

Specification Tests for Covariance Structures in High-Dimensional Statistical Models

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Abstract: We consider testing the specifications of the covariance structures in statistical models for high-dimensional data. In particular, we are interested in developing such tests when the random vectors of interests are not directly observable, and have to be derived from some estimated models. Additionally, the covariance specifications may involve extra nuisance parameters whose estimations are required. In a generic additive model setting, we develop and investigate test statistics based on the maximum discrepancy measure calculated from the residuals. To approximate the distributions of the test statistics under the null hypothesis, new multiplier bootstrap procedures are proposed with necessary adjustments incorporating the model and nuisance parameter estimation errors. Our theoretical development elucidates the impact due to the model and parameter estimation errors in different settings, and establishes the validity of our testing procedures. Extensive simulations and real data examples confirm the results from our analysis, and demonstrate the performance of the specification tests.