

Stochastic optimization algorithms, non asymptotic and asymptotic behaviour

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Abstract:

This course proposes an overview of old and recent advances on the study of stochastic algorithms. Stochastic algorithms are widely used in nowadays big data problems involved in statistics, machine learning and large scale optimization (among others). We will illustrate these methods both with a sharp description of non-asymptotic confidence bounds, and with an asymptotic point of view.

The main tools are Markov chains and processes, Martingales, Deviation inequalities (for the probability and statistical side) and convex optimization with first order methods (for the optimization side).

Outline of the lectures:

1) Remainders on the optimization of convex functions: deterministic approach 2) Stochastic Gradient Descent: as convergence 3) Asymptotic analysis of SGD 4) Rupper Polyak Averaging principle 5) Optimization of non convex functions: continuous time simulated annealing

Prerequisites: Markov chains, Martingale theory

References:

1. S. GADAT, http://perso.math.univ-toulouse.fr/gadat/files/2012/12/cours_m2R1.pdf
2. M. DUFLO , *Random Iterative Models*, Springer (1997)
3. D. BAKRY, I. GENTIL, M. LEDOUX , *Analysis and Geometry of Markov Diffusion Operators*. Springer (2014)