Xingmin (Nathan) Wang

Postdoctoral Research Fellow at University of Michigan, Ann Arbor

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Academic Appointments

Postdoctoral Researcher *Civil Engineering, University of Michigan* **Ann Arbor, MI** *2023.9 – Present*

- Advised by Dr. Henry Liu

Adjunct Lecturer *Civil Engineering, University of Michigan* **Ann Arbor, MI** *2023.9 – 2024.1*

- CEE 551 Traffic Science (graduate level)
- Teaching evaluation: Q1: 4.6/5.0 (score of the course) Q2: 4.9/5.0 (score of the instructor)

Education

Ph.D., Civil Engineering and Scientific Computing *University of Michigan* **Ann Arbor, MI** *2018.8 – 2023.8*

- Advised by Dr. Henry Liu
- Joint PhD degree in *Scientific Computing* from the Michigan Institute for Computational Discovery & Engineering (MICDE) [link], with an emphasis on scientific computing methodologies and computational science
- Thesis: "Traffic Signal Optimization with Connected Vehicle Trajectories" (winner of INFORMS TSL Best Dissertation Award [news] and finalist of IEEE ITSS Best Dissertation Award)
- GPA: 4.0/4.0, A+ in more than half of courses (including dynamic programming, data mining in transportation, probability and random process, Bayesian data science, traffic science, etc.)

B.Eng., School of Vehicle and Mobility *Tsinghua University* **Beijing, China** *2014.9 – 2018.7*

- Major in Automotive Engineering (89.0/100), Rank Top 5%

Research Interests

Transportation research

Traffic flow and network model; traffic operations and control; connected and automated transportation

Methodology

Data science, applied statistics, machine learning, optimization, and network science

Working topics

- Applying generative AI for stochastic traffic flow models and traffic state estimation
- Multi-scale traffic simulation and evaluation of large-scale deployment of automated vehicles
- Calibration of large-scale traffic simulation with low penetration rate vehicle trajectories
- Next-generation traffic operations with connected and automated vehicles

Honors & Awards

- **Winner** of INFORMS TSL Best Dissertation Award, 2024 (the oldest and most prestigious honor for doctoral dissertations in the Transportation Science and Logistics area) [news]
- **Finalist** of IEEE ITSS Best Dissertation Award, 2024
- Department Fellowship, Civil Engineering, University of Michigan, 2019
- The First Prize in 35th Tsinghua University Academic Challenge Cup, 2017
- Fellowship of Siyuan Program, Tsinghua University, 2015 – 2017
- Infineon Technology Scholarship, Tsinghua University, 2017
- Outstanding Project of Undergraduate Research Competition (3/250+), Tsinghua University, 2016

- The First Prize in Tsinghua Analytical Mechanics Contest (3/500+), 2015
- The First Prize in National Physics Contest for College Student, 2015

Patents & Technology Transfer

- Optimizing Signals as a Service (OSaaS)
  - **P1**: Henry Liu, Xingmin Wang, Zachary Jerome, Shengyin Shen, and Zihao Wang. "Optimizing Traffic Signals Using Partially Observed Vehicle Trajectory Data". *US Provisional Patent Application 18/308,996*. Filed on April 28, 2023.
  - I led the development of OSaaS, a traffic signal re-timing system that operates using low-penetration connected vehicle trajectories. In collaboration with General Motors (GM) and the Road Commission for Oakland County (RCOC), we successfully tested this system in the City of Birmingham, Michigan.
  - This technology was licensed to General Motors through the University of Michigan's technology transfer program from 2023 to 2024. We are further developing OSaaS through the USDOT SMART Grants and moving towards commercialization via the NSF's Innovation Corps (I-Corps) program.

Publications

Journal Publications

J11: Xingmin Wang, Zachary Jerome, Zihao Wang, Chenhao Zhang, Shengyin Shen, Vivek Vijaya Kumar, Fan Bai, Paul Krajewski, Danielle Deneau, Ahmad Jawad, Rachel Jones, Gary Piotrowicz, Henry X Liu. "Traffic light optimization with low penetration rate vehicle trajectory data". *Nature Communications*, 15(1) 1306, 2024, [DOI]
This publication has been covered by: UofM News, AP News, Local 4+ TV, and Wall Street Journal.

J10: Yu Han, Zhe Han, Fan Ding, Fuliang Li, Hao Wang, Xingmin Wang*. "Field-tested signal controller to mitigate spillover using trajectory data". *Computer-Aided Civil and Infrastructure Engineering*, 2023 [DOI] *: Co-correspondence

J9: Xinyu Fei, Xingmin Wang, Xian Yu, Yiheng Feng, Henry X. Liu, Siqian Shen, Yafeng Yin. "Traffic Signal Control under Stochastic Traffic Demand and Vehicle Turning via Decentralized Decomposition Approaches". *European Journal of Operational Research (EJOR)* 310 (2), 712-736, 2023 [DOI]

J8: Xingmin Wang, Yafeng Yin, Yiheng Feng, Henry X. Liu. "Learning the max pressure control for urban traffic networks considering the phase switching loss". *Transportation Research Part C: Emerging Technologies (TR part C)* 140, 103670. 2022 [DOI]

J7: Xingmin Wang, Zachary Jerome, Chenhao Zhang, Shengyin Shen, Vivek Vijaya Kumar, Henry X Liu. "Trajectory Data Processing and Mobility Performance Evaluation for Urban Traffic Networks". *Transportation Research Record (TRR)* 2677 (3), 355-370, 2022 [DOI]

J6: Zachary Jerome, Xingmin Wang, Shengyin Shen, Henry X Liu. "Determining Yellow Change and Clearance Intervals for Left-Turning Phases: Evaluation of the Current Guidelines with Connected Vehicle Data". *Transportation Research Record (TRR)*, 2676 (11), 1-14, 2022 [DOI]

J5: Xingmin Wang, Shengyin Shen, Debra Bezzina, James R Sayer, Henry X Liu, Yiheng Feng. "Data Infrastructure for Connected Vehicle Applications". *Transportation Research Record (TRR)*, 2674 (5), 85-96, 2020 [DOI]

J4: Yan Zhao, Jianfeng Zheng, Wai Wong, Xingmin Wang, Yuan Meng, Henry X Liu. "Estimation of queue lengths, probe vehicle penetration rates, and traffic volumes at signalized intersections using probe vehicle trajectories". *Transportation Research Record (TRR)*, 2673 (11), 660-670, 2019 [DOI]

J3: Yan Zhao, Jianfeng Zheng, Wai Wong, Xingmin Wang, Yuan Meng, Henry X Liu. "Various methods for queue length and traffic volume estimation using probe vehicle trajectories". *Transportation Research Part C: Emerging Technologies (TR part C)*. 107, 70-91, 2019 [DOI]

J2: Shuo Feng, Xingmin Wang, Haowei Sun, Yi Zhang, Li Li. "A better understanding of long-range temporal dependence of traffic flow time series". *Physica A: Statistical Mechanics and its Applications*. 492, 639-650, 2018 [DOI]

J1: Shuo Feng, Ruimin Ke, Xingmin Wang, Yi Zhang, Li Li. "Traffic flow data compression considering burst components". *IET Intelligent Transport Systems*. 11 (9), 572-580, 2017 [DOI]

Preprints and Conference Papers (preprints without links are available upon request)

PP7: Xingmin Wang, Xingyi He, Zihao Wang, Henry X Liu. "Multi-Scale Traffic Simulation Framework for Evaluating Target Ego Vehicles in Large-Scale Networks". *ISTTT 26*, extended abstract to be submitted soon.

PP6: Xingmin Wang, Zihao Wang, Zachary Jerome, Henry X Liu. "Inference of signal phase and timing with low penetration rate vehicle trajectories". *Transportation Research Part C*, under review [SSRN]

PP5: Xingmin Wang, Zihao Wang, Zachary Jerome, Henry X Liu. "Traffic State Estimation and Uncertainty Quantification at Signalized Intersections with Low Penetration Rate Vehicle Trajectory Data". *Transportation Science*, under review [arXiv]

PP4: Zihao Wang, Xingmin Wang, Zachary Jerome, Henry X Liu. "Improving Coordination Performance by Measuring 'Early Return to Green' Using Vehicle Trajectory Data". *2025 TRB Annual Meeting*, accepted

PP3: Zachary Jerome, Xingmin Wang, Zihao Wang, Henry X Liu. "A Signalized Intersection Performance Code Using Vehicle Trajectory Data". *2025 TRB Annual Meeting*, accepted, under review by TR part C

PP2: Haoxuan Dong, Xingmin Wang, Shuo Feng, Zhaojian Li, Ziyou Song. "A Survey on Mixed Traffic Control Using Connected and Automated Vehicles". *Applied Energy*, under review

PP1: Ran Sun, Zihao Wang, Xingmin Wang, Henry X Liu. "Automatic Calibration of Mesoscopic Traffic Simulation Using Vehicle Trajectory Data". *2025 TRB Annual Meeting*, accepted

Technical Reports

R2: Minghui Wu, Xingmin Wang, Yafeng Yin, Henry Liu, Ben Wang, and Jerome P. Lynch. "Leveraging Connected and Automated Vehicles for Participatory Traffic Control". 2023 [link]

R1: Yafeng Yin, Siqian Shen, Yiheng Feng, Xinyu Fei, Xian Yu, Xingmin Wang, and Tian Mi. "Real-time Distributed Optimization of Traffic Signal Timing". 2023 [link]

Proposal Writing

I contributed to the writing of the following awarded proposals during my time as a senior PhD student and now as a postdoctoral researcher:

F2: SMART Grant: Online Automatic Retiming of Traffic Signals Using Vehicle Trajectory Data

- Funding Agency: US Department of Transportation/Road Commission for Oakland County
- Funding Amount: $1,450,000
- Project Start/End Date: 9/15/2024 – 3/14/2026
- Award #: 69A3552441025

F1: MDOT: Automatic Signal Retiming Using Vehicular Trajectory Data

- Funding Agency: Michigan Department of Transportation
- Funding Amount: $325,040
- Project Start/End Date: 4/1/2024 – 4/30/2025
- Award #: 24-015

Conference Presentations

C7: "Traffic Light Optimization with Connected Vehicle Trajectories", Presentation for INFORMS TSL Best Dissertation Award Session at *2024 INFORMS Annual Meeting, Seattle,* 2024.10

C6: "Traffic Light Optimization with Low Penetration Rate Vehicle Trajectories", Poster at *103rd TRB Annual Meeting, Washington, D.C.* 2024.1

C5: "Learning the max pressure control for urban traffic networks", Presented at *2022 INFORMS Annual Meeting, Indianapolis* 2022.10

C4: "Trajectory Data Processing and Mobility Performance Evaluation for Urban Traffic Networks", Poster at *101st TRB Annual Meeting, Washington, D.C.* 2022.1

C3: "Determining Yellow Change and Clearance Intervals for Left-Turning Phases: Evaluation of the Current Guidelines with Connected Vehicle Data", Poster at *101st TRB Annual Meeting, Washington, D.C.* 2022.1

C2: "Max-Weight Control for Urban Traffic Networks Considering Phase Switching Loss", Poster at *100th TRB Annual Meeting, Washington, D.C.* 2021.1

C1: "Data Infrastructure for Connected Vehicle Applications", Presented at *99th TRB Annual Meeting, Washington, D.C.* 2020.1

Invited Talks

T3: "Traffic light optimization with low penetration rate vehicle trajectories", Invited talk at Zhejiang University (ZJU), Hangzhou, China, 2024.4 [News] (in Chinese)

T2: "Traffic light optimization with low penetration rate vehicle trajectories", Presented in the CCAT Mobility & Infrastructure Working Group Meeting, 2024.3

T1: "Traffic light optimization with low penetration rate vehicle trajectories", Presented in the meeting of Traffic Signal System Committee (ACP25)'s research subcommittee, *TRB Annual Meeting, Washington, D.C.* 2024.1

Services

Referee and Editorial Services

I currently serve as the reviewer of:

- Transportation Research Part C: Emerging Technologies (reviewed 30 papers by 2024.9)
- Transportation Research Part B: Methodological
- Transportation Research Part E: Logistics and Transportation Review
- Transportation Science
- IEEE Transactions on Intelligent Transportation Systems
- Transportmetrica A: Transport Science
- Transportmetrica B: Transport Dynamics
- Transportation Research Board Annual Meeting
- Bridging Transportation Researchers (BTR) Conference
- Automotive Innovation
- Intelligent Transportation Infrastructure

Editorial Assistant **Journal of Intelligent Transportation System** *2022 – 2024*
I performed the initial review (desk reject, editor assignment, etc.) for more than 150 papers of JITS

Editorial Assistant **ISTTT 25** *2022 – 2024*
Working with Dr. Henry Liu and handled more than 50 of the papers submitted to ISTTT 25 (The 25th International Symposium on Transportation and Traffic Theory)

University Services

Vice President **Michigan Transportation Student Organization (MiTSO)** *2022 – 2024*

Conference Organization and Other Professional Services

Workshop Co-organizer **IEEE ITSC 2024, Edmonton, Canada** *2024*
Vehicle Trajectory Data Camp at ITSC 2024 [Link], co-organize with researchers from Vanderbilt University and University of Alabama in Huntsville. I served as a moderator for the presentation session and as a panelist during the concluding penal discussion.

Conference organizing committee member **ISTTT 25, Ann Arbor, US** *2022 – 2024*
ISTTT (International Symposium on Transportation and Traffic Theory) is widely recognized as one of the most influential conferences in the field of transportation and traffic theory. I served as the organizing committee member for ISTTT 25 in Ann Arbor. My work included handling papers for special issues of TR part C, preparing conference proceedings, and designing the conference program. I was also the photographer!

Young Editorial Board Member **Intelligent Transportation Infrastructure** *2024 – Present*

Young Member *of Technical Committee* **3rd World Transport Convention** *2023 – 2026*
Intelligent and Connected Traffic Control with V2X

Teaching

2024 Fall: Co-Instructor for CEE 551 (for graduate students) at UofM: Traffic Science

2023 Fall: Co-Instructor for CEE 551 (for graduate students) at UofM: Traffic Science (Teaching evaluation – course rate Q1: 4.6/5.0 and instructor rate Q2: 4.9/5.0)

2022 Fall: Co-Instructor for CEE 551 (for graduate students) at UofM: Traffic Science

2020 Winter: Graduate Student Instructor for CEE 450 (undergraduate) at UofM: Introduction to Transportation Engineering

Student Mentorship

- Xingyi He (undergraduate student, Tsinghua University), 2024 – present
- Paixun Lin (master student, UofM, Civil Engineering), 2023
- Chenhao Zhang (undergraduate student, UofM, Computer Science), now at CMU, 2021 – 2023
- Saiyu Zhang (master student, UofM, Civil Engineering), 2021 – 2022
- Kechen Zhu (master student, UofM, Civil Engineering), 2021 – 2022

Referees

Dr. Henry Liu (henryliu@umich.edu)
Bruce D. Greenshields Collegiate Professor of Engineering at the University of Michigan
Director of Mcity and Center for Connected and Automated Transportation (USDOT Region 5 UTC)
Research professor at the U-M Transportation Research Institute
Founder of U-M's Next Generation Transportation Systems program

Dr. Yafeng Yin (yafeng@umich.edu)
Donald Malloure Department Chair of Civil and Environmental Engineering at the University of Michigan
Donald Cleveland Collegiate Professor of Engineering

Dr. Siqian Shen (siqian@umich.edu)
Professor at the Department of Industrial & Operations Engineering, University of Michigan
Program Director for the Civil Infrastructure Systems (CIS) program under ENG/CMMI division in the National Science Foundation (NSF)

Dr. Neda Masoud (nmasoud@umich.edu)
Associate Professor at the Department of Civil and Environmental Engineering, University of Michigan

Dr. Cathy Wu (cathywu@mit.edu)
Thomas D. and Virginia W Cabot Career Development Associate Professor, Civil and Environmental Engineering, MIT