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Face Recognition Based Attendance System

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Abstract*—*The old, ineffective techniques of measuring atten- dance are being replaced by newer, more advanced technologies. Face recognition based attendance system have become a cutting- edge and practical resolution to this problem. In order to expedite the process of taking attendance in business settings, educational institutions, and other organizations, this paper outlines the development and deployment of a facial recognition attendance system. Facial recognition, feature extraction, and face detection are some of the main parts of the system. Initially, methods like deep learning-based algorithms are used to detect faces from live camera. Following that, compact face feature extraction and representation are performed, frequently using techniques such as Principal Component Analysis (PCA), Linear Discriminant Analysis (LDA), or Convolutional Neural Networks (CNNs).

Keywords - Deep Learning, Convolutional Neural Networks (CNN), Face Detection, Feature Extraction, Facial Landmarks.

INTRODUCTION

The traditional way of marking as well as taking attendance is a tedious task. It takes a long time to note each person's attendance. Especially during important events such as lec- tures, where faculty members/ event members have to mark the attendance of a lot of people, and it consumes a lot of time, about 5 to 10 minutes of a 1-hour lecture. Even if we eliminate the method of calling the names individually and directly use pass sheets to mark their own attendance, there are great chances of marking proxy attendance. Also, the presence of a third party or a man in the middle who is responsible for entering the attendance into the system can also make a mistake while entering the wrong data in the system.

According to the research per formed, nearly about 78%of teenagers now have a cell phone, with nearly half (47%) owning smartphones. Approximately 74% of kids aged 12-

17 use mobile devices to access the internet. [1] at least occasionally which would have increased it date. In 2011, just 23% of teenagers owned cellphones, but now 37% do [2] and current also as per a survey conducted by the Mobile Ecosys- tem Forum from November to December 2019, the highest penetration rate among smartphone users was in the age group of 16 to 24 years, with 37 percent. This was followed by the users between 24 and 35 years old. Older Indians surveyed had a lower penetration rate for smartphone usage [3].Thus, there has been a magnificent growth in interest in smart phones among youths. The solution is to use a smartphone as a tool for marking their attendance. Thus, face detection-based attendance can help out from all previous methods of marking attendance just by registering the faces. Once in the system, the attendance can be marked just by scanning their faces which will be matched with the faces stored/stored in the database if the face matches the person would be marked as present which is a 1:N process where N is the number faces stored in database of the institute/organization if the face is not stored in the database which also defines that the person is not a member of institute or organization the attendance will not be marked.

Using this type of attendance method will not only save the time of a organization/institute time but as well as resources such as time, money including human resources which are responsible for data entry which would result in accurate data entry.

As a result, this new approach promises accurate insights and less time consumption.

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II -LITERATURE SURVEY

The market and literature are rife with suggestions for auto- matic attendance systems. The majority of them do concentrate on installing apps on the lecturer's device, which may be a laptop or a smartphone.

Reference [4] proposes to use QR code based attendance system to make automatic attendance entry where the app will be installed in the individuals phone and QR is generated according to the unique id of the individual and after scanning the QR code individual's attendance will be updated in the sheet the scanner application will be installed in the teachers phone.

Reference [5] proposes to use face recognition system for smart attendance system in which each person's registered in the database and the faces are detected and recognized using surveillance camera and the system also has accurate results even if the person is wearing glasses and even irrespective of expressions.

Reference [6] proposes to use face recognitions ssystem for smart attendance system in which laptop camera is used as a medium to detect and recognized faces and if face is recognized successfully the entry is send to the sheet andreport and names of absent people is mailed to the teacher, it is also capable to identify multiple person at a time.

An automatic attendance system model was presented by theauthors in [7]. The concept focuses on how permitted pupils are detected and counted as they enter and exit the classroom using facial recognition and radio frequency identification (RFID). Every enrolled student is authentically recorded by the system. Additionally, the system maintains the attendance log's data for each student enrolled in a certain course and supplies the required information based on demand.

The authors compared the receiver operating characteris- tics (ROC) curve, In [8] performed a research to discover whether the facial recognition algorithm—Eigenface and Fish- erface—provided by the OpenCV 2.4.8 is better to opt for the project or not. They then further in project integrated this type of approach in the attendance system in their particular project.The ROC curve further shows that Eigenface outperforms Fisherface in the study work carried out for this research. Further then the Eigenface method resulted in a system with an accuracy rate ranging from 70% to 90%.

In most of the projects proposed methodologies the scanningdevices are installed in the supervisor or lectures phone which is still time consuming and some of the projects where having face detection installed in surveillance cameras which would make system complex as it will scan each face appearingin front of it which is actually not required and one minor problem with systems was user interface which was not that attractive and most of them no reports were generated just the absentees name were mailed to the respective super- visor/lecturer which would require same time for them to generate monthly report of the individuals working under him/her.

III- PROPOSED SYSTEM

In our application, the particular individual first has to register himself, after which he or she must login to our application. After the particular individual has successfully logged in, the application will ask him/her to register his face. Once the process is done, his face, along with his unique ID, and other relevant information will be stored in the database. After which, they just need to open the application and scan their face, and if the face matches one stored in the database, attendance will be marked automatically. The authors of [9] suggested a facial recognition-based attendance system. In this system authors used the Support Vector Machine (SVM) classifier and methods like Viola-Jones and Histogram of Oriented Gradients (HOG). Further The authors considered a variety of real-time factors, such as scale, illumination, occlusions, and location. Further more the authors used the MATLAB GUI, and then the data of quantitative analysisbased on peak signal-to-noise ratio (PSNR) was carried out.

For additional security that the individual must not spoof with adding some other faces the provision of adding or updating faces is can be given to the team lead/manager or any other person under which the individual works.

1) **Creation of Datasets**

The smartphone's front camera is used to snap photographs of people of team by the supervisor or any responsible person. These photographs have been preprocessed. Cropping the photographs allows for getting the area of the region of interest (ROI) which will able to detect points on the face will would be helpfull for the future use, which will then be used in the identification process. The following step is resizing the cropped photographs to a certain pixel point. Afterwards, these photographs will be grayscaled from RGB. Following that, the database will save these pictures along with the correspondingpupils' name.

2**) Detection of Faces**

Open CV has several ways for achieving face detection. Con- volutional neural networks (CNNs) are one such technique. Specifically, the models that would be helpful for detecting the face from an image which would be given as an input to the model.

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Prior to using these CNN-based techniques, the input image is pre-processed, frequently by shrinking and normalizing it. The CNN architecture, which is made up of several layers of convolutional, pooling, and fully connected layers, is then fed the image. Through the collective learning of information from the input image, these layers eventually identify increasingly intricate patterns.

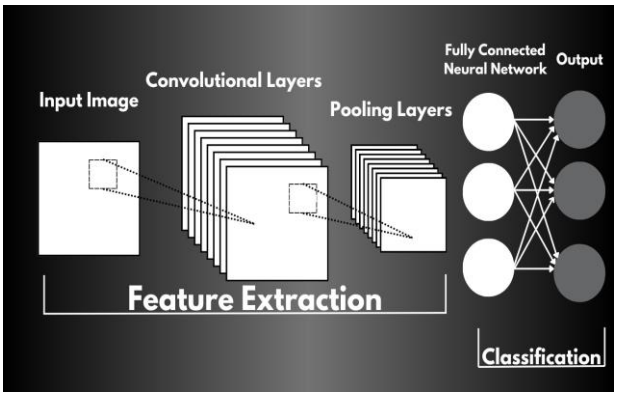

Fig. 1: CNN Layers

A sizable dataset of pictures with and without faces is used to train the CNN for face detection. The CNN gains the ability to identify unique facial traits, like the positioning of the mouth, nose, and eyes, after training. The network can also optimize a loss function that evaluates the disparity between predicted face regions and ground truth annotations whcih can make result accurate.

Lastly, to provide information about their location and size, the detected facial regions are usually boxed or annotated in the final image. This makes it possible to use the identified re- gions for applications like facial landmark detection, emotion detection, and recognition.

Fig. 2: Detected Face.

3) Recognition of Faces

Face recognition in novel, unseen photos can be achieved with the pre-trained CNN model. The following steps areincluded in this prediction process:

a) The Extraction of Features: The trained CNN model goes through a feature extraction process when it receives a new face image. The CNN model extracts hierarchical representations of characteristics like edges, textures, and facecomponents from the input image by applying a sequence of convolutional, pooling, and activation layers.

b) Calculating the Local Binary Pattern Histogram: The characteristics taken from the face are transformed into local binary patterns (LBPs) in the case of the approach outlined using the Local Binary Pattern Histogram. The connection between the intensity values of the pixels within a local neigh-borhood is represented by LBPs. Following the conversion of these LBPs into decimal values, histograms of these decimal values are calculated. The training data will have appropriate histograms for every image.

c) Comparing and Assigning Labels: The same method used for training is applied to compute the face's histogram in order to identify it. Next, a comparison is made between this histogram and the face histograms found in the training set. Usually, distance metrics like cosine similarity or Euclidean distance are used for the comparison. The label of the training image with the most similar histogram is applied to the face, revealing the person's identity.

4) Updating Attendance

After the successful identification of the face by the face which is stored in the database, an API call is performedin which the user id of the particular user is posted in it's body which updates the parameter of attendance of the user associated with the user id.

The respective member will be updated with the monthly attendance report of all the individual associated with him/her in the application in the form of graphs.

5) Security

Data security is the main aspect of any applications relia- bility which would ensure users that their is safe and any third person outside the organization has no access to the data ofthe users.

To ensure the security various encryption algorithms are used the encrypt the data one example is hashing in which any variable length data is converted to a fixed length data. Basically hashing is a basic idea that describes how to convert data into a fixed-size value, usually a string of letters or num- bers. When hashing, a unique hash value—also referred to as a digest or hash code—is generated using an algorithm called a hash function using input data of any size. The fact that a hash function constantly produces the same hash result for the same input data is one of its essential properties. But alteration to theinput data ought to produce a noticeably different hash value.

Data retrieval, data storage, and data integrity verification are just a few of the uses for hashing that are made possible bythis feature. Hashing is frequently utilized in many different applications, including data structures.

Some popular hashing algorithms are :-

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1) SHA-256 (Secure Hash Algorithm 3)
2) BLAKE2
3) Whirlpool
4) RACE Integrity Primitives Evaluation Message Digest
5) Skein
6) BLAKE3
7) xxHash

IV-ANALYSIS

It is a standard process which requires only user to only remember login id and password just to login to the application and rest is done by the system on the regular basis the user just needs to open application scan face and its done.

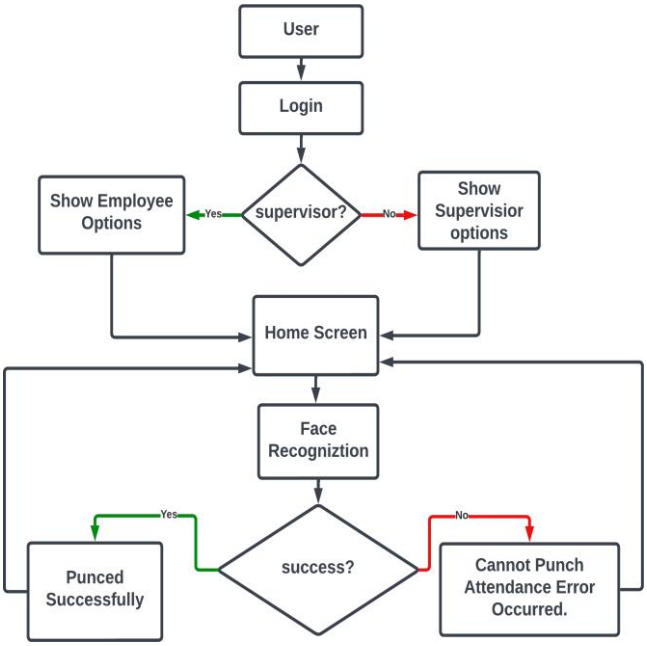

Fig. 3: Application Flow.

This process saves a lot of time, effort and money of an organization of taking the attendance of each person individ- ually.

The individually is also sure that the attendance is marked by using application dashboard.

This also save time of the member who is responsible for attendance entry and analysis he can directly access supervisor dashboard where the graphical data of each user is displayed and he/she can directly know which user was attending the sessions/office work on regular basis which would help in evaluation performance of companies and internal marks cal- culation for educational organizations.

There was a challenge introduced in front that what if the individual marking his/her attendance from home while even if not present in the organization premises to eliminate this we have used the location co-ordinates of the organization approx values as the GPS is not that accurate in some case, So along with face if the location co-ordinates don't match with value in the database the attendance will not be marked. The location coordinates will be static and provided by the organization, and the users will have compulsorily turn on location of device to record the live coordinates which be posted in the body of api to match with database coordinates it the entry is updated the success message will be shown to the user. Also the access of registering faces is given to the supervisor due to which chances of spoofing will also be reduced the option of registering faces is displayed only on supervisor's login dashboard in which he is responsible to add or update faces of people which work or study under him/her (The term supervisor can be any person under which any individuals are working).

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