Abstracts of lectures

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On convergence of point processes

In a series of three lectures, we discuss some classical and new results concerning the convergence of point processes. In lecture 1 we recall the notion of a point process and discuss several notions of vague topology on a general metric space. We introduce Laplace functionals and general distributional properties of some standard point process models with special attention dedicated to Poisson point processes. In lecture 2 we present several key results of the limiting theory for point processes, starting with the i.i.d. observations and then extending that theory to cover some standard time series models. In lecture 3 we show how this theory leads to a series of interesting results concerning the limiting behaviour of partial sums and partial maxima for dependent regularly varying observations.

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Anomalous diffusions and fractional order differential equations

Anomalous diffusion phenomenon has been observed in many natural systems, from the signaling of biological cells, to the foraging behavior of animals, to the travel times of contaminants in groundwater. In this series of three lectures, I will discuss the interplay between anomalous sub-diffusions and time-fractional differential equations, including how they arise naturally from limit theorems for random walks. I will then present some recent results in this area, in particular on the existence, uniqueness and probabilistic representation to the solutions of time fractional equations with source terms.

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Renming Song, University of Illinois
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Limit theorems for branching Markov processes

In this series of lectures, we will talk about limit theorems for supercritical branching Markov processes.

In the first talk, we will talk about strong law of large numbers and central limit theorems (CLT) for supercritical Galton-Watson processes. We will give a probabilistic proof of the classical Kesten-Stigum Theorem, given by Lyons, Pemantle and Peres (Ann. Probab. 1995), and present a proof of the CLT given by Heyde (J. Appl. Prob. 1970).

In the second talk, we will first introduce the model of branching Markov processes, and then a strong law of large numbers for branching Markov processes. We give a proof of the $L \log L$ criterion for the basic martingale to have a non-degenerate limit, using a martingale change of measure and a spine decomposition method.

In the third and forth talk, we focus on spatial central limit theorems for branching Markov processes under a second moment condition. It turns out that CLT type results have different forms for differential test functions. We will state the CLT results for different types of test functions and give an outline of the proof of the CLT for one kind of test functions.

Schedule

	Monday	**Tuesday**	**Wednesday**
09:15-09:30	Opening	-	-
09:30-11:00	Chen	Basrak	Ren
11:00-11:30	Coffee break	Coffee break	Coffee break
11:30-13:00	Song	Chen	Basrak