ARIMA Models for Forecasting Poisson Process Observations: Reliability and Quality Control

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A nonhomogeneous Poisson process (NHPP) is often appropriate for the modeling of a series of events that occur over time in a nonstationary fashion. A major difficulty with the NHPP is that it has infinitely many forms for the intensity function. In this talk, we propose a linking bridge between a point process and the classical time series via a sequence of the empirical recurrence rates (ERR), calculated sequentially at equidistant time intervals. The distinctive technique is demonstrated with an ERR-plot, designed to fingerprint the temporal pattern of a point process. Moreover, Autoregressive Integrated Moving Average (ARIMA) models are presented to find the best fitting model to forecast the mean function associated with the underlying NHPP. Valuable modeling and computing techniques are demonstrated using real data. Specifically, we split each time series data set into two groups. The first set, called the training sample, is used to develop the candidate models. The remaining data, called prediction set, is used to further evaluate the reasonableness and predictive ability of the candidate models. The information of how the candidate models considered in the model selection phase fare with the new data (prediction set), will be evaluated to conclude the "best" model for system reliability assessment and process quality control.

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