Sparse partial correlation estimation via scaled Lasso

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Abstract:
Sparse partial correlation estimation is one of the popular topics in high-dimensional data analysis, where nonzero partial correlation represents the conditional dependency between two corresponding variables given the others. In Gaussian graphical model, many methods have been developed using the ℓ_1 regularization to achieve the sparsity on the conditional dependency. Due to the nonconvexity of the partial correlation estimation, most of the existing methods impose ℓ_1 penalty on the off-diagonal entries of the precision matrix. This approach may fail to identify the conditional dependency having moderate magnitudes of the partial correlations when the corresponding entries of the precision matrix is relatively small. In this paper, we propose the two-stage procedure to estimate the sparse partial correlations with the scaled lasso. The proposed procedure resolves the nonconvexity of the partial correlation estimation by using the consistent estimator of the diagonal entries of the precision matrix from the scaled lasso. Moreover, the sure independence screening and parallel computation using the graphics processing units are applied to reduce the computational burden of the scaled lasso. Numerical study shows that the proposed method not only performs better than the existing methods in terms of the edge recovery, but also the estimation of the partial correlations under the Frobenius norm.

Keywords:
Gaussian graphical model, precision matrix, sparse partial correlation, scaled Lasso, parallel computation