Department of Statistics

DISSERTATION PROPOSAL

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Nonconvex Alternating Minimization, Nonconvex Support Recovery, and Optimization Based Approach in Medical Imaging

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Jones 304, 5747 S. Ellis Avenue

ABSTRACT

In this talk, we will discuss three different ongoing projects. First, we consider a nonconvex constrained optimization problem where the loss is a function of two decision variables. The constraint sets are not necessarily being convex. A typical application arises in a matrix decomposition problem, where one of the variables is usually enforced to be a low-rank matrix. We propose an algorithm based on alternating minimization, and the reparametrization is employed to avoid the computational difficulties of the nonconvex constraint. We briefly outline a progress in the convergence analysis.

Next, we move on to the support recovery problem in sparse linear regression. In spite of much progress in the variable selection for high-dimensional setting, the challenge still remains in the regime where p>n and non-vanishing fractions of the coefficients are nonzero. We will discuss the performance of a nonconvex penalty to recover the true support in such regime while controlling the FDR (False Discovery Rate). The open question here is how to quantify the trade-off between the amount of nonconvexity and the number of false discoveries entered in the model.

Lastly, we consider the spectrum estimation problem in X-ray imaging. We measure the distance of the spectrum curves by KL divergence, and propose a pure optimization framework to recover the spectrum curve from X-ray transmission measurements of a known phantom. One of the strength of the optimization based approach is that it can be easily generalized to include other photon counting physics of the detector for system calibration. The ultimate goal will be to incorporate our approach in a simultaneous calibration and computed tomography (CT) image reconstruction.

For information about building access for persons with disabilities, please contact Laura Rigazzi at 773.702-0541 or send an email to lrigazzi@galton.uchicago.edu. If you wish to subscribe to our email list, please visit the following web site: https://lists.uchicago.edu/web/arc/statseminars.