Bayesian analysis of conditional autoregressive models

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Abstract   Conditional autoregressive (CAR) models have been extensively used for the analysis of spatial data in diverse areas, such as demography, economy, epidemiology and geography, as models for both latent and observed variables. In the latter case, the most common inferential method has been maximum likelihood, and the Bayesian approach has not been used much. This work proposes default (automatic) Bayesian analyses of CAR models. Two versions of Jeffreys prior, the independence Jeffreys and Jeffreys-rule priors, are derived for the parameters of CAR models and properties of the priors and resulting posterior distributions are obtained. The two priors and their respective posteriors are compared based on simulated data. Also, frequentist properties of inferences based on maximum likelihood are compared with those based on the Jeffreys priors and the uniform prior. Finally, the proposed Bayesian analysis is illustrated by fitting a CAR model to a phosphate dataset from an archaeological region.