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Inference for nonstationary time series of counts with application to change-point problems

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Abstract

We consider an integer-valued time series $(Y_t)_{t\in\mathbb{Z}}$ where the model after a time k^* is Poisson autoregressive with the conditional mean that depends on a parameter $\theta^* \in \Theta \subset \mathbb{R}^d$. The structure of the process before k^* is unknown; it could be any other integer-valued process, that is, $(Y_t)_{t\in\mathbb{Z}}$ could be nonstationary. It is established that the maximum likelihood estimator of θ^* computed on the nonstationary observations is consistent and asymptotically normal. Subsequently, we carry out the sequential change-point detection in a large class of Poisson autoregressive models, and propose a monitoring scheme for detecting change. The procedure is based on an updated estimator, which is computed without the historical observations. The above results of inference in a nonstationary setting are applied to prove the consistency of the proposed procedure. A simulation study as well as a real data application are provided.

Keywords Time series of counts · Poisson autoregression · likelihood estimation · Change-point · Sequential detection · Weak convergence

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