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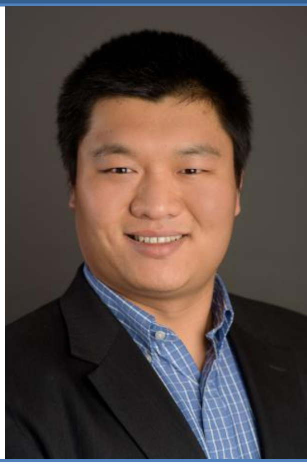

**Fengqi You**
Roxanne E. and Michael J. Zak Professor
Cornell University

## When Machine Learning Meets Robust Optimization: Data-driven Adaptive Robust Optimization Models, Algorithms & Applications

In this presentation, we will introduce a novel data-driven adaptive robust optimization framework that organically integrate machine learning techniques with optimization under uncertainty methods. We first propose a data-driven nonparametric uncertainty model could automatically adjust its complexity based on the data structure and complexity, thus accurately capturing the uncertainty information. The machine learning model is seamlessly integrated with adaptive robust optimization approach through a novel multi-level optimization framework. This framework explicitly accounts for the correlation, asymmetry and multimode of uncertainty data, so it generates less conservative solutions than conventional robust optimization approaches. Additionally, the proposed framework is robust not only to parameter variations, but also to data outliers. The data-driven adaptive robust optimization framework is further extended to systematically and automatically handle labeled multi-class uncertainty data through a stochastic robust optimization approach. The resulting optimization framework has a bi-level structure: The outer optimization problem follows a two-stage stochastic programming approach to optimize the expected objective across different classes of data; robust optimization is nested as the inner problem to ensure the robustness of the solution while maintaining computational tractability. Tailored column-and-constraint generation algorithms are further developed to solve the resulting multi-level optimization problem efficiently. Applications to short-term scheduling of batch processes and strategic planning of process networks are presented to demonstrate the applicability of the proposed frameworks and effectiveness of the solution algorithm.

**Biography:**

Fengqi You is the Roxanne E. and Michael J. Zak Professor at Cornell University, and is affiliated with Smith School of Chemical and Biomolecular Engineering, Operations Research and Information Engineering Field, Center of Applied Mathematics, and Systems Engineering

Program. He earned a B.Eng. from Tsinghua University and received his Ph.D. from Carnegie Mellon University. He served on the faculty of Northwestern University from 2011 to 2016, and worked at Argonne National Laboratory as an Argonne Scholar from 2009 to 2011. He has published over 100 peer-reviewed articles in leading journals, and has an h-index of 40. Some of his research results have been editorially highlighted in Nature, featured on journal covers (e.g. Energy & Environmental Science, ACS Sustainable Chemistry & Engineering, and Industrial & Engineering Chemistry Research), and covered by major media outlets (e.g. The New York Times, BBC, BusinessWeek, and National Geographic). His recent awards (in the past five years) include Northwestern-Argonne Early Career Investigator Award (2013), National Science Foundation CAREER Award (2016), AIChE Environmental Division Early Career Award (2017), AIChE Sustainable Engineering Research Excellence Award (2017), and ACS Sustainable Chemistry & Engineering Lectureship Award (2018), as well as a number of best paper awards and most-cited article recognitions. He is currently an Associate Editor of Computers & Chemical Engineering, a Consulting Editor of AIChE Journal, and an editorial board member of several journals (e.g. ACS Sustainable Chemistry & Engineering). His research focuses on the development of novel computational models, optimization algorithms, statistical machine learning methods, and systems analysis tools for process manufacturing, smart agriculture, energy systems, and sustainability. More information about his research group can be found from the website: <http://peese.org>.

**Join Webinar on Sept 20, 2017 at 11 AM Eastern Time (EDT) at http://goo.gl/5ySqO4**