FISHERFACES VS EIGENFACES - A COMPARISON

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In this project , we have aimed to compare the techniques of Eigenfaces and Fisherfaces for facial recognition.

We have performed the following three experiments to perform the comparisons and we have noted our results.

Paper Implemented:

Eigenfaces vs. Fisherfaces: Recognition Using Class Specific Linear Projection - IEEE Trans. on PAMI, July 1997 - Peter N. Belhumeur Joao P. Hespanha David J. Kriegman

Database used:

We have used the Yale Uncropped face database for all our experiments.It contains 11 images each of 15 individuals under different lighting, facial expressions and poses.

The following are a few sample images.
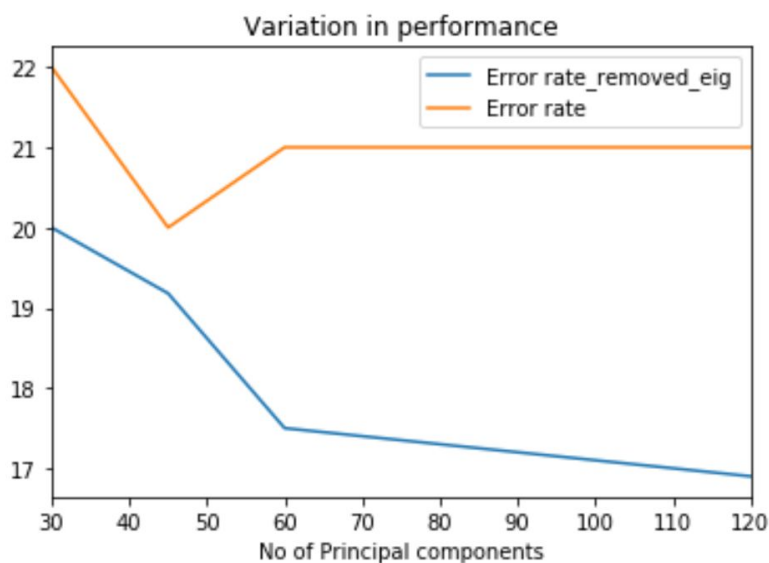
Here we can see that on removing the top 3 eigenvectors, we get a better performance.

Experiment 1: Error rate vs Method

Here we have calculated the error rate using N fold cross validation - we remove only the test image and train using the rest of the images.

METHOD	ERROR RATE(%)	ERROR RATE ACCORDING TO THE PAPER(%)
Eigenfaces with first 3 eigenvectors (30 components)	20	19.4
Eigenfaces without first 3 eigenvectors (30 components)	18	10.8
Fisherfaces	2.42	0.6
Linear Subspaces	17	15.6
Correlation	16	20
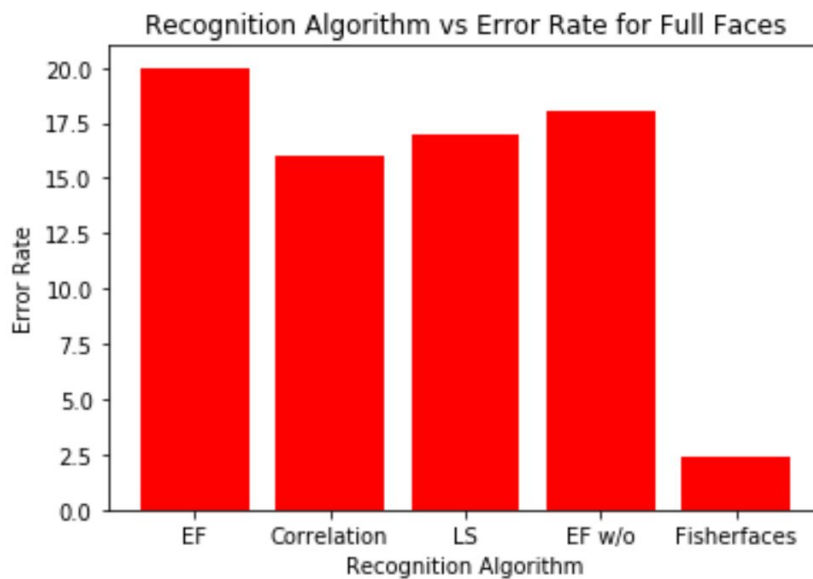
Experiment 2: Variation with eyewear - To recognize a person with glasses

Here, for a given test image(with glasses) , we remove all the images in the dataset which are the same person as the image and train the model. We then test the image with the model and obtain the error rate.

METHOD	ERROR RATE(%)	ERROR RATE ACCORDING TO THE PAPER(%)
Fisherfaces	6.7	5.3
Eigenfaces with 1st 3 eigenvectors intact (30 components)	40	52.6

Experiment 3: Variation of facial expressions - Happy, Sad, Wink, Sleepy and Surprised

This experiment is the same as Experiment 2, but here the classes are the 5 different facial expressions.

METHOD	ERROR RATE WITH 'HAPPY'(%)	ERROR RATE WITH 'SAD'(%)	ERROR RATE WITH 'SURPRISED'(%)	ERROR RATE WITH 'SLEEPY'(%)	ERROR RATE WITH 'WINK'(%)
Eigenfaces with 1st 3 eigenvectors intact (30 components)	86.67	86.67	53.3	80	46.67
Fisherfaces	73.3	73.3	93.3	73.3	80

In the above table, Fisherfaces does not perform better than Eigenfaces for certain facial expressions such as 'wink' and 'surprised' - they in fact perform very badly.

Results:

1. From Experiment 1 we found that the Fisherfaces method is much more better for facial recognition than the Eigenfaces method with a recognition rate of 2.42% compared to 20%.
2. Removing the top 3 eigenvectors to account for illumination variation does help in reducing the Error rate but it does not give an error rate as low as the error rate given by Fisherfaces.
3. The fisherface method generally performs better even in change in facial expression and even if the person wears glasses.