Numerical Analysis and Scientific Computing Seminar

Inference, Computation, and Games

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Abstract: ¡P¿In this talk, we develop algorithms for numerical computation, based on ideas from competitive games and statistical inference. ¡p¿In the first part, we propose competitive gradient descent (CGD) as a natural generalization of gradient descent to saddle point problems and general sum games. Whereas gradient descent minimizes a local linear approximation at each step, CGD uses the Nash equilibrium of a local bilinear approximation. Explicitly accounting for agent-interaction significantly improves the convergence properties, as demonstrated in applications to GANs, reinforcement learning, and computer graphics. ¡p¿In the second part, we show that the conditional near-independence properties of smooth Gaussian processes imply the near-sparsity of Cholesky factors of their dense covariance matrices. We use this insight to derive simple, fast solvers with state-of-the-art complexity vs. accuracy guarantees for general elliptic differential- and integral equations. Our methods come with rigorous error estimates, are easy to parallelize, and show good performance in practice.

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