



*Dual Averaging for Distributed Optimization: Convergence Analysis and Network Scaling*

Martin Wainwright

University of California at Berkeley

Friday, April 8, 2011

11:00 – 12:30

McGill University, McConnell Engineering building, room 603

Abstract: The goal of decentralized optimization over a network is to optimize a global objective formed by a sum of local (possibly nonsmooth) convex functions using only local computation and communication. It arises in various application domains, including distributed tracking and localization, multi-agent co-ordination, estimation in sensor networks, and large-scale optimization in machine learning. We develop and analyze distributed algorithms based on dual averaging of subgradients, and we provide sharp bounds on their convergence rates as a function of the network size and topology. Our method of analysis allows for a clear separation between the convergence of the optimization algorithm itself and the effects of communication constraints arising from the network structure. In particular, we show that the number of iterations required by our algorithm scales inversely in the spectral gap of the network. The sharpness of this prediction is confirmed both by theoretical lower bounds and simulations for various networks. Our approach includes both the cases of deterministic optimization and communication, as well as problems with stochastic optimization and/or communication.

Based on joint work with John Duchi and Alekh Agarwal.

Arxiv preprint: <http://arxiv.org/abs/1005.2012>

---

Martin Wainwright is currently an associate professor at University of California at Berkeley, with a joint appointment between the Department of Statistics and the Department of Electrical Engineering and Computer Sciences. He received a Bachelor's degree in Mathematics from University of Waterloo, Canada, and Ph.D. degree in Electrical Engineering and Computer Science (EECS) from MIT. His research interests include machine learning, mathematical statistics, distributed optimization, and information theory. He has been awarded an Alfred P. Sloan Foundation Fellowship, an NSF CAREER Award, the George M. Sprowls Prize for his dissertation research, a Natural Sciences and Engineering Research Council of Canada 1967 Fellowship, an IEEE Signal Processing Society Best Paper Award in 2008, and several outstanding conference paper awards.