Lin_Masters

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I. Abstract

II. Introduction

Motivation

Applications

Applications of Hawkes Processes can be found in a wide variety of fields such as seismology, ecology, criminology, insurance, finance, social media, and neuroscience.

In seismology, an event can be an earthquake occurance that causes aftershocks. In ecology, an event can be a set of locations where a species can be observed. In criminology, an event can be a gang rivalry that triggers retaliations following the gang crime. In insurance, an event can be a standard claim that triggers claims. In finance, an event can be a transcation that influences future prices or volumes of transcations or a news that triggers movements in stock prices or trading behaviors. In social media, an event can be a tweet about an event on Twitter that follows a cascade of retweets from other users on the same social networking platform. In neuroscience, an event can be firing of a neuron that excites spikes (or action potentials) of other neurons.

Objectives

III. Definitions and Graphs

Counting Process

(**Point Process**) Let $\{T_i, i \in N\}$ be a sequence of non-negative random variables such that $T_i < T_{i+1}$ $\forall i \in N$, a point process on R^+ is defined as

$$\{T_i, i \in N\}$$

(**Stochastic Process**) A stochastic process is a family of random variables and is defined as

$$\{X(t), t \in T\}$$

(**Counting Process**) Let $N(t)$ be the total number of events up to some time t, a stocastic process is said to be a counting process and is defined as

$$\{N(t), t \geq 0\}$$

(**Counting Process**) Let $\{T_i, i \in N\}$ be a point process, a counting process associated with $\{T_i, i \in N\}$ is defined as

$$N(t) = \sum_{i \in N} I_{\{T_i \leq t\}}$$

A counting process has to satisfy

1. $N(t) \geq 0$

2. $N(t)$ is an integer

3. If $s \leq t$, then $N(s) \leq N(t)$

4. If $s < t$, then $N(t) - N(s)$ is the number of events occur in the interval (s, t]

Poisson Process

Nonhomogeneous Poisson Process

Hawkes Process

1. Intensity-based Hawkes Process

2. Cluster-based Hawkes Process

IV. Algorithms

V. Conclusions and Discussion

Acknowledgments

Reference