spTimer: Spatio-Temporal Bayesian Modelling using `R`

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Abstract

Hierarchical Bayesian modelling of large point referenced space-time data are increasingly becoming feasible in many environmental applications due to the recent advances in both statistical methodology and computation power. Bayesian model based analysis methods using the Markov chain Monte Carlo (MCMC) techniques are, however, a very formidable task for large data sets rich in both space and time. Most such analyses are best performed using user written computer code in a low level language that takes hours and sometimes days to run in most personal computers. Currently there does not exist an `R` package which can fit and predict space-time data effectively, although the package `spBayes` (Finley, *et al.*, 2007)can analyse some moderately sized data sets.

This paper develops the `R` package, `spTimer` specifically for modelling spatio-temporal data. This allows us to fit and forecast temporal data over large spatial domains even in mid-range personal computers available today. The package implements a recently developed Bayesian hierarchical autoregressive model (Sahu, *et al.*, 2007) suitable for moderately sized problems. For modelling even larger space-time data, a predictive process approximation method proposed by Banerjee, *et al.*, (2008) is extended, implemented and illustrated with a large data set on ozone monitoring data observed in the eastern United States. mean square error results over other competitive methods currently available in the literature.

References

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