Image Recognition
EIGENFACES

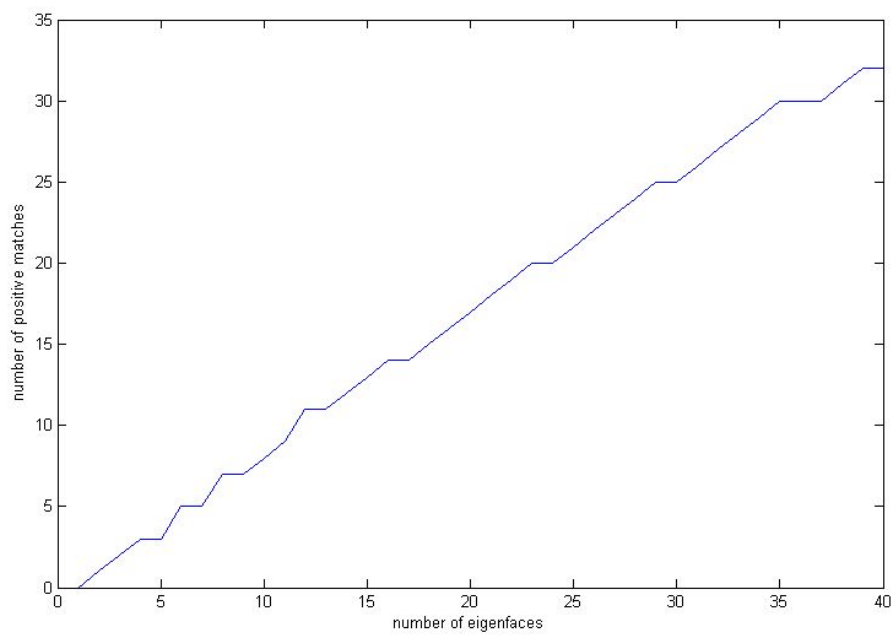### Top 10 eigenfaces for the Training Images Dataset

Mean Face

Face recognition using eigenfaces

The following graph plots the number of correct matches out of the 40 face images in a database.

The match success rate among Training images is 100%, which shows that there is no attenuation of the data during training of the algorithm.While with Test images the Success rate goes as high as 80%.

How many eigenfaces to use?

From the graph we see that as we increase the number of eigenfaces considered, the recognition improves but later on it starts to saturate(especially for 35 to 40 eigenfaces) Using more number of eigenfaces requires more time while recognition. So there is a trade off between the speed and accuracy. I also think that using more and more eigenfaces will tend to overfit the system which might not be good when we want to detect faces which are not in the database.

The number of eigenfaces to be used can be decided by looking at the eigenvalues. The eigenvectors corresponding to small eigenvalues only contain information about detailed differences in comparison to a higher level discrimination by the eigenvectors with larger eigenvalues. We can choose to remove the vectors with smaller eigenvalues without affecting the results by a great amount. Hence one way to do this will be to sort the eigenvalues in descending order and plot them as shown below.
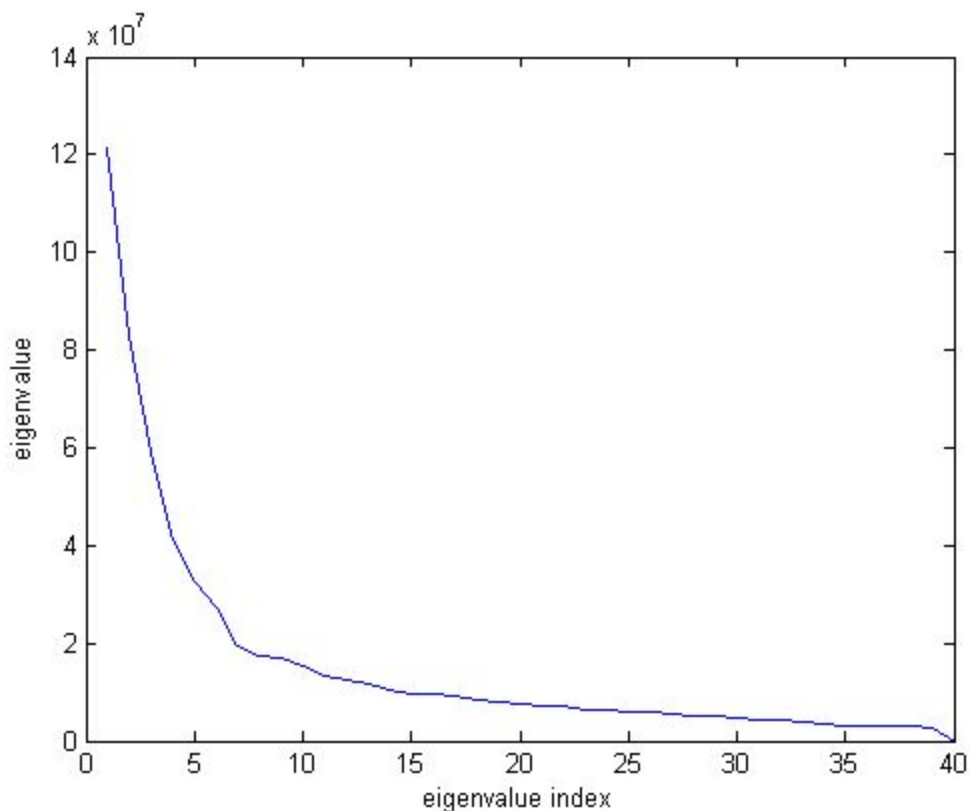

The optimal number of the eigenvalues is just before when the plot tends to become asymptotic along the x-axis. In the above graph however, there is no clear demarcation. We observed that with top 35 eigenvalues, the algorithm gives the best success rate of 80%. If we go down on the numbers then for top 28, it gives 60% success while for 16, it gives as low as 40% success rate. So, as with the trade off, an optimal value is needed to be determined. For any value greater than 35 uptill 39, success remains 80%.

What about recognition errors?

As observed from the recognition accuracy graph, we do get a lot of wrong matches(Depending on the eigenvalues chosen).

Examples:
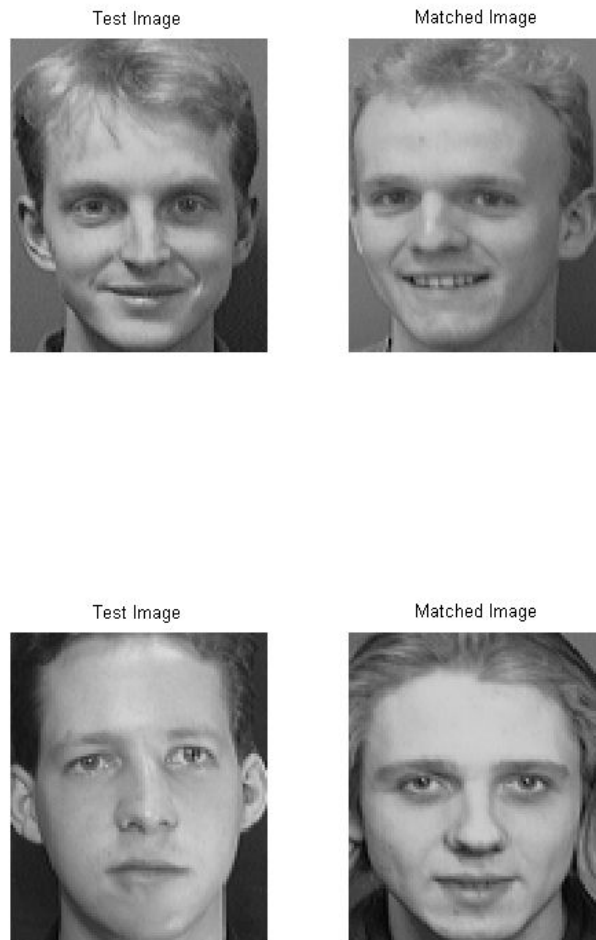
In the examples, the matched faces do look quite similar.The mistakes are sometimes good as in the second example and bad as in the first example. In general, it is observed that the system does a reasonable job.