BAYESIAN SPATIAL DATA ANALYSIS WITH APPLICATION TO THE MISSOURI OZARK FOREST ECOSYSTEM PROJECT

Xiaoqian Sun

Dr. Zhuoqiong He, Dissertation Supervisor

ABSTRACT

The first part studies the problem of estimating the covariance matrix in a star-shaped model with missing data. By introducing a class of priors based on a type of Cholesky decomposition of the precision matrix, we then obtain the closed forms of Bayesian estimators under several invariant loss functions. In the second part, we first propose an efficient algorithm for Bayesian spatial analysis via the generalized Ratio-of-Uniforms method, which generates independent samples from the resulting posterior distribution. We then present a Bayesian spatial methodology for analyzing the site index data from the Missouri Ozark Forest Ecosystem Project (MOFEP). Our results show that aspect class and soil depth are both significant while land type association is less significant. In the third part, we present a new spatial model that takes into account the special data structure and treats a cluster of measurements as repeated measurements in one location. The model is applied to the analysis of the total vegetation coverage data in the MOFEP. Our results show that the soil depth is an important factor while the aspect class is less important. We also show that the strong spatial effect exists in the data discussed and the measurements in four quadrats of a subplot are not strongly correlated but are not independent.