Ruolin Li

WiSE Gabilan Assistant Professor
University of Southern California
Civil and Environmental Engineering | Computer Science (Courtesy)

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27	$2.14M	5	20+
publications & presentations	awarded research support	current SIAS advisees	invited talks

Research Summary

I build **game-theoretic, control, and learning foundations for societally-aware interactive autonomy**: autonomous systems that anticipate strategic behavior, coordinate across agents, and improve outcomes for the people and infrastructures they serve. My group develops equilibrium models, optimization and mechanism-design tools, multi-agent learning algorithms, and trustworthy AI agents for mixed-autonomy transportation, mobility markets, robotics, and wildfire evacuation.

At USC, I direct the **Societally-aware Interactive Autonomous Systems (SIAS) Lab**, where we translate these methods into scalable decision systems for safer, more efficient, and more equitable human–AI collectives.

- **Methods:** game theory and equilibrium modeling; control and optimization; multi-agent learning and agentic AI; mechanism design; resilient decision-making.
- **Applications:** mixed-autonomy transportation; mobility platforms and markets; intelligent infrastructure; robotics; emergency response and wildfire evacuation.

Academic Appointments

University of Southern California Aug. 2024–present
WiSE Gabilan Assistant Professor, Civil and Environmental Engineering
Assistant Professor, Computer Science (Courtesy; since Feb. 2026)

Stanford University 2023–2024
CARS Postdoctoral Fellow, Aeronautics and Astronautics
Advisor: Marco Pavone

Education

University of California, Berkeley 2018–2023
Ph.D., Mechanical Engineering (Controls)
Dissertation: *Exploring the Potential of Autonomous Vehicles in Mixed Autonomy Systems*
Advisor: Roberto Horowitz

University of California, Berkeley 2016–2018
M.S., Mechanical Engineering (Controls)
Advisor: Roberto Horowitz

Jilin University, China 2012–2016
B.S., Automotive Engineering, summa cum laude

Research Grants and Sponsored Projects

Years	Sponsor and Project	Role	Status	Total Award
2026–30	**NSF FIRE Award #2623936 – EVAC-AI** Agentic AI and multi-agent decision support for wildfire evacuation.	Lead PI	Awarded	$2M
2027	**National Center for Sustainable Transportation, U.S. DOT** Strategic interactions in mixed-autonomy fleet operations.	Lead PI	Awarded	$110K
2026	**Oliveri Sustainable Prosperity Fund** Human–AV interaction.	Lead PI	Awarded	$30K

Selected Honors and Awards

Best Paper Award, 8th Bridging Transportation Researchers Conference 2026
- *One of two conference-wide awards; sole Western Track recipient.*

Finalist, IEEE Intelligent Transportation Systems Society Best Dissertation Award 2024
WiSE Gabilan Assistant Professorship, University of Southern California 2024
CARS Postdoctoral Fellowship, Stanford Center for Automotive Research 2023
Rising Star in Mechanical Engineering, Stanford University 2022
Rising Star in Civil and Environmental Engineering, MIT 2021
Helene M. Overly Memorial Scholarship, WTS Foundation 2021
Educational Foundation and Aerospace/Test Measurement Division Scholarships, ISA 2021
Graduate Division Block Grant Award, UC Berkeley 2017, 2021–22
Outstanding Graduate, Jilin University 2016
University First Prize Scholarship, Jilin University 2013–15

Publications

† current or former student advised/co-advised by Ruolin Li.

Manuscripts and Preprints

[P5] Yue Zhao, Mengyuan Li, **Ruolin Li**, Prince Zizhuang Wang, Shuli Jiang, Linsey Pang, Xiongye Xiao, and Xiyang Hu. "CatchBench: When Can an Agent Failure Be Caught?" *arXiv preprint arXiv:2608.22808*, 2026.

[P4] Yue Zhao, Xiyang Hu, Zuobin Xiong, Zhangyu Wang, and **Ruolin Li**. "AI4Fire: Evaluating Large Language Models on Wildfire Tasks." *arXiv preprint arXiv:2610.10946*, 2026.

[P3] Sheryl Paul, Samuel Williams, Kexin Wang†, **Ruolin Li**, and Jyotirmoy V. Deshmukh. "Topology-Aware Congestion Pricing: Demand Robust Routing using the Forman–Ricci Curvature." *arXiv preprint arXiv:2609.14980*, 2026.

[P2] Jiaxin Hou†, Kexin Wang†, **Ruolin Li**, and Jong-shi Pang. "Traffic Equilibrium in Mixed-Autonomy Network with Capped Customer Waiting." *arXiv preprint arXiv:2512.10194*, 2025.

[P1] **Ruolin Li**, Philip N. Brown, and Roberto Horowitz. "A Unified Toll Lane Framework for Autonomous and High-Occupancy Vehicles in Interactive Mixed Autonomy." *arXiv preprint arXiv:2403.14011*, 2024.

Journal Publications

[J3] **Ruolin Li**, Negar Mehr, and Roberto Horowitz. "Submodularity of Optimal Sensor Placement Problems for Traffic Networks." *Transportation Research Part B: Methodological*, 171:29–43, 2023.

[J2] Stanley W. Smith, Yeojun Kim, Jacopo Guanetti, **Ruolin Li**, Roya Firoozi, Bruce Wootton, Alexander A. Kurzhanskiy, Francesco Borrelli, Roberto Horowitz, and Murat Arcak. "Improving Urban Traffic Throughput with Vehicle Platooning: Theory and Experiments." *IEEE Access*, 8:141208–141223, 2020.

[J1] Negar Mehr, **Ruolin Li**, and Roberto Horowitz. "A Game-Theoretic Macroscopic Model of Lane Choices at Traffic Diverges with Applications to Mixed-Autonomy Networks." *Transportation Research Part B: Methodological*, 144:45–59, 2020.

Refereed Conference Proceedings

[C10] Sheryl Paul, Kexin Wang†, **Ruolin Li**, and Jyotirmoy V. Deshmukh. "Agent-Based Evolutionary Dynamics for Mixed Autonomy Weaving Ramps." 6th IFAC Workshop on Cyber-Physical Human Systems (CPHS), 2026.

[C9] Haohui He†, Kexin Wang†, and **Ruolin Li**. "To Stay or to Bypass: Unraveling Mainline Vehicles' Aggregate Strategic Decision-Making at Highway Weaving Ramps." IEEE International Conference on Intelligent Transportation Systems (ITSC), pp. 3178–3185, 2025.

[C8] Robert Dyro, Matthew Foutter, **Ruolin Li**, Luigi Di Lillo, Edward Schmerling, Xilin Zhou, and Marco Pavone. "Realistic Extreme Behavior Generation for Improved AV Testing." IEEE International Conference on Robotics and Automation (ICRA), pp. 1354–1362, 2025.

[C7] **Ruolin Li** and Roberto Horowitz. "Dynamic Routing and Queueing for Human-Driven and Autonomous Vehicles with Responsive Signal Control." American Control Conference (ACC), pp. 144–155, 2022.

[C6] **Ruolin Li**, Philip N. Brown, and Roberto Horowitz. "A Highway Toll Lane Framework that Unites Autonomous Vehicles and High-Occupancy Vehicles." IEEE International Conference on Intelligent Transportation Systems (ITSC), pp. 3482–3489, 2021.

[C5] **Ruolin Li**, Philip N. Brown, and Roberto Horowitz. "Employing Altruistic Vehicles at On-Ramps to Improve the Social Traffic Conditions." American Control Conference (ACC), pp. 4547–4552, 2021.

[C4] **Ruolin Li**, Negar Mehr, and Roberto Horowitz. "The Impact of Autonomous Vehicles' Headway on the Social Delay of Traffic Networks." IEEE Conference on Decision and Control (CDC), pp. 268–273, 2020.

[C3] **Ruolin Li**, Jiaxi Liu, and Roberto Horowitz. "A Game-Theoretic Model for Aggregate Lane Choice Behavior of Highway Mainline Vehicles at the Vicinity of On-Ramps." American Control Conference (ACC), pp. 5376–5381, 2020.

[C2] **Ruolin Li**, Negar Mehr, and Roberto Horowitz. "An Extended Game-Theoretic Model for Aggregate Lane Choice Behavior of Vehicles at Traffic Diverges with a Bifurcating Lane." IEEE International Conference on Intelligent Transportation Systems (ITSC), pp. 2226–2231, 2019.

[C1] Negar Mehr, **Ruolin Li**, and Roberto Horowitz. "A Game-Theoretic Model for Aggregate Bypassing Behavior of Vehicles at Traffic Diverges." IEEE International Conference on Intelligent Transportation Systems (ITSC), pp. 1968–1973, 2018.

Refereed Conference Abstracts and Papers (Without Proceedings)

[CA9] Tyler Davis†, Kexin Wang†, and **Ruolin Li**. "The Regime-Dependent Cost of Equity in Autonomous Mobility-on-Demand Rebalancing." Transportation Research Board (TRB) 106th Annual Meeting, Washington, DC, January 2027.

[CA8] Yizhe Guan†, Kexin Wang†, and **Ruolin Li**. "A Wardrop-Equilibrium-Based Model for Multi-Lane Merging Behavior at Highway On-Ramp Areas." Transportation Research Board (TRB) 106th Annual Meeting, Washington, DC, January 2027.

[CA7] Yizhe Guan†, Kexin Wang†, and **Ruolin Li**. "Interpretable Cost Modeling for Strategic Driving Decisions via LLM-Guided Symbolic Reasoning." Transportation Research Board (TRB) 106th Annual Meeting, Washington, DC, January 2027.

[CA6] Kexin Wang†, Gavin Huang†, Zehao Wang, Jiachen Li, and **Ruolin Li**. "MAPLE: Macro–Micro Aligned Predictive Lane-Change Coordination for Mixed-Autonomy Traffic Efficiency." INFORMS Annual Meeting, 2026; Transportation Research Board (TRB) 106th Annual Meeting, Washington, DC, January 2027. 🏆 **Best Paper Award**, 8th Bridging Transportation Researchers Conference

[CA5] Kexin Wang†, Yizhe Guan†, and **Ruolin Li**. "Bounded Mediation: Limiting LLM Execution Authority in Cyber-Physical Systems." NeurIPS AIWILD Workshop, 2026; Transportation Research Board (TRB) 106th Annual Meeting, Washington, DC, January 2027.

[CA4] Luyao Niu† and **Ruolin Li**. "Stackelberg Routing in Mixed-Autonomy Networks with Heterogeneous User Preferences." INFORMS Annual Meeting, 2026.

[CA3] Kexin Wang†, Haohui He†, and **Ruolin Li**. "When Altruism Meets Autonomy: Managing Weaving Ramp Congestion with Strategic AVs." Transportation Research Board (TRB) 105th Annual Meeting, Washington, DC, January 2026.

[CA2] Zhilin Zhang, Y. Sun, Z. Wang, Y. Nie, X. Ma, P. Sun, and **Ruolin Li**. "Large Language Models for Mobility in Transportation Systems: A Survey on Forecasting Tasks." Transportation Research Board (TRB) 104th Annual Meeting, Washington, DC, January 2025.

[CA1] Jiwoo Kim, Hyunwoo Ryu, Jongeun Choi, Joohwan Seo, Nikhil Potu Surya Prakash, **Ruolin Li**, and Roberto Horowitz. "Robotic Manipulation Learning with Equivariant Descriptor Fields." RSS Workshop on Symmetries in Robot Learning, 2023.

Technical Report and Dissertation

[D1] **Ruolin Li**. *Exploring the Potential of Autonomous Vehicles in Mixed Autonomy Transportation Systems.* Ph.D. dissertation, UC Berkeley, 2023.

[T1] **Ruolin Li**. *SUMI: An Arterial Traffic Performance Measure Tool.* UC Berkeley, 2018.

Invited Talks

Societally-Aware Autonomy: Games, Control, and Infrastructure for the Next Generation of Mobility Systems

– University of California, Los Angeles, Civil and Environmental Engineering Apr. 2026
– University of California, Irvine, Civil and Environmental Engineering Apr. 2026
– University of Southern California, Industrial and Systems Engineering Feb. 2026
– University of Southern California, Computer Science Oct. 2025
– Florida State University, Computer Science Sept. 2025

When Altruism Meets Autonomy: Managing Weaving-Ramp Congestion with Strategic CAVs

– Bridging Transportation Researchers Conference Aug. 2025
– International Conference on Continuous Optimization (ICCOPT) July 2025

Harnessing Autonomous Vehicles for Smarter Traffic Management

– Workshop on Mixed-Autonomy Transportation, American Control Conference (ACC) July 2025

– University of California, Riverside, Electrical and Computer Engineering May 2025
– University of Southern California, Information Sciences Institute Oct. 2024

The Potential of Autonomous Vehicles in Future Intelligent Transportation Systems
– University of Southern California, Civil and Environmental Engineering; University of Southern California, Urban Planning; University of Southern California Institute of Transportation Engineers; Stanford Center for Automotive Research; ETH Zurich Autonomy Talks; Stanford Mechanical Engineering Rising Stars; Google Research; University of Maryland, Baltimore County, Mechanical Engineering; University of Colorado Colorado Springs, Computer Science; University of Michigan, Mechanical Engineering; University of Wisconsin–Madison, Civil and Environmental Engineering; Massachusetts Institute of Technology, Civil and Environmental Engineering Rising Stars 2021–24

Teaching

CE 513: Game Theory for Interactive Autonomy, USC Spring since 2025
Designer and instructor; course evaluation: 4.6/5

CE 471: Principles of Transportation Engineering, USC Fall since 2025
Instructor

ME 132: Dynamic Systems and Feedback, UC Berkeley Fall 2022
Graduate student instructor

E 7: Introduction to Computer Programming for Scientists and Engineers, UC Berkeley Spring 2022
Graduate student instructor

ECON C110: Game Theory in Social Sciences, UC Berkeley Fall 2021
Graduate student instructor, course evaluation: 6.13/7 (department mean: 5.73/7)

Advising and Mentoring

Current Ph.D. students:

- Kexin Wang (USC, Civil and Environmental Engineering, Aug. 2025–present; Best Paper Award).
- Jiaxin Hou (USC, Industrial and Systems Engineering, Aug. 2025–present; co-advised with Jong-Shi Pang).
- Luyao Niu (USC, Civil and Environmental Engineering, Aug. 2026–present; Annenberg Fellow, 2026).

Current master's students:

- Yizhe Guan (USC, Civil and Environmental Engineering, Jan. 2026–present).

Current undergraduate researchers:

- Tyler Davis (USC, Computer Science and Business Administration, Aug. 2025–present).
- Gavin Huang (USC, Computer Science, Sept. 2025–present).

Former students:

- Haohui He (USC, Civil and Environmental Engineering, 2024–2025).
- Elinor Zhang (USC, Data Science, 2024–2025).
- Yanqi Luo (USC, Urban Planning, 2024–2025).
- Shreya Nair (USC, Computer Engineering and Computer Science, 2024–2025).
- Roda Hassan (USC, Computer Engineering, 2024–2025).
- Alina Du (USC, Computer Science and Applied Mathematics, Fall 2025).
- Brian Shi (USC, Computer Science, Fall 2025).

- Bethania Dagim (USC, Civil Engineering, Fall 2025).
- Mathias Wulfman (University of California, Berkeley, Mechanical Engineering, 2018–2019).

Highlights of Student Achievements:

- Ph.D. student Luyao Niu received the Annenberg Fellowship in August 2026, when she joined SIAS.
- Ph.D. student Kexin Wang received the 2026 ASCE Los Angeles YMF INWED Student Scholarship in her first year.
- Ph.D. student Kexin Wang led the MAPLE paper, which received the BTR 2026 Western Track Best Paper Award.
- Undergraduate researcher Gavin Huang contributed to the award-winning MAPLE project within his first year of research.
- Undergraduate researcher Tyler Davis earned a first-author conference abstract within his first year of research.

Professional Leadership and Service

Research Community Leadership:

– Program Committee, AAAI-27 Doctoral Consortium (2027).
– Co-Organizer, Geometric and Spatial Reasoning in Vision-Language Models (GSR-VLM) Workshop at the AAAI Conference on Artificial Intelligence (2027).
– Co-Chair, TrafficFlowBench, 2026 IEEE Big Data Cup Challenge (2026).
– Vice Chair for Social Media, IFAC Technical Committee 9.2 on Social Impact of Automation (2026–present).
– Organizing Committee, 6th IFAC Workshop on Cyber-Physical Human Systems (2026).
– Session Chair, International Conference on Continuous Optimization (ICCOPT) (2025).

External Reviewer for Journals, Conferences, and Grants:

- **Journals:**
  – *IEEE Transactions on Automatic Control*
  – *IEEE Robotics and Automation Letters*
  – *IEEE Transactions on Intelligent Transportation Systems*
  – *IEEE Transactions on Control of Network Systems*
  – *IEEE Transactions on Control Systems Technology*
  – *International Journal of Transportation Science and Technology*
  – *Transportation Science*
  – *Transportation Research Part B: Methodological*
  – *Transportation Research Part C: Emerging Technologies*
- **Conferences:**
  – IEEE Conference on Decision and Control (CDC)
  – American Control Conference (ACC)
  – European Control Conference (ECC)
  – IEEE International Conference on Intelligent Transportation Systems (ITSC)
  – AAAI Conference on Artificial Intelligence (AAAI)
  – IEEE International Conference on Robotics and Automation (ICRA)
  – Conference on Neural Information Processing Systems (NeurIPS)
  – IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)
  – International Conference on Learning Representations (ICLR)
- **Grants:**
  – National Science Foundation (NSF), Directorate for Engineering, Division of Civil, Mechanical and Manufacturing Innovation (CMMI), Civil Infrastructure Systems (CIS) Program
  – National Science Foundation (NSF) Smart and Connected Communities (S&CC) Program
  – National Science Foundation (NSF), Directorate for Engineering, Division of Civil, Mechanical and Manufacturing Innovation (CMMI), Infrastructure Systems and People (ISP) Program

- National Science Foundation (NSF) Cyber-Physical Systems (CPS) Program
- National Science Foundation (NSF), Directorate for Engineering, Division of Civil, Mechanical and Manufacturing Innovation (CMMI), Mind, Machine, and Motor Nexus (M3X) Program
- National Science Foundation (NSF) Computational and Data-Enabled Science and Engineering (CDS&E) Program
- National Science Foundation (NSF), Directorate for Technology, Innovation and Partnerships, Translation to Practice (TTP) Program
- Transportation Research Board, National Cooperative Highway Research Program (NCHRP)

USC Service:

- **CEE Department Seminar Committee** (Fall 2024–present).
- **CEE Department Ph.D. Achievement Award Committee** (Fall 2025).
- **Screening, Qualifying, Thesis Proposal, and Dissertation Committees (not chair):**
  - Milad Pooladsanj (USC CEE, 2024; Chair: Ketan Savla)
  - Fernando Valladares Monteiro (USC EE, 2025; Chairs: Ketan Savla and Petros Ioannou)
  - Yuehan Qin (USC CS, 2025; Chair: Yue Zhao)
  - Jiageng Mao (USC CS, 2026; Chair: Yue Wang)
  - Haoyan Xu (USC EE, 2026; Chair: Mengyuan Li)
  - Jiawei Yang (USC CS, 2026; Chair: Yue Wang)
  - Curtis Bechtel (USC CS, 2026; Chair: Shaddin Dughmi)
  - Junjie Ye (USC CS, 2026; Chair: Yue Wang)
  - Li Li (USC CS, 2026; Chair: Yue Zhao)
  - Gary Rostomyan (USC EE, 2026; Chair: Petros Ioannou)
  - Wen Ye (USC CS, 2026; Chair: Xuezhe Ma)
  - Chen Chu (USC CS, 2026; Chair: Cyrus Shahabi)
  - Shahriar Tanvir Alam (USC ISE, 2026; Chair: Maged M. Dessouky)
  - Wei Yang (USC CS, 2026; Chair: Yue Zhao)
  - Tiankai Yang (USC CS, 2026; Chair: Yue Zhao)
  - Ruohai Ge (USC CS, 2026; Chair: Gaurav Sukhatme)
  - Linxin Song (USC CS, 2026; Chair: Yue Wang)