KDD 2016 Speakers

Graphons and Machine Learning: Modeling and Estimation of Sparse Massive Networks

Jennifer Chayes: Distinguished Scientist and Managing Director / Microsoft Research

Monday, August 15 - 8:00am to 9:30am (Grand Ballroom)

Keynotes

There are numerous examples of sparse massive networks, in particular the Internet, WWW and online social networks. How do we model and learn these networks? In contrast to conventional learning problems, where we have many independent samples, it is often the case for these networks that we can get only one independent sample. How do we use a single snapshot today to learn a model for the network, and therefore be able to predict a similar, but larger network in the future? In the case of relatively small or moderately sized networks, it's appropriate to model the network parametrically, and attempt to learn these parameters. For massive networks, a non-parametric representation is more appropriate. In this talk, we first review the theory of graphons, developed over the last decade to describe limits of dense graphs, and the more the recent theory describing sparse graphs of unbounded average degree, including power-law graphs. We then show how to use these graphons as non-parametric models for sparse networks. Finally, we show how to get consistent estimators of these non-parametric models, and moreover how to do this in a way that protects the privacy of individuals on the network.

Jennifer Tour Chayes is Distinguished Scientist and Managing Director of Microsoft Research New England in Cambridge, Massachusetts, which she co-founded in 2008, and Microsoft Research New York City, which she co-founded in 2012. Chayes was Research Area Manager for Mathematics, Theoretical Computer Science and Cryptography at Microsoft Research Redmond until 2008. Chayes joined Microsoft Research in 1997, when she co-founded the Theory Group. Her research areas include phase transitions in discrete mathematics and computer science, structural and dynamical properties of self-engineered networks, and algorithmic game theory. She is the co-author of over 130 scientific papers and the co-inventor of about 30 patents.

Chayes has many ties to the academic community. She was for many years Professor of Mathematics at UCLA. She serves on numerous institute boards, advisory committees and editorial boards, including the Turing Award Selection Committee of the Association for Computing Machinery, the Board of Trustees of the Mathematical Sciences Research Institute and the Institute for Computational and Experimental Research in Mathematics, the Advisory Boards of the Center for Discrete Mathematics and Computer Science, the Howard Hughes Medical Institute Janelia Farm Research Campus, and Women Entrepreneurs in Science and Technology. Chayes is a past Chair of the Mathematics Section of the American Association for the Advancement of Science, and a past Vice-President of the American Mathematical Society.

Chayes received her B.A. in biology and physics at Wesleyan University, where she graduated first in

Science Foundation Postdoctoral Fellowship, a Sloan Fellowship, and the UCLA Distinguished Teaching Award. Chayes has recently been the recipient of many leadership awards including the Leadership Award of Women Entrepreneurs in Science and Technology, the Leading Women Award of the Girl Scouts of Eastern Massachusetts, the Women to Watch Award of the Boston Business Journal, and the Women of Leadership Vision Award of the Anita Borg Institute. She has twice been a member of the Institute for Advanced Study in Princeton. Chayes is a Fellow of the American Association for the Advancement of Science, the Fields Institute, the Association for Computing Machinery, the American Mathematical Society, a National Associate of the National Academies, and an Elected Member of the American Academy of Arts and Sciences, and the recipient of the 2015 John von Neumann Lecture Award, the highest honor of the Society for Industrial and Applied Mathematics.

Chayes is well known for her work on phase transitions, in particular for laying the foundation for the study of phase transitions in problems in discrete mathematics and theoretical computer science; this study is now giving rise to some of the fastest known algorithms for fundamental problems in combinatorial optimization. She is also one of the world's experts in the modeling and analysis of random, dynamically growing graphs, which are used to model the Internet, the World Wide Web, social networks, and networks in computational biology. Chayes is one of the inventors of the field of graph
limits (graphons), which are now being used extensively in the machine learning of massive networks. Among Chayes' contributions to Microsoft technologies are the development of methods to analyze the structure and behavior of various networks, the design of auction algorithms, and the design and analysis of various business models for the online world.