Face Recognition EigenFace

Assignment 2 20110098

Overview

PCA
PCA Algorithm reduces dimensionality of a dataset to low dimension subspace by linear projection such that reconstruction error is minimal.

Eigen Faces
Using PCA, we can find the vectors of the covariance matrix of the image that best account for the distribution of the image in the entire space or we can say eigenvectors with highest eigenvalues. So each image can be represented as a linear combination of the eigen faces.

Algorithm

There are 546 (112 X 92) grayscale face images.
Converting matrix into a column matrix of size (112*92).
We have all 546 images in matrix A of size (112*92 X 546).

1. First the mean of all the images is calculated.
2. A_tilde stores all image vectors A - A mean
3. Covariance matrix of A_tilde is calculated
4. C = 1/m(A_tilde. Tran(A_tilde))
5. L = 1/m(Tran(A_tilde).A_tilde)
6. C & L have the same eigenvalues.
7. We find eigenvectors of C using A_tilde. Vi where Vi is an eigenvector of L.
8. We take the top 350 eigenvectors. Because they are sufficient for identification
9. We normalize these eigenvectors.
10. New image(omega) = mean subtracted image projected on face space spanned by 350 eigenvectors.
11. We compute error by comparing distance between given face image and projected img
12. If error is less than threshold then we say the two images are the same.

Results

Image	True Positive	True Negative	Total Image
1i	12	520	19
1f	3	519	22
1p	6	513	25
1c	1	521	25
1g	6	513	18
1b	1	522	24
1o	4	524	18
1h	7	499	21
1d	2	523	23
1e	7	506	25
1t	8	512	34
1n	7	508	29
1l	1	513	33
1j	8	513	31
1a	0	509	37
1q	6	517	25
1s	12	493	47
1r	15	504	32
1m	8	512	25
1k	3	513	33
	117	10254	546

Performance

Accuracy
(True Positive+True Negative) / (True Positive + False Positive + False Negative + True Negative) *100

Accuracy = ((117 + 10254) / (546 * 20)) * 100 = **94.973 %**