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Machine Learning Based Smart Attendance Using Face Recognition

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Abstract: *The main objective of this project is to provide an automated system for recognition of human face for an institute or an organization to take the attendance of their students or employees. This project paper introduces face detection method using algorithms like Haar cascade and LBPH and recognition using correlation technique. The student's attendance will record by the webcam in the class room environment. This proposed system is completely automated and easily portable. User gets an authentication to the database to upload the image containing file and also to view the attendance in the database.*

Key Words: **Automated, Face Detection, Face Recognition, Haar cascade and LBPH Algorithm, Correlation, Attendance.**

1. INTRODUCTION

All the institutes have their own method in this regard. In some institute people are taking manual attendance with the help of file based or paper approach and some institute have adopted to biometric techniques. But using the above techniques more time of students is wasted in making a queue for attendance while entering to the class room or for manual file system attendance. To overcome all this drawback, this project was proposed with automatic attendance for students in the classroom. In this system we are using face recognition technique for the automatic attendance of students in the classroom environment without student's intervention or involvement.

Face recognition technology has also been used for both verification purpose and identification of each students in the classroom environment. In order to create attendance, firstly the database is created by taking videos and the captured photos of different persons facing in different directions. In this proposed system, image is captured through the camera and then face is detected, after this process the image is compared with the recorded videos and photos. If the captured input image matches with images in the database only then the person gives the authentication of this system and attendance is marked to that particular person. This paper is aimed at developing a less meddling, worthwhile and more efficient attendance system using face recognition.

2. LITERATURE SURVEY

Anil Kumar Saoetal. [1] proposed template matching algorithm for face recognition. This approach addresses the pose problem in face recognition. First the faces are representing in edge view. Then template matching is applied over the image. Edginess based approach represent the image in 1 dimension. The person identification is performed supported the matching score.

Riddhi Patel [2] proposed a summary of face recognition & discusses the tactic and its working. It also compares different techniques of face recognition. It highlights the techniques that offers good efficiency for illumination changes and different environmental conditions.

Xiaoguang Lu [3] proposed variety of algorithms which are divided approaches supported model and appearance. Three linear subspace analysis are described within the methods supported appearance. Also, for face recognition non-linear manifold analysis is explained.

Sujata G. Bhele [4] presents face detection systems reviews. This paper is usually focused on the soft computing methods like SVM, ANN etc. to detect the face. These approaches may give better results. This paper discussed the various features extraction algorithms like PCA, LDA and ICA. During this paper some problems also are mentioned reduce accuracy like image quality, pose variations and illumination changes.

S.T. Gandhe [5], presents the face recognition approach to spot the person using different experimentation. this method provides the authentication to the system by face as a biometric. this method suggested different applications like identification system, access control and document control.

3. CONCEPTUAL DIAGRAM

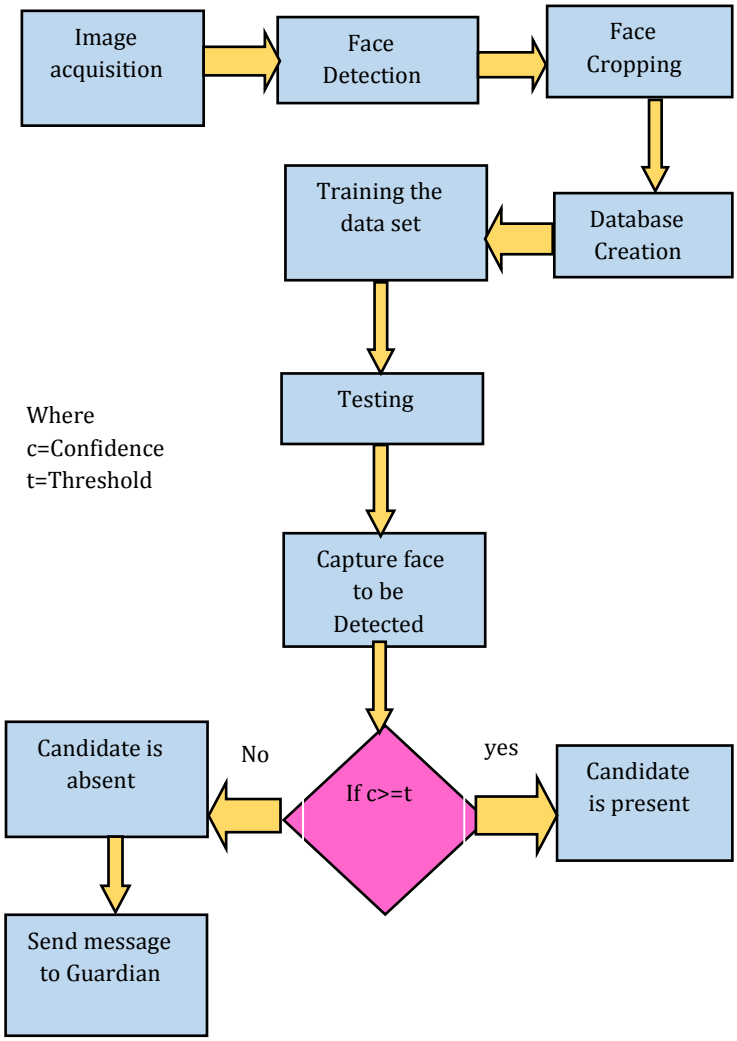

Fig-1: Conceptual Diagram of the system

4. ALGORITHM

Haar cascade algorithm is basically for face detection. Where it employed both database creation and face recognition process. Where in case of creating database, it takes input image through a camera which is connecting to internet continuously. Then the captured image undergoes into face detection process. Detected face are cropped and stored in database. The captured image undergoes to face detection and later goes to face recognition process. Cross-Correlation and Normalized-Correlation are familiar to extract the Coordinates of peak with the RIO and target images. The sub images are best correlated only when the height of the cross-correlation matrix occurs. Then find the total offset between the pictures. the whole offset or translation between images depends on the dimensions and position of the sub images and on the situation of the height within the cross matrix. Using LBPH all the faces are partitioned into different faces, and then execute the face recognition code. Each of the faces from the actual date folder with the database are checked using the local binary pattern algorithm and if similar face found the images are added to the database for better proficiency in future. Check if the face is released from the target Image. turn out where face matches exactly with inside target image.

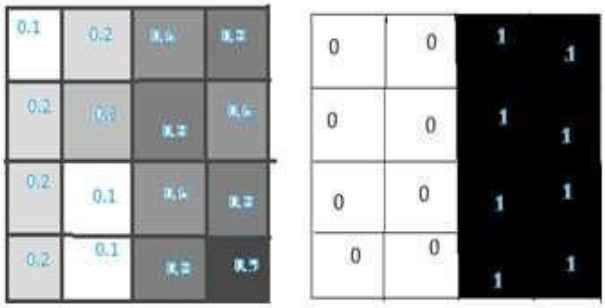

Fig-2: color representation through matrix.

This algorithm follows the main functionality:

Ideal Haar-feature pixel intensities 0- white color, 1- black color. There are more than $50000 values to detect a image. Let's sum up the white pixel intensities. calculate the sum of the black pixel intensities.

Δ = black - white

$\Delta = 1/n\sum_{black}^{n} 1(x) - 1/n\sum_{white}^{n} 1(x)$

Δ for ideal Haar-feature is 1.

Δ for the $50000 image: 0.76-0.18=0.58, The closer value to 1, similarly we've found a Haar-feature.

5. MECHANISM FOR FACE DETECTION

5.1. Face Detection:

Essential image is an algorithm for the more efficiently and fastly generating for the sum of the values during a every rectangular subset of a grids, inside the image processing domain, it is also called an integral image. Haar-like features are digital image features utilized by face detection. They owe their name to their subliminal similarity with haar cascade wavelets and they were utilized within the primary real-time face detector. All the human faces have some similar properties. These regularities are also matched using Haar Features.

Rectangle Features:

Value = Σ (black area pixels) - Σ (white area pixels) There are Three types: two-rectangles, three-rectangles, four-

rectangles. Haar Cascade classifier is a particular case of ensemble learning and it helps the join the different classifiers, using all the information collected from the output from a given classifier as additional information for the following classifier within the cascade. Unlike stacking ensembles, which are multi-expert systems, cascading is additionally a multistage one.

5.2. Face Recognition:

Firstly, the ROI is extracted from the source face image, ROI is nothing but the sub-image and is quite smaller than the initial image. Normalized Cross-Correlation is performed on ROI and the target image is going to appear in the peak coordinates. the comprehensive offset or translation is assigned reinforced the position of the peak inside the cross matrix. Check for the successful production of a face from the target image and figure out where the face exactly matches inside the target image.

5.3. Rectangular Haar-Like Features:

Rectangular Haar-like feature is proceeding to be defined just because the sum of pixels area is the difference inside the rectangle, which may present in any position and scale inside the initial image. The values which represents some particular characteristics of a specific area of the image. Each feature type can indicate the existence (or absence) of certain attributes within the image, like edges or changes in appearance. for instance, 2-rectangle features can indicate where the border lies between a black region and a white region edge feature can detect edges persuasively and line feature can detect lines successfully.

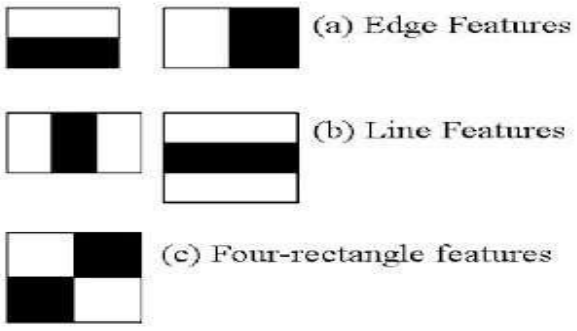

Fig-3: rectangular haar-like features

6. STEP BY STEP PROCEDURE

Exact process step by step:

- Initially Face detection file identify the faces.
- Then we need to train the machine.
- Then the image converts to the grey image.
- The numpy convert an enormous matrix variety of the image using the Haar cascade Algorithm.
- Then the machine checks the precise matrix format of the previously taken images and starts matching.
- If the faces match then it recognizes the face atlast.

6.1. Cascade Training:

After initializing algorithm, to attain a desired true detection rate with minimal complexity it was understood that training the cascade as an entire is optimized. some of the samples of such algorithms are namely RCBoost, RCECBoost or ECBoost. This algorithm might be used for rapid object detection with Haar-like features for more specific targets, including non-human objects. the method requires two sets of samples: negative and positive, where the negative samples correspond to arbitrary non-object images. Cloud-computing methods are using to circumvented the time constraint in training a Haar cascade classifier.

6.2. Cascade Detection:

After through with training we've to require the face and also detect them. Cascade classifiers are available in the OpenCV, together with pre-trained cascades for all frontal faces and upper body. once we add eye detect classifier(haarcascade_eye.xml) then it detects the eye also.

6.3. Tool Kits:

6.3.1. Matplotlib:

Matplotlib is used in Python scripts. where it could be a python 2D plotting library may produces quality figures.

6.3.2. Numpy:

Numpy stands for Numerical Python consisting of multidimensional array objects. A Numpy array is a general Homogeneous array with the items in an array have to be in the same type.

6.3.3. OpenCV:

For open cv now the coding for the face recognition is simpler than ever in open cv there are three easy steps for the coding of face recognition. that's the same as how our brain wants to recognize the face.

- Data Gathering:

gather the facial data by useful algorithms.

- Train the recognizer:

feed the facial data with unique id therefore the recognizer can detect.

- Recognition:

take the new faces and test it how recognizer can recognize the face or not.

7. OUTPUT

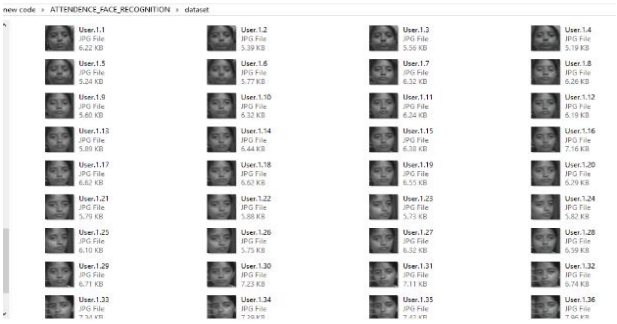

Fig-4: Stored black & White images in the Dataset

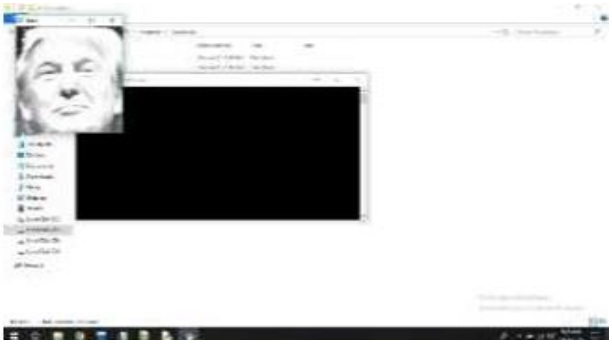

Fig-5: Train images in the Dataset

Fig-6: Image recognition with exact id, and name. the blue rectangle indicates the area of detected face.

8. CONCLUSIONS

The proposed Smart Attendance System has been visualized for the aim of reducing the proxies and fake in manual attendance taking system. There are lot of systems which can be used to manage the attendance. But using face recognition gives the best performance. In this proposed system recognition of multiple faces in the classroom at a time. During this method there is no specialized hardware for installing the system within the classroom. It is often constructed using a camera, computer and database servers are sufficient to create the smart attendance. This face detection and recognition system will help to reduce time, and quantity of labor done by the administration or faculty and replace the stationery material with already existent equipment. In Future enhancement work could also include adding several well-structured attendance registers for every class and therefore the capability to get monthly attendance reports and automatically email them to the acceptable staff or faculty for review the attendance.

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