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Optimal Experimental Design for Maximum Likelihood Estimation

We present a quite flexible methodology to solve a maximum likelihood estimation problem using optimal design theory and simultaneous optimization techniques. We consider a problem of determining maximum likelihood estimates under a hypothesis of marginal homogeneity for data in square contingency tables. This is an optimization problem with respect to variables that satisfy several constraints based on the marginal homogeneity conditions. We first formulate the Lagrangian function and then transform the problem to that of maximizing some functions of the cell probabilities simultaneously. We apply the methodologies in some data sets for which the hypothesis of marginal homogeneity is of interest. The methodologies could be applied to a wide class of optimization problems where constraints are imposed on the parameters.