

Meixin Zhu

Department of Civil and Environmental Engineering, University of Washington
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INTERESTS

Autonomous Driving, Reinforcement Learning, Driving Behavior, Traffic-Flow Modeling and Simulation, Traffic Signal Control, Multi-Agent Reinforcement Learning

EDUCATION

University of Washington, Seattle, US

- Ph.D. in Intelligent Transportation System Sep 2018 – Present
 - Advisor: Prof. Yin Hai Wang, professor in CEE, adjunct professor in ECE
 - Focus: Intelligent Transportation, Driving Behavior, Autonomous Driving, 3D Detection, Deep Reinforcement Learning
 - Core Courses: CSE 546 Machine Learning, CSE 571 Robotics (4.0/4.0), CSE 573 Artificial Intelligence, CSE 576 Computer Vision (4.0/4.0), CSE 547 Machine Learning for Big Data, CSE 599W Reinforcement Learning, CSE 599Q1 Quantum Computing
 - Cumulative GPA: 3.87/4.0

Georgia Institute of Technology, Atlanta, US

- Master of Science in Computer Science (online) Jan 2021 – Present
 - Cumulative GPA: 4.0/4.0

Tongji University, Shanghai, China

- Master of Science in Communication and Transportation Engineering Sep 2015 – Jun 2018
 - Thesis: Car-Following Behavior Modeling and Its Application in Intelligent Driving
 - Focus: Autonomous driving, reinforcement learning, car-following behavior, and naturalistic driving study
 - Cumulative GPA: 91.2 / 100; Integrated Ranking: 1 / 237
- Bachelor of Science in Traffic Engineering Sep 2011 – Jun 2015
 - Thesis: Evaluating Advanced Driving Assistance System Based on Naturalistic Driving Data
 - Cumulative GPA: 91.62 / 100; Integrated Ranking: 1 / 205

RESEARCH EXPERIENCE

Applied Scientist Intern, Amazon, Last Mile ML Science Team

Jun 2021 – Sep 2021

- Last Mile Delivery Optimization

Research Intern, Oak Ridge National Laboratory

Jun 2019 – Dec 2019

- Signal Timing Control for Large-Scale Networked Intersections
 - Advisor: Hong Wang
 - Proposed three new multi-input and multi-output (MIMO) traffic signal control methods (based on **feedback control, LQR, and bilinear modeling**) that can improve network-wide traffic operations in terms of delay and energy consumption.
 - A 35-intersection network of Bellevue, WA, is used as the basis for the development of the algorithm, where modeling and intersection controls in a globalized setting are established using MIMO linear control theory and high matrix formulation.
 - The proposed control methods were evaluated in a microscopic traffic simulation environment, VISSIM. Simulation results show that the proposed methods have much shorter average travel delays in the network when compared with the delays of conventional pretimed and actuated controls.

Research Assistant, General Motors

Apr 2015 – Jun 2018

- Shanghai Naturalistic Driving Study Data Analyses
 - Collected 60 Chinese drivers' real-world driving data, with a total mileage of 161,055 km.
 - Investigated decision-making mechanisms for essential driving behaviors based on 108,933 car-following events, 17,309 lane-change events, 7,845 cut-in events, and 3,256 vehicle-pedestrian conflicts.
 - Calibrated, validated, and cross-compared five representative car-following models and found that the intelligent driver model (IDM) performed best for Shanghai drivers.
 - Investigated the impact of a forward collision warning system on drivers' car following behavior.
 - Developed two autonomous car-following algorithms with deep reinforcement learning: one can perform human-like car following; the other is capable of controlling vehicle velocity in a safe, efficient, and comfortable manner.

Research Assistant, China First Automobile Work (FAW) Corporation

Dec 2011 – Dec 2015

- Driving Behavior Research for Intelligent Collision Avoidance Technology
 - Examined the effects of situational urgency on drivers' collision avoidance behaviors using Tongji University's eight-degree-of-freedom driving simulator.
 - Developed a kinematic-based forward collision warning (FCW) algorithm that is compatible with drivers' risk perceptions and behavioral responses.
 - Implemented the proposed FCW algorithm in Tongji University driving simulator, and evaluated the system's performance, warning timing, and safety benefits.

PUBLICATIONS

Journal Articles

- [1] **M. Zhu**, W. Zhu, J. Lutin, Y. Wang, and Z. Cui, "Developing a statistically valid and practical method to compute state-level bus occupancy rates," *Journal of Transportation Engineering, Part A: Systems*, vol. 147, issue 6, Feb 2021.
- [2] H. Yang, **M. Zhu**, C. Liu, and Y. Wang, "How fast you will drive? predicting speed of customized paths based on deep neural networks,," *IEEE Transactions on Intelligent Transportation Systems*, Feb 2021 (IF: 6.492).
- [3] **M. Zhu**, Y. Wang, J. Hu, X. Wang, and R. Ke, "Safe, efficient, and comfortable velocity control based on reinforcement learning for autonomous driving," *Transportation Research Part C: Emerging Technologies*, vol. 117, pp. 102662, Aug 2020 (IF: 8.089).
- [4] **M. Zhu**, X. Wang, and Y. Wang, "Human-like autonomous car-following planning by deep reinforcement learning," *Transportation Research Part C: Emerging Technologies*, vol. 97, pp. 348–368, Dec 2018 (IF: 8.089).
- [5] **M. Zhu**, X. Wang, A. Tarko, and S. Fang, "Modeling car-following behavior on urban freeways in Shanghai: a naturalistic driving study," *Transportation Research Part C: Emerging Technologies*, vol. 93, pp. 425–445, Aug 2018 (IF: 8.089).
- [6] **M. Zhu**, X. Wang, and J. Hu, "Impact on car following behavior of a forward collision warning system with headway monitoring ,," *Transportation Research Part C: Emerging Technologies*, vol. 111, pp. 425–244, Feb 2020 (IF: 8.089).
- [7] Z. Pu, **M. Zhu**, Z. Cui, and Y. Wang, "Mining public transit ridership flow and origin-destination information from Wi-Fi and bluetooth sensing data," *IEEE Internet of Things Journal*, Jun 2020 (IF: 9.471).
- [8] H. Wang, **M. Zhu**, W. Hong, C. Wang, G. Tao, and Y. Wang, "Optimizing signal timing control for large urban traffic networks using an adaptive linear quadratic regulator control strategy," *IEEE Transactions on Intelligent Transportation Systems*, Aug 2020 (IF: 6.492).
- [9] X. Wang, **M. Zhu**, M. Chen, and P. Tremont, "Drivers' rear end collision avoidance behaviors under different levels of situational urgency," *Transportation Research Part C: Emerging Technologies*, vol. 71, pp. 419–433, Oct 2016 (IF: 8.089).
- [10] X. Wang, M. Chen, **M. Zhu**, and P. Tremont, "Development of a kinematic-based forward collision warning algorithm using an advanced driving simulator," *IEEE Transactions on Intelligent Transportation Systems*, vol. 17, no. 9, pp. 2583–2591, Sep 2016 (IF: 6.492).
- [11] X. Wang, and **M. Zhu**, "Calibrating and validating car-following models on urban expressways for Chinese drivers using naturalistic driving data," *China Journal of Highway and Transport*, vol. 31, issue 9, pp. 129–138, Oct 2018 (in Chinese).
- [12] M. Yang, X. Wang, and **M. Zhu**, "Driving behavior research based on naturalistic driving study," *Traffic and Transportation*, vol. 33, no. 3 pp. 7–9, Mar 2017 (in Chinese).
- [13] X. Wang, **M. Zhu**, and M. Chen, "Dimension reduction and multivariate analysis of variance for drivers' forward collision avoidance behavior characteristic," *Journal of Tongji University*, vol. 44, no. 12 pp. 1858–1866, Dec 2016 (in Chinese, EI).
- [14] X. Wang, **M. Zhu**, and Y. Xing, "Impacts of collision warning system on car-following behavior based on naturalistic driving data," *Journal of Tongji University*, vol. 44, no. 7 pp. 1045–1051, Jul 2016 (in Chinese, EI).
- [15] X. Wang, **M. Zhu**, and M. Chen, "Impacts of situational urgency on drivers' collision avoidance behaviors," *Journal of Tongji University*, vol. 44, no. 6 pp. 876–883, Jun 2016 (in Chinese, EI).

Conferences

- [1] **M. Zhu**, X. Wang, and Y. Wang, "Differences in freeway car following: empirical findings from naturalistic driving studies in Shanghai and Ann Arbor," *accepted by the 99th Annual Meeting of the Transportation Research Board*, Washington D.C., USA, Jan 2020.
- [2] Z. Pu, X. Guo, Z. Cui, **M. Zhu**, and Y. Wang, "Mining public transit ridership flow and origin-destination information from wi-fi and bluetooth sensing data," *accepted by the 99th Annual Meeting of the Transportation Research Board*, Washington D.C., USA, Jan 2020.
- [2] Z. Cui, M. Fu, **M. Zhu**, X. Ban, and Y. Wang, "Transportation artificial intelligence platform for traffic forecasting," *accepted by the 99th Annual Meeting of the Transportation Research Board*, Washington D.C., USA, Jan 2020.
- [3] H. Wang, C. Wang, **M. Zhu**, and W. Hong, "Globalized modeling and signal timing control for large-scale networked intersections," in *Proceedings of the 2nd ACM/EIGSCC Symposium On Smart Cities and Communications (SCC 2019)*, Portland, OR, USA:ACM, Sep 2019.
- [4] P. Sun, X. Wang, and **M. Zhu**, "Calibrating Car-Following Models on Freeway Based on Naturalistic Driving Study," in *19th COTA International Conference of Transportation Professionals*, Jul 2019.
- [5] **M. Zhu**, X. Wang, and J. Hu, "Impact on car following behavior of a forward collision warning system with headway monitoring," *Presentation at the 98th Annual Meeting of the Transportation Research Board*, Washington D.C., USA, Jan 2019.
- [6] X. Wang, L. He, **M. Zhu**, and C. Chai, "Calibrating car-following model on surface roads using Shanghai naturalistic driving study data," *Presentation at the 98th Annual Meeting of the Transportation Research Board*, Washington D.C., USA, Jan 2019.
- [7] **M. Zhu**, X. Wang, and Y. Wang, "Human-like autonomous car-following planning by deep reinforcement learning," *Presentation at the 97th Annual Meeting of the Transportation Research Board*, Washington D.C., USA, Jan 2018.
- [8] X. Wang, M. Yang, and **M. Zhu**, "An exploration of cut-in behavior and gap acceptance using Shanghai Naturalistic Driving data," *Presentation at the 97th Annual Meeting of the Transportation Research Board*, Washington D.C., USA, Jan 2018.
- [9] **M. Zhu**, X. Wang, and Y. Wang, "Human-like autonomous car-following model by deep deterministic policy gradient reinforcement learning," *Accepted for Oral Presentation at the ASCE International Conference on Transportation and Development*, Pittsburgh, Pennsylvania, Jul 2018.
- [10] **M. Zhu**, X. Wang, and A. Tarko, "Calibrating car-following models on urban expressways for Chinese drivers using naturalistic driving data," *Oral Presentation at the 96th Annual Meeting of the Transportation Research Board*, Washington D.C., USA, Jan 2017.
- [11] **M. Zhu**, and X. Wang, "Impact of a forward collision warning system on headway and reaction time during car following," in *Proceedings of the 14th World Conference on Transport Research*, Shanghai, China, Jul 2016.
- [12] **M. Zhu**, X.S. Wang, and X.M. Wang, "Car-following headways in different driving situations: a naturalistic driving study," in *Proceedings of the 16th COTA International Conference of Transportation Professionals*, Shanghai, China, Jul 2016.
- [13] X. Wang, and **M. Zhu**, "Car-following headways in different driving situations: a naturalistic driving study in China," in *Proceedings of the 5th International Symposium on Naturalistic Driving Research*, Blacksburg, Virginia, USA, Oct 2016.

Patents

- [1] X. Wang, **M. Zhu**, and M. Chen, "A forward collision warning algorithm considering heterogeneity of drivers' reaction," *C.N. Patent 105691391 A*, filed Jun 2016, and issued Sep 2017.

Reports

- [1] Y. Wang, X. Ban, Z. Cui, and **M. Zhu**, "An artificial intelligence platform for network-wide congestion detection and prediction using multi-source data," *Connected Cities for Smart Mobility toward Accessible and Resilient Transportation Center (C2SMART)*, Jun 2019.
- [2] Y. Wang, W. Zhu, and **M. Zhu**, "A connected vehicle-based adaptive navigation algorithm," *Pacific Northwest Transportation Consortium (PacTrans)*, Jun 2019.
- [3] Y. Wang, M. Roger, J. Lutin, W. Zhu, **M. Zhu**, "Developing a statistically valid and practical method to compute bus and truck occupancy data," *Federal Highway Administration (FHWA)*, May 2019.

AWARDS & SCHOLARSHIPS	<ul style="list-style-type: none"> Wining Award, 2021 Digital China Innovation Contest Top 4 of 1332 teams, Smart Transportation-Collision Detection based on Big Data of Internet of Vehicles. 	Apr 2021
	<ul style="list-style-type: none"> Second Place, Poster Competition of 2020 PacTrans Student Transportation Conference 	Nov 2020
	<ul style="list-style-type: none"> Outstanding Graduates of Shanghai, Shanghai Education Commission Top 5%, for outstanding graduate students in Shanghai. 	Mar 2018
	<ul style="list-style-type: none"> National Graduate Scholarship (twice), Ministry of Education, China Top 0.2%, for outstanding graduate students in China. 	Oct 2017, Oct 2016
	<ul style="list-style-type: none"> Outstanding Student Award, Tongji University One of 44 awardees from the 13,864 graduate students in Tongji. 	Oct 2016
	<ul style="list-style-type: none"> China Graduate Mathematical Contest in Modeling, Second Prize 	Sep 2016
	<ul style="list-style-type: none"> Volvo Scholarship, Volvo Group One of 15 awardees in China, for outstanding engineering students. 	Dec 2014
	<ul style="list-style-type: none"> National Competition of Transport Science and Technology for Students, Second Prize One of 8 winning groups in China. Project: Traffic Parameter Analysis Platform based on Unmanned Aerial Vehicle (UAV). 	May 2014
	<ul style="list-style-type: none"> Mathematical Contest in Modeling, Honorable Mention Paper: Modeling the Keep-Right-Except-To-Pass Rule Using Cellular Automaton 	Jan 2014
	<ul style="list-style-type: none"> National Endeavor Fellowship (twice), Ministry of Education, China Top 3% of all the undergraduate students in China. 	Nov 2013, Nov 2012
	<ul style="list-style-type: none"> China Undergraduate Mathematical Contest in Modeling, Second Prize Top 5% among over 30,000 competition teams in China. 	Sep 2013
TEACHING & VOLUNTEER	Instructor , CET590 Traffic Systems Operations, University of Washington	Fall 2021
	Teaching Assistant , CET590 Traffic Systems Operations, University of Washington <ul style="list-style-type: none"> Homework grading and tutoring, simulation tutorials, and final exams preparation. 	Fall 2020
	Teaching Assistant , Statistical Analysis in Transportation Engineering, Tongji University <ul style="list-style-type: none"> Preparing course slides and tutoring students on SAS coding. 	Fall 2017
	Volunteer , Knowledge Discovery and Data Mining (KDD) 2021 Conference	Summer 2021
PROFESSIONAL ACTIVITIES	Reviewer	
	<ul style="list-style-type: none"> IEEE Transactions on Intelligent Vehicles Transportation Research Part C: Emerging Technologies Transportation Research Record Accident Analysis & Prevention Journal of Intelligent Transportation Systems ACM Transactions on Intelligent Systems and Technology IEEE Transactions on Knowledge and Data Engineering International Conference on Machine Learning (ICML) Conference on Neural Information Processing Systems (NeurIPS) International Conference on Learning Representations (ICLR) IEEE International Conference on Robotics and Automation (ICRA) 	
	Connected & Autonomous Vehicles (CAV) Impacts Committee , ASCE Transportation & Development Institute (T&DI)	
	<ul style="list-style-type: none"> Younger Committee Member 	Sep 2019 – Present
	Artificial Intelligence Committee , ASCE Transportation & Development Institute (T&DI)	
	<ul style="list-style-type: none"> Associate Committee Member 	2020 – Present
	Street and Highway Operations Committee , ASCE Transportation & Development Institute (T&DI)	
	<ul style="list-style-type: none"> Associate Committee Member 	2019 – Present
	SKILLS	
	Python, Pytorch, MATLAB, TensorFlow, C, C++, Java, R, SAS, SQL, VISSIM	