

Han Qiu

CONTACT INFORMATION

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WORKING EXPERIENCE

Ride-Hailing Business Unit, Meituan, Beijing, China

Algorithm Engineer

May, 2018 - present

Includes a variety of projects on ride-hailing operations.

- **Driver Behavior Modeling & Operation Strategy Design:**

- **Driver Portrait System:** applied supervised learning and self-supervised learning methods to mine useful patterns and obtain succinct representations of drivers from historical behavior data, which were used to support driver stratification, driver matching and budget design tasks. This system currently supports 200+ queries per day.
- **Optimization of Incentive Scheme Design:** applied machine learning and causal inference methods to model drivers' behavior under incentives, and designed optimal incentive schemes with linear programming and robust optimization methods. A/B tests showed that, compared to the baseline, this strategy increases ROI 30%+.
- **Optimization of Driver Recruitment Ads:** applied machine learning and causal inference methods to model a user's transition probability to a driver and estimate the uplifts in recruitment from different ads channels and reach channels. A/B tests showed that, compared to the baseline, this strategy increases CTR and recruitment 20%+.
- **Optimization of Dispatch Offer Design:** applied machine learning and reinforcement learning methods to evaluate spatio-temporal supply distributions and predict drivers' dispatch acceptance rates, and used linear programming methods to find optimal dispatch schemes. A/B tests showed that, compared to blank strategy, this strategy increases ride order satisfaction rate 1pp+.

- **Macroscopic Modeling & Decision Support:**

- **Optimization of Budget Allocation:** applied Gaussian Process Regression to estimate the return on investment curves of different budget units, and formulated robust linear programs to solve for optimal budget allocation plans under uncertainty.
- **Modeling of Relationship among Supply, Demand, and Matching Efficiency:** based on existing works in literature, proposed a model of macroscopic matching equilibriums and validated its accuracy with real-world data (MAPE \leq 5%). This model has been used as a building block in various pricing decision tools.

- **Analysis Tool Development:**

- **Simulation System:** developed a multi-agent simulation system for the ride-hailing business, and used this system to evaluate and design matching strategies.
- **Geospatial Analysis Tool:** developed a Python package for the conversion between road network representation and hexagonal representation of spatial statistics and the visualization of spatial statistics.
- **Experimental Design & Analysis Tool:** implemented several matching-based experiment group design methods to improve statistical power; developed a bootstrapping-based significance testing tool for experimental result analysis.

Shared Mobility Research Lab, Shanghai International Automobile City, Shanghai, China

Research Intern

September, 2017 - May, 2018

Includes several projects on the inference and prediction of traveler behavior in a carsharing business.

- Constructed and estimated a structural model of traveler coupon redemption behavior, with a focus on travelers' perceptions of future coupon redemption utilities and their awareness of

available coupons

- Developed a long short-term memory (LSTM) network to estimate the impacts of users' negative comments on their trip frequencies in the future
- Developed deep learning models for personalized demand forecasting

Shanghai Yuan Lan (Evolution Labs) Information Technology Co., Ltd, Shanghai, China

Research Intern

December, 2017 - May, 2018

Implemented state-of-the-art reinforcement learning algorithms, including PPO, DDPG, and DQN, for alpha mining and trading signal discovery in Chinese commodity markets. Developed several reward shaping schemes to further improve learning efficiencies.

Dublin Research Lab, International Business Machines (IBM) Corporation, Dublin, Ireland

Research Intern

June, 2017 - September, 2017

Developed a time-series embedding algorithm for fast top- k correlation searches in time-series databases, with a focus on deep neural network structures including recurrent neural networks (RNN) and autoencoders (AE).

RESEARCH
INTERESTS

- Human Decision Behavior Modeling
- Decision-Making Methodology & Optimization, including: Integer Programming & Combinatorial Optimization; Dynamic Programming & Reinforcement Learning; Algorithmic Game Theory
- Modeling and Mechanism Design in Urban Systems

PUBLICATIONS

Qiu, H., & Dai, X. (2021). Pricing and Matching Optimization of On-demand Mobility Services for Multi-locational Curbside Stopping Activities. *Available at SSRN 3892551*.

Dai, X., **Qiu, H.**, & Sun, L. (2021). A Data-Efficient Approach for Evacuation Demand Generation and Dissipation Prediction in Urban Rail Transit System. *Sustainability, 13(17), 9692*.

Dai, X., Sun, L., & **Qiu, H.** (2021). Evacuation Demand Prediction under Metro Rail Disruptions Based on Normal Historical Data *Transportation Research Board 2021 Annual Meeting (No. 21-04263)*.

Qiu, H., Dai, X., & Chen, J. (2020). A Macroscopic Analysis of Curbside Stopping Activities of On-demand Mobility Service. *2020 IEEE Intelligent Transportation Systems Conference (ITSC)*.

Qiu, H. (2018). An Inattention Model for Traveler Behavior with e-Coupons. *Available at SSRN 3305753*.

Qiu, H., Lam, H. T., Fusco, F., & Sinn, M. (2018). Learning Correlation Space for Time Series. *arXiv preprint arXiv:1802.03628*.

Qiu, H., Li, R., & Zhao, J. (2018). Dynamic pricing in shared mobility on demand service. *arXiv preprint arXiv:1802.03559*.

Qiu, H., Li, R., & Zhao, J. (2018). Daily Level Dynamic Pricing in Shared Mobility on Demand Service. *Transportation Research Board 2018 Annual Meeting (No. 18-00723)*.

Qiu, H., Li, R., & Liu, H. (2016). Integrated model for traffic flow forecasting under rainy conditions. *Journal of Advanced Transportation*.

WORKING PAPERS Zhang, H., Guo, X., **Qiu, H.**, Renda, M. E., & Zhao, J. Mobility Sharing with Time Flexibility.

ACADEMIC
EXPERIENCE

Massachusetts Institute of Technology, Cambridge, MA, USA

Graduate Student

September, 2015 - June, 2017

Includes master-level coursework and research projects, with a focus on discrete-choice-based estimation and optimization.

- Dynamic pricing in shared mobility-on-demand services: applied a single-period optimal pricing algorithm and evolution strategy (ES) methods to solve for near-optimal pricing strategies in a multi-period utility-maximization problem, under the assumption that the traveler choice behavior follows the multinomial logit choice model
- Assortment optimization under logit mixture models: developed heuristics to find the operator's profit-maximizing route choice set under the assumption that the traveler choice behavior follows the logit mixture model

Research Assistant

Intelligent transportation systems (ITS) Lab

September, 2015 - June, 2016

Participated in the development of simulation systems for the Flexible Mobility on Demand (FMOD) and the SimMobility projects.

Teaching Assistant

15.093 Optimization Methods

September, 2016 - January, 2017

Graded assignments and exams, and answered students' questions during office hours.

Tsinghua University, Beijing, China

Research Assistant

January, 2014 - July, 2015

Includes several research projects in the fields of transportation and operation research.

- Assortment problem under d -level nested logit models: designed both a fully polynomial-time approximation scheme (FPTAS) and an efficient heuristic to solve the assortment problem under certain regularity conditions on dissimilarity parameters and preference weights
- Traffic flow forecasting under rainy conditions: applied linear regressions to correct the effects of precipitations and improved the forecasting accuracy under rainy scenarios

PROFESSIONAL
EXPERIENCE

Reviewer, Transportation Research Board Annual Meetings.

EDUCATION

Massachusetts Institute of Technology, Cambridge, MA, USA

M.S., Transportation, June, 2017

Tsinghua University, Beijing, China

B.E., Civil Engineering, June, 2015

B.S., Pure and Applied Mathematics, June, 2015

COMPUTER SKILLS

- Machine Learning Framework: TensorFlow, PyTorch, XGBoost.
- Optimization Software: Gurobi, CLP/CBC, CSDP.
- Programming Languages: Python, C++, julia.
- General Purpose Applications: \LaTeX , Git.