

Maximum Pairwise Bayes Factors for Covariance Structure Testing^a

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Summary: Hypothesis testing of structure in covariance matrices is of significant importance, but faces great challenges in high-dimensional settings. Although consistent frequentist one-sample covariance tests have been proposed, there is a lack of simple, computationally scalable, and theoretically sound Bayesian testing methods for large covariance matrices. Motivated by this gap and by the need for tests that are powerful against sparse alternatives, we propose a novel testing framework based on the maximum pairwise Bayes factor. Our initial focus is on one-sample covariance testing; the proposed test can *optimally* distinguish null and alternative hypotheses in a frequentist asymptotic sense. We then propose diagonal tests and a scalable covariance graph selection procedure that are shown to be consistent. A simulation study evaluates the proposed approach relative to competitors.

Keywords: Bayesian hypothesis test, Modularization, Covariance matrix, Graph selection, High-dimensional.

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