

Test of the quadratic subspace under elliptically contoured distribution

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Abstract

We study tests for verifying whether a covariance matrix belongs to a quadratic subspace generated by block-repeated Kronecker products up to permutation, assuming that the observation matrix follows a matrix-variate elliptically contoured distribution. Under the null hypothesis, the covariance matrix is represented as a sum of Kronecker-structured components embedded through orthogonal projections. We derive the likelihood ratio test statistic and characterize its finite-sample null distribution through the characteristic function of $-n \log \Lambda$. In addition, we derive the modified Rao score test statistic and obtain its Wishart representation under the null hypothesis. The performance of both tests is compared by Monte Carlo simulations, including their convergence under the null hypothesis to the limiting chi-square distribution and their empirical power.

Keywords

Elliptically contoured distribution, Covariance structure, Quadratic subspace, Rao score test, Likelihood ratio test.

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