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E-Attendance Using Face Recognition System

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Abstract: Face recognition means identifying a person using face biometrics. It is one of the major applications of Image Processing in Machine Learning. It is widely used for authentication purposes such as in Education sector for marking attendance. Attendance of students directly affects their performance. Therefore, a reliable attendance taking system is needed. In this project, we have developed a Smart Attendance taking System using Python that uses real-time face recognition for marking attendance. The existing manual attendance taking system is time and effort consuming. As it includes human intervention, it is easy to manipulate and inaccurate. The main objective of this project is to overcome all the above mentioned limitations of the existing system so as to make the process of taking attendance fast and smooth. The proposed system uses Haarcascade classifiers and LBPH () Algorithm for face recognition. The system recognizes the face from the video or image that is captured through camera. Once recorded, the attendance of the students is stored in an excel sheet. This system comes out to be fast, time and cost efficient and accurate

Keywords: *Camera-Ready Format, Paper Specifications, Paper Submission*

IIntroduction

This project aims to build an Automated Face Recognition System for taking attendance. A facial recognition system is a type of computer based biometric software that can be used to identify or validate the identity of a person by comparing patterns based on their facial features. Attendance is the factor that directly affects the leaning of the students. With the advancement in the machine learning technology, the computer can now automatically recognize the students' attendance performance and keep a record of it. The number of students present in a lecture hall is counted, everyone is identified and track of the total number of students present is maintained. The traditional attendance taking system is includes manual records that can be corrupted easily and cannot be stored for long time. Carrying registers for maintaining attendance record and head count of students to verify the attendance is tiresome and time consuming. Manual efforts consumed in this process is to be reduced so as the institutions can focus on providing quality education. This project basically focuses on making attendance taking system easy, less time consuming and accurate as compared to the old traditional method. It ensures the authenticity of the records which in turn leads to increases discipline and punctuality.

II Literature Review

The study of approaches given by various developers and the shortcomings of those approaches inspire us to develop a completely automatic and accurate attendance taking system that generates reliable results.

A. Manual Attendance taking System:
This is the oldest way of taking attendance. A payroll is maintained which includes all the details of the attendance of students. It requires human efforts and resources like pen and paper and is prone to inaccuracy. As there is human Research Paper Click here to access/download;Manuscript (PDF);Facial Recognition.pdf E-Attendance using Face Recognition System intervention, the authenticity of the information may be harmed. As attendance is an everyday task, performing same task redundantly makes it inefficient.

B. Fingerprint Based recognition system:
In the Fingerprint based existing attendance system, a portable fingerprint devices used. This device is configured in advance with the fingerprints of the students. Later, during the lecture students are needed to record their fingerprints on the device to mark their attendance. The problem with this approach is that the recognition becomes difficult if the

thumb is wet or in case of some physical injuries. Also as ones biometric data is sensitive information, this system puts on stake the security of the personal data of the user.

C. RFID (Radio Frequency Identification) Based recognition system:
In this system, the student must bring a Radio Frequency Identity Card with them and place it on the card reader to mark their presence for the day. The system can connect to RS232 and save the attendance information to a database. There are possibilities for the illegal access may occur. Some students may use other students' ID to ensure their presence when the particular student is absent or they may even try to misuse it sometimes. If a student forgets to carry the ID card, the attendance cannot be marked.

D. Face Recognition Based System:
The facial recognition technology can be used in recording the attendance through a high resolution digital camera that detects and recognizes the faces of the students and the system compares the face recognized with students' face images already stored in the database earlier. If the face of the student is matched with the stored image, then the attendance is marked in attendance database for further calculation. If the captured image doesn't match with the students' face present in the database, then this image is stored as a new image onto the database. In this system, there is the possibility of missing out the students while capturing image.

III Proposed System

A. Architecture:
The proposed system is simple, manageable and easy to use. It takes the input as the image of the student and the required details such as name and enrollment number. The surveillance camera captures the video/images while the lecture is going on. Capturing video makes sure that no student is left due to improper image capturing (such as faces of students hidden in crowd) which is a limitation in image recognizing attendance systems. This system detects the faces present in the video captured. Once the video capturing is done, the details of the students get stored in an excel sheet and the images of all the students extracted from the video get stored in a 'training images' folder. On clicking the "train image" button, the system is trained on the previously captured images and those images are stored in folder named "Trained images". This is the database from where the details and the image of the student will be compared while taking attendance. After the training is complete, the tracking of images comes into play. The details of the student, whose attendance is to be marked, are entered and then 'track image' button is clicked. After that the camera detects the image of the student and compares to those saved in the database. If matched, the attendance of the student is updated and stored in the excel format automatically.

B. Methods:
The steps performed to develop this smart attendance taking system are:
1. Database Creation: The first step is to create a database (for storage purpose) at the time of enrollment of the students. This database stores the details of the students such as their names and enrollment numbers, needed to identify them uniquely. Along with this the live video is being captured by the system for training of the proposed system. The faces detected are stored as images in a folder. Fifty images per student are stored in the folder so as to attain accuracy in the face recognition process.

2. Face Detection using Viola and Jones Algorithm: It is an Object Detection Algorithm used to identify faces in an image or a real time video. It is a machine learning based algorithm that uses edge or line detection features proposed by Viola and Jones. This algorithm is given a lot of positive images (i.e. the images that consist of faces in them) and negative images (i.e. the images that consist of no faces) to train the cascade function. After that, feature extraction takes place. For this, the haar features are used. Every haar feature is a single value obtained by subtracting sum of pixels under white region from sum of pixels lying under black region. The pixels under dark region have value of haar feature close to one whereas the pixels lying under the white region have the value of haar feature close to zero. A large number of features are extracted in which a lot of features are not

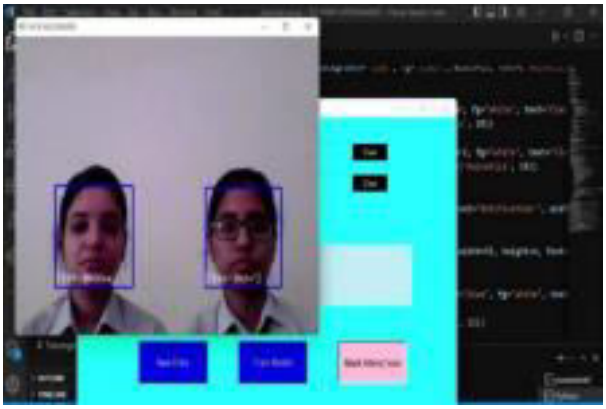
useful, therefore do not need to be taken in account while face recognition process. Adaboost is an algorithm that combines all the 'weak classifiers' into one 'strong classifier' so as to select the best features from all the available features. The negative images (no face images) also consume a part of the computation time. Cascade Classifier is a method that combines complex classifiers like Adaboost in a cascade which rapidly discards the negative images so as the computation is focused only on the positive images that contain faces. This makes the process more efficient. This algorithm takes grayscale images as input. Therefore the image captured is first converted from BGR to grayscale. Pre-trained XML files are used for marking the attendance of the students. Haarcascade classifier is present by default in the OpenCV library. In this project we use the 'haarcascade_frontalface_default.xml' XML file for detecting faces.

3. Face recognition using LBPH (Local Binary Pattern Histogram): The Local Binary Pattern Histogram (LBPH) algorithm is a face recognition algorithm which is based on a local binary operator, designed to recognize the front as well as side view of the face. This algorithm makes use of four parameters: Radius, Neighbor, Grid X and Grid Y. The image is divided into many local regions and each region. Feature extraction is done by obtaining the local binary pattern for every region in the image. The working of LBP is as follows: The image is divided into rows and columns (generally 8). The pixel value of a central cell is taken as the threshold value and the pixel values of neighboring pixels (in cells) are compared to that threshold value. The neighboring cells with pixel values greater than the threshold value are assigned '1'. The the cells with pixel values less than the threshold value are assigned '0'. This gives us a matrix representing every region. The central value of each matrix is needed to be calculated. The central value of the matrix is generated by concatenating the eight neighbor pixel values (ones or zeroes) into a binary code and converting it to decimal form. This central pixel is a pixel of the original image. This algorithm gives us a new image that represents the original image in a better way. Extracting the histograms: The new image formed in the step above is divided into multiple grids using the Grid X and Grid Y parameters. Based on this image, we can extract the histogram of each region as follows: As the images are in grayscale format, each histogram (from each grid) will contain only 256 positions (0-255) representing the occurrences of each pixel intensity. Then, we need to concatenate each histogram to create final histogram. The final histogram represents the characteristics of the image of the actual image. As the process of training algorithm is completed, every image stored in the database is represented by different histogram. In the similar way mentioned above, the histogram for the input image taken while taking the attendance is created. Then this histogram created is compared to the ones of the already stored images in the database and the image with the nearest histogram is returned. We can use a number of methods to compare histograms such as in this project we are using Euclidean distance:

$$D = \sqrt{\sum_{i=1}^{n}(hist1_i - hist2_i)^2}$$

As a result, the ID from the image with the nearest histogram is returned by the algorithm. The distance between the two histograms is represented by the 'confidence' measured. The confidence value should be less than the threshold value for better accuracy in face recognition.

Illustrations:



III Tables, Figures and Equations

A. Figures

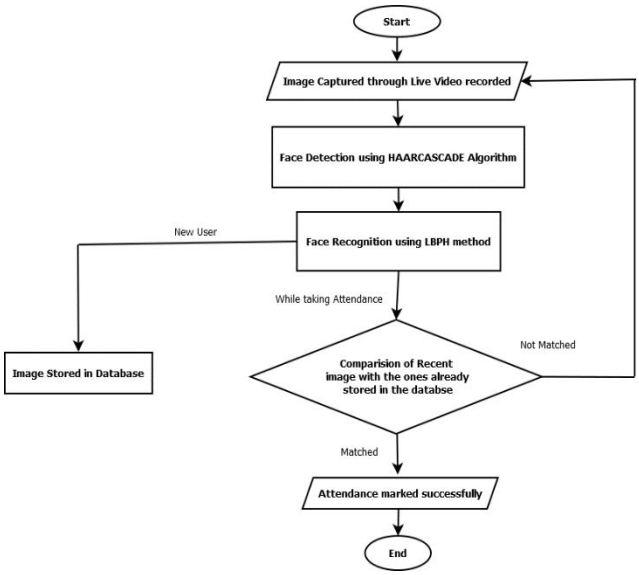


Fig. 1 Flowchart of the proposed system

B. Equations

$$D = \sqrt{\sum_{i=1}^{n}(hist1_i - hist2_i)^2}$$

Eq (1)

IVConclusions

Thesmart attendance taking system developed can be used in various organizations to maintain the attendance record. It is highly accurate, fast and reliable automatic system of marking attendance. This system records live video of the students present in the class and then recognizes their faces by comparing them to the images stored in the database already. After recognizing successfully, it generates an excel sheet that maintains the record of attendance of the students. It is updated automatically each time attendance is taken. The use of LBPH algorithm for face recognition overcomes the problem of different head orientations and substantial occlusion. The system proves to be a better alternative for all the other existing systems.

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