ELECTRICAL & COMPUTER ENGINEERING **RESEARCH SEMINAR** **Fall 2018**

Rate-Cost Tradeoffs in Control via Directed Information

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Abstract

We study the fundamental tradeoff between control and communication costs in linear stochastic control. The controller aims to minimize a quadratic cost function in the state variables and control signal, known as the linear quadratic regulator (LQR), while having access to only r bits of information per sample about the system state. Joint optimization of encoder and controller is generally intractable. We derive tight information-theoretic bounds to the rate-cost tradeoff in several realistic scenarios, and analyze suboptimal quantization schemes that perform close to these new information-theoretic bounds. Scenarios of interest include fixed- and variable- length quantized control, control over packet-drop and Gaussian channels, rate-limited control with side information, and continuous-time biomolecular control. Directed mutual information plays a key role in these problems; we clarify its operational meaning and develop new techniques to compute, optimize and bound it.

Biography

Victoria Kostina joined Caltech as an Assistant Professor of Electrical Engineering in the fall of 2014. She holds a Bachelor's degree from Moscow institute of Physics and Technology (2004), where she was affiliated with the Institute for Information Transmission Problems of the Russian Academy of Sciences, a Master's degree from University of Ottawa (2006), and a PhD from Princeton University (2013). She received the Natural Sciences and Engineering Research Council of Canada postgraduate scholarship (2009--2012), the Princeton Electrical Engineering Best Dissertation Award (2013), the Simons-Berkeley research fellowship (2015) and the NSF CAREER award (2017). Kostina's research spans information theory, coding, control and communications.