Risk and complexity in scenario optimization

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About the speaker

Simone Garatti is Associate Professor at the Dipartimento di Elettronica, Informazione e Bioingegneria of the Politecnico di Milano, Milan, Italy. He received the Laurea degree and the Ph.D. in Information Technology Engineering in 2000 and 2004, respectively, both from the Politecnico di Milano. Simone Garatti was visiting scholar at the Lund University of Technology, Lund, Sweden, in 2003, at the University of California San Diego (UCSD), San Diego, CA, USA, in 2006, and at the Massachusetts Institute of Technology and the Northeastern University, Boston, MA, USA, in 2007. He is member of the IEEE Technical Committee on Computational Aspects of Control System Design, of the IEEE Technical Committee on System Identification and Adaptive Control, and of the IFAC Technical Committee on Modeling, Identification and Signal Processing. His research interests include data-driven and stochastic optimization for problems in systems and control, stochastic systems, system identification, model quality assessment and uncertainty quantification.

Abstract

Scenario optimization is a well-recognized methodology to perform optimization based on empirical knowledge. One assumes that a sample of constraints is known from previous experience and makes a decision that is robust for the cases that have been observed. For convex optimization, a generalization theory has been developed that provides quantifications of the risk of being unfeasible for new, previously unseen, situations, based on the cardinality of the sample and the number of optimization variables. In this talk, a new generalization theory is presented where the risk is studied jointly with the complexity of the solution as given by the cardinality of the so-called support constraints. It is shown that the complexity carries fundamental information to tightly judge the risk and new complexity-dependent evaluations of the risk are presented that largely outperform those carried out based on the number of optimization variables. The result is obtained without availing of extra knowledge other than that carried by the sample of constraints, so that the proposed approach is broadly applicable.

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