Stony Brook University

# Department of Civil Engineering

College of Engineering and Applied Sciences

## SPRING 2021 ONLINE SEMINAR SERIES


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**Monday, April 12th, 2:40 – 3:35 PM**

**ZOOM LINK:** Meeting ID: 950 6760 3617; Passcode: 426506
https://stonybrook.zoom.us/j/95067603617?pwd=dXQybEprSkNlTFY3WHlWYjViUG95UT09

# Towards a Self-adaptive Smart City:
## Collaboratively Integrating Sensing, Learning and Actuation for Autonomous Monitoring and Management of Urban Infrastructure Systems


**Abstract**

With increasing populations and demand of high-quality urban services, there is an urgent need of building a "self-adaptive" city which can autonomously adapt its monitoring and management strategies for urban infrastructure systems under constantly changing dynamics. The recent rapid development of sensor networks and 5G technologies are enabling large-scale multi-source data and real-time multi-agent control. But the large-scale and interdependent physical infrastructure systems pose challenges to data-driven monitoring and management strategies. For instance, how to design low-cost paradigms for large-scale and complex infrastructure sensing, how to capture and analyze the physical dynamic interplay between infrastructure systems from the noisy and incomplete data, how to timely react to changes of urban dynamics, and more importantly, how to automate the process of sensing, learning and actuation to improve the quality of the urban services. In this talk, I will introduce a framework on collaboratively integrating resource-aware sensing, physics-informed learning and incentive mechanisms for monitoring large-scale urban infrastructure systems. First, I will talk about my work on embedding prior physical knowledge of infrastructures into adversarial transfer learning algorithms for infrastructure damage diagnosis. This framework enables knowledge transfer across different infrastructures without any labelled data on the target structure, especially in post-disaster scenarios. Further, I will introduce the integration of indirect sensing methods, including "building as sensors" and "vehicle as sensors" and physics-informed learning for large-

scale infrastructure monitoring, which are informed by ambient traffic event inferring and structural health monitoring of in-service bridges. Finally, I will briefly mention my works on incentivizing vehicle mobilities and human activities to react to the detected changes in urban infrastructure systems, in order to improve the efficiency, reliability and sustainability of urban services.

**Speaker Bio**

Dr. Susu Xu is an assistant professor at Department of Civil Engineering, Stony Brook University. She received her Ph.D. in Civil Engineering and master's degree in Machine Learning from Carnegie Mellon University, her bachelor's degree in Environmental Engineering from Tsinghua University. She has been postdoctoral research fellow at Stanford University and research scientist at the AI research team in Qualcomm Technologies. Her research focuses on collaboratively integrating crowdsensing, physics-informed machine learning, and incentive mechanisms for enabling self-adaptive smart urban infrastructure systems and improving the efficiency, reliability, and sustainability of cities. She received the Best Paper Award at the IEEE International Conference of Machine Learning and Applications (ICMLA) in 2018, and the champion of NeurIPS 2018 Adversarial Vision Challenge. She is the recipient of MIT CEE Rising Star, Dowd Fellowship, Liang Ji-Dian Graduate Fellowship, and CMU CIT Dean Fellowship. She has served as the chair of ACM Ubicomp Continual and Multimodal Learning workshop as well as the committee member of Qualcomm Innovation Fellowship, ICML workshop and Ubicomp workshop.