Meixin Zhu

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INTERESTS Autonomous Driving, Computer Vision, Driving behavior, Traffic-Flow Modeling and Simulation

EDUCATION

University of Washington, Seattle, US

- Ph.D. Candidate in Transportation Engineering — Sep 2018 – Present
  - Advisor: **Prof. Yinhai Wang**
  - Focus: Intelligent Transportation, Driving Behavior, Autonomous Driving, 3D Detection, Deep Reinforcement Learning
  - Core Courses: CSE546 Machine Learning, CSE571 Robotics (4.0/4.0), CSE573 Artificial Intelligence, CSE 576 Computer Vision (4.0/4.0), CSE 547 Machine Learning for Big Data
  - Cumulative GPA: 3.86/4.0

Tongji University, Shanghai, China

- MEng 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
  - Core Courses: Machine Learning, Fundamentals of Software Techniques, Transport Data Analysis, Fundamental of Traffic Flow Theory and Micro Simulation Analysis, Traffic Safety Analysis and Experiment
  - Online Courses: Deep Reinforcement Learning (Berkeley EECS), Deep Learning for Self-Driving Cars (MIT EECS)
- BEng 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
  - Math Courses: Advanced Mathematics, Linear Algebra, Probability and Mathematical Statistics, Operation Research, Numerical Methods and Computer Algorithms, An Introduction to Matlab and Its Application in Engineering
  - Physics Courses: General Physics, Theoretical Mechanics, Structural Mechanics, Mechanics of Materials
  - Computer Courses: C/C++ Programming, Database Technology and Applications, Fundamentals of Computers, Mobile Computing Introduction, Operating System (audit), Computer Vision (audit)
  - Professional Courses: Statistical Analysis in Transportation Engineering, Theory of Transportation System, Traffic Information Engineering, Traffic Management and Control, Traffic Safety Engineering, Transportation Planning

Coursera, Mountain View, US

- Deep Learning Specialization, deeplearning.ai — Dec 2018
  - Neural Networks and Deep Learning
  - Improving Deep Neural Networks: Hyperparameter tuning, Regularization and Optimization
  - Structuring Machine Learning Projects
  - Convolutional Neural Networks
  - Sequence Models

RESEARCH EXPERIENCE

Signal Timing Control for Large-Scale Networked Intersections — Jun 2019 – Present

- Oak Ridge National Laboratory, Oak Ridge Institute for Science and Education (ORISE)
  - Advisor: Hong Wang
  - Proposed two new multi-input and multi-output (MIMO) traffic signal control methods 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.

Shanghai Naturalistic Driving Study Data Analyses — Apr 2015 – Jun 2018

- General Motors, Active Safety Advance Development Department
  - 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 full velocity difference model 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.

Optimized Design for Combined Road Alignment Sep 2014 – Jun 2018

- Chinese National Science Foundation with Grant No. 51522810
  - Evaluating the safety performance of combined horizontal and vertical alignments in mountainous freeways, to guide the design of safer mountainous freeways.
  - Replicated the full range of combined alignments used on a mountainous freeway in China using Tongji University driving simulator.
  - Investigated the effects of combined alignment on lateral acceleration, lane offset, and speed variation.

Driving Behavior Research for Intelligent Collision Avoidance Technology Dec 2011 – Dec 2015

- China First Automobile Work (FAW) Corporation
  - 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**, 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: 3.805).

[2] **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: 3.805).

[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," *IEEE Transactions on Intelligent Transportation Systems*, under review, Jan 2019.

[4] 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: 3.805).

[5] 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: 3.724).

[6] 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).

[7] 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).

[8] 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).

[9] 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).

[10] 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 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.

[2] 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.

[3] **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.

[4] 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.

[5] **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.

[6] **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.

[7] **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.

[8] **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.

[9] 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.

AWARDS & SCHOLARSHIPS

- Outstanding Graduates of Shanghai, Shanghai Education Commission — Mar 2018
  Top 5%, for outstanding graduate students in Shanghai.
- National Graduate Scholarship (twice), Ministry of Education, China — Oct 2017, Oct 2016
  Top 0.2%, for outstanding graduate students in China.
- Outstanding Student Award, Tongji University — Oct 2016
  One of 44 awardees from the 13,864 graduate students in Tongji.
- China Post-Graduate Mathematical Contest in Modeling, Second Prize — Sep 2016
- Volvo Group Scholarship, Volvo Group — Dec 2014
  One of 15 awardees in China, for outstanding engineering students.
- National Competition of Transport Science and Technology for Students, Second Prize — May 2014
  One of 8 winning groups in China.
  Project: Traffic Parameter Analysis Platform based on Unmanned Aerial Vehicle (UAV).
- Mathematical Contest in Modeling, Honorable Mention — Jan 2014
  Paper: Modeling the Keep-Right-Except-To-Pass Rule Using Cellular Automaton
- National Endeavor Fellowship (twice), Ministry of Education, China — Nov 2013, Nov 2012
  Top 3% of all the undergraduate students in China.
- China Undergraduate Mathematical Contest in Modeling, Second Prize — Sep 2013
  Top 5% among over 30,000 competition teams in China.

VOLUNTEER & TEACHING

The 5th International Symposium on Transportation Safety, Tongji University, China — Sep 2017

- Picked up 13 international symposium attendees at the airport.
- Prepared the invitation letters, and was in charge of the symposium registration.

Transportation Safety Discipline "111 Project" Base, Tongji University, China — Sep 2016

- Translated resumes for 21 invited international experts and prepared the presentation files.

Statistical Analysis in Transportation Engineering, Teaching Assistant, Tongji University — Fall 2017

- Preparing course slides and tutoring students on SAS coding.

WORK EXPERIENCE

Cloud Base Information Corporation, Shanghai, China

- Intern, Department of Data Science — Sep 2014 – Nov 2014
  - Project: Traffic State Estimation Based on Mobile Phone Signaling Data.
  - Real-time estimation of traveling speed, traveling time and traffic congestion state.

PROFESSIONAL ACTIVITIES

Accident Analysis & Prevention, Elsevier

- Reviewer — 2017, 2018

Connected & Autonomous Vehicles (CAV) Impacts Committee, ASCE Transportation & Development Institute (T&DI)

- Younger Committee Member — Sep 2019 – Present

REFERENCES

- **Professor Yinhai Wang**, Advisor
  Department of Civil and Environmental Engineering, University of Washington
- **Professor Xuesong Wang**, Advisor
  College of Transportation Engineering, Tongji University
- **Professor Andrew P. Tarko**, Research Advisor
  Lyles School of Civil Engineering, Purdue University

SKILLS

Python, Pytorch, Julia, MATLAB, TensorFlow, Theano, C, C++, Java, R, SAS, SQL Server.