Robust Sequential Designs for Approximate Inference in Generalized Linear Mixed Models

In this paper, we investigate the possible impact on the inference precision made when approximation appears in an assumed generalized linear mixed model (GLMM). We also discuss the relationships among various types of departures from the assumed GLMMs. The maximum likelihood estimation is adopted by fitting a given GLMM. We develop the methods of constructing the optimal robust sequential designs with protection on different types of model departures. Both I-optimality and D-optimality are employed. Although the design problems in a general setting of GLMMs are addressed, the commonly used logistic and Poisson mixed models are emphasized. A simulation study is carried and it has assessed both I- and D-optimal sequential designs in terms of integrated mean squared errors of the estimators for the parameters involved in the fixed effects in the link predictor (possibly misspecified). We conclude that the I-optimal designs outperform D-optimal designs for almost all the cases considered in the examples, and both I- and D-optimal designs developed in this paper are more efficient than the conventionally used uniform designs and the classical D-optimal designs obtained when assuming the fitted GLMMs are exactly correct.

Key Words: Model-robust designs; Regression designs; Logistic mixed model; Poisson mixed model; Linear predictor; Integrated mean squared error.