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BAYESIAN HYPOTHESIS TESTING OF EQUALITY OF NORMAL COVARIANCE MATRICES

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This paper discusses hypothesis testing in multivariate analysis from a Bayesian point of view using the highest posterior density (HPD) region methodology. This approach is applied to the old, but still difficult problem of testing for the equality of normal covariance matrices, and a new Bayesian criterion is developed to carry out the test. Bartlett's classical test results as an approximate special case. It is shown that under the simple case of vague prior distributions for the covariance matrices a Bartlett-like test (Bartlett (1937)) results; but the degrees of freedom are lower, so the classical test weights the evidence against the null hypothesis of equality more heavily than is warranted by the posterior probability distribution, a result analogous to that of Berger and Selke, 1987. Moreover, more general (non-vague) prior distributions will generate a richer class of tests than were previously available.

1. Introduction. This paper concerns hypothesis testing in multivariate analysis from a Bayesian point of view. Generally, estimation and prediction are of much greater interest to Bayesian statisticians than is hypothesis testing, but there are those situations in which hypothesis testing is desirable and appropriate. Those situations are the ones with which we will be concerned in this paper.

We begin in Section2 with a brief summary of the method of Box-Tiao HPD region Bayesian hypothesis testing. In Section 3 and 4 we take up the problem of Bayesian testing for the equality of normal covariance matrices. In Section 3, we develop the joint posterior density for normal precision matrices. In Section 4 we develop the joint posterior density for the "ratios" of normal precision matrices, and we apply the HPD region method of hypothesis testing to develop new Bayesian tests for the equality of normal covariance matrices. In Section 5 we derive an asymptotic distribution appropriate for the required test.

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