

Baichuan Mo

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CAREER OBJECTIVE

Research Scientist at Lyft, Ph.D. from MIT with strong backgrounds in **operations research, statistics and probability, econometrics, and machine learning** looking for positions as a **research scientist/machine learning engineer/data scientist** to develop advanced solutions for real-world challenges.

EDUCATION

Massachusetts Institute of Technology

Cambridge, MA

*Dual M.S. in **Computer Science and Transportation**; GPA: 5.0/5.0*

Aug. 2018 – May 2020

*Ph.D. in **Transportation**; GPA: 5.0/5.0 (Finish in 4 years)*

Aug. 2018 – Aug. 2022

Relevant classes: Machine Learning • Machine Learning Under Modern Optimization Lens • Deep Learning •

Reinforcement Learning • Linear Optimization (A+) • Non-linear Optimization • Integer and Combinatorial

Optimization • Robust Optimization • Fundamentals of Probability • Modern Discrete Probability • Applied Probability

& Stochastic Models (A+) • Resilient Networks (A+) • Transport Systems Analysis (A+) • Transport Systems: Demand

& Economics (A+) • Demand Modeling (A+) • Advanced Demand Modeling • Game Theory

Tsinghua University

Beijing, China

Bachelor in Civil Engineering. GPA: 93/100. Rank: 1/105.

Aug. 2014 – May 2018

Bachelor in Management (Dual degree).

Aug. 2015 – May 2018

summa cum laude (top 1%). Valedictorian of the School of Civil and Hydraulic Engineering

Core classes: Calculus (100/100), Linear Algebra (92/100), Probability and Statistics (92/100), Physics for Scientists and

Engineers (100/100), Transportation Planning (93/100), Theoretical Mechanics (98/100), Structure Mechanics (96/100),

Hydrodynamics (97/100)

SKILLS

Programming: Python, Julia, C, SQL, R, Matlab

Developer Tools: Git, PyCharm, Visual Studio

Libraries: Pandas, NumPy, PyTorch, Tensorflow, Keras, scikit-learn, SciPy, Gurobi, FICO Xpress, Cplex

EXPERIENCE

Algorithm Data Scientist (T4), Lyft Inc.

Sep 2022 – Present

Real-time Driver Bonus Map

- **Science lead** for Lyft's most important driver incentive product: Real-time Bonus Map. Design the product's road map for next 2 years
- Develop a **heuristic** algorithm to solve a **nonlinear optimization** model to get the bonus map for drivers. Commit **20k+** lines of production codes. The algorithm is run in real time (every 2 minute) with streaming features.
- My work improves company's **annual profit by 25 million** (validated by A/B test). Got "Exceeded Expectation" for the first 6 months' performance review. **Highly like to be promoted to Senior (T5) in 2023 Sep.**

Algorithm Data Scientist (Intern), Lyft Inc.

May 2022 – Aug 2022

Vehicle Routing Problem for Dispatch Automation

- Propose a new initialization algorithm for solving the vehicle routing problem in Lyft's bike and scooter systems. Commit **3k+** lines of production codes
- Improve the operation efficiency and **save 1.6 million cost** annually. Got intern re-hire offer after the first-half of my intern period because of excellent performance

Graduate Research Assistant, MIT

Aug 2018 – Present

Operations Research:

- Derive the **closed-form formulations for the mean and variance of queue length** in a public transit system with random service suspensions. This research provides a new probability generating function for passenger arrivals in a bulk-service queue model. Paper submitted to *Operations Research*.
- Propose a **decomposition-based approximation algorithm** to solve path choice estimation problem in large-scale transit network. We prove the errors between the approximated and the exact solutions are bounded from above using fixed-point theory. Paper published in *Transportation Science*.

- Propose a robust-optimization method to solve large-scale path recommendation problem with demand uncertainty. Reducing the system travel time of Chicago's Transit system by 20% during disruptions. Paper published in *Transportation Research Part B*.

Machine Learning

- Implemented an **alternative-specific deep neural network architecture** for travel mode choice analysis. The model can outperform typical econometrics model in prediction accuracy (by 10%) while preserving interpretability
- Implemented a **residual neural network to combine discrete choice models and deep neural networks**. The model can modestly improve prediction accuracy and significantly improve interpretation and robustness
- Compared **105 machine learning classifiers** to predict travel behavior as a benchmark study
- Proposed an interpretable input-output **hidden Markov model (IOHMM)** to predict transit user's next tap-in time and location. The model has similar prediction accuracy as LSTM but can identify users' hidden activity patterns

Software:

- Developed an **agent-based autonomous vehicle and public transit simulation platform** using AnyLogic (Java-based) to analyze the market competition

Research Intern, Singapore-MIT Alliance for Research and Technology

Aug 2017, 2018, 2019

Econometrics and Policy

- Analyzed the competition between autonomous vehicles and public transit using agent-based simulation and game theory. We show that competition can result in higher profits and higher system efficiency compared to the status quo. This study was featured by [\[MIT News\]](#) and other publishers (e.g., [\[ScienceDaily\]](#), [\[AutoBala\]](#))
- Leveraged survey data to analyze users' preference to autonomous vehicles and explore how the preference is related to their attitudes to current travel modes based on a hybrid discrete choice model
- Analyzed the impact of pricing policy change on on-street parking demand and user satisfaction using parking meter and survey data. The methods include regression discontinuity design (RDD) and structural equation model (SEM).

PUBLICATIONS

- **20 Journal Publications (16 first-authored)**, including *Transportation Research Part A, B, C, E, Transportation Science, IEEE Transactions on Intelligent Transportation Systems, and Computer-Aided Civil and Infrastructure Engineering* (All Q1 SCI Journals in the transportation field with high impact factors).
- **8 Conference Papers (7 first-authored)** in *Transportation Research Board Annual Meetings* (Most important conference in transportation field, more than 10k attendees each year).
- [Google Scholar](#) Citations: **479**
- Full publication list: http://www.mit.edu/~baichuan/Baichuan/CV_Baichuan_Graduation.pdf

PROJECT

Pair-wise Attention-based Pointer Network for Amazon Last-Mile Routing Challenge Seq2Seq Prediction

MIT and Amazon

- Proposed a **pair-wise attention-based pointer network** to predict Amazon delivery driver's trajectories in response to the Amazon Last-Mile Routing Challenge
- Given a set of stops, the model can generate driver's trajectory that is close to the actual one. The model has similar performance as the second-place solution using a modified travel salesman problem (TSP) solver (also proposed by my team).

Public Transit System Disruption Management

Statistics and Optimization

MIT and Chicago Transit Authority (CTA)

- Proposed a data-driven **Bayesian model** to infer passenger behavior under urban rail service disruption
- Proposed a **robust optimization** method to obtain the optimal path recommendations during public transit service disruptions, which can reduce the affected passengers' travel time by 20%
- Proposed an **integer programming** method to address behavior uncertainty and passenger equity in the path recommendation problem. The algorithm can reduce system congestion and ensure no one becomes worse-off.

Network Performance Model for Public Transit System

Software and Optimization

MIT and Hong Kong Mass Transit Railway (MTR)

- Developed an event-based **urban rail transit simulation model** with Python to evaluate transit system performance. The model is used by MTR for daily system monitoring

- Provided four **software training seminars** to MTR employees on the model application
- Proposed a **decomposition-based optimization** algorithm to solve a path choice estimation problem using smart card data. The method can outperform typical simulation-based optimization methods in both accuracy and convergence speed.

HONORS AND AWARDS

- Best PhD Dissertation Award, Chinese Overseas Transportation Association (COTA) (Awarded to top PhD dissertations in transportation. Presented at the Dissertation Award Ceremony at TRB.)
- Runner Up Award (2nd Place), Amazon Last-Mile Routing Research Challenge, 2021. (\$50,000 cash prize, featured by [\[Amazon Science\]](#) and [\[MIT News\]](#))
- UPS PhD Fellowship, MIT, 2021. (Awarded to a top MIT PhD student conducting research in logistics, transportation, aviation, and supply chain. [\[More\]](#))
- Best Bachelor Thesis Award, Tsinghua University, 2018 (top 1%)
- Tsinghua Presidential Scholarship (a.k.a. Te Jiang), 2017. (Highest Tsinghua University undergraduate scholarship, 10 out of 3,300+ [\[More\]](#))
- China National Scholarship, 2015 (Highest scholarship given by Chinese government, top 0.1%)
- Ranked **11st** in National College Entrance Exam, Beijing, 2014. (Scores 712/750; Admitted by Tsinghua University, top 0.02%)

LEADERSHIP AND SERVICES

- Supervise 1 master student and 1 undergraduate student on research at MIT.
- Executive board member in MIT Chinese Student and Scholar Association (CSSA), co-organized Chinese Lantern festival celebration and Mid-Autumn festival celebration.
- Treasurer and Executive Team Member in MIT Chinese Entrepreneur Organization (CEO), co-organized the 2021 Fall MIT Asian Career Info Session and Venture Capital Mini-Salon.
- Reviewer for 10 Transportation Journals and 2 Conferences