Mathematics Colloquium

February 2, 2023

Mathematical and statistical analysis of compressible data on compressive network

Jingfang Huang, Shahar Kovalsky, and Jeremy Marzuola (UNC)

Abstract. We present an overview of the FRG project on the "Mathematical and Statistical Analysis of Compressible Data on Compressive Networks". Compressible features of data include the low-rank, low-dimension, sparsity, and features from the classification/categorization/clustering process. Discovering such compressible features is a major challenge in data analysis, which we will address using hierarchical decompositions derived from spectral, statistical, and algebraic geometric analysis of data. We also study how to construct optimally defined compressive networks, specifically tailored to the discovered compressible features, to enable an accurate and efficient extraction and manipulation of sparse representations in complex and high dimensional systems in an inherently interpretable manner. Sample ongoing projects include the accurate and efficient representation of layer potential using algebraic variety, spectral flow and fast computation of the eigensystems, frequency domain based statistical analysis, fast algorithms for high dimensional truncated multivariate Gaussian expectations, and recursive tree algorithms for orthogonal matrix generation and matrix-vector multiplications in rigid body Brownian dynamics simulations.