Meixin Zhu

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RESEARCH INTERESTS

Autonomous Driving, Reinforcement Learning, Big Data Analytics, Driving behavior, Traffic-Flow Modeling and Simulation.

EDUCATION

Tongji University, Shanghai, China

- MEng in Communication and Transportation Engineering — Sep 2015 – Present
  - Thesis: Car-Following Behavior Modeling and Its Application in Intelligent Driving
  - Adviser: Prof. Xuesong Wang
  - Focus: Autonomous driving, reinforcement learning, car-following behavior, and naturalistic driving study.
  - Cumulative GPA: 92 / 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.
- BSc in Traffic Engineering — Sep 2011 – Jun 2015
  - Thesis: Evaluating Advanced Driving Assistance System Based on Naturalistic Driving Data
  - Cumulative GPA: 92 / 100; Integrated Ranking: 1 / 205
  - Math Courses: Advanced Mathematics, Linear Algebra, Probability and Mathematical Statistics, Operation Research, Numerical Methods and Computer Algorithms.
  - 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, An Introduction to Matlab and Its Application in Engineering.
  - Professional Courses: Statistical Analysis in Transportation Engineering, Theory of Transportation System, Traffic Information Engineering, Traffic Management and Control, Traffic Safety Engineering, Transportation Planning.

Udacity, Mountain View, US

- Self-Driving Car Engineer Nanodegree — Oct 2016 – Oct 2017
  - Core Courses: Deep Learning, Computer Vision, Sensor Fusion, Localization, Control, Path Planning, Semantic Segmentation, Functional Safety, System Integration.
  - Capstone Project: Programming a Real Self-Driving Car. Including Traffic Light Detection, Control, and Waypoint Following.

RESEARCH EXPERIENCE

Shanghai Naturalistic Driving Study Data Analyses — Apr 2015 – Present

- General Motors, Active Safety Advance Development Department
  - Collected 60 Chinese drivers' real-world driving data, with a total mileage of 161,055 km.
  - Extracted 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 a human-like autonomous car-following algorithm using deep reinforcement learning, which outperformed traditional models.

Optimized Design for Combined Road Alignment — Sep 2014 – Present

- 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 Under Review

[1] **M. Zhu**, and X. Wang, "Reinforcement learning based velocity control for autonomous driving with multi-objectives: safety, efficiency, and comfort," *Computer-Aided Civil and Infrastructure Engineering*, submitted, under the first round review, Oct 2017.

[2] **M. Zhu**, X. Wang, and Y. Wang, "Human-like autonomous car-following planning by deep reinforcement learning," *Transportation Research Part C: Emerging Technologies*, submitted, under the first round review, Oct 2017.

[3] **M. Zhu**, and X. Wang, "Impact on car following behavior of a forward collision warning system with headway monitoring," *Transportation Research Part C: Emerging Technologies*, submitted, under the first round review, Oct 2017.

[4] **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*, submitted, under the second round review, Sep 2017.

Journal Articles Published

[1] 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).

[2] 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).

[3] 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*, in press, Oct 2017 (in Chinese, EI).

[4] 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).

[5] 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).

[6] 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).

[7] 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, "Human-like autonomous car-following planning by deep reinforcement learning," *Accepted for Presentation at the 97th Annual Meeting of the Transportation Research Board*, Washington D.C., USA, Jan 2018.

[2] X. Wang, M. Yang, and **M. Zhu**, "An exploration of cut-in behavior and gap acceptance using Shanghai Naturalistic Driving data," *Accepted for Presentation at the 97th Annual Meeting of the Transportation Research Board*, Washington D.C., USA, Jan 2018.

[3] R. Yu, H. Lin, and **M. Zhu**, "Reinforcement learning based velocity control for autonomous driving with multi-objectives: safety, efficiency, and comfort," *Accepted for Presentation at the 97th Annual Meeting of the Transportation Research Board*, Washington D.C., USA, Jan 2018.

[4] **M. Zhu**, X. Wang, and Y. Wang, "Human-like autonomous car-following model by deep deterministic policy gradient reinforcement learning," *ASCE International Conference on Transportation and Development*, Pittsburgh, Pennsylvania, Jul 2018.

[5] **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.

[6] **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.

[7] **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.

[8] 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

- 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
  Top 20% of over 8,000 competition teams in China.
- "Inspirational Star," Tongji University — Jun 2015
  One of 10 awardees from Tongji University.
- 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 EXPERIENCE

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.
- Prepared the presentation file for the application of "111 Project" base.

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.

AUDIT COURSES

- Deep Reinforcement Learning — Spring 2017
  Department of Electrical Engineering and Computer Science, UC Berkeley.
- Deep Learning for Self-Driving Cars — Spring 2017
  Department of Electrical Engineering and Computer Science, MIT.
- Operating System — Fall 2014
  School of Software Engineering, Tongji University.
- Computer Vision — Spring 2014
  School of Software Engineering, Tongji University.

STANDARD TESTS

- TOEFL: 105 (Reading 30, Listening 28, Speaking 20, Writing 27) — Oct 2017
- GRE 325 (Verbal 158, 80%, Quantitative, 167, 92%) Analytical Writing 3.5, 42% — Jun 2017

SKILLS

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