UNIVERSITY OF CENTRAL FLORIDA

COLLOQUIUM

Same Noise, Different Place: Local Geometry of CUR

Speaker: Dr. Longxiu Huang

Affiliation: Michigan State University

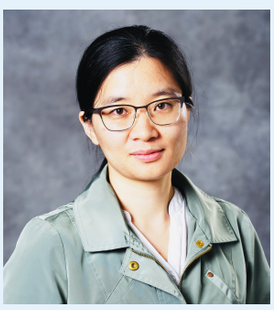
Abstract

Low-rank approximation is a staple of modern data science, and the singular value decomposition settles one version of the problem completely: it gives the smallest possible error for a given rank. But that is only half the question. The other half – what should the low-rank factors actually be? – the SVD answers with abstract directions that blend every row and column of the data. CUR decompositions answer it differently. They build the approximation out of genuine columns and rows of the matrix itself, so every factor points at something real: a gene, a sensor, a customer, a wavelength.

Classical CUR theory tells us how badly noise can hurt, with perturbation bounds controlled by the size of the noise. Those bounds are sharp as worst-case statements, but they see a perturbation only through its norm. In this talk I will describe a complementary, local picture: a perturbation expansion showing that the Fréchet derivative of the rank-truncated CUR map is an oblique tangent-space projector determined entirely by the selected rows and columns. The leading-order recovery error therefore depends on where the noise sits relative to the sample, not merely on how large it is: perturbations invisible to the selected rows and columns are removed to first order, so two corruptions of identical magnitude can produce wildly different errors.

After illustrating the theory on real data, I will close with the practical moral. Because the sample is yours to choose, robustness to the noise you can anticipate is something you design, not something you inherit. Time permitting, I will also discuss the tensor case.

Speaker Bio



Longxiu Huang is an Assistant Professor in the Department of Computational Mathematics, Science and Engineering and the Department of Mathematics at Michigan State University. She received her Ph.D. in Mathematics from Vanderbilt University in 2019, advised by Akram Aldroubi, with a thesis on dynamical sampling. She was subsequently an Assistant Adjunct Professor in the Department of Mathematics at UCLA, working with Deanna Needell. Her research sits at the interface of applied harmonic analysis and randomized numerical linear algebra. She works on sampling theory, low-rank matrix and tensor recovery, and CUR-type decompositions — with a recurring emphasis on methods that are fast, provably accurate, and interpretable in terms of the original data. She is a core member of TEMPEST, the recently funded NSF Science and Technology Center for turbulence research headquartered at Michigan State University.

Event Details

- **Date:** Monday, October 5, 2026
- **Time:** 3:30 PM – 4:30 PM
- **Location:** MSB 318

Refreshments will be served from 2:30pm–3:30pm in MSB 201

School of Data, Mathematical, and Statistical Sciences