Attendance Management System Based on Facial Recognition

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Abstract: *In this paper we recommend an automated attendance management gadget. This machine, which is based on face detection and popularity algorithms, mechanically detects the pupil while he enters the class room and marks the attendance via recognizing him. The machine architecture and algorithms utilized in each stage are defined on this paper. unique actual time eventualities are considered to assess the performance of diverse face recognition systems. This paper additionally proposes the techniques for use for you to deal with the threats like spoofing. whilst compared to traditional attendance marking this gadget saves the time and additionally enables to monitor the students.*

Keywords: Face reputation, LBP, SVM

1. Introduction

The advent of automation has led to the development of various scientific advancements and inventions that aim to improve our lives by making hard work easier and increasing accuracy. One of these developments is the automated attendance system, which replaces the traditional method of attendance marking. These systems can be bio-metric based, smart card-based, or web-based, and they are widely used in various organizations.

The traditional method of attendance marking can be time-consuming and complicated, especially when dealing with large numbers of people. Automated attendance systems offer several advantages, such as saving time, improving accuracy, and enhancing security by preventing fake attendance.

In the case of bio-metric-based attendance systems, such as those that use facial recognition technology, the process generally involves several stages. These include image acquisition, database development, face detection, pre-processing, feature extraction, classification, and post-processing.

To better understand the proposed model, this paper will conduct a literature survey and provide a detailed description of each stage involved in a facial recognition-based attendance system. The results and conclusions of this study will also be presented, along with suggestions for areas of improvement.

Overall, the goal of this paper is to provide a comprehensive analysis of facial recognition-based attendance systems and their potential for improving attendance management in various organizations.

2. Literature Survey

In [1], the authors proposed a fingerprint-based attendance device that is portable and allows students to place their finger on the sensor without the need for teacher intervention. Although this device provides a foolproof way of marking attendance, passing the device around during lecture time may distract students. Various works related to Radio Frequency Identification (RFID) based attendance systems are available in the literature. In [2], the authors proposed an RFID-based system in which students use RFID identity cards to record their attendance by placing them on a card reader. The system uses RS232 to connect to the computer and store the attendance data in a database. However, this system may lead to fraudulent access if an unauthorized person uses an authorized ID card to gain entry. Iris recognition is another biometric that can be used for attendance systems. In [3], the authors proposed an iris recognition system based on Daugman's algorithm that captures, extracts, stores, and matches iris images. However, difficulties may arise when placing the trans-challenge lines in areas with poor topography. In [4], the authors proposed a real-time face recognition system that is reliable, secure, and fast, but still requires improvement in different lighting conditions.

3. Proposed Model

The paper describes an automatic attendance management system based on a face recognition algorithm. The system's architecture is presented in Figure 1, and it works by capturing an image of the person's face as they enter the classroom. The face location is extracted and pre-processed for further analysis. Because no more than two people can enter the classroom at a time, the face detection algorithm has less work to do.

According to it, face recognition is a more efficient attendance system than others, and they provide a table (Table I) to support this claim. After a student's face is recognized, it is passed to post-processing, and the system algorithm is explained in detail.

Set of rules 1 Pseudo Code of Proposed system

1.   seize the scholar's picture
2.   apply Viola-Jones set of rules (Face Detection)
3.   Extract the ROI in square Bounding field
4.   Convert to gray scale, examine histogram equalization and Resize to 100x100
5.
if Updating Database then
save in Database
else
practice PCA/LDA/LBPH (For character Extraction) observe Distance Classifier/SVM/Bayesian (for Classification)
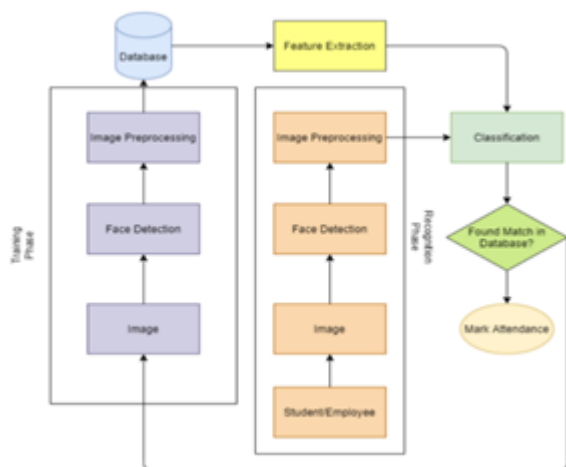forestall if
6. put up-processing

Table I: Drawbacks of various Attendance Systems

Type of the System	Drawback
RFID	Fraudulentus- age
Fingerprint	Time eating for college students to attend and give their attendance
Iris	Invadesuser privacy
Wireless	Bad Performance if topography is terrible

Figure 1: System Architecture

Figure 2: Extracted and Pre- processed faces

To ensure optimal performance, it is recommended to use images of size 640x480 in the system. This helps to avoid the need for resizing in the back-end, which can sometimes lead to decreased performance.

The automatic attendance management system has different stages, which are illustrated in Figure 1. The authors provide technical details for implementing each stage, which are described in the following sections of the paper.

1)   Image Capture
The Camera is mounted at a distance from the entrance to capture the frontal images of the students.

2)   Face Detection
To ensure the accuracy and efficiency of a face recognition system, it is essential to have a proper face detection algorithm. There are several methods proposed for detecting faces, such as face geometry-based techniques, feature invariant methods, and machine learning-based methods. Among these techniques, the Viola-Jones framework has been proposed, which provides high detection rates and is also fast, making it suitable for real-time applications.

The Viola-Jones detection algorithm is efficient due to its use of integral image and AdaBoost learning algorithm as a classifier [5]. Therefore, the proposed automatic attendance management system uses the Viola-Jones face detection algorithm, as it provides better results in different lighting conditions. To achieve higher detection rates up to an angle of 30 degrees, multiple haar classifiers were combined. This approach enhances the overall performance of the system, ensuring fool proof attendance management.

3)   Pre-processing
After the face is detected, it goes through a pre-processing step. This step involves histogram equalization of the extracted face image, and resizing it to 100x100. Histogram Equalization is a well-known method for Histogram Normalization that improves the contrast of the image by stretching the range of intensities in an image to make it clearer.

4)   DatabaseDevelopment
As we selected biometric primarily based gadget enrollment of each individual is needed. This database development segment includes image seize of each individual and extracting the bio-metric function, in our case it is face, and later it's miles improved the usage of pre-processing techniques and saved inside the database. For our project, we captured images of individuals in various angles, expressions, and lighting conditions. To create a database for our project, we collected 20 images of 80 individuals, resulting in the NITW-database. discern 2 suggests few extracted and pre-

processed faces saved in the database.

5) Feature Extraction and Classification

The accuracy of a Face recognition system also relies on the feature extraction and classification methods used. Function extraction is achieved using characteristic based techniques or holistic strategies. In a few holistic strategies we can employ dimensionality discount before classification. We in comparison the results of different holistic methods used for feature extraction and classification in real time state of affairs. desk II offers the contrast info.

important element evaluation (PCA) turned into the first algorithm that represents the faces economically. In PCA the face snap shots are represented the usage of eigenfaces and their corresponding projections alongside every eigenface. in place of the use of all of the all of the dimensions of an image best meaningful dimensions are taken into consideration to symbolize the picture. Mathematically an picture the use of PCA is represented as

$$\chi = WY + \mu$$

Here, χ is the face vector, Y is vector of eigenfaces, W is the weight or feature vector, and μ is the average face vector. These feature vectors are then used as classification functions in face recognition. Later Fisherâ ĂŹs Linear Discriminant analysis (LDA) changed into proposed in which the ratio of among-magnificence scatter and inside-magnificence scatter maximizes. PCA does no longer consider the discriminative information inside the statistics where as LDA stores the dis- criminative facts in the data. LDA can also apprehend an photo in well-illuminated circumstance but fails in terrible- illuminated conditions. There are some instances in which PCA outperforms LDA and vice versa. [6] neighborhood Binary pattern Histogram (LBPH) is currently proposed set of rules for face feature extraction. on this approach LBP photograph is segmented into local areas and histogram of every is extracted and are concatenated to form a face descriptor. [7]. Accuracy of a system carried out using PCA and LDA are affected via database length which isn't always the case in LBP. [8]

In well known capabilities extracted from PCA and LDA are subjected to distance classifiers. the distance among the functions of probe photograph and functions of trained photographs is calculated. If the space is much less than the brink then the probe image is diagnosed.

$$er = \min\|\omega - \omega i\|$$

In which er is euclidean distance ω is photograph vector and that i is wide variety of trained picture. however we can make use a few machine getting to know algorithms for better classification. PCA is used for function extraction and aid Vector gadget (SVM) is used for the classification. SVM is these days proposed set of rules which is an effective sample classification algorithm. For sample recognition SVM finds the most advantageous separation of closest points in the schooling set. This separation may be done linearly or non-linearly. In actual international state of affairs we require a multi-magnificence classification. Assist Vector Classification, a SVM kind, is used for multi-class classification. Naive Baiyes classifier is a easy classifier which assumes independence of features of a category. In Bayes Classification Small amount of education data is enough for estimation. [9]

So Face recognition involves in two tiers, feature extraction and classification. The above stated feature extractors combined with classifiers are compared in numerous real international eventualities together with lighting fixtures situations, accidental facial feature modifications (occluded faces), Ex- pressions. machine overall performance is likewise evaluated in phrases of popularity charge, distance , false nice fee, time taken for training. false positive prices are calculated by using thinking about 60 real time photograph frames in table II. it's been discovered that LBP based totally set of rules gives least fake high-quality charge and accurate recognition price as it efficiently differentiates among the unknown and recognized faces. LDA can make accurate discrimination among the photographs best if the discrimination is supplied within the database (for instance photographs at different lighting situations). Distance additionally performs as a standards on this device version as the photo frames are captured when man or woman enters the room and face vicinity is resized. So the face location captured at approximately 4feet and 7feet offers better effects for LBPH and different algorithms respectively. For a schooling records of 150 images education time is calculated. LBP based totally set of rules requires minimum time for education wherein as SVM and Bayes classifiers take extra time for training. In classifiers assessment SVM does better classification than the rest.

6) Post-processing

In the proposed attendance management system, once the faces of the students are recognized, their names are updated in an Excel sheet. Additionally, there is a provision to announce the names of all the present students at the end of the class. this is carried out the use of textual content to speech conversion. The machine is likewise equipped with the power of sending notification mail to the absentees whilst that facility is enabled.

Threats to the System

Essential chance to the face reputation structures is spoofing. therefore anti-spoofing method like eye blink detector is covered in the device. with a purpose to discover the attention blink the wide variety matter of eye detection and be counted of iris vicinity detection are compared. In static photograph the range of times eye get detected is equal to the wide variety of times the iris area is detected or iris vicinity detection be counted would be 0(if character closes his eyes). This matter is incremented for sure wide variety of frames.

In the proposed system, the eyes are extracted from the image using Haar classifiers, as shown in Figure 3(i). The extracted eye region is then converted to a grayscale image, as shown in Figure 3(ii), and subjected to inverse suppression using a binary threshold filter, as shown in Figure 3(iii). Finally, the iris region is obtained as a grayscale image.

Table II: Comparison of Holistic Face Recognition Algorithm

| Performance Evaluation Conditions	PCA+Distance Classifier	LDA+Distance Classifier	PCA+SVM	PCA + Bayes	LBPH + Distance Classifier
False Positive Rate	55%	53%	51%	52%	25%
Distance of object for correct recognition	7feet	7feet	7feet	7feet	4feet
Training time	1081millisecs	1234 millisecs	24570 millisecs	29798 millisecs	563millisecs
Recognition Rate (Static Images)	93%	91%	95%	94%	95%
Recognition Rate (Real time video)	61%	58%	68%	65%	78%
OccludedFaces	2.5%	2%	2.8%	2%	2.3%
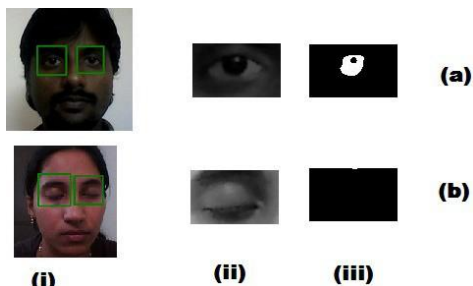
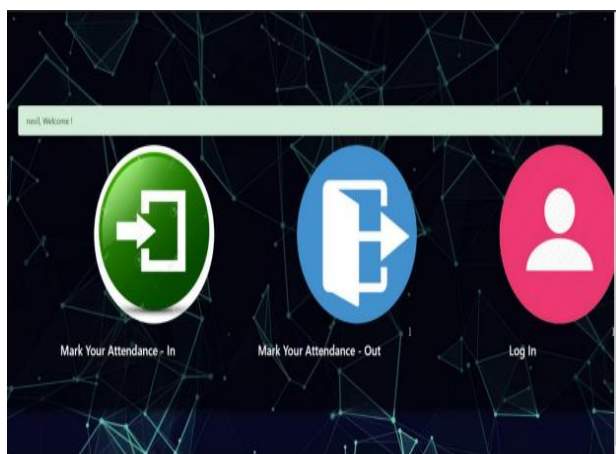**Figure 3:** Eyes and Iris Region Extraction

Figure 4: User Interface of the System Proposed

The system uses a binary threshold filter to invert the eye region and create a black image if the eyes are closed. The filter sets pixels with a value of 255 to the maximum value, and the rest to 0. This allows for the calculation of blink count based on the blackness of the inverted image. To continuously reveal the presence of college students inside the class stay streaming is also incorporated within the machine.

Choose the source of input (Webcam/Recorded Video)
- To update the Database
- choose the set of rules for education and classification (PCA/LDA/LBPH/PCA+SVM/PCA+Bayesian)
- Announce the Attendees' Names
- option for Blink Detection

Excel Sheet and Emails are generated while popularity is finished. discern five suggests the extraction of face place and updating to the database after pre-processing. parent 6 shows the popularity technique. put up-processing step includes updating the excel sheet with college students names who are gift as shown in determine 6

Figure 5: Extraction and Updating Database

Graphical User Interface (GUI)

The GUI is developed the use of Winforms software in Microsoft visible C # and EmguCV wrapper. The front end advanced is as proven in parent four.

The gadget affords the subsequent functions

Figure 6: Excel sheet of attendance

4. Conclusion and Future Work

Automated attendance systems that utilize face recognition algorithms have been shown to be both efficient and secure, resulting in significant time savings compared to traditional methods.This gadget can also be used to discover an un-recognized individual. In actual time scenarios LBPH outperforms different algorithms with higher reputation charge and low fake high quality fee. SVM and Bayesian also show to be higher classifiers whilst as compared to distance classifiers.

The future work of this project is focused on improving the recognition accuracy of the face recognition algorithms in situations where there are unintentional changes in a person's appearance, such as shaving the head, wearing a headscarf, or growing a beard. The aim is to make the system more robust and accurate in identifying individuals, even with changes in their appearance. The system developed most effective recognizes face upto 30 degrees perspective versions which has to be improved in addition. It is suggested that gait recognition technology can be combined with face recognition systems to enhance the overall performance of the system.

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