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Face Recognition Based Attendance System

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Abstract:*The first and one of the most important task that any workplace or an educational institute does is checking whether the students or the employees are present, also known as marking attendance. The method of marking attendance varies on multiple factors such as the number of people, departments and number of slots where attendance has to be taken. Schools and colleges can rely on roll call since the number of students is less. Some universities started to implement swipe cards which is a much efficient and time-saving method. Large organizations use swipe cards since there are a lot of employees to manage. Biometrics are also used in a few places to assist with attendance marking. Biometrics such as iris, handprint, fingerprint, face are used to uniquely identify a person.With growing developments and research in the field of deep learning and computer vision, both face recognition and deep learning can be integrated to create high-level models, which can be used to recognize faces and mark the appropriate attendance. We are trying to develop a system that automatically marks the attendance by using face recognition with models which are trained using deep learning.*

Keywords*:Face Recognition, Deep Learning, Biometrics.*

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I. Introduction

Attendance marking is a crucial task in an educational institute and in a workplace. Many organizations are using some automatic systems such as punch cards, RFID cards, fingerprint scanner and to some extend face recognition. The most traditional method of marking attendance is through roll calls. But this roll call method is now used only in schools and some colleges, since most of the colleges have moved towards digital methods such as swipe or punch cards to get the job done. Both the methods got some drawbacks. Roll call method is time-consuming and prone to human errors. Mistakes such as marking the present person absent and vice versa can occur in this method. Digital methods such as swipe and punch cards can overcome the drawbacks in the previous mentioned method, but it also gives rise to new issues. Swipe cards are less time consuming but it doesn't check for the presence of the person while swiping the card, which may lead to another person marking proxy attendance of the absent person. Also, another concern is that if a person loses his or her swipe card, then he or she may have to wait sometime before getting a new card. Using biometric can help to overcome the issues existing in previous techniques. Biometric-based attendance system is used in a number of places. Biometric systems rely on a person's unique physical features in order to identify them. Fingerprint, palm print, iris, retina, face are some of the biometrics that a system used to uniquely identify a person. Using Face recognition reduces error by a great extent, the unique identifier in a face recognition-based system is a person's face, therefore the risk of losing that unique identifier is next to zero. No human interaction is involved and is less time-consuming.Face recognition technologies are used in several areas, such as surveillance, healthcare, border-security, biometrics, user mapping and tracking [1]. One of the main reason face recognition technologies are reliable is due to its uniqueness on how it identifies a person. Face recognition is one of the most evolving domain of computer vision. Computer Vision has evolved a lot in the last few decades this is primarily due to intensive research put into this field to develop new algorithms and techniques to increase accuracy and efficiency.Modern computer vision technologies not only limit its ability to facial recognition, but also includes real-time tracking of that face [2]. This helps to track the movement of the person. New face recognition technologies and algorithms are being developed in order to overcome drawbacks of the previous one. Deep learning algorithms are also integrated into face recognition technologies to make it more efficient and accurate [3]-[4]. New Convolution neural networks are developed specifically to enhance the efficiency of face detection and face recognition [5].In existing systems, the accuracy of face recognition decreases when there are some changes to the facial features, such as the person grew a beard, or the person is wearing spectacles[6]. There are a number of CNN architectures available for image classification and face recognition,

but we are trying to build our face recognition module for our attendance system using VGG architecture. VGG is a deep learning architecture developed by Oxford Robotic Institute's Visual Geometry Group and it's used for object detection. Neural networks developed before VGG used bigger convolutional layer stack such as 7*7 and 11*11. But VGG limits it to 3*3 convolutional layer stack [7]. This makes working on this algorithm much easier. For storing of results, we will use a Relational database, MySQL and we will represent the results on a webpage or an Application. The proposed system can help to solve the issues existed in traditional techniques as well as it tries to overcome some of the problems that occurs in similar systems.

II. Literature Review

In 2017,Virendra P. Vishwakarma [8] introduced the approach to address the issue of low recognition rate on smaller datasets in deep learning based face recognition systems. In this they used data augmentation technique to increase number of training data and generalization power of network. The augmented training set contains additional images generated by applying Poisson and Gaussian noise on original training samples and face recognition rate is also increased from 79% to 95%. The training of deep networks provide us accurate results but were not suitable for learning from few samples and requires large training data. It was practically observed that the recognition rate of augmented training set with Poisson noise is marginally better than the one with Gaussian noise.

In 2017, KhemPuthea[9] presented the paper to find the solutions provided by other authors and consider the limitations of their proposed methods. The first paper they studied was by visarshehu to implement face recognition using HAAR classifier and computer vision algorithms. The second paper was by NAVAZ to implement face recognition using PCA to train and reduce dimensionality and ANN to classify the input data and find the pattern. The third paper was by N.Kar to implement face recognition using Eigenvector and Eigenvalue. The fourth paper was by Joseph using PCA with MATLAB for face recognition. The fifth paper was by E.Reakha using PCA and Eigenface to do a better attendance result. The sixth paper was by P.Wagh to remove noise using PCA and Histogram. The results showed that the PCA algorithm was effective and had better performance. The focus in future work is improving the accuracy by incorporating principal components with convolutional neural networks.

In 2017, Marko Arsenovic [10] proposed the method for face recognition tasks combining various modern approaches and the state of art crafts in deep learning. The method was divided into several important stages including obtaining the training dataset and augmentation, preparing images and training DNNs and last was integration into existing system to test the proposed method. This method was tested in IT company where five employees were volunteered in this research. The dataset included photographs of them and this dataset was used for training DNN. The employees tooked several different positions while being photographed. In order to make this approach applicable for production usage it is very important to capture small photographs of every employee at the site. It was possible to achieve high accuracy using DNN on larger datasets. The augmentation process was splitted in two stages. The first was noising and second was blurring the image at different levels. While developing face recognition model included several different steps: face detection, image preprocessing, generating face embeddings and classification. The last step was integrating with existing system. It was determined that 95% of accuracy can be achieved by using this approach. These results are enabling further research for purpose of obtaining even higher accuracy and making this solution production ready.

In 2014, Maulahikmah[11] presented the approach to implement and develop face recognition algorithm provided by OpenCV. The main goal was to get the best facial recognition algorithm and implement it as the main case study. Principal Component Analysis was developed to overcome expensive computation and amounts of storage of older face recognition methods such as correlation methods. This research will compare the performance of two algorithms Eigenface and Fisherface based on Receiver Operating Characteristic curve. There will be two main features created the first is Collect Face Data and second is Attendance Recognition. Collect Face Data is used to collect face images of multiple students who are going to use this application and allows preprocessing the face images to provide better performance and results. Attendance Recognition is used for training the face recognized against the training set. It also helps users to set the countdown timer where students must present their face before the countdown ends to fill the attendance. Based on the results it was found that Eigenface algorithm to be implemented in Attendance System application.

III. Research Methodology

In our proposed system, the camera will try to detect faces within its view. Once a face or multiple faces are detected, the system will try to recognize the face using pretrained models. The attendance of the people whose faces were recognized are updated into the database. The person can view their attendance using a platform such as a website or an application.The working of our proposed system is explained in the following steps:

A. A video of the person's face is stored in a folder along with the name or ID of that person.

B. Faces are extracted continuously from each video file and each image is labeled with that person's name or ID.
C. Once all the faces are extracted, the face images are trained using a pretrained model.
D. Now, whenever the attendance needs to be marked, the admin or a super user will initiate a session which will open the camera and will try to recognize the faces.
E. Once the session is completed, the name or ID of those people who are present are retrieved.
F. The attendance of those present people is marked.
G. Now, if the person wants to view his/her, he or she can login to the platform and their attendance will be displayed to them.
H. The admin can perform the same process to take attendance in each session.

The advantage of this system is the ability of recognizing multiple faces in a single frame. The system is also able to recognize the person even though some of the facial features of that person changed over a period of time, therefore increasing the real time accuracy of this system.
In our proposed system we have two phases:

PHASE 1 – FACE RECOGITION

1.1 Capturing Datasets:
Multiple photos of a person's face are taken simultaneously using a camera. Each photo will be labelled with the person's PID or name.

1.2 Storing Datasets:
Now the captured datasets must be store for future use. It can be stored in local storage of the central system, or distribute the storage to different departments.

1.3 Training the Datasets:
The stored datasets are raw and cannot be directly used for facial recognition. Therefore, the datasets must be trained using an algorithm (VGG).

1.4 Face Detection:
Before recognizing the faces, the system must detect any faces in the frame. And also, it must detect how many faces are there in a frame at a given time.

1.5 Face Recognition:
Once the faces are detected, we can use the trained datasets to recognize the faces. In this system will recognize the faces and the name/PID of that person.

1.6 Retrieving the Names/PID of recognized faces:
Recognizing faces are not enough, the name/PID of the person must be retrieved and stored in a list so that further operations can be performed.

PHASE 2- UPDATING DATABASES

2.1 Enter the attendance into the database:
SQL query is performed on the retrieved details and the respective attendance of that person is entered into the database (SQL Lite).

2.2 Update the attendance on the website:
The website must be updated. Using Flask any updates or changes made to the database is also reflected on the Website in order to maintain accuracy.

2.3 View updated attendance:
The website can be used by the students to check their attendance, by entering their respective user name and password. Students can check only their attendance. Whereas the admin can view the attendance of the entire class through their portal.
Below given is the architectural diagram of our proposed system: -

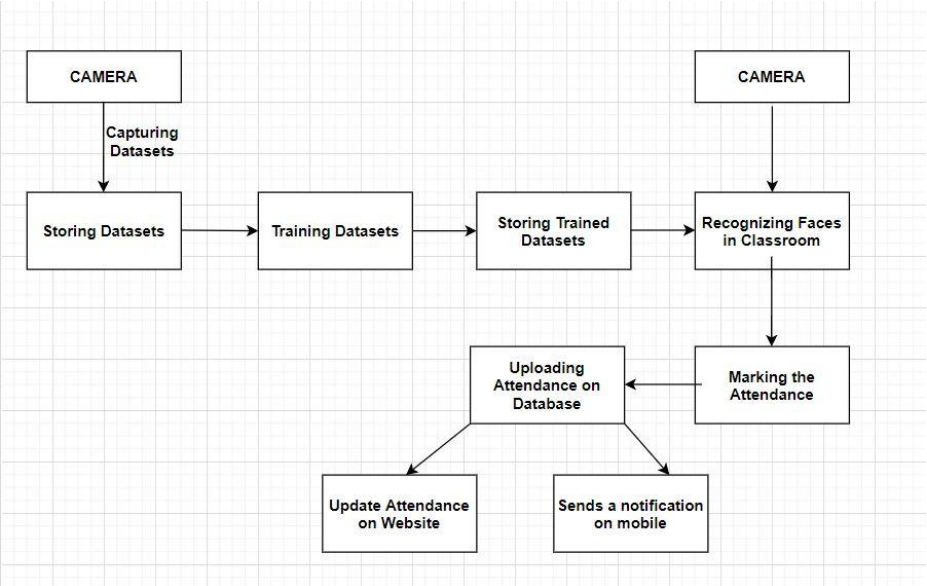

Fig .1 Architecture Diagram

IV. Experimental Results

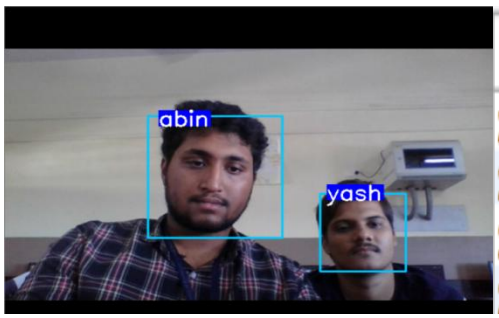

Fig 2 Face Recognition

Date	Lecture0	Lecture1	Lecture2	Lecture3	Lecture4	Lecture5
2020-02-28	Present	Present	Present	Present	Present	Present
2020-03-07	Present	Present	Absent	Present	Present	Present
2020-03-09	Present	Present	Absent	Absent	Absent	Absent
2020-03-11	Present	Present	Present	Absent	Present	Present

Fig 3 Updated Database

V. Conclusion and Future Scope

In this proposed system, we have developed a system for Automated Attendance System using Face Recognition. The drawbacks in the time-consuming and error-prone task of manually taking attendance through roll calls and the procedure of swiping cards can be overcome. We have considered the end-users of this system, and tried to design it in such a way that all the steps and the functionalities of this system is visible and understandable to the user. We also clearly differentiated the actions performed by different user classes. The actions performed by a user depends on the role assigned to that user.In future we are trying to make the system more robust, by increasing the accuracy rate of the facial recognition. We are also trying to recognize faces in a much wider coverage or view area than the current proposed system. We would also try to implement geolocation so that a person can mark their attendance using their mobile device, all they need to do is to scan their face using an application and if they are within the location and their faces are recognized then their attendance would be marked automatically.

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