

Zero Inflated Poisson Xgamma INAR(1) Model and Its Applications

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ABSTRACT. The first order non-negative integer valued autoregressive process is widely used for counts of events over time. It is obvious that if the innovations are Poisson distributed, then the marginal model is Poisson. However, this marginal process may not hold for the overdispersed count data. An example of one common type of overdispersion is when zero counts are more likely than claimed by the Poisson marginal model. In this regard, we introduce a zero inflated version of a discrete compound model and developed its first integer autoregressive process using zero inflated Poisson Xgamma (ZIPXG) innovations. We derive different structural properties of the INAR(1) model and estimated the parameters by conditional maximum likelihood, Yule-Walker and Bayesian methods. Further a simulation study has been performed to investigate the behavior of these estimated parameters. To illustrate the utility of the newly proposed INAR(1) model, a time series data on submissions to animal health laboratories has been analyzed.

1. INTRODUCTION

Time series models hold a prominent place for analyzing time dependent data. In particular, when the data are from a random count process, we are in the context of integer valued time series which preserves the discrete nature of the related data. Such a time series model can be motivated in many contexts of research, including epidemiology, economics, social sciences, insurance, and environmental studies. Traditional Gaussian autoregressive moving average (GARMA) models have limitations when modeling integer valued time series, especially if we deal with overdispersion. Integer valued autoregressive (INAR) have been put forward as a possible direction. INAR models preserve the non-negative and discrete nature of the count variable but can imply temporal dependence. The integer valued autoregressive INAR process based on the binomial thinning operator of [20] which was presented first as an innovative process by [14] & [2] has emerged as a topic of interest in the literature over the last decade. Innovations are considered to follow a Poisson because the Poisson is the classical and natural distribution

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