

Dingyi Zhuang

Research Interests

Urban Computing

- Spatiotemporal data mining
- Uncertainty quantification
- Trustworthy AI
- Foundation models and generative AI

Intelligent transportation systems

- Public transit systems
- Travel demand modeling
- Data-driven transportation policy analysis
- Equity and accessibility in urban mobility

Education

2021 – Now Massachusetts Institute of Technology

- Ph.D. in Transportation
- Expected graduation: Summer 2026
- Advisors: Jinhua Zhao
- Dissertation proposal: Quantifying Uncertainty: Advancing Sparsity-aware, Reliability, and Fairness in AI-Driven Transportation Demand Modeling
- Committee Members: Prof. Jinhua Zhao, Prof. Haris N. Koutsopoulos, Prof. Shenhao Wang, Prof. Cathy Wu, Prof. Michael Batty
- GPA: **5.0/5.0**

2019 – 2021 McGill University

- Master (Thesis) in Civil Engineering
- Advisor: Lijun Sun
- GPA: **3.8/4.0**
- Thesis: Spatial Aggregation and Temporal Convolution Graph Neural Network for Kriging

2015 – 2019 Shanghai Jiao Tong University

- Bachelor of Science in Engineering (Tsien Hsue-Shen Class)
- Advisor: Jiangang Jin
- GPA: **3.6/4.0**; Ranking: **3/8**
- Graduate with Outstanding Honor (Top 5%)

Work Experience

Jun 2025– Bosch Center for Artificial Intelligence








Aug 2025 Research Intern

Advisor: Xiaoqi Wang

Jun 2024– **Morgan Stanley Services Group, Inc.**
Aug 2024 Machine Learning Research Associate Intern
Advisor: Majid Behbahani
Sep 2021– **Chicago Transit Authority**
May 2022 Research Intern



Journal Publications

723 Google scholar citations; h-index 16; i10-index 18.

- [9] 2025 **Dynamic Autoregressive Tensor Factorization for Pattern Discovery of Spatiotemporal Systems**  .
Xinyu Chen, Dingyi Zhuang, HanQin Cai, Shenhao Wang, Jinhua Zhao
IEEE Transactions on Pattern Analysis and Machine Intelligence (TPAMI)
- [8] 2025 **Reliable Imputation of Incomplete Crash Data for Predicting Driver injury Severity**  .
Xiaowei Gao, Xinke Jiang, Dingyi Zhuang, James Haworth, Shenhao Wang, Ilya Ilyanko, Huanfa Chen
Accident Analysis and Prevention
- [7] 2024 **Uncertainty-aware probabilistic graph neural networks for road-level traffic crash prediction**  .
Xiaowei Gao, Xinke Jiang, James Haworth, Dingyi Zhuang, Shenhao Wang, Huanfa Chen, Stephen Law
Accident Analysis and Prevention
- [6] 2024 **Uncertainty Quantification of Spatiotemporal Travel Demand with Probabilistic Graph Neural Networks.**
Qingyi Wang, Shenhao Wang, Dingyi Zhuang, Haris Koutsopoulos, Jinhua Zhao
IEEE Transactions on Intelligent Transportation Systems
- [5] 2023 **Fairness-enhancing deep learning for ride-hailing demand prediction**  .
Yunhan Zheng, Qingyi Wang, Dingyi Zhuang, Shenhao Wang, Jinhua Zhao
IEEE Open Journal of Intelligent Transportation Systems
- [4] 2022 **A Universal Framework of Spatiotemporal Bias Block for Long-Term Traffic Forecasting**  .
Fuqiang Liu, Jiawei Wang, Jingbo Tian, Dingyi Zhuang, Luis Miranda-Moreno, Lijun Sun
IEEE Transactions on Intelligent Transportation Systems
- [3] 2021 **Low-Rank Hankel Tensor Completion for Traffic Speed Estimation**  .
Xudong Wang, Yuankai Wu, Dingyi Zhuang, Lijun Sun
IEEE Transactions on Intelligent Transportation Systems
- [2] 2020 **From compound word to metropolitan station: Semantic similarity analysis using smart card data**  .
Dingyi Zhuang, Siyu Hao, Lee Der-Horng, Jiangang Jin
Transportation Research Part C: Emerging Technologies
- [1] 2019 **Understanding the bike sharing travel demand and cycle lane network: the case of Shanghai**  .
Dingyi Zhuang, Jiangang Jin, Yifan Shen, Wei Jiang
International Journal of Sustainable Transportation

Conference Proceedings

CS + AI

- [11] 2025 **Sparkle: Mastering Basic Spatial Capabilities in Vision Language Models Elicits Generalization to Composite Spatial Reasoning.**
Yihong Tang, Ao Qu, Zhaokai Wang, [Dingyi Zhuang](#), Zhaofeng Wu, Wei Ma, Shenhao Wang, Yunhan Zheng, Zhan Zhao, Jinhua Zhao
The 2025 Conference on Empirical Methods in Natural Language Processing (EMNLP 2025), MKLM Workshop at IJCAI 2025 **Best Paper Award**
- [10] 2025 **UQGNN: Uncertainty Quantification of Heterogeneous Graph Neural Networks for Multimodal Urban Mobility Prediction.**
Dahai Yu, [Dingyi Zhuang](#), Yuheng Bu, Shenhao Wang, Guang Wang
The 33rd ACM SIGSPATIAL International Conference on Advances in Geographic Information Systems (SIGSPATIAL 2025)
- [9] 2025 **GETS: Ensemble Temperature Scaling for Calibration in Graph Neural Networks.**
[Dingyi Zhuang](#), Chonghe Jiang, Yunhan Zheng, Shenhao Wang, Jinhua Zhao
International Conference on Learning Representations (ICLR) 2025, **Spotlight**
- [8] 2024 **Mitigating Spatial Disparity in Urban Prediction Using Residual-Aware Spatiotemporal Graph Neural Networks: A Chicago Case Study .**
[Dingyi Zhuang](#), Hanyong Xu, Xiaotong Guo, Yunhan Zheng, Jinhua Zhao
World Wide Web Conference, 2025; **Best Paper Award** at WebST Workshop Transportation Research Board, 2025
- [7] 2025 **Timeseries Suppliers Allocation Risk Optimization via Deep Black Litterman Model.**
Jiayuan Luo, Wentao Zhang, Yuchen Fang, Xiaowei Gao, [Dingyi Zhuang](#), Hao Chen, Xinke Jiang
The Association for the Advancement of Artificial Intelligence (AAAI) 2025, **Oral presentation**
- [6] 2024 **ItiNera: Integrating Spatial Optimization with Large Language Models for Open-domain Urban Itinerary Planning .**
Yihong Tang, Zhaokai Wang, Ao Qu, Yihao Yan, Kebin Hou, [Dingyi Zhuang](#), Xiaotong Guo, Jinhua Zhao, Zhan Zhao, Wei Ma
The 2024 Conference on Empirical Methods in Natural Language Processing (EMNLP 2024), *The 13th International Workshop on Urban Computing (Urbcomp 2024)* **Best Paper Award**
- [5] 2023 **SAUC: Sparsity-Aware Uncertainty Calibration for Spatiotemporal Prediction with Graph Neural Networks** 
[Dingyi Zhuang](#), Yuheng Bu, Guang Wang, Shenhao Wang, Jinhua Zhao
32nd ACM SIGSPATIAL, NeurIPS 2024 TGL Workshop **Best Paper Candidate**
- [4] 2023 **Performance benchmarking and scalability of LPSim: a multi-GPU traffic simulation approach.**
Xuan Jiang, [Dingyi Zhuang](#), Shangqing Cao, Junzhe Cao, Yuhang Tang, Vishwanath Bulusu, Raja Sengupta, Jinhua Zhao
IEEE Transactions on Intelligent Vehicles, Digital Twin and Parallel Intelligence, 2023
- [3] 2023 **Uncertainty Quantification via Spatial-Temporal Tweedie Model for Zero-inflated and Long-tail Travel Demand Prediction** 
Xinke Jiang, [Dingyi Zhuang](#), Xianghui Zhang, Hao Chen, Jiayuan Luo, Xiaowei Gao
32nd ACM International Conference on Information and Knowledge Management (CIKM-2023)
- [2] 2022 **Uncertainty Quantification of Sparse Trip Demand Prediction with Spatial-Temporal Graph Neural Networks** 
[Dingyi Zhuang](#), Shenhao Wang, Haris N. Koutsopoulos, Jinhua Zhao
28th ACM SIGKDD Conference on Knowledge Discovery & Data Mining (KDD-2022), **oral pre.**
- [1] 2020 **Inductive graph neural networks for spatiotemporal kriging** 
Yuankai Wu, [Dingyi Zhuang](#), Lijun Sun
The Thirty-Fifth AAAI Conference on Artificial Intelligence (AAAI-21), **oral pre.** **100+ citations**

Transportation

- [7] 2024 **Virtual Nodes Improve Long-term Traffic Prediction.**
Xiaoyang Cao, [Dingyi Zhuang](#), Shenhao Wang, Jinhua Zhao
Transportation Research Board, 2025
- [6] 2024 **Large language models for travel behavior prediction.**
Baichuan Mo, Hanyong Xu, [Dingyi Zhuang](#), Ruoyun Ma, Xiaotong Guo, Jinhua Zhao
TRC-30, 2024
- [5] 2023 **ST-GIN: An Uncertainty Quantification Approach in Traffic Data Imputation with Spatio-temporal Graph Attention and Bidirectional Recurrent United Neural Networks** [↗](#).
Zepu Wang, [Dingyi Zhuang](#), Yankai Li, Jinhua Zhao, Peng Sun
IEEE International Conference on Intelligent Transportation Systems (ITSC-2023)
- [4] 2023 **Uncertainty Quantification in Road-level Traffic Risk Prediction by Spatial-Temporal Zero-Inflated Negative Binomial Graph Neural Network(STZINB-GNN)** [↗](#).
Xiaowei Gao, James Haworth, [Dingyi Zhuang](#), Huanfa Chen, Xinke Jiang
12th International Conference on Geographic Information Science (GIScience-2023)
- [3] 2022 **The Braess Paradox in Dynamic Traffic** [↗](#) .
[Dingyi Zhuang](#), Yuzhu Huang, Vindula Jayawardana, Jinhua Zhao, Dajiang Suo, Cathy Wu
25th IEEE International Conference on Intelligent Transportation Systems
- [2] 2020 **A Pseudo-3D Convolutional Neural Network based Framework for Short-term Mixed Passenger Flow Prediction in Large-scale Public Transit.**
Siyu Hao, [Dingyi Zhuang](#), De Zhao, Lee Der-Horng
Transportation Research Board 2020
- [1] 2018 **An empirical study on cycle lane network using bike sharing data: the case of Shanghai.**
[Dingyi Zhuang](#), Jiangang Jin, Yifan Shen, Wei Jiang
2018 International Conference on Transportation and Space-time Economics (oral presentation)

Submitted for Publication

All manuscripts are available upon reasonable requests

- 2025 **Interpretable Time Series Autoregression for Periodicity Quantification** [↗](#).
Xinyu Chen, Vassilis Digalakis Jr, Lijun Ding, [Dingyi Zhuang](#), Jinhua Zhao
Submitted to IEEE Transactions on Pattern Analysis and Machine Intelligence
- 2025 **TrajMixer: A Multi-Scale Multimodal Framework for Flight Trajectory Prediction.**
Chenshuo Li, [Dingyi Zhuang](#), Jing Yang, Hongyu Yang, Yuankai Wu
Submitted to IEEE Transactions on Intelligent Transportation Systems
- 2025 **Modeling Latent Demand and Reducing Prediction Disparities of Ride-hailing: a Fair Deep Quantile Regression Method.**
Xuanmian He, Hanyong Xu, ChenAn Shen, [Dingyi Zhuang](#), Yunhan Zheng, Jinhua Zhao
Submitted to Smart Cities
- 2025 **Generative Urban Design: A Stepwise Approach Integrating Human Expertise with Multimodal Diffusion Models.**
Mingyi He, Yuebing Liang, Yunhan Zheng, Qingyi Wang, [Dingyi Zhuang](#), Shenhao Wang, Jinhua Zhao
Submitted to Landscape and Urban Planning
- 2025 **Enrichment of POI Semantic Information with Large Language Models: An Example of Next Location Prediction.**
Bangzhao Shu, Yuebing Liang, Jinmeng Rao, [Dingyi Zhuang](#), Yuhao Kang
Submitted to Environment and Planning B: Urban Analytics and City Science

- 2025 **From Fixed to Learnable: Adaptive Kernel Parameters for GNN-Based Spatiotemporal Modeling.**
Zhongyue Zhang, Dingyi Zhuang, Yuankai Wu
Submitted to NeurIPS 2025
- 2025 **Addressing Imbalances in Heterogeneous Semi-Bipartite Graphs for Effective Anti-Money Laundering.**
Dingyi Zhuang, Majid Behbahani, Zhanhong Cheng, Shenhao Wang, Yuheng Bu, Guang Wang, Yuriy Nevmyvaka
Submitted to KDD 2025
- 2025 **Uncertainty-aware Spatiotemporal Graph Neural Networks for Reliable User-level Electricity Load Forecasting.**
Dahai Yu, Rongchao Xu, Lin Jiang, Tian Tang, Dingyi Zhuang, Zhanhong Cheng, Yuheng Bu, Shenhao Wang, Guang Wang
Submitted to SIGSPATIAL 2025
- 2025 **Consumption Complexity as a Driver of Urban Economic Development.**
Yunhan Zheng, Yuebing Liang, Donghang Li, Dingyi Zhuang, Shenhao Wang, Jinhua Zhao
Submitted to Nature Cities
- 2025 **Dynamic Autoregressive Tensor Factorization for Pattern Discovery of Spatiotemporal Systems.**
Xinyu Chen, Dingyi Zhuang, HanQin Cai, Shenhao Wang, Jinhua Zhao
Submitted to The IEEE Transactions on Pattern Analysis and Machine Intelligence (TPAMI), major reviewed.
- 2025 **Impacts of Subway Line Extension on Economic Vitality and Social Cohesion: A DMLDID Approach .**
Xinyi Huang, Yunhan Zheng, Dingyi Zhuang, Jinhua Zhao
Submitted to Communication in Transportation Research
- 2024 **Reliable Imputation of Incomplete Crash Data for Predicting Driver Injury Severity.**
Xiaowei Gao; Xinke Jiang; Dingyi Zhuang; James Haworth; Shenhao Wang; Ilya Ilyanko
Submitted to Accident Analysis and Prevention
- 2023 **Fairness-Enhancing Vehicle Rebalancing in the Ride-hailing System.**
Xiaotong Guo, Hanyong Xu, Yunhan Zheng, Dingyi Zhuang, Jinhua Zhao
Working paper, submitting to TR-Part A
- 2023 **Advancing Transportation Mode Share Analysis with Built Environment: Deep Hybrid Models with Urban Road Network.**
Dingyi Zhuang, Qingyi Wang, Yunhan Zheng, Xiaotong Guo, Shenhao Wang, Haris N. Koutsopoulos, Jinhua Zhao
Submmited to Transportation

Mentorship

Graduate Students

- 2025 Yunlin Li, Master Student at Oxford [↗](#)
- 2025 Zeyuan Niu, Master Student at Shanghai Jiao Tong University [↗](#)
- 2024 Yifeng Liu, Master Student at MIT [↗](#)
- 2024 Chonghe Jiang, M.Phil Student at the Chinese University of Hong Kong [↗](#)
Now: Ph.D. at MIT
- 2024 Yihong Tang, Master Student at the University of Hong Kong [↗](#)
Now: Ph.D. at McGill University
- 2023 Zepu Wang, Master Student at the University of Pennsylvania [↗](#)
Now: Ph.D. at University of Washington

Undergraduate Students

- 2025 Chenshuo Li, Sichuan University

- 2024 Xiaoyang Cao, Tsinghua University [↗](#)
Now: Ph.D. at MIT
- 2023 Xiaoyu Yan, Zhejiang University [↗](#)
Now: Ph.D. at Northwestern University
- 2023 Peisen Li, Tsinghua University [↗](#)
Now: Ph.D. at the University of Michigan

Teaching

- Spring 2024 Teaching Assistant of 1.041/1.200 Transportation Foundation and Methodology [↗](#)
- Spring 2023 Teaching Assistant of 1.041/1.200 Transportation Foundation and Methodology [↗](#)

Invited Talks & Guest Lectures

- Oct 2024 **Quantifying Uncertainty: Advancing Robustness, Reliability, and Fairness in AI-Driven Transportation Demand Modeling**
INFORMS 2024
- Jun 2024 **Uncertainty Quantification on Sparse Spatiotemporal Data Prediction**
Machine Learning Seminar, Morgan Stanley
- Oct 2023 **Modeling Multi-perspective Nature of Urban Dynamics**
Allen Turing Insitute
- Oct 2023 **Modeling Multi-perspective Nature of Urban Dynamics**
The Space Time Lab, University College London
- Oct 2023 **Sparsity-Aware Uncertainty Calibration for Spatiotemporal Prediction with Graph Neural Networks**
The Bartlett Centre for Advanced Spatial Analysis, University College London
- July 2023 **Uncertainty Quantification of Sparse Trip Demand Prediction**
Lyft
- July 2023 **Deep Hybrid Model with Urban Road Network for Travel Demand Analysis**
Transit Data Section at World Conference on Transportation Research 2023
- May 2023 **Deep Hybrid Model with Urban Road Network**
MIT Mobility Initiative Forum
- Apr 2023 **Uncertainty Quantification of Sparse Trip Demand Prediction**
Urban Artificial Intelligence Laboratory, University of Florida
- Feb 2023 **Deep Hybrid Model with Urban Road Network for Travel Demand Analysis**
CEE Research Days, MIT Media Lab
- Oct 2022 **Uncertainty Quantification of Sparse Trip Demand Prediction**
College of Computer Science, Sichuan University

Honors & Awards

- 2025 **UPS PhD Fellowship, MIT**
- 2024 **Best Paper Award, KDD 2024 Urban Computing Workshop**
- 2020 **CIRRELT Excellence Scholarships (Master's), CIRRELT**
- 2019 & 2021 **Graduate Excellence Fellowship, McGill University**
- 2019 **Hsue-shen Tsien Class, Shanghai Jiao Tong University**
Top 5%, Honor Program in School of Mechanical Engineering
- 2017 **Chungtsung Scholarship, Hui-Chun Chin and Tsung-Dao Lee Chinese Undergraduate Research Endowment**
Top 10% in selected excellent research students in Shanghai Jiao Tong University

- 2017 **Chinese Big Data Innovation Application and Modeling Contest** 
First Prize (1/135)
- 2016 & 2017 **Eleme Scholarship, Shanghai Jiao Tong University**
- 2017 **2017 Mathematical Contest in Modeling**
Honorable Mention
- 2016 **Excellent Student, Shanghai Jiao Tong University**
Top 5%
- 2015 **Freshmen Scholarship, Shanghai Jiao Tong University**

Academic Service

- Journal Referees IEEE Transactions on Neural Networks and Learning Systems • IEEE Transactions on Intelligent Transportation Systems • Transportation Research Part C • Journal of Computational and Graphical Statistics • Journal of Cleaner Production • Neurocomputing • IEEE Internet of Things Journal • IET Intelligent Transport Systems • Journal of Computational and Graphical Statistics.
- Conference Referees Transportation Research Board Annual Meeting (TRB) • IEEE Conference on Intelligent Transportation (IEEE ITSC) • International Conference on Learning Representations (ICLR)
- Program Committee the 1st Workshop on Spatial Intelligence for Smart and Connected Communities (Spatial-Connect 2025) @ SIGSPATIAL

Position of Responsibility

- Jun 2024 **2nd International Workshop on Socially Interactive Autonomous Mobility (SIAM)** 
Program Committee
- Jan 2024 **Mens, Manus and Machina (M3S) MIT-Singapore AI symposium** 
Organizer
- Oct 2015–
Sep 2017 **Center of Quality Development, Shanghai Jiao Tong University**
Vice president