

Executive Summary

I am currently a research scientist at Lyft, working on real-time driver incentive design. I obtained my Transportation Ph.D. degree at MIT in 2022 and my dual Master's degree in Transportation and Computer Science at MIT in 2020. Before joining MIT, I obtained my dual Bachelor's degree in Civil Engineering and Management from Tsinghua University. My research focuses on the **resilience of transportation systems with a specific application in public transit (PT), including 1) network performance and passenger behavior monitoring, 2) incident-aware PT control strategy design, and 3) interactions between PT and other transportation modes**. My work utilizes various mathematical techniques including optimization (robust/integer/non-linear), probability and statistics, machine learning (deep/reinforcement learning), econometrics, and game theory. I have published **20** peer-reviewed scientific papers (**16** first-authored) in leading transportation journals (TR-A, B, C, E, IEEE ITS, TS, etc.) and was awarded the 2021 MIT UPS Ph.D. Fellowship (top Ph.D. student in transportation/logistics, applicants also from computer science and operations research fields). During my master's study, I developed a self-calibrated network performance model for Hong Kong Mass Rail Transit (MTR), which MTR is using for daily service monitoring. I proposed a path recommendation model that can reduce the delay of passengers in the transit system of the Chicago Transit Authority (CTA) by 20%. During my internship at Lyft, I proposed a new vehicle routing algorithm for bike and scooter rebalancing and battery swap. The algorithm improves operation efficiency and save 1.6 million costs per year, which has been implemented in production. My current work at Lyft focuses on real-time driver incentive design. The algorithm I proposed helps to save 25 million costs per year (validated by A/B test) and has been implemented in the production.

Education

2018–2022 **Massachusetts Institute of Technology**, Cambridge, MA

- PhD in Transportation (finish in four years)
- GPA: **5.0/5.0**; Complete 15 registered courses in the fields of transportation, computer science, optimization, probability and statistics, and economics. Obtain 6 A+.
- Advisors: Jinhua Zhao, Haris N. Koutsopoulos
- Committee members: Jinhua Zhao, Haris N. Koutsopoulos, Zuo-Jun Max Shen, Cathy Wu

2018–2020 **Massachusetts Institute of Technology**, Cambridge, MA

- Master of Science in Transportation
- Master of Science in Electrical Engineering and Computer Science (EECS)
- GPA: **5.0/5.0**
- Advisors: Jinhua Zhao, Haris N. Koutsopoulos,
- EECS Thesis reader: Patrick Jaillet

2014–2018 **Tsinghua University**, Beijing, China

- Bachelor of Civil Engineering
- Bachelor of Management (Dual degree)
- GPA: **93/100**; Rank: **1/105**
- Advisor: Ruimin Li
- *summa cum laude* (top 1%); Tsinghua Presidential Scholarship (a.k.a. Te Jiang); Valedictorian of the School of Civil and Hydraulic Engineering

Journal Publications







[\[Google Scholar\]](#) ; [\[Research Gate\]](#)

* means corresponding author. † means contributing equally

[J20] 2023 **Modeling Virus Transmission Risks in Commuting with Emerging Mobility Services: A Case Study of COVID-19**

[Baichuan Mo](#)^{*}, Peyman Noursalehi, Haris N. Koutsopoulos, Jinhua Zhao
Travel Behavior and Society, Forthcoming, 2023

- [J19] 2023 **Predicting Driver's Trajectory in the Last-Mile Delivery Using A Pair-wise Attention-Based Pointer Neural Network** 
Baichuan Mo, Qing Yi Wang*, Xiaotong Guo, Matthias Winkenbach, Jinhua Zhao
Transportation Research Part E, 2023, 175, 103168
- [J18] 2023 **Ex Post Path Choice Estimation for Urban Rail Systems Using Smart Card Data: An Aggregated Time-Space Hypernetwork Approach** 
Baichuan Mo, Zhenliang Ma*, Haris N. Koutsopoulos, Jinhua Zhao
Transportation Science, 2023, 57 (2), 313-335
- [J17] 2023 **Robust Path Recommendations During Public Transit Disruptions Under Demand Uncertainty** 
Baichuan Mo*, Haris N. Koutsopoulos, Max Zuo-Jun Shen, Jinhua Zhao
Transportation Research Part B: Methodological, 2023, 169, 82-107
- [J16] 2023 **Proof of Travel for Trust-Based Data Validation in V2I Communication** 
Dajiang Suo*, Baichuan Mo, Jinhua Zhao, Sanjay E. Sarma
IEEE Internet of Things Journal, 2023, 10 (11), 9565-9584
- [J15] 2022 **Impact of Unplanned Long-term Service Disruptions on Urban Public Transit Systems** 
Baichuan Mo*, Max Y von Franque, Haris N. Koutsopoulos, John Attanucci, Jinhua Zhao
IEEE Open Journal of Intelligent Transportation Systems, 2022, 3, 551-569
- [J14] 2022 **Individual Mobility Prediction in Mass Transit Systems Using Smart Card Data: An Interpretable Activity-based Hidden Markov Approach** 
Baichuan Mo, Zhan Zhao*, Haris N. Koutsopoulos, Jinhua Zhao
IEEE Transactions on Intelligent Transportation Systems, 2022, 23 (8), 12014-12026
- [J13] 2022 **Alleviating Data Sparsity Problems in Estimated Time of Arrival via Auxiliary Metric Learning** 
Yiwen Sun, Wenzheng Hu, Donghua Zhou, Baichuan Mo, Kun Fu, Zhengping Che, Zheng Wang, Shenhao Wang, Jinhua Zhao, Jieping Ye, Jian Tang, Changshui Zhang*
IEEE Transactions on Intelligent Transportation Systems, 2022, 23 (12), 23231-23243
- [J12] 2022 **Inferring Passenger Response to Urban Rail Disruptions Using Smart Card Data: A Probabilistic Framework** 
Baichuan Mo*, Haris N. Koutsopoulos, Jinhua Zhao
Transportation Research Part E: Logistics and Transportation Review, 2022, 159, 102628
- [J11] 2021 **Impacts of Subjective Evaluations and Inertia from Existing Travel Modes on Adoption of Autonomous Mobility-on-Demand** 
Baichuan Mo, Qing Yi Wang, Joanna Moody*, Yu Shen, Jinhua Zhao
Transportation Research Part C: Emerging Technologies, 2021, 130, 103281
- [J10] 2021 **Impact of Pricing Policy Change on On-street Parking Demand and User Satisfaction: A Case Study in Nanning, China** 
Baichuan Mo, Hui Kong, Hao Wang, Xiaokun (Cara) Wang, Ruimin Li*
Transportation Research Part A: Policy and Practice, 2021, 148, 445-469
- [J9] 2021 **Theory-based Deep Residual Neural Networks: A Synergy of Decision-Making Theories and Deep Neural Networks** 
Shenhao Wang*, Baichuan Mo, Jinhua Zhao
Transportation Research Part B: Methodological, 2021, 146, 333-358
- [J8] 2021 **Competition between Shared Autonomous Vehicles and Public Transit: A Case Study in Singapore** 
Baichuan Mo, Zhejiang Cao, Hongmou Zhang, Yu Shen, Jinhua Zhao*
Transportation Research Part C: Emerging Technologies, 2021, 127, 103058
- [J7] 2021 **Calibrating Path Choices and Train Capacities for Urban Rail Transit Simulation Models Using Smart Card and Train Movement Data** 
Baichuan Mo, Zhenliang Ma*, Haris N. Koutsopoulos, Jinhua Zhao
Journal of Advanced Transportation, 2021, 5597130

- [J6] 2021 **Modeling Epidemic Spreading through Public Transit Using Time-Varying Encounter Network** 
 Baichuan Mo[†], Kairui Feng[†], Yu Shen*, Clarence Tam, Daqing Li, Yafeng Yin, Jinhua Zhao
Transportation Research Part C: Emerging Technologies, 2021, 122, 102893
- [J5] 2020 **Capacity-Constrained Network Performance Model for Urban Rail Systems** 
 Baichuan Mo, Zhenliang Ma*, Haris N. Koutsopoulos, Jinhua Zhao
Transportation Research Record, 2020, 2674 (5), 59-69
- [J4] 2020 **Deep Neural Networks for Choice Analysis: Architecture Design with Alternative-Specific Utility Functions** 
 Shenhao Wang, Baichuan Mo, Jinhua Zhao*
Transportation Research Part C: Emerging Technologies, 2020, 112, 234-251
- [J3] 2020 **Estimating Dynamic Origin-Destination Demand: A Hybrid Framework Using License Plate Recognition Data** 
 Baichuan Mo, Ruimin Li*, Jingchen Dai
Computer-Aided Civil and Infrastructure Engineering, 2020, 35, 734-752
- [J2] 2018 **Impact of Built Environment on First- and Last-Mile Travel Mode Choice** 
 Baichuan Mo, Yu Shen*, Jinhua Zhao
Transportation Research Record, 2018, 2672 (6), 40-51
- [J1] 2017 **Speed Profile Estimation Using License Plate Recognition Data** 
 Baichuan Mo, Ruimin Li*, Xianyuan Zhan
Transportation Research Part C: Emerging Technologies, 2017, 82, 358-378

Conference Proceedings

- [C9] 2023 **Individual Longitudinal Adoption Pattern Analysis under Fare Incentives Using Smart Card Data**
 Leizhen Wang, Zhenliang Ma*, Pengfei Zhang, Xin Chen, Baichuan Mo, Peibo Duan
Transportation Research Board 102th Annual Meeting (TRB, Oral presentation)
- [C8] 2022 **Robust Path Recommendations During Public Transit Disruptions Under Demand Uncertainty**
 Baichuan Mo*, Haris N. Koutsopoulos, Jinhua Zhao
Transportation Research Board 101th Annual Meeting (TRB, Poster presentation)
- [C7] 2021 **Impact of Unplanned Rail Disruption on Urban Transit Systems**
 Baichuan Mo*, Max Y von Franque, Haris N. Koutsopoulos, John Attanucci, Jinhua Zhao
Transportation Research Board 100th Annual Meeting (TRB, Poster presentation)
- [C6] 2020 **Calibrating Route Choice for Urban Rail System: A Comparative Analysis Using Simulation-based Optimization Methods**
 Baichuan Mo, Zhenliang Ma*, Haris N. Koutsopoulos, Jinhua Zhao
Transportation Research Board 99th Annual Meeting (TRB, Poster presentation)
- [C5] 2020 **Network Performance Model for Urban Rail Systems**
 Baichuan Mo, Zhenliang Ma*, Haris N. Koutsopoulos, Jinhua Zhao
Transportation Research Board 99th Annual Meeting (TRB, Oral presentation)
- [C4] 2020 **Latent Attitudes of Existing Travel Modes on Autonomous Vehicle Adoption**
 Baichuan Mo, Qing Yi Wang, Yu Shen*, Jinhua Zhao
Transportation Research Board 99th Annual Meeting (TRB, Poster presentation)
- [C3] 2020 **Predicting Travel Mode Choice with 86 Machine Learning Classifiers: An Empirical Benchmark Study**
 Shenhao Wang*, Baichuan Mo, Jinhua Zhao
Transportation Research Board 99th Annual Meeting (TRB, Poster presentation)
- [C2] 2019 **Built Environment and Autonomous Vehicle Mode Choice: A First-Mile Scenario in Singapore**
 Yu Shen, Baichuan Mo, Xiaohu Zhang*, Jinhua Zhao
Transportation Research Board 98th Annual Meeting (TRB, Poster and special issue presentation)

- [C1] 2018 **Impact of Built Environment on First- and Last-mile Travel Mode Choice**
Baichuan Mo, Yu Shen*, Jinhua Zhao
Transportation Research Board 97th Annual Meeting (TRB, Oral presentation)

In Preparation

All manuscripts are available upon reasonable requests

- 2023 **Individual Path Recommendation Under Public Transit Service Disruptions Considering Behavior Uncertainty and Equity**
Baichuan Mo*, Haris N. Koutsopoulos, Zuo-Jun Max Shen, Jinhua Zhao
Submitted to Transportation Science on May 25, 2023
- 2022 **Evaluation of Public Transit Systems under Short Random Service Suspensions: A Bulk-Service Queuing Approach**
Baichuan Mo, Li Jin*, Max Zuo-Jun Shen, Haris N. Koutsopoulos, Jinhua Zhao
Submitted to Operations Research on Dec 1, 2022
- 2022 **Transit Frequency Setting Problem with Demand Uncertainty**
Xiaotong Guo*, Baichuan Mo, Haris N. Koutsopoulos; Shenhao Wang; Jinhua Zhao
Submitted to IEEE Transactions on Intelligent Transportation Systems on Dec 25, 2022
- 2021 **Passenger Path Choice Estimation Using Smart Card Data: A Latent Class Approach with Panel Effects Across Days**
Baichuan Mo, Zhenliang Ma*, Haris N. Koutsopoulos, Jinhua Zhao
Submitted to Transportation Research Part C, April 20, 2023
- 2021 **Robust Discrete Choice Model With Data Uncertainties**
Baichuan Mo, Yunhan Zheng*, Xiaotong Guo, Jinhua Zhao
To be submitted to Transportation Research Part B
- 2021 **Comparing Hundreds of Machine Learning Classifiers and Discrete Choice Models in Predicting Travel Behavior: An Empirical Benchmark**
Shenhao Wang*, Baichuan Mo, Stephane Hess, Jinhua Zhao
To be submitted to Transportation Research Part C
- 2020 **On the Schedule-based Dynamic Transit Assignment with Hard Capacity Constraints and Boarding Priority**
Baichuan Mo*[†], Xiaotong Guo[†], Haris N. Koutsopoulos, Jinhua Zhao
To be submitted to Transportation Science
- 2020 **Households Residential Preference and Remaining Excess Commuting: The Case of Singapore**
Juanjuan Zhao[†], Baichuan Mo*[†], Nicholas S. Caros, Jinhua Zhao
To be submitted to Nature Sustainability

Projects & Funding Application

- 2020 – 2021 **Modeling COVID-19 Infection Risks in Commuting, \$90,000**
Lead Researcher: Write proposal; Design research framework
- The project aims to develop a commuting infection risk evaluation model for MIT community to support the decision-making for the MIT reopen plan during the COVID-19 pandemic
 - The project got \$90,000 funding support from MIT QUEST for Intelligence for 1 year
- Submitted **Individual Travel Path Recommendation and Incentive Design, \$200,000**
Lead Researcher: Write proposal; Design research framework
- The project is in cooperation with Ferrovial, which has a large number of highway toll facilities in US
 - We propose to design a personalized route recommendation algorithm and reward mechanism for Ferrovial's users, aiming to reduce user's travel time, improve facility's usage, and increase the company's income. The proposal is submitted and under review

- Submitted **Carbon Token to Increase Transit Ridership and Improve Equity, \$200,000**
 Co-Lead Researcher: Write proposal; Design research framework
- The project aims to design a blockchain-based travel incentive mechanism to encourage people's sustainable travel by using cryptocurrency. The token distribution algorithm we design can guarantee the minimum value of a token (related to the value of reduced carbon emissions). Our future prospective is to establish a blockchain-based carbon credits trading market
 - The proposal is submitted to US DOT Small Business Innovation Research Program and is currently under review
- Rejected **Public Transit and COVID-19 Spread: Model, Control, and Management, \$200,000**
 Lead Researcher: Write proposal; Design research framework
- The project aims to understand the mechanism of the COVID-19 spreading in public transit systems (buses, subways), and propose associated operation and management strategies to control the COVID-19 spreading and prepare for other infectious diseases in the future.
 - The proposal was submitted to the Greater Boston Consortium on Pathogen Readiness Evergrande COVID-19 Response Fund Awards, but not being accepted

Work & Research Experience

- Sep 2022 – Present **Lyft Inc., Real Time Supply Management Team**
 Research Scientist
- Lead the algorithm design in “Real-time Money Map” project (core team at Lyft).
- May 2022 – Aug 2022 **Lyft Inc., Transit Bike Scooter (TBS) Operation Technology Team**
 Algorithm Data Scientist Intern
- Propose a new initialization algorithm for solving vehicle routing problem in micromobility systems
 - Improve the operation efficiency by 4.2% based on offline testing, equivalent to 1.6 million cost saving per year
 - Implement the algorithm to production in all markets and create dashboards for continuous performance monitoring
- Aug 2018 – Present **Urban Mobility Lab and Transit Lab, MIT**
 Research Assistant
- Conducting research in public transit, demand modeling, optimization, and machine learning.
- Jan, Aug 2020 **Chicago Transit Authority (CTA)**
 Research Intern
- Analyzed the impact of rail disruptions
 - Designed passenger path recommendation strategies under rail disruptions
- Jul 2019 – Aug 2019 **Hong Kong Mass Transit Railway (MTR)**
 Research Intern
- Delivered a network performance model which is capable for system performance monitoring. [\[More\]](#)
 - Gave four training seminars to MTR employees about the model application.
- Jun – Jul in 2016 – 2019 **Singapore-MIT Alliance for Research and Technology (SMART) Center**
 Research Intern
- Analyzed people's preference of autonomous vehicles (AV) [\[More\]](#).
 - Studied the relationship between built environment of travel mode choice. [\[More\]](#)
 - Simulated the interaction between AV and public transit from a competitive perspective. [\[More\]](#)
- Dec 2015 – Aug 2018 **Institute of Transportation Research, Tsinghua University**
 Research Assistant
- Proposed a vehicle speed profile estimation model. [\[More\]](#)
 - Analyzed people's satisfaction of on-street parking. [\[More\]](#)

Awards & Honors

- 2022 **Best PhD Dissertation Award, Chinese Overseas Transportation Association (COTA)**
 Awarded to top PhD dissertations in transportation. Presented at the Dissertation Award Ceremony at TRB

- 2021 **Runner Up Award (2nd Place), Amazon Last-Mile Routing Research Challenge**
\$50,000 cash prize shared with my teammates Xiaotong Guo and Qingyi Wang. Featured by [\[Amazon Science\]](#) and [\[MIT News\]](#)
- 2021 **UPS PhD Fellowship, MIT**
Around \$90,000 fellowship covers one-year tuition and stipends. Awarded to a top PhD student conducting research in logistics, transportation, and supply chain. [\[More\]](#)
- 2018 **Best Bachelor Thesis Award, Tsinghua University**
Top 1%
- 2018 **Outstanding Graduate Award, Tsinghua University and Beijing**
Top 1%
- 2017 **Tsinghua Presidential Scholarship (a.k.a. Te Jiang)**
Highest Tsinghua University undergraduate scholarship, 10 out of 3,300+ per year. [\[More\]](#)
- 2017 **Cai Xiong Scholarship, Tsinghua University**
Awarded to students with strong scientific potential, 10 out of 3,300+ per year. [\[More\]](#)
- 2016 **First Place, Structural Design Competition, Tsinghua University**
Along with the Best Loading Capacity Award and Best Structure Calculation Award. Most important competition in Tsinghua Dept. of Civil Engineering
- 2016–2022 **Tang Lixin Scholarship, Tsinghua University**
Awarded to students with outstanding academic performance until they finish the graduate study, ~30 out of 3,300+ per year
- 2015 **10-th “Spark” Innovative Talent Cultivation Program, Tsinghua University**
Academic and scientific research talents training program for top Tsinghua undergraduates, ~40 per year [\[More\]](#)
- 2015–2018 **Tang Zhongying Moral Education Scholarship, Tsinghua University**
Awarded to students with excellent academic performance and enthusiasm for public welfare, ~100 per year
- 2015 **China National Scholarship**
Highest scholarship given by Chinese government, top 0.1%
- 2014 **Outstanding Graduate Award (for High School), Beijing**
Top 5%
- 2014 **Ranked 11st in National College Entrance Exam, Beijing**
Scores 712/750; Admitted by Tsinghua University, top 0.02%

Invited Talks & Guest Lectures

- May 2023 **Implementation of Algorithms in Shared Mobility Industry**
University of California, Berkeley
- Dec 2022 **Toward a Resilient Transportation System: Applications to Public Transit**
Young Scholars Symposium on Frontiers in Innovative Technology, Shanghai Jiao Tong University
- July 2022 **Individual Path Recommendation Under Public Transit Service Disruptions Considering Behavior Uncertainty and Equity**
C2SMART Center, New York University
- Aug 2021 **Individual Mobility Prediction: An Interpretable Hidden Markov Approach**
Southeast University-Monash University Joint Graduate School
- May 2021 **Toward a Resilient Public Transit System**
International Young Scholars Forum, Tongji University
- Apr 2021 **Toward a Resilient Public Transit System**
Smart Transportation Lab, McGill University
- Jul 2020 **Modeling Epidemic Spreading through Public Transit using Time-Varying Encounter Network**
MIT Center for Real Estate, Virtual Summer Seminar Series

Jun 2019 **Assignment-based Path Choice Estimation for Metro Systems Using Smart Card Data**
Southeast University-Monash University Joint Graduate School

Academic Service

Journal Referees Transportation Research Part A • Transportation Research Part C • Transportation Research Part E • IEEE Transactions on Intelligent Transportation Systems • Transportation • Transport Policy • Journal of Transport Geography • Travel Behavior and Society • Transportmetrica A • Journal of Public Transportation • PLOS One • Journal of Advanced Transportation • Communications in Transportation Research • Data Science for Transportation • Computer Modeling in Engineering & Sciences • Journal of Data Analysis and Information Processing

Conference Referees Transportation Research Board Annual Meeting (TRB) • IEEE Conference on Intelligent Transportation Systems (IEEE ITSC)

Leadership & Community Activities

Jan. 2021 – **MIT Chinese Student and Scholar Association (CSSA)**
Sep. 2022 Executive Board Member

- Co-organized 2021 MIT-Harvard online Chinese Lantern festival celebration and 2021 Mid-Autumn festival celebration.
- Volunteer for healthy bags dispatching

Jun. 2021 – **MIT Chinese Entrepreneur Organization (CEO)**
Sep. 2022 Treasurer and Executive Team Member

- Reimbursement and funding management
- Co-organized “FreesFund” mini-salon activity
- Co-organized 2021 Fall MIT Asian Career Info Session Series

Dec. 2016 – **American Society of Civil Engineers International Student Group (ASCE-ISG) of Tsinghua University**
Dec. 2017 President

- Organized 23rd Tsinghua University Structure Design Competition (300+ participants)
- Organized more than 15 group meetings for around 50 active members
- Represented Tsinghua at 3rd ASCE-ISG China Regional Annual Meeting

Dec. 2016 – **Student Association for Science and Technology (SAST) in Dept. of Civil Engineering**
Dec. 2017 President

- Organized 20+ competitions and activities, including Transportation Technology Competition
- Initiated “Innovative Talent Training Program”, which financially supported undergraduate research projects and summer research training at top international institutions
- Obtained Outstanding SAST Award in Tsinghua University (< 20%)

Sep. 2015 – **Class 42 in Dept. of Civil Engineering**
Dec. 2016 Class President

- Organized class parties and other team-building activities
- Obtained Tsinghua University Excellent Class Award (< 10%)

Computer Skills

Proficient Python, Matlab, R, \LaTeX , Julia, AutoCAD

Familiar C, MySQL, HTML, ArcGIS, Weka

Libraries Pandas, NumPy, Tensorflow, Keras, PyTorch, scikit-learn, SciPy, Gurobi, Matplotlib

Language

English Fluent

Chinese Mother tongue