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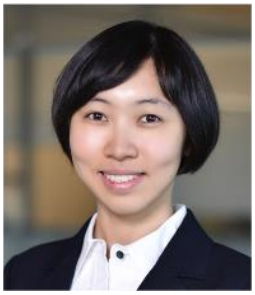

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"Predicting Human Discretion to Adjust Algorithmic Prescription: A Large-Scale Field Experiment in Warehouse Operations"

Abstract: Conventional optimization algorithms that prescribe order packing instructions (which items to pack in which sequence in which box) focus on box volume utilization yet tend to overlook human behavioral deviations. We observe that packing workers at the warehouses of Alibaba Group deviate from algorithmic prescriptions for 5.8% of packages, and these deviations increase packing time and reduce operational efficiency. We posit two mechanisms and demonstrate that they result in two types of deviations: (1) information deviations stem from workers having more information and in turn better solutions than the algorithm; and (2) complexity deviations result from workers' aversion, inability or discretion to precisely implement algorithmic prescriptions. We propose a new "human-centric bin packing algorithm" that anticipates and incorporates human deviations to reduce deviations and improve performance. It predicts when workers are more likely to switch to larger boxes using machine learning techniques and then pro-actively adjusts the algorithmic prescriptions of those "targeted packages." We conducted a large-scale randomized field experiment with the Alibaba Group. Orders were randomly assigned to either the new algorithm (treatment group) or Alibaba's original algorithm (control group). Our field experiment results show that our new algorithm lowers the rate of switching to larger boxes from 29.5% to 23.8% for targeted packages and reduces the average packing time of targeted packages by 4.5%. This idea of incorporating human deviations to improve optimization algorithms could also be generalized to other processes in logistics and operations.

Biosketch: Jiankun Sun is an Assistant Professor of Operations Management at Imperial College Business School, Imperial College London. Her research interest is in digital platform operations, especially how digitalization and artificial intelligence reshapes operations in an organization and impacts consumer behavior. She applies both data analytics and theoretical modeling techniques to study practical problems in digital platform operations. Jiankun Sun obtained her Ph.D. in Operations Management from Kellogg School of Management, Northwestern University, and her B.E. in Industrial Engineering from Tsinghua University.