



# A blockwise network autoregressive model with application for fraud detection

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## Abstract

This paper proposes a blockwise network autoregressive (BWNAR) model by grouping nodes in the network into nonoverlapping blocks to adapt networks with blockwise structures. Before modeling, we employ the pseudo likelihood ratio criterion (pseudo-LR) together with the standard spectral clustering approach and a binary segmentation method developed by Ma et al. (*Journal of Machine Learning Research*, **22**, 1–63, 2021) to estimate the number of blocks and their memberships, respectively. Then, we acquire the consistency and asymptotic normality of the estimator of influence parameters by the quasi-maximum likelihood estimation method without imposing any distribution assumptions. In addition, a novel likelihood ratio test statistic is proposed to verify the heterogeneity of the influencing parameters. The performance and usefulness of the model are assessed through simulations and an empirical example of the detection of fraud in financial transactions, respectively.

**Keywords** Blockwise network autoregressive model · Blockwise structure · Community detection · Likelihood ratio test · Quasi-maximum likelihood estimation

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