Imperial College
London

Centre for Process Systems Engineering
2019 Seminar Series

Data-Driven Distributionally Robust Optimization

Prof. Daniel Kuhn
École polytechnique fédérale de Lausanne

10 April 2019, 11am, Seminar Room RODH C617

Abstract: We consider stochastic programs where the distribution of the uncertain parameters is only observable through a finite training dataset. Using the Wasserstein metric, we construct a ball in the space of (multivariate and non-discrete) probability distributions centered at the uniform distribution on the training samples, and we seek decisions that perform best in view of the worst-case distribution within this Wasserstein ball. The state-of-the-art methods for solving the resulting distributionally robust optimization problems rely on global optimization techniques, which quickly become computationally excruciating. In this talk we will see that, under mild assumptions, the distributionally robust optimization problems over Wasserstein balls can in fact be reformulated as finite convex programs - in many interesting cases even as tractable linear programs. Leveraging recent measure concentration results, we also show that their solutions enjoy powerful finite-sample performance guarantees. Our theoretical results are exemplified in mean-risk portfolio optimization, uncertainty quantification and machine learning.

Bio: Daniel Kuhn is Professor of Operations Research at the College of Management of Technology at EPFL, where he holds the Chair of Risk Analytics and Optimization (RAO). His current research interests are focused on data-driven optimization, the development of efficient computational methods for the solution of stochastic and robust optimization problems and the design of approximation schemes that ensure their computational tractability. This work is primarily application-driven, the main application areas being engineered systems, machine learning, operations management and finance. Before joining EPFL, Daniel Kuhn was a faculty member in the Department of Computing at Imperial College London (2007-2013) and a postdoctoral research associate in the Department of Management Science and Engineering at Stanford University (2005-2006). He holds a PhD degree in Economics from University of St. Gallen and an MSc degree in Theoretical Physics from ETH Zurich. He serves as the area editor for continuous optimization for Operations Research and as an associate editor for several other journals including Management Science, Mathematical Programming, Mathematics of Operations Research and Operations Research Letters. He also chairs the steering committee of the Stochastic Programming Society.