Bayesian Meta-Regression Hierarchical Models for Cholesterol Data

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Abstract: A flexible class of multivariate meta-regression models are proposed for Individual Patient Data (IPD). The methodology is well motivated from 26 pivotal Merck clinical trials that compare statins (cholesterol lowering drugs) in combination with ezetimibe and statins alone on treatment-naïve patients and those continuing on statins at baseline. The research goal is to jointly analyze the multivariate outcomes, Low Density Lipoprotein Cholesterol (LDL-C), High Density Lipoprotein Cholesterol (HDL-C), and Triglycerides (TG). These three continuous outcome measures are correlated and shed much light on a subject's lipid status. The proposed multivariate meta-regression models allow for different skewness parameters and different degrees of freedom for the multivariate outcomes from different trials under the general class of skewed t-distributions. The theoretical properties of the proposed models are examined and an efficient Markov chain Monte Carlo (MCMC) computational algorithm is developed for sampling from the posterior distribution under the proposed multivariate meta-regression model. In addition, the Conditional Predictive Ordinates (CPOs) are computed via an efficient Monte Carlo method. Consequently, the logarithm of the pseudo marginal likelihood and Bayesian residuals are obtained for model comparison and assessment, respectively. A detailed analysis of the IPD meta data from the 26 Merck clinical trials is carried out to demonstrate the usefulness of the proposed methodology. This is a joint work with Sung Duk Kim, Joseph G. Ibrahim, Arvind Shah, and Jianxin Lin.