

The Hong Kong University of Science and Technology  
Dept of Information Systems, Business Statistics and Operations Management  
Dept of Industrial Engineering & Decision Analytics  
Joint Seminar Announcement



**Transfer Learning, Cross Learning and  
Co-Learning Across Newsvendor Systems  
with Operational Data Analytics (ODA)**

by

**Prof. Lei LI**

**The Hong Kong Polytechnic University**

**Date** : **13 December 2024 (Friday)**  
**Time** : **10:30 – 11:45 AM**  
**Venue** : **Classroom 1014, LSK Business Building**

**Abstract:** Decision making with limited statistical characterization and limited data is challenging. The typical statistical-machine-learning approaches would call for migrating the experience of a related system with ample data through transfer learning or leveraging the similarity of multiple systems with limited data through data pooling. We, instead, develop new solution concepts to learn across related systems by adapting the parametric Operational Data Analytics (ODA) framework, which is known to produce uniformly optimal data-integrated decisions in the corresponding parametric settings, for non-parametric decision making. We demonstrate, through the application of newsvendor systems, that transfer learning can, indeed, improve decision performance in the focal system by utilizing a model pre-trained using the ample data in a related system. However, in the lens of the ODA framework, the best transfer-learning decision falls in a subclass of operational statistics, limiting the ultimate optimality. In contrast, the ODA cross-learning approach utilizes the ample data from the related system to mimic the stochastic environment of the focal system. When the data from the old system are sufficiently large, the cross-learning solutions derived outperforms any transfer learning solution, and they are shown to asymptotically approach the parametric ODA solutions. When there are multiple related systems with limited data, we aggregate the data from different systems to create a generic stochastic environment for the decision-making problem, which facilitates the implementation of the parametric ODA solutions. We show that the derived co-learning solutions are asymptotically optimal for the aggregate system and for each sub-system. This approach outperforms the existing data-pooling techniques in the sense that the latter focuses only on the aggregated performance, and the chosen solution may be (asymptotically) suboptimal for individual sub-systems. 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. Though we demonstrate our development through the application of newsvendor systems, the solutions developed in this study applies to a much wider class of operational decision-making problems that exhibit certain homogenous properties.

**Bio:** Lei Li is an Assistant Professor in the Department of Logistics and Maritime Studies at The Hong Kong Polytechnic University. He received a Ph.D. degree from Purdue University in 2023, a B.S. degree and a M.S. degree in Management from Zhejiang University, in 2015 and 2017, respectively. His research interests include stochastic modeling, data-integrated decision making, supply chain management, and not-for-profit operations. His research papers have been published in Management Science, Production and Operations Management.

All interested are welcome!  
Enquiries: Dept of ISOM