The Hong Kong University of Science and Technology

Seminar on Business Data Science

Department of ISOM

When can weak latent factors be statistically inferred?
By
Professor Jianqing FAN, Princeton University

Date: 6 Jun 2025 (Friday)
Time: 2:30pm – 3:30pm
Venue: Case Room 1001 (LSK Business Building)

Abstract

We establish a new and comprehensive estimation and inference theory for principal component analysis (PCA) under the weak factor model that allow for cross-sectional dependent idiosyncratic components under the nearly minimal factor strength relative to the noise level or signal-to-noise ratio. Our theory is applicable regardless of the relative growth rate between the cross-sectional dimension N and temporal dimension T. This more realistic assumption and noticeable result require completely new technical device, as the commonly-used leave-one-out trick is no longer applicable to the case with cross-sectional dependence. Our theory is entirely non-asymptotic, offering finite-sample characterizations for both the estimation error and the uncertainty level of statistical inference. A notable technical innovation is our closed-form first-order approximation of PCA-based estimator, which paves the way for various statistical tests. Furthermore, we apply our theories to design easy-to-implement statistics for validating whether given factors fall in the linear spans of unknown latent factors, testing structural breaks in the factor loadings for an individual unit, checking whether two units have the same risk exposures, and constructing confidence intervals for systematic risks. Our empirical studies uncover insightful correlations between our test results and economic cycles.
(Joint work with Yulin Yan and Yuheng Zheng)

Bio

Jianqing Fan, is a statistician, financial econometrician, and data scientist. He is Frederick L. Moore '18 Professor of Finance, Professor of Statistics, and Professor of Operations Research and Financial Engineering at the Princeton University, where he chaired the department from 2012 to 2015. He is the winner of The 2000 COPSS Presidents' Award, Morningside Gold Medal for Applied Mathematics(2007), Guggenheim Fellow(2009), Pao-Lu Hsu Prize (2013), Guy Medal in Silver(2014), Noether Distinguished Scholar (2018), Le Cam Award and Lectures (2021). He got elected to Academician from Academia Sinica in 2012 and Royal Flemish Academy of Belgium in 2023.

All interested are welcome!

For details, please contact ISOM Department.