Title: ***Old Tricks for New Problems: Nonconvex Optimization and Langevin Dynamics***

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Place: MC313

Abstract

The Augmented Lagrangian Method (ALM) and its variants, such as the popular Alternating Direction Method of Multipliers (ADMM), are the workhorses of constrained convex optimization. The simple but powerful idea of enforcing constraints using penalty functions has interesting applications beyond convex optimization, and this talk focuses on two of them.

In the first part of the talk, we design efficient and intuitive ALM and ADMM variants to solve nonconvex optimization problems, with provable local sublinear convergence rates. We show how the ubiquitous Slater's condition in convex optimization gives its place to a geometric condition which is reminiscent of the Mangasarian-Fromovitz constraint qualification. We then apply these new algorithms to a variety of applications, including clustering, generalized eigenvalue decomposition, sparse regression, and even robustness in deep neaural networks. The convergence can be improved to obtain linear rates, using the concepts of restricted strong convexity and smoothness.

In the second part of the talk, we use penalty functions and homotpy techniques to address a key weakness of the popular Langevin Monte Carlo in sampling from probability measures which are not dominated by the Lebesgue measure. To be specific, we design provable and efficient algorithms to sample from distributions which are supported on an affine subspace or a convex polytope. Some of our results are new and the rest improve the best-known iteration complexities for sampling.

This is a joint work with the LIONS lab at EPFL.