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Implementing Banking and Payment System using Face Detection and Recognition Method

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Abstract:- Face Recognition is an active topic for research and development in the field of biometric and pattern recognition. A lot of research has been done since last few years and this topic has a great potential for future research and development in various applications as well. Among the various application like insecurity, criminal identification, healthcare etc. This technology can be very helpful in various payments and banking systems. The objective of this paper is dedicated in the further research of implementing face recognition technology for the application in the field of banking and various payment systems. In this paper, we present a method useful for the proposed application area.

Keywords:- *PCA, SIFT, Face Recognition, Viola-Jones.*

I. INTRODUCTION

Biometric identification is a technique of identifying a person by his/her either physical or behavioral characteristics. For the purpose of security and more authentication this method is preferred over traditional method. Biometric identification works on the basis of pattern recognition technique in which the stored data set is compared with feature set stored in the database. [1]Facial recognition comes under physiological biometric identification. Despite the other biometric methods, face recognition is a non-contact way method as the person does not have to interact with the system. Face recognition system is a three step process. The three steps are Face detection, Feature extraction and Face recognition. [2]. Face detection is a first step in this process. It detects the location of the face from the input image. Then after the face is being detected features are extracted from the input image. These features including some face regions, different variations and angle of the faces. Feature extraction is an important step as the extracted facial features are useful in tracking and recognizing emotions from the face. [3] And lastly, the face is recognized from the input image with the help of detected location and extracted features from the image.

For detecting and recognizing the faces from the sample images there are some problems that have to be covered. Some of the problems are different pose variations, occlusion, various facial expressions, light and a dark background etc. [4] Different pose variation occurs when the angle of the camera is not still. The problem of occlusions happens when the face is partially covered with any of the object, some difference in the background of the images and such other problems. So for detecting faces from the images, the sample images must be free from such problems. [5]. There are various sectors where this technology is already serving like security, law enforcement, identifying criminal, for advertising and marketing brands, medical line, student and employee management system etc. But there is one another sector where this technology can be very helpful. The future of facial recognition can be seen in using various payments and banking systems. As, in these cases we can use our face as a currency wherever we want to make any payments or either in the banks or ATMs for queries like cash withdrawal or any other. Let suppose, at any checkout counter in the mall or any restaurants where we pay either using cash or by using any credit or debit cards. Here we can use our face as a currency instead of using any cash or cards. We can use our face as pin numbers or passwords and we can pay by scanning our face and the amount will be deducted from our banks as we do with our credit or debit cards. In fact, this technique is more powerful and secure as we don't need to carry any cash or cards with ourselves. So, using facial recognition system in such applications can be a great future of research in this field.

II. RELATED WORK

Priyanka Wagh et al. presented an automatic face recognition and detection-based attendance system for classroom attendance. For the detection purpose they used Viola-Jones method and for the recognition process they used Eigenface method. [6]Kim et al. presented a method for feature extraction which was based on Kernel PCA. They used polynomial KPCA to measure the space of input pixels which will lead to pattern for face. They used ORL database and to perform the face recognition process they used SVM method on ORL database [7]. Gan et al. researched on the normalization and they compared the improved method with traditional PCA. In their paper they worked on the normalization of within class face image and they presented an improved method for this and then they compared these two methods as their results showed functions that process sample inputs with same and different class. [8]. Timotius et al. proposed new method by combining two algorithms KPCA and SVM. KPCA method was applied to extract features from the input sample images. SVM was used for the classification

of the images and then the comparison was done with other applied methods and the results showed that mixing these two algorithms performed better than other used methods. [9]Z. Fan et al. worked on improved LDA method, and the performance of this method was better as the algorithm trains very small portion of the training set before testing samples. This methodology works better when global data structure is not consistent with the local data structure and this method is more appropriate for the databases that are large and input data dimensions are also high. [10]Mohammad A. U. Khan et al. Proposed method for face recognition based on the core method PCA and directional Filter bank responses. By using the original data sample image, directional images are created with the help of DFB and then converted into eigen value. And as result, the average recognition rate is enhanced by using directional images as inputs. [11]Akrouf Samir et al. proposed hybrid method for face recognition process by combining PCA and DCT. Basically, the initial data is encoded to pass to different space of dimensions and reducing the data dimensions by storing only useful information. [12]

III. PROPOSED METHODOLOGY

To implement a Face Detection and Face Recognition technique, we proposed method using appropriate algorithms which are apt for using various differences like different hair style, eyes and lips angle, different beard style, make-up and accessories and with and without specs. The algorithm being used are Viola-Jones, PCA and SIFT.

A. Face Detection

For the face detection process, the algorithm applied is Viola-Jones method. This method is used to detect the faces from the input data images. The reason of choosing this method is because of its high detection rate and also because of its fast and robust properties it is more efficient for real time application. This method was proposed by Paul Viola and Michael Jones in 2001 and it was considered as first object detection method that provide object detection in real time. [13] For the object detection, it basically has three main concepts that helps to run this method in real time. These concepts are Integral Image, Ada boost, Cascade Structure. The base of this method for detection is computing Haar features. So, basically Haar like features are the rectangle patterns present in data image and cascade is a series of these "Haar-like features" that all are combined together to form a classifier [15].

B. Face Recognition

After detecting faces from the images with the help of Viola Jones method, the process of face recognition has to be done.

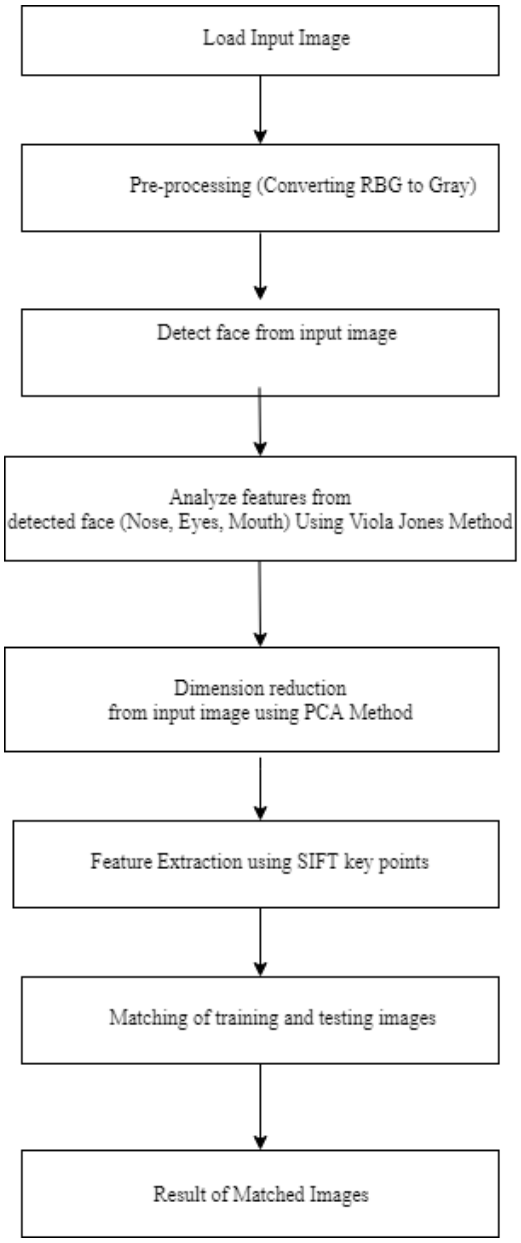

Fig 1:- Flow Chart of proposed Method

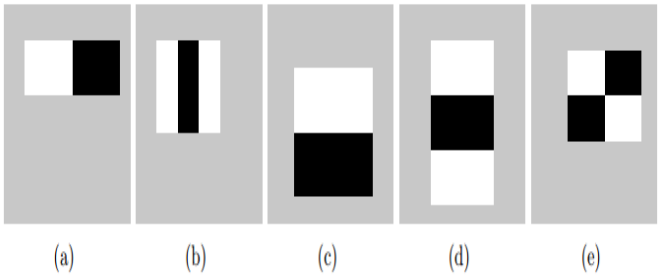

Fig 2:- Haar-like features with different sizes and orientation [14]

For this step, we are using PCA (Principle Component Analysis) and SIFT (Scale Invariant Feature Transform).Principle Component Analysis is generally the most used and applied method for face recognition. The reason this method is widely used is because of its property of dimension reduction. And here, also it is used for dimension reduction and feature selection by reducing and compressing the image that provide low dimension of the image. [16]In this method the input images are treated as vector which is in high dimension and then PCA is used to generate new image vector with low dimensions. By using dimension reduction process it removes the useless information and then converts into eigenface. So, eigenfaces are actually the principle components that convert the detected face into feature vectors. As the eigenface works on the pixels of the image, the accuracy of this method depends upon the varying lighting intensity of the image. Eigenfaces make the algorithm very efficient but at the same time, the drawback is that this method is sensitive for light and intensity of the background. [17]
SIFT (Scale-Invariant Feature Transform) is a method which is invariant for scaling, rotation, and lighting condition. [18] In this method, there are 4 steps. The first stage creates the key points by using Gaussian function. Then, the candidate points are used for pixel accuracy and if it is found unreliable then they are removed. Then the final key points are extracted then, with the help of minimum and maximum pixel values neighboring pixels that are the key points are located. [19]

IV. RESULT AND ANALYSIS

In our experiment, we have used images with different color variations, black / white and colored background and with variations in hair, beard, and lip and eye angle. The dataset contains images with resolutions of 480 x 480 pixels. The testing set contains variety of background, illumination, gender and the sample images used are real world images.

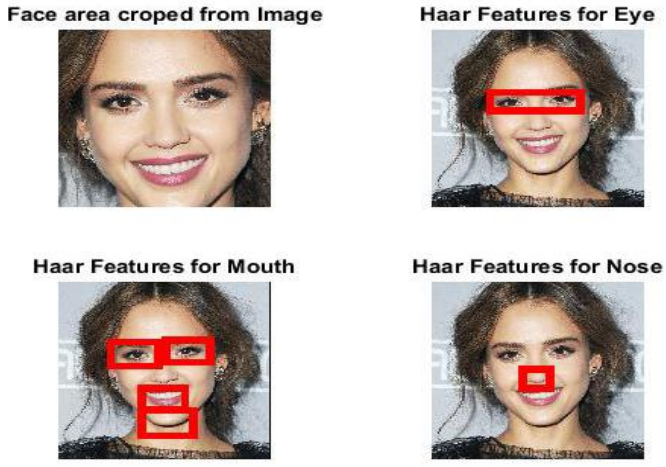

Fig 3:- Face identified from the image and face parts are identified from Viola-Jones Method.

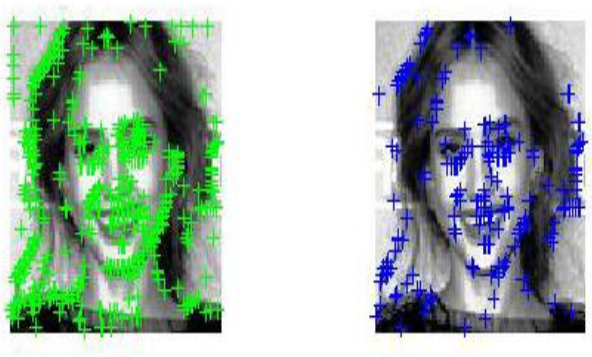

Fig 4:- SIFT Features extracted from the image.

The accuracy the experiment of detecting and recognizing faces is compared with other existing methods as shown in Fig. 5. Using the PCA alone is having accuracy less than all the other methods compared. The proposed method of in which Viola-Jones used for detection and then fusion of PCA and SIFT gives better results than other compared methods.

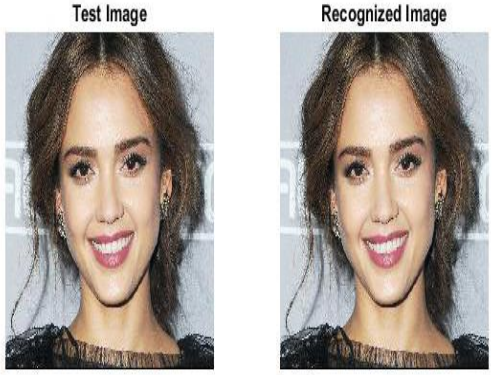

Fig 5:- Result by matching the image from the database.

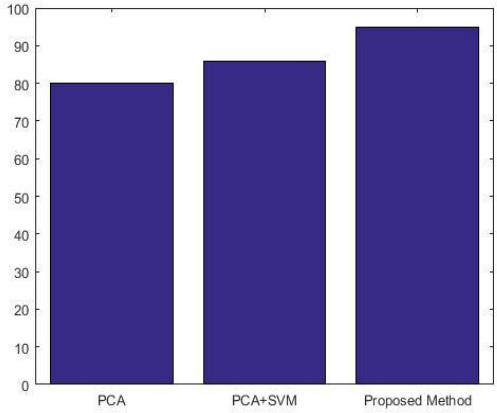

Fig 6:- Comparison of Proposed method with other methods

V. CONCLUSION

Face recognition is a type of biometric systems which is having a large number of applications. In this paper, we discussed about the application of face recognition in payments and banking systems. This paper presented an efficient method for implementing face recognition to the discussed area. The performance of the proposed method is compared with other existing methods and we observed that using Viola Jones method for the face detection step and then combining the method like PCA and SIFT for face recognition step gives the better results.

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