Distinguished Colloquium in Interdisciplinary & Applied Mathematics

AMIT SINGER
Princeton University

“Mathematics of Cryo-Electron Microscopy”

Single-particle electron cryomicroscopy (cryo-EM) is becoming an increasingly popular technique for elucidating the three-dimensional structure of proteins and other biologically significant complexes at near-atomic resolution. Unlike X-ray crystallography, single-particle cryo-EM is an entirely general imaging method that does not require crystallization and can capture molecules in their native states.

In single-particle cryo-EM, the three-dimensional molecular structure needs to be determined from many noisy two-dimensional tomographic projections of individual molecules, whose orientations and positions are unknown. The high level of noise and the unknown pose parameters are two key elements that make reconstruction a challenging computational problem. Even more challenging is the inference of structural variability and flexible motions when the individual molecules being imaged are in different conformational states.

This lecture discusses computational methods for structure determination by single-particle cryo-EM and their guiding mathematical principles including statistical inference, machine learning, and signal processing that also play a significant role in many other data science applications.

Amit Singer is a Professor of Mathematics and core member of the Program in Applied and Computational Mathematics and of the Center for Statistics and Machine Learning at Princeton University. He was awarded the Simons Math+X Investigator Award (2017), National Finalist for Blavatnik Awards for Young Scientists (2016), Moore Investigator in Data-Driven Discovery (2014), Simons Investigator Award (2012), Presidential Early Career Award for Scientists and Engineers (2010), Sloan Research Fellowship (2010), and the Nessyahu Prize for Best PhD in Mathematics in Israel (2007). His current research focuses on theoretical and computational aspects of data science, and on developing computational methods and software for structural biology.

Thursday, November 7, 2019
4:00 pm, 750 Costa Engineering, CEPSR
530 West 120th Street
(Refreshments in 200 Mudd at 3:15 PM)

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