



復旦大學
FUDAN UNIVERSITY

Applied Math
Ph.D. Seminar

Numerical Methods for Two Kinds of Sparse Optimization Problems with Probabilistic Simplex Constraints

Speaker: Guiyun Xiao (Fudan University)

Time: 2022-10-20, 16:10 to 17:00

Location: Rm 1801, Guanghua East Tower

Mentor: Shuqin Zhang (Fudan University)

Abstract: Sparse optimization problems arise from a remarkable variety of applications including machine learning, signal and image processing, data science, medical imaging, compressed sensing, computer vision, statistical regression, computational biology, and so on. In this paper, we mainly focus on the numerical methods for solving the sparse least squares regression problem with probabilistic simplex constraint in various applications such as computational biology and hyperspectral unmixing and the sparse stochastic matrix factorization in document clustering. We reformulate the least squares regression problem as a nonconvex and nonsmooth ℓ_1 regularized minimization problem over the unit sphere and present a geometric proximal gradient method for solving the regularized problem. We provide explicit expression of the global solutions to the involved subproblems of our method and give the global convergence analysis. We also consider a special nonnegative matrix factorization, the sparse stochastic matrix factorization. We directly apply the ℓ_0 constraint to measure the sparseness in the sparse stochastic matrix factorization. Based on the given factorization rank and the prescribed sparsity level, the considered sparse stochastic matrix factorization is reformulated as an unconstrained nonconvex-nonsmooth minimization problem and a column-wise update algorithm is introduced. We combine the alternating minimization method with the proximal alternating linearized minimization method to update the factorization factors. Numerical experiments on both synthetic and real data sets are given to demonstrate the proposed algorithm is effective.