USC Department of Mathematics

Probability & Statistics Seminar

3:30 PM, Friday 13.Nov.09
414 Kaprielian Hall
(Refreshments served at 2:45 PM)

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Simulation-based optimization of Markov decision processes: An empirical process theory approach

It is well-known that solving Markov decision processes using dynamic programming is computationally intractable. We propose a simulation-based framework that exploits the uniform laws of large numbers (ULLNs) developed by Vapnik, Chervonenkis, and others. The Vapnik-Chervonenkis theory is a generalization of the classical Glivenko-Cantelli theorem. The rate of convergence in ULLNs can be characterized in terms of the epsilon-covering number of a function class introduced by Kolmogorov and Tihomirov.

We present the beginnings of a corresponding empirical process theory for Markov decision processes. We provide uniform law of large number results for particular functionals of Markov decision processes. When uniform convergence is obtained, we also obtain the rate of convergence in terms of P-dimension of the policy class. We then introduce a simulation-based framework for optimization of Markov decision processes. In particular, we give a simulation-based algorithm to compute an epsilon-optimal policy and show the regret minimization property of such a framework.

This is joint work with Pravin Varaiya, UC Berkeley.