

Tuesday, December 14, 2021 | 9:00AM (remote)



Zuo-Jun Max Shen

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“A Practical End-to-End Inventory Management Model with Deep Learning”

Abstract: We investigate a data-driven multi-period inventory replenishment problem with uncertain demand and vendor lead time (VLT), with accessibility to a large quantity of historical data. Different from the traditional two-step predict-then-optimize (PTO) solution framework, we propose a one-step end-to-end (E2E) framework that uses deep-learning models to output the suggested replenishment amount directly from input features without any intermediate step. The E2E model is trained to capture the behavior of the optimal dynamic programming solution under historical observations, without any prior assumptions on the distributions of the demand and the VLT. By conducting a series of thorough numerical experiments using real data from one of the leading e-commerce companies, we demonstrate the advantages of the proposed E2E model over conventional PTO frameworks. We also conduct a field experiment with JD.com and the results show that our new algorithm reduces holding cost, stockout cost, total inventory cost and turnover rate substantially compared to JD's current practice. For the supply-chain management industry, our E2E model shortens the decision process and provides an automatic inventory management solution with the possibility to generalize and scale. The concept of E2E, which uses the input information directly for the ultimate goal, can also be useful in practice for other supply-chain management circumstances.

Biosketch: Zuo-Jun Max Shen is the Vice-President and Pro-Vice-Chancellor (Research) and the Chair Professor in Logistics and Supply Chain Management at the University of Hong Kong. He is on leave from the University of California, Berkeley, where he is a Chancellor's Professor in the Department of Industrial Engineering and Operations Research and the Department of Civil and Environmental Engineering. He received his Ph.D. from the Department of Industrial Engineering and Management Sciences at Northwestern University. He has been active in the following research areas: integrated supply chain design and management, operations management, data driven optimization algorithms and applications, energy systems, and transportation system planning and optimization. Max has extensive research collaborations with government agencies as well as private companies (both US and international). He is currently the Chief Supply Chain Scientist for JD.com. Max is serving as the president-elect for the Production and Operations Management Society, a Department Editor for Production and Operations Management, and Associate Editors for leading journals such as Operations Research, Management Science, Manufacturing & Service Operations Management, Decision Sciences, Naval Research Logistics, and IISE Transactions. Max received the CAREER award from National Science Foundation, the Franz Edelman Laureate Award from INFORMS, won several best paper awards, and was elected Fellow of INFORMS in 2018.