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Distributionally Robust Optimization Driven by Stochastic and Online Data

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Abstract

We present decision/optimization models/problems driven by uncertain and online data, and show how analytical models and computational algorithms can be used to achieve solution efficiency and near optimality.

First, we describe the so-called Distributionally or Likelihood Robust optimization (DRO) models and their algorithms in dealing stochastic decision problems when the exact uncertainty distribution is unknown but certain statistical moments and/or sample distributions can be estimated.

Secondly, when decisions are made in presence of high dimensional stochastic data, handling joint distribution of correlated random variables can present a formidable task, both in terms of sampling and estimation as well as algorithmic complexity. A common heuristic is to estimate only marginal distributions and substitute joint distribution by independent (product) distribution. Here, we study possible loss incurred on ignoring correlations through the DRO approach, and quantify that loss as Price of Correlations (POC).

Thirdly, we describe an online combinatorial auction problem using online linear programming technologies. We discuss near-optimal algorithms for solving this surprisingly general class of online problems under the assumption of random order of arrivals and some conditions on the data and size of the problem.

Biography

Yinyu Ye is currently the K.T. Li Chair Professor of Engineering at Department of Management Science and Engineering and Institute of Computational and Mathematical Engineering, Stanford University. He is also the Director of the MS&E Industrial Affiliates Program. He received the B.S. degree from the Huazhong University of Science and Technology, China, and the M.S. and Ph.D. degrees from Stanford University. His current research interests include Continuous and Discrete Optimization, Data Science and Application, Algorithm Design and Analysis, Computational Game/Market Equilibrium, Metric Distance Geometry, Dynamic Resource Allocation, and Stochastic and Robust Decision Making, etc. He is an INFORMS Fellow since 2012, and has received several academic awards including: the **2009 John von Neumann Theory Prize** for fundamental sustained contributions to theory in Operations Research and the Management Sciences, the 2015 **SPS Signal Processing Magazine Best Paper** Award, the winner of the 2014 **SIAM Optimization Prize** awarded, the inaugural 2012 **ISMP Tseng Lectureship Prize**, the inaugural 2006 **Farkas Prize** on Optimization, the 2009 IBM Faculty Award, etc.. His text book written with David Luenberger, "Linear and Nonlinear Programming," has been popularly used in academic education.