Bayesian Semiparametric Modelling of Univariate and Bivariate Longitudinal Data

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Many pharmacological studies involve experiments aimed at testing for a difference between treatment groups wherein the data are longitudinal in nature, with long sequences per subject. We consider such an example coming from Cardiovascular safety experiments carried out in dogs. Particular interest, especially in cases where treatment effect is not constant over time, may lie in comparing the experimental groups at each time point. Imposing a parametric mean structure is often too restrictive. A more flexible approach is to model the mean using a semiparametric smooth function, estimated using, for example, penalized smoothing splines. Since penalized splines can be considered as BLUPS in the mixed model framework, the models can be fitted using software developed for Bayesian analysis of mixed models. The Bayesian approach becomes more attractive in this setting because one can directly monitor the difference between the groups, thereby rendering 'exact' inference. Moreover, the credible intervals derived thereof account for variability in all parameters in the model. We formulate a sequence of semiparametric mixed models depicting possible differences between the experimental groups and use the Deviance Information Criteria for model selection.
Further, in the same context of smoothing longitudinal data, we propose a joint model for two longitudinally measured outcomes. While this concept is well known in literature, the bivariate model we propose includes, among other ways of accounting for correlation, a component of correlated smoothers. If responses tend to evolve in a similar pattern, it is expected that the knot coefficients responsible for smoothing both responses will also tend be correlated.