Dingyi Zhuang

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Research Interests

Urban Computing
- Spatiotemporal data mining
- Time series
- Graph neural network
- Bayesian probabilistic models
- Unstructured data mining

Intelligent transportation system
- Reinforcement learning based traffic control

Education

2021 – Now **Massachusetts Institute of Technology**
- Ph.D. in Transportation
- Advisor: Jinhua Zhao, Haris N. Koutsopoulos
- GPA: **5.0**/**5.0**

2019 – 2021 **McGill University**
- Master (Thesis) in Transportation 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 Mechanical Engineering (Tsien Hsue-Shen Class)
- Advisor: Jiangang Jin
- GPA: **3.6**/**4.0**; Ranking: **3/8**
- Graduate with Outstanding Honor (Top 5%)

Journal Publications

[J5] 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

[J4] 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

[J3] 2021 **Low-Rank Hankel Tensor Completion for Traffic Speed Estimation** ☑ .
Xudong Wang, Yuankai Wu, Dingyi Zhuang, Lijun Sun*
IEEE Transactions on Intelligent Transportation Systems

[J2] 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, Volume 114, May 2020, Pages 322-337

[J1] 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, 2019: 1-13

Conference Proceedings

[C10] 2023 **SAUC: Sparsity-Aware Uncertainty Calibration for Spatiotemporal Prediction with Graph Neural Networks**.
Dingyi Zhuang, Yuheng Bu, Guang Wang, Shenhao Wang, Jinhua Zhao
NeurIPS 2024 TGL Workshop

[C9] 2023 **Performance benchmarking and scalability of LPSim: a multi-GPU traffic simulation approach**.
Xuan Jiang, Dingyi Zhuang, Shangqing Cao, Junzhe Cao, Yuhan Tang, Vishwanath Bulusu, Raja Sengupta, Jinhua Zhao
IEEE Transactions on Intelligent Vehicles, Digital Twin and Parallel Intelligence, 2023

[C8] 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)

[C7] 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)

[C6] 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)

[C5] 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.**)*

[C4] 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

[C3] 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.**)*

[C2] 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

[C1] 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 pre.**)

In Preparation

All manuscripts are available upon reasonable requests

2023 **A Deep Learning Framework to Predict Traffic Incident Injury Severity under Missing Information**.
Xiaowei Gao, Xinke Jiang, Dingyi Zhuang, Ilya Ilyankou, James Haworth, Huanfa Chen
Working paper

2023 **Large Language Model in Travel Mode Choice Prediction**.
Baichuan Mo, Hanyong Xu, Dingyi Zhuang, Xiaotong Guo, Jinhua Zhao
Working paper

2023 **Fairness-Enhancing Vehicle Rebalancing in the Ride-hailing System**.
Xiaotong Guo, Hanyong Xu, Yunhan Zheng, Dingyi Zhuang, Jinhua Zhao
Working paper, submitting to TRB 2023

2023 **Virtual Nodes Improve Graph Neural Networks for Long-horizon Traffic Forecasting**.
Dingyi Zhuang, Shenhao Wang*, Haris N. Koutsopoulos, Jinhua Zhao
Working paper, targeting at International World Wide Web Conference 2023 conference

2023 **Spatio-temporal Sparse Data Mining Urban Traffic Risk Prediction Uncertainty Quantification Zero-Inflated Tweedie Distribution**.
Xiaowei Gao, Xinke Jiang, Dingyi Zhuang, Huanfa Chen, Shenhao Wang, James Haworth
In submission to Transportation Research Part C: Emerging Technologies

2023 **Deep Hybrid Model for Choice Modelling with Graph-embedded Urban Road Network**.
Dingyi Zhuang, Qingyi Wang, Yunhan Zheng, Xiaotong Guo, Shenhao Wang*, Haris N. Koutsopoulos, Jinhua Zhao
Working paper, targeting at Transportation Research Part C: Emerging Technologies

2023 **Uncertainty Quantification of Spatiotemporal Travel Demand with Probabilistic Graph Neural Networks**.
Qingyi Wang, Shenhao Wang*, Dingyi Zhuang, Haris Koutsopoulos, Jinhua Zhao
Submitted to IEEE Transactions on Intelligent Transportation Systems

2022 **Understanding Incident Impacts on Ridership Demand Change in Urban Transit System: the Case in Chicago**.
Dingyi Zhuang, Baichuan Mo, Haris N. Koutsopoulos, Jinhua Zhao*

2021 **Spatial Aggregation and Temporal Convolution Networks for Real-time Kriging** ⬀.
Yuankai Wu, Dingyi Zhuang, Lijun Sun*

Invited Talks & Guest Lectures

Oct 2023 **Modeling Multi-perspective Nature of Urban Dynamics (Ph.D. thesis framework)**
Allen Turing Insitute

Oct 2023 **Modeling Multi-perspective Nature of Urban Dynamics (Ph.D. thesis framework)**
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**
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

Work & Research Experience

Oct 2023– Feb 2024	**Singapore-MIT Alliance for Research and Technology (SMART)** ⬀ Research Assistant Advisor: Jinhua Zhao; Shenhao Wang; Alex 'Sandy' Pentland Working project: The Mens, Manus and Machina - How AI Empowers People, Institutions and the City in Singapore (M3S)
Apr 2021– Now	**MIT Transit Lab** ⬀ Research Assistant Advisor: Jinhua Zhao; Shenhao Wang Working agencies: ○ Chicago Transit Authority (CTA), rail incident data analysis ○ Department of Energy (DoE), travel demand prediction
Aug 2020– Jun 2021	**Mitacs Accelerate with ExPretio** ⬀ Winter Intern ○ Combination of multi-horizon models for demand forecasting
2019-2021	**Interuniversity Research Centre on Enterprise Networks, Logistics and Transportation (CIRRELT)** ⬀ Master's Student Advisor: Lijun Sun
Jul 2018– Sep 2018	**Civil and Environmental Engineering, National University of Singapore** Research Assistant Advisor: Lee Der-Horng
Oct 2017– Nov 2017	**Institute of Refrigeration and Cryogenic Engineering, Shanghai Jiao Tong Univ.** Research Assistant
Mar 2017– Jun 2018	**Chuntsung Program, Shanghai Jiao Tong Univ.** ⬀ Research Assistant
Aug 2016– Sep 2015	**Robotics Institute, Shanghai Jiao Tong Univ.** Research Assistant

Honors & Awards

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
Conference Referees	Transportation Research Board Annual Meeting (TRB) ● IEEE Conference on Intelligent Transportation (IEEE ITSC) ● COTA International Conference of Transportation Professionals

Position of Responsibility

Mar 2023– Now	**MIT Film Makers Association** President of publicity
Oct 2015– Sep 2017	**Center of Quality Development, Shanghai Jiao Tong University** Vice president

Teaching

Spring 2023	Teaching Assistant of 1.041/1.200 Transportation Foundation and Methodology ⬀

Technical skills

Languages	`Python,MATLAB,R,Julia`, JavaScript, SQL, `C++`, `Unix scripting`, LaTeX
Packages	PyTorch, TensorFlow, Keras, Scikit-learn, SciPy, JAX
Tools	Adobe PhotoShop, Premier, Lightroom