

Independence Testing Based on the Covariance Matrix

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Abstract

The problem of testing the independence between groups of variables has a long history in multivariate statistics. One of the earliest contributions was made by Wilks (1935) ([1]), who studied the problem of testing the independence of two groups of variables. Since then, the theory has been extended, particularly in the context of high-dimensional data. We consider two groups of jointly normally distributed random variables. By combining both groups into a single random vector, the corresponding covariance matrix has a block structure, where the diagonal blocks describe the covariance structure within each group and the off-diagonal blocks represent the dependence between the groups.

We formulate likelihood ratio tests for assessing the separability of one block of the covariance matrix and, subsequently, the independence between two groups of variables under the assumption of a separable covariance structure. The finite sample properties of the proposed tests are evaluated through an extensive simulation study.

Keywords

Block covariance structure, Independence testing, Separable covariance matrix, Likelihood ratio test.

References

- [1] Wilks., S.S. (1935). Test Criteria for Statistical Hypotheses Involving Several Variables. *J. Am. Stat. Assoc.* 30:191a, 549–560.