CE956: Statistical Learning
Department of Computer Engineering
Sharif University of Technology
Spring 2019: Room CE204, Sat. & Mon.: 13:30-15:00

Quiz 04 (20 Points) – (April-20-2019)

Solution

Point Processes: (each question 5 points)

1. Briefly, but concisely define a temporal point process? What is a Mark in a temporal point process? In general, is the assumption of mark being independent of the dynamic of the system, valid?
   - In statistics and probability theory, a point process or point field is a collection of mathematical points randomly located on some underlying mathematical space such as the real line. A temporal point process is a random process whose realizations consist of the times of isolated events. Marks are simply the features that are associated with the events. In general, the assumption of mark being independent of the dynamic of system it is not a valid assumption.

2. In general, the intensity functions are related to density/distribution functions:
   a. Then, why do we use intensity functions as building blocks of a Temporal Point Process?
   b. Name 4 popular intensity functions and by example, discuss which ones are suitable for modeling events in a social network.
   - (a) The densities need to integrate to 1 and it is difficult to combine timelines with density function. On the other hand, intensities only need to be nonnegative and it is easy to combine timeline with them. Therefore, they are more suitable to model and interpret the real system. (b) Homogeneous Poisson process, inhomogeneous Poisson process, terminating processes, and self-exciting processes. The self-exciting processes (such as Hawkes processes) are more suitable to model the history dependent events in social networks.

3. Briefly explain, how do you use Temporal Point Processes along with non-parametric Bayesian models for modeling content diffusion over social media?
   - Since temporal point processes are suitable for predicting the time of the next events and their marks, non-parametric Bayesian models can be utilized to solve them as a regression problem with proper priors.

4. Briefly explain how NetCode detect communities by using individual activities?
   - Since individual activities within a community has more effect on others in the same community we may use the effect of individuals on other community members in the same community to detect communities. In NetCode, the inter-community effect and structure are being considered, simultaneously (please refer to the reference paper and class notes/discussions)