More hypotheses versus more power: Designing a Multiple Hypothesis Testing Experiment Subject to a Maximum Overall Number of Possible Observations

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Abstract

With modern complex datasets, situations involving a large number of testing problems become more and more common. In some cases, the overall number of observations m to be collected is limited, but there is some choice at the design stage concerning the allocation of the observations among the hypotheses testing problems of interest. Indeed, when m is fixed, the consideration of a large number K of hypothesis pairs implies a small average number of observations $n \approx m/K$ for the individual problems. As a consequence, one faces small power when a multiple hypothesis testing procedure is used. Thus the overall number of rejections of null hypotheses may well be increased by restricting inference to a smaller number k of hypothesis pairs for which a larger number of observations will then be available. We are interested in finding the optimum number k to pick out of the K hypotheses. We present some general observations and provide asymptotic approximations for the optimum k as m and k both tend to infinity. We also give an illustrative example. Further details can be found in Futschik and Posch (2005).

Reference:

Futschik, A. and Posch, M. (2005) On the Optimum Number of Hypotheses when the Number of Observations is Limited. Statistica Sinica 15, 841-855.