Selection of fixed and random effects in linear mixed-effects models

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Abstract

The linear mixed effects model (LMM) is popular in the analysis of panel data. In the practice of LMM, it is crucial to properly model the random effects component to draw valid statistical inference. With an under-specified random-effects component in the LMM, the conditional independence assumption will be violated, and an over-specified random effects-component will cause the loss of estimation efficiency. Therefore, an effective method to select random-effect component is very much desired, especially when the number of candidate random effects component is large. In many important practical problems, people also want to select important fixed effects and have a parsimonious model. We propose a data-driven method to select both of fixed effects and random effects in LMM via the penalized likelihood approach. The Cholesky decomposition is used to guarantee the positive-definiteness of the covariance matrix of random effects. We also propose an effective algorithm to solve the optimization problem, whose computational load is almost the same as the Newton-Raphson algorithm for MLE (or REML). We demonstrate our method using both simulation study and real data analysis.

This was joint work with Sijian Wang (University of Wisconsin-Madison) and Ji Zhu (University of Michigan).