Kexin Wang

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Research Interests

Cooperation among independent agents; multi-agent coordination under limited information, authority, and computation; incentive design and game theory; intelligent transportation systems.

Education

University of Southern California, Los Angeles, CA 08/2025 – Present
Ph.D. in Civil Engineering (Advisor: Prof. Ruolin Li); GPA: 3.76/4.0
Concurrently pursuing an M.S. in Computer Science.

Cornell University, Ithaca, NY 08/2021 – 12/2022
M.Eng. in Civil Engineering; GPA: 3.83/4.0

Nanjing Forestry University, Nanjing, China 09/2016 – 06/2021
B.S. in Civil Engineering (Top 5%); GPA: 3.80/4.0

University of Minnesota, Twin Cities, Minneapolis, MN 08/2019 – 07/2020
Exchange Student; GPA: 3.77/4.0

Research Experience

Multi-Agent Coordination & Decision-Making

Population-Agent Coordination for Wildfire Response 09/2026 – Present
Research Assistant; Advisors: Prof. Ruolin Li and Prof. Yue Zhao

- Developing a population-agent framework for wildfire robot orchestration, using adaptive price incentives to coordinate task selection, team formation, and communication under changing resource constraints.

Selective Reasoning for Cooperative Driving with Frozen VLA Agents 09/2026 – Present
Research Assistant; Advisors: Prof. Ruolin Li and Prof. Yue Wang

- Coordinating independently trained, frozen driving vision-language-action (VLA) models in closed-loop CARLA by steering them through native conditioning inputs, such as interaction roles, instead of overriding actions.
- Proposed BOND, a budgeted stopping formulation that allocates limited inference by value of computation. Advanced to the proposal round of the Qualcomm Innovation Fellowship 2027 (with Hongyi Jing).

Bounded LLM Mediation for Mixed-Autonomy Traffic 01/2026 – 09/2026
Research Assistant; Advisor: Prof. Ruolin Li

- Proposed DAMA, a dual-LLM framework that interprets congestion regimes and coordinates CAVs through bounded action masks and reward incentives while retaining the base controller's execution authority.
- Proved a performance-loss bound that scales with separate budgets on action restriction and reward shaping. In traffic experiments, DAMA recorded zero collisions, while direct and override LLM interfaces caused 38 and 2 collisions in a ten-seed test.

Traffic Control & Game-Theoretic Coordination

MAPLE: Predictive Macro–Micro Lane-Change Coordination 12/2025 – 09/2026
Research Assistant; Advisors: Prof. Ruolin Li and Prof. Jiachen Li

- Developed a predictive macro–micro framework that maps lane-level congestion sensitivities to decentralized CAV maneuver costs, linking individual lane choices to a regional traffic objective.
- Showed that vehicles decide sequentially in one forward pass with at most three score evaluations each, and bounded the gap between score-based and predicted-cost-optimal choices. Validated the framework in SUMO on synthetic and US-101 weaving scenarios, with multi-agent reinforcement learning (MARL) for longitudinal control.
- **Best Paper Award, BTR#8 (2026).** Reduced mean delay by 9.5–21.3% relative to four conventional lane-change methods across six demand regimes with 50% automated vehicles.

Altruistic AV Control at Highway Weaving Ramps 01/2025 – 12/2025
Research Assistant; Advisor: Prof. Ruolin Li

- Modeled human-driven vehicles' strategic lane choices through Wardrop equilibrium and established equilibrium existence and uniqueness.
- Developed Stackelberg–Wardrop control and Social Value Orientation extensions for altruistic CAVs; characterized penetration thresholds and the effects of CAV strategies on system efficiency.

Transportation Networks, Marketplaces & Operations

Multi-Homing and AV Permit Design in Ride-Hailing Markets 03/2026 – Present

Extension of mixed-autonomy ride-hailing network equilibrium research

- Investigating multi-homing, AV permit policies, and demand–fleet interactions in mixed-autonomy ride-hailing markets, extending the network equilibrium framework to marketplace operations and regulation.

Equilibrium in Mixed-Autonomy Ride-Hailing Networks 01/2025 – Present

Research Assistant; Advisors: Prof. Jong-shi Pang and Prof. Ruolin Li

- Developed a network equilibrium framework coupling ride-hailing profit maximization, human-driven and autonomous fleet operations, traffic congestion, and traveler choice.
- Solved the mixed complementarity problem (MCP) in GAMS using PATH and assessed effects of AV penetration and relaxation parameters on company performance, traveler welfare, and network efficiency.

Street-Level Competitive Ride-Hailing 12/2025 – 07/2026

Research Assistant; Advisors: Prof. Ruolin Li, Prof. Yue Zhao, and Prof. Xiyang Hu

- Built a street-level competitive ride-hailing simulator with per-vehicle pricing, relocation, and service decisions; designed a hybrid spatial controller and U-Net residual policy for multi-agent competition.
- Proposed DF-PSRO, a KL-DRO reweighting of population-based training, to study robustness–efficiency trade-offs against off-equilibrium adversarial opponents.

Publications & Manuscripts

Peer-Reviewed Papers

P1. He, H., **Wang, K.**, & Li, R. (2025). To Stay or to Bypass: Unraveling Mainline Vehicles' Aggregate Strategic Decision-Making in Weaving Ramps. *IEEE Intelligent Transportation Systems Conference (ITSC 2025)*.

P2. Paul, S., **Wang, K.**, Li, R., & Deshmukh, J. V. (2026). Agent-Based Evolutionary Dynamics for Mixed Autonomy Weaving Ramps. *2026 IFAC Workshop on Cyber-Physical Human Systems*.

P3. **Wang, K.**, Guan, Y., & Li, R. (2026). Bounded Mediation: Limiting LLM Execution Authority in Cyber-Physical Systems. *NeurIPS 2026 Workshop on Agents in the Wild: Safety, Security, and Beyond*. Also accepted for presentation at TRB 2027.

P4. Paul, S., Williams, S. J., **Wang, K.**, Qin, X., Li, R., & Deshmukh, J. V. (2026). Topology-Aware Congestion Pricing: Demand-Robust Routing using the Forman–Ricci Curvature. *IEEE Control Systems Letters (L-CSS)*.

Manuscripts Under Review

S1. **Wang, K.**, Huang, G., Wang, Z., Li, J., & Li, R. (2026). MAPLE: Macro–Micro Aligned Predictive Lane-Change Coordination for Mixed-Autonomy Traffic Efficiency. Submitted to *American Control Conference (ACC 2027)*. Accepted for presentation at TRB 2027. **Best Paper Award, BTR#8 (2026).**

S2. **Wang, K.**, Wang, Z., Huang, G., Li, J., & Li, R. (2026). From Macroscopic Congestion to Microscopic Lane-Change Decisions: A Pigouvian-Inspired Coordination Framework. Under review at *Transportation Research Part C: Emerging Technologies*.

S3. **Wang, K.**, Guan, Y., Niu, L., He, H., & Li, R. (2026). When Altruism Meets Autonomy: Managing Weaving Ramp Congestion with Strategic AVs. Under review at *Transportation Science*; presented at TRB 2026.

S4. Zheng, L., **Wang, K.**, Hu, X., Zhao, Y., & Li, R. (2026). Street-Level Competitive Ride-Hailing: Fine-Grained Multi-Agent Learning with Hybrid Policies and Strategic Robustness. Under review at *AAAI-27*.

Manuscripts in Preparation

M1. **Wang, K.**, Wang, Z., Li, J., & Li, R. (2026). SREC: Space-Release Ejection Chains for Deadlock Recovery in Automated Vehicle Depots. In preparation for *IEEE Intelligent Vehicles Symposium (IV 2027)*.

M2. **Wang, K.**, Nian, Y., Zhao, Y., & Li, R. (2026). Breaking the Tie: Role Coordination for Frozen Driving VLAs Through Their Native Conditioning Interface. In preparation for *Robotics: Science and Systems (RSS 2027)*.

M3. Hou, J., **Wang, K.**, Li, R., & Pang, J. (2026). Traffic Equilibrium in Mixed-Autonomy Network with Capped Customer Waiting. In preparation for *Transportation Science*.

M4. Guan, Y., **Wang, K.**, Niu, L., & Li, R. (2026). A Wardrop-Equilibrium-Based Model for Multi-Lane Merging Behavior at Highway On-Ramp Areas. In preparation.

M5. Guan, Y., **Wang, K.**, Niu, L., & Li, R. (2026). Interpretable Cost Modeling for Strategic Driving Decisions via LLM-Guided Symbolic Reasoning. In preparation for *Transportation Research Part C*.

Teaching & Mentoring Experience

USC CURVE Program, Ph.D. Mentor 08/2025 – 06/2026

Los Angeles, CA

- Mentored seven undergraduate and master's students from Computer Science, Electrical Engineering, and Civil Engineering on independent intelligent transportation projects, including Tyler Travis (first author, TRB 2027 presentation) and Gavin Huang (second author on MAPLE, BTR 2026 Best Paper Award), who also serves as a Claude Campus Ambassador.

USC Civil and Environmental Engineering, Teaching Assistant 08/2025 – 12/2025 & 08/2026 –Present

Los Angeles, CA

- Supported CE-119, *Statistical Data Analysis in Engineering*, and CE-471, *Principles of Transportation Engineering*, through assignment design, grading, student evaluation, and office hours on data exploration and visualization.

Cornell Civil and Environmental Engineering, Academic Assistant 08/2022 – 12/2022

Prof. Matthew Reiter; Ithaca, NY

- Assisted with *Masonry Design* and *Metal Structure*.

Presentations

Transportation Research Board (TRB) Annual Meeting, Washington, DC, USA	01/2027 (scheduled), 01/2026
NeurIPS 2026 Workshop on Agents in the Wild, Sydney, Australia	12/2026 (scheduled)
INFORMS Annual Meeting (oral), San Francisco, USA (2026) and Atlanta, USA (2025)	11/2026, 10/2025
Bridging Transportation Researchers Conference (BTR), Remote	08/2026
INFORMS Transportation Science and Logistics Conference, MA, USA	07/2026
SoCal CEE Research Symposium, Los Angeles, USA	04/2026, 04/2025
USC Center for Autonomy & AI Workshop, Los Angeles, USA	09/2025
USC STEM Bytes Seminar (oral), Los Angeles, USA	07/2025

Awards & Honors

Lambda Research Grant, Lambda, Inc.	2026
Best Paper Award, 8th Bridging Transportation Researchers Conference (BTR#8)	2026
ASCE LA YMF INWED Student Scholarship	2026
USC CURVE Fellowship, University of Southern California	2026
Das Family Travel Award, University of Southern California	2025/2026
Second Place, Garmezy Concrete Competition, Cornell University	2022
Outstanding Graduate Award, Nanjing Forestry University	2021
Undergraduate Research Scholarship, University of Minnesota, Twin Cities	2020
First Class, KLAUSNER, and Germany LEITZ Scholarships, Nanjing Forestry University	2017 – 2019

Professional & Academic Service

Peer Review

- Conference: ACC (2026); TRB (2025, 2026); IEEE CDC (2025, 2026); IEEE ITSC (2026); IEEE IV (2026); IEEE ICRA (2026); BTR (2026); NeurIPS Workshop on Agents in the Wild (2026).
- Journal: Transportation Research Part C, IET Intelligent Transport Systems.

Additional Service

- Student Volunteer, NASA Formal Methods Symposium (2026).
- Website Designer, IFAC Workshop on Cyber-Physical Human Systems (2026).

Technical Skills

Programming & Scientific Computing: Python, C++, Java, R, MATLAB.
AI & Machine Learning: PyTorch, reinforcement learning, LLM-based agents, multi-agent coordination.
Simulation & Optimization: SUMO/TraCI, CARLA, GAMS.
Languages: Mandarin (native), English (proficient).