Efficient Information Aggregation Strategies for Distributed Optimization

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Abstract

This talk will discuss a fast distributed algorithm for convex optimization by multiple cooperating agents. Application areas include target tracking, localization, coverage, and learning problems for large and potentially mobile sensor networks. Widespread deployment of such sensors is expected to revolutionize our ability to monitor and control physical environments from remote locations; however, most implementations of such systems so far have been limited both in the range of tasks they can perform and in the need for close centralized supervision.

Motivated by this, we will describe here a class of algorithms, recently proposed in the literature, for approximating the minimum of a convex function satisfying a separability condition. These algorithms are fully distributed, require no centralized supervision, robust to unpredictable link and node failures, and solve a general class of optimization problems which include those mentioned above and others.

Our results concern the quantitative performance of these algorithms in a sensor network with unpredictable link and node failures. A key subroutine used by these algorithms is a distributed scheme for computing the average of a collection of numbers stored throughout the network. This scheme involves each node taking repeated linear combinations of the values of its neighbors, and over time, as information diffuses through these linear combination, each node's value approaches the average. By designing the best known scheme for such "diffusive" averaging, we are able to derive the best known convergence time for distributed optimization algorithms in this setting, which is our main result. We will also describe a lower bound showing our algorithm has the optimal convergence time among algorithms with some natural properties.

Biography

Alex Olshevsky received a BS in Mathematics and a BS in Electrical Engineering from the Georgia Institute of Technology, and an MS and a PhD in Electrical Engineering and Computer Science from MIT. He is currently a postdoctoral scholar at Princeton University, as well as a research associate at Los Alamos National Laboratory. His research interests are in control theory, optimization, and applied probability.