

A General Method of Computing Mixed Poisson Probabilities by Monte Carlo Sampling

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Abstract

Mixed Poisson distributions form an important class of distributions in applications. However, the application of many of these mixed Poisson distributions are hampered by the complicated probability distributions. The paper examines Monte Carlo sampling as a general technique for computation of mixed Poisson probabilities which is applicable to any mixed Poisson distribution with arbitrary mixing distribution. The accuracy and computational speed of this method is illustrated with the Poisson-inverse Gaussian distribution. The proposed method is then applied to compute probabilities of the Poisson-lognormal distribution, a popular species abundance model, It is also shown that in the maximum likelihood estimation of Poisson-lognormal parameters by E-M algorithm, the application of the proposed Monte Carlo computation in the algorithm avoids numerical problems.

Keywords

Gamma distribution, Poisson-lognormal, species abundance, multivariate mixed Poisson, variance reduction, quasi-Monte Carlo, antithetic variate, maximum likelihood; EM algorithm