Civil and Environmental Engineering

Present

Learning and Control for Safety, Efficiency and Security of Cyber-Physical Systems

Speaker:

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Ubiquitous sensing enables large-scale multi-source data of cyber-physical systems (CPS) collected in real-time and poses both challenges and opportunities for a paradigm-shift to data-driven CPS. For instance, how to capture the complexity and analyze the dynamical state information from data, and make decisions to improve safety, efficiency and security of the networked CPS is still challenging. In this talk, we present our research that integrates optimization, machine learning, control theory, and game theory to address these challenges. We first present data-driven distributionally robust optimization (DRO) methods for mobility-on-demand (MoD) systems, with the uncertainty sets of predicted demand and supply constructed from data. We prove the computationally tractable forms of the DRO problems to make real-time decisions with the worst-case expected cost guarantees for the system. We show the improvement of service fairness and efficiency based on real-world large-scale taxi and electric vehicle data. Second, we introduce our research contribution for CPS security, including a hybrid state stochastic game model and proved suboptimal algorithms to calculate the mixed policies. Finally, we present our recent work about safe and efficient multi-agent reinforcement learning and benefits analysis of information sharing for connected and autonomous vehicles.

Bio:
Dr. Fei Miao is an Assistant Professor of the Department of Computer Science & Engineering, a Courtesy Faculty of the Department of Electrical & Computer Engineering, University of Connecticut since 2017. She is also affiliated to the Institute of Advanced Systems Engineering and Eversource Energy Center. She was a postdoc researcher at the GRASP Lab and the PRECISE Lab of the University of Pennsylvania from 2016 to 2017. She received the Ph.D. degree and the Best Doctoral Dissertation Award in Electrical and Systems Engineering, with a dual M.S. degree in Statistics from the University of Pennsylvania in 2016. She received the B.S. degree in Automation from Shanghai Jiao Tong University. Her research interests lie in the optimization, machine learning, control, and game theory, to address safety, efficiency, and security challenges of cyber-physical systems. Dr. Miao is a receipt of the NSF CAREER award and a couple of other awards from NSF. She received the Best Paper Award and Best Paper Award Finalist at the 12th and 6th ACM/IEEE International Conference on Cyber-Physical Systems (ICCPS) in 2021 and 2015, respectively.

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