Zhouqiao Zhao, Ph.D.

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EMPLOYMENT

Postdoctoral Associate *Sep. 2023 – Present*

Center for Transportation & Logistics, AgeLab, MIT (Supervisor: Dr. Pnina Gershon & Dr. Bryan Reimer)

Graduate Student Researcher *Sep. 2018 – Jul. 2023*

Transportation Systems Research Lab, University of California, Riverside (Supervisor: Dr. Matthew Barth & Dr. Guoyuan Wu)

Research Intern *Sep. 2022 - Jan. 2023*

Honda Research Institute, Ann Arbor, MI (Mentors: Dr. Ehsan Moradi-Pari)

Research Intern *Jun. 2021 – Sep. 2021*

Toyota Motor North America R&D, InfoTech Labs, Mountain View, CA (Mentors: Dr. Kyungtae Han & Dr. Ziran Wang)

Research Intern *Mar. 2018 – Jun. 2018*

Intelligent Driving Research Group, Tsinghua Unigroup Co. Ltd., Beijing, China

Graduate Research Assistant *Jun. 2017 – Jan. 2018*

Control and Intelligent Transportation Research Laboratory, Ohio State University (Supervisor: Umit Ozguner)

Graduate Research Assistant *Sep. 2016 – May 2017*

Intelligent Transportation System Laboratory, Ohio State University (Supervisor: Dr. Benjamin Coifman)

EDUCATION

Ph.D. in Electrical Engineering *Sep. 2018 – Jun. 2023*

University of California, Riverside, CA (UCR)

Co-Advisors: Dr. Matthew J. Barth, Yeager Family Chair Professor, Electrical and Computer Engineering
Dr. Guoyuan Wu, Adjunct Professor, Electrical and Computer Engineering

Dissertation: A Connected Automation Enabled Cooperative Management Framework for Mixed Traffic
[Top Five in AED50 Student Dissertation Competition]
[National Center for Sustainable Transportation (NCST) Dissertation Award]

M.S. in Electrical and Computer Engineering *Sep. 2015 – May 2017*

The Ohio State University, Columbus, OH (OSU)

B.S. in Electronic and Information Engineering *Sep. 2012 – May 2015*

University of Electronic Science and Technology of China, Sichuan, China (UESTC)

REFEREED PUBLICATIONS

Under Review

[C14] Using Multimodal Large Language Models to Characterize Driver-Pedestrian Dynamic

- Zhouqiao Zhao, Bruce Mehler, Bryan Reimer, Pnina Gershon
- 2026 IEEE Intelligent Vehicles Symposium, under review

[J10] Context-Aware XAI for Modeling and Understanding Driver Responses to Forward Collision Warnings: A Bi-Level GNN Framework

- Zhouqiao Zhao, Thomas Z. Noonan, Bruce Mehler, Bryan Reimer, Pnina Gershon
- IEEE Transactions on Robotics (T-RO), under review

[J9] A Digital Twin Framework for Personalized Adaptive Cruise Control: Integrating Inverse Reinforcement Learning and Adaptive Model Predictive Control

- Zhouqiao Zhao, Ziran Wang, Kyungtae Han, Rohit Gupta, Matthew Barth, Guoyuan Wu
- IEEE Transactions on Systems, Man, and Cybernetics: Systems, under review

Conference Proceedings

[C13] Design, Implementation, and Evaluation of an Innovative Vehicle-Powertrain Eco-Operation System for Plug-in Hybrid Electric Buses

- Zhouqiao Zhao, Dylan Brown, Danny Esaid, Peng Hao, Guoyuan Wu, Kanok Boriboonsomsin
- 2025 IEEE Conference on Technologies for Sustainability, *Los Angeles, CA, USA*

[C12] Driver Behavior in Response to Forward Collision Warnings Considering Driving Context

- Zhouqiao Zhao, Linda Pipkorn, Bruce Mehler, Bryan Reimer, Pnina Gershon
- Proceedings of the Human Factors and Ergonomics Society Annual Meeting, AZ, United States, *Sep. 2024*

[C11] Real-time Learning of Driving Gap Preference for Personalized Adaptive Cruise Control

- Zhouqiao Zhao, Xishun Liao, Amr Abdelraouf, Kyungtae Han, Rohit Gupta, Matthew J Barth, Guoyuan Wu
- 2023 IEEE International Conference on Systems, Man, and Cybernetics (SMC), *Hawaii, 2023*

[C10] Inverse Reinforcement Learning and Gaussian Process Regression-based Real-Time Framework for Personalized Adaptive Cruise Control

- Zhouqiao Zhao, Xishun Liao, Amr Abdelraouf, Kyungtae Han, Rohit Gupta, Matthew J Barth, Guoyuan Wu
- 2023 IEEE 26th International Conference on Intelligent Transportation Systems (ITSC) Bilbao, Bizkaia, *Spain, 2023*

[C9] End-To-End Spatio-Temporal Attention-Based Lane-Change Intention Prediction from Multi-Perspective Cameras

- Zhouqiao Zhao, Zhensong Wei, Danyang Tian, Bryan Reimer, Pnina Gershon, Ehsan Moradi-Pari
- 2023 IEEE Intelligent Vehicles Symposium (IV), Anchorage, AK, United States, *Jul. 2023*

[C8] Real-time Adaptive Background Subtraction for Traffic Scenarios at Signalized Intersections Based on Roadside Fisheye Cameras

- Jiahe Cao, Zhouqiao Zhao, Guoyuan Wu, Matthew Barth, Yongkang Liu, Emrah Akin Sisbot, Kentaro Oguchi
- IEEE 25th International Conference on Intelligent Transportation Systems (ITSC), Macau, China, *Oct. 2022*

[C7] Personalized Car Following for Autonomous Driving with Inverse Reinforcement Learning

- Zhouqiao Zhao, Ziran Wang, Kyungtae Han, Gupta Rohit, Prashant Tiwari, Guoyuan Wu, Matthew Barth
- 2022 IEEE International Conference on Robotics and Automation (ICRA), Philadelphia, PA, *May 2022*

[C6] Online Prediction of Lane Change with a Hierarchical Learning-Based Approach

- Xishun Liao, Ziran Wang, Xuanpeng Zhao, Zhouqiao Zhao, Kyungtae Han, Prashant Tiwari, Matthew J. Barth, Guoyuan Wu
- 2022 IEEE International Conference on Robotics and Automation (ICRA), Philadelphia, PA, *May 2022*

[C5] Connected Vehicle-Based Advanced Detection of "Slow-Down" Events on Freeways

- Zhouqiao Zhao, Guoyuan Wu, Matthew J. Barth, Hossein Nourkhiz Mahjoub, Yasir Khudhair Al-Nadawi, Laith Daman, Shigenobu Saigusa
- IEEE 24th International Conference on Intelligent Transportation Systems (ITSC), Indianapolis, IN, *Sep. 2021*

[C4] Vehicle Dispatching and Scheduling Algorithms for Battery Electric Heavy-Duty Truck Fleets Considering En-route Opportunity

- Zhouqiao Zhao, Guoyuan Wu, Kanok Boriboonsomsin, Aravind Kailas
- 2021 IEEE Conference on Technologies for Sustainability (SusTech), Irvine, CA, *Apr. 2021*

[C3] Developing a Data-driven Modularized Model for Plug-in Hybrid Electric Bus (PHEB) for Connected and Automated Vehicle Applications

- Zhouqiao Zhao, Zhensong Wei, Guoyuan Wu, Matthew J. Barth
- IEEE 23rd International Conference on Intelligent Transportation Systems (ITSC), Rhodes, Greece, *Sep. 2020*

[C2] Optimal Control-Based Eco-Ramp Merging System for Connected and Automated Electric Vehicles

- Zhouqiao Zhao, Guoyuan Wu, Ziran Wang, and Matthew J. Barth
- 2020 IEEE Intelligent Vehicles Symposium (IV), Las Vegas, NV, United States, *Jun. 2020*

[C1] The State-of-the-art of Coordinated Ramp Control with Mixed Traffic Conditions

- Zhouqiao Zhao, Ziran Wang, Guoyuan Wu, and Matthew J. Barth
- IEEE 22nd International Conference on Intelligent Transportation Systems (ITSC), Auckland, New Zealand, *Oct. 2019*

Journal Publications

[J7] A review of personalization in driving behavior: Dataset, modeling, and validation

- Xishun Liao, Zhouqiao Zhao, Matthew J Barth, Amr Abdelraouf, Rohit Gupta, Kyungtae Han, Jiaqi Ma, Guoyuan Wu
- IEEE Transactions on Intelligent Vehicles, *2024*

[J6] Driver Digital Twin for Online Prediction of Personalized Lane Change Behavior

- Xishun Liao, Xuanpeng Zhao, Ziran Wang, Zhouqiao Zhao, Kyungtae Han, Rohit Gupta, Matthew J. Barth, Guoyuan Wu
- IEEE Internet of Things Journal, *2023*

[J5] Robotic Competitions to Design Future Transport Systems: The Case of JRC AUTOTRAC 2020

- Biagio Ciuffo, Michail Makridis, Valter Padovan, Emilio Benenati, Kanok Boriboonsomsin, …, Zhouqiao Zhao
- Transportation Research Record, no. 03611981221110566, *2022*

[J4] Bi-Level Fleet Dispatching Strategy for Battery-Electric Trucks: A Real-World Case Study

- Dongbo Peng, Zhouqiao Zhao, Guoyuan Wu, Kanok Boriboonsom
- Sustainability, vol. 15, issue 2, page 925, *2023*

[J3] Corridor-Wise Eco-Friendly Cooperative Ramp Management System for Connected and Automated Vehicles

- Zhouqiao Zhao, Guoyuan Wu, Matthew Barth
- Sustainability, vol. 13, issue 15, page 8557, *2021*

[J2] Shared Automated Mobility with Demand-side Cooperation: A Proof-of-Concept Microsimulation Study

- Lei Zhu, Zhouqiao Zhao, Guoyuan Wu
- Sustainability, vol. 13, issue 5, page 2483, *2021*

[J1] Review on Connected and Automated Vehicles Based Cooperative Eco-Driving Strategies

- Lan Yang, Xiangmo Zhao, Guoyuan Wu, Zhigang Xu, Matthew J. Barth, Fei Hui, Peng Hao, Mengjie Han, Zhouqiao Zhao, Shan Fang, Shoucai Jing
- Journal of Traffic and Transportation Engineering, vol.20, issue 5, page 58-72, *Oct. 2020*

Technical Reports

[R3] Dyno-in-the-Loop: An Innovative Hardware-in-the-Loop Development and Testing Platform for Emerging Mobility Technologies

- Guoyuan Wu, Dylan Brown, Zhouqiao Zhao, Peng Hao, Michael Todd, Kanok Boriboonsomsin, Matthew J. Barth, Zhiming Gao, and Tim LaClair
- SAE Technical Paper, 2020-01-1057, Apr. *2020*

[R2] PTV VISSIM Simulation Data for Efficient Eco-ramp Control

- Guoyuan Wu, Zhouqiao Zhao
- Transportation Research Information Services (TRIS) Database, *2020*

[R1] Development of Eco-Friendly Ramp Control for Connected and Automated Electric Vehicles

- Guoyuan Wu, Zhouqiao Zhao, Ziran Wang, and Matthew J. Barth
- National Center for Sustainable Transportation Research Reports, *2020*

PATENTS

[P4] Personalized Adaptive Cruise Control based on Steady-State Operation

- Zhouqiao Zhao, Ziran Wang, Rohit Gupta, Kyungtae Han, and Prashant Tiwari
- U.S. patent application 17/578300, Jan. 2022

[P3] Personalized Vehicle Operation for Autonomous Driving with Inverse Reinforcement Learning

- Zhouqiao Zhao, Ziran Wang, Rohit Gupta, Kyungtae Han, and Prashant Tiwari
- U.S. patent application 17/572486, *Jan. 2022*

[P2] Systems and Methods for Predicting Driver Visual Impairment with Artificial Intelligence

- Rohit Gupta, Zhouqiao Zhao, Ziran Wang, Kyungtae Han, and Prashant Tiwari
- U.S. patent application 17/586593, *Jan. 2022*

[P1] Method and System for Personalized Car Following with Transformers

- Ziran Wang, Zhouqiao Zhao, Rohit Gupta, Kyungtae Han, and Prashant Tiwari
- U.S. patent application 17/567504, *Jan. 2022*

FOUNDED PROJECTS

Modeling and Analyzing Driver Behavior in Response to Forward Collision Warnings (FCW) Considering Driving Context, *2023 – Present*

- Sponsored by MIT Advanced Vehicle Technology (AVT) Consortium
- Designed and implemented a multi-stage data extraction and annotation pipeline for FCW events from a large-scale naturalistic driving database, integrating a multi-modal, ego-centric context representation framework to capture intricate driving dynamics
- Developed a novel modeling and analysis framework utilizing Graph Neural Networks (GNN) and Explainable AI (XAI) to predict driver behavior in response to FCW events, providing deeper insights into the underlying interactions within the driver-vehicle-environment system

Characterizing the Differences in Driving Kinematics and Risky Driving Behaviors Between EV and ICE Vehicles, *2024 – Present*

- Sponsored by MIT Advanced Vehicle Technology (AVT) Consortium
- Conducted in-depth statistical analysis comparing driving kinematics and risky behaviors across EV and ICE vehicles, and evaluated trip distance, road type, and driving exposure to assess how driving behaviors evolve over time and under different driving contexts

Modeling Driver's Steering Behavior when Using Partial Automation Across Vehicles with Different Steering Design Strategies, *2023 - 2024*

- Sponsored by MIT Advanced Vehicle Technology (AVT) Consortium
- Extracted a large vehicle encounter (LVE) dataset from a naturalistic driving database using advanced computer vision techniques and comprehensive driver behavior and context annotations to support steering behavior analysis.
- Developed a machine learning model to predict steering patterns, providing insights into the influence of automation and vehicle design strategies on driver control.

End-to-End Spatio-Temporal Attention-Based Lane-Change Intention Prediction, *2022 - 2023*

- Internship work at Honda Research Institute (HRI), collaborating with MIT Advanced Vehicle Technology (AVT) Consortium
- Created one of the highest quality lane-change datasets with multi-view camera and vehicle status data
- Developed an online lane change intention prediction model based on an innovative spatio-temporal attention neural network

Evaluating Connected Vehicle Applications in a Mixed Traffic Environment using a "Digital Twin" Approach, *2021 - 2023*

- Sponsored by Toyota Motor North America, InfoTech Labs
- Developed Graph Neural Network and Reinforcement Learning-based personalized cooperative trajectory planning and control algorithm
- Developed an Inverse Reinforcement Learning (IRL)-based Personalized Adaptive Cruise Control (PACC) algorithm and implemented it in both Unity-based driving simulators and real-world test vehicles
- Developed an online lane change prediction and trajectory planning algorithm and conducted a real-world demo

Cyber Mobility Mirror for Enabling Cooperative Driving Automation (CDA), *2021 - 2023*

- Sponsored by Toyota Motor North America, InfoTech Labs
- Developed a fish-eye camera-based real-time vehicle detection and tracking system for infrastructure-supported cooperative perception at the intersection
- Built RTK-based ground truth system for test vehicle

Small-scale autonomous vehicle traffic challenge (AUTOTRAC), *2020-2021*

- Sponsored by the Joint Research Center (JRC) Exploratory Research Program of the European Commission
- Led a team to design a fleet of 1/24 scale autonomous vehicles with multiple sensors and communication ability to achieve fast and cooperative driving in both freeway and urban scenarios using the Robot Operating System (ROS)
- Designed the system architecture and hardware to meet the competition requirements
- Built multiple algorithms to realize multisensory environment perception, vehicle cooperation, and automation

Connected Vehicle-based Advanced Detection of "Slow-Down" Events on Freeways, *2021*

- Sponsored by Honda Research Institute (HRI)
- Developed effective algorithms for the advanced detection of "slow-down" events, by leveraging connected vehicle and machine learning technologies

Dispatching and Scheduling Algorithms for Battery Electric Heavy-Duty Truck Fleets, *2020-2021*

- Sponsored by Volvo LIGHTS (Low Impact Green Heavy Transport Solutions) Project
- Proposed a bi-level hierarchical method to optimize battery-electric truck dispatch during pickup and delivery runs by improving and implementing the Ant Colony Optimization (ACO)
- Conducted numerical simulation and compared the results with the real-world data from the dispatching company, showing a significant reduction in the operation cost

An Innovative Vehicle-Powertrain Eco-Operation System for Efficient Plug-In Hybrid Electric Buses*, 2019-2020*

- Sponsored by Advanced Research Projects Agency-Energy (ARPA-E), United States Department of Energy
- Developed and realized a real-time automatic controller through MATLAB/Simulink and CANCaseXL
- Investigated the energy consumption of both the default hybrid power split controller and the proposed innovative automatic hybrid power split controller
- Proposed an innovative machine learning-based modularized model for PHEB using LSTM

Developing Eco-Friendly Ramp Control based on Connected and Automated Vehicle Technology, *2019-2020*

- Sponsored by the National Center for Sustainable Transportation (NCST), United States Department of Transportation
- Conducted a comprehensive literature review about the state-of-the-art of coordinated ramp control under mixed traffic conditions
- Developed a corridor-level cooperative ramp merging control system based on an optimal control strategy to provide a more energy-efficient, safer, and higher mobility freeway ramp system
- Applied the proposed system to the traffic simulation environment (PTV VISSIM)

SERVICES

Journal Reviewer

- IEEE Transactions on Vehicular Technology, *2024 - Present*
- IEEE Transactions on Systems, Man, and Cybernetics, *2024 - Present*
- IEEE Intelligent Transportation Systems Magazine, *2024 - Present*
- IEEE Transactions on Robotics, *2023 - Present*
- IEEE Transactions on Intelligent Transportation Systems, *2023 - Present*
- IEEE Internet of Things Journal, *2022 - Present*
- IEEE Transaction on Intelligent Vehicle, *2022 - Present*
- IET Intelligent Transport Systems, *2022 - Present*
- International Journal of Mechanical System Dynamics, *2022 - Present*
- SAE International Journal of Connected and Automated Vehicles, *2020 – Present*
- Transportation Research Record, *2019 - Present*

Conference Reviewer

- The Human Factors and Ergonomics Society (HFES) International Annual Meeting, *2024 - Present*
- IEEE Forum for Innovative Sustainable Transportation Systems, *2024 – Present*
- ACM CHI Conference on Human Factors in Computing Systems, *2023 - Present*
- ITS World Congress, *2023 - Present*
- IEEE Vehicular Technology Conference, *2021 - Present*
- IEEE Intelligent Vehicle Symposium, *2020 - Present*
- IEEE Intelligent Transportation System, *2020 - Present*
- TRB Annual Meeting, *2019 - Present*

TEACHING EXPERIENCE

Intelligent Transportation Systems (UCR EE246)

- Conducted 6 hours of lecture independently as a rotating lecturer of the course
- Introduced car-following models, cooperative adaptive cruise control, and simulation tools

Fundamentals of Electric Circuits II (UCR EE030B)

- Conducted 60 hours of lab sessions and discussion sessions independently as a teaching assistant of the course
- Introduced the operation of equipment such as oscilloscope and experiment to verify frequency response, resonant circuit, passive/active filters, Laplace transformation, and Fourier transformation

STUDENT MENTORING

Mentored at MIT

- Christian Grashei, M.S. visiting student in AgeLab @ MIT, now: Ph.D. student in Computational Pathology @ TUM

Mentored at UCR

- Xuanpeng Zhao, B.S. & M.S. student in ECE @ UCR, now: Ph.D. candidate in ECE @ UCR
- Yu Jiang, B.S. & M.S. student in ECE @ UCR, now: Software Engineer @ GRAIL
- Pingbo Ruan, B.S. & M.S. student in ECE @ UCR, now: M.S. student in ECE @ UCR
- Shangrui Liu, B.S. & M.S. student in ECE @ UCR, now: M.S. student in ECE @ UCR
- Yu Wang, M.S. student in ME @ UCR
- Yuan-Pu Hsu*:* M.S. student in ECE @ UCR, now*:* Software Engineer @ Microsoft

INVITED TALKS

Context-Aware XAI for Analyzing and Modeling Driver Responses to Forward Collision Warnings

- CTL Summer Seminar, Cambridge, MA, *Jul. 2024*

Driver Behavior in Response to Forward Collision Warnings Considering Driving Context

- 2024 MASSDOT Innovation Conference, Worcester, MA, *Apr. 2024*
- NEUTC Symposium, Worcester, MA, *Apr. 2024*

End-to-End Spatio-Temporal Attention-Based Lane-Change Intention Prediction

- Next-Generation Transport Systems Conference (NGTS-3), West Lafayette, IN, *May 2023*

A Connected Automation Enabled Cooperative Management Framework for Mixed Traffic

- Cooperative Interactive Vehicle (CIV) Summer School 2022, Lake Tahoe, CA, *Jul. 2022*

Personalized Car Following for Autonomous Driving with Inverse Reinforcement Learning

- SoCalHub Workshop on Secure Autonomy, Alumni Center, UC Riverside, CA, *Jun. 2022*

Connected Vehicle-Enabled Cooperative Smart Lane Selection Application

- IEEE SusTech 2021, Irvine, CA, *Apr. 2021*

Cooperative Traffic Management of Connected and Automated Vehicles in a Miniature Urban Environment

- IEEE SusTech 2021, Irvine, CA, *Apr. 2021*

HONORS & AWARDS

Top Five in TRB AED50 Student Dissertation Competition *Jan. 2024*
Best Presentation Award, 3rd Annual Conference of Next-Generation Transport Systems Conference (NGTS-3) *May 2023*
Outstanding Reviewer Award, International Journal of Mechanical System Dynamics *Nov. 2022*
National Center for Sustainable Transportation (NCST) Dissertation Award *Sep. 2022*
Transportation System Research Award at CE-CERT *Jul. 2022*
Esther F. Hays Graduate Fellowship Award *Mar. 2021*
Dean's Distinguished Fellowship Award *Sep. 2018 – Sep. 2020*
UESTC Outstanding Graduate Award *Jul. 2017*
UESTC Scholarship Award *Jun. 2021, Jun. 2013, & Jun. 2014*