Parallel Bayesian Global Optimization of Expensive Functions, for metrics Optimization at Yelp

Abstract:
We consider parallel derivative-free global optimization of expensive-to-evaluate functions. We present a new decision-theoretic algorithm for this problem, which places a Bayesian prior distribution on the objective function, and chooses the set of points to evaluate next that provide the largest value of the information. This decision-theoretic approach was previously proposed by Ginsbourger and co-authors in 2008, but was deemed too difficult to actually implement in practice. Using stochastic approximation, we provide a practical algorithm implementing this approach, and demonstrate that it provides a significant speedup over the single-threaded expected improvement algorithm. We then describe how Yelp, the online business review company, uses this algorithm to optimize the content that their users see. An open source implementation, called the Metrics Optimization Engine (MOE), was co-developed with engineers at Yelp and is available at github.com/yelp/MOE.

BIO:
Peter I. Frazier is an assistant professor in the School of Operations Research and Information Engineering at Cornell University, and received a Ph.D. in Operations Research and Financial Engineering from Princeton University in 2009. He is the recipient of an AFOSR Young Investigator Award, and an NSF CAREER Award. He is an associate editor for Operations Research, ACM Transactions on Modeling and Computer Simulation and IIE Transactions. His research interest is in dynamic programming and Bayesian statistics, focusing on the optimal acquisition of information and sequential design of experiments. He works on applications in simulation, optimization, operations management, medicine, and materials science.