On Some Multivariate Time Series Models for Count Data

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Non–negative integer–valued time series are often encountered in many different scientific fields, usually in the form of counts of events at consecutive time points. Representative examples can be found in epidemiology, ecology, finance and elsewhere. Due to their frequent occurrence, a wide variety of models appropriate for treating count time series data have been proposed in the literature [3, 2]. The vast majority of such models consider the univariate case since the analysis of multivariate counting processes presents much more difficulties. In specific, the need to account for both serial and cross–correlation complicates model specification, estimation and inference. Many of the models that have been built for count time series data are based on the notion of binomial thinning [5]. The model in its simplest form. i.e. the first–order integer–valued autoregressive model (INAR(1)), was introduced by [4] and [1] as a convenient way to transfer the usual autoregressive structure to discrete valued time series. We discuss extensions of the simple INAR(1) model to the multi–dimensional space and examine properties of the generated processes. Emphasis is placed on models with multivariate Poisson and multivariate negative binomial innovations. Several real data examples illustrate the models.

References

[1] Al–Osh M.A. and Alzaid A.A. First–Order Integer–Valued Autoregressive Process. *Journal of Time Series Analysis*, 8:261–275, 1987.

[2] *Handbook of Discrete–Valued Time Series*. Edited by R.A. Davis, S.H. Holan, R.B. Lund, N. Ravishanker. Chapman and Hall/ CRC, 2015.

[3] Fokianos K. Count Time Series Models. *In Handbook of Statistics Vol 30: Time Series Methods and Applications, eds. T. Subba Rao, S. Subba Rao and C.R. Rao, Elsevier B.V., Amsterdam*, 315–347, 2012.

[4] McKenzie E. Some Simple Models for Discrete Variate Time Series. *Water Resources Bulletin*, 21:645–650, 1985.

[5] Steutel F.W. and van Harn K. Discrete Analogues of Self–Decomposability and Stability. *The Annals of Probability*, 7:893-899, 1979.