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Combinatorial Probability
Virtual Opening Workshop
January 14-15 and 19, 2021

SPEAKER TITLES/ABSTRACTS

Louigi Addario-Berry
McGill University

"Extremes in Random Trees"

I will discuss a variety of recent work on extreme displacements in various models of random rooted trees (time permitting: random trees with a given degree sequence; Mallows trees; continuous random energy models). In trees with edge weights, the displacement of a node is the some of the edge weights along the path to the node. In unweighted trees, simply view all edges as having weight 1; then the displacement of a node is its distance to the root, and the largest displacement is the height of the tree.

Based on joint works with Celine Kerriou, Benoit Corsini, and Pascal Maillard

Persi Diaconis
Stanford University

"A Course in Probabilistic Combinatorics"

This is an unusual talk. Six months ago, I gave a 10 week graduate course on Probabilistic Combinatorics at Stanford. My plan is to discuss the topics I choose, and give examples which I hope will be fresh to this audience (From algorithm to theorem). I will also discuss the structure of the course as it played out. All of you will have your own ideas of what should go into such a course. I hope that you are not too annoyed at my choices.

Christopher Hoffman
University of Washington

"Random Stable Matchings"

Since the pioneering work of Gale and Shapley the study of stable matchings has been popular in mathematics computer, science and economics. In addition to their theoretical interest, stable matchings are also used in a wide variety of real-world situations. When probabilistic questions related to stable matchings have been studied the preferences of different users are typically presumed to be uniform over all possible rankings. However in most real world situations the preferences of different users are far from uniform. In this talk we will consider a family of preferences that are all a perturbation of some "true" ranking. In we analyze the structure of the set

of stable matchings with these correlated preferences. This talk is based on joint work with Elchanan Mossel and Avi Levy.

Matthew Kahle
Ohio State University

"Random Simplicial Complexes"

We will survey the rapidly developing field of stochastic topology, especially from a combinatorial point of view. In particular, we will discuss a number of results for the 2-dimensional random simplicial complex introduced by Linial and Meshulam. We will pay particularly attention to thresholds for various topological properties.

Oanh Nguyen
University of Illinois

"Epidemics on Random Networks"

In this talk, we discuss the contact process, a model for the spread of epidemics on networks. We focus on the phase transitions of the contact process: when the infection rate is small, the epidemics dies out quickly (extinction phase); on the other hand, when the infection rate is large, the epidemics survives for a long time (survival phase). We propose new methods to study the survival time of the process and establish the necessary and sufficient criteria for the existence of the extinction phase. Moreover, we derive the asymptotics for the value of the infection rate at the threshold. The underlying networks are the Galton-Watson trees and random graphs with general degree distributions.

This talk is based on joint works with Shankar Bhamidi, Danny Nam and Allan Sly.

Gabriele Sicuro and **Lenka Zdeborova**
EPFL

"The Planted K-factor Problem"

I will discuss the problem of recovering an unknown k-factor hidden in a weighted random graph. The inference problem is solved by exploiting the information arising from the use of two different distributions for the weights on the edges inside and outside the planted sub-graph. In the large size limit, a phase transition can appear between a full and a partial recovery phase as a function of the signal-to-noise ratio. I will present a conjecture for the location of the transition. The problem has the so-called planted matching problem as a particular case (k=1), while the k=2 case is closely related to the planted traveling salesman problem.

Allan Sly
Princeton University

"Local Functions for the Ising Model on the Tree"

This talk will look at the question of what processes can or cannot be constructed using local randomness. Work of Gamarnik and Sudan and later Rahman and Virag showed that local algorithms on random d-regular graphs can only construct independent sets of size approximately

half the maximal size when d is large. Like the optimization problem, a closely related question arising in ergodic theory asks can a particular distribution such as a uniformly random colouring on the tree be constructed as a factor of IID, a type of local functions. I'll survey results in this area and describe new work constructing a factor of IID for the Ising model on the tree in its intermediate regime.

Joint work with Danny Nam and Lingfu Zhang

Prasad Tetali
Georgia Tech

"Catalan Shuffles, Concentration and Related Problems"

The lecture will primarily be an update on various outstanding open problems in Markov chain mixing times, Cheeger-type inequalities, and concentration inequalities concerning censored random walks on combinatorial structures.

Yun Wei
SAMSI

"A Unified Framework for Correlation Mining in Ultra-high Dimension"

An important problem in large scale inference is the identification of variables that have large correlations or partial correlations. Recent work has yielded breakthroughs in the ultra-high dimensional setting when the sample size n is fixed and the dimension $p \rightarrow \infty$ (Hero, Rajaratnam 2011, 2012). Despite these advances, the correlation screening framework suffers from some serious practical, methodological and theoretical deficiencies. For instance, theoretical safeguards for partial correlation screening requires that the population covariance matrix be block diagonal. This block sparsity assumption is however highly restrictive in numerous practical applications. As a second example, results for correlation and partial correlation screening framework requires the estimation of dependence measures or functionals, which can be highly prohibitive computationally. In this paper, we propose a unifying approach to correlation and partial correlation mining which specifically goes beyond the block diagonal correlation structure, thus yielding a methodology that is suitable for modern applications. By making connections to random geometric graphs, the number of highly correlated or partially correlated variables are shown to have novel compound Poisson finite-sample characterizations, which hold for both the finite p case and when $p \rightarrow \infty$. The unifying framework also demonstrates an important duality between correlation and partial correlation screening with important theoretical and practical consequences.

This is joint work with Alfred Hero and Bala Rajaratnam.

Peter Winkler
Dartmouth

"Large Permutations"

What do large permutations look like? We can in some cases answer this question with the help of limit structures called "permutons," and a variational principle. Examples show nice apparent behavior and a contrast to the case of graphs and graphons.

Work with Rick Kenyon, Dan Kral' and Charles Radin; later, with Chris Coscia, Sayan Das, Sumit Mukherjee and Martin Tassy.