On the choice of a prior distribution for Bayesian D-optimal designs for the logistic regression model

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Abstract

A common way to design a binary response experiment is to design the experiment to be most efficient for a best guess of the parameter values on which the optimal design depends. A design which is optimal for a best guess, however, may not be efficient for other parameter values. The Bayesian optimal design approach is a useful tool to take into account uncertainty of the parameter values. Bayesian D-optimal designs for a logistic regression model with two parameters are investigated. Such designs depend on the choice of a prior distribution. Using numerical search and sampling from normal and uniform priors we show that if we do not have much information about the value of the parameters, a prior distribution with relatively large variance will lead to a Bayesian design which remains highly efficient under other prior distributions. We also compare uniform and normal priors and find that both distributions are approximately equally efficient. Finally, we study the efficiencies of designs with equidistant equally weighted design points against the Bayesian D-optimal designs and find that 4 and 5 equidistant equally weighted design points are highly efficient.

Keywords

Bayesian D-optimal designs, Logistic regression model, Maximin Bayesian D-optimal design, Locally D-optimal designs, Relative efficiency.

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