MS9: Tensor Computations and Applications I

Symmetric Outer Product Decomposition for Tensors

Christina Glenn, *University of Alabama at Birmingham*

Tensor decomposition methods that decrease tensor complexity while lowering computational costs are in high demand. Symmetric Outer Product Decomposition (SOPD) factors a fully (partially) symmetric tensor into a number of rank-one symmetric tensors. Few numerical methods exist for finding the SOPD. The standard method, Alternating Least Squares (ALS), often yields wrong solutions. We propose a new iterative method for SOPD called Partial Column-wise Least Squares (PCLS). Numerical examples are provided to compare the performance of PCLS to ALS for the SOPD.

Tensors as Linear Operators: Implications for Multiway Data Analytics

Shuchin Aeron, *Tufts University*

In this talk we will consider several applications of a recently proposed algebraic framework, which considers multiway data or tensors as linear operators over free modules. Using this perspective in this talk we will focus on two problems for multiway data, namely data completion from missing entries, and unsupervised clustering of (2-D) images. For both of these problems we will derive probably optimal algorithms with performance guarantees that parallel recent results for one-dimensional data. We will also show the performance of the proposed methods on some real data sets and compare with some of the existing techniques. We will then discuss some implications of these results and directions of future work.

Low Rank Approximation of Tensor from the Viewpoint of Sparsity

Xiaofei Wang, *Northeast Normal University, China and University of Alabama at Birmingham*

The goal of this paper is to find a low rank approximation for a given tensor. Specifically, we also give a computable strategy on calculating the rank of a given tensor, basing on approximating the solution of the NP-hard problem: $\min_{\mathcal{B}} rank(\mathcal{B}) \quad s.t. \|\mathcal{A} - \mathcal{B}\|_F^2 \leq \varepsilon$ for a given tensor $\mathcal{A}$.