IE406 LAB ASSIGNMENT 6

**PCA for feature Extraction**

Date: Nov 4, 2019

Given a set of face images use PCA to obtain dimensionality reduction. Use the following steps :

1. Load the Data matrix (X) faceimages.mat given to you. There are 400 face images of size 112×92 giving 10304\*400 matrix.
2. Mean subtract the data and use it to obtain sample covariance matrix (10304\*10304).
3. Find the eigenvalues and eigenvectors (which are orthogonal and have unit norm representing directions) from the above covariance matrix.
4. Use the eigen vectors as rows of the transformation matrix A, starting with eigen vector (called principal component) corresponding to largest eigen value (representing largest power/variance direction in the transformed data) as the first row.
5. Obtain 10304 \* 400 low dimensional representation of X: Y = A X.
6. Now, reconstruct back any of the image by choosing first 50, 100, and 400 values (also represent features) from columns in Y. Reconstructed X can be simply obtained by multiplying transpose of A i.e., truncated eigen vector matrix with truncated column of Y. (10304X1 i.e., reconstructed X) = 10304X50 (truncated eigen vector matrix) multiplied by 50X1 (truncated column in Y) )
7. Calculate reconstruction error between original X and reconstructed X (Xhat) (Frobenius norm or matrix norm: square root of sum of absolute squares of errors) for all the three cases.