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Adaptive sequential learning

Venugopal V Veeravalli
University of Illinois at Urbana-Champaign, USA

A framework is introduced for learning a sequence of slowly changing tasks, where the parameters of the learning algorithm are obtained by minimizing a loss function to the desired accuracy using optimization algorithms such as Stochastic Gradient Descent (SGD). The tasks are assumed to change slowly in the sense that the optimum values of the learning algorithm parameters change at a bounded rate. An adaptive sequential learning algorithm is developed to efficiently solve such a slowly varying sequence of tasks. The key idea behind the approach, which distinguishes it from existing methods for online optimization, involves using a probably efficient estimator for the change in minimizer in conjunction with the optimization at each stage. This estimator allows for an accurate tracking of the minimizer over time, thereby adapting the algorithm to allow it to use the fewest number of samples at each stage. Experiments with synthetic and real data sets are presented that validate the theoretical results. Extensions to incorporate possible abrupt changes and active learning are also discussed..

vvv@illinois.edu