Occlusion Detection and Recognizing Human Face using Neural Network

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***Abstract*— Face recognition is one of the most important problems of verifying or identifying a face from query image or input image. This system has emerged as an important field in case of surveillance systems. Face detection is a very powerful tool for video surveillance, human computer interface, face recognition, and image database management. Occlusion means extraneous objects that hinder face recognition, e.g., face covered with scarf, wearing glasses, beard, cap etc., is one of the greatest challenges in face recognition systems. Other issues are illumination, pose, expressions etc. An efficient method is used for detection of occlusions, which specifies the missing information in the occluded face. Method used for face detection is Viola-Jones algorithm, for occlusion detection and reconstruction of face fast weighted PCA is used are Neural Network (NN) is used for face recognition. Other appropriate methods are Principal Component Analysis (PCA), Local Binary Pattern (LBP), Eigenfaces. Propose method which is used will detect occluded face and recognize the face with the help of given same faces from the database.**

***Keywords*— Neural Network (NN), Principal Component Analysis (PCA), Fast Weighted PCA (FWPCA), Viola – Jones.**

I. INTRODUCTION

Human often uses faces to recognize individuals. Face detection and alignment are essential to many face applications, such as face recognition and facial expression analysis [1].

Advancement in computing capabilities over the years now enables similar recognition automatically. Recognizing face is a pattern recognition task usually performed on human faces. Humans are very good at recognizing faces and complex patterns [1].

Face recognition problem can be used for both identification and verification. Today, recognition technology is applied to a wide variety of problems like passport fraud, human computer interaction and support for law enforcement. This has motivated researchers to develop computational models to identify faces, which are relatively simple and easy to implement [2].

Occlusion is defined as an Obstacle or any unnecessary-object in image disturbing the matching sometimes called recognizing process. Occlusion in an image refers to barrier (interference) in the view of an object. Occlusion observed can normally be of two types: natural as well as synthetic [4].

Figure 1 Examples of occluded face images from different sources [3]

Figure 1 illustrates the different occluded faces images which have different background and are also different parts covered of the face.

Natural occlusion indicates to obstruction of views between the two image objects without any intension while synthetic occlusion refers to artificial blockade of intentionally covering the images view with a white/black solid rectangular block. In many areas of image processing, Partial occlusion has been observed. Even in real time application face image intentionally becomes occluded via accessories such as [4]:

- Wearing Glasses, face covered with scarf, hat, Face on Hand.
- Dirt on face, Face behind Fence, Texture on Face images, etc [5].

Structuring of remaining paper is as follows. Section II classifies proposed system for occluded face detection and recognition. Section III shows experimental result for occlusion detection and recognition. Furthermore, Section IV shows conclusion and future work of paper.

II. PROPOSED SYSTEM

This section discusses the proposed approach that has been used for occluded face detection and recognition. The following diagram shows the steps involved in face detection and recognition process.

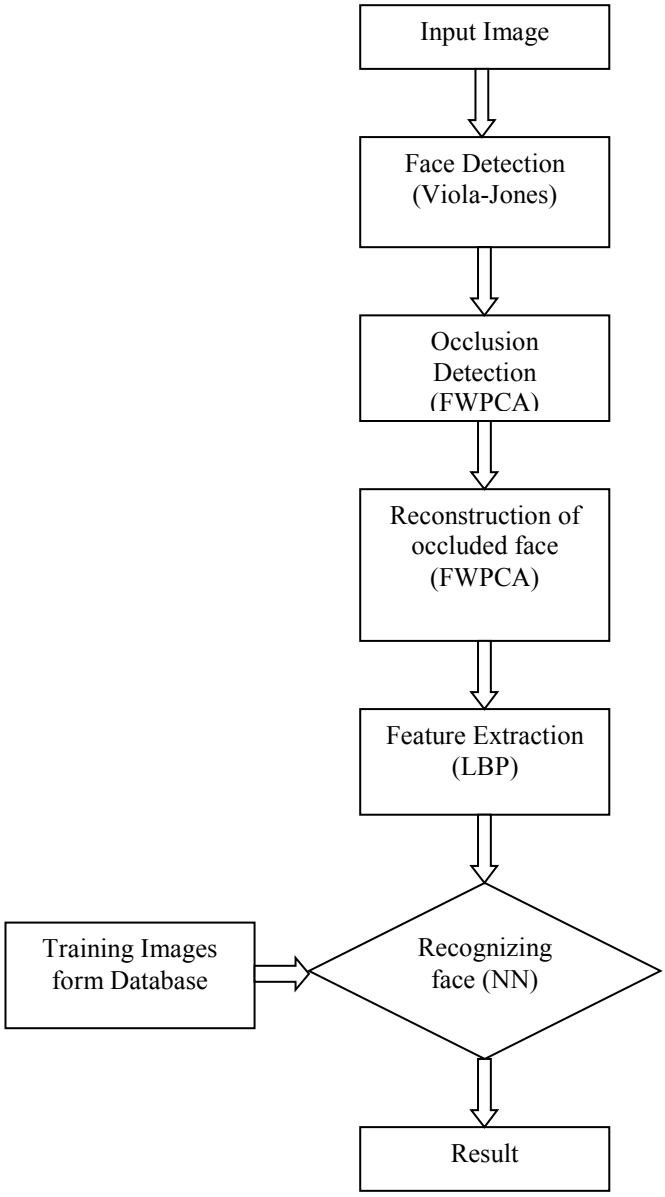

Figure 2 Proposed system of face recognition and recognition

Firstly, face detection is done on the input image. Then, occlusion is detected and reconstruction of face is done, features are extracted with the help of certain techniques and then recognition techniques are applied. And lastly, output verification or identification is done.

Step 1 Face Detection: Detect face from the input image.

Step 2 Occlusion Detection: After detecting face form the input image, it will detect the occluded face by applying fast weighted principal component analysis method.
Reconstruction of occluded face image: After occlusion is detected it will restore occluded regions in face image.

Step 3 Feature Extraction: Feature extraction is used to compare features like skin color, color of eye, etc. For feature extraction local binary pattern method is used which will recognize facial features.

Step 4 Recognizing occluded face: Here Neural Network is used to recognize face and give the resultant image by comparing faces from given database.

III. EXPERIMENTAL RESULT

This section describes experimental result of occluded face recognition after detecting the face.

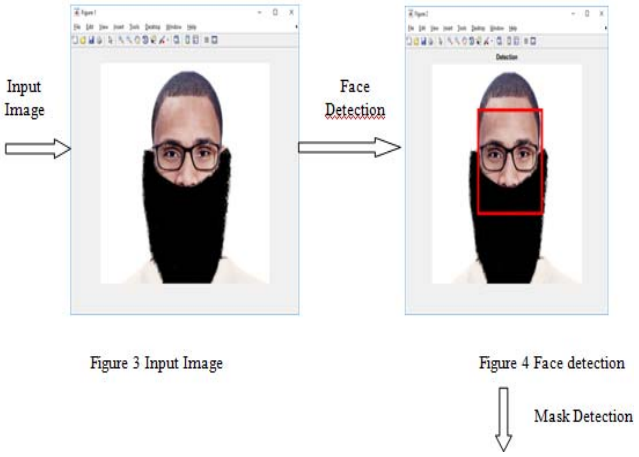

Figure 3 Input Image

Figure 4 Face detection

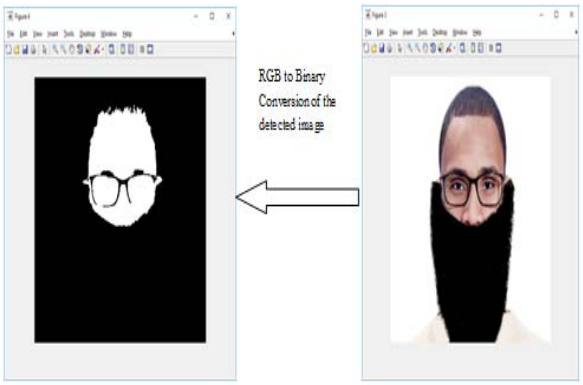

Figure 6 RGB to Binary conversion

Figure 5 Mask Detection

Eye
detected

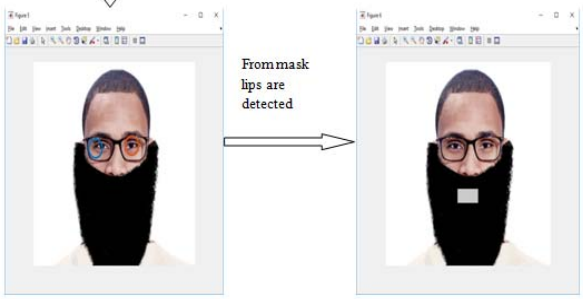

Figure 7 Eyes detected

Figure 8 from mask lips are detected

Triangular portion
shows reconstruction of
face from the eyes and
lips location

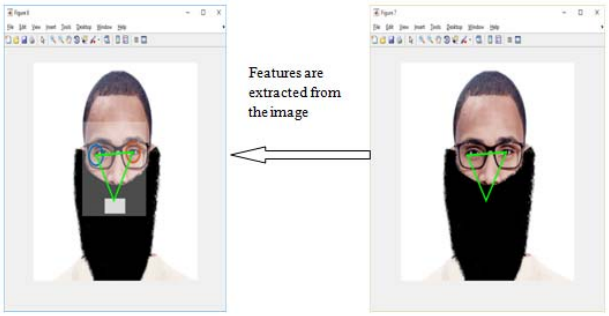

Figure 10 feature are extracted

Figure 9 reconstruction of occluded face

Comparison of input
image with different
faces from the training
database

Comparing greyscale image with the graph of
original image to match the content of input image

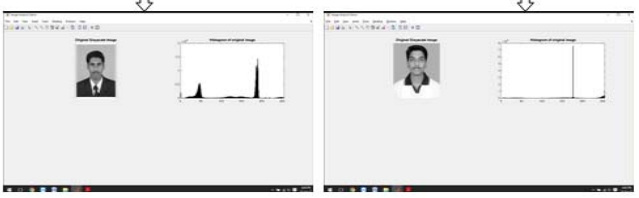

Figure 11 (a)

Figure 11 (b)

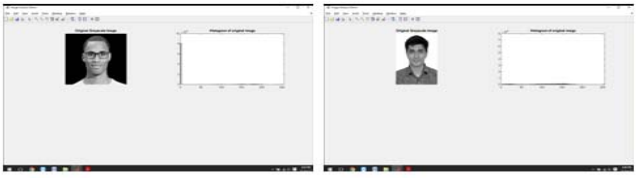

Figure 11 (c)

Figure 11 (d)

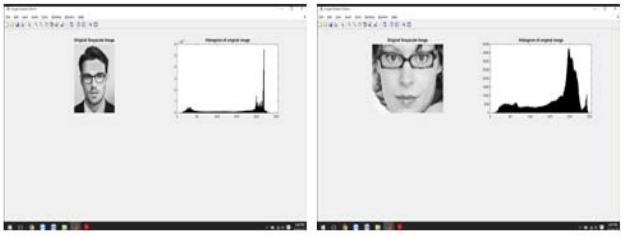

Figure 11 (e)

Figure 11 (f)

Figure 11 (a-f) shows comparision of input image with training database

By comparing images from database it generates
pattern to recognise original image

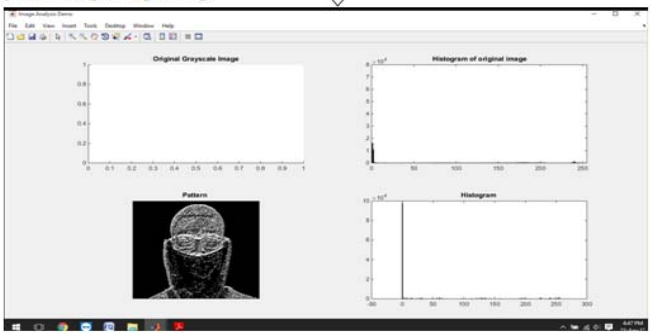

Figure 12 generates pattern to recognise original face

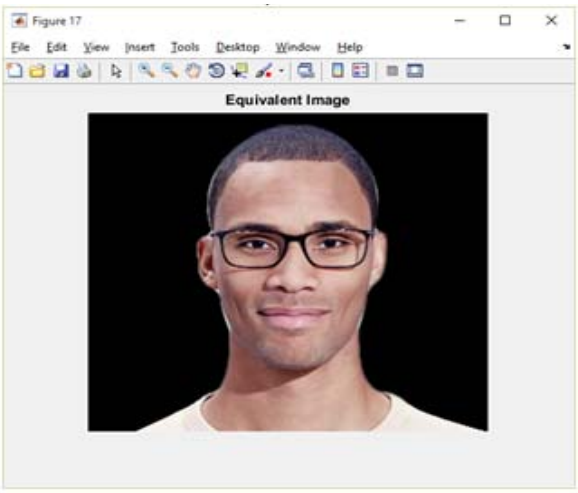

Figure 13 equivalent output image

Comparison table:

Table 1 shows accuracy and false alarm rate of different methods

Method	Accuracy	False alarm rate
Eigenfaces	16.6%	83.4%
Fisherfaces	85%	15%
SVM	66.32%	33.68%
LDA	88.1%	11.9%
NN	95%	5%

Accuracy refers to how closely the measured value of a quantity corresponds to its "true" value and according to our proposed flow design effective implementation and getting 95% accuracy with trail multiple times execution with 5% false alarm rate.

By comparing recognition accuracy with existing system, following results are obtained:

Table 2 shows the accuracy and false alarm rate of existing and proposed system

Method	(Existing system) Accuracy	(Existing system) False alarm rate	(Proposed) Accuracy	(Proposed) False alarm rate
NN	87.2%	12.8	95%	5%

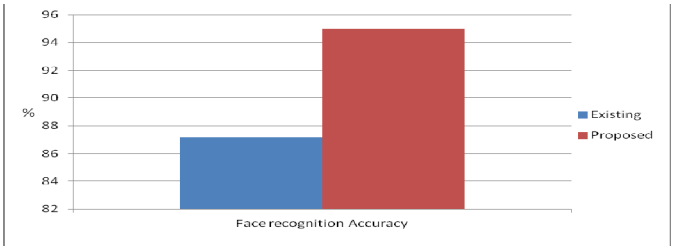

Figure 14 face recognition accuracy

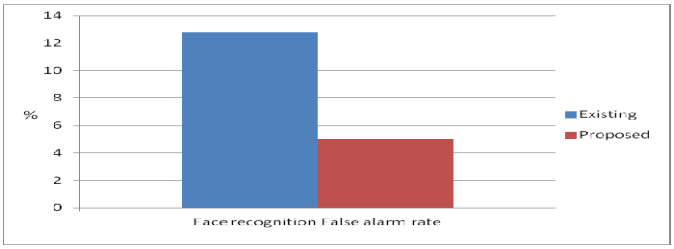

Figure 15 face recognition false alarm rate

IV. CONCLUSION

Human often uses faces to recognize individuals. Face detection and alignment are essential to many face applications, such as face recognition and facial expression analysis. Today, recognition technology is applied to a wide variety of problems like passport fraud, human computer interaction and support for law enforcement. As seen from above results, the proposed scheme provides better accuracy than existing system, and accurately detects and recognizes occluded face. Also work on different parameters like structural similarity index and feature similarity index for prove system better. Further I am trying to work on low intensity images and side view image.

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