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Human Face Recognition using LBPH

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Abstract*: During the beginning of seventieth centuries, human facial recognition has become one among the researched areas in the area of finger print scanning and computer vision. Identifying a person with an image has been popularized through the mass media. The recent technologies are totally focusing on developing the smart systems that will recognize the faces for biometric purposes. In this context automatic face recognition is applied for security purposes to find the criminal, attendance system, scientific laboratories etc. This research paper presents the frame work for real time face detection. However, it is less robust to finger print or retina scanning. This paper describes about the face detection and recognition. These technologies are available in the Open-Computer-Vision (OpenCV) library and methodology to implement them using Python in image processing and machine learning. For face detection, Haar-Cascades algorithms were used and for face recognition the algorithm like Eigen faces, and Local binary pattern histograms were used.

***Keywords:* Face Recognition, Machine Learning, Haar-Cascades, Eigen faces, LBPH**

I. INTRODUCTION

Face identification can be viewed as a particular instance of article class recognition. In object-class identification, the errand is to discover the areas and sizes of all articles in a picture that have a place with a given class. Models incorporate upper middles, people on foot, and cars. Face-location calculations center around the recognition of frontal human countenances. It is practically equivalent to picture recognition in which the picture of an individual is coordinated a little bit at a time. Picture matches with the picture stores in database. Any facial element changes in the database will discredit the coordinating process. A dependable face-location approach dependent on the hereditary calculation and the eigen-face method: Firstly, the conceivable human eye districts are identified by testing all the valley areas in the dim level picture [1]. At that point the hereditary calculation is utilized to produce all the conceivable face locales which incorporate the eyebrows, the iris, the nostril and the mouth corners. Each possible face up-and-comer is institutionalized to diminish both the lighting sway, which is realized by unbalanced lighting up; and the shirring sway, which is a result of head development. The wellness estimation of every competitor is estimated dependent on its projection on the eigen-faces. After various cycles, all the face applicants with high wellness esteem are chosen for additional confirmation. At this stage, the face balance is estimated and the presence of the distinctive facial highlights is confirmed for each face up-and-comer. Other normal utilizations of face acknowledgment incorporate access control, misrepresentation discovery, character check and online networking Face acknowledgment is a major testing recognition techniques, when sent in unrestrained conditions because of the peak changeability that facet pictures existing in reality [2]. These type of face pictures are usually alluded as countenances in nature. A portion of these varieties incorporate head presents, maturing, impediments, brightening conditions, and outward appearances. Face acknowledgment strategies have moved fundamentally throughout the years. Customary techniques depended close by created highlights, for example, edges and surface descriptors, joined with machine.

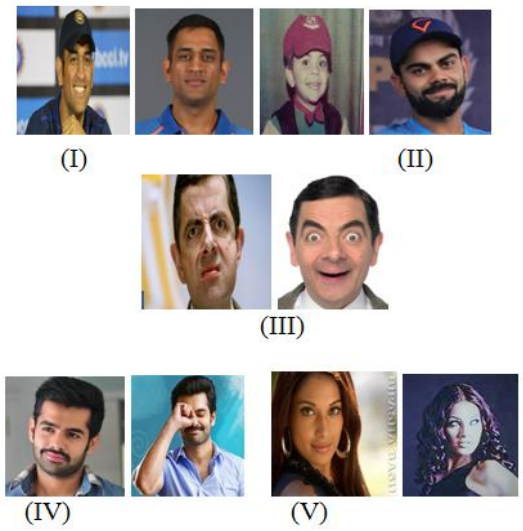

Fig. 1: Variations and postures found in faces, Head posture, stages of life of a human being, Illumination, Facial gestures and looks and Learning approaches

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II. LITERATURE REVIEW

Facet Representation is a major part of the whole system. Image Processing Technique had been used to compare and fix the charectoristics, which gives an outline geometry of the faces i.e in a rectangle. The systems can easily identify the face procedures under any kind of limitations. These methods consider the total face region as input. Evolution in vision and biometric spheres gave rise to feature extractions. These defined the consistency of a picture taken at another location [3][4].Feature based methods are composed of the match of features across the facet pictures taken to detect the facets. These methods were developed and added into some higher methods like hybrid methods. Deep learning was considered as an outstanding method to different applicability areas of computer vision. This paper provides a summary of a number of research works as well as the implementations with the said methods [5].

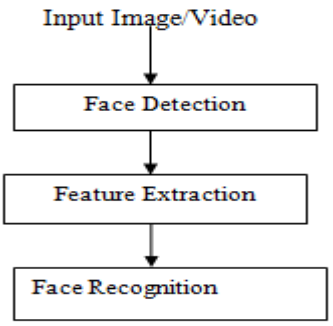

Fig 2. : A Face Recognition System

III. WORKFLOW

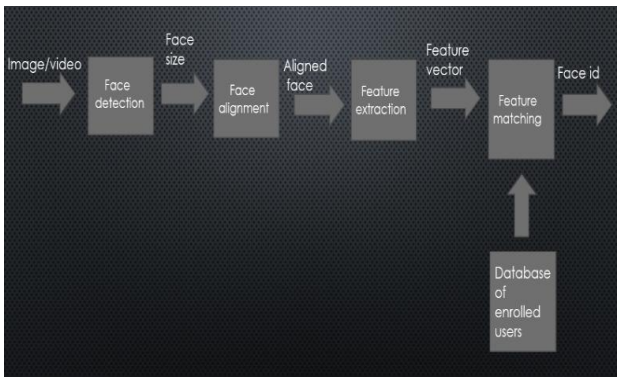

Fig. 3 : Face Recognition Building Blocks

Facial Recognition systems consists of the followings:

- Face Identification- A System used for this is able to get the facial position in an image and video. It gives the coordinates of a bounding box for each of the image taken.
- Face Alignment- Face alignment has the objective to scale and crop the facial picture with the help of a number of reference points, which are located at a fixed locations in the image [4].

It is a Computer Vision method of finding geometrical human facial structure. By giving the facial size and location, it finds the structure of the components of face like ears, eyes and nose.

- Feature Extraction- Here the pixel values of a face are mapped into a compact feature vector, which is considered a template.
- Feature Matching- Here two templates are compared and result score, which specifies the likelihood, which belong to the same subject.
- Database of enrolled users. It will match the face from the given datasets of enrolled users.

This research works consists of three major steps.

1. To detect the face- From the given images, it will detect that which part of the image is a face.
2. To generate the labels for the training data- It will generate the labels and then it will train the classifier.
3. To predict the face- It will predict the face. From the given image it will predict that whose face is this.

Open-CV:

OpenCV stands for Open Source Computer Vision Library. It is an open source computer vision as well as software library for machine learning. It was developed with an aim to facilitate the resource used for computer vision applications. Another advantage of it is getting the machine perception.

We have imported the Operating System for training data to create levels. The number of functions are defined in face recognition.py which are the common functionality and is required for import the modules. One more py file is required for testing all these modules. We have taken the images in gray scale [7].The grayscale representations are necessary for extracting the descriptors is due to the reason of simplification of the algorithm and reduction in resource requirements.

We have used the Haar-Cascade classifiers for the extraction of features. We downloaded the xml file of Haar- Cascade from the google and save in directory. We found a no of features are encoded within it. By the help of this classifier we are going to detect the faces.

Haar-Cascade :

Haar Cascade is considered as a classifier. Its objective is object detection. For this it has been trained from the source.The training can be performed by overlaying the positive images over a collection of negative images. The training is performed on server with help of a number of phases. The results can be get with the help of high quality images and increasing the amount of stages for which the classifier is trained [8].

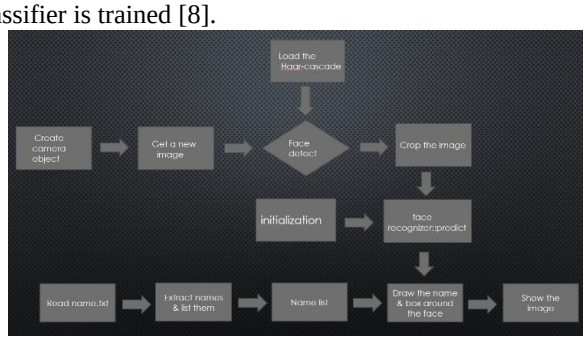

Fig. 4: Work flow of Haar-cascade classifier

We have called the function where the face will detect with in a rectangle which have the four corners x,y,w and h. Then after we passed a grey image having the parameter like scale factor decreased the size by 32% why because it will focus, and detect only the faces by the classifier [9].

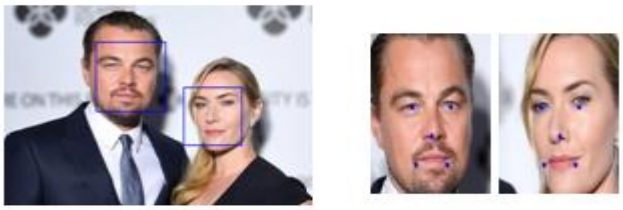

Fig. 5 : Bounding boxes found by a face detector, Aligned faces and point of reference.

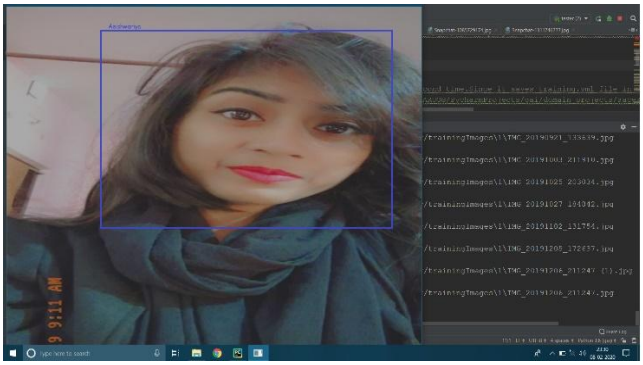

Fig. 6: Detecting faces in a bounding box

We have taken min neighbors as five. It is an algorithm that stores all the available cases and classifies the new data or case based on a similarity measure [9]. Generally its use is to classify data point based on how its neighbors are classified. After that a grey image will return within that rectangle. We resized the images why because sometimes the resolution is very big. We have written wait key (0) because it is going to held indefinitely .So, any key is pressed [10].

Now we took two folders of images named as 0,1 for training and for testing the images. We want to extract our image like grey image [y: y+w, x:x+h][11][12].

LBPH:

LBPH algorithm stands for Local Binary Pattern Histogram which is a simple solution for the face recognition problem [13][14]. It can be distinguishing both the front face, and side face. LBPH algorithm is a simple and efficient text description operator. The picture pixels are labeled using threshold value of each pixel and produce a binary number [15]. Then the Local Binary Pattern Histogram is combined with histogram and characterizes the face images with a simple data vector.

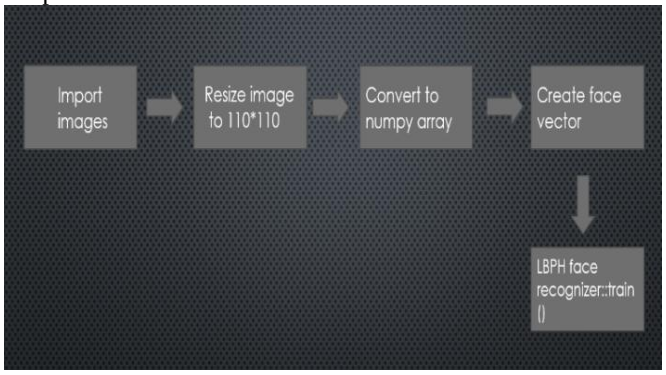

Fig. 7 : LBPH algorithm

The LBPH Face Recognizer Process-

We have taken a 3×3 dimension matrix and pass it across one image taken. At each move, the pixel at the centre is compared with pixels all across [16][17]. Find out a threshold value. The neighbours are denoted by intensity value, which is less than or equal to the centre pixel by 1 and the rest by 0.After reading these 0 or 1 value in the 3×3 dimension matrix, a binary pattern like 11100011 is found, which is local to particular area of the image. By applying on the image,a set of local binary patterns will be get [18].

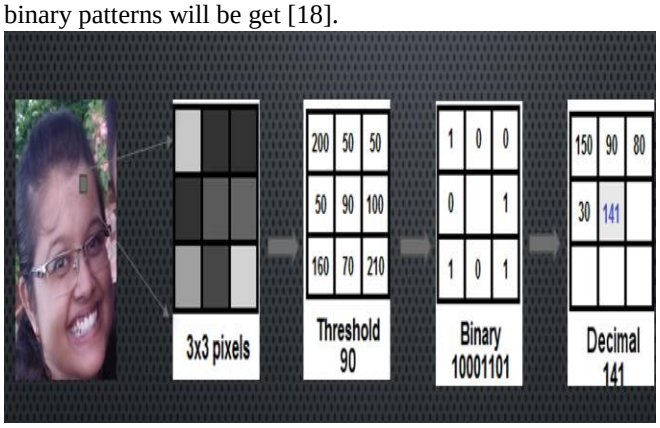

Fig.8: Image Thresholding

Threshold Value –

It is a value which has two regions on its either side i.e. below the threshold or above the threshold. In general any function can have a threshold value. Below the threshold value the function has an expression while above the value it has another [19].

After training the images we have used LBPH algorithm and by the help of the histogram we are able to recognize the faces of the given data.

We have given the proper path to the folders where the images of the persons are there. Then after we have done the video streaming through the web camera [20][21]. It will detect the photos in the video frame by frame and show the name of the person whose face is it. We have imported current time and date modules for showing in which time and date that it had recognized the faces [22].

We are not having sufficient pictures of a particular person, we failed to train our model to detect the faces. So our accuracy level is fluctuating time to time [23][24].

IV. RESULT

Machine learning has the objectivity to train a model in such a manner that it can fit our dataset into it. Firstly, We have tested by taking the different datasets from UCI repository and Kaggle. Later we have taken our customized datasets. While training and testing, we have got 77% of average accuracy level. We have also added the time module to check the date and time in video streaming.

Followings are the simulations outputs.

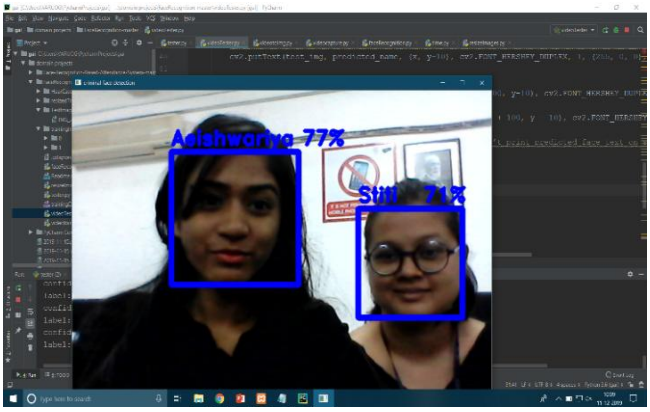

Fig.9: Simulation Result using LBPH

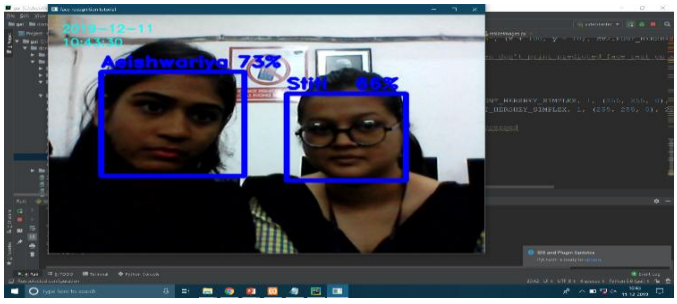

Fig.10: Simulation Result using LBPH & Time Module

V. CONCLUSION

First we have taken the datasets from Kaggle and UCI repository. Later on we have used the customize datasets of our own friends. We have taken seventy images for training. We have got 77% of average accuracy level. We drew a conclusion that how facial recognition have become a survey with evolutions of a number of computer vision applications. This describes the project for visual perception, and autonomy module. Next, it explains the technologies used in the project and the methodologies used. Finally, it shows the results, discuss the challenges. Using Haar-cascades algorithm for face detection worked extremely well even when the subjects have worn spectacles. Real time video speed was satisfactory as well devoid of noticeable frame lag. Considering all factors, LBPH (Linear Binary Pattern Histogram) algorithm combined with Haar-cascades can be executed as a cost effective face recognition platform. The computational models, which were implemented in this paper, were chosen after extensive exploration, and the successful testing results confirm that the choices made by the researcher were consistent. Due to the limited number of eigenfaces that were used for the PCA transform.

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