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Title: Point processes and integer valued time series.

Abstract: In some context such as modelling the credit contagion, the clustering of defaults is consistent with the Hawkes process, but the default intensity could be impacted exogenously by other factors, which means the distribution of cluster centres may not act as a homogeneous Poisson process in real financial data. In order to address this, Dassios and Zhao and introduced the dynamic contagion process by generalizing the Hawkes process (with exponential decay kernel) and the Cox process with shot noise intensity (exponential decay kernel..

Integer-valued autoregressive (INAR) time series were defined and examined by McKenzie and Al-Osh and Alzaid . The idea here is to manipulate the operation between coefficients and variables as well as the innovation terms in a way that the values are always integer. They apply the similar idea of the INAR model to a standard MA model.

it seems that no one had studied the connection between point processes and integer-valued time series until Kirchner , who showed that Hawkes point processes are continuous-time versions of Poisson thinning INAR time series with infinite order and vice versa. We formally define the INMA model in a similar way to Kirchner and prove that the INMA model with infinite order is actually a discrete version of a Cox point process. We then define the INARMA and prove that it is also a discrete version of the dynamic contagion process, as Kirchner expected.

The main advantage of this work is that using our results we can conclude that statistical methods used in integer valued time series can be used for point processes and vice versa.

Time permitting we will also look at advanced approximations involving point processes and more advanced integer autoregressive models that go beyond binomial or Poisson thinning and allow for “fattening” .