Human Face Identification using Haar Cascade & Local Binary Pattern Histogram Algorithm

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Abstract— In the modern era of the 21st century there has been a massive development and growth in the field of applications and technology, several highly sensitive data like banking data, stock market data are now being dealt with a simple mobile application or by web-applications. A great deal of security is assured by everyone but is it really that secure? The sensitive information is present in the form of data which can be easily stolen used to scam or plot against someone. Security intrusion can be simply caused by a lurker one glance of your computer or mobile is enough to get you in a great deal of trouble. This study aims to conduct an experiment by applying new methods and techniques in order to provide new results which will increase the scope to security.

Keywords: Face Recognition, Face Detection, Component Analysis, Artificial Neural Network, Viola-Jones algorithm, Haar-cascade classifier, Image processing

I. INTRODUCTION

Face recognition is a major challenging task to perform at a high speed, visual facial analysis is a hot area of research. The art of recognizing the human face is quite difficult as it exhibits varying characteristics like expressions, age and other small details like these. Among the applications, facial recognition is one of the emerging areas in the research field and widely used to recognize the identity of a person, serve as access control to protect their devices, aid in security purposes.

Although many systems have been proposed related to this topic collecting a huge amount of data and training it still a daunting task.

Facial analysis has been an important research field due its wide range of applications like: law enforcement, surveillance, entertainment like video games and virtual reality, information security, banking, human computer interface.

The original interest in facial analysis relied on face recognition, but later on the interest in the field was extended and research efforts where focused in the appearance of model-based image, video coding, face tracking, pose estimation, facial expression, emotion analysis and video indexing. Face detection and recognition are still a very difficult challenge and there is no unique method that provides an efficient solution to all situations face processing may encounter. In this paper a novel approach is presented to face recognition which considers both shape and texture information to represent the face.

II. THE PRINCIPLE OF THE FACE RECOGNITION

Despite the fact that at this moment already multiple number of commercial face identification systems are being used, this way of facial identification continues to be an interesting topic for researchers till date. This is due to the fact that the current systems perform well under relatively simple and controlled environments, but perform much worse when variations in different factors are present, such as pose, viewpoint, facial expressions, time (when the pictures are made) and illumination (lightening changes). The goal in this research area is to minimize the influence of these factors and create robust face recognition system

Face recognition system identifies a face by matching it with the facial database. It has gained great progress in the recent years due to improvement in design, technology and learning and of features and face recognition models. As humans have an exceptional ability to recognize people irrespective of their age, lighting conditions and varying expressions. The aim of researchers is to design an face recognition system which can match even surpass the Human Recognition rate which is nearly 97.5%.

The entire process can be understood with the help of Flow 1 which gives us the exact flow of the project.

III. PROPOSED SYSTEM

Built a system that can be trained with or without data sets to identify the human faces and extract certain features which can provide a real time monitoring with nearly no delay even when implemented with a lower specification setup, the extracted features can be used to identify a person and can be used for security with further studies one could identify a human basic emotions like Anger, Sad, happy and confused by plotting nodal-points on different features. The application of our system is not only limited to emotion detection but recognising the capabilities that this can be
used to identify criminals on cameras if they’re exposed to by their suspicious activities and face.

A. System Architecture

Our system is developed in Python using Tensorflow, Keras, Opec CV, Haar cascade and LBPH that uses device camera to capture the image which is used to detect objects in the image. The Fig.1 shows the basic functionalities of the application like how it works what’s accessible to whom.

![Fig. 1:](image)

The above image strip (Img 1) shows the images being captured using a low resolution camera (webcam) in different angles and lighting conditions. Which will serve as the training datasets of the module after applying the Cropping and Grey Scaling. In the testing process, the prototype model is used with the implementation of Haar Cascade Classification for analyzing the facial features, which consist of eyebrows, eyes, nose and the mouth. Then the model extracts the facial features using Local Binary Pattern (LBPH), and for face detection, the model which is closest to a match based on the histogram value of the image from the training dataset is classified.

The following images (Img 2.1 & 2.2) shows the pre-processing of the image from its raw file then cropped to 164 x 164 in dimension then converts the image goes under greyscaling:

![Fig. 2:](image)

IV. FACE DETECTION

For the first step of face detection the Haar Cascade Classifier Algorithm is being used as the image might have multiple faces distorted faces or no faces at all, the algorithm helps to detect the face on the image as and convert the image into grayscale which simply means the colour of the image is disposed and converted to a black and white image further it.

Calculates the x and y coordinates of the face using frontal face classifier which consists of eyebrows, eyes, nose, and mouth. Landmarks is used to for normalization of the images. The following image strip (Img 3) is an example of the output of the above algorithm.

![Fig. 3:](image)

V. FEATURE EXTRACTION

The extraction of facial features are done by the Local Binary Pattern Histogram Algorithm (LBPH). using local binary patterning the image is divided into several blocks of data then the blocks are divided into a 3 x 3 pixel image and the intensity of each block is calculated with respect to the central block. The central value of the matrix is used as the threshold value. Later, it would lay a new binary value for each of its neighbors of the central value which is the threshold value. Then, the algorithm converts the binary values to decimal value as it can be read by humans and set it as a central matrix value. This process would be repeated to each region of pixels of the image until all regions has its values. After calculating all the LBPH values, the image would be divided into multiple grids using Grid X and Grid Y then with the help of this data the algorithm extracts a histogram in each region (grid). Finally, it would join each histogram to create the final histogram of the image. These histograms are saved in the system in the form of YAML (“YAML Ain’t Markup Language”) file. The extracted histograms would also serve as the trained datasets which is further used in recognition of the faces in real time.

![Fig. 4:](image)

VI. CONCLUSION

This paper presents a novel and efficient approach for the evaluation of the performance of the face recognition system by making use of feature extraction with local binary pattern. Based on results, the prototype model works efficiently when the subject is near the camera and in the presence of enough light so that the camera can detect the face correctly. However, it may create adverse result due to face occlusion, resolution, noise and distance issues. For further improvement and efficiency of this manuscript, the researchers recommend the following:

- Use a high-resolution web camera
- Presence of sufficient light

Experimental results clearly show that facial images can be seen as a composition of micro patterns such as flat areas, spots, lines and edges which can be well described by LBPs.

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REFERENCES


