

DEPARTMENT OF STATISTICS



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*Maximum likelihood for high-noise group orbit
estimation and cryo-EM*

**Wednesday, October 27, 2021
11:45 AM EST**

**Zoom Meeting: Meeting ID: 924 8283 7055
Password: 378160**

<https://rutgers.zoom.us/j/92482837055?pwd=TktKVVU2ZlJzZnZQbm1TNUs3K0pmZz09>

Virtual Coffee session before the seminar at 11:30 AM EST

Abstract: Motivated by applications to single-particle cryo-electron microscopy, we study a problem of group orbit estimation where samples of an unknown signal are observed under random rotations from a rotational group. In high-noise settings, we show that both the global and local geometries of the log-likelihood function are closely related to the structure of the algebra of invariant polynomials of the group action. Eigenvalues of the Fisher information matrix are stratified according to a sequence of transcendence degrees in this invariant algebra, and critical points of the log-likelihood optimization landscape are in correspondence with those of a sequence of polynomial optimization problems. I will discuss several examples, including a simplified model of cryo-EM, where we elucidate the structure of this invariant algebra and numerically confirm the predicted scalings of the Fisher information eigenvalues for electric potential maps of two small protein molecules.

This is joint work with Roy Lederman, Yi Sun, Tianhao Wang, Yihong Wu, and Sheng Xu.

Bio: Zhou Fan is an Assistant Professor in the Department of Statistics and Data Science at Yale University. His research focuses on random matrix theory and free probability, connections between statistical physics and inference, high-dimensional statistics and machine learning, and applications in genetics and computational biology. He received his Ph.D. in 2018 from Stanford University. Prior to this, he worked at DE Shaw Research, developing statistical and software tools for molecular dynamics simulations of biomolecules.

