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# Multiple Face Detection Using Image Processing In Python And Open cv

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***Abstract*—** *Face detection and recognition from an image or a video is a popular topic in biometrics research. Face recognition technology has widely attracted attention due to its enormous application value and market potential, such as real-time video surveillance system. It is widely acknowledged that the face recognition has played an important role in surveillance system as it doesn't need the object's co-operation. We design a real-time face recognition system based on IP camera and image set algorithm by way of OpenCV and Python programming development. The system includes three parts: Detection module, training module and recognition module. An application for automatic face detection and tracking on video streams from surveillance cameras in public or commercial places is discussed in this project.*

***Keywords:*** *Face Recognition, PCA Algorithm, Gray Scale Algorithm, Eigen faces*

## I. Introduction

Human identity recognition has been evolved hugely with time and we use various body characteristics to identify like fingerprints, iris scans and face etc. Face recognition is widely popular nowadays due to the increase of use in modern smartphones and laptops. For facial recognition the most basic steps are to detect faces and then recognize the person. Face Detection where a photo is searched to find a face, then the image is processed to crop and extract the person's face for easier recognition. Face Recognition where that detected and processed face is compared to a database of known faces, to decide who that person is. Face recognition however is much less reliable than face detection, with an accuracy of 30-70% in general[1]. Open CV uses c/c++ library functions which directly provides the computer with the machine language code and hence helps in faster execution. Using OpenCV results in more utilization of time and resources in image processing and less in interpreting[2]. In Python we use a Library called Pillow which is used for image processing in face recognition technology. In recent decade, a number of algorithms for face recognition have been proposed [3], but most of these works deal with only single image of a face at a time. By continuously observing of face information, our approach can solve the problem of the face detection, and improve the accuracy of face recognition. All of this makes face recognition ideal for high traffic areas open to the general public, such as: Airports and railway stations, Corporations, Cashpoints , Stadiums, Public transportation, Financial institutions, Government offices, Businesses of all kinds[4].Here we also use Haar cascades that is widely used in face recognition. Haar cascades makes use of the image subtraction morphological process to detect the face. In this the cascades of different images of the same person is taken and recorded in the database. All the pixels in the influence of white region are subtracted from all the pixels in the influence of black region[]. Face recognition and detection can be achieved using technologies related to computer science. Features extracted from a face are processed and compared with similarly processed faces present in the database. If a face is recognized it is known or the system may show a similar face existing in database else it is unknown. In surveillance system if a unknown face appears more than one time then it is stored in database for further recognition. These steps are very useful in criminal identification. In general, face recognition techniques can be divided into two groups based on the face representation they use appearance-based, which uses holistic texture features and is applied to either whole-face or specific face image and feature-based, which uses geometric facial features (mouth, eyebrows, cheeks etc), and geo-metric relationships between them.

Biometrics is used in the process of authentication of a person by verifying or identifying that a user requesting a network resource is who he, she, or it claims to be, and vice versa. It uses the property that a human trait associated with a person itself like structure of data with the incoming data we can verify the identity of a particular person [1]. There are many types of biometric system like detection and recognition, iris recognition etc., these traits are used for human identification in surveillance system, criminal identification, face details etc. By comparing the existing fingerprint recognition

## II. Literature Review

This section gives an overview on the major human face recognition techniques that apply mostly to frontal faces, advantages and disadvantages of each method are also given. Eigen face is one of the most thoroughly investigated approaches to face recognition. It is also known as Karhunen Loève expansion, eigen picture, eigenvector, and principal component. References [26, 27] used principal component analysis to efficiently represent pictures of faces.

They argued that any face images could be approximately reconstructed by a small collection of weights for each face and a standard face picture (eigen picture). The weights describing each face are obtained by projecting the face image onto the eigen picture. Reference [28] used Eigen faces, which was motivated by the technique of Kirby and Sirovich, for face detection and identification. In mathematical terms, eigen faces are the principal components of the distribution of faces, or the eigenvectors of the covariance matrix of the set of face images. The eigenvectors are ordered to represent different amounts of the variation, respectively, among the faces. Each face can be represented exactly by a linear combination of the eigen faces. It can also be approximated using only the "best" eigenvectors with the largest eigen values. The best M eigen faces construct an M dimensional space, i.e., the "face space". The authors reported 96 percent, 85 percent, and 64 percent correct classifications averaged over lighting, orientation, and size variations, respectively.

*Linear Discriminate Analysis:*

LDA is a method to find a linear combination of features which characterize or separate two or more classes of objects or events. Linear classifier can be obtained from the resultant. Large number of pixels are used to represent face in computerized face recognition. Before classification Linear discriminate analysis is used to reduce features and makes it more manageable. New dimensions are a linear combination of pixel values which forms a template.

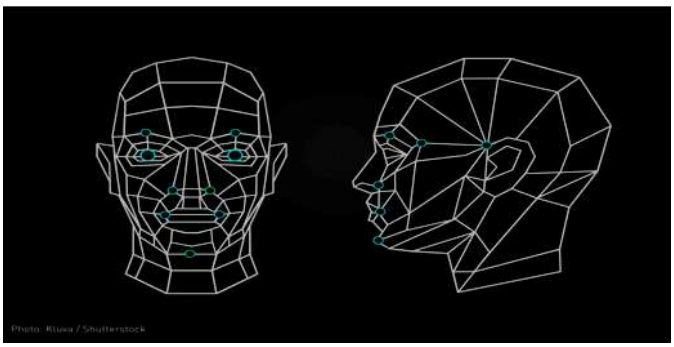
*Principal Component Analysis:*

PCA involves a mathematical procedure that transforms a number of possibly correlated variables into a smaller number of uncorrelated variables Please purchase PDF Split Merge on www.verypdf.com to remove this watermark. 5 called principal components. The variability in the data is accounted by the first principal components and the succeeding components accounts for further variability. For exploratory data analysis and for making predictive models PCA is the most used tool. The calculation of the eigen value decomposition of a data covariance matrix or singular value decomposition of a data matrix is done with the help of PCA. Eigenvector-based multivariate the data is best explained by revealing the internal structure of the data which is considered to be one of the important operations. If a multivariate dataset is visualized as a set of coordinates in a high- dimensional data space (one axis per variable, a lower-dimensional picture is supplied by PCA, a " shadow " of this object is visible when viewed from it's (in some sense) most informative viewpoint.

## III. Proposed Work

*Working Architecture*

To develop a biometric authentication system using facial recognition technique. To make a system for facial recognition using agent faces values.

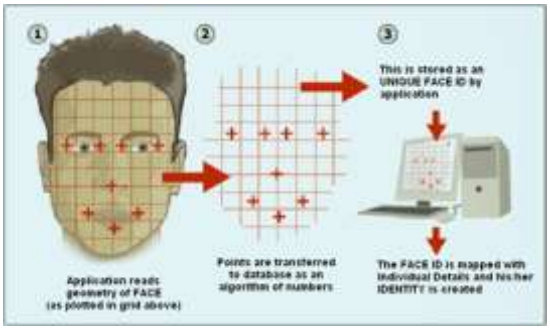


The algorithms and methodologies are studied

*FERET: Face Recognition Technology*

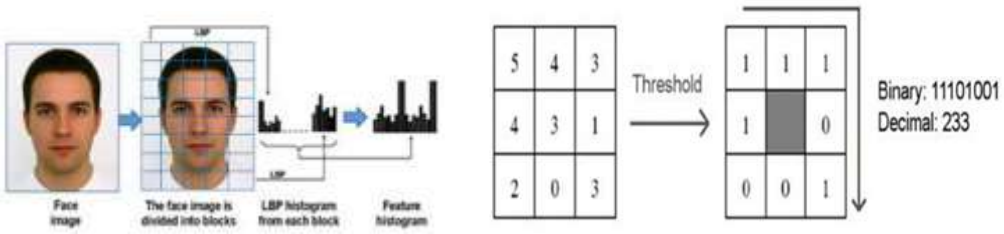
This test was designed to measure performance of algorithms that could automatically locate, normalize and identify faces from a database.

Face images are projected onto face space that encodes best variation among face images.




*LBPH: Local Binary Patterns Histogram*

It does the comparison of pixels in binary formats LBPH converts an image into 3*3 matrix and compares each pixel with the central pixel.




*Eigen Faces:*
It uses PCA for recognition of images which may not correspond to general facial features.

## IV. Conclusion

In this project, face recognition system have been presented using deep learning which exhibits robustness towards recognition of the users with accuracy of 98.3% . The result shows the capability of the system to cope with the change in posing and projection of faces. From face recognition with deep learning, it has been determined that during face detection, the problem of illumination is solved as the original image is turned into a HOG representation that captures the major features of the image regardless of image brightness. In the face recognition method, local facial landmarks are considered for further processing. After which faces are encoded which generates 100 measurements of the captured face and the optimal face recognition is done by finding the person's name from the encoding. In this thesis, we have proposed three novel methods to solve the face recognition problem and a multiple classifier combination strategy for combining multiple modalities.

Several difficulties in an automatic face recognition problem (such as illumination, pose, expression, camouflage etc.) are addressed in our proposed face recognition techniques. The decision combination of face and fingerprint classifiers is attempted to obtain a robust multimodal biometric system. Following is the summary and contributions of the work presented in this thesis

**FACE RECOGNITION TECHNOLOGY**

Facial recognition analyses the characteristics of a person's face images input through a digital video camera. It measures the overall facial structure, including distances between eyes, nose, mouth, and jaw edges. These measurements are retained in a database and used as a comparison when a user stands before the camera. This biometric has been widely, and perhaps wildly, touted as a fantastic system for recognizing potential threats (whether terrorist, scam artist, or known criminal) but so far has not seen wide acceptance in high-level usage. It is projected that biometric facial recognition technology will soon overtake fingerprint biometrics as the most popular form of user authentication [4]. The basic requirement for facial recognition is a camera. Here we use a normal laptop web cam to access the data i.e., face. The web cam will first collect the datasets and then will recognize it. But the main role is done by the Python and OpenCV modules that help the web cam do the things. Here we use a 0.9 Megapixel web cam.

Open cv : OpenCV (Open Source Computer Vision Library) is an open source computer vision and machine learning software library. OpenCV was built to provide a common infrastructure for computer vision applications and to accelerate the use of machine perception in the commercial products. Being a BSD-licensed product, OpenCV makes it easy for businesses to utilize and modify the code.It has C++, Python, Java and MATLAB interfaces and supports Windows, Linux, Android and Mac OS.[5]

*Python*

Python is a popular programming language. It was created in 1991 by Guido van Rossum. It is used for web development (server-side), software development , mathematics, system scripting. Python can connect to database systems. It can also read and modify files. Python can be used to handle big data and perform complex mathematics. Python can be used for rapid prototyping, or for production-ready software development .Python works on different platforms (Windows, Mac, Linux, Raspberry Pi, etc).Python has a simple syntax similar to the English language. Python has syntax that allows developers to write programs with fewer lines than some other programming languages. Python runs on an interpreter system, meaning that code can be executed as soon as it is written. This means that prototyping can be very quick. Python can be treated in a procedural way, an object-orientated way or a functional way[6].

## V. Result

*COMPARISON BETWEEN SINGLE AND MULTIPLE FACES*

| Single face accuracy | Multiple face accuracy |
|---|---|
| 1. 100% | 2. 50% |

The face detection rate referring to a one-person image is 100%.Due to discrepancy in the brightness of one image, when it comes to an image containing two persons the face recognition rate is 88.8%.

The Experimental research illustrates an approach to detect a face by comparing in with the already stored image in database. It captures 100s of image of a person with different angles and then compares it with real-time ones in order to get accuracy. This system is basically used for security purpose, to identify the persons real identity .It compares every detail of persons face (unique details like specific mole, distance between the eyes, eyebrow etc).these are key examination for better proximity about face detection. There is further more research required with unique approach on which we are still working.


*Fig. Eigen Face*

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