Homework 4

Collaborators:
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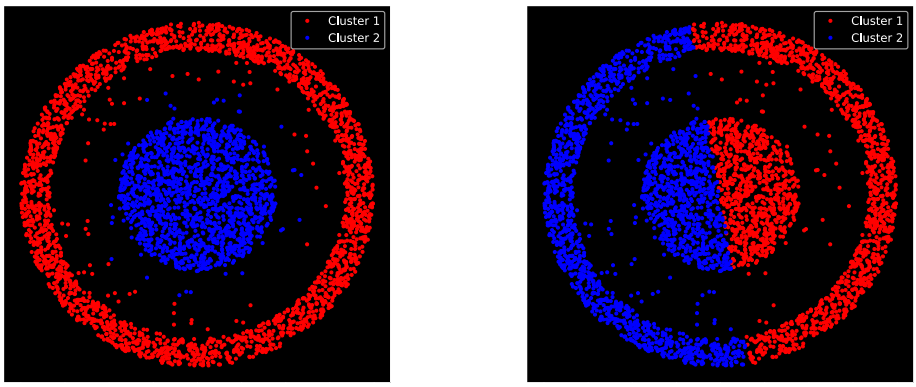
Problem 4-1. Spectral Clustering

In this problem, we will try a dimensionality reduction based clustering algorithm – Spectral Clustering.

(a) We will first experiment Spectral Clustering on synthesis data

Answer: See fig.1



(a) Spectral Cluster (b) Kmeans Cluster

Figure 1: Comparsion between spectral cluster and kmeans cluster

(b) Now let us try Spectral Clustering on real-world data.

Answer: See tab.1

Table 1: Performance of two cluster methods on TDT2

	Spectral Cluster	Kmeans
Accuracy	73.15%	0.5966
MutualInfo	13.67%	0.4472

Problem 4-2. Principal Component Analysis

Let us deepen our understanding of PCA by the following problems.

(a) Your task is to implement *hack_pca.m* to recover the rotated CAPTCHA image using PCA.

Answer: See fig.2

Figure 2: Rotation captcha image

(b) Now let us apply PCA to a face image dataset.

Answer:

1. Eigenface see fig.3

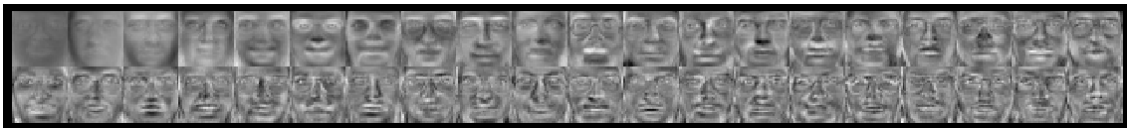


Figure 3: Rotation captcha image

2. See tab.2

Table 2: Error rate on diffrent dimension (PCA)

dim	8	16	32	64	128
error rate	24.5%	20%	18%	15%	15%

3. See fig.4
4. LDA KNN err rate see table.3

(a) Recovered images with dimension=8

(b) Recovered images with dimension=16

(c) Recovered images with dimension=32

(d) Recovered images with dimension=64

(e) Recovered images with dimension=128

(f) Original image

Figure 4: Comparsion between recovered images with different dimension

Table 3: Error rate on diffrent dimension (LDA)

dim	8	16	32	64	128
error rate	13%	6.5%	4%	3.5%	3.5%