Novel Estimates of The number of True Null Hypotheses in Multiplicity Testing

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The chance of making false positive finding is known to increase as the number of statistical tests needed to be performed increases. The traditional means to control the Type I error rate is to control the familywise error rate (FWER), i.e., the probability of at least one true null hypothesis. The existing procedures for controlling the Type I error rate are usually lower than the desired level when some alternatives are true. It was shown that incorporating the estimate of the number of true null hypotheses (m_0) increases the performance of the existing procedures.
Since p-values computing from true null hypotheses are uniformly distributed on the interval $(0, 1)$, the cumulative plot should be approximately linear when all the hypotheses are true null. Based on this, Schweder and Spjøtvoll (1982) proposed using the sample sequentially to find an index where the slope changes on the plot of cumulative p-values as an estimate of m_0. Many researchers have proposed similarly estimates but slightly different constructions. However, they might overestimate or underestimate m_0 since all the procedures begin from the most or least significant p values. Based on some parametric assumption, this paper intends to find the distribution of the index where the slope changes. Based on this distribution, the mean, the medium and the mode are computed. Estimates for m_0 are derived based on the mean, medium and mode of the distribution of the index. The feasibility of estimates of m_0 is shown through the Monte Carlo simulations.

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