

Bayesian Hierarchical Spatial Regression Models for Spatial Data in the Presence of Missing Covariates with Applications

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Abstract: In many applications, survey data are collected from different survey centers in different regions. It happens that in some circumstances, response variables are completely observed while the covariates have missing values. In this paper, we propose a joint spatial regression model for the response variable and missing covariates via a sequence of one-dimensional conditional spatial regression models. We further construct a joint spatial model for missing covariate data mechanisms. The properties of the proposed models are examined and a Markov chain Monte Carlo sampling algorithm is used to sample from the posterior distribution. In addition, the Bayesian model comparison criteria, the modified Deviance Information Criterion (mDIC) and the modified Logarithm of the Pseudo-Marginal Likelihood (mLPML), are developed to assess the fit of spatial regression models for spatial data. Extensive simulation studies are carried out to examine empirical performance of the proposed methods. We further apply the proposed methodology to analyze a real data set from a Chinese Health and Nutrition Survey (CHNS) conducted in 2011.