Bayesian Regression Analysis of Data with Random Effects Covariates from Nonlinear Longitudinal Measurements

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Abstract: Joint models for a wide class of response variables and longitudinal measurements consist on a mixed-effects model to fit longitudinal trajectories whose random effects enter as covariates in a generalized linear model for the primary response. They provide a useful way to asses association between these two kinds of data, which in clinical studies are often collected jointly on a series of individuals and may help understanding, for instance, the mechanisms of recovery of a certain disease or the efficacy of a given therapy. When a nonlinear mixed-effects model is used to fit the longitudinal trajectories, the existing estimation strategies based on likelihood approximations have been shown to exhibit some computational efficiency problems (De la Cruz et al., 2011). In this article we consider a Bayesian estimation procedure for the joint model with a nonlinear mixed-effects model for the longitudinal data and a generalized linear model for the primary response. The proposed prior structure allows for the implementation of an MCMC sampler. Moreover, we consider that the errors in the longitudinal model may be correlated. We apply our method to the analysis of hormone levels measured at the early stages of pregnancy that can be used to predict normal versus abnormal pregnancy outcomes. We also conduct a simulation study to asses the importance of modelling correlated errors and quantify the consequences of model misspecification.

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