

Testing patterned covariance matrices under quadratic subspace

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Abstract

Although real-world phenomena are inherently complex, empirical data frequently exhibit structured dependence patterns arising from nested or grouped observations. This article addresses the problem of testing whether a population scale matrix belongs to a commutative quadratic subspace. Under a multivariate elliptically contoured model, we derive both the likelihood ratio test and the Rao score test statistics, and determine the exact distribution of the likelihood ratio test statistic. The performance of the proposed tests is evaluated through simulation studies, and their practical utility is illustrated with two real-data examples. In addition, we consider a high-dimensional setting in which the number of distinct eigenvalues remains fixed as the dimension grows.

Keywords

Beta random variables, Commutative quadratic subspace, Doubly multivariate model, Elliptical contoured distribution, Likelihood ratio test, Rao score test.

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