

Distributions for p-values and their applications

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What is the distribution of the p-value under the alternative hypothesis? We derive the distribution for some common statistical tests, such as the normal, t, and chi-squared tests. Then we present two applications to demonstrate their utility. The first is a microarray gene expression study in which we want to estimate the proportion of the p-values sampled from the null hypothesis. We propose a parametric method to estimate the proportion. The second application is to a meta-analysis with a sample of p-values. The Fisher's combination procedure provides a chi-squared test of whether the p-values were sampled from the null uniform distribution. After rejecting the null uniform hypothesis, we are faced with the problem of how to combine the assembled p-values. We present the maximum likelihood estimate of the standardized mean difference from the p-values using our derived distributions.

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