Crowdsourcing Last-Mile Deliveries

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Abstract: Because of the emergence and development of e-commerce, customers demand faster and cheaper delivery services. However, many retailers find it challenging to efficiently provide fast and on-time delivery services to their customers. Amazon and Walmart are among the retailers that are relying on independent crowd drivers to cope with on-demand delivery expectations. We propose a novel robust crowdsourcing optimization model to study labor planning and pricing for crowdsourced last-mile delivery systems that are utilized for satisfying on-demand orders with guaranteed delivery time windows. We develop our model by combining crowdsourcing, robust queueing, and robust routing theories. We show the value of the robust optimization approach by analytically studying how to provide fast and guaranteed delivery services utilizing independent crowd drivers under uncertainties in customer demands, crowd availability, service times, and traffic patterns; we also allow for trend and seasonality in these uncertainties. For a given delivery time window and an on-time delivery guarantee level, our model allows us to analytically derive the optimal delivery assignments to available independent crowd drivers and their optimal hourly wage. Our results show that crowdsourcing can help firms decrease their delivery costs significantly while keeping the promise of on- time delivery to their customers.

Bio: Michael Wagner is an Associate Professor of Operations Management and a Neal and Jan Dempsey Endowed Faculty Fellow at the Foster School of Business, University of Washington. He is also an Amazon Scholar, working on improving fast last-mile deliveries at Amazon. His Ph.D. is in Operations Research from MIT. His research interests include crowdsourcing, robust optimization, machine learning, and reinforcement learning.