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Model selection for time series of count data

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Abstract

Selecting between competing statistical models is a challenging problem especially when the competing models are non-nested. An effective algorithm is developed in a Bayesian framework for selecting between a parameter-driven autoregressive Poisson regression model and an observation-driven integer valued autoregressive model when modeling time series count data. In order to achieve this a particle MCMC algorithm for the autoregressive Poisson regression model is introduced. The particle filter underpinning the particle MCMC algorithm plays a key role in estimating the marginal likelihood of the autoregressive Poisson regression model via importance sampling and is also utilised to estimate the DIC. The performance of the model selection algorithms are assessed via a simulation study. Two real-life data sets, monthly US polio cases (1970-1983) and monthly benefit claims from the logging industry to the British Columbia Workers Compensation Board (1985-1994) are successfully analysed.

Key words:autoregressive Poisson regression model; INAR model; INGARCH model; marginal likelihood; MCMC; particle filter.

MSC classification: 62M10; 62F15.

1 Introduction

There are a plethora of integer valued time series models for modelling low count time series data. There are two broad class of approaches for constructing integer valued time series models, observation-driven (*e.g.* McKenzie (2003); Neal and Subba Rao (2007); Enciso-Mora *et al.* (2009a)) and parameter-driven (*e.g.* Davis *et al.* (2003)) models, see Davis *et al.* (2015) for an overview. The INAR(p), the p^{th}

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