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Real Time Face Recognition Automatic Attendance System

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ABSTRACT -Human beings perform face recognition automatically every day and practically with no effort. Various organizations like schools, colleges, companies, etc., require to keep the daily record of their students/employees. Manual attendance maintaining is difficult process, especially for large group of students. This paper introduces face detection method using the Viola and Jones algorithm and Face recognition using Local Binary Patterns Histograms (LBPH) algorithm, this proposed system aims to develop an automated system that records the student's attendance by using facial recognition technology. The main objective of this work is to make the attendance marking and management system efficient, time saving, simple and easy. Here faces will be recognized using face recognition algorithms. The processed image will then be compared against the existing stored record and then attendance is marked in the database accordingly. Compared to existing system traditional attendance marking system, this system reduces the workload of people. This proposed system will be implemented with 4 phases such as Image Capturing, Image Pre-Processing and Face Detection, Training Data and Face recognition Updating of attendance in database/csv file.

KEYWORDS: Image processing, Expressions, HAAR features, HOG features, Face Detection Method, Face Recognition Method, Features Extraction, Features Matching, Query Image

1. INTRODUCTION

Fidelity is the future of automated student check-in. This Artificial Intelligence (AI-powered) Touchless Facial Recognition System detects your student's face each time they enter or exit the colleges and saves the ID. Tracking student attendance in the classroom is done manually by using the traditional pen and paper or file based approach which is normally passed around the classroom while faculty member is conducting the lecture. The task of every day attendance is a real struggle as it frustrates the one who is calling each name in every class that too in every single lecture. The human effort in the existing system is much more than the proposed system. The retrieval of the information is not as easy as the records are maintained in the hand written registers. This application requires correct feed on input into the respective field. Suppose the wrong inputs are entered, the application resist to work. So the user finds it difficult to use. Our proposed system consists of a camera that captures the images of the classroom and sends it to the image enhancement module. After enhancement the image comes in the Face Detection and Recognition modules and then the attendance is marked on the database server as well as csv file. At the time of enrolment, templates of face images of individual students are stored in the face database. If any face is recognized the attendance is marked on the database from where teachers can access and use it for different purposes. Camera takes the images to detect and recognize all the students in the classroom. Two databases are displayed in the experimental setup. Face Database is the collection of face images and extracted features at the time of enrolment process and the second attendance database contains the information about the teachers and students and also uses to mark attendance.

2. RELATED WORK

Ojala et al. [10] initially used Local Binary Pattern (LBP). LBP refers unremarkably to displacement pixels with an 8-bit dual code from the neighborhood of the pixels. For a 3 square, the center component estimate is ablated from that of each of its eight neighboring pixels and is relegated to a bit based on the indication of the subtraction result 1 or 0. The created bits are then connected for all neighboring pixels and encoded into double strings. The dual strings inferred are referred to as Local Binary Patterns or LBP codes. The decimal estimate of the center component's LBP code (xc, yc). The LBP administrator LBP (P, R) produces 2p different yield values, about 2p distinctive two-fold examples formed by

the P pixels within the varying R space. It has been shown that there is a lot of information in particular examples than others. It is conceivable to simply use a set of 2p double examples to portray the surface of the photographs. These examples were named by Ojala et al. as uniform examples.

All face images are viewed as the formation of small patterns that the LBP operator could recognize successfully. For face identification, Ahonen et al. [11] presented an LBP primarily based facial illustration. They have bifurcated facial images into M minor non-covering areas $R(0)$, $R(1)$, ..., $R(M)$ to compare the facial structure. The LBP histograms extracted from each sub-region are then combined into a single, spatially enhanced histogram feature..

In [12] as suggested by Ahonen et al, the texture classification LBP approach describes the occurrence of LBP codes in an image being collected into a histogram. The classification is then carried out by calculating the similarities between straight-forward histograms. However,

a loss of spatial data results in considering the same methodology for illustration of the facial image. An approach to achieving this goal is to use the LBP texture descriptors to create

III. PROPOSED SYSTEM

Systems design is the process of defining the architecture, components, modules, interfaces, and data for a system to satisfy specified requirements. Systems design could be seen as the application of systems theory to product development. The proposed automated attendance system can be divided into five main modules. The modules and their functions are defined in this section. The five modules into which the proposed system is divided are:



(a) User Interface

A. Image capturing

The Camera is mounted at a distance from the entrance to capture the frontal images of the students and further process goes for face detection. A proper and efficient face detection algorithm always enhances the performance of face recognition systems. Various algorithms are proposed for face detection such as Face geometry based methods, Feature Invariant methods, System Diagram Machine learning based methods. Out of all these methods Viola and Jones proposed a framework which gives a high detection rate and is also fast. Viola-Jones detection algorithm is efficient for real time application as it is fast and robust. Hence we chose Viola-Jones face detection algorithm which makes use of Integral Image and AdaBoost learning algorithm as classifier. We observed that this algorithm gives better results in different lighting conditions and we combined multiple haar classifiers to achieve a better detection rates up to an angle of 30 degrees.

B. Pre-Processing

The detected face is extracted and subjected to pre-processing. This pre-processing step involves with histogram equalization of the extracted face image and is resized to 100x100. Histogram Equalization is the most common Histogram Normalization technique. This improves the contrast of the image as it stretches the range of the intensities in an image by making it more clear

C. Face detection

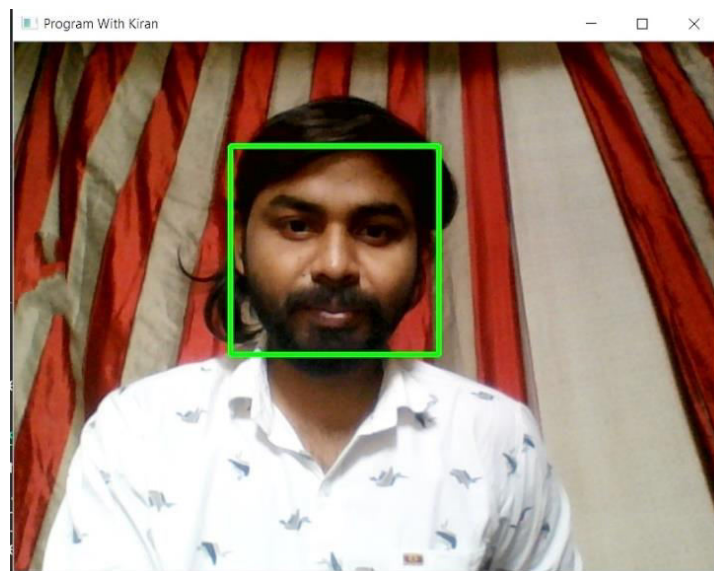
Although many different algorithms exist to perform face detection, each has its own weaknesses and strengths. Facial detection is impossible if the face is not isolated from the background. Analyzing the pixels for face detection is time consuming and difficult to accomplish because of wide variations of shape and indecent within a human face. Pixels are also required for scaling and precision. Viola and Jones devised an algorithm, called Haar Classifiers, to rapidly detect any object, including human faces, using AdaBoost classifier cascades that are based on Haar-like features and not pixels. Adaboost stands for 'Adaptive Boosting'. Final Equation for classification is given as:

$$F(x) = \text{sign}\left(\sum_{m=1}^M \theta_m f_m(x)\right),$$

Here f_m designates the m th weak classifier and m represents its corresponding weight.

1.1 Result:

Here is the result of running the code above and using as input the video stream of a built-in webcam



(b) Face Detection

1.2 Haar Cascade Classifier:

The core basis for Haar classifier object detection is the Haar-like features. These features, rather than using the intensity values of a pixel, use the change in contrast values between adjacent rectangular groups of pixels. The contrast variances between the pixel groups are used to determine relative light and dark areas. Two or three adjacent groups with a relative contrast variance form a Haar-like feature. Haar-like features as shown in figure are used to detect an image. Haar features

can easily be scaled by increasing or decreasing the size of the pixel group being examined. This allows features to be used to detect objects of various sizes. The cascading of the classifiers allows only the sub-images with the highest probability to be analyzed for all Haar-features that distinguish an object. It also allows one to vary the accuracy of a classifier. One can increase both the false alarm rate and positive hit rate by decreasing the number of stages. The inverse of this is also true. Viola and Jones were able to achieve a 90% accuracy rate for the detection of a human face using only 100 simple features. Detecting human facial features, such as the mouth, eyes, and nose require that Haar classifier cascades first are trained. In order to train the classifiers, this gentle AdaBoost algorithm and Haar feature algorithms must be implemented. Fortunately, Intel developed an open source library devoted to easing the implementation of computer vision related programs called Open Computer Vision Library (OpenCV). The OpenCV library is designed to be used in conjunction with applications that pertain to the field of HCI, robotics, biometrics, image processing, and other areas where visualization is important and includes an implementation of Haar classifier detection and training. Thus with help of this algorithm system will detect the person's face in the video. Face of the person gets Green Square as an indication of detection process. As soon as the face gets detected user can paused the video and enters the data of detected person such as person's name, address, profession, criminal record if any. If the detected person has criminal record then it can be defined as suspect. Check box option is given in the system where user can tick whether the person is suspect or not. This is the working of first module in which sample video is browsed and face is detected.

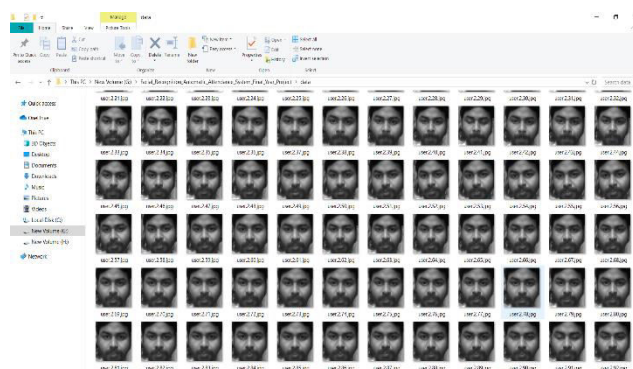


(c) Haar Features

D. Training Model

First, we need to train the algorithm. To do so, we need to use a dataset with the facial images of the people we want to recognize. We need to also set an ID (it may be a number or the name of the person) for each image, so the algorithm will use this information to recognize an input image and give you an output. Images of the same person must have the same ID. With the training set already constructed, let's see the LBPH computational steps.

After the 'opencv_traincascade' application has finished its work, the trained cascade will be saved in 'cascade.xml' file in the folder, which was passed as -data parameter.



(d) Image Samples

E. Face Recognition

With the facial images already extracted, cropped, resized and usually converted to grayscale, the face recognition algorithm is responsible for finding characteristics which best describe the image.

1. Local Binary Pattern Histogram (LBPH):

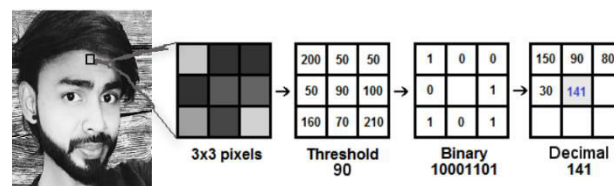
Local Binary Pattern (LBP) is a simple yet very efficient texture operator which labels the pixels of an image by thresholding the neighborhood of each pixel and considers the result as a binary number.

The first computational step of the LBPH is to create an intermediate image that describes the original image in a better way, by highlighting the facial characteristics. To do so, the algorithm uses a concept of a sliding window, based on the parameters radius and neighbors.

1.1 Applying the LBP operation:

The first computational step of the LBPH is to create an intermediate image that describes the original image in a better way, by highlighting the facial characteristics. To do so, the algorithm uses a concept of a sliding window, based on the parameters radius and neighbors.

The image below shows this procedure:



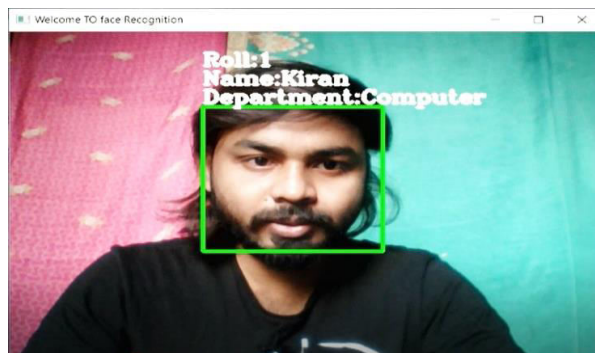
(e)Applying the LBP operation

1.2. Performing the face recognition:

- In this step, the algorithm is already trained. Each histogram created is used to represent each image from the training dataset. So, given an input image, we perform the steps again for this new image and creates a histogram which represents the image.
- So to find the image that matches the input image we just need to compare two histograms and return the image with the closest histogram.
- We can use various approaches to compare the histograms (calculate the distance between two histograms), for example: Euclidean distance, chi-square, absolute value, etc. In this example, we can use the Euclidean distance (which is quite known) based on the following formula:

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

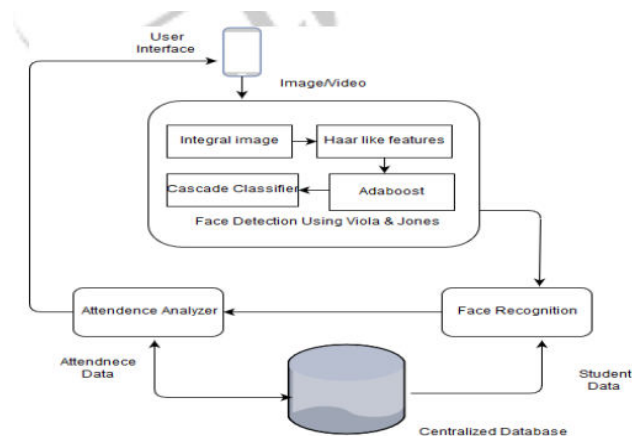
- So the algorithm output is the ID from the image with the closest histogram. The algorithm should also return the calculated distance, which can be used as a ‘confidence’ measurement. **Note:** don’t be fooled about the ‘confidence’ name, as lower confidences are better because it means the distance between the two histograms is closer.
- We can then use a threshold and the ‘confidence’ to automatically estimate if the algorithm has correctly recognized the image. We can assume that the algorithm has successfully recognized if the confidence is lower than the threshold defined.



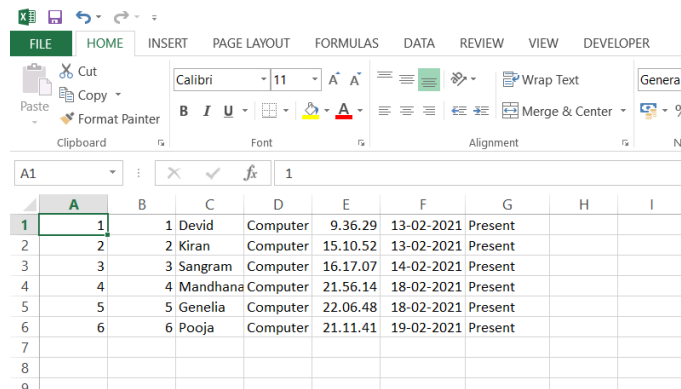
(f)Face Recognition

F.Database Development

As we chose face based system enrolment of every individual is required. This database development phase consists of image capture of every individual and extracting the LBPH feature, in our case it is face, and later it is enhanced using preprocessing techniques and stored in the database. Post-Processing In the proposed system, after recognizing the faces of the students, the names are updated into an excel sheet. The excel sheet is generated by exporting mechanism present in the database system. The database also has the ability to generate monthly and weekly reports of student’s attendance records. These generated records can be sent to parents or guardians of students. At the end of the class a provision to announce the names of all students who are present in the class is also included. This ensures that students whose faces are not recognized correctly by the system have the chance to send a ticket to staff. And thus giving them the ability to correct the system and make it more stable and accurate. The announcement system is implemented using text to speech conversion. Many algorithms and applications are available that can convert text to lifelike speech.



(g)Proposed System



	A	B	C	D	E	F	G	H	I
1	1	1	Devid	Computer	9.36.29	13-02-2021	Present		
2	2	2	Kiran	Computer	15.10.52	13-02-2021	Present		
3	3	3	Sangram	Computer	16.17.07	14-02-2021	Present		
4	4	4	Mandhana	Computer	21.56.14	18-02-2021	Present		
5	5	5	Genelia	Computer	22.06.48	18-02-2021	Present		
6	6	6	Pooja	Computer	21.11.41	19-02-2021	Present		
7									
8									
9									

(h) Attendance being marked using excel sheets.

IV. APPLICATIONS

A. Institutions

Have the traditional way of marking attendance where call out each student name to check if they are present. This method of roll call is time consuming and tedious. By using Facial Recognition, the process of taking attendance can be significantly improved to save time and provide a hassle-free way to automatically mark attendance. Since the number of students in an institution are more, using an automated system improves the productivity and standard of the college.

B. Companies

In most companies, employees have the practice of using their facial recognition or ID card to log their time of entry and exit. During the peak hours the number of people entering and exiting the office.

V. CONCLUSION

Automated Attendance System has been envisioned for the purpose of reducing the errors that occur in the traditional (manual) attendance taking system. The aim is to automate and make a system that is useful to the organization such as an institute. The efficient and accurate method of attendance in the office environment that can replace the old manual methods. This method is secure enough, reliable and available for use. No need for specialized hardware for installing the system in the office. It can be constructed using a camera and computer.

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