Final Project Proposal for ECE539: Biometrics

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1 Project Background

Sparse and low rank models have been proven to be extremely powerful and have received a great deal of attentions in recent years in research communities including signal processing, computer vision and machine learning etc. In the midterm project we were asked to understand basic ideas of sparse representation-based classification [1] and apply the algorithm to real world face recognition dataset, experimental results exhibit the best performance among all the methods been implemented. However I also encountered the problem of heavy computation. I would like to explore the sparse representation and low rank models in various scenarios, try to understand their advantages as well as drawbacks that need to be improved.

2 Introduction

High-dimensional data are ubiquitous in various research areas, which requires heavy computation and large memory use. However, high-dimensional data often lie in or near low-dimensional structures [2]. In practice, Overcomplete basis(or dictionaries) are often used to describe these low-dimensional subspaces, thus underlying low rank representations exist. This key fact in sparse models is that each signal point a union of subspaces has a sparse representation with respect to the dictionary mentioned above. Sparse representation model is explored both in supervised and unsupervised learning tasks, such as sparse representation-based classification [3] for supervised learning and subspace sparse clustering [4] in unsupervised learning.

3 Objectives and Plan of Actions

I propose to review the available literature about sparse and low rank model and their applications in recognition tasks, Try to explore concepts related to the idea and test their performance on some popular face recognition datasets. Methods including but not limited to :

1. Subspace Sparse Clustering [4]
   Unsupervised way of utilizing the sparse model, a similarity matrix is learned and spectral clustering technique is involved to cluster the data.

2. Low Rank Matrix Recovery(or Robust PCA) [3]
   Reconstructing matrix of low rank from sparse noise using nuclear norm and $l1$ norm approximation.

3. K-SVD algorithm [5]
   Focus on designing of the overcomplete dictionary.

4. Dictionary-based Domain Adaptive Method [6, 7]

References

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