

改進時間空間跨欄模式及其應用

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摘要

This study introduces a modified spatial hurdle integer-valued generalized autoregressive conditional heteroscedasticity (INGARCH) model that enhances prediction for spatiotemporal count data, particularly under over-dispersion and zero inflation. To ensure parsimony, the model builds on existing spatial hurdle INGARCH frameworks and incorporates an empirical Bayes approach to estimate the probability of positive counts, offering greater flexibility in modeling zero values. We apply Bayesian inference with an adaptive Markov Chain Monte Carlo (MCMC) algorithm to efficiently estimate the model parameters. We assess model performance using the Deviance Information Criterion (DIC) and predictive accuracy metrics, including mean squared error (MSE), mean absolute error (MAE), and mean absolute scaled error (MASE). Simulation studies and real applications to weekly dengue fever case data from four provinces in Thailand and four cantons in Costa Rica demonstrate the model's effectiveness. Seasonal patterns are incorporated using either climate covariates or Fourier terms to better capture in-sample dynamics. The improved model captures spatiotemporal dependencies more accurately and handles excess zeros more robustly than traditional spatial hurdle and zero-inflated INGARCH models. These results underscore the model's utility in advancing the analysis of spatiotemporal disease patterns.

關鍵字：Spatial INGARCH model, Hurdle model, Markov chain Monte Carlo method, Count time series, Generalized Poisson distribution, Dengue fever