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Bayesian sample size determination for Multisite Replication Studies

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To overcome the frequently debated "reproducibility crisis"in science, replicating studies is becoming increasingly common across a variety of disciplines such as psychology, economics and medicine. Their aim is to assess whether the original study is statistically consistent with the replications, and to assess the evidence for the presence of an effect of interest. While the majority of the analyses is based on a single replication, multiple replications of the same experiment, usually conducted at different sites, are becoming more frequent. In this framework, our interest concerns the variation of results between sites and, more specifically, the issue of how to design the replication studies (i.e. how many sites and how many subjects within site) in order to yield sufficiently sensitive conclusions. For instance, if interest centers on hypothesis-testing, this means that tests should be well-powered, as described in Hedges and Schauer (2021) from a frequentist perspective. In this work, we propose a Bayesian scheme for designing multisite replication studies in view of testing heterogeneity between sites. We adopt a normal-normal hierarchical model and use the Bayes factor as a measure of evidence.

Keywords

Bayesian Design, Analysis prior, Design prior, Heterogeneity, Meta-analysis

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