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Employment

Columbia University	2016-
Assistant Professor, Department of Civil Engineering and Engineering Mechanics	2016-2020
Associate Professor, Department of Civil Engineering and Engineering Mechanics	2021-present
Co-Chair, Center for Smart Cities, Data Science Institute	2025-present
University of Michigan, Ann Arbor	2014-2016
Postdoctoral Researcher, University of Michigan Transportation Research Institute (UMTRI)	
University of Minnesota, Twin Cities	2008-2014
Research/Teaching Assistant, Department of Civil, Environmental, and Geo- Engineering	

Education

University of Minnesota, Twin Cities	
Ph.D.in Transportation Engineering, Department of Civil, Environmental, and Geo- Engineering	2014
Dissertation: Boundedly Rational User Equilibria: Theory and Applications	
Committee members: Gary Davis (Chair), Henry Liu (Advisor), David Levinson, Shuzhong Zhang (IEOR)	

Academic Awards

1. INRIX + MetroLab Challenge (Leading Institute: NSF Center for Smart Streetscapes)	2025
2. NSF Center for Smart Streetscapes Validator Award (student: Bowen Fang)	2025
3. Columbia's Alliance Visiting Professor at Ecole Polytechnique, France	2023-2024
4. Finalist for Qualcomm Innovation Fellowship (student: Kangrui Ruan)	2023
5. Winner of International Data Corporation's Smart Cities North America Awards	2023
6. Best Paper Award, ACM SIGKDD Workshop on Urban Computing	2022
7. Transportation Science Meritorious Service Award (INFORMS)	2022
8. Visiting research fellow at Bielefeld University, Germany	2021-2023
9. CAREER Award, National Science Foundation (NSF)	2020
10. Amazon AWS Machine Learning Research Awards	2020
11. Transportation Data Analytics Contest Winner, Transportation Research Board (TRB)	2017
12. Dafermos Best Paper Award Honorable Mention, TRB Network Modeling Committee	2017
13. Chan Wui & Yunyin Rising Star Workshop Fellowship for Early Career Professionals, TRB (<i>only 6 fellows were selected internationally</i>)	2016
14. Outstanding Reviewer of <i>Transportation Research Part B/C</i> , Elsevier	2015-2019
15. Best Paper Award, North-Central Section ITE	2014
16. Graduate Student Scholarship, North-Central Section ITE	2012, 2013, 2014
17. ITS SIG Outstanding Presentation Award, INFORMS	2013
18. Matthew J. Huber Graduate Student Award, Center for Transportation Studies	2013
19. Helene M. Overly Memorial Scholarship, WTS Foundation	2013
20. Kasia Winiarczyk Scholarship award, ITE Student Chapter of University of Minnesota	2013
21. Graduate Student Award, ITS MN	2009, 2012
22. Student Leadership Award, College of Science and Engineering, University of Minnesota	2012
23. Graduate Student Fellowship, Department of Civil Engineering, University of Minnesota	2008-2009
24. National Scholarship with Highest Honor, Ministry of Education of the People's Republic of China	2002
25. Outstanding Student Scholarship, Tongji University	2001, 2002, 2003

Research Interests

Physics-Informed Machine Learning
Causal AI for Autonomous Driving

Mean Field Games
Foundational Models for Traffic Safety

Publications

Peer-Reviewed Top Tier AI Conference Proceedings

1. Zhang, C.Y., Chen, X., **Di, X.**, 2025. Stochastic Semi-Gradient Descent for Learning Mean Field Games with Population-Aware Function Approximation, *ICLR*.
2. Zhou, F.Z., Zhang, C.Y., Chen, X., **Di, X.***, 2024. Learning Label-State joint formulated Graphon games. *ICML*.
3. Ruan, K.R., Zhang, J.Z., **Di, X.***, Bareinboim, E, 2024. Causal Imitation for Markov Decision Processes: a Partial Identification Approach. *NeurIPS*.
4. Ruan, K.R., Zhang, J.Z., **Di, X.**, Bareinboim, E, 2023. Causal Imitation learning via Inverse Reinforcement Learning. *ICLR*.

Peer-Reviewed AI Conference Proceedings

5. Zhang, C.Y., Chen, X., **Di, X.***, 2024. Can a single online agent learn mean-field games efficiently? *ECAI*.
6. Fang, B.W., Chen, X., **Di, X.***, 2024. SLAMuZero: Plan and learn to Map for Joint SLAM and Navigation. *International Conference on Automated Planning and Scheduling (ICAPS)*.
7. Mo, Z.B., Fu, Y.J., **Di, X.***, 2024. PI-NeuGODE: Physics-Informed Graph Neural Ordinary Differential Equations for Spatiotemporal Trajectory Prediction, *AAMAS*.
8. Chen, X., Liu, S., **Di, X.***, 2024. Bridging Agent Dynamics and Population Behaviors: Scalable Learning for Mean Field Games on Graph via Neural Operators, *AAAI CMASDL Workshop (Cooperative Multi-Agent Systems Decision-Making and Learning: From Individual Needs to Swarm Intelligence)*.
9. Chen, X., Liu, S. and **Di, X.***, 2023. Learning Dual Mean Field Games on Graphs. *European Conference on Artificial Intelligence (ECAI)*.
10. Chen, X., Fu, Y.J., Liu, S., **Di, X.***, 2023. Physics-informed neural operator for coupled forward-backward partial differential equations. *ICML Workshop on the Synergy of Scientific and Machine Learning Modeling*.
11. Chen, X., Liu, S., **Di, X.***, 2023. A Hybrid Framework of Reinforcement Learning and Physics-Informed Deep Learning for Spatiotemporal Mean Field Games, *In Proceedings of the 20th International Conference on Autonomous Agents and Multiagent Systems (AAMAS2023)*.
12. Mo, Z.B., **Di, X.***, 2022. Uncertainty Quantification of Car-Following Behaviors: Physics-Informed Generative Adversarial Networks, the *28th ACM SIGKDD in conjunction with the 11th International Workshop on Urban Computing (UrbComp2022)* (Best paper award).
13. Mo, Z.B., Fu, Y.J., **Di, X.***, 2022. TrafficFlowGAN: Physics-informed Flow based GAN for Uncertainty Quantification, *European Conference on Machine Learning and Data Mining (ECML PKDD)*.
14. Ruan, K.R., **Di, X.***, 2022. Learning Human Driving Behaviors with Sequential Causal Imitation Learning, *In Proceedings of the AAAI Conference on Artificial Intelligence*, 36(4): 4583-4592.
15. Shi, R.Y., Mo, Z.B., **Di, X.***, 2021. Physics-Informed Deep Learning for Traffic State Estimation: A Hybrid Paradigm Informed By Second-Order Traffic Models, *In Proceedings of the AAAI Conference on Artificial Intelligence*, 35(1): 540-547.

Peer-Reviewed Journal Papers

16. Mo, Z.B., Xiang, H.T., **Di, X.***, 2025. diffIRM: A Diffusion-Augmented Invariant Risk Minimization Framework for Spatiotemporal Prediction over Graphs, *Transportation Science*.
17. Mo, Z.B., Chen, X., **Di, X.***, Iacomini, E., Segala, C., Herty, M., Lauriere, M., 2024. A Game-Theoretic Framework for Generic Second Order Traffic Flow Using Mean Field Games and Adversarial Inverse Reinforcement Learning, *Transportation Science*, DOI: 10.1287/trsc.2024.0532.
18. Chen, X., Di, X.*, 2024. A Network Equilibrium for Integrated Shared Mobility Services With Ride-Pooling, *Transportation Research Part C*, 167: 104837.

19. Ruan, K.R., Di, X.* , 2024. InfoSTGCAN: Information Maximizing Spatial-Temporal Graph Convolutional Attention Network for Heterogeneous Human Trajectory Prediction, *Computers*, 13(6), 151.
20. Mo, Z.B.*, Xiang, H.T., Di, X., 2024. Cross- and Context-Aware Attention Based Spatial-Temporal Graph Convolutional Networks for Human Mobility Prediction, *ACM Transactions on Spatial Algorithms and Systems*.
21. Chen, X., Liu, S., Di, X.*, 2024. Physics-Informed Graph Neural Operator for Mean Field Games on Graph: A Scalable Learning Approach, *Games*.
22. Liu, S., Chen, X., Di, X.*, 2024. Scalable Learning for Spatiotemporal Mean Field Games using Physics-Informed Neural Operator, *Mathematics*.
23. Dawid, H., Di, X.*, Kort, P.M., Muehlheusser, G., 2024. Connected and autonomous vehicles policy and safety investment: an equilibrium analysis with endogenous demand, *Transportation Research Part B*, 182: 102908.
24. Shu, Y.P., Chen, X., Di, X.*, 2024. Mobility Pattern Analysis During Russia-Ukraine War Using Twitter Location Data, *Information*, 15(2), 76.
25. Di, X.*, Shi, R.Y., Mo, Z.B., Fu, Y.J., 2023. Physics-Informed Deep Learning For Traffic State Estimation: A Survey and the Outlook, *Algorithms*, 16(6): 305.
26. Chen, X., Shea, R., Di, X.*, 2023. Travel Pattern Analysis on Switching Behavior in Response to the COVID-19 Pandemic, *Consilience Journal of Sustainable Development*.
27. Chen, X., Li, Z.C., Di, X.*, 2023. Social Learning for Sequential Driving Dilemmas, *Games*, 14(3): 41.
28. Chen, X., Di, X.*, 2023. Legal Framework for Rear-End Crashes in Mixed Traffic Platooning: A Matrix Game Approach. *Future Transportation*, 3(2): 417-428.
29. Bautista, R., Aguilera, R.G., Mo, Z.B., Fu, Y.J., Bustamante, R., Di, X.*, 2023. Longitudinal Control Strategy for Connected Electric Vehicle with Regenerative Braking in Eco Approach and Departure, *Applied Sciences*, 13(8): 5089.
30. Di, X.*, Yin, Y.Q., Mo, Z.B., Fu, Y.J., Shaw-Hwa Lo, DiGuseppi, C., Eby, D.W., Hill, L.L., Mielenz, T.J., Molnar, L.J., Strogatz, D., Andrews, H.F., Goldberg, T.E. and Lang, B.H., Kim, M., Li, G.H., 2023. Predicting Mild Cognitive Impairment and Dementia in Older Drivers from Naturalistic Driving Data Using Influence Score, *Artificial Intelligence in Medicine*, 138: 102510.
31. Chen, X., Wu, Z.G., Di, X.*, 2023. Network Design for Silent Link User Equilibrium. *Research Reports on Computer Science*, 2(1): 46-55.
32. Chen, X., Wang, Z.H., Di, X.*, 2023. Sentiment Analysis on Multimodal Transportation During the COVID-19 Using Social Media Data, *Information*, 14 (2), 113.
33. Mo, Z.B., Di, X.*, Shi, R.Y., 2023. Robust Data Sampling in Machine Learning: A Game-Theoretic Framework For Training and Validation Data Selection, *Games*, 14(1):13.
34. Ozer, E., Malekloo, A., Ramadan, W., Tran, T., and Di, X., 2022. Systemic Reliability of Bridge Networks with Mobile Sensing-Based Model Updating for Post-Event Transportation Decisions. *Computer-Aided Civil and Infrastructure Engineering*, DOI:10.1111/mice.12892.
35. Mo, Z.B., Li, W.Z., Ruan, K.R., Fu, Y.J., Di, X.*, 2022. CVLight: Deep Reinforcement Learning For Traffic Signal Control with Connected Vehicles, *Transportation Research Part C*, 141: 103728.
36. Bautista, R., Aguilera, R.G., Ruan, K.R., Fu, Y.J., Di, X.*, 2022. Autonomous Navigation at Unsignalized Intersections: A Coupled Reinforcement Learning and Model Predictive Control Approach, *Transportation Research Part C*, 139: 103662.
37. Gless, S., Di, X., Silverman, E., 2022. Ca(r)veat Emptor: Crowdsourcing Data to Challenge the Testimony of In-Car Technology. *Jurimetrics Journal of Law, Science and Technology*, 62(3).
38. Shou, Z.Y., Chen, X., Fu, Y.J., Di, X.*, 2022. Multi-Agent Reinforcement Learning for Markov Routing Games: A New Modeling Paradigm For Dynamic Traffic Assignment, *Transportation Research Part C*, 137: 103560.
39. Shi, R.Y., Mo, Z.B., Huang, K., Di, X.*, Du, Q., 2021. A Physics-Informed Deep Learning Paradigm for Traffic State and Fundamental Diagram Estimation. *IEEE Transactions on Intelligent Transportation Systems*, 23(8): 11688-11698.
40. Mo, Z.B., Shi, R.Y., Di, X.*, 2021. A Physics-Informed Deep Learning Paradigm for Car-Following Models, *Transportation Research Part C*, 130: 103240.
41. Di, X., Shi, R.Y., DiGuseppi, C., Eby, D., Hill, L., Mielenz, T., Molnar, L., Strogatz, D., Goldberg, T., Lang, B., Kim, M., Li, G.H., 2021. Association of Driving Patterns with Mild Cognitive Impairment and Dementia: Preliminary Findings from the Longitudinal Research on Aging Drivers (LongROAD) Study, *Geriatrics*, 6(2): 45.

42. Chen, X., Di, X.*, 2021. Ridesharing User Equilibrium with Nodal Matching Cost and Its Implications for Network Design Problems. *Transportation Research Part C & the 8th International Symposium on Dynamic Traffic Assignment (DTA2020)*, 129: 103233.
43. Di, X.*, Shi, R.Y., 2021. A Survey on Autonomous Vehicle Control in the Era of Mixed-Autonomy: From Physics-Based to AI-Guided Driving Policy Learning. *Transportation Research Part C*, 125: 103008.
44. Huang, K., Chen, X., Di, X.*, Du, Q., 2021. Driving and Routing Game for Autonomous Vehicles on a Network, *Transportation Research Part C*, 128: 103189 & *24th International Symposium on Transportation and Traffic Theory (ISTTT24)*.
45. Shou, Z.Y., Di, X.*, 2020. Reward Design for Driver Repositioning Using Multi-Agent Reinforcement Learning, *Transportation Research Part C*, 119: 102738.
46. Di, X.*, Chen, X., Talley, E., 2020. Liability Design for Autonomous Vehicles and Human-Driven Vehicles: A Hierarchical Game-Theoretic Approach. *Transportation Research Part C*, 118: 102710.
47. Luo, Q., Dou, X.C., Di, X., Hampshire, R.C, 2020. Multimodal Connections between Micro-Mobility and Microtransit: Conceptual Foundations and Empirical Evidence, *IEEE Intelligent Transportation Systems Magazine*.
48. Li, Z.H., Gu, Z.C., Di, X., Shi, R.Y., 2020. An LSTM-Based Autonomous Driving Model Using Waymo Open Dataset, *Applied Sciences - Intelligent Transportation Systems: Beyond Intelligent Vehicles*, 10(6), 2046.
49. Huang, K., Di, X.*, Du, Q., Chen, X., 2020. A Game-Theoretic Framework for Autonomous Vehicles Velocity Control: Bridging Microscopic Differential Games and Macroscopic Mean Field Games, *Discrete and Continuous Dynamical Systems - Series B*, 25(12): 4869-4903.
50. Huang, K., Di, X.*, Du, Q., Chen, X., 2020. Scalable Traffic Stability Analysis in Mixed-Autonomy Using Continuum Models, *Transportation Research Part C*, 111: 616-630.
51. Meinrenken, C.J., Shou, Z.Y., Di, X.*, 2020. Using GPS-data to determine optimum electric vehicle ranges: A Michigan case study, *Transportation Research Part D*, 78: 102203.
52. Shou, Z.Y., Di, X.*, Ye, J.P., Zhu, H.T., Zhang, H., Hampshire, R., 2020. Optimal Passenger-Seeking Policies on E-hailing Platforms Using Markov Decision Process and Imitation Learning, *Transportation Research Part C*, 111: 91-113.
53. Di, X.*, Ban, X., 2019. A Unified Equilibrium Framework of New Shared Mobility Systems, *Transportation Research Part B*, 129: 50-78.
54. Li, M., Di, X.*, Liu, H.X., Huang, H-J., 2019. A Restricted Path-Based Ridesharing User Equilibrium, *Journal of Intelligent Transportation Systems*, 24(4): 383-403.
55. Di, X.*, Fabusuyi, T., Simek, C., Chen, X., Hampshire, R., 2019. Inferred Switching Behavior in Response to Re-Entry of Uber and Lyft: A Revealed Study in Austin, TX, *Transport Findings*, DOI: 10.32866/7568.
56. Di, X., Zhao, Y., Huang, S.H., Liu, H.X., 2019. A Similitude Theory for Modeling Connected and Automated Vehicle Systems, *IEEE Transactions on Intelligent Transportation Systems*, 20(3): 900-911.
57. Shou, Z.Y., Di, X.*, 2018. Similarity Analysis of Frequent Sequential Activity Patterns Mining, *Transportation Research Part C*, 96: 122-143.
58. Di, X.*, Ma, R., Liu, H.X., Ban, X., 2018. A Link-Node Reformulation of Ridesharing User Equilibrium With Network Design, *Transportation Research Part B*, 112: 230-255.
59. Di, X.*, Liu, H.X., Ban, X., Yang, H., 2017. Ridesharing User Equilibrium and Its Implications for High-Occupancy Toll Lane Pricing, *Transportation Research Record*, 2667: 39-50.
60. Danczyk, A., Di, X., Liu, H.X., Levinson, D.M., 2017. Unexpected versus Expected Network Disruption: Effects on Travel Behavior, *Transport Policy*, 57: 68-78.
61. Di, X., Liu, H.X., Zhu, S.J., Levinson, D.M, 2017. Indifference Bands for Boundedly Rational Route Switching, *Transportation*, 44(5): 1169-1194.
62. Danczyk, A., Di, X., Liu, H.X., 2016. A Probabilistic Optimization Model for Allocating Freeway Sensors, *Transportation Research Part C*, 67, 378-398.
63. Di, X., Liu, H.X., 2016. Boundedly Rational Travel Behavior: A Review of Models and Methodologies, *Transportation Research Part B*, 85: 142-179.
64. Di, X., Liu, H.X., Ban, X., 2016. Second Best Toll Pricing Within the Framework of Bounded Rationality, *Transportation Research Part B*, 83: 74-90.
65. Di, X., Liu, H.X., Ban, X., Yu, J.W., 2015. On the Stability of a Boundedly Rational Day-to-day Dynamic, *Networks and Spatial Economics*, 15 (3): 537-557.

66. **Di, X.**, Liu, H.X., Levinson, D.M., 2014. Multi-Agent Route Choice Game for Transportation Engineering, *Transportation Research Record*, 2480: 55-63.
67. **Di, X.**, Liu, H.X., He, X.Z., 2014. Braess Paradox under the Boundedly Rational User Equilibria, *Transportation Research Part B*, 67: 86–108.
68. **Di, X.***, Liu, H.X., Pang, J.S., Ban, X., 2013. Boundedly Rational User Equilibria (BRUE): Mathematical Formulation and Solution Sets, *Transportation Research Part B*, 57: 300–313.
69. **Di, X.**, Liu, H. X., Davis, G. A., 2010. Hybrid Extended Kalman Filtering Approach for Traffic Density Estimation Along Signalized Arterials. *Transportation Research Record*, 2188 (1), 165-173.
70. **Di, X.**, Zhang, X.N., Zhang, M.H., 2008. Cellular Automata based Expressway Weaving Section Modeling and Simulation (in Chinese), *Transportation and Computer*, 26 (2), 23-26.

Peer-Reviewed Proceedings

71. **Fang, B.W.**, **Di, X.***, 2025. Efficient Consistency Model Training for Policy Distillation in Reinforcement Learning. *ICLR DeLTA Workshop*.
72. **Gao, Q.**, Huang, K., **Di, X.***, 2025. Moment Neural Operator: Interpretable mapping in discontinuous functional space. *ICLR Workshop XAI4Science*.
73. Yan, B.H., Liu, Q.Y., **Mo, Z.B.**, **Ruan, K.R.**, **Di, X.***, 2025. Balanced Latent Space Of Diffusion Models For Counterfactual Generation, *ICLR DeLTA Workshop*.
74. **Fu, Y.J.**, Jain, A., **Di, X.**, 2024. DriveGenVLM: Real-world Video Generation for Vision Language Model based Autonomous Driving, *IAVVC*.
75. **Chen, X.**, Wang, B., Duan, H, Feng, Y., **Di, X.**, 2024. Can LLMs Understand Social Norms in Autonomous Driving Games? *IAVVC*.
76. **Gao, Q.**, **Di, X.***, 2024. Comparative Studies of Neural Operators For Traffic State Estimation, *ITSC*.
77. **Ruan, K.R.**, Wang, X., **Di, X.***, 2024. From Twitter to Reasoner: Understand Mobility Travel Modes and Sentiment Using Large Language Models, *ITSC*.
78. **Fu, Y.J.**, Li, Y.L., **Di, X.***, 2024. GenDDS: Generating Diverse Driving Video Scenarios with Prompt-to-Video Generative Model, *ITSC*.
79. **Mo, Z.B.**, Li, Y.L., **Di, X.***, 2024. SafeAug: Safety-Critical Driving Data Augmentation from Naturalistic Datasets, *ITSC*.
80. **Mo, Z.B.**, Liu, Q.Y., Yan, B.H., Zhang, L.X., **Di, X.***, 2024. Causal Adjacency Learning for Spatiotemporal Prediction Over Graphs, *ITSC*.
81. **Fu, Y.J.**, Turkcan, M., Anantha, V., Kostic, Z., Zussman, G., **Di, X.***, 2023. Digital Twin for Pedestrian Safety Warning at a Single Urban Traffic Intersection, *IEEE IV*.
82. Bautista, R., Aguilera, R.G., **Di, X.***, Bustamante, R., 2023. Reinforcement Learning-based Navigation Approach for a Downscaled Autonomous Vehicle in Urban Scenarios, the *International Symposium on Electromobility (ISEM)*.
83. **Fu, Y.J.**, **Di, X.***, 2023. Federated Reinforcement Learning for Adaptive Traffic Signal Control: A Case Study in New York City, *ITSC*.
84. **Chen, X.**, Wang, Y.S., **Di, X.***, 2023. Whose Attitudes Towards Transit Are Most Affected by Rising Subway Crimes in New York City? *ITSC*.
85. **Chen, X.**, **Di, X.***, 2022. How the COVID-19 Pandemic Influences Human Mobility? Similarity Analysis Leveraging Social Media Data, *ITSC*.
86. **Mo, Z.B.**, **Fu, Y.J.**, **Di, X.***, 2022. Quantifying Uncertainty In Traffic State Estimation Using Generative Adversarial Networks, *ITSC*.
87. **Shou, Z.Y.**, **Chen, X.**, **Di, X.***, 2022. Bayesian Optimization for Multi-Agent Routing in Markov Games, *ITSC*.
88. Liu, S., Wang, Y.H., **Chen, X.**, **Fu, Y.J.**, **Di, X.***, 2022. SMART-eFlo: An Integrated SUMO-Gym Framework for Multi-Agent Reinforcement Learning in Electric Fleet Management Problem, *ITSC*.
89. **Chen, X.**, Li, Z.C., **Di, X.***, 2022. Social Learning In Markov Games: Empowering Autonomous Driving, *IEEE IV*, 478-483, DOI: 10.1109/IV51971.2022.9827289.
90. **Chen, X.**, Zeng, H.H., Xu, H., **Di, X.***, 2021. Sentiment Analysis of Autonomous Vehicles After Extreme Events Using Social Media Data, *ITSC*.
91. **Shou, Z.Y.**, Cao, Z.H., **Di, X.***, 2020. Similarity Analysis of Spatial-Temporal Travel Patterns for Travel Mode Prediction Using Twitter Data. *ITSC*.

92. Shou, Z.Y., Wang, Z.R., Han, K., Liu, Y.K., Tiwari, P., **Di, X.**, 2020. Long-Term Prediction of Lane Change Maneuver Through a Multilayer Perceptron, *the 2020 IEEE Intelligent Vehicles Symposium (IEEE IV)*.
93. Huang, K., **Di, X.***, Du, Q., Chen, X., 2019. Stabilizing Traffic via Autonomous Vehicles: A Continuum Mean Field Game Approach, *ITSC*.
94. Luo, Q., Dou, X.C., **Di, X.***, Hampshire, R.C., 2018. Multimodal Connections between Dockless Bikesharing and Ride-Hailing: An Empirical Study in New York City, *the 21st IEEE International Conference on Intelligent Transportation Systems (ITSC)*, DOI: 10.1109/ITSC.2018.8569896, pp. 2256-2261.
95. Fabusuyi, T., Simek, C., **Di, X.**, Chen, X., Hampshire, R.C., 2020. Analyzing the Suspension Effect of Uber and Lyft Ride-sourcing Services on Travel Behavior, available at <http://ssrn.com/abstract=2977969>.
96. Liao, S.Y., Zhou, L.T., **Di, X.**, Yuan, B., Xiong, J.J., 2018. Large-scale Short-term Urban Taxi Demand Forecasting Using Deep Learning, invited paper at *IEEE Conference on 23rd Asia and South Pacific Design Automation Conference (ASP-DAC)*.
97. **Di, X.***, Liu, H.X., Pang, J.S., Ban, X., 2013, Boundedly Rational User Equilibria (BRUE): Mathematical Formulation and Solution Sets, *Proceedings of 20th International Symposium on Transportation and Traffic Theory*, 231-248.
98. Zhang, X.N., **Di, X.**, Zhang, M.H., Simulating Traffic Spillback of the Expressway Weaving Area Based on Cellular Automata, 2009, *IEEE Computer Society Proceedings of the World Research Institutes (WRI) World Congress on Software Engineering (WCSE)*, 2: 137 - 141.

(*: corresponding author; __: my (co)advised PhD students/postdocs)

Grant Activities

Funded:

1. NSF DMS MATH-DT: RareDT: Rare event quantification and control in digital twins; Co-PI (PI: Tong, S.); (9/30/2025-8/31/2027; \$500,005).
2. SiNERGI: Sustainable Cities Network of Education and Research for Social Good with AI. *Columbia Alliance Program Joint Project*. PI (9/1/2025-3/31/2027; \$15,000).
3. Mobility For All. *Columbia Global Early Career Faculty Impact Fellowship*. PI (6/1/2024-3/31/2026; \$25,000).
4. Policy Evaluation with Transfer Learning: How to Assess Safety Performance of Self-Driving Cars in NYC? *Columbia's Data Science Institute Seed Funds*. Co-PI (PI: Wang, K.Z.) (3/1/2024-2/28/2025; \$75,000).
5. Riding the Age Wave: Building Age-Friendly Walkable Cities. *Columbia's SEAS Societal Impact Seed Grants*. PI (1/31/2024-6/30/2025; \$15,000).
6. Northeast Big Data Hub: Making Roads Safer for Pedestrians in Disadvantaged Communities and Rural Areas. *Federal Highway Administration*. Co-PI (PI: Florence Hudson) (10/1/2023-3/31/2025; \$205,311).
7. Causality-Guided Diffusion for Scenario-Based ADS Testing. *Columbia's SEAS Interdisciplinary Research Seed (SIRS)*; Co-PI (7/1/2023-6/30/2024; \$85,000).
8. NSF SCC-IRG Track 1: Preparing for Future Pandemics: Subway Crowd Management to Minimize Airborne Transmission of Respiratory Viruses (Way-CARE); PI (1/1/2023-12/31/2026; \$2,500,000).
9. NSF Engineering Research Center for Smart Streetscapes (CS3); Senior personnel (9/2022-8/2027, \$26,000,000).
10. NSF CPS: Medium: Hybrid Twins for Urban Transportation: From Intersections to Citywide Management; PI (10/1/2021-9/30/2024, \$1,200,000).
11. NSF CPS India-US Supplement: Networked Adaptive Traffic Signal Control in IoT-Enabled Smart Cities; PI (9/1/2022-9/30/2023, \$100,000).
12. NSF BIGDATA: F: Statistical Foundation of Predictivity: A Novel Architecture for Big Data Learning; Co-PI (1/1/2022-12/30/2023, \$900,000).
13. Real-Time Crowd Management to Prepare Subway Stations for Future Pandemics. *SEAS Technology Innovations for Urban Living in the Face of COVID-19*; PI (9/1/2020-8/31/2021, \$85,000).
14. How Social Learning and Causal Inference Empower Selfdriving Cars for Social Good? *Columbia's SEAS Interdisciplinary Research Seed - He Research Fund for Artificial Intelligence, Robotics and/or Autonomous Vehicles*; PI (9/1/2020-8/31/2022, \$160,000).

15. AWS Machine Learning Research Awards. Multi-Autonomous Vehicle Driving Policy Learning for Efficient and Safe Traffic; PI (9/1/2020-8/31/2021, \$35,000 cash gift + \$90,000 AWS credits).
16. NSF CAREER: Multi-Scale Multi-Population Mean Field Game-Theoretic Framework for the Autonomous Mobility Ecosystem; PI. (5/1/2020-4/30/2025, \$584,137).
17. SAFE2RIDE: Sustainable and Fair Ecosystem Towards Robotic-Human Vehicle Interactive Driving Equilibrium. *Columbia Provost's Grants Program for Junior Faculty*; PI (1/1/2018-12/31/2018, \$25,000)
18. A Game-Theoretical Framework for Modeling Strategic Interactions Between Autonomous and Human-Driven Vehicles. *Columbia's Data Science Institute Seed Funds*; PI (1/1/2018-12/31/2019, \$200,000)
19. Center for Advanced Infrastructure and Transportation (CAIT) Regional UTC. *USDOT The Region 2 University Transportation Research Center (UTRC)*; Subcontract PI (6/5/2018-8/31/2023, \$89,000).
20. First-Last Mile connections for Ridehailing Services and Bikeshare: A Multi-Modal Approach. *DidiChuxing*; Subcontract PI (9/1/2017-8/31/2018, \$31,985)
21. NSF RAPID/Collaborative Research: Measuring the Impact of the Re-entry of Ride Sourcing in Austin, Texas: A Natural Experiment; PI (8/1/2017-7/31/2018, \$2,200).
22. NSF RAPID/Collaborative Research: Measuring the Impact of An Unanticipated Disruption of On-Demand Ride Services in Austin, Texas; Co-PI (9/1/2016-8/31/2017, \$2,200).

Teaching Experience

Department of Civil Engineering and Engineering Mechanics, Columbia University

CEOR E4011 Civil Infrastructure Systems Optimization, Instructor

Fall Semester

CIEN E4011 Big Data Analytics in Transportation, Instructor

Spring Semester

Presentations

- Control of Automated Vehicles in the Era of Mixed Autonomy. *TU Delft ADaS Lab Webinar*, 2025.
- AI-Powered Safety-Aware Urban Transportation Digital Twins: A Mean Field Game Approach. *Joint Seminar Between Ecole des Ponts and ITSS France Talk Series*, 2025.
- Transportation & Machine Learning. Energy4Climate Summer School, *Ecole Polytechnique*, 2025.
- Harnessing Game Theory and Big Data for Emerging Transportation Modeling. *Argonne National Lab LANS Seminar*, 2024.
- AI For Transportation Digital Twins. *University of South California, New York University ECE Seminar*, 2023; *New York University CUSP Urban Science Seminar, Columbia Teachers College Digital Futures Institute (DFI) Speaker series, Ecole Polytechnique Computer Science Seminar, Université Gustave Eiffel Paris*, 2024.
- What Are Research Gaps and Fundamentals For Transportation Digital Twins? *NSF Workshop "Mathematical Opportunities in Digital Twins"*, DC, 2023.
- What do engineers mean by Incentive in autonomous vehicle control? *Workshop "Smart Products," Bielefeld University Center for Interdisciplinary Research (Zentrum für interdisziplinäre Forschung, ZiF), Germany*, 2023.
- Physics-Informed Deep Learning For Transportation Hybrid Twin. *Google's Workshop "Sustainable Urban Mobility Simulation and Optimization," Mountain View*, 2023.
- Mixed Autonomy Traffic: Opportunities, Challenges & Questions. *CIRCLES workshop "Traffic and Autonomy," Italy*, 2023.
- Physics-Informed Deep Learning for Traffic State Estimation and Uncertainty Quantification. *IPAM UCLA, Google Mountain View*, 2022.
- Harnessing Mean Field Game and Physics-Informed Learning for Emerging Transportation Modeling. *University of South Carolina, University of Connecticut, Cornell University, Old Dominion University*, 2022; *University of Chicago Institute for Mathematical and Statistical Innovation (IMSI), Stony Brook University*, 2021.
- Physics-Informed Deep Learning for Traffic State Estimation and Fundamental Diagram Discovery, *IEEE ITSC Workshop on Internet of Things in Intelligent Transportation Systems; CIRCLES Workshop on traffic and autonomy*, 2021.
- Driving and Routing Games for Autonomous Vehicles on Networks - A Mean Field Game Approach, *Google Brain DeepMind's Machine Learning and Mean Field Games seminar, ISTTT24 (International Symposium on Transportation and Traffic Theory)*, 2022; *IEEE ITSC Workshop on Next Generation Transportation Networks*, 2021.

- Improving Driving and Health In the Wake of the Pandemic, *Tongji University*, 2021.
- Using Naturalistic Driving Data to Predict Mild Cognitive Impairment and Dementia: Preliminary Findings from the Longitudinal Research on Aging Drivers (LongROAD) Study, *IEEE IV - WS22 8th Workshop on Naturalistic Driving Data Analytics*, 2021.
- Harnessing Game Theory and Big Data for Connected and Autonomous Vehicle Systems: *Purdue University, Northwestern, EPFL*, 2020; *University of Michigan in Ann Arbor, University of Texas at Austin, University of California Davis, Traffic Flow Theory and Characteristics Committee of TRB (ACP50) Webinar*, 2021; *Technical University of Munich (TUM)*, 2022.
- A Unified Equilibrium Framework of New Shared Mobility Systems: *99th TRB Annual Meeting*, 2020.
- Panelist, Artificial Intelligence for Good: Thoughts, Deeds and Words. *Columbia University DSI- DiDi Labs*, 2019.
- AI-Guided Experiment Design for Car-Following Behavior Calibration: A Two-Player Reinforcement Learning Based Game. *25th ACM SIGKDD Conference on Knowledge Discovery and Data Mining*, 2019.
- SAFE2RIDE: Sustainable and Fair Ecosystem Towards Robotic-Human Vehicle Interactive Driving Equilibrium. *Applied Mathematics and Scientific Computing Seminar, Temple University*, 2019.
- Game-Theoretic Models for Human-Robotic Vehicle Interaction in the Mixed-Autonomy Transportation Ecosystem. *Goldman Sachs Engineering Insights & Guest lecture for Spring '19: IEOR4505 Operation Research in Public Policy*, 2019.
- Deep Learning in Transportation. *TRIPODS Deep Learning Workshop*, 2019.
- Where to find the next passenger on e-hailing platforms? - A reinforcement learning approach: *IMA invited workshop on Forging a New Discipline: Data-driven Supply Chain Management*, 2018.
- Multimodal Connections between Dockless Bikes and Ride-Hailing: An Empirical Study in New York City: *21st IEEE ITSC*, 2018.
- Connected and Automated Vehicles, Guest lecture for Fall '17: *EECS E4764 IoT – Intelligent and Connected Systems*, 2017.
- Ridesharing User Equilibrium and Its Implications for High-Occupancy Toll Lane Pricing: *Columbia University's Data Science Institute Data Science Day*, 2017.
- Activity-Based Travel Demand Analysis using Michigan Connected Vehicles Test Bed Data: invited talk, *Center for Urban Intelligent Transportation Systems, NYU Civil & Urban Engineering*, 2016.

Media Exposure

1. [It's What Older Drivers Fear: Behaviors Behind The Wheel Harbor Early Signals Of Dementia](#). Forbes
2. [Who Is Responsible In A Crash With A Self-Driving Car?](#) Forbes.
3. [Where you go tells who you are - and vice versa](#). ScienceDaily.
4. [RideAustin Battles to survive in space dominated by Uber, Lyft](#), 512tech
5. [Columbia Researchers Studying How To Ensure Safety of Driverless Cars](#), Columbia DSI.
6. [Is Uber Helping or Hurting Mass Transit?](#) October 16, 2017, NY Times.
7. [Smart Cities: Focus on Networks and Governance First, Devices and Apps Second](#), HP Enterprise.
8. [Ride-hailing nonprofit struggles to survive in Austin](#). The Texas Tribune.
9. [Uber and Lyft may lead to drops in personal car ownership](#). The Verge.

Professional Activities & Service

Professional Membership

- IEEE Intelligent Transportation Systems Society (ITSS)
- Association for Computing Machinery (ACM)
- Institute of Transportation Engineers (ITE)
- Institute for Operations Research and the Management Sciences (INFORMS)
- Women's Transportation Seminar (WTS)
- Transportation Research Board (TRB) Standing Committee on Traffic Flow Theory and Characteristics (ACP50)

Associate Editor:

- IEEE Transactions on ITS (2021-2023)

Sharon (Xuan) Di

- Transportation Research Part B: Methodological (2022-)
- Transportation Research Part C: Emerging Technologies (2024-)
- Transportation Science (2022-)

Reviewer

- Transportation Science
- Transportation Research Part B/C/D
- European Journal of Operational Research
- Networks and Spatial Economics
- Transportation
- Transportmetrica A: Transport Science
- Journal of Intelligent Transport Systems (The Institution of Engineering and Technology)
- Computer-Aided Civil and Infrastructure Engineering
- Transportation Research Board Annual Meeting Proceedings
- COTA International Conference for Transportation Professionals (CICTP2013, CICTP2014, CICTP2015)
- IEEE Intelligent Transportation Systems Society Conference (ITSC 2014,2018)
- 11th International Conference of Chinese Transportation Professionals (ICCTP 2011)
- Springer Book Series in Reliability Engineering on “Game Theoretic Analysis of Congestion, Safety and Security”

Student Advisory

- PhD Students: Zhaobin Mo (graduated in Dec. 2025), Kangrui Ruan (graduated in Aug. 2024), Zhenyu Shou (graduated in Dec. 2020), Kuang Huang (APAM, graduated in May 2022), Xu Chen (graduated in May 2025), Yongjie Fu, Qi Gao, Bowen Fang, Bohua Yan