Face Recognition using Machine Learning and Deep Learning

Raja Soorya A

Assistant Professor, Department of Computer Applications,

The Standard Fireworks Rajaratnam College for Women, Sivakasi, TamilNadu, India

Abstract: *Facial Recognition is the biometric method used in face detection. Confirming or identifying a face from multi-media pictures is done using the facial recognition technique. With the development of a forward-thinking society, the requirement for face identification has been really important. Detection and identification of faces have grown globally. It owes to the request for security such as permission, national safety, and other dynamic situations. Face can be detected using various algorithms. This paper aims to present the assessment of two face recognition techniques Haar Cascade and Local Binary Pattern. As anoutcome, the accuracy of Haar Cascade is better than the Local Binary Pattern but the execution time in Haar Cascade is better than Local Binary Pattern.*

Keywords: Haar cascade, Local binary pattern (LBP), OpenCV Radio-frequency identification(RFID), Support-vector machine (SVM).

I. INTRODUCTION

Biometrical facial recognition is one of the most demanded identification solutions for online identity verification. facial recognition refers to the technology capable of recognizing or confirming a subject through an image, video, or any audio-visual element of his face. Generally, this proof of identity is used to access an application, system, or service and it works like a face scanner. It is a method of biometric identification that uses body measures, in this case, face and head, to verify a person's identity through its facial biometric pattern and data. The technology collects a set of inimitable biometric data of each person linked with their face and facial expression to recognize, confirm and/or authenticate a person.

Important exploration had been done on LBP and Haar cascading techniques. But they used only one algorithm or they are sensing a single face in the image. In the current work, two algorithms are used to detect the faces in the image containing many faces to calculate the accuracy. The attained accuracy will be linked by plotting the curve and bar graph to find the efficient algorithm.

Positive and negative images are the two types of images. Positive images are those images that contain the face and negative images are the images that contain non-face images. The classifier is a device that decides whether the taken image is negative or positive. It is trained on hundreds of thousands of faces and non-face images to correctly classify a new image as a face or non-face image. OpenCV offers two classifiers Haar Classifier and LBP Classifier. Both of these classifiers process images in gray scales as it doesn't need color information to decide if the image has a face or not.

II. LITERATURE REVIEW

Jenif D Souza W S et al.in 2019, proposed a system where image processing techniques are used for facial recognition. The refined photo is utilized to compare with the staved catalog. The commenced procedure was effectuated with 4 modules as Image Capturing, Cleavage of group photo and Face Detection, Face comparison, and Recognition.

Palanivel N et al. in 2019, approached a module that signs the existence of people by detecting their facial nature and creating the attendance data itself. Face Recognition's reliability charge is bestrewed with aspects similar to changing the glowing, posture changes, expression changes, and occlusion. They used the K-means clustering algorithmic rule for analyzing the face characteristics. The biometric nature of the face features has been withdrawn. The K-mean clustering approach is used in gathering the face characteristics. Then, the SVM method is used in the detection of the photo's characteristics. It may fulfill high identification showing with lesser characteristics number.

AZM Ehtesham Chowdhury et al. in 2019, proposed a rare camera prototype to analyze attendance much more effectively. For developing a model with additional vigorous and steady. A different algorithm was also put fforwardto exercise the technique perfectly. This technique will make use of a modus to analyze sstudent''attendance. This is based on face recognition and detection. Precision in average was the basic interest for selecting the most valid modus.

Mayur Surve et al. in 2020, developed a model which catches live images from the Camera. Then it applies different algorithms for face detection and face recognition. They also created the GUI witha single click which catches the images, forms the dataset, and inculcate the dataset. They used the Haar cascade algorithm to recognize the face in the image.

III. HAAR CASCADING

Haar Cascading is a machine learning technique where a classifier is sliced from positive and negative photos. Haar feature-based cascade classifiers are the classifiers applied for object detection. This classifier chases a machine-learning procedure in which a cascade operation is trained from the photos to discover items in additional photos. Face detection and facial expressions in an image are detected effectively. The process is done by offering positive and negative pictures to the classifier. Then the characteristics are taken out of the picture. Each characteristic is an individual value, which is acquired by subtracting the sum of pixels in a white rectangle from a summation of pixels in a black rectangle. In which it detects the faces of different individuals in different environments. Because of integral images, the Haar-like feature of any size can be calculated on time.
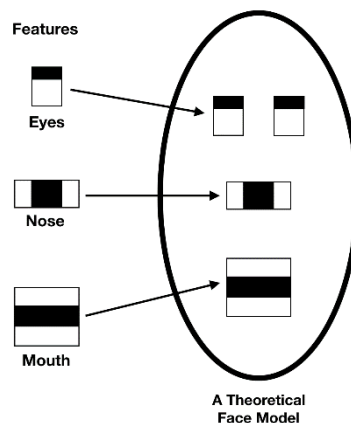

Figure 1: Features of Haar Cascade Classifier

IV. LOCAL BINARY PATTERNS

Local Binary Pattern is a photographic course used for the classificationof computer vision. LBP is aseparate case of the Texture Spectrum imitation put forward in 1990.LBP was first demonstrated in 1994. By applyingthe LBP operator, the photo is examined as a structure of micro-patterns. The histogram of LBP is computed throughout the face, which encrypts the circumstances of micro-patterns. The figure of documentation is gathered by splitting the face picture toward m minor non-overlapping sections such as R0, R1…, Rm.The original LBP labels the pixels by threshold the 3 × 3 neighborhood in relation to the central pixel value. In a particular numerical scale, the common features, such as edges, lines, and points, can be represented by a value. Consequently, it is probable to distinguish objects in an image using a set of values extracted a priori.

V. METHODOLOGY

5.1 Face Detection

In the arena of expertise, Face detection is treated as a challenging and nearly applied approach. The identification of each face present in an image is the major task of face detection. The execution is done using OpenCV.

- Load the input images.
- Convert the input images into gray scale images.
- Apply the Haar cascade and LBP classifier.

- Compare both classifiers based on accuracy and time.
  - Import the required libraries
  - Take the images captured by the camera.
  - To process the image through the classifiers it is converted into grayscale image.
  - Image will be loaded using OpenCV
  - By default, the image will be loaded into BGR color space

5.2 Haar Cascade Classifier
  - Load the input image using built in function cv2.imread(img_path).
  - Convert into gray scale mode and then displaying it
  - Load the haar cascade classifier

5.3 LBP classifier
  - Load the input image using the built-in function cv2.imread(img_path).
  - Convert into gray-scale mode and then displaying it
  - Load the LBP classifier

The LBP for each pixel is calculated. For each pixel p, the 8 neighbors of the center pixel are compared with the pixel p and the neighbors are assigned a value 1 if x is greater than or equals p.

5.4 Accuracy Calculation
  - True positive (TP): It is an actual object of interest that is correctly identified.
  - True positives rate (TPR) = TP/(TP+FP)
  - False-positives (FP): It is a non-object of interest which is falsely identified as the true object.
  - False-negatives (FN): It is an actual object of interest falsely identified as negative.
    (FNR)=FN/(FN+TP)
    Accuracy=(TP+TN)/(TP+TN+FP+FN)

Where,   TP: True Positive

       FP: False Positive

       TN: True Negative

       FN: False Negative

The accuracy obtained for the Haar cascade is 96.24% and for LBP classifier 94.74%.

VI. RESULT

The execution is performed on both Haar cascade and LBP classifier by using number of images. The accuracy of Haar Cascade is better than the Local Binary Pattern but the execution time in Haar Cascade isbetter than Local Binary Pattern.

VII. FUTURE WORK

In identification methods, face recognition is one of them. It is one of the major claims compared to other different identification ways like the fingerprint, iris scanner, and RFID. The clear image and correct pose may increase face recognition accuracy. In which the conclusion is that the Haar cascade classifier is more accurate than the LBP classifier. This will help people to choose the best algorithm for their work. Image recognition using the fisher face method is based on the reduction of face space dimension using Principal Component Analysis (PCA) method, then applying Fisher's Linear Discriminant (FDL) method or also known as Linear Discriminant Analysis (LDA) method to obtain feature of image characteristic. The accuracy may reach 100% if face recognition is done by the Fisher Face algorithm.

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