Joint Seminar

Joint Statistics Seminar
co-organized with
Center for Statistical Science

The Hong Kong University of Science and Technology

Models and Inference for Sparse Graphs using Exchangeable Random Measures

by

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Date: February 19, 2016 (Friday)
Time: 11:00 a.m. – 12:00 noon
Venue: Room 4047 (LSK Business Building)

Abstract

We introduce a class of random graphs that we argue meets many of the desiderata one would demand of a model to serve as the foundation for a statistical analysis of real-world networks. The class of random graphs is defined by a probabilistic symmetry: invariance of the distribution of each graph to an arbitrary relabelings of its vertices. In particular, following Caron and Fox, we interpret a symmetric simple point process on $\mathbb{R}_+^2$ as the edge set of a random graph, and formalize the probabilistic symmetry as joint exchangeability of the point process. We give a representation theorem for the class of random graphs satisfying this symmetry via a straightforward specialization of Kallenberg's representation theorem for jointly exchangeable random measures on $\mathbb{R}_+^2$. The distribution of every such random graph is characterized by three (potentially random) components: a nonnegative real $I \in \mathbb{R}_+$, an integrable function $S : \mathbb{R}_+ \to \mathbb{R}_+$, and a symmetric measurable function $W : \mathbb{R}_+^2 \to [0,1]$ that satisfies several weak integrability conditions. We call the triple (I, S, W) a graphex, in analogy to graphons, which characterize the (dense) exchangeable graphs on $\mathbb{N}$. Indeed, the model we introduce here contains the exchangeable graphs as a special case, as well as the "sparse exchangeable" model of Caron and Fox. We study the structure of these random graphs, and show that they can give rise to interesting structure, including sparse graph sequences. We give explicit equations for expectations of certain graph statistics, as well as the limiting degree distribution. We also show that certain families of graphexes give rise to random graphs that, asymptotically, contain an arbitrarily large fraction of the vertices in a single connected component. I will also discuss recent work on consistent estimation.

Joint work with Victor Veitch.

All interested are welcome!

For details, please contact ISOM Department.