IOSR Journal of Computer Engineering (IOSR-JCE)
e-ISSN: 2278-0661,p-ISSN: 2278-8727
PP 31-35
www.iosrjournals.org

A Novel Technique for Face Identification

Mr.Vijayamahantesh S. Kanavi[1], Prof. K. B. Pawar[2], Prof. Shweta Patil[3]
[1] *Freelancer, Gadag, Karnataka,India*
[2,3] *Assistant Professor Department of Information Science and Engineering,*
B.L.D.E. Associations V. P. Dr P. G. Halakatti College of Engineering and Technology, Vijayapur, Karnataka, India

Abstract: *This paper presents a correspondence measure method based on novel method which combines a permutation of Voila Jones Face Detection method and Eigen Face Recognition (Identification) technique. The proposed strategy used to defeat the issue of low precision by adjusting the face using Voila Jones Face detection method followed by Eigen Face Recognition technique. Compared to other Face Detection methods, the proposed method is very efficient for the Face Detection purpose. The system is built to meet real time face recognition criteria.*

Keywords: *Eigen faces recognition (Identification) technique, Low Precision, Voila Jones Face detection method*

I. Introduction

The face plays a major role in our social intercourse in conveying identity and emotions. The human ability to recognize faces is remarkable. We can recognize thousands of faces learned throughout our lifetime and identify familiar faces at a glance even after years of separation. The skill is quite robust, despite large changes in the visual stimulus due to viewing conditions, expressions, aging, and distractions such as glasses or changes in hairstyle. But developing a computational model of face recognition is quite difficult, because faces are complex, multidimensional, and subject to change over time [5]. Typical applications of Face Recognition System are : Human-Robot-interaction, Human-Computer-interaction, Driver‘s license, Smart cards, National ID, Passports, Voter registration, Security system, Criminal identification, Personal device logon, Desktop logon, Information security, Database security, Intranet security, Internet access, Medical records Video surveillance, CCTV control and Suspect tracking and investigation[5].

A face detector has to tell whether an image of arbitrary size contains a human face and if it is so, where it is. One natural framework for considering this problem is that of binary classification, in which a classifier is constructed to minimize the misclassification risk. Since no objective distribution can describe the actual prior probability for a given image to have a face, the algorithm must minimize both the false negative and false positive rates in order to achieve an acceptable performance. This task requires an accurate numerical description of what sets human faces apart from the other objects. It turns out that these characteristics can be extracted with remarkable committee learning algorithm called Adaboost, which relies on a committee of weak classifiers to form a strong one through a voting mechanism. A classifier is weak if, in general, it cannot meet a predefined classification target in error terms. An operational algorithm must also work with a reasonable computational budget [4]. Techniques such as integral image and attention cascade make the Viola-Jones algorithm highly efficient: fed with a real time image sequence generated from a standard webcam, it performs well on a standard PC.[3]. Face recognition is an active area of research since 1980s. It is one of the most successful and important applications of image analysis and processing.

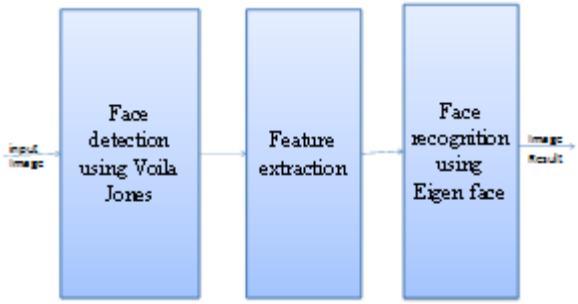

Figure 1: Block diagram of proposed system

II. Related Works

An Eigen faces approach which represents a PCA method in which a small set of significant features are used to describe the variation between face images [1].Face recognition algorithms are divided into three categories, Geometric feature based methods, where the significant facial features are detected and the distances among them as well as other geometric characteristics are combined in a feature vector for face representation [13]. Template based methods, which are the most popular technique used to recognize and detect faces, use a feature vector that represents the entire face template rather than only the most significant facial features. Model based methods, where a mathematical model is fitted for each face and models are compared in recognition process [13]. Eigen face approach is one of the earliest appearance-based face recognition methods, which was developed by M. Turk and A. Pentland in 1991. This method utilizes the idea of the Principal Component Analysis (PCA) which decomposes a face image into a small set of characteristic feature images called Eigen faces and recognition **(Identification)** 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 [5].

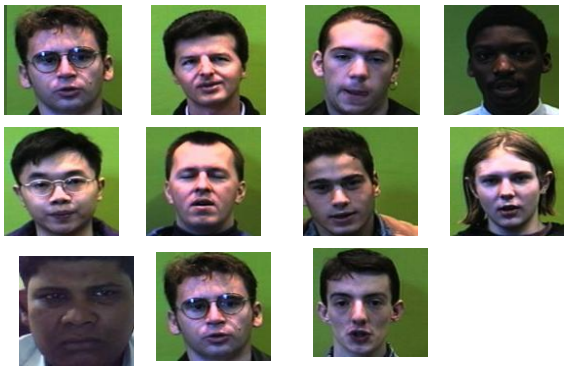

Figure 2: Images from test database

III. Proposed Algorithm

Most of the works are being proposed so far on database images. Database images, faces are already aligned and background information is minimalistic. Therefore recognition **(Identification)** accuracy is quite high. However when such systems are modelled in real time, accuracy decreases significantly. With a specific end goal to conquer this issue of low precision we have propose another framework here to adjust the face utilizing Voila Jones Face discovery strategy [4] followed by Eigen face recognition technique. The system is built to meet real time face recognition criteria.

In the method proposed by Viola and Jones, each weak classifier could at most depend on a single Haar feature. The algorithm simply performs an exhaustive search using a sliding window, using different sizes, aspect ratios, and locations. The classification scheme used by the Viola-Jones method is actually a **cascade** of **boosted** classifiers. Each stage in the cascade is itself a strong classifier, in the sense it can obtain a really high rejection rate by combining a series of weaker classifiers in some fashion. In the method proposed by Viola and Jones, each weak classifier could at most depend on a single Haar feature.

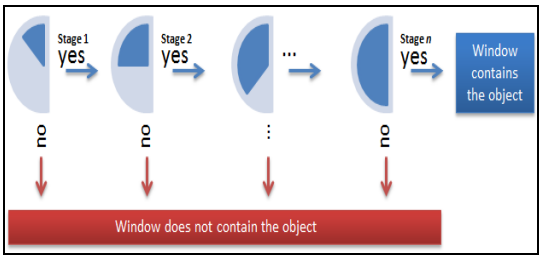

Figure 3: A cascade of classifiers

Eigen face is one of the most thoroughly investigated approaches to face recognition. It is also known as Karhunen- Loève expansion, Eigen picture, Eigen vector, and principal component. Any face images could be approximately reconstructed by a small collection of weights for each face and a standard Eigen picture. The weights describing each face are obtained by projecting the face image onto the Eigen picture or the face picture.

Algorithm is based on applying the Voila Jones algorithm for detection of facial characteristics and then the features are extracted using mean and the covariance matrix. The Eigen vectors and Eigen values of the covariance matrix are calculated. Now we will be having the feature vectors. Voila Jones the algorithm simply performs an exhaustive search using a sliding window, using different sizes, aspect ratios, and locations. The block diagram is as shown in Figure 1

Method for Eigen Face technique consists of the following steps:

1. Get Facial data
2. Subtract the mean
3. Calculate the covariance matrix
4. Calculate the Eigenvectors and Eigen values of the covariance matrix.
5. Choosing components and forming a feature vector
6. Deriving the new data set

IV. Results

In this work we have combined both of these techniques to propose unique real time face recognition **(Identification)** system. Accuracy for database faces is 100%. Face detection efficiency is about 98% and is neutral to intensity and angles. This can be further improved by incorporating techniques to compensate for lighting and intensity variations.

Role of Algorithm is shown with the help of GUI

The GUI (Graphical User interface) used to browse the image is as shown in figure

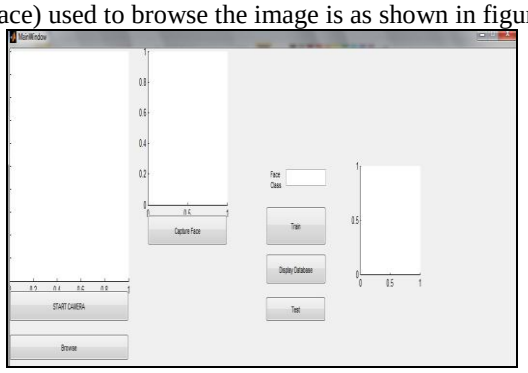

Figure 4: GUI

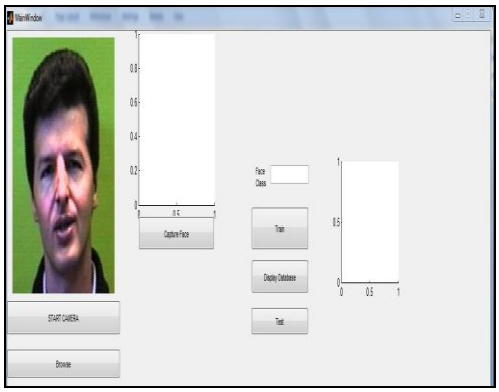

Figure 5: After taking image from database

After selecting the image the image is captured and it is shown as in figure

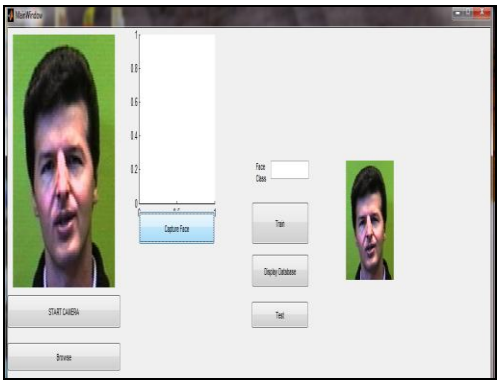

Figure 6: After capturing the image

Once the image is captured and training is done, the image for testing is browsed from the testing database and if the image is matched then the result will be shown as "recognized image".

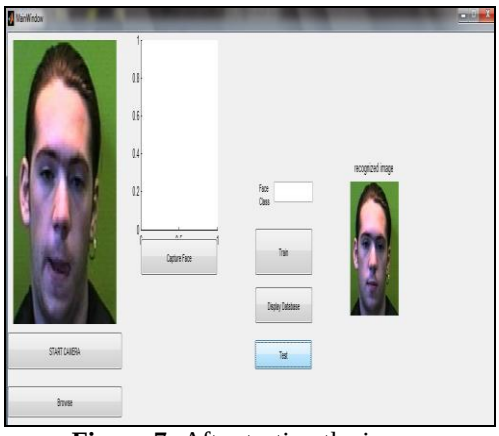

Figure 7: After testing the image

V. Conclusion

This paper proposes a novel technique for face detection and recognition **(Identification)** by combining two of the most popular techniques in this direction. Voila Jones method comes directly ported in almost all firm wire and software dealing with computer vision. Similarly Eigen face recognition technique has been existent for long. In this work we have combined both of these techniques to propose a unique real time face recognition system. Accuracy for database faces is 100%. Face detection efficiency is about 98% and is neutral to intensity and angles. This can be further improved by incorporating techniques to compensate for lighting and intensity variations.

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About the Authors

Mr.Vijayamahantesh S Kanavi is a freelancer, worked as an Assistant Professor in Department of Computer Science and Engineering,KLE Institute of Technology, Hubballi, Karnataka, India. Completed Master of Technology (M.Tech) from Basaveshwara College of Engineering, Bagalkote, Karnataka, India.

Prof. K. B. Pawar. is been working as an Assistant Professor in Department of Information Science and Engineering, at B.L.D.E. Associations V. P. Dr P. G. Halakatti College of Engineering and Technology, Vijayapur, Karnataka, India. Completed Master of Technology (M.Tech) from Basaveshwara College of Engineering, Bagalkote, Karnataka, India.

Prof .Shweta. Patil is been working as an Assistant Professor in Department of Information Science and Engineering, at B.L.D.E. Associations V. P. Dr P. G. Halakatti College of Engineering and Technology, Vijayapur, Karnataka, India. Completed Master of Technology (M.Tech) from Basaveshwara College of Engineering, Bagalkote, Karnataka, India.