Two-Sample Covariance Matrix Testing And Support Recovery

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I will talk about three inter-related problems: (a) testing the equality of two covariance matrices $\boldsymbol{\Sigma}_1$ and $\boldsymbol{\Sigma}_2$; (b) recovering the support of $\boldsymbol{\Sigma}_1 - \boldsymbol{\Sigma}_2$; and (c) testing the equality of $\boldsymbol{\Sigma}_1$ and $\boldsymbol{\Sigma}_2$ row by row. A new test for testing the hypothesis H_0: $\boldsymbol{\Sigma}_1 = \boldsymbol{\Sigma}_2$ is proposed and its theoretical and numerical properties are studied. The limiting null distribution of the test statistic is derived and the power of the test is investigated. The test is shown to enjoy certain optimality and to be especially powerful against sparse alternatives. The simulation results show that the test significantly outperforms the existing methods both in terms of size and power.

When the null hypothesis of equal covariance matrices is rejected, it is often of significant interest to further investigate in which way they differ. Motivated by applications in genomics, I will also talk about recovering the support of $\boldsymbol{\Sigma}_1 - \boldsymbol{\Sigma}_2$ and testing the equality of the two covariance matrices row by row. New procedures are introduced and their properties are studied. Applications to gene selection is also discussed.

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