Department of
Systems Engineering
香港城市大學
City University of Hong Kong

Neural Network-Assisted Simulation Metamodel for Real-time System Performance Evaluation

Mr Haoting ZHANG
PhD candidate,
Department of Industrial Engineering
and Operations Research,
University of California, Berkeley, USA

2 January 2025 (Thu) | 10:30 am

Seminar Link: https://cityu.zoom.us/j/82793766088

Abstract

For many real-time decision problems in complex stochastic systems, a decision-maker observes the system-status data online in real-time and needs to immediately evaluate the performance of alternative decision choices based on the observed system status. Such problems appear in applications such as supply chain management, service system operations, and manufacturing processes. Simulation metamodels have the capacity to effectively support these needs by constructing a fast-to-evaluate mapping from the system status and decision to system performance, using offline-generated simulation samples. However, when the system status involves high-dimensional information and a large number of simulated samples, classical simulation metamodeling approaches, such as stochastic kriging, may face challenges in terms of model specification, computational complexities, and computer storage demands. To address these challenges, we propose using machine learning—a powerful tool in data science—to assist stochastic kriging in building metamodels offline, which is then deployed to support online applications. The machine learning models can capture the potential nonlinear dependence of the stochastic kriging parameters on the high-dimensional system status. We analyze standard properties, such as mean squared errors and uncertainty quantification, for the proposed machine learning-assisted metamodel, and show its consistency and asymptotic validity. We demonstrate the comparative advantage of our approach through numerical experiments, highlighting its potential for leveraging data science to evaluate the performance of complex stochastic systems.

About the Speaker

Haoting Zhang is a PhD candidate in the Department of Industrial Engineering and Operations Research at the University of California, Berkeley. His research focuses on the intersection of simulation analytics and machine learning. He has completed two internships at the Amazon supply chain optimization technology team.

Enquiry: 3442 8422 | All are welcome