Robust Bayesian Cumulative Probit Linear Mixed Models for Longitudinal Ordinal Data

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Abstract

Longitudinal studies have been conducted in various fields, including medicine, economics and the social sciences. In this study, the longitudinal ordinal data are considered. Since the longitudinal data are collected over time, repeated outcomes within each subject may be serially correlated. To account for both within-subjects serial correlation and between-subjects specific variance, we propose a Bayesian cumulative probit random effects model to analyze longitudinal ordinal data using the hypersphere decomposition approach to solve the positive definiteness constraint and high-dimensionality of the correlation matrix. Furthermore, we propose a hybrid of the Gibbs/Metropolis-Hastings algorithm to generate cutoff points from truncated normal distributions in order to speed up the convergence of the Markov chain Monte Carlo (MCMC) algorithm. The proposed method performed well when examining simulation studies with complete data, MCAR, and MAR missingness. We used the proposed approach to examine two sets of actual ordinal data: the arthritis set and the lung cancer set. To generate the results, we developed BayesRGMM, an open source R package on CRAN.