Simultaneous fixed and random effect selection in finite mixture of linear mixed-effect models

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Abstract

Linear mixed-effects (LME) models are frequently employed for modeling longitudinal data. One complicating factor in the analysis of such data is that samples are sometimes obtained from a population with significant underlying heterogeneity, which would be hard to capture by a single LME model. Such problems may be addressed by a finite mixture of linear mixed-effects (FMLME) models, which segments the population into subpopulations and models each subpopulation by a distinct LME model. Often in the initial stage of a study, a large number of covariates are introduced. However, their associations to the response variable vary from one component to another of the FMLME model. To enhance predictability and to obtain a parsimonious model, it is of great practical interest to identify the important effects, both fixed and random, in the model. Traditional variable selection techniques such as stepwise deletion and subset selection are computationally expensive as the number of covariates and components in the mixture model increases. In this article, we introduce a new penalized likelihood approach for simultaneous selection of fixed and random effects in FMLME models. We also propose a nested EM algorithm for efficient numerical computations. The estimators are shown to possess consistency and sparsity properties and asymptotic normality. We illustrate the performance of our method through simulations and a real data example.

Keywords

Linear mixed-effect models, mixture models, Regularization methods, EM algorithm.