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Confidence bounds for the true discovery proportion based on the exact distribution of the number of rejections

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Abstract

In multiple hypotheses testing it has become widely popular to make inference on the true discovery proportion (TDP) of a set $\mathscr{M}$ of null hypotheses. This approach is useful for several application fields, such as neuroimaging and genomics. Several procedures to compute simultaneous lower confidence bounds for the TDP have been suggested in prior literature. Simultaneity allows for post-hoc selection of $\mathscr{M}$. If sets of interest are specified a priori, it is possible to gain power by removing the simultaneity requirement. We present an approach to compute lower confidence bounds for the TDP if the set of null hypotheses is defined a priori. The proposed method determines the bounds using the exact distribution of the number of rejections based on a step-up multiple testing procedure under independence assumptions. We assess robustness properties of our procedure and apply it to real data from the field of functional magnetic resonance imaging.

Keywords Multiple testing · Step-up test · Cluster inference · False discovery proportion · Functional magnetic resonance imaging

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