



香港中文大學統計學系

Department of Statistics

THE CHINESE UNIVERSITY OF HONG KONG

# SEMINAR

DEPARTMENT OF STATISTICS  
THE CHINESE UNIVERSITY OF HONG KONG

## Fast Estimation of Rotation-Invariant Covariance of Cryo-EM Images

### INVITED SPEAKER

Dr. Yunpeng Shi

Program in Applied and Computational Mathematics

Princeton University

### TIME

June 27, 2023 (Tue) · 2:30 pm - 3:30 pm

### VENUE

LT2 · Lady Shaw Building · CUHK

### ABSTRACT

Covariance estimation of images plays a crucial role in numerous tasks, including image compression, classification, and denoising. However, due to the often exceedingly high dimensions of image covariance, we face significant statistical and computational challenges. One noteworthy observation is that if the image manifold remains invariant under global in-plane rotations, this symmetry can be leveraged to substantially accelerate computation and reduce dimensionality.

In this talk, I will illustrate how a recent advancement in the fast expansion of harmonics on the disk allows us to take advantage of this rotational symmetry, resulting in a thousand-fold acceleration in covariance estimation compared to the fastest method previously available. Furthermore, I will discuss successful applications of this method in joint deconvolution and denoising of large-scale, real-world Cryo-electron microscopy (Cryo-EM) images. No prior knowledge of Cryo-EM is needed to understand this talk.