Learning Laplacian Constrained Graphical Models: Sparsity, Algorithms, and Theory

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In this talk, I will discuss the problem of learning sparse Gaussian graphical models whose precision matrices are Laplacian matrices. Like in the classical graphical lasso problem, recent works made use of the l1-norm with the goal of promoting sparsity in learning Laplacian constrained graphical models. However, through empirical evidence, we observe that the l1-norm fails to impose a sparse solution to this problem. From a theoretical perspective, we prove that a large regularization parameter will unexpectedly result in a solution that represents a complete graph, i.e., every pair of vertices is connected by an edge. To address this issue, we propose a nonconvex penalized maximum likelihood estimation method and establish model selection consistency. Numerical experiments involving synthetic and real-world data sets demonstrate the effectiveness of the proposed method.