CS 754: Project Proposal

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1 Paper Selection

Paper 1: Estimation of the sample covariance matrix from compressive measurements
Author: Farhad Pourkamali-Anaraki

Paper 2: Memory and Computation Efficient PCA via Very Sparse Random Projections
(Reference paper[20] mentioned in Paper 1)
Author: Farhad Pourkamali-Anaraki, Shannon M. Hughes

2 Description of Project

We aim to implement the unbiased estimator of the sample covariance matrix from low-dimensional random projections of data (also known as compressive measurements) as described by the authors of **Paper 1** which works by extracting the covariance structure from compressive measurements, obtained using random projection matrices from a general class, characterized by i.i.d. zero-mean entries and finite first four moments. Also, we aim to implement the biased estimator of sample covariance matrix, as proposed in the **Paper 2** by the authors and verify the results and conclusions drawn at the end of the **Paper 1**.

3 Datasets to be used :

We will implement our algorithm on the belowmentioned datasets to validate the results:

- MNIST data set
- Gen4 data set
- Traffic data set

4 Evaluation/Validation Strategy

We will follow a checkpoint-based strategy for systematic completion of the project and evaluation of the proposed solution.

- **Checkpoint 1:** Understanding the biased covariance estimator $\hat{\mathbf{C}}_\mathbf{n}$ of sample covariance matrix as described in **Paper 2**
- **Checkpoint 2:** Understanding the unbiased estimator $\hat{\mathbf{\Sigma}}_\mathbf{n}$ of sample covariance matrix and validating the theoretical results present in **Paper 1**
- **Checkpoint 3:** Implementing the code for both the biased and unbiased estimators.
- **Checkpoint 4:** Validating the results obtained on the 3 datasets in accordance with **Paper 1**.
  The validation of our results will be done visually as well as on these two metrics:
  - Accuracy
  - Computation Cost