Face Recognition Based Attendance Management System Using Machine Learning

Akshatha P R[1], Jaipriya V M[2], Jayapaveethra K P[3], Koushik J A[4], Mr Chethan Kumar B H[5]
[1, 2, 3, 4] Dept of Information Science and Engineering
[5]Asst. Professor, Dept of Information Science and Engineering
[1, 2, 3, 4, 5] East West Institute of Technology, Bengaluru.

Abstract- *It is a burden to manage the attendance system manually. The use of biometrics came into view at this rate. There are many ways to adopt the smart automated biometrics for students or employees, such as fingerprint, palm scanning, iris recognition, face recognition etc. Face recognition is one of the methods to improve this system, It is used to solve the issues like fake attendance and proxies. Facial recognition method is enormously used in several applications, like CCTV footage system, video monitoring, security access etc. The method proposed here for real-time character identification of individuals, this involves techniques like Haar-like features with a cascade classifier. Here we imply local binary patterns (LBPH) for face recognition and for the identification of individual features we use Haar-Cascade . This proposes a model for capturing the images, storing the captured images in the database with the help of openCV and detecting the faces and recognizing them. Conversion of gray scale is used to detect the features by Haar-Cascade, this helps to cross check the detected faces with the images present in the database. This model will be successful to manage the attendance and records of the students or employees.*

Keywords- Biometrics, Face recognition, Face detection, Haar-Cascade, Local binary pattern histogram (LBPH), openCV.

I. INTRODUCTION

The manual work of taking attendance or maintaining the records of students or faculties is a long term process. As we know biometrics plays a huge role at this rate of time. Face recognition is the one of the methods that comes under biometrics but it plays a vital role.

Most educational institutions consider the students' role in their academic and their participation records to be maintained with their respective attendance, The face recognition method is effective at this kind of significance.

In a classroom with a very large number of students it may be time consuming to take attendance manually.Hence we apply the effective system i.e., face recognition technique which will mark attendance by recognizing the face of the individual students.

In this process it may be divided into various steps like face detection, face recognition, storing into database but the two important steps are detecting and recognizing. With the help Local binary patterns histogram (LBPH) it recognizes the individual face of the students and with help of Haar-Cascade the features of the student are compared with images that are already stored in the database. OpenCV plays a vital role to store the images in the database.

1.1 The main objectives:

- It helps the lectures to organize and manage the student attendance.
- It reduces the errors made by manually.
- Consumes less time and it is flexible to use.
- Automatic marking of attendance takes place and the absence of students is informed through sms to their parents.
- Detection of unique features of the individual person, from a group of people.
- Detection of unique face images amongst the natural components such as walls, background, etc.
- Extraction of unique characteristics of face such as beard, spectacles, etc and effective recognition of the individual features from a group.
- Automatic updation of the attendance of the students and if the student is not present a message is sent to the parents..
- Guides can send a copy of the students attendance with their records to the parents.
- It overcomes the errors which are made manually.
- Proxies and fake attendance can be avoided.

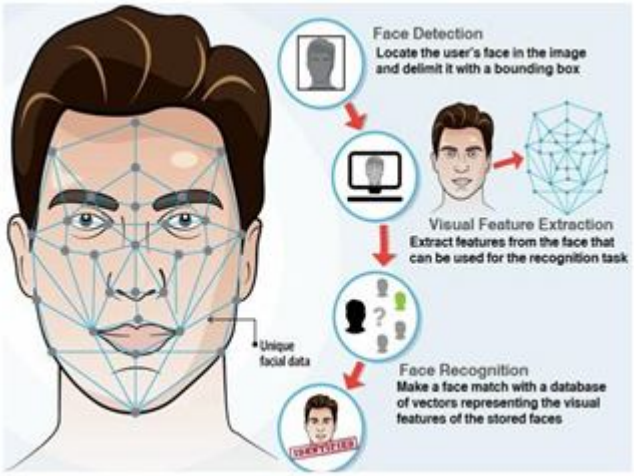

Fig 1: Landmarks present in the face

II. LITERATURE SURVEY

The main objective is to implement smart biometrics to help for marking attendance. Here we mainly focus on Face recognition technique which was invented by Paul Viola and Micheal Jones in early 2000's to detect human faces. Other than this several algorithms are used by past researcher's. These are discussed under this section.

P. Wagh, S. Patil, J. Chaudhari and R. Thakare, [1] represents the deep neural network to output the person's face with identification. Here the neural network needs to be trained to automatically identify the person's face. Here if we pass the different images of the same person the output will be similar whereas if we pass the different images of different person the output will be very different.

P. Viola and M. Jones [2] represent objects such as HAAR based on a composite image and Cascade classifier for the acquisition of an object using a machine learning algorithm. This describes the machine learning approach for visual object detection which is capable of processing images extremely rapidly and achieving high detection rates. This work is distinguished by three contributions. The first introduction of new image representation is called 'integral approach' here the features of the image are detected and computed. The second is the algorithm, here the algorithm used is adaboost which is used to select small features from large set and yields extremely efficient classifiers. The third contribution is the cascade which allows to discard the background of the image.

Sharma, Poonam Arya, KV and Yadav, Ram N,[3] represents an efficient face recognition method where Local Gabor Binary Pattern Histogram is used.In this method we first decomposed into multiresolution Gabor Wavelets. The efficiency has been significantly improved by combining the two efficient local appearance descriptors and enhanced the local binary patterns with generalised neural networks. Generalized neural network is a proven technique for pattern recognition and is insensitive to small changes in input data. The proposed method is robust-to-slight variation of imaging conditions and pose variations. Performance comparison with other existing techniques shows that the proposed technique provides better results in terms of false acceptance rate, false rejection rate, equal error rate and time complexity.

III. PROPOSED SYSTEM

3.1 Architecture

The architecture of this face recognition based attendance system is shown in the following diagram. The working of this technique is very flexible and simple to understand. The components used in this project here is web camera but for the future scope we can implement into CCTV cameras. Firstly we install the camera in the classroom at a suitable location in a perfect angle where the whole class is covered.

Here we have already updated the student's images to the database. Here the person's picture is converted to a gray-scale image and then it will be equalized using histogram technique. After the enhancement of gray-scale effect then the next step is face detection with the help LBPH i.e., Local Binary Patterns Histogram where it can detect individual faces from the group of people and for the features detection we use Haar-Cascade features to detect individual person features like spectacles, beard, etc.

Attendance of the person is marked when they are present in the classroom, the person is recognized when the person's image is present in the database. We have already stored 300 pics of a person to recognize actual features.

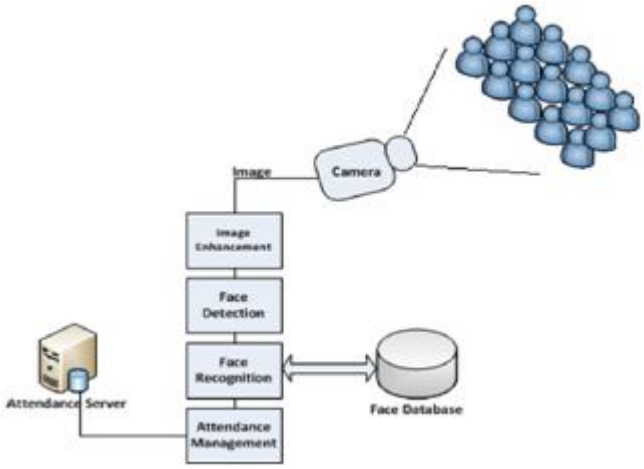

Fig 2: Representation

3.2 Methodology

To develop the smart attendance management system, some steps are required to be followed for accomplishing this task successfully. The steps can be defined in the following ways:

- Create Database
- Image Acquisition
- Face Detection
- Face Recognition
- Attendance Marking

Create Database

A database of students and guides is created with the help of python and openCV. It is a one time process where the admin creates the student record once and further the records are updated with the help of admin and the admin also stores the images of the student to the database.

Here we store the students images with the help of a web camera , the student has to give different poses and different expressions so that the database contains different types of photos of individual person when it is created. Also the faces detected from the captured images will be added to the database so that the database is updated continuously.

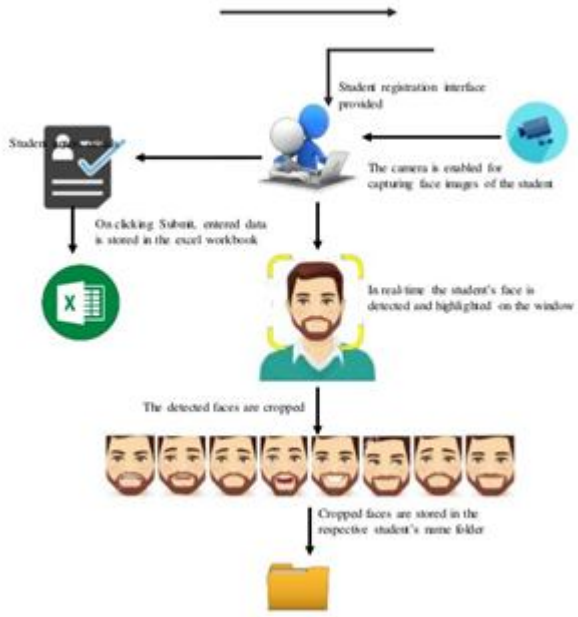

Fig 3: Creation Of Database

Image Acquisition

A high definition camera will be installed in the classroom in such so that it can capture all the students present in the class. The camera can be manually controlled or it can be programmed as per the choice of the user. After capturing the image, it will be sent to the system for further processing.

Face Detection

After the enhancement of the image, then the image comes to the face detection module.The Haar-Classifier is a machine learning system, an algorithm developed by Viola and Jones is used for the purpose of face detection. Initially it takes a lot of positive images (images of faces) and negative images (images without face) to train the classifier then we need to extract features from it and place it as windows to calculate a single feature.

This single valued feature is obtained by subtracting the sum of pixels under the white part of the window from the sum of the pixels under the black part of the window. All possible sizes of each window are placed on all locations of each image to calculate plenty of features. The gray scale images that are detected will now be stored in a folder.

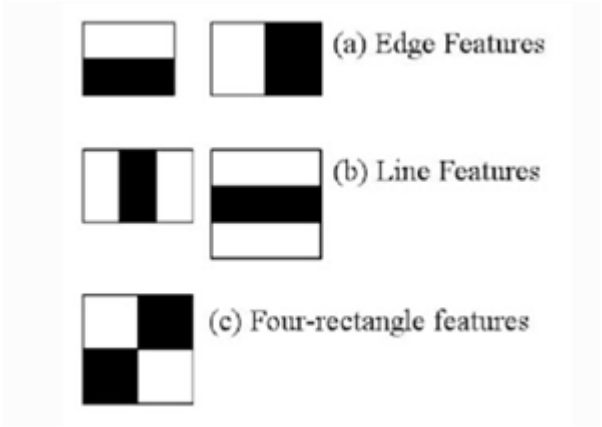

Fig 4: Haar Features

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.

The face recognition systems can operate basically in two modes:

Verification or authentication of a facial image: it basically compares the input facial image with the facial image related to the user which is requiring the authentication. It is basically a 1x1 comparison.

Identification or facial recognition: it basically compares the input facial image with all facial images from a dataset with the aim to find the user that matches that face. It is basically a 1xN comparison.

The algorithm used for recognition is Local Binary Patterns Histogram(LBPH). The face area is first divided into small regions from which Local Binary Pattern Histogram (LBPH) histograms are extracted and concatenated into a single, spatially enhanced feature histogram efficiently representing the face image.

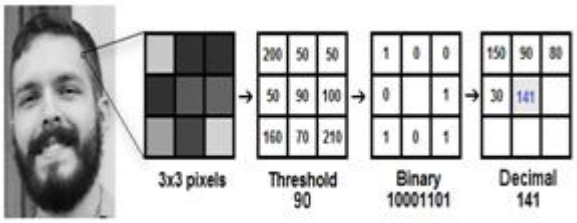

Fig 5: LBPH Threshold

The recognition is performed using a nearest neighbour classifier in the computed feature space with Chi square as a dissimilarity measure. Extensive experiments clearly show the superiority of the proposed scheme over all considered methods (PCA, Bayesian Intra/extrapersonal Classifier and Elastic Bunch Graph Matching) on FERET tests which include testing the robustness of the method against different facial expressions, lighting and aging of the subjects. In addition to its efficiency, the simplicity of the proposed method allows for very fast feature extraction.

Based on the image above let's say suppose we have a facial image in grayscale we can divide the image as a window of 3x3 pixels as a matrix containing the intensity of each pixel.Then, we need to take the central value of the matrix to be used as the threshold. This value will be used to define the new values from the 8 neighbors. For each neighbor of the central value (threshold), we set a new binary value. We set 1 for values equal or higher than the threshold and 0 for values lower than the threshold.

Now the matrix will contain only binary values. We need to concatenate each binary value from each position from the matrix line by line into a new binary value. Then convert this binary value to decimal value and then set as a central value of the matrix, which is actually a pixel from the original image.At the end of this procedure we obtain a new image which will have a better intensity and characteristics of the original image.

Attendance Marking

The recognized face is matched with the database and if there is a match, then that particular student will be marked present. Following the same procedure, a list of students who are present is made a record and the rest of them will be marked absent. The students who are absent to the class the sms or mail will be sent to their parents regarding their absence.The attendance of students will only take place when their respective guides or lectures face is identified, this is an advantage to avoid proxies and fake attendance.

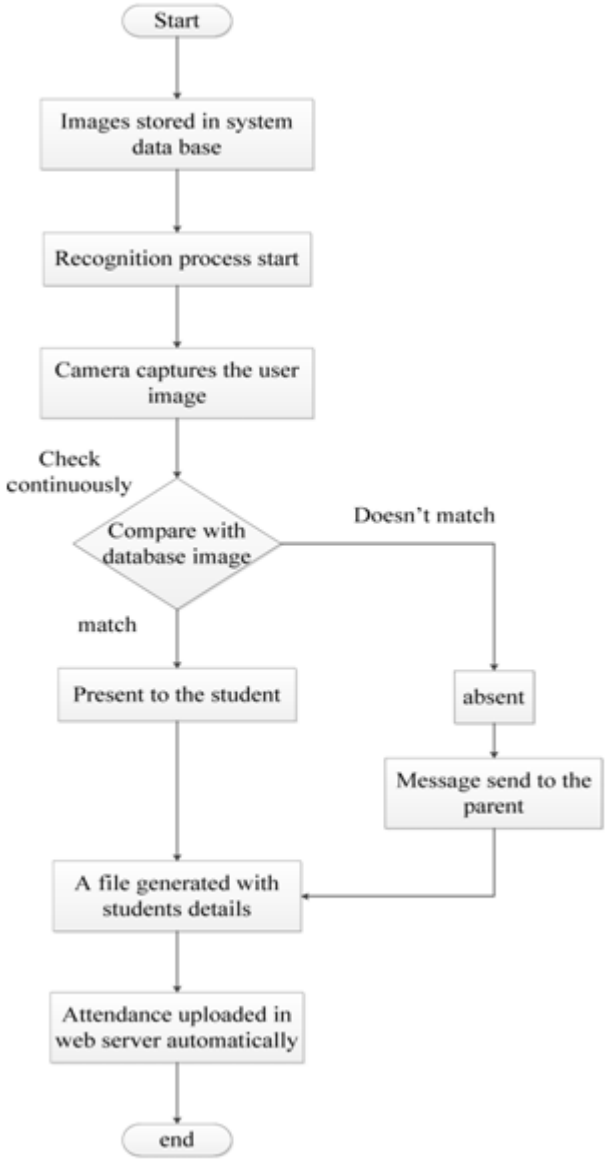

Fig 6: Flow Chart

3.3 Algorithm

ALGORITHM:FACE_RECOGNITION_BASED_ATTENDANCE_MANAGEMENT_SYSTEM_USING_MACHINE_LEARNING

INPUTS: Faces of students at Entrance, Inside Classroom.

OUTPUT: Automatic Marking of the attendance.

PROBLEM DESCRIPTION: Recognition of faces and marking attendance accordingly.

Step 1: Start
Step 2: Enrollment of Student's data into database
Step3: Camera is installed in the classroom and recognition process of student's images
Step 4: Capture the image of the student
Step 5: Compares the images with the images stored in the database.
IF: it matches with database the student is present
ELSE: absent, send message to the parents
Step 6: Marked present in the attendance record
Step 7: End

IV. CONCLUSION AND FUTURE SCOPE

The proposed model system using face recognition attendance management system is a great model for attendance marking system. Here it overcomes the disadvantage of proxies and fake attendance. The attendance is marked when their respective guides face is recognized hence the proxies are avoided. However when compared to other smart biometrics face recognition technique plays a vital role. This proposed system aims to provide a significant level of security. Hence, a highly pro-efficient attendance system for classroom attendance needs to be developed which can perform recognition on multiple faces at one instance. Also, there is no requirement of any special hardware for its implementation. A camera, a PC and database servers .

Here we use a live video to capture the images and we use features like Haar-Cascade and LBPH hence we obtain about 82% of accuracy which is ideal for the machine learning process. Accuracy can be improved with the increasing number of classes and the amount of relevant data, as well as in-depth model training. the accuracy of the gray images is better than the color images but according to the real state of the observation system we have color images (frames), next time we can deal with the color images with improved accuracy.

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