Assessing Stochastic Algorithms for Large Scale Nonlinear Least Squares Problems

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Abstract: This talk considers stochastic algorithms for efficiently solving a class of large scale non-linear least squares (NLS) problems which frequently arise in applications. We propose eight variants of a practical randomized algorithm where the uncertainties in the major stochastic steps are quantified. Such stochastic steps involve approximating the NLS objective function using Monte-Carlo methods, and this is equivalent to the estimation of the trace of corresponding symmetric positive semi-definite matrices. For the latter, we prove *tight necessary* and *sufficient* conditions on the sample size (which translates to cost) to satisfy the prescribed probabilistic accuracy. We show that these conditions are practically computable and yield small sample sizes. They are then incorporated in our stochastic algorithm to quantify the uncertainty in each randomized step. Numerical examples will be given to demontrate the efficiency of our proposed algorithms.

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