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Bayesian Quantile Joint Modeling with an Application to Leukemia Maintenance Studies

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Abstract

Linear mixed models are traditionally used for jointly modeling longitudinal outcomes and event-time(s). However, in the presence of some time-varying covariates it might be of interest to see how the effects of different covariates vary from one quantile level (of outcomes) to the other, and consequently how the event-time changes across different quantiles. For such analyses linear quantile mixed models can be used into the joint modeling framework, and an efficient computational tool can be developed. We analyze a dataset from the Acute Lymphocytic Leukemia (ALL) maintenance study conducted by Tata Medical Center, Kolkata. In this study, the patients suffering from ALL were treated with two standard drugs (6MP and MTx) for the first two years, and three biomarkers (e.g. lymphocyte count, neutrophil count and platelet count) were longitudinally measured. After treatment, the patients were followed nearly for the next three years, and the relapse-time (if any) of each patient was recorded. We consider an Asymmetric Laplace Distribution (ALD) for each outcome, and exploit the mixture representation of the ALD for developing an efficient Gibbs sampler algorithm for the proposed linear quantile joint regression model. We infer that a higher lymphocyte count accelerates the chance of a relapse while a higher neutrophil count and a higher platelet count (jointly) reduce it. Also, we infer that across (almost) all quantiles 6MP reduces the lymphocyte count, while MTx increases the neutrophil count. Simulation studies are performed to assess the effectiveness of the proposed approach. of the BOLD Selector. Not only can it identify robust biomarkers with pathophysiological significance, thus facilitating D/D, but it can also pave the way towards identifying disease-relevant targets. It is a joint work with Damitri Kundu, ISI Kolkata.

Keywords:
Acute Lymphocytic Leukemia (ALL); Asymmetric Laplace Distribution (ALD); Joint Model; MCMC; Quantile Regression.