# Preprocessing Technique to Improve Eigen face Algorithm in Face Recognition

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***Abstract*—*Face recognition has been an active area of research with numerous applications since late 1980s. Eigen face approach is one of the earliest appearance-based face recognition methods. This method utilizes the idea of the principal component analysis and decomposes face images into a small set of characteristic feature images called Eigen faces. Recognition is performed by projecting a new face onto a low dimensional linear "face space" defined by the Eigen faces, followed by computing the distance between the resultant position in the face space and those of known face classes. The Eigen face approach is quite robust to head/face orientation, but sensitive to scale and illumination. Eigen face has several limitations and drawbacks so to overcome the drawback of the algorithm by applying preprocessing technique on it.*

**Keywords—**Face recognition, Eigen face.

## I. INTRODUCTION

Face recognition has become a popular area of research in computer vision. Face recognition is also one of the most successful applications of image analysis and understanding. Because of the nature of the problem of face recognition, not only computer science researchers are interested in it, but neuroscientists and psychologists are also interested for the same. It is the general opinion that advances in computer vision research will provide useful insights to neuroscientists and psychologists into how human brain works, and vice versa.

The basic overall face recognition model looks like the one below.


Figure 1.1 Flow of Recognition

Different approaches of face recognition for still images can be categorized into tree main groups such as holistic approach, feature-based approach, and hybrid approach [1]. Face recognition form a still image can have basic three categories, such as holistic approach, feature based approach and hybrid approach [2].

### *A. Holistic Approach: -*

In holistic approach, the whole face region is taken as an input in face detection system to perform face recognition.

### *B. Feature-based Approach: -*

In feature-based approach, local features on face such as nose and eyes are segmented and then given to the face detection system to easier the task of face recognition.

### *C. Hybrid Approach: -*

In hybrid approach, both local features and the whole face is used as the input to the face detection system. It is more similar to the behavior or human being to recognize the face.

## II. EIGEN FACE APPROACH

Eigen face is a one of the most thoroughly investigated approaches to face recognition. It is also known as Karhunen-Loeve expansion, Eigen picture, eigenvector, and principal component. Sirovich and M. Kirby [9, 10] used principal component analysis to efficiently represent pictures of faces. Any face image could be approximately reconstructed by a small collection of weights for each face and a standard face picture, that is, Eigen picture. The weights here are theobtained by projecting the face image onto the Eigenpicture. In mathematics, Eigen faces are the set of eigenvectors used in the computer vision problem of human face recognition. The principal components of the distribution of faces or the eigenvectors of the covariance matrix of the set of face image are the Eigen face. Each face can be represented exactly by a linear combination of the Eigen faces. The best M Eigen faces construct an M dimension (M-D) space that is called the "face space".

### *A. Workflow of the Recognition Process in Eigen faces Approach*

- Form a face library that consists of the face images of known individuals.
- Choose a training set that includes a number of images (M) for each person with some variation in expression and in the lighting.
- Calculate the M x M matrix L, find its eigenvectors and eigenvalues, and choose the M' eigenvectors with the highest associated eigenvalues.
- Combine the normalized training set of images to produce M' Eigenfaces.
- Store these Eigenfaces for later use.
- For each member in the face library, compute and store a feature vector.
- Choose a threshold e that defines the maximum allowable distance from any face class. Optionally choose a threshold f that defines the maximum allowable distance from face space.
- For each new face image to be identified, calculate its feature vector and compare it with the stored feature vectors of the face library members.

– If the comparison satisfies the threshold for at least one member, then classify this face image as "known", otherwise a miss has occurred and classify.

## III. EIGEN FACE APPROACH

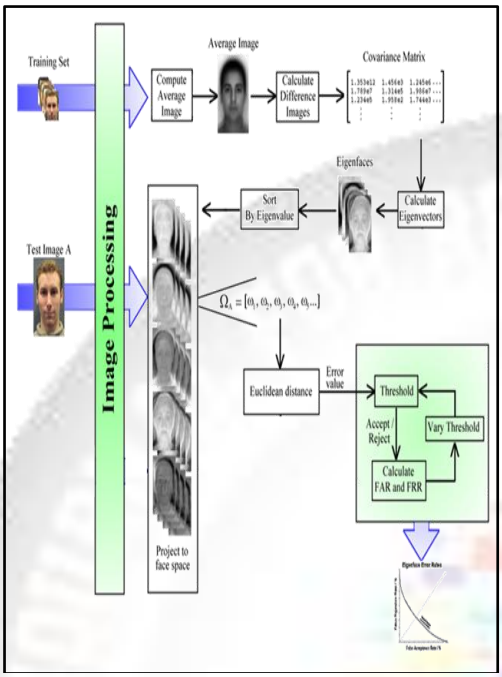


Figure 1.2: Eigen faceapproach

This is the existing approach of Eigen face. It basically uses the captured image and finds the average face from it then it will calculate the covariance matrix to find the difference of the images .it will then calculate the eigenvectors and eigenvalues for the given image. then when a new image will come for the comparison it will directly check the Euclidean difference between the two images and based on the value of threshold it will identify whether the face is matched or not. And accordingly it will give result based on false acceptance Rate and False Rejection Rate.

The Result For the Approach is looks like this...

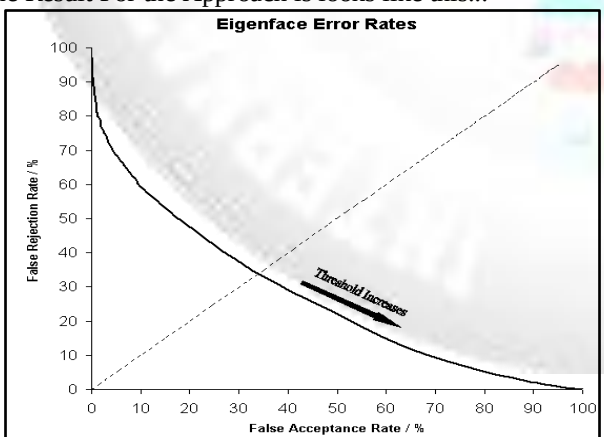


Figure 1.3. Ratio Of FAR & FRR

– FAR: The percentage of distance measures below the threshold, when images of different people are being compared.
– FRR: The percentage of distance measures above the threshold when images of the same person are being compared. By varying the threshold we obtain error rate pairs describing a curve. The EER is used to compare pre-processing techniques. However, it should not be used as a guideline to the system performance in a real world situation.

This approach has several limitations and that limitations may be overcome using the new modified algorithm and that is my proposed algorithm explained below.

### *A. Proposed Eigen face Approach*

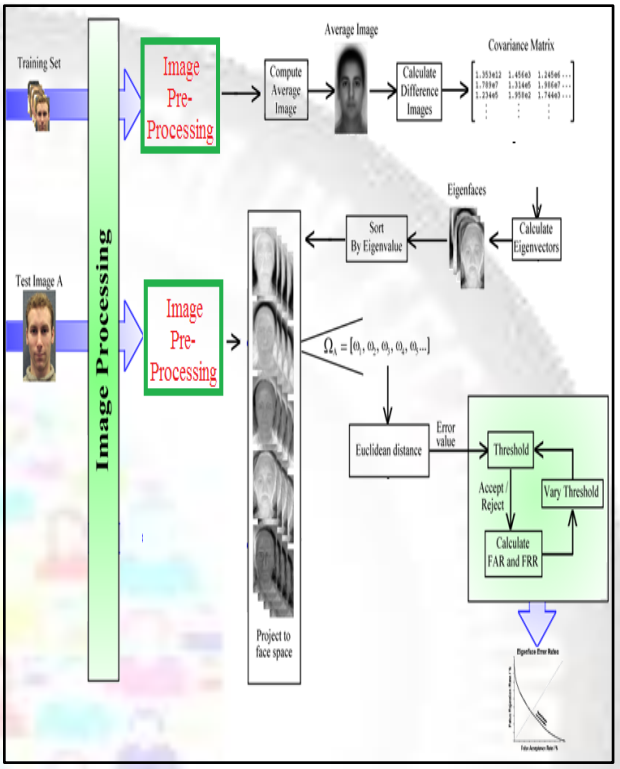


Figure 1.4: proposed Eigen face approach

This is the proposed approach that is almost remains as it is in normal approach the only change is that before calculation the average face and eigenvalues of any images we are going to normalize the image. By normalizing the base image we can improve theaccuracy of any image and the quality of the image. So whenever we willsupply that image to a face recognition algorithm then it can give better result than the normal unprocessed image.

## IV. FACE PRE-PROCESSING APPROACHES

If preprocessing techniques are applied before Eigen face approach implemented on image, by normalizing the base image we can improve the accuracy of any image and the quality of the image.

For the normalization purpose we can apply several approaches on a base image some of them are explained Below

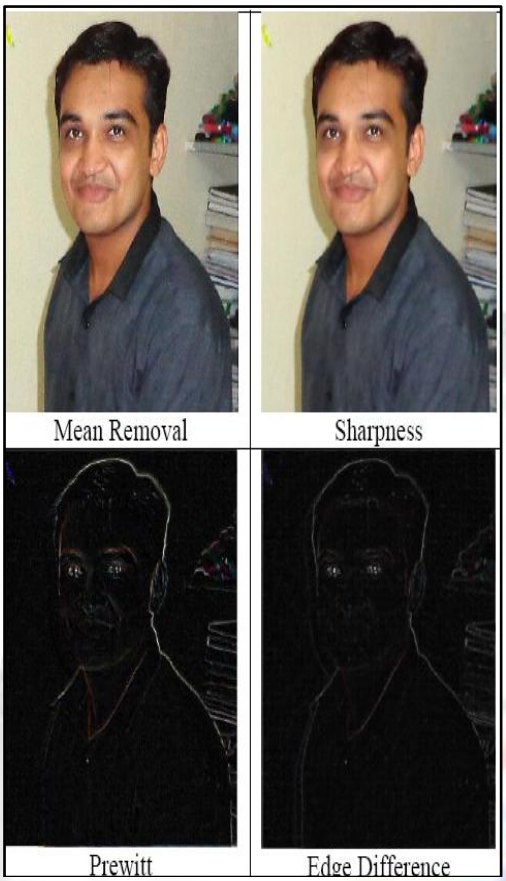


Figure 1.5: processed images

*A. Expected Output after Pre-Processing*

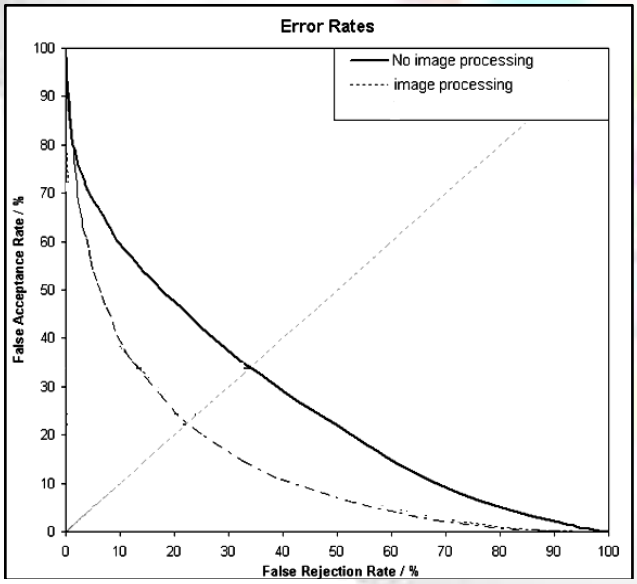


Figure 1.6.: expected output

Some of the Research papers suggest that if we increase the quality of the image by pre-processing then we can decrease the error rate.

For the Implementation purpose Opencv And Luxand Client Vision library are used. Some of the important function code is given below.

## V. CONCLUSION

Face recognition is a challenging problem in the field of image analysis and computer vision that has received a great deal of attention over the last few years because of its many applications in various domains. Research has been conducted vigorously in this area for the past four decades or so, and though huge progress has been made, encouraging results have been obtained. So By the reference of experiment and all the literature survey we can conclude that if we apply and preprocessing technique on the Eigen face algorithm then we can surely increase the accuracy of the Eigen face algorithm and improve the face recognition approach.

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