

Joint Distinguished Colloquium in Interdisciplinary & Applied Mathematics / Columbia Data Science Institute Colloquium

Jennifer Tour Chayes
Microsoft Research

“Once Upon a Graph: How to Get from Now to Then in Massive Networks”

Networks are increasingly important in many aspects of our world: physical networks like transportation networks, utility networks and the Internet, online information networks like the WWW, online social networks like Facebook and Twitter, epidemiological networks for global disease transmission, genomic and protein networks in computational biology, and many more. 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. Here I show how to use the theory of graph limits, developed over the last decade, to give consistent estimators for machine learning of massive sparse networks, 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, MA, which she co-founded in 2008, and Microsoft Research NYC, 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 about 125 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 her class, and her Ph.D. in mathematical physics at Princeton. She did her postdoctoral work in the mathematics and physics departments at Harvard and Cornell. She is the recipient of a National 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.

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 and a host of other technological and social 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.

Wednesday, April 20, 2016
5:00 pm, Davis Auditorium
412 CEPSR, 530 West 120th Street

Organizing Committee:
Qiang Du (APAM)
Don Goldfarb (IEOR)
Eitan Grinspin (Computer Science / APAM)
Ioannis Karatzas (Mathematics)
Michael I. Weinstein (APAM / Mathematics)