Seminar Series

Thursday March 30th, 2017
1:30PM - 2:30PM
UConn, Storrs Campus – Rowe 318
To view live webcast click here

Data-Driven Dynamic Robust Resource Allocation for Efficient Transportation

Ubiquitous sensing in smart cities enables large-scale multi-source data collected in real-time, poses several challenges and requires a paradigm-shift to capture the ever growing complexity and dynamics of systems. Data-driven cyber-physical systems (CPSs) integrating machine learning, statistical methods, optimization, and control are highly desirable for this paradigm shift, since existing model-based techniques of CPSs become inadequate. For instance, how to identify, analyze the dynamical interplay between urban-scale phenomena (such as mobility demand and supply) from data, and take actions to improve system-level service efficiency is still a challenging and unsolved problem in transportation systems. In this talk, we present a unified data-driven dynamic robust resource allocation framework to match supply towards spatial-temporally uncertain demand, while seeking to reduce total resource allocation cost in real-time. First, we present a receding horizon control framework that incorporates large-scale historical and real-time sensing data in demand prediction and dispatch decisions under practical constraints. However, demand prediction error is not negligible and affects the system's performance. Therefore, with spatial-temporal demand uncertainty models constructed from data, we then propose two computationally tractable or real-time robust resource allocation methods to provide probabilistic guarantees for the system's worst-case and expected performances. As a case study, we evaluated the proposed framework using real taxi operational data, and showed that the data driven robust resource allocation methods reduce the average total idle distance in the city by 55%. Lastly, I will provide an overview of my research that uses the knowledge of the system dynamics for guarantee safety, security and resiliency properties of CPSs and smart cities. I will introduce my research of coding schemes for stealthy data injection attacks detection, and stochastic game schemes for resilient control of CPSs.

Fei Miao

Fei Miao received the B.Sc. degree in Automation from Shanghai Jiao Tong University, Shanghai, China, in June 2010. She received the dual M.A. degree in Statistics in August 2015, and the Ph.D. degree in Electrical and Systems Engineering in May 2016, both from the University of Pennsylvania. Currently, she is a postdoc researcher at the Department of Electrical and Systems Engineering, University of Pennsylvania. Her broad research agenda is to develop the foundations for the science of data-driven cyber-physical systems and autonomous transportation systems to assure safety, efficiency and security. Dr. Miao received the "Charles Hallac and Sarah Keil Wolf Award for Best Doctoral Dissertation" in Electrical and Systems Engineering Department from University of Pennsylvania, in 2016, and she was a Best Paper Award Finalist at the 6th ACM/IEEE International Conference on Cyber-Physical Systems (ICCPS) in 2015.

Upcoming Distinguished Lectures

5/08/17 – Ignacio Grossmann

Upcoming Seminars

4/7/17 – Ilias Bilonis
Uncertainty Quantification using Embarrassingly Small Numbers of Simulations and Experiments

4/10/17 – Nick Sahindis
The ALAMO Approach to Machine Learning: Best Subset Selection, Adaptive Sampling, and Constrained Regression

4/17/17 – Dane Boysen
Democratizing Energy TECHNOLOGY

5/22/17 – James Davis

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