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A Survey on Face Recognition Based Attendance System

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***Abstract*: The Face Recognition Attendance System (FRAS) is an innovative solution designed to streamline and enhance the attendance tracking process in various organizational settings. This paper presents a thorough examination of the recent advancements in face recognition-based attendance systems through an in-depth analysis of ten influential survey papers. With the growing need for efficient and secure attendance tracking methods, face recognition technology has emerged as a promising solution. Our study synthesizes insights from a diverse range of survey papers, offering a comprehensive overview of the current state-of-the-art methodologies, challenges, and future directions in the field.**

***Keywords*: attendance system, Dlib, image processing, face detection, face recognition, OpenCV.**

1. Introduction

In the ever-evolving landscape of technology, traditional methods of attendance tracking in various organizational settings are being replaced by more sophisticated and efficient solutions. One such groundbreaking innovation is the Face Recognition Attendance System (FRAS). This system represents a paradigm shift in the way attendance is managed, offering a seamless and secure alternative to conventional methods. The Face Recognition Attendance System leverages the capabilities of advanced computer vision and machine learning technologies to automate the process of attendance tracking. Unlike traditional methods that rely on manual data entry, cards, or biometric scans, FRAS identifies and records attendance through the analysis of facial features unique to each individual. This contactless and non-intrusive approach not only enhances security but also provides a more convenient and user-friendly experience.

2. Motivation

The motivation behind the development of FRAS stems from the need for organizations to streamline attendance management, reduce administrative burdens, and enhance overall efficiency. Traditional methods often suffer from inaccuracies, time delays, and susceptibility to fraudulent practices. In contrast, FRAS offers a real-time, accurate, and secure solution that is adaptable to a variety of environments, from educational institutions to corporate offices.

3. Objectives

1. Reducing time wastage during conventional class attendance.
2. Utilizing latest trends in machine vision to implement a feasible solution for class attendance system.
3. Automating the whole process so that we have digital environment.
4. Preventing fake roll calls as one to one attendance marking is possible only.
5. Encouraging the use of technology in daily lives.

4. Literature Survey

NFC (Near Field Communication) Technology with a camera incorporated in a mobile device," according to a study publication, NFC technology and a mobile application are used to improve the attendance system. At the time of enrolment in the faculty, each student is issued an NFC tag with a unique ID, according to the research article. The travelling instructor will then take attendance at each lesson by touching or distributing these tags. The integrated camera will then take a picture of the student's face before sending all of the data to the college server for verification. The benefits of this technology include the ease of use of NFC and the fast connection speed. It greatly facilitates the process of being in the present moment. However, if the NFC tag was not tagged by the user, the system would not be able to identify infringement automatically. Aside from that, the usage of a mobile app was necessary since the NFC student was interrupting the teacher. Would it be a support system to record everyone present if a pastor failed to bring his mobile phone to work? Furthermore, because of a confidential topic, most professors would not want their iPhones to be used in this manner. As a result, instead of the NFC marker, unique student information such as biometrics or face recognition, guanine to the student should be employed. This ensures that a specific student will be the first to take attendance.

This method involves taking images of the employee using a camera in order to capture their faces and visions. When the result is located on the face website, the taken image is compared individually with the face mask to display the employee's face, where presence is noted. The key benefit of this method is that the presence is recorded on a highly secure server that no one else can access. Furthermore, the face

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detection algorithm in this suggested system is built employing a skin-splitting approach to improve the accuracy of the detection process. Despite ongoing efforts to improve the accuracy of the face detection algorithm, the system remains unaffected at this time. This application needs a stand-alone computer with a constant power source that is not portable. This sort of system is prepared to mark staff attendance since they only need to submit attendance once a day, unlike students who must indicate that they are present in each class on a certain day. If marking is present, it will be tough. The system is out of control. To address this issue, the whole old system management system is converted to a portable module, which is then used to operate a Python system.

According to the fourth research journal "RFID based Student Attendance System" (Hussain, Dugar, Deka, Hannan, 2014), the proposed solution is almost identical to the first research journal in which RFID technology was used to enhance the adult attendance program. during this process, the tag and the student are also used as a way to track the presence of students. The difference between the original journals and that is where the information for the participants will be available through the web site. Provides very easy to retrieve information. Also, this method is not perfect in the sense that, first of all, it is not portable, because the RFID reader can only work if it is connected to a PC. Second, the RFID tag is not guanine information that can specifically identify the reader, thus, leading to inaccuracies in the data collected by attendees.

Images of students are captured using a web cam. Multiple images of single student will be acquired with varied gestures and angles. These images undergo pre-processing. The images are cropped to obtain the Region of Interest (ROI) which will be further used in recognition process. Next step is to resize the cropped images to particular pixel position. Then these images will be converted from RGB to gray scale images. And then these images will be saved as the names of respective student in a folder.

Face detection here is performed using Haar-Cascade Classifier with OpenCV. Haar Cascade algorithm needs to be trained to detect human faces before it can be used for face detection. This is called feature extraction. The haar cascade training data used is an xml file-haarcascade_frontalface_default.

Face recognition process can be divided into three steps-prepare training data, train face recognizer, prediction. Here training data will be the images present in the dataset. They will be assigned with an integer label of the student it belongs to. These images are then used for face recognition. Face recognizer used in this system is Local Binary Pattern Histogram. Initially, the list of local binary patterns (LBP) of entire face is obtained. These LBPs are converted into decimal number and then histograms of all those decimal values are made. At the end, one histogram will be formed for each images in the training data.

After face recognition process, the recognized faces will be marked as present in the excel sheet and the rest will be marked as absent and the list of absentees will be mailed to the respective faculties. Faculties will be updated with monthly attendance sheet at the end of every month.

This system has been implemented with the help of three basic steps: A. detect and extract face image and save the face information in an xml file for future references. B. Learn and train the face image and calculate eigen value and eigen vector of that image. C. Recognise and match face images with existing face images information stored in xml file.

At first, openCAM_CB() is called to open the camera for image capture. Next the frontal face [2] is extracted from the video frame by calling the function ExtractFace(). The ExtractFace() function uses the OpenCv HaarCascade method to load the haarcascade_ frontalface_alt_tree.xml as the classifier. The classifier outputs a "1" if the region is likely to show the object (i.e., face), and "0" otherwise. The classifier is designed such a manner that it can be easily "resized" in order to be able to find the objects of interest at different sizes, which is more efficient than resizing the image itself. So, to find an object of an unknown size in the image the scan procedure is done several times at different scales. After the face is detected it is clipped into a gray scale image of 50x50 pixels.

Learn() function which performs the PCA algorithm on the training set.

To do PCA, the dataset must first be "centered." For our face images, this means finding the average image - an image in which each pixel contains the average value for that pixel across all face images in the training set. The dataset is centred by subtracting the average face's pixel values from each training image. It happens inside cvCalcEigenObjects().Recognize() function, which implements the recognition phase of the Eigenface program [5]. It has just three steps. Two of them - loading the face images and projecting them onto the subspace - are already familiar. The call to loadFaceImgArray() loads the face images, listed in the train.txt, into the faceImgArr and stores the ground truth for person ID number in personNumTruthMat. Here, the number of face images is stored in the local variable, n TestFaces.

The task of this is to capture the face of each student and to store it in the database for their attendance. The face of the student needs to be captured in such a manner that all the feature of the students' face needs are recorded and analyzed to the existing record. The face recognition process is divided into two parts: Face Detection and Face Recognition using Datasets. Face detection is detecting the presence of the face and face location in the image or live video frame. Once a face is detected, its features are matched to the features stored in the database. If a proper match is found, the attendance of the corresponding student is marked in the database along with the date and time of entry.

In Image Enhancement process it takes images from user side check all quality of images and enhance quality of image using method in machine learning. Image quality is the most crucial factor for specify a particular person so Haar Cascade algorithm is very accommodating for the image enhancement and improvement process.

In attendance management system initially detention images enroll by the student and that Image patterned in our database created by the management side. Registered image matched to

every database image if that is existing in system database then that student patent as a present either marked as a absent.

Feature Extraction: In this step, all data will be extracted from the sample created to make template using facial recognition.

Face Database: In this step system can use the dataset that is earlier present-day in the database of system for parallel a entered carbon copy with database images. In database save all student info for helping to system to take detailed student presence in very less time.

Face Recognition: In this last stage of face recognition, the face structures of a collected samples are similar with the one from a facial database or not. It will take just a second. In this system we can use Haar Cascade method. A Haar Cascade is a type of artificial neural network used in image recognition and image processing that us specially designed for pixel data.

Jyotshana Kanti proposed a smart attendance marking system which combines two differencing algorithms such Principal Component Analysis and Artificial Neural Network. The purpose of the author is to solve the traditional attendance marking system and to resolve the time-consuming. In the system implement with Principal Component Analysis, it does an extraction and identify the similarities of the face database and acquire images. Artificial Neural Network is used to solve the problem of the input data or learn from the input data, and the expect value. In the system implemented by the author using back propagation algorithm and combines with mathematical function to perform in that system. As a result, written by the author research, it shows that the system can use to recognize in a different environment

Priyanka Thakare proposes a method using Eigenface and principal component analysis with architecture as follows. The camera is installed in the front, which is used to capture entire face of the students inside the class. Then, the captured images are transferred into the system as inputs. The images captured from the camera could be too dark or too bright, thus enhancement is needed to convert them to gray images. In the next step, histogram normalization is used to remove the contrast of the images, thus it is easy to recognize the students who sit in the back row. The median filter is used to remove noise from the images. Noise sometimes still occurs even when high-definition camera is used. The system also implements skin classification that changes all pixels to black, except the pixels that are close to the skin.

In the first step, the database will be created at the time of enrollment of students. The database will store generic information of students like name, identification number, course, semester subjects. alongside the image of the student is to be captured by the system for training of the proposed system. This system captures single image for a student for training purpose. With the aid of all the pictures the student has stored in the database, facial recognition for all of the students attending a lecture. It can be accomplished.

Due to the movements of a student in a classroom, the image captured by the camera may get blurred, the image can be ameliorated using Generative Adversarial Networks. GANS are known for their ability to retain texture information in images, create solutions similar to the actual range of aspects, and look perceptibly convincing.

For detection of faces 68 landmarks of faces are taken into account. with the help of these landmarks, faces are detected. For face detection, Haar classifiers have been used. It is an approach based on machine learning in which a cascade function is trained from many positive and negative images. This is then used on other images to detect images. These classifiers are simply the subtraction of the sum of pixels under the black area from the sum of pixels under the white area. applying 6000 features on each window frame was found to be difficult. features were grouped into stages which are known as cascades of a classifier.

AdaBoost is used for removing redundant features and for selecting only appropriate features. These features are known as weak classifiers. A weighted combination of weak classifiers is used to detect faces, using the AdaBoost linear combination of weak classifiers is constructed known as a strong classifier.

The system proposed in this paper was tested in an IT company where the authors' previous work was integrated. Five employees volunteered in this research. The dataset included the photographs of them. Also, this dataset was only used for training the DNN. The employees took several different positions while being photographed. In order to make this approach applicable for production usage, it is of great importance to capture a small number of photographs of every employee at the site.

The first step of the face recognition process is face detection. Face detection presents the well-studied field in the computer vision domain. As a result of decades of research, nowadays there are numerous machine learning algorithms applicable for this task. In recent years, CNNs achieved advanced results in image classification and object detection.

Due to its runtime performance, for this step, a state-of-the-art CNN cascade is used for a face detection task, introduced by Haoxiang Li et al in [16]. The cascade consists of 6 CNNs, 3 CNNs for binary classification (face and non-face) and 3 CNNs for bounding box calibration. A Torch, machine learning framework is used for developing this face detector used as the first step of face recognition model.

The final step of developing the face recognition model for tracking employees' attendance consists of training the classifier based on the previously generated embedding from employees' dataset by the deep CNN. Due to the fact that this system is based on smaller dataset, linear Support Vector Machine (SVM) was applied for this classification task.

The paper used trained feature models from Convolutional Neural Network; model has the features of the entire labels of the face recognition systems. The test images are validated against these models and provide the maximum probability value among the labels and claims that to be the person. FAREC takes 20 epoch for converging learning rate from 0.01 and produce 96%accuracy for FRGC and False acceptance rate of 0.1% (1 in 100). The training losses are drastically reduced to 0very soon as before 5th epoch. The following figure 9 and figure 10 showing the learning rate convergence and accuracy of FAREC.

In this, project experimented with 30 faces as a training set of 7 people for measurement of accuracy of the system. The Extract () function shows a sample binary image obtained with the help of face extracting frame work detection method by Paul – Viola. The results shows that with respect to face detection and recognition rate, on increasing the face angle, camera decreases. Introducing entry and exit times, the authors intend to develop an attendance management system for colleges which is based on facial recognition technology. Every student's attendance is collected by the system through constant observation at the entry and exit points. The results of our initial experiment performed better in performance assessment than traditional black and white display systems. This system is mainly developed for face recognition from images or video frames.

Arun Katara et al. (2017) mentioned disadvantages of RFID (Radio Frequency Identification) card system, fingerprint system and iris recognition system. RFID card system is implemented due to its simplicity. However, the user tends to help their friends to check in as long as they have their friend's ID card. The fingerprint system is indeed effective but not efficient because it takes time for the verification process so the user has to line up and perform the verification one by one. However, for face recognition, the human face is always exposed and contains less information compared to iris. Iris recognition system which contains more detail might invade the privacy of the user. Voice recognition is available, but it is less accurate compared to other methods. Hence, face recognition system is suggested to be implemented in the faculty attendance system.

5. Conclusion

The face recognition attendance system using dlib and OpenCV offers a precise, contactless, and efficient solution for attendance management. The surveyed literature covers various aspects, including facial feature extraction techniques, recognition algorithms, dataset characteristics, and performance evaluation metrics. We identify common trends and divergent approaches adopted by researchers, shedding light on the evolution of face recognition technology within the context of attendance systems.

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