Industrial Big Data Analytics for Process Control and Operations

Dr. Fengqi You, Roxanne E. and Michael J. Zak Professor
Process-Energy-Environmental Systems Engineering
fengq.you@cornell.edu | you.cbe.cornell.edu

Data-driven optimization has received immense attentions nowadays due to its close integrations with both machine learning and operation research. Decision-making under uncertainty poses significant challenges for industrial process control and operations. Machine learning provide powerful tools for uncertainty quantification and modeling, and in turn facilitates the advances of decision-making tools.

Production scheduling is a general problem in process industries that involves various types of uncertainties, such as random processing times, fluctuating demands, etc. With the development of sensor and data storage technologies, a significant amount of uncertainty data are being collected online, which provide possibilities to leverage the power of big data analytics to address the challenge of decision-making under uncertainties.

In this project, we will use kernel learning-based robust optimization approach to formulate the decision-making problem. Support vector clustering (SVC) as a powerful machine learning technique will be adopted to extract meaningful statistical information from historical data first, which is integrated into the robust optimization model. Then the robust counterpart in the form of mixed-integer linear program will be derived and solved to inform the process control and operations decisions. Comparative studies will be performed to illustrate the exclusive benefits that massive historical data could provide in decision-making in process industries. This project will be helpful for enhancing one’s knowledge and programming skills in both machine learning and optimization.