

# Transportation Optimization: Data-enabled Advances in a Sharing Economy

Chiwei Yan, PhD

Data Scientist  
Uber Technologies INC.  
San Francisco, CA

**Abstract:** The transportation and logistics industries are undergoing a round of revolutionary innovation. This innovation is fueled by two key drivers: (1) the growing availability of data, and (2) new operational paradigms in a sharing economy. This talk focuses on showcasing how new models, enabled by the prevalence of data, can lead to significant value in operational decision-making. We begin by presenting our research that shows how trip data in bike-sharing systems can be mined to infer rider substitution behaviors when there are bike or dock shortages. Based on a non-parametric ranking-based choice model, we propose efficient enumeration procedures and first-order methods to solve the large-scale estimation problem by exploiting problem structure. We prove consistency results of our method. We then demonstrate, with Boston Hubway data, that ridership can be significantly improved through effective inventory allocation operations with better demand modeling. Next, we describe a recent work in which we propose a new car-pooling mechanism in ride-hailing, called dynamic waiting which varies rider waiting before dispatch. The goal is to limit price volatility in ride-hailing services by reducing the role of surge pricing. We describe a steady-state model depicting the long-run average performance of a ride-hailing service, and characterize the system equilibrium. Calibrating the model using Uber data, we reveal insights on welfare-maximizing pricing and waiting strategies. We show that, with dynamic waiting, price can be lowered, its variability is mitigated and total welfare is increased.

**Bio:** Chiwei Yan received his PhD from the Operations Research Center at MIT in 2017. His current research interest is in transportation and logistics, with a focus on data-driven optimization and emerging problems in a sharing economy. He is a recipient of the Best Dissertation Award Honorable Mention and the Outstanding Paper Award in Air Transportation from INFORMS Transportation Science and Logistics Society, the Best Dissertation Award from INFORMS Aviation Application Section, the AGIFORS Anna Valicek Award, and the UPS Doctoral Fellowship, among others. His research involves collaborations with both the private and public sectors, including the Federal Aviation Administration, Sabre Airline Solutions, Boston Hubway Bikes and Uber. Before coming to MIT, he obtained the Bachelor of Science in Industrial Engineering from Tsinghua University. Currently, Dr. Yan is a data scientist in the marketplace optimization group at Uber, leading the design and implementation of the latest rider surge pricing algorithm which balances supply and demand in real time across 600+ global markets.