# Normal-reference test for high-dimensional covariance matrices

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**Abstract**

In the past decade, much attention has been paid for testing the equality of high-dimensional covariance matrices. Several test statistics have been proposed for this purpose. Some of them imposed strong assumptions, aiming to yield the asymptotic normality of the associated test statistics. In practice, however, these assumptions are often challenging to verify, resulting in size control issues when the required assumptions are not met. To address this challenge, in this talk, we investigate a normal-reference test which can effectively control the size. In the normal-reference test, the null distribution of a test statistic is approximated with that of a chi-square-type mixture which is obtained from the test statistic under the null hypothesis, assuming normality of the data samples. To accurately approximate the distribution of the chi-square-type mixture, we employ a three-cumulant matched $x^2$-approximation with the approximation parameters being consistently estimated from the data. Two simulation studies demonstrate that in terms of size control, the proposed normal-reference test performs well across a range of scenarios and it outperforms several existing competitors. A real data example illustrates the proposed normal-reference test.

**KEY WORDS**: $x^2$-type mixtures; high-dimensional data; three-cumulant matched $x^2$-approximation.