Lab-4: PCA based face recognition

Submit in Blackboard by 11:59PM, Tuesday, September 26th, 2017

We will use the ORL database, available to anyone on AT&T's web site. This database contains photographs showing the faces of 40 people. Each one of them was photographed 10 times. These photos are stored as images in levels of grey with 112x92 pixels. In our example, we constructed a catalog called orlfaces, comprised of the catalogs named s1, s2, . . . , s40, each one of them containing the 10 photographs we are going to process. The data has been split in two-parts train and test. For each catalog we use the first 9 photograph s for training and the last photograph for test.

1. Load the training data.
2. Change each (d1 = 112) x (d2 = 92) photograph into a vector;

3. Using a photograph of each of the N people in the training data, a subspace H the dimension of which is less than or equal to N, and such as to have the maximum dispersion of the N projections. To extract the subspace, use PCA step which are described as follow.

    - Center the data.
    - Compute the correlation matrix.
    - Use SVD matlab function? (You can also use eig matlab function)
    - Normalize the eigen vectors by the corresponding eigen values

4. Plot the eigenvalues?
5. Plot the first 3 eigen faces and last eigen face (i.e., eigen vectors)

6. Reconstruct one face example with its 10, 20, 30, and 40 eigenvectors. Plot and compare all the reconstructions. Also plot the original image, reconstructed image and difference between reconstruction and original image in each case. Write your observations.

7. Load the test data.
8. Check the identity corresponding to each photograph in the test dataset by determining its projection onto H (with dimension 10, 20, 30 and 40) and then by comparing the distances of this projection with respect to all projections in the training data. For each test category find the close category in the test.

9. Show the close image for test s1 example.

Submit all the code and different outputs obtained