

Beyond Observed Traffic: Scalable and Physically Grounded Counterfactuals for Transportation

Assistant Professor Zilin Bian

**Rochester Institute of Technology, Department of Civil Engineering
Technology and Environmental Management**

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Civil Engineering Department, Room ST 105, Steinman Hall

<https://ccny.zoom.us/j/81143716707?pwd=aMZOk1AgPeAUChwSYIXRtpwYNOIl.I&from=addon>

Abstract: Transportation research often relies on observations of what actually happened, while many important safety and operations questions concern what could have happened under different physical, behavioral, or environmental conditions. This talk presents three recent efforts toward scalable and physically grounded counterfactual transportation analysis. SceneFactory enables massively parallel simulation of alternative physical conditions in real driving scenes; SIREN-Bench generates configurable emergency-vehicle interactions with varied agent behaviors; and MuSync-GS creates physically synchronized scene edits in which roadway changes propagate through vehicle motion, camera pose, and visual appearance. These capabilities support counterfactual traffic analysis that is scalable, behaviorally responsive, and physically consistent, while opening new directions in counterfactual infrastructure and three-dimensional roadway design.

Biography: Zilin Bian is an Assistant Professor in the Department of Civil Engineering Technology and Environmental Management at Rochester Institute of Technology (RIT), with courtesy appointments in the Department of Electrical and Computer Engineering and the ESL Global Cybersecurity Institute. He received his B.S. degree from Harbin Institute of Technology, his M.S. degree in Civil Engineering from the University of Florida, and his Ph.D. degree in Transportation Planning and Engineering from New York University. He has published more than 40 refereed papers in peer-reviewed journals and conference proceedings. His research lies at the intersection of artificial intelligence, intelligent transportation systems, and computational urban science, with particular interests in AI-enabled modeling and simulation of transportation systems, physics-aware learning, digital twins, and smart and connected infrastructure. His work develops sensing, modeling, simulation, and decision-support technologies to understand and predict complex transportation systems and to improve mobility, safety, resilience, and sustainability. He has served as PI or Co-PI on research projects supported by government agencies and industry partners, including NVIDIA. He was a recipient of the 2023 Best Dissertation Award from the Transportation Research Board (TRB) Artificial Intelligence Committee.

