INVITED SPEAKERS

A MATTER OF GRAVITY

Dr. Steven G. Krantz
Washington University in St. Louis

Abstract: We take a new look at the concept of center of gravity. In particular we look at the stability of the center of gravity, and also what geometric conditions guarantee that the centroid lies in the region. Matter become particularly interesting when we consider these questions in very high dimensions, and asymptotically as the dimension tends to infinity. Some of this work is joint with Harold Parks, John McCarthy, and undergraduate Eric Hintikka.

Biography: Dr. Steven G. Krantz was born in San Francisco, California in 1951. He received the B.A. degree from the University of California at Santa Cruz in 1971 and the Ph.D. from Princeton University in 1974. His thesis advisor was E. M. Stein. Krantz has taught at UCLA, Princeton University, Penn State, and Washington University in St. Louis. He was Chair of the latter department for five years. Krantz has had 9 Masters students and 20 Ph.D. students. He has written more than 110 books and more than 235 scholarly papers. He edits 5 journals, and is Managing Editor of 3. He is the founding editor of the Journal of Geometric Analysis and of Complex Analysis and its Synergies. Krantz has won the Chauvenet Prize, the Beckenbach Book Award, and the Kemper Prize. He was recently named to the Sequoia High School Hall of Fame. He is an AMS Fellow. Among Krantz's research interests are: several complex variables, harmonic analysis, partial differential equations, differential geometry, interpolation of operators, Lie theory, smoothness of functions, convexity theory, the corona problem, the inner functions problem, Fourier analysis, singular integrals, Lusin area integrals, Lipschitz spaces, finite difference operators, Hardy spaces, functions of bounded mean oscillation, geometric measure theory, sets of positive reach, the implicit function theorem, approximation theory, real analytic functions, analysis on the Heisenberg group, complex function theory, and real analysis. He applied wavelet analysis to plastic surgery, creating software for facial recognition. Krantz has also written software for the pharmaceutical industry.

GEOMETRIC OPTIMIZATION PROBLEMS FOR EFFICIENT VIEWING: FINDING GOOD WAYS TO SEE THINGS WELL

Dr. Joe Mitchell
Stony Brook University

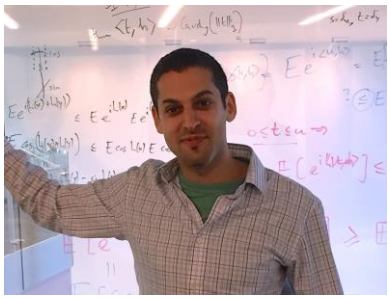
Abstract: A famous problem posed by Victor Klee in the early 1970's is the Art Gallery Problem: How many points (“guards”) are sufficient to place within a simple polygon P having n vertices so that every point of P is “seen'” by at least one guard? This problem falls into a rich class of computational geometry problems that ask one to optimally cover a domain. We discuss several interesting mathematical and algorithmic questions that arise in this class, both in the case of stationary guards and mobile robotic guards. The problems are simple to state, easy to visualize, but often very challenging to solve.

Biography: Dr. Joseph S. B. Mitchell received a BS (Physics and Applied Mathematics), and an MS (Mathematics) from Carnegie-Mellon University, and Ph.D. (Operations Research) from Stanford University (under advisorship of Christos Papadimitriou). Mitchell was with Hughes Research Labs and then on the faculty of Cornell University. He is now SUNY Distinguished Professor at Stony Brook University, where he serves as chair (since 2014) of the Applied Mathematics and Statistics Department and as research faculty in the Department of Computer Science. Mitchell has received various research awards (ACM Fellow, 2010 Godel Prize, NSF Presidential Young Investigator, Fulbright Scholar, President's Award for Excellence in Scholarship and Creative Activities) and numerous teaching awards. His primary research area is computational geometry, applied to problems in computer graphics, visualization, air traffic management, manufacturing, and geographic information systems. Mitchell has served for several years on the Computational Geometry Steering Committee, often as Chair. He is on the editorial board of the journals Algorithmica, Discrete and Computational Geometry, Computational Geometry: Theory and Applications, Journal of Computational Geometry, and the Journal of Graph Algorithms and Applications, and is an Editor-in-Chief of the International Journal of Computational Geometry and Applications. He has served on numerous program committees and was co-chair of the PC for the 21st ACM Symposium on Computational Geometry (2005).

THE FUTURE OF PREDICTION

Dr. Lionel Levine

Cornell University



Abstract: Can you predict the next term in this sequence?

0,1,3,4,9,10,12,13,27,28,30,31,...

I'll share my experience in a prediction tournament with thousands of players, focusing on the uses (and abuses!) of mathematics in predicting the future; why Bayes' rule is not the answer to everything; how to incentivize good predictions; and when to expect surprises. We'll see how randomness can be more predictable than you think, and determinism can be less predictable than you think! I'll hazard a few predictions with input from the audience: Will we ever know the 10^100th digit of pi? Will we discover life on Mars (and should we hope the answer is yes or no?)?

Biography: Lionel Levine is an associate professor at Cornell University. His research is on abelian networks. His hobby is inventing toy universes and studying their physics. You can usually find him thinking about why things are the way they are, or why they aren't the way they aren't.

LEARNING TO PERSONALIZE FROM OBSERVATIONAL DATA

Dr. Nathan Kallus

Cornell University

Abstract: Personalization has long been central in machine learning, with successful applications in online news and product recommendation systems. A question of growing urgency is how to translate this success to emergent challenges such as personalized medicine, where personalization is key but experimentation can be prohibitively small-scale, costly, dangerous, and/or unethical in comparison to passive data collection. In this talk I will discuss recent advances in learning to personalize from purely observational data, such as hospitals' electronic medical records (EMR), where the isolated effect of a treatment is hidden by a myriad confounding factors. This question brings together machine learning, to handle individual-level targeting and very rich data, with causal inference, to handle the counterfactual nature of the question. I will present a particular application to personalizing pharmacological treatments for type-2 diabetes (T2D) management based on patient characteristics, disease progression, and treatment history by leveraging the EMR database of a large hospital. I will show how standard reductions of the problem to supervised learning, where predictive algorithms are used as a black box, can fail to achieve no-regret learning and also fail in practice. I will present instead a principled approach to learning to personalize that is based on mathematical optimization and demonstrate its success empirically and explain it theoretically.

Biography: Nathan Kallus is Assistant Professor in the School of Operations Research and Information Engineering and Cornell Tech at Cornell University. Nathan's research revolves around data-driven decision making, the interplay of optimization and statistics in decision making and in inference, and the analytical capacities and challenges of observational, large-scale, and web-driven data. He holds a PhD in Operations Research from MIT as well as a BA in Mathematics and a BS in Computer Science both from UC Berkeley. Before coming to Cornell, Nathan was a Visiting Scholar at USC's Department of Data Sciences and Operations and a Postdoctoral Associate at MIT's Operations Research and Statistics group.