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Estimation and Model Selection of Higher-order Spatial Autoregressive Model: An Efficient Bayesian Approach☆

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Abstract

In this paper we consider estimation and model selection of higher-order spatial autoregressive model by an efficient Bayesian approach. Based upon the exchange algorithm, we develop an efficient MCMC sampler, which does not rely on special features of spatial weights matrices and does not require the evaluation of the Jacobian determinant in the likelihood function. We also propose a computationally simple procedure to tackle nested model selection issues of higher-order spatial autoregressive models. We find that the exchange algorithm can be utilized to simplify the computation of Bayes factor through the Savage-Dickey density ratio. We apply the efficient estimation algorithm and model selection procedure to study the "tournament competition" across Chinese cities and the spatial dependence of county-level voter participation rates in the 1980 U.S. presidential election.

Keywords: Higher-order spatial autoregressive model, Exchange algorithm, Bayesian estimation, Bayes factor, Savage-Dickey density ratio

JEL classification: C11, C21, C33

1. Introduction

Higher-order spatial autoregressive (SAR) models include more than one spatial weights matrix. While a SAR model with a single spatial weights matrix can capture one type of dependence relation, higher-order SAR models introduce different kinds of neighbors and can characterize different types of spatial dependence. For instance, in the context of strategic interaction among local governments, a government's expenditure on schooling might be affected by both of its geographically close and economically similar neighbors, (Tao, 2005). In this setting, two spatial weights matrices are needed: one is based upon geographical contiguity while the other is based upon economic similarity. Additionally, in the context of social interaction,

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