

Recent Trends in High-Dimensional Covariance Estimation: A GLM Perspective

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In the last three decades there has been a few great breakthroughs in covariance estimation from the perspectives of sparsity and parsimony. We review the progress and pool together ideas and techniques from regression and time series analysis toward the goal of extending the popular framework of generalized linear models (GLMs) to covariance matrices. Finding a link function or an unconstrained and statistically interpretable reparameterization of a general covariance matrix turns out to be challenging and remains an open problem. Its solution is crucial for parsimonious modeling and guaranteeing the positive-definiteness of an estimated covariance matrix in application areas such as business and economics, health and natural sciences where time series, longitudinal and panel data are collected. In addition to the identity and matrix-log link functions, we present a compromise involving the two components of the modified Cholesky decomposition of a covariance matrix. It reduces the difficult and unintuitive task of modeling covariance matrices to that of modeling a sequence of regressions. Therefore, the full force of the existing regression machineries such as parametric, semiparametric, nonparametric, Bayesian, shrinkage and the recent regularization methods can be brought to the service of modeling covariance matrices.