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Multi-location Inventory Management under Time-varying Demands: A Deep Reinforcement Learning Approach

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Abstract

We study the multi-location inventory management problem where orders are to be placed at each of multiple locations and inventory can be transshipped between locations. Orders placed arrive after a certain lead time, whereas transshipments are completed instantly. In this setting, transshipments can help to prevent stockouts that arise due to unexpectedly high demand, as excess demand at one location can be met by transshipping excess inventory from another location. The objective is to minimize the total cost, which consists of inventory costs, ordering costs and transshipment costs. Demand at each location is time-varying and possibly correlated, and the demand forecast is used by the central planner to make the ordering and transshipment decisions. We model the inventory problem as a Markov decision process and apply deep reinforcement learning (DRL) to it. We show that the DRL solution performs well and is robust to forecast error.

Keywords
Inventory, multi-location, transshipment, deep reinforcement learning

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Biography
Jinsheng Chen is a Research Scientist at the Advanced Remanufacturing and Technology Centre (ARTC), Agency for Science, Technology and Research (A*STAR) in Singapore. He holds a Bachelor of Arts degree in Mathematics from the University of Cambridge and a Master of Science and PhD in Operations Research from Columbia University. His research focuses on making good decisions under certainty and uses a variety of methodologies such as optimal control, stochastic models, queueing theory, and reinforcement learning. He is interested in applications to domains such as manufacturing, healthcare, and supply chain management. He has published several journal articles on his research and has also given many talks at relevant conferences.