BAYESIAN ANALYSIS OF SPATIAL AND SURVIVAL MODELS WITH APPLICATIONS OF COMPUTATION TECHNIQUES

Yajun Liu

Dr. Dongchu Sun, Dissertation Supervisor

ABSTRACT

This dissertation discusses the methodologies of applying Bayesian hierarchical models to different data with geographical characteristics or with right-censored failure time. A conditional autoregressive (CAR) prior is used for the model to capture spatial effects. Markov chain Monte Carlo (MCMC) methods are used in the sampling. The Ancillary-Sufficient Interweaving Strategy (ASIS) is applied to improve the performance for some parameters. The convergence of some of the parameters improved greatly, but the others do not have very significant improvement. However, the overall performance has improved greatly since it needs much fewer iterations than using regular Gibbs sampling to achieve convergence. For the survival analysis, we propose a generalized linear mixed model with different effects for the hazard rates, and adopte a cure rate model in Chen et al. (1999) for the hazards. A ratio-of-uniforms method is used to get the posterior density of some parameters that can not be simply sampled by common methods. Both the Weibull model and cure rate models are compared. Moreover, for the same data set, competing risks model is considered by incorporating spatial effect to a latent competing risk model from Gelfand et al. (2000). The sampling method mentioned in Berger & Sun (1993) is adapted for efficiency. Finally, spatial confounding occurs when incorporating spatial effects in a regression model. Several estimators of the coefficients are compared for their Mean Squared Errors. The corresponding prediction errors are also discussed.