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Attendance System Using Deep Learning

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Abstract: *In the traditional system, it is difficult to handle the attendance of a huge number of students in the classroom. Attendance of the students is very important for every university, college as well as school as it keeps the record of every individual. The conventional methodology of taking attendance by calling out the roll number or name of the student and then recording the attendance is a tedious task. Assume the duration of the lecture is 60 minutes or 1 hour and to record the attendance it would take 5 to 10 minutes. Also for every tutor, this is time-consuming. To overcome this problem, real-time face recognition is a real-world solution, which will help in marking the attendance of students in bulk. In this project, face detection and face recognition are used. Attendance marking through face recognition can be implemented in the classroom by capturing the image of students in the classroom via a surveillance camera. Later Haar Cascade algorithm is used for face detection, which helps in locating the position of the face region, and LBPH (Local binary pattern histogram) algorithm for face recognition. The images of all the students in the class are stored in the database and when the face of the individual student matches with one of the faces stored in the database then the attendance is recorded.*

Keywords: Haar cascade classifier, LBPH algorithm, face recognition, face detection

I. INTRODUCTION

1.1 Traditional vs Automatic Attendance Marking System

Attendance is of prime importance for both the teacher and student of an educational organization. Therefore, it is important to keep records of attendance. The problem arises when we think about the traditional process of taking attendance in the classroom. Calling the name or roll number of the student for attendance is not only a problem of time-consuming but also needs energy. Traditional methods are still being followed to mark attendance in many colleges. The most common conventional methods being practiced in routine lifestyle are, the student is supposed to sign the attendance sheet manually, which is passed around the classroom while the lecturer is giving the lecture. Sometimes this particular approach could undoubtedly allow the students to cheat about their attendance, where a student present in the class may sign for a physically absent student. In addition, there are chances of missing the sheets from the lecturer. Another traditional method that is more commonly used in practice is the roll call system. In this method the student is supposed to answer his/her roll call made by the lecturer, sometimes this method also allows the student to cheat about their attendance by answering the roll call as present for a student who is not available in the class, which is again a time-consuming task.

The Automated Attendance marking system is a process where attendance is marked only through the physical presence of the student in the classroom. Automation helps in simplifying time tracking and there is no need to have a person monitor the system. It also eliminates human error. A time and attendance system using facial recognition technology can accurately report attendance, absence, and overtime with an identification process that is fast as well as accurate.

1.1 Why use a Face Recognition System?

A process of obtaining the face of the student to ensure his/her presence in the class and to mark attendance is called face Recognition. A High-Definition camera can be installed in all the classrooms, which will help to capture the image of the students. Further from the captured image, the face of each student is separated by bounding the face region. Then this image will be compared with the images, which are stored in the databases. If the image is present then the attendance of the student will be marked. In considering the biometric system, the physical fingerprint of the student is required to mark the attendance. However, the proposed system does need any physical interference from any student.

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There are two phases in Face Recognition Attendance System:

- **Face Detection:** Face Detection is a method of detecting faces in images. It mainly comes under object detection like for example car in an image or any face in an image and can use in many areas such as security, biometrics, law enforcement, entertainment, personal safety, etc.
- **Face Recognition:** Face Recognition is a method of identifying or verifying a person from images and videos that are captured through a camera. Its Key role is to identify people in photos, video, or in real-time.

The objective of our proposed system is to create a face recognition-based attendance system with getting a less false-positive rate in detecting unknown persons by applying a threshold and saving their images. We used the Haar cascade for face detection because of its robustness and LBPH algorithm for face recognition. It is robust against monotonic grayscale transformations.

II. LITERATURE SURVEY

[1]The Paper is based on the HaarCascade Classifier to detect the face and PCA to recognize the face. In the proposed Algorithm, the author Shivam Singh has used the OpenCV Library Function to draw the Bounding Box around the face. The author has resized the images in 100 *100 dimensions to reduce the complexity but as a result, the images will be unclear. For feature extraction, the principal Component Analysis is used which is the dimensionality reduction algorithm.

[2]The Paper is based on convolutional Neural Networks to recognize the face of the person. The author Aneesa M P , Sabina N, Meera K have used the Flicker Faces HQ Dataset to perform the training which is a dataset containing 70000 images of human faces, each image is of dimension 512 *512 .They have used Alexnet and the MobileNet to create the model.

[3]In this paper the author Jie Wang and Zihao L have developed the system to recognize the faces using the Convolutional Neural networks from scratch. they have created a complex neural network to create the architecture .The Paper explained the detailed working of convolutional neural networks .The image size used in this paper is 32*32.The Author have used the softmax activation function in the last layer to predict the class of the image. The class represents the person, which is predicted from the image.

[4]In this paper, the authors have compared face recognition algorithm with LBPH algorithm. The authors have explained the workflow of LBPH algorithm for low resolution images. In their experiment, they first prepared the face database and then extract the LBPH texture features. For this test, they collected 2500 face images were taken using TTQ HD 1080px camera. This information of face image of known and an unknown identity was compared with the face image of known individuals from the available database. There proposed system operates better at the minimum low resolution of 35px to identify the human face in various angles, side poses and tracking the face during human motion, which was achieved using LBPH algorithm

[5] In this research paper, we got to know about the working of the haar cascade classifier. We got to know that the haar cascade is simple algorithm which can run in real time irrespective of the scale of the image and location. We got to know that the haar cascade uses cascading windows and tries to compute features in every windows and classify weather it could be an object. The Haar cascade works as a classifier and provide positive data points, which are part of our detected object. The haar cascade classifier uses different filters to detect the corner and edges this filters are auto generated so we do not have to provide the filters by our own.

III. METHODOLOGY

- Haar Cascade Classifier
- Local Binary Patterns Histogram

These two methodologies come under OpenCV. OpenCV comes with a trainer and as well as a detector. Therefore, if you want to train your classifier for any object then you can use this classifier called Haar Cascade Classifier.

3.1 Haar Cascade Classifier

Haar cascade is an algorithm that can detect objects in images, irrespective of their scale in image and location. This algorithm is not so complex and can run in real time. We can train a haar-cascade detector to detect various objects like

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cars, bikes, buildings, fruits, etc. Haar cascade uses the cascading window, and it tries to compute features in every window and classify whether it could be an object.

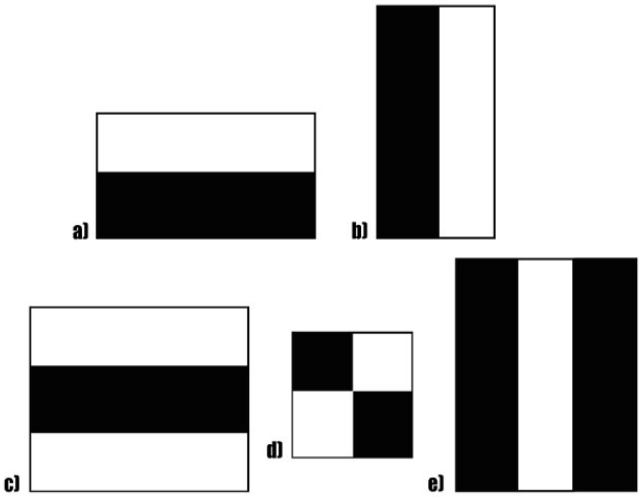

Fig. 1. Haar Cascade Classifier

Sample haar features traverse in window-sized across the picture to compute and match features. Haar cascade works as a classifier. It classifies positive data points → that are part of our detected object and negative data points → that don't contain our object.

- Haar cascades are fast and can work well in real time.
- Haar cascade is not as accurate as modern object detection techniques.
- Haar cascade has a downside. It predicts many false positives.

Simple to implement, less computing power required.

3.2 Local Binary Pattern Histogram

Local Binary Patterns (LBP) is a perceptible descriptor style used in the classification of computer vision. LBP is the specific case of the 1990 proposed Texture Spectrum model. In 1994, LBP was represented for the first time. Since then, it has been found as a solid element for classifying texture. More specifically, once LBP is combined with the descriptor histogram of oriented gradients (HOG). It improves the execution of identification on some datasets. The image is divided into cells (4 x 4 pixels) for the encoding of features. It is contrasted by using a clockwise or counter-clockwise bearing of surrounding pixel values. The value of each neighbour's intensity is compared to the central pixel. The location is assigned a one or a zero depending on the difference whether it is higher or lower than 0. The result gives a single cell an 8-bit value. Fig 2 shows the matrix calculation comparing the value of the middle element of the matrix with the neighbouring elements.

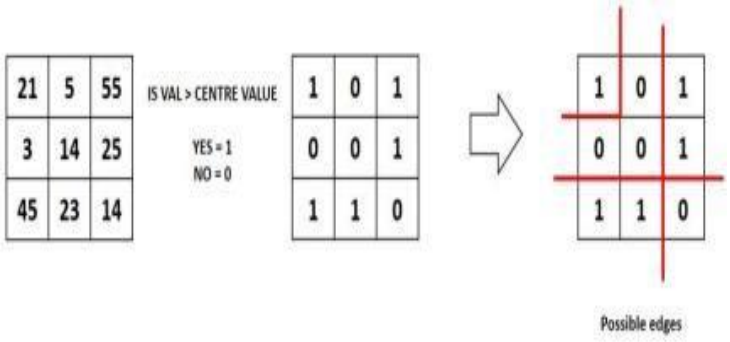

Fig. 2. LBPH creating an 8-bit number

If the illumination condition of the image is changed, the final result is equivalent to the previous result. Histograms are used in larger cells as well as the frequency of values that make the system robust. Edges can be identified as quality changes by dissecting the results in the cell. It is possible to obtain feature vectors by calculating the values of all cells

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and connecting the histograms. Pictures can be grouped by ID-connected handling methods. Input pictures are classified using the same procedure and the data set is contrasted and separation is obtained. It is very well recognized by setting a limit value whether it is a known or obscure face. Fig 3 represents the values of the matrix when the light intensity is wavering.

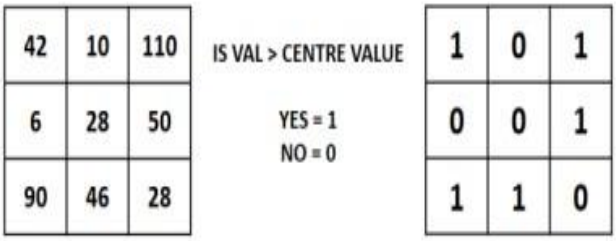

Fig. 3. If the brightness changes, the results will be the same

IV. PROPOSED SYSTEM

4.1 System Flow Diagram

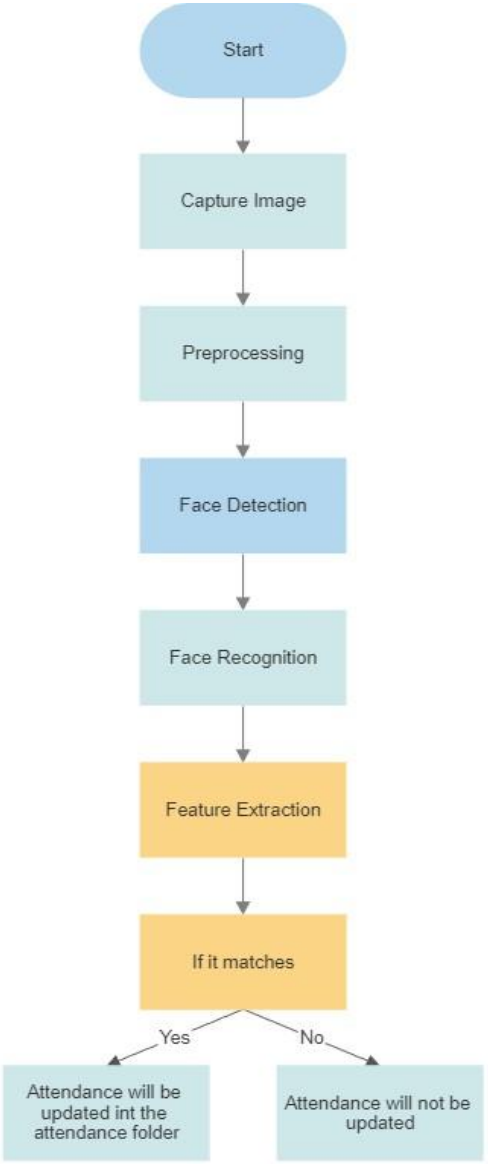

Fig. 4. Proposed system flow diagram

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Step 1: First, it captures the input image
Step 2: after capturing the image, it will pre-process the image and converts the image into a grayscale Image.
Step 3: By using the Haar Cascade Classifier face detection will be done and extracts features from the image and then be stored in a trained set database.
Step 4: Similarly, face recognition is done by using Local Binary Patterns Histogram.
Step 5: And then extracted features will be compared with the trained data set.
Step 6: if it matches, attendance will be updated in the attendance folder.
Step 7: If not matched attendance will not be updated in the attendance folder.

4.2 System Architecture

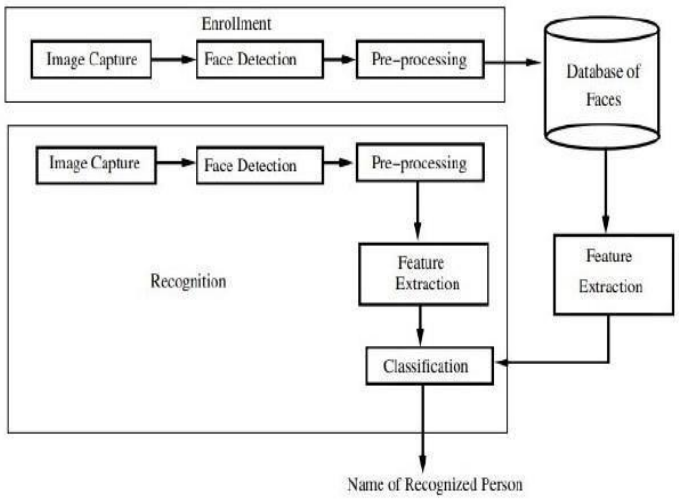

Fig. 5. System Architecture

The proposed face recognition approach has four main steps: the module for image acquisition, the module for extraction of features, the module for training the classifier database, and the module for classification. Initially, the image acquisition module collects the face datasets. Then, a series of salient features are extracted by applying a feature extraction module. These facial features are used to analyse face landmarks that represent human identity information. In the next process, the classifier is trained for recognizing the face. In the last module, the system recognizes the face image and fetches information about the person from the SQL database.

A. Face Detection

For face detection, OpenCV is used which introduces a Haar cascade classifier. The classifier of the Haar cascade uses the AdaBoost algorithm to locate numerous image facial features. Initially, it takes an input image using the camera and converts that colour image into a grayscale image. After this, it loads the Haar cascade classifier for determining whether the image contains any faces in the frame or not. When any face is detected, other facial features are checked and a square frame is drawn on the face. Otherwise, it starts reading other pictures.

B. Feature Extraction

For extracting the facial features from an image, the LBP operation is used that compares the intensity value of every component with the eight nearest neighbour pixels values. If the value of the neighbouring pixel is greater than the value of the central pixel, it will assign one to its neighbouring pixel, otherwise, it will assign zero. For each pixel, this task provides an 8-bit string. A decimal value of an 8-bit pixel string determines the LBP value. The inputimage is divided into many small sub-images after the application of the LBP operation and the histograms of the LBP value of each sub-images are extracted. Then all histograms are linked to make an image-representing feature vector and used to train a facial recognition classifier.

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C. Dataset

We designed our dataset, with 200 individual photos. Throughout the image acquisition process, face images are cropped and converted into grey images, and then these images are saved in the same folder to make face databases for extraction tasks. After this, the standardization technique is applied to all images to reduce noise and set the correct image scaling position to quickly obtain the result of recognition.

D. Face Recognition

For the face recognition process, the Local Binary Pattern Histogram algorithm is applied. The LBP operator uses local binary patterns to reduce the local spatial distribution of a face image. The LBP operator is a collection of binary pixel value ratios in the centre at regular pixel intervals and is around eight pixels

V. CONCLUSION

We have proposed an attendance management system for student's attendance. It helps to reduce time and effort, especially in the case of a large number of students marking attendance. The whole system is implemented in Python programming language. In the proposed system, we used the Local Binary Patterns histogram algorithm for recognizing faces. The whole procedure is divided into three major components, i.e. detection of faces, facial feature extraction, and classification of the image. The Face detection process describes the face of a person in an input image. In feature extraction, facial landmarks are extracted to make an LBPH histogram that gives a unique result, and then in the recognition process, the histogram of the input image is compared with the database histogram using the classifier. The system can recognize a known and unknown person.

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