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ENHANCING VIDEO SURVEILLANCE: DEEP LEARNING APPROACHES FOR FACE DETECTION AND RECOGNITION

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ABSTRACT

Attendance management can be a significant burden on teachers if done manually. To solve this problem, It is proposed that we use an intelligent and automatic presence management system. Using this framework, the problem of proxies and tagged students present while they are not physically present can easily be resolved. This system marks the attendance using live video stream. The frames are extracted from video using Open CV. The main implementation stages used in this type of system are detection and recognition of the detected face, for which dlib is used. After this, the connection of the acknowledged faces should be conceivable by comparing with the database containing the faces of the students. It will be an effective technique to manage student attendance..

KEYWORDS: Attendance system, Automated attendance, Image Processing, Face detection, Feature matching, Face recognition.
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I. INTRODUCTION

The technology aims in imparting a tremendous knowledge oriented technical innovations these days. Deep Learning is one among the interesting domain that enables the machine to train itself by providing some datasets as input and provides an appropriate output during testing by applying different learning algorithms. Nowadays, attendance is considered an important factor for both the student and the professor of an educational organisation. With the advancement of deep learning technology, the machine automatically detects student attendance performance and maintains a registry of collected data.

Generally, the student attendance system may be maintained in two different forms:

· Manual Attendance System (MAS)
· Automated Attendance System (AAS).

The Manual Student Attendance Management System is a process whereby a teacher involved in the specific subject should call students by name and mark them manually. Manual attendance may be considered as a time-consuming process or sometimes it happens for the teacher to miss someone or students may answer multiple times on the absence of their friends.

So the challenge is with the traditional classroom attendance process. To fix these problem, we go with Auto Attendance System (AAS) Automated Attendance System (AAS) is a process to automatically estimate the presence or the absence of the student in the classroom by using face recognition technology. It is also possible to recognise if the student is asleep or awake during the lecture. It can also be implemented in the exam sessions to ensure the presence of the student. The presence of the students can be determined by capturing their faces on to a high-definition monitor video streaming

service, so it becomes highly reliable for the machine to understand the presence of all the students in the classroom. The two common Human Face Recognition techniques are,

· Feature-based approach
· Brightness-based approach.

The Feature-based approach also known as local face recognition system, used in pointing the key features of the face like eyes, ears, nose, mouth, edges, etc., whereas the brightness-based approach also termed as the global face recognition system, used in recognizing all the parts of the image.

II. LITERATURE SURVEY

Authors in [3] proposed a model of an automated attendance system. The model focuses on how face recognition incorporated with Radio Frequency Identification (RFID) detect the authorized students and counts as they get in and get out form the classroom. The system keeps the authentic record of every registered student. The system also keeps the data of every student registered for a particular course in the attendance log and provides necessary information according to the need.
In this paper [4], authors have designed and implemented an attendance system which uses iris biometrics. Initially, the attendees were asked to register their details along with their unique iris template. At the time of attendance, the system automatically took class attendance by capturing the eye image of each attendee, recognizing their iris, and searching for a match in the created database. The prototype was web based. In [5], authors proposed an attendance system based onfacial recognition. The algorithms like Viola-Jones and Histogram of Oriented Gradients (HOG) features along with Support Vector Machine (SVM) classifier were used to implement the system. Various real time scenarios such as scaling, illumination, occlusions and pose was considered by the authors. Quantitative analysis was done on the basis of Peak Signal to Noise Ratio (PSNR) values and was implemented in MATLAB GUI.Authors in [6] researches to get best facial recognition algorithm (Eigenface and Fisherface) provided by the Open CV 2.4.8 by comparing the Receiver Operating Characteristics (ROC) curve and then implemented it in the attendance system. Based on the experiments carried out in this paper, the ROC curve proved that, Eigen face achieves better result than Fisher face. System implemented using Eigenface algorithm achieved an accuracy rate of 70% to 90%. In [7], authors proposed a method for student attendance system in classroom using face recognition technique by combining Discrete Wavelet Transforms (DWT) and Discrete Cosine Transform (DCT). These algorithms were used to extract the features of student’s face followed by applying Radial Basis Function (RBF) for classifying the facial objects. This system achieved an accuracy rate of 82%.

III. PROPOSED MODEL

The task of the proposed system is to grasp the face of every student and store it in the database. The student's face must be grasped in such a way that all characteristics of the student's face must be detected. Also the student's seating and posture should be recognised. There is no need for the teacher to manually take attendance in the class, as the system capture multiple frame and in further processing steps the face is being recognized and the attendance is updated.

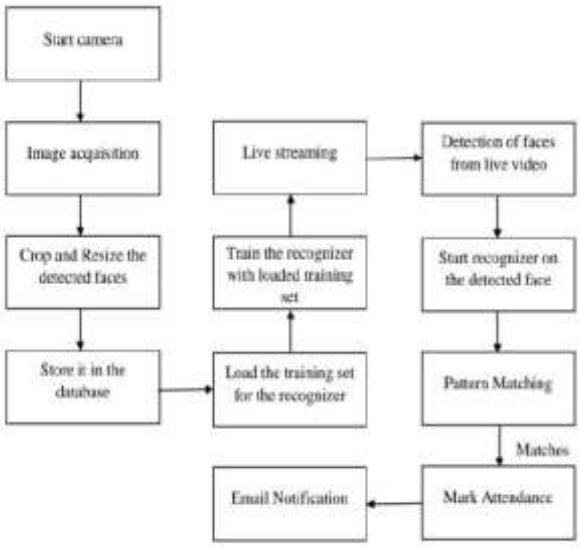


Fig.1. System Architecture

1. Dataset Creation

The students' pictures are captured using a webcam. Several images of one student will be acquired with various gestures and angles. These images undergo pre-processing. The images are cropped to get the region of interest (ROI) that will then be used in the recognition process. The next step is to re-size the cropped images to a specific pixels 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.

2. Face Detection

Face detection here is performed using deep-learning with Open CV. Our network architecture for face recognition is based on ResNet-34 from the Deep Residual Learning for Image Recognition paper by He et al., but with fewer layers and the number of filters reduced by half. The network itself was trained by Davis King on a dataset of ~3 million images. On the Labelled Faces in the Wild (LFW) dataset the network compares to other state-of-the-art methods, reaching 99.38% accuracy

3. Face Recognition

In order to build our face recognition pipeline, we'll be applying deep learning in two key steps:

• To apply face detection, which detects the presence and location of a face in an image, but does not identify it .

• To extract the 128-d feature vectors (called "embeddings") that quantify each face in an image The Face Net deep learning model computes a 128-d embedding that quantifies the face itself.

But how does the network actually compute the face embedding? The answer lies in the training process itself, including:

- The input data to the network
- The triplet loss function

To train a face recognition model with deep learning, each input batch of data includes three images:

- The anchor
- The positive image
- The negative image

The anchor is our current face and has identity A.

The second image is our positive image — this image also contains a face of person A. The negative image, on the other hand, does not have the same identity, and could belong to person B, C, or even Y! The point is that the anchor and positive image both belong to the same person/face while the negative image does not contain the same face.

The neural network computes the 128-d embeddings for each face and then tweaks the weights of the network (via the triplet loss function) such that:

- The 128-d embeddings of the anchor and positive image lie closer together
- While at the same time, pushing the embeddings for the negative image father away

In this manner, the network is able to learn to quantify faces and return highly robust and discriminating embeddings suitable for face recognition.

4. Attendance Updating

After face recognition process. the recognized faces will be marked as present in the excel sheet and Faculties will be updated with monthly attendance sheet at the end of every month. For each face detected and matched the name of student along with day and time of attendance is also be stored in the database.

IV. RESULT & DISCUSSION

The users can interact with the system using a GUI. Here users will be mainly provided with three different options such as, student registration, faculty registration, and mark attendance. The students are supposed to enter all the required details in the student registration form. After clicking on register button, the web cam starts automatically and window as shown in Fig.3. pops up and starts detecting the faces in the frame. Then it automatically starts clicking photos until 60 samples are collected or CRTL+Q is pressed. These images then will be pre-processed and stored entraining images folder. The faculties are supposed to register with the respective course codes along with their email-id in the faculty registration form provided. This is important because the list of absentees will be ultimately mailed to the respective faculties.

Fig:1-- Data-Set of a Person

Face Detection is the process where the image, given as an input (picture) is searched to find any face, after finding the face the image processing cleans up the facial image for easier recognition of the face.CNN algorithm can be implemented to detect the faces.

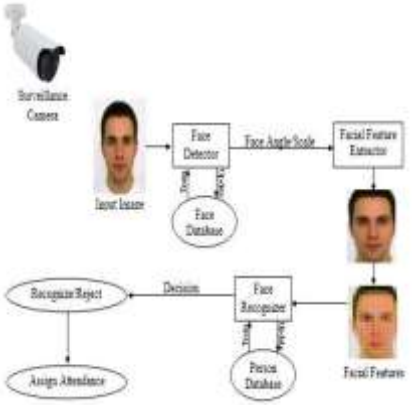
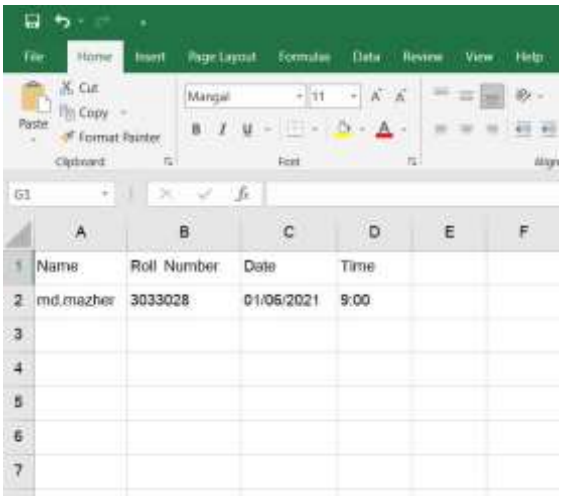


Fig:2—Flow diagram

The Fig:2 - After the completion of detecting Processing is done ,In a traditional image classification pipeline, we convert the image into a feature vector (or equivalently a point) in higher dimensional space processing the face, This was done by calculating the feature descriptor (e.g. HOG) for an image patch. Once the image is represented as a point in higher dimensional space, we then use a learning algorithm like SVM to partition the space using hyper planes that separated points representing different classes .it is compared to the faces present in the students' database to update the attendance of the students.

Fig:3 – Result /Output

The Fig:3 -The post-processing mechanism involves the process of updating the names of the student into an excel sheet. The excel sheet can be maintained on a weekly basis or monthly basis to record the students' attendance. This attendance record can be sent to parents or guardians of students to report the performance of the student.



	A	B	C	D	E	F
1	Name	Roll Number	Date	Time		
2	md.mazher	3033028	01/06/2021	9:00		
3						
4						
5						
6						
7						

Fig:4 – Attendance Sheet

A CNN (Convolution Neural Network) uses a system like a multilayer perceptron that has been designed to process the requirements faster. The CNN layer consist of an input layer, an output layer and a hidden layer that includes multiple convolution layers, pooling layers, fully connected layers, and normalization layers. The removal of limitations and increase in efficiency for image processing results in a system that is far more effective, simpler to trains limited for image processing and natural language processing.

The Fig.4 shows the attendance sheet updated after recognition process and recognized students are marked.

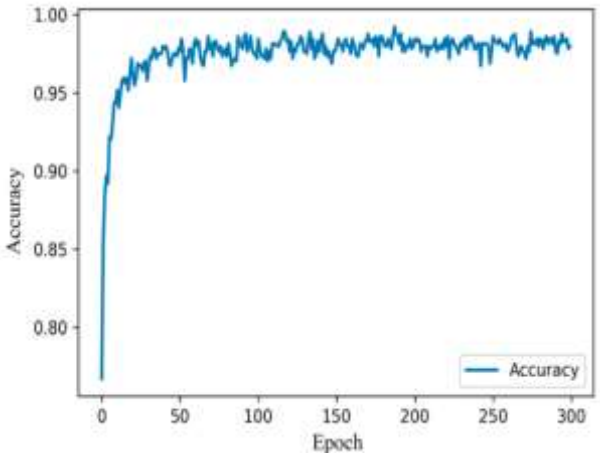


Fig:5 –Accuracy

The Fig:5shows the process of training the model using the training and validation datasets. The best accuracy was 99.22%, and the best loss was about 2.83%. At the same time, the overall accuracy in the test phase was about 98.69%.

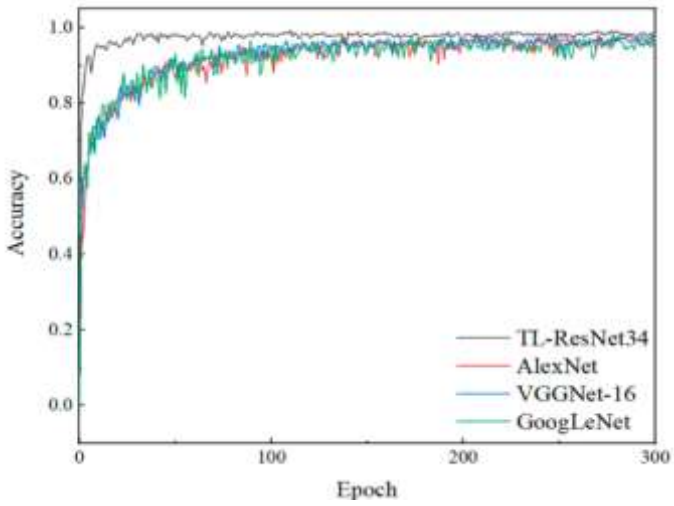


Fig:6 – Accuracy Comparison

The Fig: 6shows the accuracy and loss values of TL-ResNet34, AlexNet, VGGNet-16, and GoogLe Net during the training phase. The experimental results show that these four models can converge within 300 training epochs, but their convergence rates are different. The convergence rate of GoogLe Net is the slowest. The training process of Alex Net is similar to that of VGGNet-16, it converges and tends to be stable after 150 training epochs.

TL-ResNet34 converges within 50 training epochs, which is faster than the other three CNN models. Meanwhile, within 300 training epochs, the loss value of TL-ResNet34 is always lower than that of the other three models, and the accuracy value is always higher than the that of other three models. The results show that, compared with the other three models, TL-ResNet34 has the highest accuracy and the fastest convergence rate.

V. CONCLUSION

Thus, the aim of this paper is to capture the video of the students, convert it into frames, relate it with the database to ensure their presence or absence, mark attendance to the particular student to maintain the record. The Automated Classroom Attendance System helps in increasing the accuracy

and speed ultimately achieve the high-precision real-time attendance to meet the need for automatic classroom evaluation.

VI. FUTURE SCOPE

Almost all academic institutions require attendance record of students and maintaining attendance manually can be hectic as well as time consuming task. Hence maintaining attendance automatically with the help of face recognition will be very helpful and less prone to errors as compared to manual process. This will also reduce manipulation of attendance record done by students and it will save time as well. The future scope of the proposed work can be, capturing multiple detailed images of the students and using any cloud technology to store these images. The system can be configured and used in Atm machines to detect frauds. Also, the system can be used at the time of elections where the voter can be identified by recognizing the face.

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