Homework of ECE 594BB: Selected Topics of High-Dimensional Tensor Data Analysis

Due Date: Nov 07, 2019 Thursday

Submission requirement:

1. Please submit your zipped Matlab codes
2. Please submit a brief report to explain the key ideas of your Matlab codes and your results.
3. The report should be typed (either in word or in latex).

Problem 1 (Lecture 4-5)

(a) Implement **either CP or Tucker** decomposition for a general d-way tensor with size I_1-by-I_2-by…-by-I_d for a specified rank (or multilinear rank in Tucker).

(b) Given any two tensors of the same size, compute their inner product by **using only** the tensor factors (and also cores if you implement Tucker) obtained from your codes. Compare your result with the exact inner product on the original full tensors.

Problem 2 (Lecture 6-9)

(a) Implement **tensor-train decomposition** or **Hierarchical Tucker factorization** for a general d-way tensor.

(b) Given two tensors **A** and **B** of the same size, compute the tensor-train (or hierarchal Tucker) decomposition of **A**, compute the CP (or Tucker) decomposition for **B** using your codes developed in Problem 1. Compute the inner product using only the obtained factors (and also the possible cores), and compare the result with the exact tensor inner product.

Hints to generate a low-rank tensor (possibly used for testing your algorithm): you can randomly generate d factor matrices with R columns, then use CP representation to construct a rank-R tensor.