

# 國立中央大學

## 統計研究所

### 學術演講

主 講 人：黃世豪 助理教授（國立中央大學數學系）

講 題：**On the Asymptotic Normality and Efficiency of Kronecker Envelope Principal Component Analysis**

時 間：111 年 01 月 04 日（星期二）上午 11：00 ~ 12：00

地 點：中央大學鴻經館 M-429 室

茶 會：上午 10：30 ~ 11：00 地 點：鴻經館 M510 室

### ABSTRACT

Dimension reduction methods for matrix or tensor data have been an active research field in recent years. Kronecker envelope principal component analysis (PCA) is a two-step procedure, which consists of projecting data onto a multilinear envelope subspace as the first step, followed by ordinary PCA on the projected core tensor. The multilinear envelope subspace preserves the natural Kronecker product structure of observations when searching for the leading principal subspace. The main advantage of preserving the Kronecker product structure is the parsimonious usage of parameters in specifying the leading principal subspace, which mitigates the adverse influence of high dimensionality. The method of PCA will convert possibly correlated variables to uncorrelated ones and further reduce the dimension of the projected core tensor. In this work we derive the asymptotic normality of Kronecker envelope PCA, and show that it outperforms ordinary PCA under some conditions. A motivating real data example of cryogenic electron microscopy image clustering and simulation studies are presented to show the merits of Kronecker envelope PCA. (Work done jointly with Su-Yun Huang).

Keywords: Cryogenic electron microscopy; Dimension reduction; Kronecker envelope; Multilinear principal component analysis; Principal component analysis; Tensor data