overall cost. By constructing a symmetric network, we discover structural properties of the optimal repair policy determined by the trade-off between the disparity in failure rates and centripetality of transportation demand. The robust model demonstrates a shorter optimal repair period compared to the deterministic model, with a slight price in robustness significantly improving solution feasibility. Furthermore, the preventive

maintenance model yields two analytical results that shed light on the existence of a threshold policy and the selection of the assignment policy. A real-world case study validates the effectiveness of our methodologies and offers valuable managerial insights.

Title: The Impacts of Ride-hailing on Car Ownership under Individual Choice Endogeneity

Presenter: Ying Xu, Singapore University of Technology and Design

Co-author(s): Yuliu Su, Shih-Fen Cheng, Costas Courcoubetis

Abstract:

With the emergency of ride-hailing platforms, individuals with travel needs face a new tradeoff: either to purchase a car and provide ride-hailing service or to use the ride-hailing service. Individuals' choices lead to varying matching rates of ride-hailing service, which inversely affects their utilities of being service provider or user. With such complexity we develop a discrete choice model to capture the choices of a group of heterogeneous individuals at equilibrium. We calibrate the model using Singapore data and conduct counterfactual analysis to illustrate the impacts of ride-hailing rate and driving cost on car demand and usage.

Parallel Session (C22) - Emerging Topics in Supply Chain Management I

Day 2: 6th Jan (Sat) 13:30-14:50 Venue: 2132C

Session Chair: Zhou Xu, The Hong Kong Polytechnic University

Title: Stochastic Network Programs over Multigraph with Random Arc Capacities

Presenter: Haiqing Song, Sun Yat-Sen University

Co-author(s): Fudong Xie, Yun Cai

Abstract:

A multigraph is a graph in which two nodes may be connected by more than one link. In this

paper, we explore a special class of stochastic network programs where the recourse problem involves a multigraph with random arc capacities. This type of multigraph can be employed to model a logistics service network with multiple levels of service between two nodes. We introduce an efficient procedure, named the MREC algorithm, to precisely obtain the expected recourse function of the multigraph dynamic network with random arc capacities problem. Numerical experiments demonstrate that the MREC algorithm is effective for large-scale multigraph network recourse problems.

Title: Beyond Traditional Transshipment: A Flexible Mechanism for Multi-Echelon Logistics System

Presenter: Lindong Liu, University of Science and Technology of China

Co-author(s): Zheng Tan, Yugang Yu

Abstract:

Multi-echelon warehousing and logistics systems often face limitations in terms of high costs, particularly for heavy cargo that is inconvenient to store separately. A home appliance logistics company's data reveals that over 54% of orders require transshipment between warehouses, resulting in significant operational costs. To overcome these challenges, we propose a novel mechanism that surpasses traditional transshipment approaches. Our approach introduces a Flexible Transshipment Vehicle (FTV) that unloads goods from the mainline fleet at multiple transshipment points. By incorporating an additional FTV into the system, some transshipment demands from depots near the transshipment points can be replaced with flexible delivery, thereby reducing the overall transshipment cost. While the static scheduling problem of FTV has been addressed in existing literature with pseudo-polynomial algorithms, solving the corresponding problem in a more realistic dynamic scenario is challenging. To tackle this, we employ a multi-stage robust optimization method and utilize a data-driven framework with continuous support of ambiguity sets. Through extensive evaluation, our proposed method outperforms current approaches, achieving an average improvement in the optimal gap of 11.69%. Furthermore, in real-data experiments, our algorithm demonstrates a 6.54% reduction in operational costs compared to existing methods used in multi-echelon systems.

Title: Multi-Product Inventory Control with Consolidated Shipping and Demand Learning

Presenter: Shining Wu, The Hong Kong Polytechnic University

Co-author(s): Liutao Yang

Abstract:

We consider the inventory optimization problem of an e-commerce firm that sells two products with unknown correlated demand where sequentially arriving customers may demand either or both products. The firm uses consolidated shipping for delivery in the way that items requested in an order are shipped via one package if they are all available or are delivered by multiple sequential shipments otherwise. We formulate the problem, analyze the optimal inventory decisions when the firm has full demand information, and develop machine learning-based algorithms for online optimization of the inventory decisions when the information is unknown and needs to be learned.

Title: Driving Growth in Competing Supply Chains: Leveraging Upstream Demand Expansion and Downstream Information Sharing

Presenter: Ruina Yang, Xi'an Jiaotong University

Co-author(s): Yingdan Zhang, Zelong Yi

Abstract:

This paper studies the interaction between demand expansion and information sharing in competing supply chains, each consisting of one manufacturer and one retailer. Each retailer decides whether or not to share their private demand information with their manufacturers, and then each manufacturer (or only one manufacturer) invests to expand demand across the market. Our results indicate that a retailer, whose manufacturer has a higher expansion effectiveness or is the only one to expand demand, is more likely to share information than the other retailer. It reflects that demand expansion acts as an incentive leverage for a retailer to share information. However, such demand expansion can lead to

the spillover effect and free-riding, and it may harm manufacturers in Cournot competition. Nevertheless, manufacturers' expansion investments do not fall to zero due to the incentive leverage of demand expansion for information sharing, whose benefits can dominate the harm caused by freeriding. But in Bertrand competition, demand expansion always benefits both manufacturers and retailers, creating a win-win outcome, and information sharing always enlarges this win-win region. These results imply that information sharing provides an incentive for manufacturers to expand demand. Furthermore, we examine the equilibrium information sharing decisions and find that the expansion effectiveness discrepancy between the two manufacturers plays a significant role. Specifically, it is more likely to reach an equilibrium in which both retailers share information when the effectiveness discrepancy is lower, while when the effectiveness discrepancy is higher, it is more likely to reach an equilibrium in which only one retailer whose manufacturer has a higher expansion effectiveness shares information. Our findings provide theoretical guidance for manufacturers to adopt optimal expansion actions that incentivize information sharing and respond to competitors' free-riding behavior.

Parallel Session (D1) - Data-Driven Operations Management**Day 2: 6th Jan (Sat) 15:10-16:30 Venue: 2126D****Session Chair: Kai Pan, The Hong Kong Polytechnic University****Title: Operating a Grid-Vehicle Integration System: A Machine Learning-Driven Optimization Approach**

Presenter: Ziliang Jin, The Hong Kong Polytechnic University

Co-author(s): Jianqiang Cheng, Kai Pan, Zuo-Jun Max Shen, Yulan Wang

Abstract:

We examine a grid-vehicle integration system that uses vehicle-to-grid (V2G) technology to connect the grid and the electrical vehicle mobility system. We focus on the operation of this integration system under uncertainties. We formulate a two-stage robust mixed-integer program. We propose a machine learning-driven optimization approach that incorporates alternating direction method of multipliers (ADMM), machine learning, and strong valid inequalities. This approach significantly outperforms a commercial solver in both computational time and solution quality based on real data. Our findings suggest that in addition to enhancing the operation efficiency of the grid, V2G also promotes sustainability by reducing carbon emissions. However, the extent of this contribution varies under different power load patterns.

Title: Optimized Dimensionality Reduction for Moment-based Distributionally Robust Optimization

Presenter: Shiyi Jiang, The Hong Kong Polytechnic University

Co-author(s): Jianqiang Cheng, Kai Pan, Zuo-Jun Max Shen

Abstract:

This talk discusses an optimized dimensionality reduction approach to solve the SDP reformulation of moment-based distributionally robust optimization. We first show that the

ranks of the matrices in the SDP reformulations are small, by which we are then motivated to integrate the dimensionality reduction of random parameters with the subsequent optimization problems. Such integration enables two outer and one inner approximations of the original problem, all of which are low-dimensional SDPs that can be solved efficiently. More importantly, these approximations can theoretically achieve the optimal value of the original high-dimensional SDPs. Numerical results show significant advantages of our approach.

Title: Transfer Learning, Cross Learning and Co-Learning Across Newsvendor Systems with Operational Data Analytics (ODA)

Presenter: Lei Li, The Hong Kong Polytechnic University

Co-author(s): Qi Feng, J. George Shanthikumar

Abstract:

Making inventory decision under limited demand data can be challenging. We apply operational data analytics (ODA) framework to develop prescriptive solutions under transfer learning, cross learning, and co-learning of the demands. We propose cross-learning (co-learning) solutions that improve decision performance in the focal system with limited data by utilizing the ample data in a related system (limited data in multiple related systems). We also show the asymptotic optimality for both cross-learning and co-learning solutions. Our results underscore the roles of domain knowledge and the structural relationships between the data and the decision in designing efficient learning solutions with limited data.

Title: Data-Driven Distributionally Robust Chance-Constrained Linear Matrix Inequalities

Presenter: Fengjie Liang, The Hong Kong Polytechnic University

Co-author(s): Jianqiang Cheng, Kai Pan

Abstract:

This paper presents approximation techniques for distributionally robust chance-constrained linear matrix inequalities (DRCCLMIs), addressing the computational challenges posed by multidimensional integration and non-convexity of the feasible set. We propose an inner approximation for general DRCCLMIs using the Conditional Value-at-Risk (CVaR) method. Furthermore, we derive exact reformulations for DRCCLMIs that exhibit a block matrix structure within the linear matrix inequalities. Our methods enable the transformation of the original DRCCLMIs into a more tractable semidefinite programming (SDP) problem. The effectiveness of these techniques is demonstrated through a numerical study on two real-world applications: truss topology design problem and calibration problem.

Parallel Session (D2) - Distributionally Robust Optimization and Its Applications**Day 2: 6th Jan (Sat) 15:10-16:30 Venue: 2126A****Session Chair: Daniel Zhuoyu Long, The Chinese University of Hong Kong****Title: Distributionally Robust Contextual Optimization with Contaminated Data**

Presenter: Chun Wang, Tsinghua University

Co-author(s): Ningyuan Chen, Tianyu Wang

Abstract:

In contextual optimization, traditional robust approaches rely on the assumption that the distribution of testing data is the same as that of training data, which usually fails in the covariate-shifting scenarios. To handle this, we propose a new distributionally robust approach that constructs the nominal distribution based on the Nadaraya-Watson kernel estimator. We find that it converges to the actual conditional distribution under the Wasserstein distance. We develop a tractable computation framework and show the out-of-sample guarantees. We demonstrate the strong performance of the proposed framework in applications of newsvendor problems and portfolio optimization.

Title: Distributionally Robust Pricing with Asymmetric Information

Presenter: Yihua He, The Hong Kong University of Science and Technology

Co-author(s): Hongqiao Chen, Jin Qi, Lianmin Zhang

Abstract:

We study a distributionally robust pricing model based on asymmetric information of the customers' valuation distribution by using mean, variance and semivariance. We obtain the worst-case profit under any exogenous price, which is gradually approached by several series of asymptotic three-point distributions. Subsequently, we obtain the optimal robust price in a closed form. We further consider two significant extensions. The first one is the randomized pricing strategy, which can guarantee a larger revenue compared to the posted strategy. The second one is a general pricing problem under the Hurwicz criterion, where we can also calculate the optimal price efficiently.

Title: Robust Security Design with Moment Information

Presenter: Kerui Tu, City University of Hong Kong

Co-author(s): Yi Li, Yimin Yu, Du Du

Abstract:

We examine how a risk-neutral investor designs optimal security for an entrepreneur with complete information versus the investor's limited moment information (e.g., mean and variance). Facing such information ambiguity, the investor maximizes its objective under the worst-case criterion. For risk-neutral entrepreneurs, robust optimal securities are linear with mean-only information and quadratic with mean-variance information. The security's convexity/concavity depends on the marginal effect of the second moment on the entrepreneur's effort. Quadratic security outperforms linear security, achieving mutually beneficial outcomes under less stringent conditions. For risk-averse entrepreneurs, robust optimal securities take a transformed quadratic form. We also provide numerical experiment results.

Title: Distributionally Robust Group Testing with Correlation Information

Presenter: Yu Sun, The Chinese University of Hong Kong

Co-author(s): Zhuoyu Long, Jin Qi, Aiqi Zhang

Abstract:

We consider a distributionally robust group testing problem to derive an optimal partition policy that minimizes the systematic objective. With the information on prevalence and pairwise correlation among subjects' infection, we derive that in an optimal partition, all groups have the same size, which can be identified by an efficient algorithm. We further extend our model to the partially correlated case (i.e., correlation only exists within clusters, and subjects from different clusters are independent) and construct structural properties of the optimal partition. Numerically, we reveal that incorporating distributionally robust correlation contributes to a substantial reduction in the overall testing costs.

Parallel Session (D3) - Empirical Research on Retail Operations

Day 2: 6th Jan (Sat) 15:10-16:30 Venue: 2126B

Session Chair: Ying Rong, Shanghai Jiao Tong University

Xiaojing Feng, Southwestern University of Finance and Economics

Title: The Value of Curated Boxes: Evidence from an Omnichannel Fashion Retailer

Presenter: Yiwei Wang, Zhejiang University

Co-author(s): Lauren Xiaoyuan Lu

Abstract:

Curated boxes consist of thoughtfully selected assortments of products that can be sold as one-time purchases or as part of a subscription service. By exploring field experiment data from an online omnichannel fashion retailer, we study the effect of introducing a curated box channel to randomly selected customers on their behaviors in the online sales and subscription rental channels. We find that the treatment of curated boxes increases the total

sales and results in a demand spillover effect on the existing channels. We also propose a data-driven approach to optimize the box distribution strategies and improve profits.

Title: Me vs. You: The Effect of Relative Performance Feedback on Employee Behavior in Real-Time Feedback System

Presenter: Zhi Chen, Zhejiang University

Co-author(s): Weihua Zhou, Yuqian Xu, Jay Swaminathan

Abstract:

An increasing number of warehouses are implementing real-time feedback systems to enhance employee motivation. In this study, we investigate the impact of these systems on task performance. Collaborating with Alibaba Group, we observed a 7.9% reduction in work time upon introducing the real-time feedback system. Negative internal impacts (moving backward in rankings) urge employees to increase speed, albeit at the expense of quality, while negative external impacts (below average) result in decreased efforts. Notably, positive internal impact mitigates the negative effect of external feedback. Our findings offer valuable insights for managers seeking to enhance productivity.

Title: Relationship between Package Delivery Speed and Product Returns Revisited: Endogeneity and Nonlinearity

Presenter: Xiaojing Feng, Southwestern University of Finance and Economics

Co-author(s): Mengmeng Wang, Guangzhi Shang, Ying Rong, Cheng Fang

Abstract:

Rao et al. (2014) revealed that there exists a negative linear relationship between package delivery reliability and product returns. Building on their seminal findings, our research examines this understudied effect in a more granular manner by leveraging a transaction-level dataset that is more up-to-date and larger in size. We find that customers' tendency to return an order concavely increases with the actual delivery time, which can be explained by the customer's subjective time perception that psychophysically differs from objective

time, rather than by two alternative mechanisms. The results are robust when we use an instrumental variable to address the endogeneity issues.

Parallel Session (D4) - Empirical Research in Operations Management

Day 2: 6th Jan (Sat) 15:10-16:30 Venue: 2126C

Session Chair: Yilin Shi, The Chinese University of Hong Kong

Jing Wu, The Chinese University of Hong Kong

Title: Mergers and Product Repositioning: Theory and Empirical Evidence Presenting

Presenter: Yushu Zeng, The Hong Kong University of Science and Technology

Co-author(s): Xin Wang, Soo-Haeng Cho, Zijun (June) Shi

Abstract:

We develop a game-theoretical model to investigate the changes of quality, variety, and price after a merger and their impacts on firms and consumers. We find that cost savings from consolidating the products benefit the merged firm, but might hurt consumers. We then find empirical evidence by employing a propensity score matching and difference-in-differences model to investigate the market welfare changes after mergers, using observational data from the airline industry. The empirical findings further confirm that a merger must be evaluated in an integrated way by examining its impact on product quality and variety as well as price.

Title: The US-China Trade War and Global Supply Chain Rerouting

Presenter: Boya Peng, The Chinese University of Hong Kong

Abstract:

We study the impact of the U.S.-China trade war on the rerouting of global supply chain.

Based on country-level evidence, the United States has reduced its imports from China while increasing imports from North American countries and other Asian countries. The substitution patterns were influenced by factors such as the pre-war import share from China and the types of products. Additionally, since the beginning of the trade war, the shares of China in imports to Mexico, Canada, Japan, Korea, Vietnam, Malaysia, and Thailand have increased. China has also increased its exports of products that serve as inputs for goods subject to U.S. tariffs on China to these countries, indicating the indirect link between the United States and China.

Title: Value of Exclusive Doorstep Delivery in the Last-100-Meter Distribution

Presenter: Yang Zhan, Zhejiang University of Technology

Co-author(s): Zheng Zhang, Jiwen Ge

Abstract:

The last-100-meter distribution service provided by self-pickup points in residential communities in China serves as the last e-commerce order-fulfillment leg. With repeated interactions with consumers, it shapes their delivery-service experience and online-shopping choices. We investigate the value of upgrading this service leg exclusively by exploiting a large-scale natural experiment. In the experiment, doorstep delivery is provided exclusively for Alibaba packages by self-pickup points as an additional option, while Non-Alibaba consumers can only self-pick their packages. Leveraging difference-in-differences models and using data of more than 1.5 billion packages, we show that the exclusive doorstep-delivery initiative brought significant sales growth (decline) of Alibaba (Non-Alibaba) and reversed the sales growth trends -- outgrown by 3.09% pre-treatment, Alibaba outgrew its competitors by 3.80% post-treatment. We define novel consumer-choice-driven service-quality metrics and uncover that service-quality improvement (deterioration) drives the sales growth (decline) of Alibaba (Non-Alibaba). We reveal that such a negative spillover effect is due to doorstep-delivery-induced service-capacity competition. We also show a counter-intuitive positive spillover effect possibly due to self-benefiting-driven service-capacity sharing. Finally, we provide managerial insights on treatment heterogeneity. Self-pickup points serve different strategical roles depending on Alibaba fast-moving package share and Non-Alibaba overdue package share. Those with

one high and the other low can only serve as sales generators or competitor destroyers; those with both high can kill two birds with one stone; those with both low achieve none of the two goals. Policy-wise, Alibaba needs to customize its business-development effort and subsidy based on the two metrics.

Title: Facility Location Choices through the Supply Chain

Presenter: Xiaoran Ma, The Chinese University of Hong Kong

Abstract:

By leveraging the National Establishment Time Series data, a detailed longitudinal database at the establishment level, alongside a database tracking supply chain relationships, our study investigates the facility location choices made by US firms through their supply chains. Our preliminary results demonstrate a positive impact of supply chain agglomerations on location decisions. Specifically, the proximity to supply chain partners plays an important role in shaping the location preferences of new establishments for US firms. Our analysis spans both the firm level and the supply chain dyad level, yielding consistent results.

Parallel Session (D5) - Emerging Topics in Operations Management

Day 2: 6th Jan (Sat) 15:10-16:30 Venue: 2127A

Session Chair: Zhichao Feng, The Hong Kong Polytechnic University
Zechao Li, Tsinghua University

Title: Preservation of Multimodularity with Nonlattice Structures and Its Applications in Stochastic Optimization Problems

Presenter: Fen Xu, Tsinghua Shenzhen International Graduate School, Tsinghua University
Co-author(s): Tong Wang, Li Xiao

Abstract:

This paper establishes a new preservation result of multimodularity with nonlattice structures for a class of resource allocation problems with multiple resources and multiple demands. Our result shows that if the resources have different priorities to be allocated and demands have different priorities to be satisfied under the optimal policy, then the multimodularity and bounded cost differences of the objective function are preserved to the value function after optimization. We then illustrate the use of the result in several stochastic optimization problems.

Title: Improving Farmer Welfare via Weather Index Insurance: Sell-Direct and Sell-Through Mechanisms

Presenter: Yuxuan Zhang, University of International Business and Economics

Co-author(s): Christopher S. Tang, Jiayi Joey Yu

Abstract:

In developing economies, risk-averse farmers shy away from traditional crop insurance for two major reasons: lack of understanding, and tedious claim process. Unlike traditional crop insurance that relies on assessing each farmer's actual yield loss, weather index insurance uses an "index" (such as rainfall levels) as a proxy for determining the insurance payout. Because it is transparent, easy to understand, and fast to settle claims, smallholder farmers are embracing weather index insurance. In this paper, we consider two mechanisms for selling weather index insurance: sell-direct and sell-through. We quantify the value created by the weather index insurance (under both mechanisms) for farmers, the seed seller, and the insurance firm.

Title: Capacity and Pricing Management with Demand Learning

Presenter: Zechao Li, Tsinghua University

Co-author(s): Jian Chen, Anyan Qi, Yining Wang

Abstract:

Capacity adjustment and dynamic pricing are long-term and short-term decisions respectively to match supply with demand. In an environment where the demand is unknown to the firm, it is important to investigate how the two decisions can be integrated such that the firm can learn about the demand on the fly while making capacity and pricing decisions. In this paper, we design learning algorithms for the joint capacity and pricing management problem. To evaluate the performance of our algorithms, we consider a large-demand asymptotic regime where the demand and capacity are scaled up with the selling horizon T . We first establish an $\Omega(T^{3/5})$ lower bound on the regret under any admissible policy. Then, we propose a double-trisection algorithm and establish that the cumulative regret of the algorithm is upper bounded by $O(T^{3/5})$ matching the lower bound. We also show that a modified algorithm can address the problem when the number of capacity adjustment opportunities is limited. We finally conduct numerical experiments on a testing bed inspired by public operational and financial data.

Title: No Algorithmic Collusion in Two-Player Blindfolded Game with Thompson Sampling

Presenter: Yi Xiong, Shanghai University of Finance and Economics

Co-author(s): Ningyuan Chen, Xuefeng Gao

Abstract:

When two players are engaged in a repeated game, they may be completely unaware of the existence of each other and use multi-armed bandit algorithms to choose the actions, which is referred to as the "blindfolded game" in this paper. We show that when the players use Thompson sampling, the game dynamics converges to the Nash equilibrium, under a general condition. Therefore, algorithmic collusion doesn't arise in this case despite the fact that the players do not intentionally use competitive strategies.

Parallel Session (D6) - Platform Operations and Pricing Strategies**Day 2: 6th Jan (Sat) 15:10-16:30 Venue: 2127B****Session Chair: Tianjun Feng, Fudan University****Jingchen Liu, Renmin University of China****Title: Online Dynamic Pricing on Asset-Selling Platforms**

Presenter: Puping Jiang, Shanghai Jiao Tong University

Co-author(s): Rene Caldentey, Lingxiu Dong

Abstract:

Unique features of asset-selling industry (e.g., used cars) make classical retailing models hard to meet practical needs. We propose a dynamic pricing framework for asset-selling platforms that make acquisition and selling decisions. We formulate the problem as a discounted infinite-horizon dynamic programming and propose an algorithm that is equivalent to training a reinforcement learning (RL) agent. We find that the regret of policy critically depends on customers' outside options. To resolve the computational difficulties, we show that when customers follow a nested logit choice model, we generally only need to solve a fixed-size problem to achieve a constant performance guarantee.

Title: Personalized Pricing with Limited Capacity

Presenter: Yuhang Ji, Fudan University

Co-author(s): Huiqi Guan, Tianjun Feng, Fuqiang Zhang

Abstract:

We examine the impact of capacity on the firm's profit and consumer surplus when the firm implements personalized pricing. First, we find that the firm's profit is unimodal in capacity, indicating that the firm may achieve higher profit with lower capacity. This is because limited capacity can alleviate consumers' strategic waiting behavior and benefit the firm. Second, lower capacity may result in lower prices, which is in contrast to the common

wisdom that higher prices are necessary due to scarcity. Third, the reduction of capacity may lead to a win-win result for both the firm and consumers.

Title: Bonus Competition in the Gig Economy

Presenter: Jingchen Liu, Renmin University of China

Co-author(s): Li Chen, Yao Cui, Xiaoyan Liu

Abstract:

Gig platforms have commonly relied on bonus strategies to drive participation of gig workers. We study the impact of bonus strategies on gig platforms and their welfare implications. We consider two types of bonus strategies used by gig platforms: 1) fixed bonus that is paid in addition to commissions as long as a service provider participates, and 2) contingent bonus that is paid only if a service provider participates consistently over time. We develop a game theory model to study platform competition with bonus strategies.

Title: Personalized Pricing with Storable Products

Presenter: Wangyang Lu, Fudan University

Co-author(s): Huiqi Guan, Tianjun Feng, Fuqiang Zhang

Abstract:

We investigate the impact of consumer stockpiling on the firm's profit and consumer surplus when the firm implements personalized pricing. We find that consumer stockpiling reduces firm profit, and the utilization of a more advanced pricing strategy may have adverse effects on all parties involved, which contradicts previous literature on non-storable products. That is because consumers tend to avoid paying personalized prices by stockpiling, thereby undermining the firm's ability to effectively implement personalized pricing. Our findings suggest that firms should exercise caution regarding the potential negative consequences of consumer stockpiling when implementing personalized pricing strategies.

Parallel Session (D7) - New Frontiers in Revenue Management**Day 2: 6th Jan (Sat) 15:10-16:30 Venue: 2127C****Session Chair: Jiameng Lyu, Tsinghua University****Title: Dynamic Film Scheduling under Multinomial Logit Model**

Presenter: Yongchang Fu, Zhejiang University

Co-author(s): Junyu Cao, Long He, Weihua Zhou

Abstract:

We consider a dynamic film scheduling problem, where each day the cinema can change the schedule to maximize box-office revenue, and audiences make choices based on the MNL choice model. We formulate the problem as a dynamic assortment problem. The theater estimates the preference parameters of viewing time by observing the audience's past choices and gives the optimal scheduling plan based on this estimation. Unlike the dynamic assortment studied in the past, we assume that the theater cannot observe any no-purchase choices (total audience size is unknown), for which we propose an efficient algorithm and prove the result is near-optimal.

Title: Rational Choice Models: The Temporal Tree Representation

Presenter: Mengying Xue, University of Science and Technology of China

Co-author(s): Qi Feng, J. George Shanthikumar

Abstract:

We propose a temporal tree representation of choice that covers all rational choice models. The tree representation exhibits two major advantages that overcome the major challenges of model identification. First, all rational choice models have a tree representation, and a subclass of tree representation has a one-to-one correspondence to the rational choice models. Second, the tree representation allows for the flexibility of systematically specifying the choice structure based on available knowledge and data. In particular, the number of

parameters needed to specify a tree representation can be primarily determined by the sufficient knowledge level.

Title: Online Choice-Based Decision Making for Consumer Preferences

Presenter: Ping Wang, Central South University

Co-author(s): Qingxian An

Abstract:

This paper studies consumer preferences for item attributes based on multiple online transactions over a period of time. We define a new “performance price ratio” utility function, and propose two utility-based consumer preference models in which the consumer choice yielding the maximum utility value. The consumer preferences are data-driven which are identified by our model based on the objective data without requiring subjective judgement. We also propose preference model in dynamic situation to reveal consumer preferences trend. The results of numerical and experiment studies show that our models perform well on predicting consumer choice and TOP N item ranking.

Title: Network Revenue Management with Demand Learning and Fair Resource-Consumption Balancing

Presenter: Jiameng Lyu, Tsinghua University

Co-author(s): Xi Chen, Yining Wang, Yuan Zhou

Abstract:

In addition to maximizing the total revenue, decision-makers in lots of industries would like to guarantee balanced consumption across different resources. For instance, in the retailing industry, ensuring a balanced consumption of resources from different suppliers enhances fairness and helps maintain a healthy channel relationship; in the cloud computing industry, resource-consumption balance helps increase customer satisfaction and reduce operational costs. Motivated by these practical needs, this paper studies the price-based network revenue management (NRM) problem with both demand learning and fair resource-

consumption balancing. We introduce the regularized revenue, i.e., the total revenue with a balancing regularization, as our objective to incorporate fair resource-consumption balancing into the revenue maximization goal. We propose a primal-dual-type online policy with the Upper-Confidence-Bound (UCB) demand learning method to maximize the regularized revenue. We adopt several innovative techniques to make our algorithm a unified and computationally efficient framework for the continuous price set and a wide class of balancing regularizers. Our algorithm achieves a worst-case regret of $\tilde{O}(N^{5/2} \sqrt{T})$, where N denotes the number of products and T denotes the number of time periods. Numerical experiments in a few NRM examples demonstrate the effectiveness of our algorithm in simultaneously achieving revenue maximization and fair resource-consumption balancing.

Parallel Session (D8) - Innovation OM

Day 2: 6th Jan (Sat) 15:10-16:30 Venue: 2128A

Session Chair: Guiyun Feng, Singapore Management University

Title: Aggregating or Interacting: How to Create Collective Forecasts?

Presenter: Steffen Keck, University of Vienna

Co-author(s): Wenjie Tang

Abstract:

We explore to what extent group interactions can improve on commonly-used aggregation procedures of independent individual forecasts such as averaging. In two laboratory studies, participants made forecasts for the expected duration of new product development projects across several rounds with feedback. Forecasts were based on different features of the projects and made either individually or in small interacting groups. Our results show that in highly predictable environments interacting groups significantly outperform statistically aggregated individual forecasts, especially at the beginning of the forecasting process where only little learning had occurred, but significantly underperform in environments with low levels of predictability.

Title: Does Supplier Concentration Impede Firms' Digital Innovation? A Resource Dependence Perspective

Presenter: Jie Deng, University of Nottingham Ningbo China

Co-author(s): Shao Lin, Jing Dai, Jinan Shao, Wuyue Shangguan

Abstract:

While digital innovation has the potential to significantly enhance firm performance, the factors that drive such innovation remain elusive. To shed light on this mystery We adopt a theoretical lens of resource dependence theory and utilized a panel dataset comprising 2,347 Chinese manufacturing listed firms spanning the period from 2008 to 2020 to reveal the negative relationship between supplier concentration and digital innovation. Furthermore, we identified slack resources represented by operational resource and human capital represented by the technical experience in top management teams (TMTs) and educational background of employees serve as mitigating factors that attenuate the adverse effects of supplier concentration on digital innovation.

Title: Blessing or Curse: Third-Party Information for First-Party Brand Development

Presenter: Jinzhi Li, Fudan University

Co-author(s): Tian Lin, L. Jeff Hong

Abstract:

E-commerce platforms often play a dual role as both a marketplace for and a competitor to third-party sellers. This dual-role mode arouses great anti-competitive concern, and some sellers start to take countermeasures for information protection. In this paper, we assume a seller strategically lowers its product variety to reduce information exposed to a platform. We find platform's dual-role mode may eventually hurt all parties, including the seller, online customers, and even the platform itself. More interestingly, the all-lose situation does not depend on platform's head-to-head competition with the seller. Solely platform's intention to enter the market is enough to cause everyone's loss.

Title: R&D Project Portfolio Collaboration: How to Structure the Strategic Alliance?

Presenter: Guiyun Feng, Singapore Management University

Co-author(s): Pascale Crama, Wenqi Lian

Abstract:

Incumbent companies target innovative firms with promising research and development (R&D) projects to rejuvenate their product portfolio. The partner firm chooses the timing and payment terms of the strategic alliance, accounting for the innovator's budget and marketing capability, and the project portfolio's market interaction and revenue variability. We derive conditions under which upfront and delayed alliances are preferred, respectively. Interestingly, the partner's profit does not always decrease in the innovator's marketing capability. Furthermore, the partner's profit weakly increases in the innovator's R&D budget up to a threshold, yet may exhibit a discontinuous jump/drop at that threshold.

Parallel Session (D9) - Consumer Privacy and Trust in E-Commerce

Day 2: 6th Jan (Sat) 15:10-16:30 Venue: 2128B

Session Chair: Yu (Anna) Lin, The Chinese University of Hong Kong

Title: Information Richness, Consumer Privacy, and Manufacturer Encroachment

Presenter: Nina Yan, Central University of Finance and Economics

Co-author(s): Jizhou Lu, Hao Li

Abstract:

Information richness varies across digital and physical channels, affecting consumers' privacy concerns. These factors shape consumer attitudes toward privacy and influence purchasing decisions. We develop a game-theoretical model investigating manufacturers' decisions about the encroachment and retention of the existing indirect channel. Three strategies are explored: no-encroachment, encroachment, and shifting. The findings show consumers' privacy preferences influence manufacturer strategies: for privacy disclosure

preference, manufacturers prefer shifting strategy; for privacy protection preference, the strategy choice hinges on preference strength. A win-win outcome relies on efficient information infrastructure; encroaching benefits consumers. We advise channel strategies by considering consumers' privacy preferences and information richness.

Title: Data Sharing Regulation in Digital Supply Chain: Impact of Contracts and Privacy

Presenter: Ayesha Arora, Indian Institute of Management Bangalore

Co-author(s): Tarun Jain

Abstract:

Online platforms share their customers' data with their upstream sellers, which is utilized by the sellers to gain better insights about the customers. This may help sellers to develop a product that would provide higher value to the customers. However, such data sharing among the firms causes privacy concerns among customers. In this paper, we study a game-theoretic model with an online platform (or buyer), seller, and customers facing privacy concerns. We study scenarios where the platform, the seller, and the customers may decide the extent of data to be shared by the platform with the seller under different models, such as marketplace and reselling models. Later, we also analyze the regulation of data sharing by the social planner. Our analysis characterizes the equilibrium data sharing and quality decisions, leading to intriguing findings. Specifically, under the marketplace model, the regulation of data sharing can result in either an increase or a decrease in the extent of data shared by the platform. Furthermore, compared to the scenario where a platform decides the extent of data sharing, the regulation of data sharing proves advantageous for seller and customers while being less beneficial for the platform itself. Interestingly, in the context of reselling model, we find that the regulation of data sharing does not influence the extent of data shared or the players' payoffs compared to unregulated scenarios.

Title: Consumer Trust and Product Choice in Online Marketplace: A Motivated Belief Perspective

Presenter: Yu (Anna) Lin, The Chinese University of Hong Kong

Co-author(s): Xianchi Dai, Wenjie Tang

Abstract:

Platforms invest substantial resources and effort to improve consumers' trust. Whereas past studies have demonstrated a variety of positive impacts of trust building in platforms, little is known about its potential negative impacts. In this research, we propose an unintended positive impact of low trust for e-commerce platforms. In particular, consumers with relatively low trust in a platform tend to choose products offered at higher prices, which in turn may potentially increase the platform's revenue. This effect emerges because the belief that higher-priced products have higher quality is more pronounced among consumers with relatively low trust in a platform, and such a motivated belief subsequently leads to a greater preference for these products. A unique dataset obtained from an e-commerce platform and a series of online experiments provide convergent support for the proposed effect of low trust on price choices and the mechanism underlying this effect. Finally, we discuss theoretical contributions and managerial implications of our findings.

Title: Voluntary Information Disclosure of an E-Commerce Platform under Reselling, Marketplace, and Hybrid Selling

Presenter: Jia Shi, Southwest Jiaotong University

Co-author(s): Lap Keung Chu, Huajiang Luo

Abstract:

This study investigates an e-commerce platform's incentive to voluntarily disclose demand information to an upstream manufacturer. In contrast to previous studies that emphasize the platform's mandatory information disclosure, we examine voluntary information disclosure, which allows the platform to selectively decide whether to perform information disclosure based on the level of forecast demand. The typical online selling channels in

which the platform or the manufacturer (or both) play the role of seller are identified as reselling, marketplace, and hybrid cases. In each transaction case, the interactions between the platform's information disclosure strategy, the platform's forecasting capability and channel substitutability are analyzed.

Parallel Session (D10) - Reviews, Rebates, and Recommendations in E-Commerce

Day 2: 6th Jan (Sat) 15:10-16:30 Venue: 2128C

Session Chair: Xuefeng Peng, University of Science and Technology of China

Title: Who Launches Coupon Promotion in an E-Commerce Supply Chain?

Presenter: Shan Du, Chongqing University

Co-author(s): He Huang, Hongyan Xu

Abstract:

Nowadays, many firms sell products through online platforms by two common selling formats: agency selling or reselling. This study focuses on the issue of “who launches coupon promotion in an e-commerce supply chain.” The results show that the consumer’s valuation of the product and the hassle cost play key roles in shaping the coupon promotion strategy under both selling formats. Compared with the agency selling format, the coupon promotion is more likely to be launched under the reselling format. At the same time, the launch of coupon promotion pushes the manufacturer to select the agency selling format.

Title: Online Consumer Reviews in a Supply Chain with Horizontal Competition

Presenter: Hao Li, Central University of Finance and Economics

Co-author(s): Nina Yan, Jizhou Lu

Abstract:

Online consumer reviews significantly influence consumers’ purchasing decisions and capture manufacturers’ attention. We explore the manufacturer’s online review strategy

effects on pricing and quality decisions amidst horizontal competition. The results show the online review strategy decreases (increases) the retail price in the offline (online) channel during the continuous sales phase, widening the gap between the retail prices in the two channels and mitigating competition intensity. Moreover, factors influencing optimal quality include cost efficiency, bargaining power, and consumers' perceived level of quality. The numerical analysis emphasizes the online review strategy's reliance on inter-channel consumer shifts, inconsistently benefiting supply chains or welfare.

Title: Inducing Consumer Reviews with Rebate Provision in Platform Selling

Presenter: Ruixiao Dong, Huazhong University of Science and Technology

Co-author(s): Xu Guan

Abstract:

Motivated by emerging business practices, this paper studies the optimal rebate provision strategy in a dyadic platform channel, wherein a seller sells a new experienced product through the platform over two periods. We consider two rebate provision formats: seller rebate provision and platform rebate provision, depending on whether the seller or the platform launches the rebate program and affords the incurred rebate costs. Under either rebate provision format, the optimal rebate provision format is determined by the benefit of rebate provision and the corresponding cost. Interestingly, we show that it is possible that all participants expect to provide rebates themselves.

Title: Conditional Rebates for Multi-Product Firms: Implications for E-Commerce

Presenter: Xuefeng Peng, University of Science and Technology of China

Co-author(s): Qiao-Chu He, Shaofu Du

Abstract:

Review manipulation via conditional rebates entices consumers to post positive reviews, which seemingly intensifies the prevalence of fake reviews. The preceding studies focus on the single-product firm's rebate decisions; however, they overlook the firm's business

practices of offering multiple products and how these firms leverage the rebate strategies to manipulate review outcomes. This study investigates the strategic interactions between product offerings and conditional rebates wherein the firm anticipates its own rebate decisions when designing the product line. Specifically, we consider a stylized two-period model where consumers are uncertain about the products' horizontal attribute value, which is the product commonality and reveals the informational complementarity of online reviews. Considering single- and multi-product situations, we characterize the four equilibria: no rebates (organic reviews), low rebates (boosted authentic reviews), intermediate rebates (induced fake reviews), and high rebates (intensified fake reviews). Our results counter-intuitively indicate that, when leveraging conditional rebates, the firm may prefer single-product offerings to multiple products under certain conditions and thus strengthen the high-end foci. Furthermore, firms that offer multiple rather than single products are more likely to provide low rebates and expand the boosted-authentic-reviews equilibrium scope, which thus benefits consumer surplus. These analyses provide practical implications for the platform-policy debate regarding conditional rebates implemented by firms that offer a wider product line.

Parallel Session (D11) - Operations-Marketing Interface

Day 2: 6th Jan (Sat) 15:10-16:30 Venue: 2129A

Session Chair: Xiaomeng Guo, The Hong Kong Polytechnic University

Title: Product Safety and Liability with Deceptive Advertising and Moral Hazard

Presenter: Xu Guan, Huazhong University of Science and Technology

Co-author(s): Huan Cao, Yucheng Ding, Krista Li

Abstract:

This paper examines how these two common liability policies affect firms and consumers when firms can advertise product quality deceptively, and consumers exert precaution efforts endogenously. Common wisdom suggests that comparative negligence shifts responsibility from firms to consumers, which benefits firms and motivates consumers to

exert precautions to improve safety. However, we find that comparative negligence leads firms to use deceptive advertising, while strict liability induces firms to advertise product quality more truthfully. The latter can induce consumers to exert precaution efforts to avoid product failures, thereby improving firm profit and product safety.

Title: Managing Newsboys: Product Substitution for Online Marketplaces

Presenter: Jiaqi Lu, The Chinese University of Hong Kong, Shenzhen

Co-author(s): Yilun Chen

Abstract:

We consider a platform (she) that manages inventory for her third-party sellers while the latter make their own self-interested inventory decisions in a newsboy fashion. We investigate how the platform should conduct proactive product substitution, at a cost, to maximize her total expected profit. We give a sharp characterization of the platform's optimal substitution policy which follows a simple threshold structure. We study the implications of the policy on each agent for different substitution costs. In general, product substitution can mitigate the tension between the platform and the sellers. We also compare with a passive stockout-based substitution.

Title: Product Return Policies: The Impacts of Vertical Bargaining and Contracting with Retail Competition

Presenter: Chengzhang Li, Shanghai Jiao Tong University

Co-author(s): Yufei Huang, Tingliang Huang

Abstract:

We study the money-back guarantee (MBG) policies in distribution channels consisting of a manufacturer and two competing retailers. We adopt a multi-unit bilateral bargaining framework to flexibly capture the unbalanced power distributions among firms. We find that both bargaining power and contract forms are the key determinants of MBG policies. In symmetric distribution channels, i.e., both retailers possess the same bargaining power,

while both retailers offer MBGs under the wholesale-price contract, the asymmetric MBG decisions arise when retailers are relatively powerful under the two-part tariff contract. When the retailers possess different bargaining powers, the retailer is less powerful in negotiation with the manufacturer than the other provides an MBG while the other may not.

Title: Managing Returns in Livestream Retailing

Presenter: Xue Zhao, The Hong Kong Polytechnic University

Co-author(s): Xiaomeng Guo, Guang Xiao

Abstract:

This study investigates the impact of social influence on livestream shopping. Social influence plays a crucial role in generating high demand. However, due to the time lag between ordering and receiving the product and the declining effect of social influence over time, buyers' decisions may change, resulting in returns. The more the influencer initially sells, the greater the returns. We consider a retailer that cooperates with an influencer by offering him a specified quantity of products and paying him a commission fee. We investigate how the social influence affects the initial demand and returns, and how to manage returns.

Parallel Session (D12) - Algorithmic Methods in OM- Finance Interface

Day 2: 6th Jan (Sat) 15:10-16:30 Venue: 2129B

Session Chair: Zonghao Yang, City University of Hong Kong

Title: Efficient Portfolio Rebalancing via Cost-Aware Bayesian Optimization

Presenter: Peng Liu, Singapore Management University

Abstract:

Mean-variance optimization (MVO) has been widely used for portfolio optimization.

However, it often neglects transaction costs and may suggest frequent and substantial portfolio changes, leading to diminished real-world returns. In this paper, we present a novel approach to portfolio rebalancing that leverages the power of Bayesian optimization (BO) while incorporating transaction costs, a critical yet often overlooked aspect in portfolio management. We introduce a cost-aware variant of BO that explicitly accounts for the cost of transitioning between different portfolio weight configurations. We compare our approach with the traditional MVO method, a cornerstone of modern portfolio theory. Our empirical results demonstrate that the proposed cost-aware BO method outperforms MVO in generating higher risk-adjusted returns, particularly in scenarios with significant transaction costs. Furthermore, our method exhibits sublinear regret, indicating that it quickly learns the optimal portfolio allocation and adapts effectively to new market information. Our research contributes to financial optimization by providing a more realistic and effective method for portfolio rebalancing. Our work highlights the importance of considering transaction costs in portfolio management and demonstrates the potential of Bayesian optimization as a powerful tool for financial decision making.

Title: Optimal Trade Execution with Learning

Presenter: Andrew Lim, National University of Singapore

Co-author(s): Galvin Ng

Abstract:

A trader would like to maximize expected revenue from selling an inventory of stocks by a specified terminal time when expected returns are linear in the trading rate but with unknown intercept (drift) and slope (price impact). Since the trading rate affects the data, this is intrinsically a problem of exploration and exploitation. To sidestep the challenges of solving the high-dimensional dynamic program, we consider a high-noise asymptotic regime and use Taylor Series to extract the exploration component of the optimal policy. Exploration depends, in a complex but intuitive way, on the time horizon, inventory level, and parameter uncertainty.

Title: A Two Timescale Evolutionary Game Approach to Multi-Agent Learning and its Application in Algorithmic Collusion Study

Presenter: Nan Chen, The Chinese University of Hong Kong

Co-author(s): Chengli Ren, Mingyue Zhong

Abstract:

We propose a two-time scale evolutionary game approach to solving multi-agent reinforcement learning (MARL) problems. Different from the existent literature that requires to solve Nash equilibrium strategies, exactly or approximately, in each period of learning, the new approach provably converges to epsilon-Nash equilibria of MARL problems without imposing restrictive assumptions that are typically needed in the literature.

AI-powered algorithms are now widely adopted in marketplaces to price goods and services. However, serious concerns have been raised by the regulators and academia about the possibility that these algorithms may learn to collude through their strategic interactions. Researchers predominately use Q-learning to model the behavior of pricing algorithms. With convergence guarantees, our approach provides an innovative framework for algorithmic collusion studies.

Title: Doing Well by Doing Good: Interest Rate Determination for Unsecured Personal Loans

Presenter: Zonghao Yang, City University of Hong Kong

Co-author(s): Ram Gopal, Xiao Qiao, Moris Strub

Abstract:

Perhaps the most important aspect of an unsecured personal loan is its interest rate. Interest rates that accurately reflect risk are not only important from a financial perspective but also promote financial inclusion and fairness in credit markets. In practice, interest rates often fail to accurately reflect loan risk, leading to sub-optimal credit allocation and biases

of borrowers. We propose a novel method of interest rate determination based on the economic rationale that all borrowers should have fair access to credit at prices commensurate to their repayment risk. The implication of this rationale is that interest rates should provide the same risk-return trade-off across loans. We evaluate the pricing framework using loan samples from LendingClub. Compared with LendingClub's existing pricing strategy, our methodology effectively reduces the interest rate disparity between borrowers with different credit scores by 38.7% and removes the existing bias in interest rates against African American borrowers. Meanwhile, loans maintain their return on investment for lenders under the new interest rates. Our results show that by setting interest rates that reflect the inherent risk of loans, online lending platforms have the potential to improve social welfare by promoting fairer lending practices – doing well by doing good.

Parallel Session (D13) - Recent Topics in Service Operations

Day 2: 6th Jan (Sat) 15:10-16:30 Venue: 2129C

Session Chair: Yuchen Liang, National University of Singapore

Title: Coping with the Service Paradox: The Role of Digital Platforms

Presenter: Xinyi Fan, Zhejiang University

Co-author(s): Yongyi Shou, Steven Day

Abstract:

Prior empirical studies on the servitization–performance relationship have yielded mixed findings—a high-level investment in servitization does not consistently results in the expected high performance. This study suggests that the recent surge in digital platforms, which enables manufacturers to concurrently pursue both customization and operational efficiency, offers the potential for mitigating this paradox. We categorize servitization into services supporting products and services supporting clients and explore the impact of these two service categories on operational performance in the Chinese manufacturing sector. Moreover, we further investigate the role of emerging digital platforms in shaping the dynamics of this relationship.

Title: Offline Retailer's Add-on Service Provision in Omnichannel Retailing

Presenter: Jingye Huang, Southern University of Science and Technology

Co-author(s): Xuefeng Peng, Qiao-Chu He

Abstract:

The prevalence of online retailing has intensified the competition between offline and online channels, placing immense pressure on brick-and-mortar retailers. Offline stores begin to adopt add-on service strategies to establish a competitive advantage for their offline offerings in comparison to online e-commerce. In this study, we investigate a market whether and how offline stores should implement add-on services in bundled or separated forms to deter the e-tailer's entry. Drawing on the game-theoretic model, our findings reveal that service bundling reduces the price sensitivity of consumers. Both symmetric and asymmetric configurations arise in equilibrium and can fully deter the online retailer's entry under certain conditions. Due to the mitigation of congestion costs and more efficient market segmentation, service bundling may make both firms and consumers better off. However, when the congestion cost is low, we find that the service bundling equilibrium in the traditional markets exists as a prisoner's dilemma where both offline stores become worse off, which can be eliminated by the e-tailer's encroachment. Furthermore, accounting for consumer heterogeneity on the add-on service value, implementation of add-on services can only partially deter online entry and realize higher social welfare. This study contributes to the revitalization of offline physical stores and offers novel insights within the context of omnichannel retailing.

Title: Cooperation in Queues

Presenter: Zheyuan Huang, Tsinghua University

Co-author(s): Liu Yang

Abstract:

When customers have some control over their service time, they often speed up their service when others are waiting. This research aims to gain insights into this cooperative

behavior from rational decision makers' perspective. We develop a repeated game model to study the "Threshold-Rush" equilibria. We show that the Pareto-dominant threshold coincides with the centralized optimal one. We further study the optimal community size maximizing customer welfare. We find that cooperative equilibria can be inferior to a non-cooperative one when customers have poor patience, as a large community is required to trigger cooperation and the system will become too congested.

Title: The Impact of Workload on Operational Performance: Empirical Evidence from Last-Mile Delivery

Presenter: Yuchen Liang, National University of Singapore

Co-author(s): Stanley Lim, Guodong Lyu, Chung-Piaw Teo

Abstract:

Leveraging a data set of last-mile deliveries from a parcel operator in Singapore, we examine the impact of employees' workload on delivery performance. We find that workload exhibits a U-shape relationship with delivery failure rate. We study moderating factors and subsample analysis. We investigate the workload design problem to balance workload through a workload assignment model that employs various assignment mechanisms.

Parallel Session (D14) - On-Demand Services and Platforms

Day 2: 6th Jan (Sat) 15:10-16:30 Venue: 2130A

Session Chair: Yang Bo, The Chinese University of Hong Kong

Title: Pricing and Lead-time Optimization in Service Platforms with Heterogeneous Customers: The Value of On-demand Service

Presenter: Xin Weng, Tsinghua-Berkeley Shenzhen Institute

Co-author(s): Lijian Lu, Li Xiao

Abstract:

On-demand services have been rapidly growing and are widely adopted in practice by many service providers. This is mainly driven by the needs to lower system congestion and reduce waiting time by supplementing the existing firm-scheduled services. In this paper, we consider a service provider (SP) that provides both on-demand and firm-scheduled services and examine the impacts of on-demand service on the operational decisions and all parties' welfare. Customers are both price-and-waiting sensitive with heterogeneous sensitive of waiting and select which service to join or balk the service upon arrival, and agents are heterogeneous in the earning reservation and participate in providing the on-demand service only when this is more profitable. The SP selects the prices of both services and wage rate paid to agents, that then endogeneously determine the demand for each service and supply of on-demand service. We show that it may not always be profitable for the SP to launch on-demand service and provide conditions under which introducing on-demand service increases the profit of SP. Besides, when adding on-demand service is profitable to the SP, it also benefits the consumer surplus, agent welfare, and the total social welfare, resulting in a 'win-win-win' outcome. Finally, we evaluate, both theoretically and numerically using real data, the value of the on-demand service and discuss key factors that drive this value. Our research findings provide concrete recommendations to the practice on the integrated design of the on-demand and firm-scheduled services.

Title: Expanding Platform Capacity through Asset Rental Programs: Design and Implications

Presenter: Deyin Ji, Singapore Management University

Co-author(s): Guiyun Feng, Yannis Bellos

Abstract:

In recent years, the growth of on-demand platforms has been hindered by the lack of available workers. To address this challenge, platforms have been introducing short-term asset rental programs for individuals who are interested in providing services but do not own a qualifying asset or are reluctant to use their own. Different designs of such programs have been adopted with some of them discriminating between workers renting versus using their own assets by either: i) imposing restrictions on how rented assets can be used, ii)

imposing a surcharge for the personal use of rented assets, or iii) offering different wages to the two pools of workers. These practices, however, have raised fairness concerns regarding the treatment of workers who do not own an asset. Motivated by these concerns and the divergent platform practices, we attempt to understand the role played by the discriminating rental policies and their implications for workers and the whole system. To that end, we develop a game-theoretic model and analyze different rental program designs. Our study reveals that if a platform discriminates by offering different wages, it should pay higher wages to the workers who rent, which challenges the prevailing practice of offering lower wages. Contrary to fairness concerns, all discriminatory designs can benefit workers and under certain conditions, can also lead to higher platform profit and more customers served. Our research provides valuable managerial insights for designing effective rental programs and a comprehensive understanding of their social impact.

Title: Uber-izing Dabbawala: Enabling Massive On-Demand Delivery via Urban Public Transport-Based Scheme

Presenter: Yundong Feng, Tsinghua University

Co-author(s): Wei Qi, Zuojun (Max) Shen

Abstract:

Urban on-demand delivery market is expanding rapidly and evolving towards a full-distance scenario. However, the current end-to-end delivery method faces challenges such as high transportation costs, limited service capacity, narrow coverage area, and short transportation distance, which hinder its ability to adapt to the expanding market.

To address these challenges, this paper proposes a public transport-based scheme to improve the service level of Urban on-demand delivery services. The scheme aggregates demand through terminal delivery personnel to the public transport network. Its advantage lies in reducing costs and improving service capacity, and the difficulties include arranging the sequence of services and pricing while ensuring transportation timeliness.

To overcome these difficulties, the paper analyzes joint pricing and capacity allocation problems in public transport-based on-demand delivery networks over a finite planning horizon. In each period, the service provider assigns undelivered shipments to the upcoming service-capable carriers, with the objective of maximize the total expected profit

considering the time delay penalty cost.

We formulate a dynamic programming model with a fixed dimension of states and employ the concept of L^k -concavity to demonstrate several monotonicity properties of the optimal policies. We also construct an affine control policy based on the demonstrated properties.

The effectiveness of the algorithm is analyzed theoretically and numerically.

Our research results demonstrate that utilization of the public transport network to assist transportation can significantly improve delivery efficiency and reduce costs. Moreover, our system provides possibilities for long-haul transportation services and brings new possibilities to the existing logistics model.

Title: Food-Delivery Platforms: Near-Optimal Policies for Capacity Sizing, Order-Batching and Routing

Presenter: Yang Bo, The Chinese University of Hong Kong

Co-author(s): Milind Dawande, Ganesh Janakiraman

Abstract:

We study the one-time capacity sizing and infinite-horizon real-time orders' batching and routing problem for a food delivery platform. The objective is to minimize the long-run average cost incurred per unit time, where the cost includes wages to servers plus the delay penalty cost. We characterize the fundamental trade-off between spatial economies of scale and orders' waiting time through a lower bound on the cost under any policy within a general class of policies. We then identify a simple, near optimal algorithm whose performance gap with respect to this lower bound vanishes in a meaningful asymptotic regime.

Parallel Session (D15) - Game-Theoretic Models in Operations Management**Day 2: 6th Jan (Sat) 15:10-16:30 Venue: 2130B****Session Chair: Duo Shi, The Chinese University of Hong Kong, Shenzhen****Title: Adulteration in Traceable Supply Chains under Government Inspections: Side-Effect and Competition from Non-Traceable Supply Chains**

Presenter: Jinxin Yang, Zhejiang University

Co-author(s): Weihua Zhou, Zhong Chen, Retsef Levi

Abstract:

To deter economically motivated adulteration (EMA) in farming supply chains, government agencies inspect products sold in markets and penalize non-compliant entities. Traceability aids the inspection agency in precisely identifying the provenance of sampled products, thereby targeting the farm to impose penalty if adulteration detected. In this paper, we develop a game-theoretical model to assess the effectiveness of government inspections in deterring EMA in a market containing both traceable and non-traceable supply chains. Our analysis indicates that higher government penalties may inadvertently induce the traceable farm to adulterate. A preliminary empirical analysis also supports this finding.

Title: Selling to Consumers with Discretionary Search

Presenter: Shuaishi Yuan, University of Science and Technology of China

Co-author(s): Quan Zheng, Kai Pan, Xuying Zhao, Yugang Yu

Abstract:

This paper studies a monopolist's optimal selling strategy for consumers who have only partial knowledge of the product prior to purchase. Consumers can choose between buying immediately and searching for more information, i.e., search is discretionary. We analyse both discriminatory and uniform pricing schemes, differing in whether the buy-later price is contingent on consumers' search behaviour. Our analysis shows that the monopolist can

benefit from exploiting consumers' ex post heterogeneity in valuation uncertainty through both monetary and non-monetary interventions. Our work sheds light on the price discrimination theory and search obfuscation.

Title: Recycled Label Design and Green Competition

Presenter: Xiaoli Zhang, The Hong Kong Polytechnic University

Co-author(s): Xiaomeng Guo, Duo Shi, Guang Xiao

Abstract:

Driven by the push for a circular economy and the heightened consumer environmental awareness, firms now engage in competition over the use of recycled materials. However, utilizing recycled materials is not trivial. Different firms face distinct challenges and costs when investing in recycling technologies. Moreover, they also need to use credible recycled labels provided by third-party certifiers to convey their efforts. In practice, we observe two major types of recycled labels: continuous label and binary label. We examine the impacts of different label designs on competing firms' decisions and profits as well as the label certifier's payoff and consumer surplus.

Title: Free Samples in Achieving Data Validation: Blessing or Curse?

Presenter: Hong Zheng, Beijing Institute of Technology

Co-author(s): Lin Tian, Guo Li

Abstract:

This study explores the mechanism underlying data validation, and evaluate the option of offering free samples. Results show that data validation can be achieved by a signaling approach. When without free samples, high-type seller (whose data are of a high quality in demand forecasting) has to sell less data to reveal her type to the buyer. In contrast, when with free samples, the high-type seller can offer a certain volume of free samples to achieve it. Regarding data validation, the option of free samples helps boost the data sales as well as

the monetary payment, but it will further undermine the profit of the high-type seller.

Parallel Session (D16) - Drones and Urban Air Mobility

Day 2: 6th Jan (Sat) 15:10-16:30 Venue: 2130C

Session Chair: Hai Wang, Singapore Management University

Title: UAM Airspace Design and Management: Issues and Challenges

Presenter: Yanjun Wang, Nanjing University of Aeronautics and Astronautics

Co-author(s): Jin Yang, Qizhao Liang, Xu Hang

Abstract:

As Urban Air Mobility (UAM) emerges as a new mode of transportation, the integration of both passenger and cargo-carrying Unmanned Aerial Vehicles (UAVs) into controlled airspace, where manned aircraft operate, presents significant challenges for airspace management and operation. While considerable attention has been dedicated to optimizing UAV operations, from vertiport location to network design, while less attention has been given to the design and management of the shared airspace between UAVs and manned aircraft. This paper explores the multifaceted challenge of designing and managing UAM airspace with a focus on safety assessment and dynamic airspace reconfiguration. The design phase prioritizes safety considerations, incorporating thorough risk analysis and mitigation strategies to ensure the secure coexistence of UAVs and manned aircraft. Meanwhile, dynamic airspace reconfiguration emerges as a strategic managerial tool, enabling seamless integration and deconfliction among passenger and cargo UAVs. A showcase of UAM airspace near Shenzhen Bao'an airport is presented, and some preliminary results are discussed.

Title: Route Network Planning Methods for Drone Delivery Services in Cities

Presenter: Xinyu He, City University of Hong Kong

Co-author(s): Lishuai Li

Abstract:

This presentation explores innovative route network planning for drone delivery in urban environments. It introduces two graph-search-based methods: a priority-based approach optimizing airspace occupancy and a competition-based approach balancing single routes and system performance. A mathematical programming-based method using a multi-commodity network flow model is also discussed. Additionally, the presentation assesses the third-party risks associated with these network designs. It also explores various potential concepts of operations (ConOps) for diverse traffic management scenarios. These methods collectively address the challenges of designing safe, efficient drone delivery networks, contributing significantly to urban air mobility.

Title: Multi-Agent Deep Reinforcement Learning for Dynamic Routing Problem with Drones

Presenter: Chuankai Xiang, City University of Hong Kong & Sichuan University

Co-author(s): Lishuai Li, Zhibin Wu

Abstract:

To guarantee a certain service level, the company operates a set of vehicles and drones to meet the dynamically placed customer demand. Thus, in this paper, we study a special dynamic routing problem with drones (DRPD) that arises in such an environment. The company seeks route policies for drones and vehicles so as to minimize the total costs. Based on the deep reinforcement learning framework, the attention model with centralized order allocation network (AMCOAN) method is established to solve the proposed DRPD. The effectiveness of our approach is demonstrated through extensive numerical analyses, with the results showing the benefits derived from the COAN and the designed Attention-based route generating network (ARGN). The solution quality, computation time, and generalization ability of the proposed approach are all proven to be superior over existing methods.

Title: Urban Delivery with a Coordinated Fleet of Trucks and Drones

Presenter: Wenjia Zeng, The Hong Kong University of Science and Technology

Co-author(s): Hai Yang, Hai Wang, Mingyao Qi

Abstract:

With the rapid growth of urban delivery demand due to the fast expansion of e-commerce, the recent development of drones has attracted increasing attention from logistics companies, which are motivated to use drones in urban delivery. This paper studies an urban delivery system with multiple trucks and drones, in which trucks deliver parcels and are resupplied by drones. We formulate the coordinated delivery problem as a mixed-integer programming model and propose an exact JAMES framework accordingly. We conduct extensive computational studies to verify the effectiveness of our method and evaluate the benefits of the coordinated fleet for urban delivery.

Parallel Session (D17) - Resource Planning in Healthcare Operations

Day 2: 6th Jan (Sat) 15:10-16:30 Venue: 2131A

Session Chair: Shumin Ma, BNU-HKBU United International College

Title: Optimal Admission Control With Workload and Overwork Effects

Presenter: Qingfa Zhang, The Hong Kong University of Science and Technology

Co-author(s): Yiwen Shen

Abstract:

The system workload and server overwork can significantly impact the speed and quality in service systems. One important example is the admission problem in intensive care unit (ICU). We employ a Markov Decision Process (MDP) framework for ICU admission control, incorporating the potential effects of workload and overwork. We analyze an optimal policy structure that considers these biases. Through rigorous analytical and numerical analysis, we establish an optimal threshold admission policy that effectively

addresses workload effects and overwork fatigue. The findings emphasize the importance of incorporating these factors into ICU admission control, as it leads to improved resource utilization.

Title: Managing Appointment-Based Services with E-visits

Presenter: Yun Cai, Sun Yat-sen University

Co-author(s): Haiqing Song, Shan Wang

Abstract:

Electronic visits, or “E-visits” for short, have emerged as a promising channel for accessing healthcare and can significantly impact daily operations in healthcare facilities. However, there is a lack of research on how to efficiently manage appointments for outpatient care providers when faced with E-visits that exhibit different waiting cost patterns. Our study investigates how providers can use appointment scheduling as a “passive” control when patients have full access to the E-visit channel, to better utilize resources and reduce patient waiting. Specifically, we demonstrate that multimodularity still applies to the model with E-visits, despite their waiting costs being typically nonlinear. Furthermore, we analyze how providers can “actively” control the arrival of E-visits by scheduling their time windows. By examining the structures of the optimal joint schedule of appointments and E-visit time windows, and reformulating the problem into a two-stage program, we have designed an Accelerated Cut Generation Algorithm, which is shown to be efficient in our numerical study. To the best of our knowledge, this is the first study to explore the optimal scheduling of both appointments and E-visit time windows. By implementing proper scheduling, the negative impact of E-visits can be mitigated, their benefits to the provider can be enhanced, and overall operational efficiency can be improved.

Title: Emergency Department Boarding: Quantifying the Impact of ED Boarding on Patient Outcomes and Downstream Hospital Operations

Presenter: Huifeng Su, Yale University

Co-author(s): Lesley Meng, Rohit Sangal, Edieal Pinker

Abstract:

Emergency Department (ED) boarding refers to the delay experienced by ED patients who are admitted to the hospital and are waiting for an inpatient bed to become available. Key drivers of ED boarding include an insufficient number of staffed beds in the downstream inpatient units, high demand for medical care, and inefficiencies in patient flow throughout the hospital. In this study, we quantify the impact of ED boarding on downstream patient outcomes at a large academic medical center using an instrumental variable design for causal identification. For the average admitted patient, we find that one additional hour of boarding results in a 0.8% increase in the patient's subsequent hospital length of stay, a 16.7% increase in the odds of the patient experiencing an escalation in their required care level on admission and a 1.3% increase in their total hospital charges for the visit. We expand upon these findings by estimating the heterogeneous treatment effect of ED boarding across different groups of patients examine whether different groups of patients observe different impacts. We find that patient groups differ in their estimated "cost of boarding": the impact of an additional hour of ED boarding on hospital length of stay varies quite substantially across patient condition, ESI, and age group. To further this work, we construct a simulation model to assess different policy to improve ED operations by taking cost of boarding into consideration. The hope is that we can leverage these findings to propose interventions for experimentation in practice that will help mitigate this ED boarding crisis in our partner hospital and hopefully also across the nation.

Title: Travel Restriction Policies During Pandemic

Presenter: Shumin Ma, BNU-HKBU United International College

Co-author(s): Nana Li, Jin Qi, Xiangtong Qi

Abstract:

During the Covid-19 pandemic, many countries have experienced significant economic damage while attempting to control the spread of the virus. To mitigate the pandemic, travel restrictions have been implemented as a more flexible and economically feasible approach. However, previous studies on travel restrictions in multi-regions during the pandemic have primarily focused on forecasting the spread of the pandemic or optimizing restriction levels

for border contacts. These studies have not explicitly considered travel and have mainly discussed the total economic cost of several regions, without fully examining the economic cost of each region individually or the equilibrium of these regions.

Our proposed model presents a game among various regions and addresses the management of economic costs while mitigating the pandemic. The model focuses on determining travel restriction levels for explicit travel in different regions during the pandemic. Each region aims to minimize its travel restriction and infection costs, and several regions together achieve a Nash Equilibrium. By analyzing the Nash Equilibriums, we can examine the mechanism of disease transmission among multiple regions, highlighting the significance of infection rates and population sizes in transmission and policy-making.

Parallel Session (D18) - New Topics in Healthcare Operations Management

Day 2: 6th Jan (Sat) 15:10-16:30 Venue: 2131B

Session Chair: Li Luo, Sichuan University

Title: Biology-Inspired Network Medicine Approach to Drug Discovery

Presenter: Qingpeng Zhang, The University of Hong Kong

Abstract:

Drug discovery is a challenging and costly process that requires a deep understanding of the mechanism of drug action (MODA), which is how a drug affects the biological system at the molecular level. In this talk, I will present our recent studies on using a network-based machine learning approach to characterize MODA by analyzing a comprehensive biological network that captures the complex high-dimensional molecular interactions between genes, proteins and chemicals. I will show that our methods outperform state-of-the-art machine learning baselines in predicting MODA. I will also demonstrate that our methods can identify explicit critical paths that are consistent with clinical evidence, and explain how these paths reveal the underlying biological mechanisms of drug action. Our research provides a novel interpretable artificial intelligence perspective on drug discovery, and has the potential to facilitate the development of new and effective drugs.

Title: Structural Estimation of Intertemporal Externalities in ICU Admission Decisions

Presenter: Yiwen Shen, The Hong Kong University of Science and Technology

Co-author(s): Carri Chan, Fanyin Zheng

Abstract:

In many service systems, it is important to understand the trade-off between providing service to current customers versus saving capacity for future customers. We study such trade-off in the context of ICU admissions. We develop a structural model that captures the intertemporal externalities of ICU admissions. Using a large hospitalization data set, we empirically estimate the discount factor in the model from observed data. We find that there is substantial heterogeneity in how hospitals balance the needs of current patients and impact on future system state. We show by counterfactual simulations that hospitals can reduce high ICU congestion period by being more forward-thinking in admission decisions.

Title: Emergency Preparedness: Optimal Pharmacy Purchasing Strategies

Presenter: Jie Xiang, Sichuan University

Co-author(s): Renbang Shan, Li Luo

Abstract:

This study examines the purchasing decision-making of pharmacies when the potential for emergencies arises within a single period. Beyond accounting for conventional demand, pharmacies also need to plan for emergency demand. This paper employs the classic newsvendor model as a benchmark (PN) and explores three pre-purchasing strategies: a combination of routine procurement and option procurement (POM), one-time procurement taking possible emergencies into account (PNO), a combination of routine procurement and emergency procurement (PNE). Through an analysis of these procurement strategies, we find that, while POM often performs better as a strategy, this standing is subject to the costs of inventory shortages and the timing of emergencies. Nevertheless, neither PNO nor PNE provide any absolute advantages. When faced with

higher emergency wholesale prices or lower emergency shortage costs, PNO outperforms. Conversely, PNE becomes the favourable choice for pharmacies under certain conditions. Specifically, PNE best serves pharmacies when they experience a significant rise in emergency demand, whereas PNO is more advantageous when emergencies occur closer to the end of the operating period.

Title: Forecast then Optimize: A Bayesian Temporal Factorization Model for Physical Examination Demands

Presenter: Benkun Chen, Sichuan University

Co-author(s): Li Luo, Mengzhuo Guo

Abstract:

Physical examinations are vital for diagnoses, but scheduling multiple physical examinations on the same device can be inefficient due to different parameter requirements. This study proposed a Bayesian temporal factorization method to accurately forecast the demand for different physical examinations. On this basis, we help the physician optimize the schedule of different examinations for each device in a period, and make the examinations sharing similar parameter settings conducted together, which enhances the efficiency of medical resource allocation. Real-world data has demonstrated the efficacy of the proposed two-stage framework.

Parallel Session (D19) - Advances in Healthcare Operations

Day 2: 6th Jan (Sat) 15:10-16:30 Venue: 2131C

Session Chair: Joel Goh, National University of Singapore

Yvonne Huijun Zhu, National University of Singapore

Title: Drop in the Ocean: Inventory Management for Large Public Cord Blood Banks

Presenter: Sundara Natarajan Panchanatham, The University of Hong Kong

Co-author(s): Harry Groenevelt, Sameer Hasija

Abstract:

Treating many blood-related diseases requires the transplantation of genetically compatible stem cells extracted from the umbilical cord blood (CB) of babies. Institutions known as public CB banks store the CB units donated for public use. With more than 10 million genetic variants in the US, limited inventory w.r.t. variety, and random replenishment, CB bank compositions are random, interdependent, and change non-deterministically over time. We propose several inventory and screening policies for the CB banks to achieve efficient matching with smaller sizes. The different strategies are compared in a trade-off plot to provide a decision-framework for the policymakers under different scenarios.

Title: On Waiting Time Prediction in Hospital Emergency Departments

Presenter: Chengye Zou, City University of Hong Kong

Co-author(s): Yiran Zhang, Huiyin Ouyang, Zhankun Sun

Abstract:

Many emergency departments (EDs) have posted the predicted waiting time to see a doctor for workload balancing within their hospital network. Using a data-calibrated simulation model, we investigate the impact of operational factors, including the prediction accuracy, update frequency, and influence proportion, on the effectiveness of workload balancing. We find that with real-time, perfect prediction, the average patient waiting time decreases as the influence proportion increases. However, when the predicted waiting times are not sufficiently accurate or the predictions are not updated frequently enough, the average waiting time first decreases and then increases with the influence proportion.

Title: The Impact of Humanitarian Operations on Doctors' Care Provision: Empirical Evidence from a Volunteering Program

Presenter: Qiyuan Wang, The Hong Kong Polytechnic University

Co-author(s): Charles B. Weinberg, Chunhua Wu

Abstract:

This paper examines the impact of doctors' participation in humanitarian operations on their care delivery (through an online platform) to existing patients outside of disasters. Using a volunteer program deployed during the COVID-19 pandemic in China, we show that volunteer doctors offered less care to existing patients than non-volunteer doctors did. However, the magnitude decreased over time, suggesting that doctors gradually recovered from humanitarian services. Further analysis reveals a divergent recovery pattern at the extensive margin and the intensive margin. Importantly, we do not find evidence of compromise in care quality.

Title: Dynamic Staffing of Healthcare Workers in a Pandemic

Presenter: Yvonne Huijun Zhu, National University of Singapore

Co-author(s): Joel Goh

Abstract:

A dynamic model of healthcare service provider staffing is considered in the context of an infectious disease pandemic. In the model, physicians are split into two teams, a "hot" team that serves patients who have the infectious disease, and a "clean" team that serves regular patients. A unique feature of the model is that service providers can themselves be infected with the disease, which takes them out of service for a period of recovery. Through the model, we analyze the structure of dynamic optimal policies for staffing these two teams.

Parallel Session (D20) - Integrated and Data-Driven Energy Systems**Day 2: 6th Jan (Sat) 15:10-16:30 Venue: 2132A****Session Chair: Wenqing Ai, University of Science and Technology Beijing
Wei Qi, Tsinghua University****Title: Data Sharing in Energy Systems**

Presenter: Jianxiao Wang, Peking University

Abstract:

Data have grown into a third basic production factor on top of matter and energy, driving a great wave of the next-generation revolution across diverse industrial sectors. Here a technical architecture and market framework of future data sharing will be introduced. A utility-driven data asset pricing method will be elaborated in a predictive and decision-making process, specifically in the case of forecasting-based stochastic unit commitment. A meta-reinforcement learning algorithm will then be discussed to identify priority of data subsets. Finally, some latest research about data-driven applications concludes this talk.

Title: Crowdsourcing Electric Mobility for Omni-Sharing Distributed Energy Resources

Presenter: Wenqing Ai, University of Science and Technology Beijing

Co-author(s): Wei Qi, Tianhu Deng

Abstract:

Ever-increasing coupling of energy and mobility sectors is underway in our cities. However, whether and how to use such coupling to optimize the portfolio and operations of urban energy assets has rarely been studied. We fill this gap by studying “omni-sharing,” which is a novel business model (beyond “peer-to-peer” energy sharing) that allows a distributed energy resource (DER) community to crowdsource electricity from shared electric vehicles (EVs). Our analysis shows the value of omni-sharing as an additional channel of efficiently

matching local energy supply and demand.

Title: Decision-Making Towards an Active Distribution Network

Presenter: Chenye Wu, The Chinese University of Hong Kong, Shenzhen

Co-author(s): Nan Gu, Jingshi Cui

Abstract:

The proliferation of distributed energy resources (DERs) has transformed the electricity distribution landscape. However, the DER control faces several potential challenges. We submit that DER aggregation helps meet the minimum-size requirement and produce a stable and predictable generation profile. Moreover, with gradual revelation of uncertainties, the real-time operation should adopt a dynamic, multi-stage formulation that integrates prediction with optimization. We formulate the problem as a multi-stage distributionally robust problem and utilize approximate dynamic programming to account for non-anticipative constraints. The proposed control policy outperforms its rivals in terms of robustness, efficiency, and computational speed.

Title: First-in-First-out (FIFO) or Highest-Energy-First-out (HEFO)? A Tale of Two Electric Vehicle Battery Swapping Policies

Presenter: Wei Qi, Tsinghua University

Co-author(s): Mengyi Sha, Yuli Zhang

Abstract:

Battery swapping is gaining traction in cities. To deal with random service requests and random status of incoming batteries, the literature has assumed a FIFO policy of swapping batteries due to its tractability. We propose models to compare FIFO and HEFO swapping policies. The results demonstrate that HEFO is superior to FIFO in most scenarios, except when all EVs wait for the recharged batteries to reach a target state-of-charge (SOC).

Parallel Session (D21) - On-Demand Delivery Platform**Day 2: 6th Jan (Sat) 15:10-16:30 Venue: 2132B****Session Chair: Yanlu Zhao, Durham University****Chang Dong, Durham University****Title: Smoothing Peak and Filling Valley: Predictive Dynamic Pricing and Routing for Same-Day Delivery and Next-Day Delivery**

Presenter: Di Wu, Tongji University & The Hong Kong Polytechnic University

Co-author(s): Xiangyong Li, Kai Pan

Abstract:

More and more e-grocers offer their customers short delivery deadlines, from Same-Day Delivery (SDD) to Next-Day Delivery (NDD). The demand-arriving processes of Same-Day Delivery (SDD) and Next-Day Delivery (NDD) of e-grocery have demand peaks and valleys. Due to this demand fluctuation, excess capacity during low-demand hours becomes insufficient during peak hours. To solve the problem, we design the Predictive Dynamic Pricing and Routing Approach for SDD and NDD delivery time options (PDPR-SDND). As an offline/online method, PDPR-SDND can learn from historical data and determine the appropriate price predictively based on the current state to mitigate the effects of demand fluctuations.

Title: Distance-Based Fee Design of On-Demand Delivery

Presenter: Mingliu Chen, University of Texas at Dallas

Co-author(s): Manlu Chen, Ming Hu, Jianfu Wang

Abstract:

We consider a vendor that serves customers' online requests and charges a two-part delivery fee, consisting of a uniform base fee and a variable fee that depends on delivery distance. Compared to an optimal flat delivery fee, the vendor can serve a broader region

and increase profit and social welfare by charging distant customers a lower delivery fee. The delivery price design depends on customer density when considering customer valuation heterogeneity. We also explore the effect of having a self-pickup option and find that introducing the self-pickup option can enhance system throughput and lead to a win-win situation.

Title: Climate Change and On-demand Food Delivery Platform: Impacts and Managerial Implications

Presenter: Run Ge, Shanghai University of Finance and Economics

Co-author(s): Susan Feng Lu, Wenzheng Mao

Abstract:

Climate change increasingly threatens business operations. We examine the effects of extreme weather (high temperatures and heavy rainfall) on online food delivery platforms. During extreme weather, we uncover a spike in service demand, which brings more (new) customers to the platform, yet also experience supply inefficiencies (longer waiting time). We observe variations in service efficiency among riders with differing experience levels and distinct reordering patterns among frequent and infrequent consumers after extreme weather. To mitigate the impact of extreme weather, we propose a simple staffing model that incorporates weather information to optimize the number of working riders and enhance profitability.

Title: Market Thickness in Online Food Delivery Platforms: The Impact of Food Processing Times

Presenter: Yanlu Zhao, Durham University

Co-author(s): Felix Papier, Chung-Piaw Teo

Abstract:

A core functionality of Online Food Delivery (OFD) platforms is the algorithmic matching of drivers to food orders, which is the focus of our study as we aim to optimize this driver-

order matching process. We formulate real-time matching algorithms that take into account uncertain food processing times to strategically delay the assignment of drivers to orders. In scenarios with a single order in isolation, we show that the optimal policy adopts a threshold structure. Building on this insight, we propose a new k-level thickening policy with driving time limits for the general case of multiple orders.

Parallel Session (D22) - Emerging Topics in Supply Chain Management II

Day 2: 6th Jan (Sat) 15:10-16:30 Venue: 2132C

Session Chair: Weixin Shang, Lingnan University

Title: Data Driven Inventory Management for Perishable Products

Presenter: Weihua Zhou, Zhejiang University

Abstract:

We consider a distribution system in which retailers replenish perishable goods from a warehouse, which, in turn, replenishes from an outside source. Demand at each retailer depends on exogenous features and a random shock, and unfulfilled demand is lost. The objective is to obtain a data-driven replenishment and allocation policy that minimizes the average inventory cost per time period. We propose a policy that resolves these issues in two steps. In the first step, we assume that the distributions of features and random shocks are known. We develop an effective heuristic policy by using Taylor expansion to approximate the retailer's inventory cost. The resulting solution is closed-form, referred to as Taylor Approximation (TA) policy. We show that the TA policy is asymptotically optimal in the number of retailers. In the second step, we apply the linear quantile regression and kernel density estimation to the TA solution to obtain the data-driven policy called Data-Driven Taylor Approximation (DDTA) Policy. We prove that the DDTA policy is consistent with the TA policy. A numerical study shows that the DDTA policy is very effective. Using a real data set provided by Fresh Hema, we show that the DDTA policy reduces the average cost by 10.9% compared to Hema's policy. Finally, we show that the main results still hold in the cases of correlated demand features, positive lead times, and censored demand.

Title: Values of Personalization in O2O On-Demand Delivery with Crowd-Sourced Drivers

Presenter: Hongyan Dai, Central University of Finance and Economics

Abstract:

The recent emergence of crowdsourcing has become the major workforce for O2O services. However, this new mode leads to inconsistent service capability. In this paper, we apply machine learning techniques to learn the crowd-sourced drivers' heterogeneous behavior and develop a personalized forecast model to accurately predict the delivery time. We then incorporate the ML-based learning model into the O2O assignment and routing model to improve the on-time performance. Based on a real-world dataset in one of the largest O2O platform in China, we show that the proposed algorithm can reduce the delay ratio and shorten the delivery time.

Title: Robust Multi-source Capacity Planning

Presenter: Qi Fu, University of Macau

Abstract:

We study a distributionally robust capacity planning problem with multiple supply sources. The firm reserves various capacities in the procurement stage; and uses the available capacities to produce the end product in the fulfillment stage to satisfy the realized demand. The capacities from different sources incur different reservation and processing costs. When only the mean and variance of the demand distribution are known, we apply the max-min criterion to derive the worst distribution, the optimal robust capacity vector, and the worst-case expected profit in closed forms.

Title: Mass Production Timing and Information Sharing

Presenter: Weixin Shang, Lingnan University

Abstract:

We study two competing firms' incentives for demand information sharing and their production timing strategies. We analyze the optimal production timing decisions for the strategic firm under different information sharing scenarios and find that a preemptive move is generally not optimal. We demonstrate that endogenous production timing can create incentives for information sharing and fully characterize the information sharing outcome.

Parallel Session (E1) - Machine Learning and Operations Management**Day 2: 6th Jan (Sat) 16:50-18:10 Venue: 2126D****Session Chair: Zhi Wang, McCombs School of Business, UT Austin****Title: High-Dimensional Linear Bandits with Knapsacks**

Presenter: Wanteng Ma, The Hong Kong University of Science and Technology

Co-author(s): Dong Xia, Jiashuo Jiang

Abstract:

We study the contextual bandits with knapsack (CBwK) problem under the high-dimensional setting where the dimension of the feature is large. The reward of pulling each arm equals the multiplication of a sparse high-dimensional weight vector and the feature of the current arrival, with additional random noise. In this paper, we investigate how to exploit this sparsity structure to achieve improved regret for the CBwK problem. To this end, we first develop an online variant of the hard thresholding algorithm that performs the sparse estimation in an online manner. We further combine our online estimator with a primal-dual framework, where we assign a dual variable to each knapsack constraint and utilize an online learning algorithm to update the dual variable, thereby controlling the consumption of the knapsack capacity. We show that this integrated approach allows us to achieve a sublinear regret that depends logarithmically on the feature dimension, thus improving the polynomial dependency established in the previous literature. We also apply our framework to the high-dimension contextual bandit problem without the knapsack constraint and achieve optimal regret in both the data-poor regime and the data-rich regime. We finally conduct numerical experiments to show the efficient empirical performance of our algorithms under the high dimensional setting.

Title: Online Resource Allocation: Bandits Feedback and Advice on Time-varying Demands

Presenter: Lixing Lyu, National University of Singapore

Co-author(s): Wang Chi Cheung

Abstract:

We consider a general online resource allocation model with bandit feedback and time-varying demands. While online resource allocation has been well studied in the literature, most existing works make the strong assumption that the demand arrival process is stationary. In practical applications, such as online advertisement and revenue management settings, however, demand arrival processes are generally exogenous and non-stationary, such as the case of constantly changing internet traffic. Motivated by the recent online algorithms with advice framework (Mitzenmacher and Vassilvitskii (2022a)), we incorporate online advice into policies for online resource allocation. We first establish an impossibility result. In settings with non-stationary demands, any algorithm without any online advice performs poorly in terms of regret. In complement, we design a robust online algorithm, dubbed OA-UCB, that leverages online predictions on the total demand volume. Empowered with online advice, OA-UCB is theoretically shown to converge to the optimality when the online advice is sufficiently accurate. Importantly, OA-UCB achieves an optimal rate of convergence even when the accuracy of the online advice is not known. We also provide two explicit examples for the time-varying demand scenarios, and derive corresponding theoretical performance guarantees. Finally, we adapt our model to a network revenue management problem, and numerically demonstrate that our algorithm can still performs competitively compared to existing baselines.

Title: End-to-End Deep Learning Algorithms for Inventory Rebalancing Strategies in Shared Capacitated Micro-Mobility Systems

Presenter: Ruicheng Liu, Xi'an Jiaotong-Liverpool University

Co-author(s): Jianyu Xu, Cagatay Iris, Jianghang Chen

Abstract:

Shared micro-mobility suffers the operational research problem of imbalanced systems due to the nonhomogeneous and asymmetric demand. One solution is to rebalance the system by relocating mobilities between stations. Due to lost sales, station capacity and non-monotonic demand, rebalancing the inventory of micro-mobility systems becomes challenging. This study proposes an optimisation model to deliver the optimal relocation

quantity. Meanwhile, an end-to-end (E2E) deep learning algorithm is developed to output relocation quantities directly from the input. By conducting numerical experiments using real data of Citi Bike in New York City, we show that the proposed E2E algorithm outperforms predict-then-optimize (PTO) benchmarks.

Title: UCB-C: Efficient UCB Algorithm for Contextual Bandit-Based Learning with Continuous Actions

Presenter: Zhi Wang, McCombs School of Business, UT Austin

Co-author(s): Rui Gao

Abstract:

In decision-making with contextual information, upper-confidence-bound (UCB) algorithms are a celebrated class of algorithms. Each iteration of the algorithm involves a subproblem optimizing over the action set and the parameter confidence set. When the action set is in a continuum, this sub-problem is generally computationally intractable. In this paper, we propose an efficient UCB algorithm and derive its performance guarantees for various problems. For feature-based dynamic pricing, our algorithm significantly improves the known regret bound with its dependence on the number of products. Numerical experiments demonstrate the superior performance of our algorithm compared to the greedy algorithms and Thompson sampling.

Parallel Session (E2) - Advanced Topics in Robust Optimization

Day 2: 6th Jan (Sat) 16:50-18:10 Venue: 2126A

Session Chair: Haolin Ruan, City University of Hong Kong

Title: Robust Contextual Portfolio Optimization with Gaussian Mixture Models

Presenter: Ling Dai, City University of Hong Kong

Co-author(s): Yijie Wang, Grani A. Hanasusanto, Chin Pang Ho

Abstract:

We consider the portfolio optimization problem with contextual information that is available to better quantify and predict the uncertain returns of assets. We show that the problem is equivalent to an adjusted nominal portfolio problem under Gaussian Mixture setting. To reduce the sensitivity that is caused by the model parameters of the Gaussian Mixture Model, we propose the robust contextual portfolio optimization problem and derive a tractable second-order cone program formulation to approximate this problem. Numerical experiments on US market and global market demonstrate the advantages of our proposed model against other benchmark methods.

Title: Robust Queue Inference from Waiting Times

Presenter: Eojin Han, Southern Methodist University

Co-author(s): Chaithanya Bandi, Alexej Proskynitopoulos

Abstract:

Observational data from queues is of great practical for inference of service systems, while it only provides partial information for inference. Motivated by healthcare and virtual waitlist management firms, we consider the problem of inferring service times from waiting time observations via robust optimization, where service times are described via sets that are calibrated by the waiting times. We provide conditions under which these sets contain unknown service times almost surely as the number of observations grows. We also introduce optimization formulations to compute bounds on various service time characteristics. And their generalizations tandem queues and feed-forward networks.

Title: Adversarially Robust Optimal Control with Causal Transport Distance

Presenter: Yizhe Huang, University of Texas

Co-author(s): Rui Gao

Abstract:

We investigate stochastic optimal control problems in the presence of ambiguous disturbance distributions. To address this dynamic uncertainty, we propose a minimax distributionally robust formulation based on the ∞ -causal transport distance. We develop a nested dynamic programming reformulation for this problem. To tackle the dynamic programming problem involving continuous states and controls, we devise a stochastic dual dynamic programming algorithm. Numerical experiments on energy planning demonstrate the effectiveness of our approach.

Title: Robust Satisficing MDPs

Presenter: Haolin Ruan, City University of Hong Kong

Co-author(s): Siyu Zhou, Zhi Chen, Chin Pang Ho

Abstract:

Markov decision processes often suffer from ambiguity in model parameters. While robust MDPs (RMDPs) can provide reliable policies with limited data, their performances are often overly conservative. This paper proposes robust satisficing MDPs (RSMDPs), where the expected returns of feasible policies are softly constrained to achieve a user-specified target under ambiguity. We derive a tractable reformulation for RSMDPs and a first-order method for large instances. Experiments demonstrate that RSMDPs achieve their targets much higher than those of RMDPs. Moreover, the average and percentile performances of RSMDPs are competitive. We also demonstrate the scalability of the proposed algorithm compared with Gurobi.

Parallel Session (E3) - Recent Developments in Decision Analytics**Day 2: 6th Jan (Sat) 16:50-18:10 Venue: 2126B****Session Chair: Dohyun Ahn, The Chinese University of Hong Kong****Title: An Information-Theoretic Analysis of Nonstationary Bandit Learning**

Presenter: Seungki Min, KAIST

Co-author(s): Daniel Russo

Abstract:

In nonstationary bandit learning problems, the decision-maker must continually gather information and adapt their action selection as the latent state of the environment evolves. In each time period, some latent optimal action maximizes expected reward under the environment state. We view the optimal action sequence as a stochastic process, and take an information-theoretic approach to analyze attainable performance. We bound per-period regret in terms of the entropy rate of the optimal action process. The bound applies to a wide array of problems studied in the literature and reflects the problem's information structure through its information-ratio.

Title: Herding in Probabilistic Forecasts

Presenter: Yanwei Jia, The Chinese University of Hong Kong

Co-author(s): Jussi Keppo, Ville Satopaa

Abstract:

In this paper, we consider experts' probabilistic forecasts under herding, an extensively studied behavioural bias, find a closed-form expression for the first two moments of a unique equilibrium forecast, and show that the experts report too similar locations and inflate the variance of their forecasts. Furthermore, we show that the negative externality of public information no longer holds in probabilistic forecasts. We show that our model is up to two solutions based on one probabilistic forecast per expert. We then provide a Bayesian estimation procedure for these two solutions and apply it to economic forecasting data.

Title: Service System Design via Partial Simulations

Presenter: Fei Xing, City University of Hong Kong

Co-author(s): Jiang Li, Siyang Gao, Weiwei Chen, Yunzhe Qiu

Abstract:

This research studies the service system design problem. We use the tool of simulation to model the system dynamics, and focus on a subset of problems where the performance metric evolves in a discernible pattern as the simulation run progresses. We employ prediction models to predict the output of full-run simulations and develop an optimal computing budget allocation (OCBA) formulation to optimize system designs. The asymptotic optimality conditions of this formulation are derived, and a sequential selection algorithm is developed by implementing these optimality conditions. The superior performance of the proposed algorithm is demonstrated via numerical experiments.

Title: Optimal Selection of Heavy-Tailed Systems for Tail Risk Mitigation

Presenter: Dohyun Ahn, The Chinese University of Hong Kong

Co-author(s): Taeho Kim

Abstract:

We investigate the problem of selecting the optimal system with minimal tail risk—the possibility of extreme outcomes—from a pool of heavy-tailed systems. In a nonparametric setting where the characteristics of system outcomes are initially unknown but can be learned via sample observations, we encounter a critical challenge arising from the rarity of samples associated with tail risk events, which results in significant errors in tail risk estimation. To address this issue, we leverage the so-called ratio estimator in extreme value theory and develop a sequential sampling rule that maximizes the likelihood of selecting the optimal system.

Parallel Session (E4) - Business Analytics and Operations**Day 2: 6th Jan (Sat) 16:50-18:10 Venue: 2126C****Session Chair: Hsiao-Hui Lee, National Chengchi University****Title: Understanding Human-Algorithm Interaction in Retail Ordering Decisions: A Causal Machine Learning Approach**

Presenter: Howard Hao-Chun Chuang, National Chengchi University

Co-author(s): Ping Chou, Yen-Chun Chou, Rogelio Oliva

Abstract:

We analyze human-algorithm interaction within the context of automated stock ordering (ASO) at a large European retail chain. We leverage a longitudinal dataset with abundant observations pertinent to the system's proposal along with the modifications made by managers. Our exploratory investigation answers which kind of modification and to what extent does it improve inventory performance from a causal inference lens. Unlike prior studies that focus on binary modifications and ignore sequential dependencies, we propose a double machine learning approach to estimate the conditional average treatment effect (CATE) of per-unit modification. To consistently infer how the effect of human intervention is moderated by a large array of contextual factors, our method accounts for continuous treatment, sequential confounding, and regularization biases. The empirical findings pinpoint the circumstances under which algorithmic decisions would be benefited from human modifications. Our study enhances the understanding about human-algorithm interaction in operations management and derives propositions for subsequent theory testing.

Title: Ordering Problem in Meituan Youxuan: From Data Partitions to Model Stacking

Presenter: Ying Rong, Shanghai Jiao Tong University

Co-author(s): Zhenkang Peng, Chengzhang Li, Guangrui Ma, Zichao Luo, Mingyong Zhao, You Li

Abstract:

In Meituan's flash sales mode, known as Meituan Youxuan, thousands of products are launched daily, each with only a one-day selling window. Any unsold items are returned to the supplier at the end of the day. Meituan primarily assesses performance based on the total remaining inventory and lost sales. Consequently, Meituan faces the daily challenge of determining the order quantities for thousands of SKUs across different regions

simultaneously. To address this challenge, we've implemented a strategy that involves data partitioning from various perspectives and levels, along with the selection of distinct models tailored to these levels. Then, we employ a simple linear model to combine the outputs from these diverse models at different levels. Based on the analysis of actual sales data from Meituan Youxuan, our proposed approach demonstrates an improvement over Meituan's existing algorithms for new products and delivers competitive performance for other product categories.

Title: From Storefronts to Screens: An Exploration of Ship-from-Store, Customer Behavior, and SKU-Level Impacts

Presenter: Wenzheng Mao, Tongji University

Co-author(s): Zhanyu Dong, Hsiao-Hui Lee, Xiaoli Liu

Abstract:

In the ongoing evolution from brick-and-mortar (B&M) stores to multichannel operations, the "Ship-from-Store" (SFS) strategy stands out as a pivotal approach for achieving seamless omnichannel integration. Leveraging empirical data from a pharmacy retailing chain, this paper embarks on an investigation into the effects of SFS on customer behavior, inventory management, and resultant profitability. With empirical observations as a foundation, we construct a stylized model and find the conditions under which a B&M retailer can benefit from SFS. The study further reveals that reduced online waiting costs through SFS can induce market expansion or channel cannibalization, with the former proving the most profitable trajectory. In scenarios of partial channel cannibalization, profits can be augmented by astutely selecting high-margin, high cross-selling, and well-stocked items for online listing. Finally, our empirical analyses substantiate the paper's theoretical postulations and results, providing a cohesive narrative on the dynamics of SFS in modern retail.

Title: Are Firms Voluntarily Disclosing Emissions Greener?

Presenter: Yilin Shi, The Chinese University of Hong Kong

Co-author(s): Jing Wu, Christopher S. Tang

Abstract:

We reveal that companies who make voluntary carbon disclosures generate less "internal emissions" (i.e., Scope 1 emissions) but more "external emissions" from upstream suppliers (i.e., Scope 3 emissions). The net effect is that disclosing firms generate more emissions in the entire supply chain, implying they "outsource" emissions to upstream suppliers. This study highlights that managers should adopt comprehensive emission reduction strategies that address both in-house and outsourced emissions and underscores the importance of regulatory intervention in enhancing the disclosure of the supply chain carbon footprint.

Parallel Session (E5) - Data Driven Supply Chain Management

Day 2: 6th Jan (Sat) 16:50-18:10 Venue: 2127A

Session Chair: Xiaoyu Fan, New York University

Title: Sparse Additive Contextual Bandits: A Nonparametric Approach for Online Decision-making with High-Dimensional Covariates

Presenter: Qingwen Zhang, The Hong Kong University of Science and Technology

Co-author(s): Wenjia Wang, Xiaowei Zhang

Abstract:

Personalized services, pivotal to the contemporary economy, are prevalent in diverse sectors, including online advertising, revenue management, and healthcare. They are often modeled as a contextual bandit, a prominent framework for addressing online decision-making challenges. The efficacy of this model lies in accurately capturing the reward as a function of the decision and covariates, a task complicated by two factors: (i) an unknown and complex relationship between reward, decision, and covariates, and (ii) the high dimensionality of the covariates. To simultaneously address these challenges, we consider a nonparametric, high-dimensional model for the reward function, specifically a sparse additive model. We present a new algorithm, SPARKLE, based on the doubly penalized

estimation of the reward function. We prove that this algorithm's cumulative regret exhibits sub-linear growth in the time horizon and scales at most polylogarithmically in the covariates' dimensionality. This is the first such result for dealing with the high-dimensional regime and non-linear contextual bandit problems. The proof relies on a new convergence analysis of the doubly penalized estimator for adaptively collected data. Furthermore, we propose an enhanced version, SPARKLE+, which significantly reduces computational cost while retaining the same asymptotic order of cumulative regret. Lastly, we demonstrate the superior performance of our proposed algorithms compared to existing state-of-the-art alternatives, particularly in highdimensional settings, through extensive numerical experiments.

Title: A Machine Learning Approach to Solving Large Bilevel and Stochastic Programs: Application to Cycling Network Design

Presenter: Bo Lin, University of Toronto

Co-author(s): Timothy C. Y. Chan, Shoshanna Saxe

Abstract:

We present a novel machine learning-based approach to solving bilevel programs that involve a large number of independent followers, which as a special case include two-stage stochastic programming. We propose an optimization model that explicitly considers a sampled subset of followers and exploits a machine learning model to estimate the objective values of unsampled followers. Unlike existing approaches, we embed machine learning model training into the optimization problem, which allows us to employ general follower features that can not be represented using leader decisions. We prove bounds on the optimality gap of the generated leader decision as measured by the original objective function that considers the full follower set. We then develop follower sampling algorithms to tighten the bounds and a representation learning approach to learn follower features, which can be used as inputs to the embedded machine learning model. Using synthetic instances of a cycling network design problem, we compare the computational performance of our approach versus baseline methods. Our approach provides more accurate predictions for follower objective values, and more importantly, generates leader decisions of higher quality. Finally, we perform a real-world case study on cycling infrastructure

planning, where we apply our approach to solve a network design problem with over one million followers. Our approach presents favorable performance compared to the current cycling network expansion practices.

Title: Data Aggregation for Stochastic Optimization

Presenter: Zhenkang Peng, Shanghai Jiao Tong University

Co-author(s): Chengzhang Li, Ying Rong

Abstract:

In a climate of volatile markets and rapid product innovation, decision-making for large-scale systems is challenged by numerous problems and limited data. To address this, data aggregation methods aim to improve individual problem-solving by combining information across different problems. Our research shows that as problem numbers grow, utilizing the known cluster structure of problems offers significant advantages over approaches that neglect it. Even when the cluster structure is unknown, substantial inter-cluster distances can still provide benefit over the cost of a few data points. Numerical experiments and distance metric analyses validate our approach, highlighting its superiority, particularly in the context of small-data large-scale systems compared to existing methods.

Title: Sample Complexity of Policy Learning for Inventory Control with Censored Demand

Presenter: Xiaoyu Fan, New York University

Co-author(s): Boxiao Chen, Zhengyuan Zhou

Abstract:

We consider the newsvendor problem with unknown demand distribution and propose sampling-based approximation policies using censored demand data. We develop upper bounds for the number of samples required to guarantee that the performance of our proposed policy is close to that of the true optimal policy at any given accuracy level.

Parallel Session (E6) - Assortment Optimization**Day 2: 6th Jan (Sat) 16:50-18:10 Venue: 2127B****Session Chair: Wenjie Huang, The University of Hong Kong****Title: An Exact Method for Cardinality-Constrained Assortment Optimization under the Cross-Nested Logit Model**

Presenter: Le Zhang, Tsinghua University

Co-author(s): Hai Jiang

Abstract:

We study a class of assortment optimization problems where customers choose according to the cross-nested logit model and only limited number of products can be offered in the assortment. We design an exact algorithm to solve this NP-hard problem by finding the fixed point of a function through binary search. The subproblem at each point corresponds to a non-linear binary integer programming problem, which can be solved by Branch-and-Bound with novel variable fixing operations and upper bounds generation. Numerical results show that our approach can solve large assortment instances and derive superior objective value than heuristics.

Title: Assortment Optimization for the Multinomial Logit Model with Repeated Customer Interactions

Presenter: Chenhao Wang, The Chinese University of Hong Kong, Shenzhen

Co-author(s): Pin Gao, Ningyuan Chen, Yao Wang

Abstract:

This paper presents the multinomial logit model with repeated customer interactions. In each period, the same customer selects a product from the assortment recommended in that period or opts out. It captures the essence of an increasingly popular business model called the subscription box, exemplified by Stitch Fix and Wantable. From the seller's perspective,

the choice probability is updated based on the purchase history. We study the adaptive assortment recommendation strategy for all the periods. Although the problem is generally NP-hard as we show, when the customer interacts with the seller for two periods, we discover the structures of the optimal assortment when the available products in the two periods are identical and develop approximation algorithms in other cases. For more than two periods, although the optimal assortments are intractable, we find that the optimal fixed assortments that are not adapted to the purchase history can achieve 68.47% or 50% of the optimal expected revenue, respectively, when the available products across periods are disjoint or not. Using two public datasets, we demonstrate that the model with repeated customer interactions can better predict the purchase behavior and generate higher revenues.

Title: Multi-Warehouse Assortment Selection: Minimizing Order Splitting in E-Commerce Logistics

Presenter: Hongyuan Lin, National University of Singapore

Co-author(s): Xiaobo Li, Fang Liu

Abstract:

This paper addresses the multi-warehouse assortment selection (MWAS) problem in e-commerce logistics, with an emphasis on minimizing order splitting—a factor contributing to increased operational costs, elevated carbon emissions, and potentially compromised customer satisfaction. Building upon Li et al. (2022), we expand the analysis to multi-warehouse systems subject to cardinality constraints. We unveil a general structured framework for (MWAS) and reformulate it into a mixed-integer linear programming problem when fulfillment costs are uniform across all warehouses. This uniform cost scenario coincides with the crucial special case of minimizing split orders. We identify properties essential for optimal selection under specified nested demand structures and in contexts where warehouse assortments are either overlapping or non-overlapping. We also introduce two easily implemented heuristics for managing the problem within a two-warehouse environment. Our proposed extended marginal choice indexing policy proves optimal under certain demand distributions. Extensive numerical experiments affirm that even when these optimal conditions are not met, the proposed heuristics yield near-optimal

solutions. Lastly, we explore the multi-tier multi-warehouse assortment selection (MMWAS) problem, contributing a novel programming formulation and a sequential heuristic tailored for this context.

Title: The Impact of Risk-Awareness on Assortment Planning

Presenter: Wenjie Huang, The University of Hong Kong

Co-author(s): Junjie Lei, Zizhuo Wang

Abstract:

Fundamental questions: Static and dynamic single-leg assortment planning problems, under multinomial logit model from the perspective of risk-aware decision makers, are studied. The risk preference of retailer is modelled by spectral risk measure. We give characterizations of the optimal assortment offering decision/policy in both problems, and show that the optimality can be efficiently attained from revenue-ordered assortments. Several structural properties are also derived. In particular, higher level of risk-aversion implies larger assortment, both for static model and for each stage of dynamic model. A decomposition algorithm is developed for solving the dynamic model with approximation error guarantee. Numerical experiments are conducted to validate the above theoretical findings.

Parallel Session (E7) - Content and Advertising Management

Day 2: 6th Jan (Sat) 16:50-18:10 Venue: 2127C

Session Chair: Qirui Yang, City University of Hong Kong

Title: Sponsored Data: A Game-Theoretic Model with Content Provider Video Resolution Differentiation

Presenter: Yunbing Li, University of Science and Technology of China

Co-author(s): Jie Wu, Yong Zha

Abstract:

Excessive traffic consumption creates anxiety about traffic costs, it encourages the popularity of data subsidy, a business model in which Internet service providers (ISPs) encourage digital content providers (CPs) to help consumers who consume their content bear part of mobile data costs. In practice, content with data subsidy may be output in higher or lower resolution. We propose a game-theoretic model in which three cooperation options between ISP and CP: Case N (no subsidy is allowed), Case L (allowing the CP to subsidise low-definition resolution only), and Case H (allowing the CP to subsidise high-definition resolution).

Title: Planning Content in News Outlets, Fast and Slow

Presenter: Wenjuan Li, The Hong Kong University of Science and Technology

Co-author(s): Peiwen Yu, Qing Li

Abstract:

News outlets often use two strategies to manage costs in time-sensitive news article production: the news planning strategy (creating feature articles held as inventory) and the content syndication strategy (reproducing news articles from external sources through revenue sharing). In this context, we model a news outlet's content production decisions as a dynamic program. We identify structural properties of optimal decisions and explore how the nature of the content relationship (substitutes or complements) influences these decisions. Interestingly, when feature articles and reproduced articles are complements, the adoption of one strategy may either discourage or encourage news outlets from implementing the other.

Title: Ad Blockers and Ad Quality

Presenter: Jingyan Li, University of Science and Technology of China

Co-author(s): Quan Zheng, Shichang Li, Jie Wu, Duo Shi

Abstract:

Problem Definition: There is a fierce debate among practitioners regarding ad blockers. On one hand, ad blockers are considered a serious threat to content platforms because advertising is a key revenue driver. On the other hand, people also argue that ad blockers improve the advertising industry by pushing the creation of more attractive ads. This paper investigates the impact of ad blockers on a content platform when the advertiser's ad-quality decision is taken into account.

Methodology/Results: We develop an analytical model with a content platform, an advertiser, and a mass of consumers. We consider two settings: the ad fee is either exogenously given or endogenously set by the platform. The advertiser determines ad quality, which may affect the utility consumers obtain from consuming content. Consumers are heterogeneous in whether they value ads and how much nuisance they perceive from ads. In the exogenous-ad-fee setting, we identify two effects of ad blockers: The consumer screening effect screens out non-valuable consumers who cannot generate revenue for the advertiser as well as a portion of valuable consumers who perceive a strong nuisance from ads. The quality-enhancement effect induces the advertiser to improve ad quality to retain more valuable consumers. As a result of the two effects, the presence of ad blockers can result in a "win-win-win" outcome for all parties when the proportion of valuable consumers is low, or when the proportion of valuable consumers is high and consumers' nuisance costs in general fall within a moderate range. In the endogenous-ad-fee setting, the effects and win-win-win outcome carry over, but we also find some dynamics that deviate from the exogenous ad-fee setting; e.g., ad blockers may reduce ad quality and diminish consumer welfare.

Managerial Implications: Advertisers and content platforms should manage ad blockers strategically, which may make the system more efficient and benefit every party. Always opposing ad blockers is not the best solution, and permission should be given under certain conditions. How firms deal with ad blockers should depend on the consumer distribution with respect to the gain and loss consumers get from ads.

Title: Bidding in Online Display Advertising: A Deep Reinforcement Learning Model for Mobile Gaming Market

Presenter: Qirui Yang, City University of Hong Kong

Co-author(s): Mengzhuo Guo, Qingpeng Zhang, Youhua Chen

Abstract:

In real-time bidding, advertisers may submit a bid for each impression in an advertising platform. Their goal is to maximize the total revenue of successful bids under indispensable constraints such as budget. In the context of the mobile gaming market, it is a challenging issue due to the unpredictability of both user propensity for in-game purchases and competitors' bids. To address this, we propose a model to simulate and analyse the process of online bidding, and apply reinforcement learning to obtain the optimal bid for each impression. Real-world experiments demonstrate an increase in ROI by over 80% than current practices.

Parallel Session (E8) - Supply Chain Analytics

Day 2: 6th Jan (Sat) 16:50-18:10 Venue: 2128A

Session Chair: Eugene T.Y. Ang, National University of Singapore

Title: Nested Inexact Column and Constraint Generation for Stochastic Integrated Production and Replenishment Planning

Presenter: Zhihao Chen, Huazhong University of Science and Technology

Co-author(s): Zhixue Liu, Feng Li

Abstract:

This work investigates integrated production and replenishment planning under demand and lead time uncertainty. We present a two-stage robust optimization model for this problem. We proposed a nested inexact column and constraint generation based on structural analysis and model transformation to solve this model. Our computational experiments imply that two-stage robust optimization (two-stage RO) outperforms other policies in terms of cost and fill-rate. Besides, two-stage robust optimization is able to derive a relatively stable outcome under different level of uncertainty, indicating its outstanding robustness.

Title: Reducing Freight Delays in the Indian Railway Network: A Structural Analysis

Presenter: Himanshu Arha, Indian School of Business, Hyderabad

Co-author(s): Kashish Arora, Milind Sohoni, Raja Gopalakrishnan

Abstract:

Indian Railways, the world's fourth-largest in size, operates one of the world's slowest freight networks. The slow pace of freight trains is because passenger trains, which share the same infrastructure, get prioritized in dispatch by railway section managers (also known as section controllers). In this paper, we study how section controllers make freight train stop and hold decisions while managing the movement of freight trains. Subsequently, we propose policies to reduce freight delays and, thus, increase trains' speed through the network. We use detailed high-frequency network congestion data and estimate a structural model to reverse engineer the key parameters underlying the controllers' decisions. The estimated parameters provide empirical evidence for (i) the priority accorded to passenger trains over freight trains, (ii) the push effects in the freight train queue, and (iii) the strategic behavior of section controllers in holding trains at larger stations. Using the estimated model, we conduct a set of counterfactual analyses to address the problem of slow freight train speeds. First, we evaluate the impact of constructing Dedicated Freight Corridors (DFCs), high-capacity corridors reserved for freight transport. We find that the DFCs lead to about a 29% reduction in train delays and a 12% improvement in speeds. Then, we also evaluate non-capacity-investment-based alternatives to DFCs, like threshold-based releases and freight capacity consolidation. Interestingly, we find that our non-capacity interventions can provide benefits similar to those of DFCs while being nearly costless. Specifically, a 45-minute threshold release policy leads to around 31% reduction in dwell times. Similarly, consolidating freight capacity by about 25% leads to around a 10% increase in speed, comparable to the improvement achievable with the DFC.

Title: Optimizing A Human-AI Warehouse: Integrating Product Stowage and Retrieval Using Autonomous Robots

Presenter: Yuyu Liu, University of Science and Technology of China

Co-author(s): Yun Fong Lim, Marcus Ang, Yugang Yu

Abstract:

We consider an autonomous robotic system, such as a Kiva system, operating in a warehouse with multiple storage locations and work stations over a multi-period horizon. We assume products arrive according to a predetermined schedule but their demands are uncertain. At the start of each period, we need to select pods from the warehouse to stow each arriving product at each station. Likewise, at the end of the period, we need to select pods from the warehouse to retrieve products that are demanded at each station. Our objective is to minimize the expected total travel cost of the pods.

Title: Robust Supply Chain Network Design: Maximizing Matching Size With Adversarial Node Deletion

Presenter: Eugene T.Y. Ang, National University of Singapore

Co-author(s): Yifan Feng

Abstract:

Supply chain disruptions are a major challenge for businesses worldwide. In our paper, we investigate how appropriate graph design can enhance the robustness of supply chain networks, by maximizing its matching size after some nodes are adversarially deleted. In brevity, this is a (n,m,k) problem, where n and m are the order and the size of the designed graph respectively, and k is the number of adversarially deleted nodes. We derive several key graph properties that are necessary for the graph to be optimal. We then propose several optimal graph designs up to their isomorphism classes. To quantify the loss in matching size due to size constraints, we construct corresponding loss curves for fixed n and k . We illustrate how certain graph classes determine the loss thresholds along the curves. Through our work, we provide a valuable framework for stakeholders to enhance the adaptability of the supply chain in an increasingly volatile world.

Parallel Session (E9) - Advanced Topic in Revenue Management**Day 2: 6th Jan (Sat) 16:50-18:10 Venue: 2128B****Session Chair: Renjun Hu, University of Michigan****Title: Dynamic Pricing for Multi-Product Consumer Electronics Trade-in Program**

Presenter: Zhuoluo Zhang, Xiamen University

Co-author(s): Sean X. Zhou, Yanzhe (Murray) Lei

Abstract:

We consider a firm that offers trade-in program that collects used products and resells refurbished products to the market. Bargainers sell their used products either for cash or for trade-in for upgrade and new customers purchase refurbished products. We propose near-optimal pricing policy and show the loss is $O(T^{1/3})$. We also study three extensions: initial stocking of new products, vertically differentiated products, and additional features of trade-in programs in practice, and adapt the heuristics and their theoretical performance analysis to these extension.

Title: Economic Impacts of Consumers' Add-On Purchases on Retailers' Pricing Decisions

Presenter: Samuel Shuai Liu, The Hong Kong Polytechnic University

Co-author(s): T.C.E. Cheng, Xiaoping Xu

Abstract:

When shopping online, consumers would like to purchase add-on items in addition to regular products to avoid the shipping fee. Such observed consumer behaviour affects the revenue management of retailers. In this paper we examine the online retailer's optimal pricing and shipping fee decisions, taking into account both consumers' add-on purchase and consumer segmentation of whether joining the retailer's membership-based free shipping scheme. Models with and without considering consumers' add-on purchase are

developed. We find that consumers' add-on purchase does not necessarily benefit the retailer, although such purchase brings extra revenues to the retailer. Only when consumers view add-on items as of high value may the retailer be able to charge a higher price and generate a significant profit. In addition, when there are more free shipping consumers in the market, the retailer raises its price but cuts the shipping fee. We also suggest that offering the free shipping service to more consumers may not be an effective way to increase revenues. To confirm the robustness of the results derived from the basic models, we extend the analysis to consider the disutility from buying add-on items, the time guarantee service, and consumers' strategic behaviour of returning add-on items. We conclude that with disutility of purchasing add-on items, although consumers' add-on purchase allows the retailer to increase the shipping fee, the retailer would still have to reduce the price and face a loss of profit. In addition, the rising cost of the time guarantee service would not affect the retailer's shipping decision.

Title: Research on the Competitive Strategy of Community Group Buying Platform considering Users' Participation under Network Externality

Presenter: Jing Zheng, Chongqing University

Co-author(s): Yong Wang, Yue Chen, Yi-Min Song

Abstract:

The prosperity of the platform economy intensifies the competition in the retail market. As a new retailing model, community group buying has attracted much attention. We consider the network externalities and affiliation situations, construct a duopoly competition model to analyze the pricing strategy, market share and profit of community group buying platforms. We find that: when users are single-homing, the community group buying platforms always share the markets equally. In different attribution situations, the platforms' charging/subsidizing strategies to consumers are affected by users' preferences and network externalities. In any situation, the platforms adopt a charging strategy for suppliers.

Title: Assortment and Fulfillment Optimization in Online Grocery Retail

Presenter: Renjun Hu, University of Michigan

Co-author(s): Hyun-Soo Ahn, Lennart Baardman

Abstract:

Despite the rapid growth of online grocery retail in recent years, most supermarkets have not turned this growth into a profitable business model. One of the key reasons is the excessively high picking and delivery cost in an industry with low profit margins. Technological innovation, in the form of the Micro Fulfillment Center (MFC), has great potential to reduce costs by improving the efficiency in picking operations. The MFC is a small local warehouse, often attached to a brick-and-mortar store or regular fulfillment center, which very efficiently fulfills a subset of items that are available in the assortment of the online store. For a grocery retailer with an online store and an MFC, it is important to decide which items are offered in the assortment of the online store and which items are fulfilled from the MFC. This is especially important in online grocery retail where cart abandonment is ubiquitous. If customers cannot find the items they are looking for, they can abandon their shopping cart and move to another online grocery retailer. In this work, we formulate the assortment and fulfillment problem for an online grocery retailer with an MFC whose customers exhibit cart abandonment behavior. We show that this problem is difficult to solve, and hence, we develop an algorithm to quickly compute near-optimal decisions at large scale. Our algorithm is shown to be a good approximation with theoretical results and computational experiments.

Parallel Session (E10) - Fintech and Blockchain**Day 2: 6th Jan (Sat) 16:50-18:10 Venue: 2128C****Session Chair: Shuai Hao, Southern University of Science and Technology****Title: AI, Blockchain, Supply Chain Visibility, Agility, and Supply Chain resilience: Configuration Analysis Based on fsQCA**

Presenter: Hao Zheng, University of Nottingham

Co-author(s): Jing Dai, Boying Li

Abstract:

In today's ever-changing landscape, developing supply chain resilience is paramount. Prior studies explored the role of emerging technologies, visibility, and agility in developing resilience. Given this, our study adopts the fuzzy set qualitative comparative analysis(fsQCA) to investigate the influence of AI, blockchain, supply chain visibility, and agility on supply chain resilience. Utilizing data from 174 Chinese firms, this study reveals that AI and blockchain exhibit a substitutive effect in conjunction with supply chain visibility and agility to develop resilience. Additionally, this study finds that AI and blockchain conditions complementarily enhance agility when synchronized with supply chain visibility, further promoting resilience.

Title: Invoice Tokenization for Deep-Tier Payables Finance

Presenter: Jing Hou, Nanjing University

Co-author(s): Burak Kazaz, Fasheng Xu

Abstract:

Invoices from tier-1 suppliers to the downstream anchor manufacturer can be tokenized onto a blockchain. The tier-1 suppliers are then able to split and transfer the tokens to their own (tier-2) suppliers, enabling deep-tier suppliers to sell tokens and access financing at more affordable rates based on the anchor manufacturer's credit rating. We investigate how invoice tokenization impacts the multitier supply chain's decisions and profits under different supply network configurations.

Title: Fintech Operations: An Overview of Recent Developments and Future Research Directions

Presenter: Shuai Hao, Southern University of Science and Technology

Co-author(s): Baile Lu, Michael Pinedo, Yuqian Xu

Abstract:

In this paper, we provide a survey of recent developments in the fintech (financial technology) industry, focusing on the operational structures, the technologies involved, and the operational risks associated with the new systems. In particular, we discuss payment systems, algorithmic trading, robo-advisory, crowdfunding, and peer-to-peer lending. In the conclusion section, we discuss various promising research directions.

Parallel Session (E11) - Operations Management Under Competition

Day 2: 6th Jan (Sat) 16:50-18:10 Venue: 2129A

Session Chair: Derui Wang, University of Science and Technology of China

Title: Provision of Software Features amid Hardware Commoditization: Standard or Optional?

Presenter: Haiyang He, Chongqing University
Co-author(s): Peiwen Yu, Feng Yang, Minyue Jin

Abstract:

Motivated by the trend of hardware becoming commoditized and software driving differentiation in various industries, we explore whether firms should provide software features as standard or optional in the presence of hardware commoditization. In the absence of competition, each firm should bundle software with hardware. However, competition drives firms to sell software as optional when hardware has a low marginal cost or software is highly differentiated, even though sales of the undifferentiated hardware do not generate any profits. Our analysis highlights the importance of hardware costs in shaping firms' strategies toward software provision, even in the face of hardware commoditization.

Title: Media Platform Competitive Strategy with Heterogeneous Consumer Behavior

Presenter: Xue Li, Beijing Foreign Studies University

Co-author(s): Jing Fan, Jihong Zhang, Tianyu Yang

Abstract:

Starting from the real problems of multimedia platforms in practice, we build a media platform competition model and focus on two different business strategies: advertising and subscription. Optimal strategies and conditions for competing platforms are revealed by analyzing and comparing four cases; and the impact of competition on platform value differences and consumer behavior heterogeneity is analyzed.

Title: Tariff Hedging with a New Supplier? An Analysis of Sourcing Strategies Under Competition

Presenter: Shuyue Yi, Fudan University

Co-author(s): Lezhen Wu, Xiaole Wu

Abstract:

Due to the U.S.-China trade war, multinational firms may develop new contract manufacturers outside China to hedge against high tariffs on Chinese exports to the U.S. market. We study two competing firms' contract manufacturer development decisions in a sequential game. We find that multinational firms prefer to develop new contract manufacturers when tariffs are expected to rise moderately rather than sharply. This implies, when taking into account competition, an overly high tariff on Chinese exports to the U.S. does not necessarily serve the purpose of switching suppliers from China to other regions.

Title: Endogenous Merger Decisions Among Competitors: Impact of Limited Capacity and Loyal Segments

Presenter: Derui Wang, University of Science and Technology of China

Co-author(s): Xiaole Wu, Christopher S. Tang, Yue Dai

Abstract:

We study endogenous merger decisions among three competing firms: one large firm and two small firms. When two firms merge, the merged entity and the independent firm use the resulting capacity to capture their own “loyal buyers” and compete in price for price-sensitive “disloyal switchers”. We find that, in equilibrium, either there is no merger or the large firm will merge with a small firm. We explain how this equilibrium structure is driven by the “asymmetric capacity effect” and the “underutilized capacity effect”. The impacts of mergers on social welfare and consumer surplus provide practical implications from the antitrust perspective.

Parallel Session (E12) - Policy Development in OM- Finance Interface**Day 2: 6th Jan (Sat) 16:50-18:10 Venue: 2129B****Session Chair: Yu Du, The Hong Kong Polytechnic University****Title: How a Platform’s Private Label Interacts with a Manufacturer’s Financing Strategy**

Presenter: Prasenjit Mandal, NEOMA Business School, REIMS

Co-author(s): Sambit Brata Rath, Preetam Basu

Abstract:

We study an e-commerce supply chain in which a capital-constrained manufacturer, exposed to operational risk, chooses its optimal financing strategy, bank financing or platform financing. We examine how the platform’s PL introduction strategy impacts the manufacturer’s financing choice. We find that with the PL, the manufacturer may choose platform financing whereas without the PL, the manufacturer would have preferred bank financing, resulting in a cooperative relationship. Interestingly, if the manufacturer chooses platform financing, the platform may employ a cooperative strategy by refraining from introducing the PL. We recommend that the platform can effectively leverage the PL to mitigate operational risk.

Title: Who is the Best Insurance Buyer? Financing the Capital-Constrained Manufacturer with Trade Credit Insurance

Presenter: Hechen Zhong, Central University of Finance and Economics

Co-author(s): Nina Yan, Tingting Tong

Abstract:

To mitigate default risk, integrating trade credit insurance (TCI) into factoring finance is increasingly popular. Through game analysis, this study examines supply chain participants' decisions and profits in two TCI schemes, i.e., manufacturer-insured TCI (MI) and factor-insured TCI (FI). We find that when manufacturers are highly capital-constrained, both schemes generate higher profits for retailers and manufacturers. Comparative analysis indicates retailers prefer MI when manufacturers encounter high unit production costs, while factors prefer MI when manufacturers face low unit production costs and high capital constraints. Otherwise, they prefer FI. Furthermore, when manufacturers are moderately capital-constrained, FI achieves all participants' Pareto improvement.

Title: Cointegrated Product and Financial Markets: Production Planning and Risk Hedging

Presenter: Tingjin Yan, East China Normal University

Co-author(s): Jinhui Han

Abstract:

We observe a statistically significant cointegration effect between product demands and financial asset prices. Motivated by this, we consider the production planning problem with risk hedging in a cointegration model. We optimize both production capacity and the associated financial hedging strategy in a dynamic mean-variance framework. Theoretically, we establish a time-consistent solution, resulting in a hedging strategy that integrates considerations for demand risk hedging and statistical arbitrage. Comparative statics, especially the impacts of cointegration on production decisions, are studied comprehensively. We find that the obtained strategy can significantly improve the firm's

operational risk management, as evidenced by real-data experiments.

Title: The Impacts of Winner-takes-all Policy on Crowd Participation in an Innovation Contest

Presenter: Yu Du, The Hong Kong Polytechnic University

Co-author(s): Chi To Ng, Yefei Yang

Abstract:

Innovation contest platforms help companies leverage the crowd's power to solve innovation-related challenges. Recently, many platforms have adopted the multiple prizes policy, i.e., the award is shared equally among the top L participants. However, there is an ongoing debate that the winner-takes-all policy, which grants the award only to the winner, may attract more crowd participation. Our study investigates and compares the impact of these two policies on the number of submissions to the platform. We conduct a quasi-experiment using the difference-in-differences (DID) analysis. Our findings offer valuable insights for sponsors seeking to attract more participants to their innovation contests.

Parallel Session (E13) - Operational Transparency and Visibility

Day 2: 6th Jan (Sat) 16:50-18:10 Venue: 2129C

Session Chair: Ehsan Bolandifar, Peking University Shenzhen Graduate School

Title: Invisibility of Financial Terms in Competing Supply Chains

Presenter: Zelong Yi, Shenzhen University

Co-author(s): Hao Huang, Zhen Tan

Abstract:

Maintaining financial terms' confidentiality is common for manufacturers in practice, contrary to literature assumptions of visible financial terms in supply chains. Our investigation into the impact of financial terms' invisibility and retailers' financial distress

on supply chain performance reveals that, when both retailers are financially distressed, the manufacturer may adopt a differential strategy, providing visible financial term to one retailer and invisible financial term to the other. However, unbalanced retailer financial status may prompt the manufacturer to prefer invisible terms for both. Interestingly, it emerges that a financially distressed retailer may perform better than the case when she is well-capitalized.

Title: Queue Visibility Decisions in Customer-Intensive Services

Presenter: Junxue Zhang, The Hong Kong University of Science and Technology

Co-author(s): Chenguang (Allen) Wu, Ying-Ju Chen

Abstract:

In *customer-intensive services*, managers often encounter a “quality-speed conundrum” where increasing service speed leads to a perceived decline in service quality for strategic customers. These customers decide whether to engage with the service based on the quality of service and the cost of waiting. While many studies have uncovered novel implications of such *speed-quality trade-off* across various operational strategies, the impact of *queue information*— another crucial factor influencing customers’ queueing behavior—remains less explored. In this study, we investigate a customer-intensive service provider’s queue disclosure strategy, where the queue length is either known or unknown to all customers. Under exogenous service price, we find that disclosing queue length is the dominant strategy when market valuation is low and/or customer sensitivity to quality changes is high. However, service quality is likely to decline when the service provider opts to disclose the queue length. Interestingly, under endogenous service price, the queue information strategy remains robust, but the choice of quality may reverse. Specifically, higher quality service is offered when the server switches to reveal the queue information. Our analysis suggests that disclosing queue information benefits the server by revealing the system state of a shorter queue, leading to the adoption of higher service speeds at the risk of poorer service quality. Nonetheless, implementing an appropriate level of tolls provides another dimension to manage congestion in the queue so that significant quality improvement is anticipated under endogenous price. As a result, superior service quality typically accompanies information disclosure when the server has pricing discretion.

Title: Operational Transparency: Showing We are Different

Presenter: Meng Zheng, Shanghai University of Finance and Economics

Co-author(s): Simai He, Christopher Thomas Ryan, Danli Yao

Abstract:

Existing studies on operational transparency have stressed the many benefits of adopting transparent processes. But the benefits of transparency described in these studies largely apply equally to all competing firms in a given market. And yet, operational transparency is far from universal. In a food court of present-day malls, one will find open kitchens next door to closed ones. Our point of departure from the existing literature is to explore the impact of competition on transparency choice. Reasons why a firm might not go transparent primarily focus on the situation where “opening up” reveals something unsavory about the product or service. We show that even when both firms have “nothing to hide”, they still might not go transparent. The reason? “Opening up” can diminish variance in perceived differences in offerings and intensify price competition, leading to lower profits. Conversely, this reveals a previously unexplored reason for going transparent. If operational transparency differentiates a firm’s offering from competitors by “showing we are different”, this avoids price competition and increases profits. Our insights derive from analyzing a two-player and three-period game-theoretic model of operational transparency where the transparency and pricing decisions of firms are endogenous. The model considers two impacts of operational transparency: (i) a mean-shifting effect that boosts customer valuations (as typically discussed in existing literature) and (ii) a heterogeneity-reducing effect that reduces the variability of customer perceptions of the quality of operational practices. With these two effects, we show how an equilibrium can arise among two nearly identical firms where one goes transparent and the other does not. This outcome realizes the food court phenomenon of an open kitchen next to a closed one arising from competitive concerns.

Title: The Paradox of Budget Transparency in Crowdfunding

Presenter: Ehsan Bolandifar, Peking University Shenzhen Graduate School

Abstract:

Budget disclosure has been introduced as a potential tool to increase customer trust in commercial products. This study investigates whether and how budget disclosure affects the funding outcome of reward-based crowdfunding campaigns. Leveraging a new feature offered by Kickstarter called Project Budget, we show that budget transparency can hurt campaign managers, reducing their funding; the effect exists mainly for low-risk and less innovative projects. To investigate the mechanism that drives such findings, we study details of budgets, showing that higher production costs in a proposed budget can increase funding while higher marketing costs reduce funding.

Parallel Session (E14) - Recent Advances in Service Operations**Day 2: 6th Jan (Sat) 16:50-18:10 Venue: 2130A****Session Chair: Minjian Liu, University of Science and Technology of China****Title: Carbon Footprint Reduction in an E-Commerce Market: Impacts of Logistics Service Sharing**

Presenter: Xuelian Qin, Huazhong University of Science and Technology

Co-author(s): Zhixue Liu, Zhi Yang, Lin Tian

Abstract:

In the e-commerce market, green technology investment and carbon offset purchase are two widely-used approaches for reducing the carbon footprint of logistics services. However, implementing carbon footprint reduction in logistics services generally incurs heavy costs. To distribute heavy costs and improve resource utilization, a novel strategy of logistics service sharing—e-commerce platforms with self-supporting logistics service systems and carbon footprint reduction approaches share their services with third-party sellers—has played an important role. Nevertheless, it is still unclear, in a co-opetitive e-commerce market, how to make use of different approaches and what the impacts of logistics service sharing are.

Title: Interactions of Strategic Inventory and Contract Design on the Retail Platform's Entry in Logistics Service Sharing

Presenter: Xi Yang, Wuhan University

Co-author(s): Bin Dai

Abstract:

Retail platforms, like JD and Amazon, have recently initiated the business model of sharing logistics services with suppliers in agency selling to increase revenue at the cost of competition loss. Thus far, there is no clear strategy for which supplier should be offered logistics service sharing and through what contract, particularly when the retail platform withholds strategic inventory. In this paper, considering No-Service-Sharing (N) and two typical Service-Sharing contracts: Service-Sharing with fixed fee (contract F), and Service-Sharing with linear fee (contract L), we examine the equilibrium dynamic pricing and ordering decisions under various logistics service sharing contracts and further analyze the interactions of strategic inventory and contract design on logistics service sharing. Our analysis reveals that logistics service sharing decisions hinge on the fulfillment service level of the retail platform and cross-service sensitivity.

Title: Risk Sharing in a Two-Level Supply Chain with Variable Capacity and Random Yield

Presenter: Xiao Xiao, California State University Stanislaus

Co-author(s): Xiang Fang

Abstract:

Research on production uncertainty is crucial for supply chain management, as supply chains face numerous uncertainties. This study examines two types of production uncertainty, Variable Capacity (VC) and Random Yield (RY), and their impact on supply capability, relationships among supply chain members, behaviors, and performance, focusing on both centralized and decentralized supply chains. RY, arising from imperfect processes, is predictable and measurable, while VC, caused by random factors such as

unforeseen interruptions and unplanned maintenance, is uncontrollable. Our research findings indicate that VC and RY do not always significantly impact production and ordering decisions in certain scenario.

Title: Pricing, Channel Design, and Platform Operations with Buy-Online-and-Pick-up-in-Store in Online Food Delivery Market

Presenter: Minjian Liu, University of Science and Technology of China

Co-author(s): Shaofu Du, Tengfei Nie, Yangguang Zhu

Abstract:

Omnichannel selling has gradually become popular in recent years, and the booming online food delivery (OFD) industry is no exception. Buy online and pick up in-store (BOPS) is regarded as the most important omnichannel fulfilment strategy. In this paper, we establish a stylised model to analyse the effects of BOPS on consumer purchases and merchant profitability in the OFD market. We also examine merchants' pricing, channel design strategies, and OFD platform operation management. We consider two merchant segments: online-only merchants who sell products only online and omni-merchants who sell both online and offline.

Parallel Session (E15) - Scheduling and Design in Operations Management

Day 2: 6th Jan (Sat) 16:50-18:10 Venue: 2130B

Session Chair: Yifu Li, University of Science and Technology of China

Title: Integrated Production and Transportation Scheduling Problem under Nonlinear Cost Structures

Presenter: Julong Wang, Huazhong University of Science and Technology

Co-author(s): Zhixue Liu, Feng Li

Abstract:

We consider an integrated production and transportation scheduling problem arising in

make-to-order settings, where customer orders have release times and some fixed departure times. These orders are first processed in a plant and, thereafter, delivered to customer sites by transporters with nonlinear cost functions. Storage before transportation incurs holding costs. The objective is finding an integrated schedule such that the total cost is minimized. We study the problem without or with partial delivery. For each case, we propose a column generation-based heuristic, which can generate near-optimal solutions within a reasonable computational time. Finally, we consider the sequence-dependent setup times into the problem.

Title: Order Selection and Fulfillment Integration Problem with Flexible Products

Presenter: Miao Wang, Huazhong University of Science and Technology

Co-author(s): Feng Li

Abstract:

This paper first incorporates revenue management problems with the distribution schedule (denoted as RFD), which has a significant impact on the firm's total revenue yet has not been considered in previous research. With the goal of maximizing total revenue given limited resources, the firm must determine: (i) accept or reject each customer request, (ii) how to fulfill all requests. Decision making are considered in offline and online contexts: the information about every customer is known in advance with certainty in offline case, and customers arrive randomly with their information unknown until they arrive in online case.

Title: A Branch-and-Bound Algorithm for the Resource Constrained Project Scheduling Problem with Transfer Times

Presenter: Ying Liu, Southwest Jiaotong University

Co-author(s): Shuang Jin, Jing Zhou, Qian Hu

Abstract:

We study a resource constrained project scheduling problem which considers unary resources and resource transfer times. The problem is to decide the activity start times and resource transfer plan such that the makespan is minimized. To solve the problem exactly,

we propose a branch-and-bound algorithm that utilizes a branching scheme to branch over all eligible activities to be scheduled, five effective dominance rules and two lower bounding techniques to efficiently prune dominated nodes. Computational results show that our algorithm performs significantly better than the commercial solvers, i.e., CPLEX and CP Optimizer.

Title: Optimal World Design in Video Games

Presenter: Yifu Li, University of Science and Technology of China

Co-author(s): Christopher Thomas Ryan, Lifei Sheng, Benny Wong

Abstract:

Spending time in virtual spaces is a growing part of the human experience. We study the design of virtual spaces in a video game context, with an emphasis on understanding how people spend more or less time enjoying these spaces. People enjoy spending time immersed in a video game world but also want a sense of achievement. When deciding how to chart a meaningful path through a virtual world, game players confront a series of choices. An effective design of a virtual world must balance two things. First, the world should be flexible to differing time budgets of players. Second, complex designs can overwhelm players with decision fatigue. We model virtual world design as a graph design problem. We find a polynomial-time algorithm when decision fatigue depends only on the number of vertices and paths in the graph. The algorithm uses an elegant optimality condition: optimal world maps have a "side-quest" tree structure that is amendable to an efficient inductive construction.

Parallel Session (E16) - Vehicle Routing Problems

Day 2: 6th Jan (Sat) 16:50-18:10 Venue: 2130C

Session Chair: Yang Xia, City University of Hong Kong

Title: Optimizing Vessel Routing Problems for Maintenance Activities in Offshore Wind Farms

Presenter: Chandra Ade Irawan, University of Nottingham Ningbo China

Co-author(s): Said Salhi, Giampaolo Buticchi, Hing Kai Chan

Abstract:

This study investigates a challenging routing problem in offshore wind farms. Two types of vessels are used to support maintenance activities, namely a service operation vessel (SOV) and a set of safe transfer boats (STB). The SOV carries the STBs that can be deployed to transfer technicians to the turbines. The problem is to simultaneously obtain optimal routes for the SOV and STBs to deliver and pick up the technicians from the turbines. A mixed-integer linear programming model is designed, and a metaheuristic method is developed. The computational results show the effectiveness of the proposed model and method.

Title: A Novel Decision Support Framework for Multi-Objective Aircraft Routing Problem

Presenter: Francisco Benita, Singapore University of Technology and Design

Co-author(s): Francisco López-Ramos, Nuno Antunes Ribeiro

Abstract:

This paper introduces a novel framework and decision support tool for the Multi-Objective Aircraft Routing Problem. It includes three key components: efficient data management, a rapid linear programming model, and a multi-objective algorithmic framework that effectively employs parallelization techniques. These elements combine into a unified tool that enables airline managers to assess various routing solutions, considering multiple objectives and Key Performance Indicators. Tested with AirAsia data, the tool produces high-quality, well-balanced solutions, offering practicality and real-world effectiveness.

Title: Urban Medical Waste Management: A Data-Driven Chance-constrained Optimization Approach

Presenter: Ginger Y. Ke, Memorial University of Newfoundland

Co-author(s): Jiaohong Zhao, Jianfeng Chen, Zhiwei Chen

Abstract:

The processing and transportation of medical waste pose uncertain threats to the surrounding people and the environment. This paper aims to mitigate the risk associated with urban medical waste management under an emergency system with uncertain response times. Taking the randomness of traffic conditions into consideration, a data-driven bi-objective chance-constrained model is developed to seek optimal facility locations, vehicle acquisitions, as well as route and tour plans, such that both the risk and cost are simultaneously minimized. We propose a comprehensive solution procedure, which incorporates a Back Propagation Neural Network approach in the fuzzy chance constraint for treating uncertainties.

Title: A Branch-and-Price-and-Cut Algorithm for the Vehicle Routing Problem with Load-dependent Drones

Presenter: Yang Xia, City University of Hong Kong

Co-author(s): Wenjia Zeng, Canrong Zhang, Hai Yang

Abstract:

We study the vehicle routing problem with load-dependent drones (VRPLD), where the energy consumption of drones is load-dependent. To strengthen the collaboration between trucks and drones, the docking hub is introduced. We formulate a mixed-integer model and design a BPC algorithm to solve the problem. Our computational results show that the proposed algorithm is efficient. Compared with VRPLD, the VRPD which ignores the load-dependent constraints underestimates the total travel cost by 6.83%. Moreover, we observe that a more accurate representation of the energy consumption makes the drones more dependent on the auxiliary facilities. We also conduct sensitivity analysis to draw some managerial insights that setting the hub at a reasonable location can significantly reduce the delivery cost and efficiency.

Parallel Session (E17) - Humanitarian and Crisis Management**Day 2: 6th Jan (Sat) 16:50-18:10 Venue: 2131A****Session Chair: Ning Zhu, Tianjin University****Title: Equity-Based Multi-Objective Model for Mothership and Drone-Boat Routing Problem in Relief Distribution**

Presenter: Fadillah Ramadhan, University of Nottingham Ningbo China

Co-author(s): Chandra Ade Irawan, Zhao Cai

Abstract:

This study proposed new multi-objective models for disaster relief distribution using the mothership coordination of truck, drone, and boat vehicles, which aims to optimize the equity-based aspects. Novel mixed integer non-linear and linear programming models for the mothership and drone-boat routing problem are developed. An improved augmented ε -constraint method is used to solve the proposed model. The experimental results show that the proposed method performs exceptionally well for solving the small datasets in the non-linear model, while the linear model takes less time to compute and produces better solutions for medium-sized datasets.

Title: Relief Items' Prepositioning and Distribution Based on Spatial Losses Prediction for Typhoon Disasters

Presenter: Xintong Zhang, Tongji University

Co-author(s): Zhaolin Hu

Abstract:

This paper uses K Nearest Neighbors method to find similar typhoons in history when a certain typhoon is coming. It will give disaster losses prediction 24 hours in advance using certain features. After predicting typhoon disaster losses, we use a two-stage stochastic programming model to choose certain potential disaster relief points and allocate relief

supplies in the first stage, while repurchasing and distributing the relief supplies in the second stage. Our model considers satisfying casualties' demands as far as possible in the meanwhile minimizes the total cost. Moreover, this paper shows the necessity of constructing city integrated emergency response system.

Title: Distributional Robustness and Inequity Mitigation in Disaster Preparedness of Humanitarian Operations

Presenter: Ning Zhu, Tianjin University

Co-author(s): Hongming Li, Erick Delage, Michael Pinedo, Shoufeng Ma

Abstract:

We study a predisaster relief network design problem with uncertain demands. The aim is to determine the prepositioning and reallocation of relief supplies. We consider three important practical aspects of humanitarian operations: shortages, equity, and uncertainty. We employ a form of robust satisficing measure, which we call the Shortage Severity Measure, to evaluate the severity of the shortage caused by uncertain demand in a context with limited distribution information. We then formulate a mixed-integer lexicographic optimization problem with non-convex objectives and design a new branch-and-bound algorithm. We also propose two approaches for identifying optimal postdisaster adaptable resource reallocation.

Parallel Session (E18) - Healthcare Information Systems and Provision

Day 2: 6th Jan (Sat) 16:50-18:10 Venue: 2131B

Session Chair: Chao Zhang, Southern University of Science and Technology

Title: How does Health Information Exchange Technology Affect Patients' Care Seeking? Perspective from Continuity of Care

Presenter: Mingshan Zhang, Southern University of Science and Technology

Co-author(s): Yao Li

Abstract:

For patients with chronic diseases, the trade-off between pursuing continuity of care (CoC) and seeking a second opinion is critical to their health outcomes. However, fragmented healthcare systems can limit patients' options and flexibility in seeking care. Health information exchanges (HIEs) offer a solution by providing seamless data exchange channels for healthcare providers. Using diabetes patient outpatient visits data from 95 hospitals in New York State, we analyze patient visit histories using a Markov score model. Our results indicate that HIE adoption is associated with a 3.9% decrease in the likelihood of patient retention.

Title: Combatting Opioid Abuse: The Role of Drug Dosage Alert Systems

Presenter: Yongchun Fang, Southern University of Science and Technology

Co-author(s): Lin Qiu, Yao Li

Abstract:

The opioid epidemic has swept the United States. Opioid overprescribing by physicians is a primary contributing factor, as it could facilitate opioid abuse. Drug dosage alert systems provide real-time alerts to physicians when they prescribe doses exceeding the recommended ranges. This study examines the effectiveness of drug dosage alert systems in curbing opioid abuse incidents. Leveraging panel datasets across 172 hospitals in New York State, our results from both patient-visit and hospital-level panels, suggest that the implementation of drug dosage alert systems significantly reduces the risk of opioid abuse. Our future study would observe the opioid overprescribing mechanism.

Title: Adoption of Healthcare Information Exchange: A Mixed-Method Approach

Presenter: Qi Lin, University of International Business and Economics

Co-author(s): Yao Li

Abstract:

This paper explores the incentive issues and gaming behaviors of healthcare providers associated with health information exchange (HIE) adoption. We develop a theoretical research model to investigate the interaction between two competing healthcare providers and how they determine the adoption and depth of HIE. Through our analysis, we indicate that the optimal level of HIE adoption in a healthcare system mainly depends on the quality levels of and the costs of patients switching between healthcare providers. In addition, we perform an empirical study to supplement and get further insights in comparison with the analytical results.

Title: Strategic Communications in Sequential Dialysis Modality Selection

Presenter: Chao Zhang, Southern University of Science and Technology

Abstract:

Problem definition: Peritoneal dialysis (PD) and hemodialysis (HD) are both effective treatment options for patients with end-stage renal disease (ESRD). In this paper, we investigate the optimal information design to guide patients in self-selecting dialysis modalities to address the under-utilization of PD treatments and HD overcrowding. **Methodology/results:** To tackle PD failures due to patients' non-compliance, we consider a one-shot communication benchmark. We show that full information disclosure can alleviate dialysis center congestion, but partial information provision can do better. The best outcomes can be achieved as long as the congestion intensity is not too high. We extend to a two-stage model to reflect long-term communications when PD patients experience complications. We characterize the optimal information design in a sequential Bayesian persuasion manner.

Managerial implications: Our research highlights the value of “gradualism” in fine-tuning information provision in the context of healthcare operations management.

Parallel Session (E19) - Decision-Making in Healthcare Operations**Day 2: 6th Jan (Sat) 16:50-18:10 Venue: 2131C****Session Chair: Hanzhe Li, The University of Hong Kong****Title: The Impact of Physician Practice Behavior on Emergency Department Congestion**

Presenter: Huifeng Su, Yale University

Co-author(s): Lesley Meng, Rohit Sangal, Edieal Pinker

Abstract:

Emergency department (ED) physicians play a crucial role in deciding patient diagnosis and treatment plans, and post-ED admissions and discharges. Such decision-making significantly impacts medical resource utilization within the hospital, as it often relies on a range of shared diagnostic resources, such as laboratory tests and imaging. Moreover, admitted patients contribute to ED crowding because these patients often occupy ED spaces while awaiting transfer to downstream units. This study explores the differences between physicians in requesting diagnostic resources, making admission decisions, and the impact of such work style heterogeneity on ED congestion.

Title: The Impact of Patient Choice on Referral-Based Healthcare Systems

Presenter: Guohao Li, Tongji University

Co-author(s): Brian Rongqing Han, Mahesh Nagarajan, Chunyang Tong

Abstract:

Motivated by China's healthcare systems in which patients have the freedom to choose between community hospitals (CHP) or advanced hospitals (AHP) as their first touch of care, this paper investigates the effect of patient choice on system efficiency. We first formulate an optimization problem in which the healthcare Payer has direct control over both the community hospitals' referral policy and patients' pathway. The analysis of this optimization, called the firstbest in our paper, is followed by a second-best study in which the patients'

pathway becomes subject to patient choice equilibrium. We find that the underlying factor warranting a strict gate-keeping system whereby patients are disallowed to visit AHP directly stems from CHP's declining odds of treating patients with more complex conditions, and the system would be compelled to be operating in an over-referral mode in the presence of patients' choice. We also examine the effectiveness of capacity reallocation initiatives being launched in China's healthcare reform. Although the policymaker hopes that such an initiative can boost the professional skills of the CHP by reallocating some capacity from AHP to CHP, and the patients would be accordingly incentivized to choose CHP over AHP, our analysis calls for a careful assessment of CHP's learning capability and shows that only when the CHP's learning capability is sufficiently large, does the system efficiency get improved.

Title: Evaluating the Impact of Supply Frequency in Vaccine Distribution Network Under Demand Uncertainty

Presenter: Paulina Kus Ariningsih, University of Nottingham Ningbo China

Co-author(s): Chandra Ade Irawan, Jing Dai, Antony Paulraj

Abstract:

The replenishment coordination across parties in perishable vaccine distribution in emerging countries is applied in a particular annual supply frequency, influencing network capacity and design. This study investigates the effect of the supply frequency by proposing a two-stage stochastic multiperiod mixed integer linear programming optimization considering capacity expansion under demand uncertainties with novel network structure for developing countries. The decision variable includes the hub location, network assignment, capacity, transportation, commodity flow, and inventory. A heuristic algorithm procedure is proposed for obtaining the solutions. Managerial implications are also developed by applying the model in the case of Indonesia's Covid-19 vaccination.

Title: AI Persuasion, Bayesian Attribution, and Career Concerns of Doctors

Presenter: Hanzhe Li, The University of Hong Kong

Co-author(s): Jin Li, Ye Luo, Xiaowei Zhang

Abstract:

A substantial challenge to AI adoption is that humans often resist following AI. We study this AI aversion problem in the context of disease diagnosis and provide a new perspective, highlighting that disagreement between doctors and AI can result from multiple sources. When a doctor attributes her disagreement with AI to different sources, her willingness to follow AI varies. This feature allows us to manage doctor incentives by designing AI's interpretability. In particular, making AI uninterpretable can actually enhance AI persuasion. When the doctor resists following AI due to career concerns, uninterpretable can decrease AI aversion and improve diagnostic accuracy.

Parallel Session (E20) - Sustainable Operations**Day 2: 6th Jan (Sat) 16:50-18:10 Venue: 2132A****Session Chair: Zimeng Li, Zhejiang University & City University of Hong Kong****Title: The Effect of Subscription Service for Electric Vehicles on the Market Performance of Supply Chain Partners and Relevant Stakeholders**

Presenter: Yifan Hou, Guangdong University of Finance and Economics

Co-author(s): Jie Zhang

Abstract:

In the face of opportunities in the electric vehicle (EV) industry, automobile companies are actively addressing challenges such as market volatility and supply chain disruptions. To counter these challenges and enhance sales performance, some companies are exploring more flexible business models, such as subscription service. This paper employs the Event Study Methodology to examine the performance implications of NIO's implementation of a solitary model for subscription service on itself and its relevant stakeholders. Our results reveal this event adversely impacted NIO, its supply chain partners, and other stakeholders. The market value loss of NIO's stakeholders significantly exceeds that of NIO. This study also finds that competitors, especially those closely competing with NIO, experienced a greater impact. We then analyze the reasons behind the limited adoption of subscription

model and provide valuable insights for policymakers, businesses, and consumers to drive sustainable development and innovation in the EV industry.

Title: Mitigating the Risk of Flooding Caused by Sea Level Rise and Hurricane Storm Surge

Presenter: Foad Mahdavi Pajouh, Stevens Institute of Technology

Co-author(s): Donald Jenkins, Paul Kirshen, and Mahyar Eftekhari

Abstract:

Incomplete climate change knowledge presents decision-makers in coastal cities with challenges to protect their cities from flooding disasters. This study aims to mitigate the effects of flooding in a coastal area caused by sea level rise and storm surge through levees construction. The problem is modeled as a stochastic program that minimizes overall land elevation and expected flood costs over time and space for sampled probabilistic sea level rise scenarios. Using City of Boston as a case for this study, our proposed methodology resulted in more than 90% cost reduction compared to a "do nothing" strategy.

Title: Cold Storage Installation and E-commerce for Perishable Crops

Presenter: Zhuo Feng, Dalian University of Technology

Co-author(s): Shiliang Cui

Abstract:

Cold storage plays a pivotal role in enabling farmers to sell perishable crops on platforms. This paper studies the joint investment made by both farmers and platforms in cold storage installation. To this aim, we have first characterized farmers' selling decisions with and without cold storage. Then, we present conditions under which the participation of platforms, with the wholesale model, can improve supply chain performance by sharing the installation costs. Finally, we show that the local government should provide subsidies when both the installation cost and the total quantity to be sold fall within the medium range.

Title: Capacity Management for Battery Swap Stations Under Demand Charges

Presenter: Zimeng Li, Zhejiang University & City University of Hong Kong

Co-author(s): Zhankun Sun, Quan Yuan

Abstract:

Battery swap stations have revolutionized electric vehicle charging practice by replacing an empty battery with a fully-charged one. We propose a two-stage decision model to shed light on the joint optimization of charging operations and capacity investment for battery swap stations with the consideration of demand charges. We establish the existence of a monotone optimal charging policy and find that demand charges lead to higher initial charging levels, gradually decreasing over time. Additionally, we observe strategic complementarity between solar and battery capacities, except for high battery investments, where they unexpectedly become strategic substitutes.

Parallel Session (E21) - Behavioural Bias in Operations Management

Day 2: 6th Jan (Sat) 16:50-18:10 Venue: 2132B

Session Chair: Juan Li, Nanjing University

Title: Demand Forecast for Product Selection with Signals: An Experimental Study

Presenter: Juan Li, Renmin University

Co-author(s): Wanshan Zhu, Manqi Li

Abstract:

In live streaming e-commerce, selecting the right product to be live-streamed is a crucial decision that relies on available signals indicating the products' market popularity. However, human bias in interpreting these signals can lead to both overestimation and underestimation of product demand forecasts. This, in turn, can result in a product selection mistake, where a less profitable product is chosen for live-streaming. To address this issue, we first develop theory to characterize the necessary and sufficient conditions for signal

strength and quantity that contribute to product selection mistakes. By conducting experiments, we estimate the parameters of human bias and validate the conditions for such mistakes. The experiments validate our theoretical findings, showing that when faced with two products, human subjects may select a less profitable product due to either overestimation or underestimation. Specifically, these mistakes occur when one product has higher signal strength but lower signal quantity compared to the other, or vice versa.

Title: Beyond Home Delivery: An Empirical Examination of the Impact of Self-Pickup Stations on Online Shopping

Presenter: Chenxi Liao, The Chinese University of Hong Kong

Co-author(s): Jingcun Cao, Ying Xie

Abstract:

This study examines the impact of self-pickup stations on e-commerce, using transaction data from a leading Asian e-commerce platform. We found a positive correlation between the number of nearby self-pickup stations and customers' shopping frequency and weekly spending, including a spillover effect on home-delivery sales. Moreover, the effects varied based on customer experience and the COVID-19 pandemic. While experienced customers increased their spending and frequency, newer customers showed a decrease. These findings suggest that self-pickup stations can complement home delivery, but online shopping habits need to be nurtured in new customers to prevent a return to offline shopping.

Title: Behavioral Biases of Users in P2P Sharing and Its' Implications: An Experimental Study

Presenter: Yanan Song, University of Science and Technology Beijing

Co-author(s): Yaozhong Wu, Xiaobo Zhao

Abstract:

We build a decision model of users who participate in P2P sharing on a platform. The users

can choose whether to be an owner or renter. Their decisions will influence on the balance of supply and demand. The equilibrium of decisions and balance of supply and demand are both considered to predict the users' strategic decisions. The laboratory experiments were conducted to study the users' decision bias and analyse how the match of supply and demand is affected. The experiments reveal that users hold different attitude to payoff of being an owner and a renter. Based on the explorations of the experimental study, some managerial implications are proposed.

Title: Analysis of Return Behaviour in Live Streaming E-Commerce: From the Perspective of Projection Bias

Presenter: Juan Li, Nanjing University

Co-author(s): Yazhou Niu, Yunhui Huang, Xinping Wei

Abstract:

The return rate is a major challenge in the e-commerce industry, which not only affects sales performance, but also increases logistics costs and the risk of goods being lost. Previous studies have found that projection bias leads to consumers' excessive consumption of goods, but they have not yet explored what factors lead to projection bias in the context of online shopping. This study uses the online operation data of a women's clothing store to explore the phenomenon of consumer returns on e-commerce platforms based on the projection bias theory. We found significant correlations between natural factors (e.g., temperature, precipitation, cloud cover) and consumer behaviour factors (e.g., order time, purchase status, live streaming) and return behaviour. We also found the role of delayed delivery intervals in curbing behavioural bias. However, this effect varies across different buying scenarios, especially for low-priced goods and credit consumption patterns, where the effect is limited. This study suggests that merchants should try to avoid some factors that are likely to cause high return rates when carrying out online marketing, and control the return rate by delaying the delivery interval.

Parallel Session (E22) - Emerging Topics in Supply Chain Management III

Day 2: 6th Jan (Sat) 16:50-18:10 Venue: 2132C

Session Chair: Pin Gao, The Chinese University of Hong Kong, Shenzhen**Title: Kernel Multigrid: Accelerating Back-Fitting via Intrinsic Sparsity of Additive Gaussian Processes**

Presenter: Liang Ding, Fudan University

Co-author(s): Lu Zou

Abstract:

We prove a sparse formulation for Matérn additive Gaussian Processes, which establishes a connection between Gaussian Process regression (GPR) and sparse matrices. Leveraging this connection, we prove that Bayesian back-fitting requires at least $O(n \log n)$ iterations for convergence, where n is the size of data. Inspired by the algebraic multigrid in finite difference method, we modify back-fitting by applying a sparse GPR to the residual after each back-fit iteration. Theoretically, the proposed algorithm reduces the required number of iterations to $O(\log n)$ while computes each iteration in $O(n)$ time.

Title: Assortment Optimization with Consumer Search: Approximations and Applications

Presenter: Pin GAO, The Chinese University of Hong Kong, Shenzhen

Co-author(s): Guillermo Gallego, Zhen Wang

Abstract:

This paper examines a choice model building upon the seminal work of Weitzman(1979). We investigate the assortment optimization problem under three scenarios, differentiated by the retailer's ability to execute personalized strategies and her possession of accurate consumer-type information. Our analysis also reveals a significant by-product finding,

showing that under the independent attraction model, a retailer's optimal revenue is approximately monotone submodular with respect to the set of products eligible for recommendation. Exploiting this property, we put forth computationally feasible constant-factor approximations for several practical applications.

Title: Joint Resource Planning for Multiple Hospitals during an Epidemic

Presenter: Yan Zhu, University of Science and Technology of China

Co-author(s): Xiangtong Qi, Lindong Liu

Abstract:

This paper addresses a joint resource planning problem with multiple hospitals during an epidemic outbreak. With the onset of infectious disease and the surge in infectious patients requiring urgent care, hospitals face the challenge of meeting the increased demand for critical resources for accommodating infectious patients, especially the scarcity of intensive care units (ICUs). One potential solution to alleviate this strain is to convert certain resources like operating rooms (OR) and post-anesthesia care units (PACU) into supplementary ICUs. However, such conversion will inevitably disrupt scheduled elective surgeries, and the conversion efforts of a single hospital cannot adequately address the overall regional demand, thereby highlighting the imperative for a joint resource plan among hospitals. The main objective of this paper is to develop a joint resource plan that minimizes the impact on elective procedures while ensuring the availability of adequate resources for treating infectious patients. Initially, we analyze the trade-offs associated with OR and PACU conversions within a single hospital and among multiple hospitals. Additionally, we consider the stability of resource planning and the appropriate forecast horizon of resource planning when the distant demand forecasts are inaccurate.

Campus Map

The Hong Kong University of Science and Technology



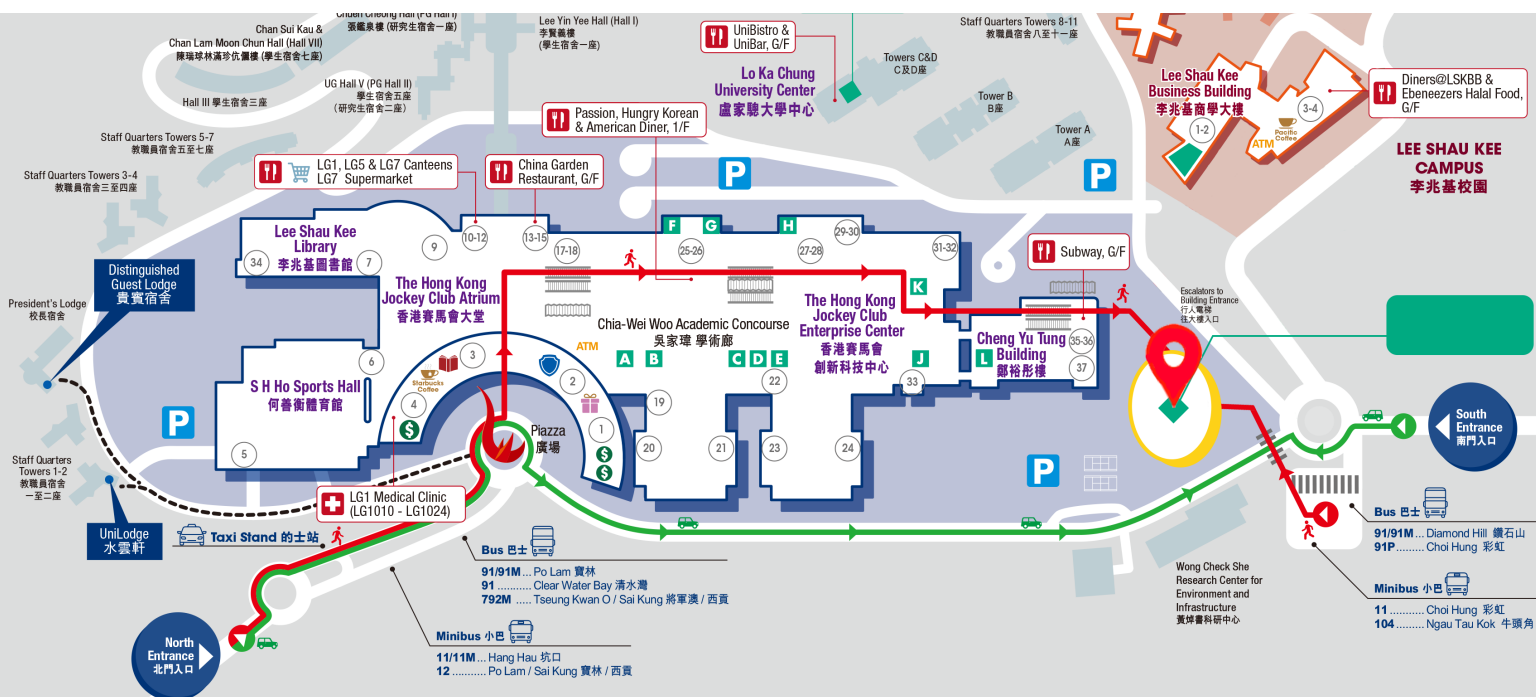
Conference Venue for Keynote Speech

HKUST Shaw Auditorium, Clear Water Bay, Hong Kong



The new Shaw Auditorium is home to HKUST's cultural activities and a new landmark for large scale events, providing new flexibilities and possibilities to create a vibrant arts and cultural scene at the University.

As a multi-purpose auditorium with a seating capacity of around 850 for concerts and over 1,300 in flat floor configurations, the venue can be used to host different kinds of events such as concerts, theater performances, lectures, exhibitions, and ceremonies. There are also supporting facilities offering space for seminars, rehearsals, small-scale performances, and gatherings both indoors and outdoors.

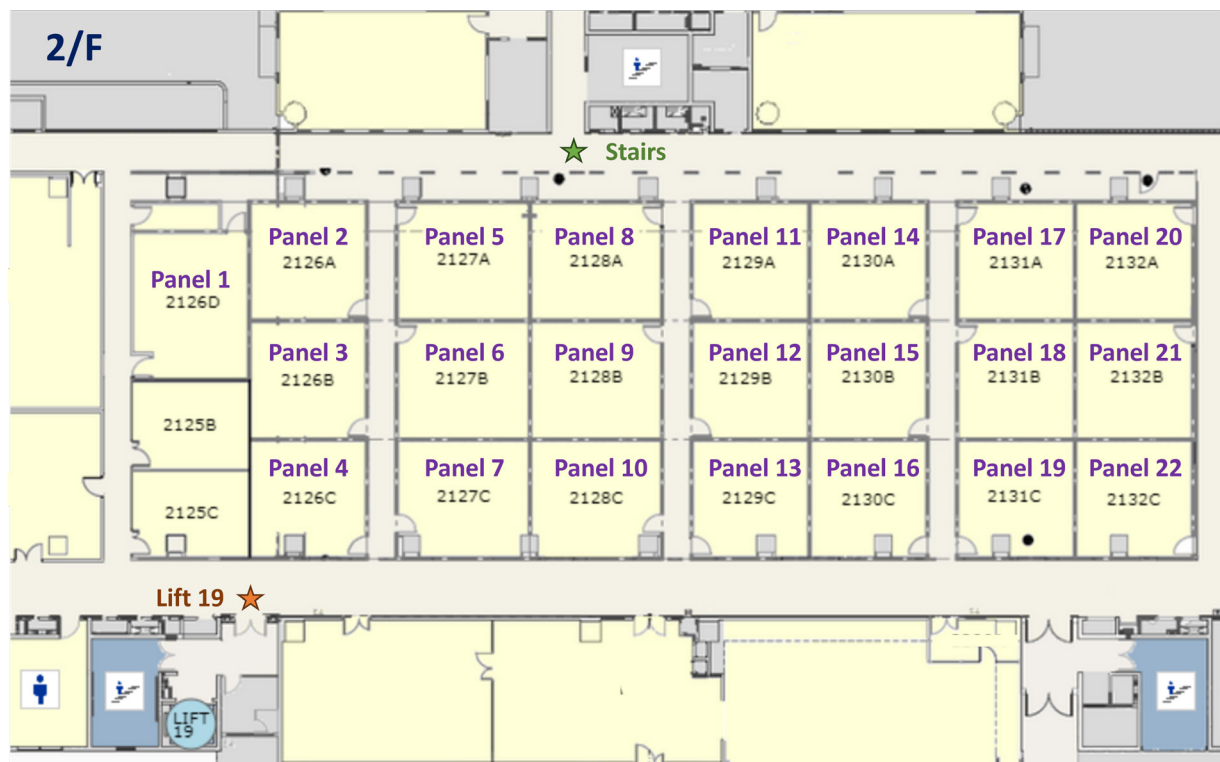


Campus Map for Parallel Sessions

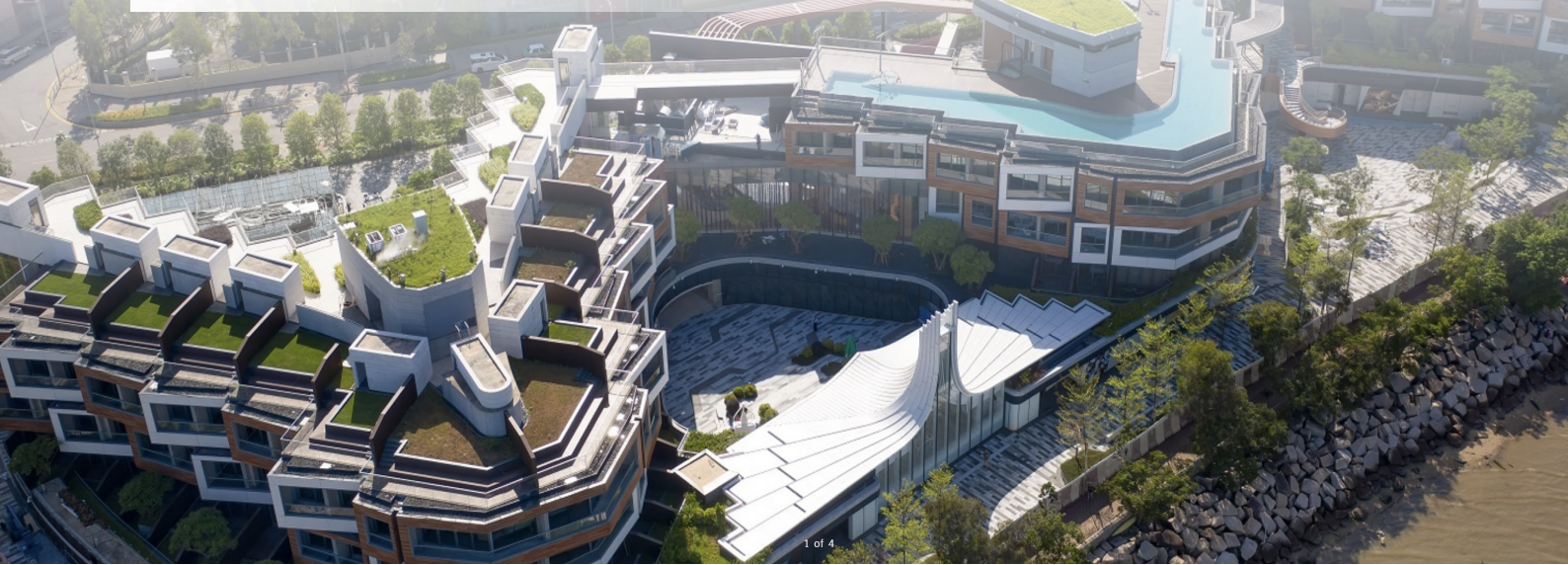
1/F Academic Concourse (venue for Best Student Paper Sessions and lift / stairs to Parallel Sessions)



2/F - Parallel Sessions (Rooms 2126A - 2132C)



The WM Hotel, Sai Kung



A TOUCH OF PARADISE MOMENTS FROM DOWNTOWN

Located in Sai Kung, the back garden of Hong Kong, WM Hotel sits amongst the expansive seascapes and rolling mountainous ranges treasured against the usual bustle of Hong Kong. A heartfelt welcome from WM Hotel, a tranquil and relaxing paradise, guests can reconnect with the lush abundance of nature and explore this unique and beautiful oasis through various hiking trails and beaches nearby.

Shuttle Buses Schedule

Shuttle buses to WM Hotel will depart from [HKUST Piazza](#) at 5:45pm, 5 January.

Shuttle buses from WM Hotel will depart outside the hotel at 9:45pm, 5 January, stopping at:

1. [HKUST Piazza](#)
2. [HKUST Conference Lodge](#)
3. [Crowne Plaza Hong Kong Kowloon East / Tseung Kwan O MTR Station](#)

Transportation Map







The Hong Kong University of Science and Technology

Known for its rigorous academic standards, HKUST attracts top students and faculty from around the world. The university is recognized for its vibrant and diverse community, with a student body representing more than 80 nationalities. The campus provides state-of-the-art facilities, fostering an environment conducive to learning, innovation, and research.









Public Transport to HKUST

South Bus Stop

Route	From	Via	To
 91M	* Po Lam	HKUST	* Diamond Hill
 91	Clear Water Bay	HKUST	* Diamond Hill
 11	* Hang Hau	HKUST	* Choi Hung
 11B	HKUST		* Choi Hung
 11S	Po Lam	HKUST	* Choi Hung
 104	HKUST	* Ng Tau Kok	HKUST

Public Transport to HKUST

North Bus Stop

Route	From	Via	To
 91M	* Diamond Hill	HKUST	* Po Lam
 91	* Diamond Hill	HKUST	Clear Water Bay
 792M	Sai Kung * Tseung Kwan O	HKUST	* Tseung Kwan O Sai Kung
 11	* Choi Hung	HKUST	* Hang Hau
 11M	* Hang Hau	HKUST	* Hang Hau
 12	Sai Kung	HKUST	* Po Lam

Campus Catering

Academic Building




Caterers on Campuis	Category	Location	Opening Hours
 China Garden	Table-serviced	G/F, Academic Building	11:30 - 22:00 (Sat) 10:30 - 22:00 (Sun) 11:30 - 22:00 (Weekdays)
 Can.teen II	Asian Food	LG1, Academic Building	07:30 - 21:00
 McDonald's	Western Food	LG5, Academic Building	07:00 - 24:00
 McCafe	Café & Bakery	LG5, Academic Building	07:00 - 24:00
 Asia Pacific Catering	Local Food	LG7 Kitchen 1, Academic Building	07:30 - 21:00 (Sat) 09:00 - 21:00 (Sun) 07:30 - 21:00 (Weekdays)
 Gold Rice Bowl	Japanese and South East Asian Food	LG7 Kitchen 2, Academic Building	11:00 - 21:00
 TT Veggie	Vegetarian Food	LG7 Kitchen 3, Academic Building	11:00 - 20:00 (Sat) Closed (Sun) 11:00 - 20:00 (Weekdays)
 Oliver's Super Sandwiches	Western Food	LG7 new extension, Academic Building	08:00 - 17:00 (Sat) Closed (Sun) 08:00 - 19:00 (Weekdays)

Campus Catering Cont.

Concourse

Caterers on Campuis	Category	Location	Opening Hours
 Passion	Western Food	Floor 1, Concourse, Academic Building	08:00 - 16:30 (Sat) Closed (Sun) 08:00 - 19:30 (Weekdays)
 Hungry Korean	Asian Food	Floor 1, Concourse, Academic Building	Closed (Sat) Closed (Sun) 10:30 - 19:00 (Weekdays)
 American Diner	Western Food	Floor 1, Concourse, Academic Building	08:00 - 17:00 (Sat) Closed (Sun) 08:00 - 20:00 (Weekdays)

Lee Shau Kee Business Building

 Diners @LSKBB	Local Food	G/F, Lee Shau Kee Business Building	07:30 - 17:00 (Sat) Closed (Sun) 07:30 - 17:00 (Weekdays)
 Pacific Coffee	Café & Bakery	G/F, Lee Shau Kee Business Building	08:00 - 17:00 (Sat) Closed (Sun) 08:00 - 18:30 (Weekday)
 Ebenezer's	Variety	G/F, Lee Shau Kee Business Building	10:00 - 20:00 (Sat) Closed (Sun) 10:00 - 20:00 (Weekdays)

Campus Catering Cont.

Others

Caterers on Campuis	Category	Location	Opening Hours
 HFT Life	Local Food	G/F, The Shaw Auditorium	08:00 - 19:00 (Sat) 08:00 - 19:00 (Sun) 07:30 - 19:00 (Weekdays)
 Starbucks	Café & Bakery	The Hong Kong Jockey Club Atrium	08:30 - 19:00 (Sat) 08:30 - 19:00 (Sun) 08:00 - 20:00 (Weekdays)
 Subway	Western Food	G/F, Cheng Yu Tung Building	09:00- 19:00 (Sat) Closed (Sun) 09:00- 19:00 (Weekdays)
 UniQue	Table-serviced	2/F, Li Dak Sum Yip Yio Chin Kenneth Li Conference Lodge	07:30 - 23:00
 UniBistro	Table-serviced	G/F, Lo Ka Chung University Center	12:00 - 21:00
 The UniBar	Japanese and South East Asian Food	LG7 Kitchen 2, Academic Building	11:00 - 21:00
 TT Veggie	Variety	G/F, Lo Ka Chung University Center	12:00 - 21:00
 Seafront Cafeteria	Local Food	G/F, Hall VI	Closed (Sat) 17:00 - 00:30 (Sun) 17:00 - 00:30 (Weekdays)

Wi-Fi Connection Information

Wifi SSID: eduroam

Wifi Username: pomshk24@ust.hk

Wifi Password: 2024Conference

EDUROAM WI-FI SERVICE CONFIGURATION GUIDES



pomshk2024.hkust.edu.hk