COMPARISONS OF SEVERAL OMNIBUS COMBINATIONS IN THE CASE OF NORMAL DISTRIBUTION

BY

KHAWLA OMAR AL-RJOUB
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Thesis Defence Committee

Dr. Hussein Al-Rawwash Chairman

Dr. Walid Abu-Dayyeh Member

Prof. Moh'd Abu-shaleh Member

Dr. Mohammad Fraiwan Member

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ABSTRACT

The LRT exists for most of statistical hypotheses, though it does not always have desired optimal properties. Therefore many authors try to find another method for constructing an optimal test. The problem of combining independent tests is one of these methods. The combination procedures studied in this thesis are Fisher, logistic, sum of the p-values, maximum of the p-values, minimum of the p-values and Inverse Normal. The purpose of this thesis is to make comparison among these procedures.

In this thesis we consider the problem of combining independent tests in the case of Bivariate Normal distribution. We derive the power functions for the six popular omnibus combination procedures mentioned above in the one-sided and two-sided alternatives.

Some numerical computations are conducted to compare the power functions of these tests. From these computations we cite some remarks and conclude some symmetry properties about the power functions of these tests.

Also we derive the power functions of some Bayes combination tests in the case of two types of prior distributions. Numerical computations of the power functions indicate that the Bayes test in the case of type I prior is better than in case of type II prior at angles \( \frac{0\pi}{12}, \frac{6\pi}{12} \) but vice versa at angles \( \frac{1\pi}{12}, \frac{2\pi}{12}, \frac{3\pi}{12}, \frac{4\pi}{12}, \frac{5\pi}{12} \), where type I prior assigns \( \alpha_1 \) to the point \((0_1, 0)\) and \( \alpha_2 \) to the point \((0, 0_2)\) where \( \alpha_1 + \alpha_2 = 1 \) and in type II prior distribution \((0_1, 0_2)\) vary independently over \( H_1 \).
Bahadur efficiency is studied in the case of combining a finite number of independent tests. We prove that the exact Bahadur slope of Fisher, the exact Bahadur slope of logistic and the exact Bahadur slope of LRT are equal but greater than exact Bahadur slope of Inverse Normal which is greater than the exact Bhadur slope of sum of the p-values. In the case of infinite number of independent tests we conclude that as \( r \to 0 \) the Inverse Normal is the best, followed by the logistic, sum of the p-values then by the Fisher test. The worst tests are the minimum of the p-values and the maximum of the p-values tests. But as \( r \to \infty \) we find that the Fisher test is the best, followed by Inverse Normal, logistic then sum of the p-values tests. The worst tests are the maximum of the p-values and minimum of the p-values tests (over the alternative \( \theta_1 = r \cos \gamma, \theta_2 = r \sin \gamma \), where \( r = \theta_1 + \theta_2 \)).