Modelling of nonlinear filtering Poisson time series

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Abstract

© Published under licence by IOP Publishing Ltd.In this article, algorithms of non-linear filtering of Poisson time series are tested using statistical modelling. The objective is to find a representation of a time series as a wavelet series with a small number of non-linear coefficients, which allows distinguishing statistically significant details. There are well-known efficient algorithms of non-linear wavelet filtering for the case when the values of a time series have a normal distribution. However, if the distribution is not normal, good results can be expected using the maximum likelihood estimations. The filtration is studied according to the criterion of maximum likelihood by the example of Poisson time series. For direct optimisation of the likelihood function, different stochastic (genetic algorithms, annealing method) and deterministic optimization algorithms are used. Testing of the algorithm using both simulated series and empirical data (series of rare words frequencies according to the Google Books Ngram data were used) showed that filtering based on the criterion of maximum likelihood has a great advantage over well-known algorithms for the case of Poisson series. Also, the most perspective methods of optimisation were selected for this problem.