

國立中央大學

統計研究所

學術演講

主講人：鍾思齊 助理教授（國立中山大學應用數學系）

講題：**A framework for orientation recovery with uncertainty measure with the application in cryo-EM image analysis**

時間：**111年10月18日（星期二）上午11：00 ~ 12：00**

地點：中央大學鴻經館M429室

茶會：**上午 10：30 ~ 11：00** 地點：鴻經館 510 室

ABSTRACT

Cryogenic electron microscopy (cryo-EM) is a promising method to determine the 3D structure of a protein. A major bottleneck in single-particle cryo-EM is to efficiently estimate the orientation parameters of the 2D projection images to reconstruct the 3D structure. The situation is worsened by the fact that only a small dose is used during imaging which results in highly noisy images in the cryo-EM dataset. This means that outliers such as contaminants or low-quality images may exist in the dataset during the orientation estimation. Recently, several approaches based on deep learning have been proposed to alleviate the time-consuming orientation estimation process by employing amortized inference to obviate the need to estimate parameters for each image. However, these works often overlook the issue of outliers and the generalization capability of the network.

In this talk, I will present a method to recover these orientations directly from the acquired set of 2D projections in an end-to-end manner. In our framework, we represent the orientation using a 10-dimensional feature vector followed by the Quadratically-Constrained Quadratic Program to get the orientation prediction in unit quaternion format with uncertainty measure. Furthermore, a novel loss function that incorporates the information of pairwise distance between orientations is proposed to enhance the accuracy. Finally, I will discuss some ongoing research directions, including using self-supervised learning to denoise the particles and the end-to-end estimation procedure for real data.