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FACIAL RECOGNITION SYSTEM

A Report for the Final Evaluation of Project 2

Submitted by

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GALGOTIAS UNIVERSITY

SCHOOL OF COMPUTING AND SCIENCE AND ENGINEERING

BONAFIDE CERTIFICATE

Certified that this project report "**FACIAL RECOGNITION SYSTEM**" is the bonafide work of "**ASHIRUL HARAMAIN ANSARI (1613101186)**" who carried out the project work under my supervision.

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CHAPTER 1: 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. For face detection, Haar-Cascades were used and for face recognition Eigenfaces, Fisherfaces and Local binary pattern histograms were used.

CHAPTER 2: Introduction

It involves building a system for face detection and face recognition using several classifiers available in the open computer vision library (OpenCV). Face recognition is a non-invasive identification system and faster than other systems since multiple faces can be analysed at the same time. The difference between face detection and identification is, face detection is to identify a face from an image and locate the face. Face recognition is making the decision "whose face is it?" using an image database. In this project both are accomplished using different techniques. The report begins with a brief history of face recognition. This is followed by the explanation of HAAR-cascades, Eigenface, Fisherface and Local binary pattern histogram (LBPH) algorithms. Next, the methodology and the results of the project are described. A discussion regarding the challenges and the resolutions are described. Finally, a conclusion is provided on the pros and cons of each algorithm and possible implementations.

Face Detection using Haar-Cascades: A Haar wavelet is a mathematical fiction that produces square-shaped waves with a beginning and an end and used to create box shaped patterns to recognise signals with sudden transformations. By combining several wavelets, a cascade can be created that can identify edges, lines and circles with different colour intensities. These sets are used in Viola Jones face detection technique in 2001 and since then more patterns are introduced for object detection. To analyse an image using Haar cascades, a scale is selected smaller than the target image. It is then placed on the image, and the average of the values of pixels in each section is taken. If the difference between two values pass a given threshold, it is considered a match. Face detection on a human face is performed by matching a combination of different Haar-like-features. For example, forehead, eyebrows and eyes contrast as well as the nose with eyes as a single classifier is not accurate enough. Several classifiers are combined as to provide an accurate face detection system and the average of the values of pixels in each

section is taken. If the difference between two values pass a given threshold, it is considered a match. Face detection on a human face is performed by matching a combination of different Haar-like-features. For example, forehead, eyebrows and eyes contrast as well as the nose with eyes as a single classifier is not accurate enough. Several classifiers are combined as to provide an accurate face detection system**.**

Eigenface: Eigenface is based on PCA that classify images to extract features using a set of images. It is important that the images are in the same lighting condition and the eyes match in each image. Also, images used in this method must contain the same number of pixels and in grayscale.

Fisherface: Fisherface technique builds upon the Eigenface and is based on LDA derived from Ronald Fishers' linear discriminant technique used for pattern recognition. However, it uses labels for classes as well as data point information. When reducing dimensions, PCA looks at the greatest variance, while LDA, using labels, looks at an interesting dimension such that, when you project to that dimension you maximise the difference between the mean of the classes normalised by their variance . LDA maximises the ratio of the between-class scatter and within-class scatter matrices. Due to this, different lighting conditions in images has a limited effect on the classification process using LDA technique. Eigenface maximises the variations while Fisherface maximises the mean distance between and different classes and minimises variation within classes. This enables LDA to differentiate between feature classes better than PCA. Furthermore, it takes less amount of space and it is faster than other algorithms.

CHAPTER 3: Existing System

A. 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 discriminant analysis is used to reduce features and makes it more manageable. New dimensions are a linear combination of pixel values which forms a template.

B. Principal Component Analysis

PCA involves a mathematical procedure that transforms a number of possibly correlated variables into a smaller number of uncorrelated variables 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 analysis is made easy with the help of PCA. The variance present in 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 its (in some sense) most informative viewpoint.

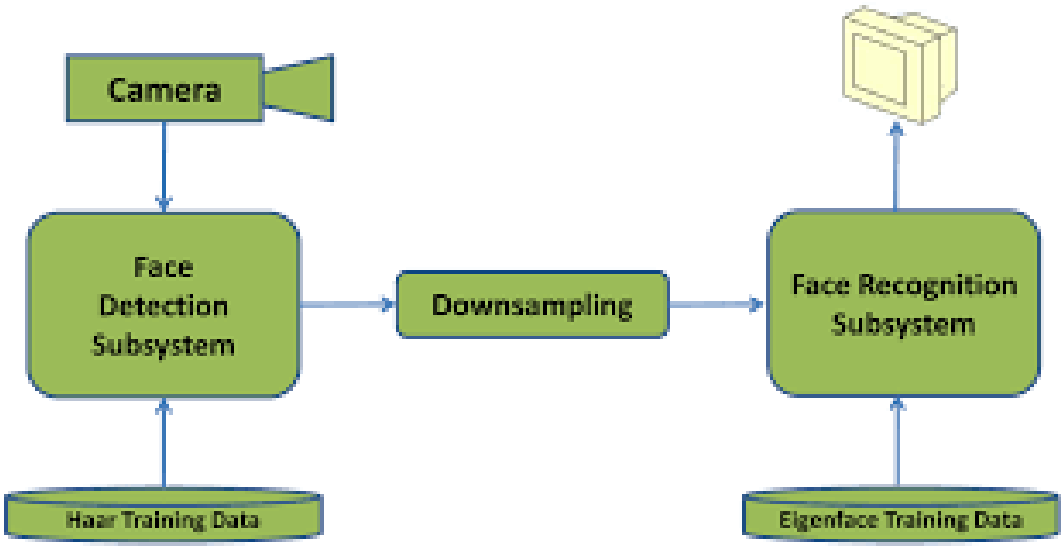
C. Hidden Markov Model

A *hidden Markov model (HMM)* is a statistical model that can be used to describe the evolution of observable events that depend on internal factors, which are not directly observable. The observed event is called as a `symbol' and the factor underlying the observation is a `state'. Hidden Markov models are especially known for their applications in temporal pattern recognition such as speech, handwriting, gesture recognition, part-of-speech tagging, partial discharges and bioinformatics.

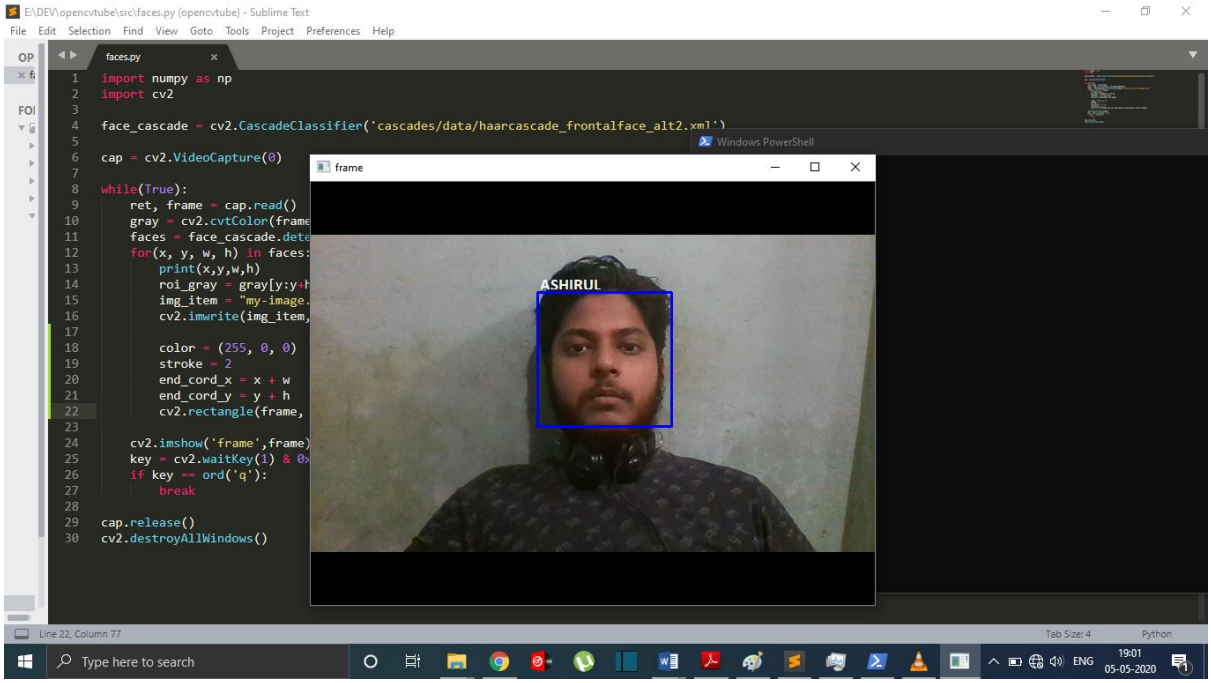
CHAPTER 4: Proposed System

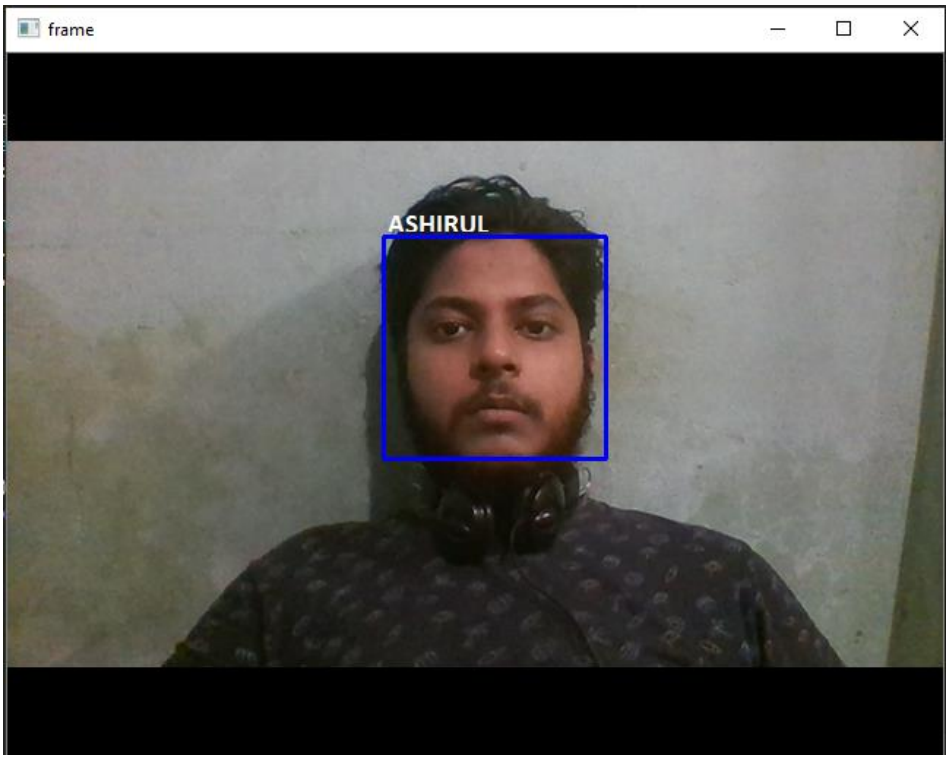
The quality of image depends on plethora of factors that influence the system's accuracy. It is important to apply various pre-processing techniques to standardize the images that you supply to a face recognition system. Face recognition algorithm usually find it difficult to recognize a face under extreme light sensitive conditions. If the system was trained to recognize a person when they are in a dark room, then it is highly possible that it won't recognize them in a bright room. This problem is referred to as "lumination dependent". There are many other issues, such as the face should also be in a very consistent position within the images like the eyes being in the same pixel coordinates, consistent size, rotation angle, hair and makeup, emotion like smiling, angry, etc. Hence it is important to use a good image pre-processing filter. For simplicity, the face recognition system presented in this paper is Eigenfaces using grayscale images. This paper shows us that it is easy to convert colour images to grayscale (also called 'grayscale') and then to apply Histogram Equalization. It is a very simple method of automatically standardizing the brightness and contrast of your facial images. For better results, apply more processing stages such as edge enhancement, contour detection, motion detection, etc. OpenCV uses a face detector algorithm called a Haar Cascade classifier. An image, can come from a file or from live video, the face detector examines each image location and classifies it as "Face" or "Not Face." Classification assumes a fixed scale for the face. Faces in an image can be smaller or larger, the classifier runs over the image several times, to search for faces across a range of images. The classification is fast, even when it's applied at several scales.

CHAPTER 5: Architecture Diagram



CHAPTER 6: Output – Screenshots





CHAPTER 7: Conclusion

In this paper we have developed a system for face detection and recognition using opencv. It is used to detect and recognize human faces. The images of the persons are the datasets which are defined and trained before recognizing.

Haar cascade algorithm is used for detection.

For better face recognition and detection small features can be improved. In the coming future, as technology advances, more advance features will be added to the system.

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