School of Data Science
香港城市大學
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Online Seminar

Pickup Opportunity as Resource: Demand-Aware Ride-Sharing Optimization

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Date: 29 April 2020 (Wed)

Time: 11-12pm

Link:

https://cityu.zoom.us/meeting/register/tJYtd-2qpjloHtxQo8S8ioPr3vixV7Jaa6RI

All CityU staff and students are welcome

ABSTRACT

Ride-sharing is a modern urban-mobility paradigm with tremendous potential in reducing congestion and pollution. Demand-aware design is a promising avenue for addressing a critical challenge in ride-sharing systems, namely joint optimization of request-vehicle assignment and routing for a fleet of vehicles. In this work, we develop a probabilistic demand-aware framework to tackle the challenge. We focus on maximizing the expected number of passenger pickups, given the probability distributions of future demands. The key idea of our approach is to assign requests to vehicles in a probabilistic manner. It differentiates our work from existing ones and allows us to explore a richer design space to tackle the request-vehicle assignment puzzle with a performance guarantee but still keeping the final solution practically implementable. The optimization problem is non-convex, combinatorial, and NP-hard in nature. As a key contribution, we explore the problem structure and propose an approximation of the objective function to develop a dual-subgradient heuristic. We characterize a condition under which the heuristic generates a (1 – 1/e) approximation solution. The solution is simple and scalable, amendable for practical implementation. Simulation results based on real-world traces in Manhattan show that our demand-aware solution improves the passenger pickups by up to 46%, as compared to a conventional demand-oblivious scheme. The results also show that joint optimization at the fleet level leads to 19% more pickups than that by separate optimizations at individual vehicles.

BIOGRAPHY

Minghua Chen received his B.Eng. and M.S. degrees from the Department of Electronic Engineering at Tsinghua University. He received his Ph.D. degree from the Department of Electrical Engineering and Computer Sciences, University of California Berkeley. He is currently a Professor in the School of Data Science, City University of Hong Kong. He received the Eli Jury award from UC Berkeley in 2007 (presented to a graduate student or recent alumnus for outstanding achievement in the area of Systems, Communications, Control, or Signal Processing) and The Chinese University of Hong Kong Young Researcher Award in 2013. He also received several best paper awards, including IEEE ICME Best Paper Award in 2009, IEEE Transactions on Multimedia Prize Paper Award in 2009, and ACM Multimedia Best Paper Award in 2012. He serves as TPC Co-Chair, General Chair, and Steering Committee Chair of ACM e-Energy in 2016, 2017, and 2018 - present, respectively. He is currently TPC Co-Chair for ACM MobiHoc 2020. He also serves as Associate Editor of IEEE/ACM Transactions on Networking in 2014 - 2018. His recent research interests include online optimization and algorithms, energy systems (e.g., smart power grids and energy-efficient data centers), intelligent transportation systems, distributed optimization, delay-constrained network coding, and capitalizing the benefit of data-driven prediction in the algorithm/system design.

This is joint work with Qiulin LIN and Wenjie XU from CUHK and Xiaojun LIN from Purdue University.