Inference for bivariate integer-valued moving average models

Isabel Silva[1], Maria Eduarda Silva[2] and Cristina Torres[3]

[1]*Faculdade de Engenharia da Universidade do Porto, Portugal*
[2]*Faculdade de Economia da Universidade do Porto and CIDMA, Portugal*
[3]*ISCAP-IPP and Universidade do Porto, Portugal*

Abstract

Time series of (small) counts are common in practice and appear in a wide variety of fields. In the last three decades, their statistical analysis has emerged as an important area of research by exploring models that explicitly account for the discreteness of the data. Among the proposed models are the INARMA (INteger-valued AutoRegressive Moving Average) models, which are constructed by replacing the multiplication in the conventional ARMA models by an appropriate random operator. The most popular of such operator is the binomial thinning operator (Steutal and Van Harn, 1979). Scotto *et al* (2015) present an overview about univariate time series of counts. However, for multivariate time series of counts several difficulties arise and the literature is not so detailed.

This work presents the so called Bivariate INteger-valued Moving Average model of first order, BINMA(1, 1), proposed by Torres *et al.* (2012). The main probabilistic and statistical properties of BINMA models are exhibited. Emphasis is placed on models with Bivariate Poisson and Bivariate Negative Binomial distributions for the innovation process (Kocherlakota and Kocherlakota, 1992).

The generalized method of moments is used to estimate the parameters (Silva *et al.*, 2014). Finally, methods for model diagnostic and validation based on residual analysis, predictive distributions and parametric resampling methods are presented (Silva *et al.*, 2015). These methods will be illustrated by simulation and by using a real dataset.

Keywords

Count time series, BINMA model, Parameter estimation, Model diagnostic.

1

References:

Kocherlakota, S. and Kocherlakota, K. (1992). *Bivariate discrete distributions.* Markel Dekker, New York.

Scotto, M. G., Weiß, C. H. and Gouveia, S. (2015) Thinning-based models in the analysis of integer-valued time series: a review. *Stat. Modelling* (to appear).

Silva, I., Torres, C. and Silva, M. E. (2014). Estimating bivariate integer-valued moving average models with the generalized method of moments. *Livro de resumos das XXI Jornadas de Classificação e Análise de Dados* (*JOCLAD 2014*), 111–114.

Silva, I., Silva, M. E. and Torres, C. (2015). Diagnostic tools for bivariate time series of counts. *XXII Jornadas de Classificação e Análise de Dados* (*JOCLAD 2015*) *- Livro de programa e resumos*, 85–86.

Steutel, F. W. and Van Harn, K. (1979). Discrete analogues of self-decomposability and stability. *Ann. Probab. 7*, 893–899.

Torres, C., Silva, I. and Silva, M. E. (2012). Modelos bivariados de médias móveis de valor inteiro. *XX Congresso Anual da Sociedade Portuguesa de Estatística - Programa e Livro de Resumos*, 25–27.