THE UNIVERSITY  OF HONG KONG

Institute of Mathematical Research
Department of Mathematics

C O L L O Q U I U M

New matrix perturbation bounds and applications

Professor Van Vu

Yale University

Abstract

Matrix perturbation bounds (such as Weyl bound for eigenvalues and Davis-Kahan for eigenvectors) are essential tools in many branches of mathematics, computer science, and engineering. These bounds give us control on the behavior of the leading spectral parameters of a large matrix under noise.

Most of the classical results in perturbation theory are optimal, in the worst-case analysis. However, in modern applications, both the ground and the nose matrices frequently have extra structural properties. In particular, it often occurs that the ground matrix is essentially low rank, and the nose matrix is random or pseudo-random. Furthermore, the input of many central problems in data science can be written as the sum of a deterministic low rank matrix and a random matrix. One can also view this as a generalization of classical models in random matrix theory (where the deterministic part is zero).

We aim to rebuild a part of perturbation theory, adapting to these modern assumptions. The key idea is to exploit the skewness between the leading eigenvectors of the ground matrix and the noise matrix. We will do this by combining the contour integration method with combinatorial ideas, resulting in a new machinery, which has a wide range of applications.

Date:	March 20, 2025 (Thursday)
Time:	5:00 pm – 6:00 pm
Venue:	Room 210, Run Run Shaw Bldg., HKU

All are welcome