

**Poisson Autoregressive Hidden Markov Process with  
Poisson Regression Type Measurements**

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## ABSTRACT

Count time series data is usually represented by Integer-valued autoregressive (INAR), Poisson exponentially weighted moving average (PEWMA), or Poisson autoregressive (PAR) models. However, these models assume that the data are correctly measured. We propose to estimate a PAR model assuming that the observed data is contaminated by Poisson noise in a Hidden Markov modeling paradigm. The uncontaminated model parameters were estimated using the Maximum Likelihood Estimator (MLE) computed using data cloning. After the parameter estimation, the hidden process was then estimated using particle filter. Simulation studies indicate asymptotic unbiasedness and efficiency of the estimator of the autoregressive parameter. Misspecification of the covariate parameter leads to poor predictive ability of the model, while in general, predictive ability is not affected by the length of the time series.

*Keywords:* Count Time Series, Hidden Markov Model, Poisson Autoregressive, Poisson Regression, Data Cloning, Particle Filter