



C R RAO ADVANCED INSTITUTE OF MATHEMATICS, STATISTICS AND COMPUTER SCIENCE

Prof. C R Rao Road, University of Hyderabad Campus, Gachibowli, Hyderabad

Seminar
on

Discrete-valued time series using categorical ARMA models

by

Atanu Biswas

Indian Statistical Institute, Kolkata

Abstract

A discrete-valued time series using a class of categorical ARMA models was proposed by Biswas and Song (2009). Such ARMA processes are flexible to model discrete-valued time series, allowing a wide range of marginal distributions such as binomial, multinomial, Poisson and nominal/ordinal categorical probability mass functions. To apply these models in the data analysis this paper focuses on the development of a needed statistical toolbox, which includes maximum likelihood estimation and inference, model selection, and goodness-of-fit test. Particularly in AR models a bias-corrected AIC statistic is derived for the order selection, while a randomized conditional moment (RCM) test is furnished to examine the goodness-of-fit. Finite-sample performances of the proposed methods are examined through simulation studies, in which the bias-corrected AIC is shown to outperform the traditional AIC and BIC statistics and the RCM test achieves desirable power. As part of the numeric illustration, a data analysis of categorical time series on infant sleep quality is provided by the application of this new toolbox.

In this connection we also observe that the concept of correlation is not always suitable for categorical data. As a sensible alternative, we discuss use the concept of mutual information, and introduce auto-mutual information to define the time series process of categorical data.

Keywords: AIC, BIC, Corrected AIC, Maximum likelihood estimation, Mixture distribution, Mutual information, Pegram's mixing operator, Order selection, Randomized conditional moment test.

Dates: 24 February 2014, 12:00 noon – 01:00 PM

**Venue: Classroom-1, First Floor, Ramanujan Building,
C R Rao AIMSCS**

Brief Bio-Sketch



Atanu Biswas

Professor,
Applied Statistics Unit,
Indian Statistical Institute,
Kolkata

URL: www.isical.ac.in/~atanu/

Email: atanu@isical.ac.in

Education:

Ph.D. in Statistics from the Calcutta University in January 1998.
Master of Science in Statistics from Calcutta University in 1993.
Bachelor of Science (Honours in Statistics) from Calcutta University in 1991.

Research Interest:

Statistics, theoretical and applied, covering the following areas in particular:
Adaptive designs and group sequential designs in clinical trials, urn models, delayed response.
Categorical data, multivariate categorical and longitudinal regression.
Time series of discrete data.
Model selection, problems on selection and ranking.
Nonparametric inference, sequential analysis.
Survival analysis, illness-death model.
Distribution theory.

Awards:

- **National Award in Statistics (Professor C.R. Rao Award)** for 2008-09 given by the **Ministry of Statistics and Programme Implementation, Govt. of India.**
- **M. N. Murthy Award** for 2000-01 given by the **Indian Statistical Institute** for research in **Applied Statistics.**

Editorial Service:

- **Editor**, *Sankhya Series B* since the year 2012
- **Associate Editor**, *Sequential Analysis* (from June 2003 till date). [Publisher of *Sequential Analysis*: **Marcel Dekker, New York** (up to 2004), **Taylor and Francis** (from 2005 till date).]
- **Associate Editor**, *Communications in Statistics* (from January 2007 till date). Publisher of *Communications in Statistics*: **Taylor and Francis.**
- **Editorial Board member**: *Calcutta Statistical Association Bulletin* (from January 2006 till date).

Recent book:

Atkinson, A.C. and Biswas, A. (2013). Randomised response-adaptive designs in clinical trials. Chapman & Hall/CRC Press. [In Monographs on Statistics and Applied Probability Series.]