School of Computer Science and Engineering
Presentation

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Stochastic Learning and Optimization with Imperfect Data in Cyber-Physical Systems

ABSTRACT:
The world is witnessing an unprecedented growth of cyber-physical systems (CPS), which are foreseen to revolutionize our world via creating new services and applications in a variety of sectors such as environmental monitoring, mobile health systems, and intelligent energy systems. Driven by this trend, various types of Internet of things (IoT) sensors have been deployed to collect data and then use these data to improve all aspects of CPS. However, this enormous amount of data renders a significant challenge for existing systems to efficiently and effectively process in real-time. Moreover, various issues (e.g., communication delay, sensor failures) may degrade the quality of data, and operations and control based on such data may result in a CPS with less reliability, adaptability, scalability, resiliency, safety, security, and usability. Toward this end, this talk focuses on stochastic optimization and learning in CPSs with the focus on data quality and data scalability issues. The goal is to propose robust data-driven approaches that can effectively learn and infer the system model characteristics in presence of data imperfections. In this talk, I will first present a novel data recovery framework based on a regularized tensor completion approach. I will share the results on real DOE dataset, which showed that our tool recovers the missing data with higher accuracy compared to the conventional methods. I will also discuss our most recent work about designing an intelligent contingency management framework by leveraging a robust deep reinforcement learning (DRL) algorithm to better handle the contingencies in real-time operations while considering the effect of the measurement noise in the design process.