Lin_Masters_Written

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2.1 Counting Process

Counting processes count the occurrences (or numbers) of events over time. For example, if we were to count the numbers of events $N(t)$ such as the numbers of customers arriving at a supermarket or the numbers of phone calls receiving at the help line up to some time t, we can use counting processes.

Counting processes is independent, stationary, and homogeneous. In addition,

2.2 Poisson Process

Homogeneous Poisson process (HPP) is one of the simplest and most-widely used point processes. For example, if we were to model the numbers of events such as the numbers of bus arrivals at a bus stop, the numbers of car accidents at a site or the requests for documents on a web server, we can use Poisson processes.

HPP is independent, stationary, and homogeneous. In addition, we assume that the numbers of events $N(t)$ follows a Poisson distribution with a constant rate λ and the interarrival times between events W are exponentially distributed.

2.3 Nonhomogeneous Poisson Process

Nonhomogeneous Poisson processes (NPP) is a generalization of homogeneous Poisson processes that allow the rate (or intensity) λ to vary with function of time t.

Previously, we assume that the intensity λ is constant. If we have reasons to believe that the intensity is not constant, we should model using nonhomogeneous Poisson processes. For example, if we were to model the number of customers arriving at a supermarket and we have reasons to believe that the arrivial rate of customers is higher during lunch time as compared to say, 2pm, we should model using nonhomogeneous Poisson processes.

In contrast to HPP, NPP is independent but not stationary nor homogeneous. In addition, for NPP, we assume that $N(t)$ follows a Poisson distribution with an intensity function $\lambda(t)$.

2.4 Cox and Cluster Process

2.5 Hawkes Process

Hawkes process is also known as a self-exciting point process. (?) Hawkes processes can be temporal or spatio-temporal. When we retain the spatial components of Hawkes's, it becomes closely related to Cox processes.

In Hawkes processes, the events also do not occur independently. The occurrence rate of the events depends not only on time t but also past events $\mathcal{H}_t^N$ up to some time t.

Examples that can be modelled using Hawkes processes include locations of earthquake epicenters, locations of crimes, and locations of patients with a disease. In these examples, the occurrence of an event increases the occurrence of subsequent events.