AUTOMATIC ATTENDANCE MONITORING SYSTEM USING CNN

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***Abstract*— We are living in the 21st century which is the era of modern technology. Many traditional problems are being solved using new innovative technologies. Taking attendance daily is an indispensable part of educational institutions as well as offices. An automatic attendance system is one that keeps track of individuals' attendance. Recording the daily attendance of individuals in all educational institutions is a major concern. In the traditional attendance system, a person has to check one by one if someone is absent or not. It is both exhausting and time-consuming. Manual ways are prone to errors due to the sheer number of individuals, they're in/out timings, leaves, absences etc. On the other hand, automated systems ensure accurate payroll data. Biometric attendance systems through voice, iris, and fingerprint recognition require complex and expensive hardware support. An auto attendance system using face recognition, which is another biometric trait, can resolve all these problems in this work, we have developed a biometric artificial intelligence (AI) based system that will be advantageous in educational/official sectors where regular attendance is greatly needed.**

Keywords*— *Face Detection and Recognition, Automatic Attendance, Convolutional Neural Network, Image Processing.

I. INTRODUCTION

A major concern is to keep an eye on the daily attendance of students at all educational establishments. It takes a long time to check each person's attendance in the conventional attendance system. Each person signs an attendance sheet in a different way, which is also inappropriate because it is easy to copy other people's signatures. All of the complexity can be reduced by using an automated attendance system. A framework based on biometric man-made brainpower (simulated intelligence) has been developed in this work. It will be useful in educational and official settings where widespread participation is necessary.

A facial recognition system is able to identify or verify a person by using a digital image or a video stream from a video source. There are many different ways these systems work. In order to identify a person, they typically compare extracted facial features from an input image of human faces stored in a database. It is also referred to as a biometric AI application that uses facial shape and texture patterns to identify a person in a unique way. The application saves a record after using face recognition models to identify a person.

Face recognition from still and moving images has become a popular but challenging area of research in the fields of image processing, pattern recognition, and related fields in recent years. As a training dataset, initial images of a person in various positions are collected. The intensity value estimation of the input facial images is then used for face recognition. Face recognition is a type of computer application that has recently gained popularity on mobile platforms. It has also been extensively utilized in robotics and other technological fields. In most security systems, it controls access. With the help of fingerprint, voice, or iris recognition, this can be distinguished from other biometric systems. Despite the fact that they are less accurate than fingerprint and iris recognition systems for biometric applications, facial recognition systems are widely used. However, their non-contact, quick, and unobtrusive method makes them popular. It is now desired as a marketing and

authentication tool for businesses. Advanced human-computer interaction, automatic image indexing, a video database, and other similar technologies can all benefit from facial recognition.

Here, in this work, the intention was to detect faces and recognize them in real-time for effortless recording of attendance. The main objectives of this work are:

- To detect faces from real-time video stream.
- To develop a machine learning model to recognize a person from a pre-trained dataset.
- To record attendance after recognition for future use.

The rest of the paper is divided as follows: Section II discusses recent related works regarding face recognition and attendance automation; Section III presents the methodology and the system overview; Section IV shows the results of the experiments, final considerations, and future work.

II. LITERATURE REVIEW

In recent times, different techniques, methods and algorithms have been used to perform facial recognition and increase the accuracy of facial recognition.

In [1] the image input is taken by a camera and the accuracy of this system would highly depend on the quality of image and the resolution. For GUI they have used MATLABS GUI design which could be accessed via GUIDE. The camera will take the images as input. In this stage the number of faces in the image will be detected and the cropping of the images is done for the necessary size required for feature extraction, after that they will be stored in memory. The system should be able to automatically count the number of faces detected on the image. The face detection part of the project is done by making use of viola- jones algorithm. The second part is face recognition where we will match faces from the stored dataset to that of from the camera input in step one. The recognition part of the system has been implemented using Hidden Markov Model with Singular Value Decomposition (SVD). The second phase of the system will involve the training of images on a dataset that are to be used for recognition. The features are extracted using SVD. This is because the coefficients have continuous values and build observation vectors. As these values are continuous, it is clear to encounter an infinite number of possible observations vectors that cannot be modelled by discrete HMM. Quantization is used to model the probability density function by distribution of prototype vectors. It processes by dividing the large set of vectors into groups of approximately the same number of points that may lead to information loss. If there is no match it will raise a alert informing there is no match. Recognition rate is also calculated

[9] Uses the concepts of LSVM and Face Net. After Detecting face using CNN, the images pass through the FaceNet algorithm and FaceNet learns a mapping from face images to a compact Euclidean Space. Distance metric directly correspond to the similarity between two images. The algorithm will click the image of the classroom, and it will automatically detect the faces of students sitting in the lecture room and recognize them during lectures then mark their attendance

[8] Uses the concept of FaceNet embedding distances as a metric. face detection stage using HOG and a CNN with Max-Margin Object Detection based features. ue to the positive relationship between the presence of students in classes and their performance, student attendance assessment is considered essential within the classroom environment, even as a tiring and time-consuming task. We proposed a solution for student attendance control using face recognition with deep one-shot learning and evaluated our approach in different conditions and image capturing devices to confirm that such a pipeline may work in a real-world setting

The main concern of [7] is to build an IoT-based automated attendance management system for educational institutes by biometric recognition to incorporate fake/proxy attendance and errors of entry and to replace old manual methods of taking students' attendance by calling their names or roll numbers. The AAS will click the image of the classroom, and it will automatically detect the faces of students sitting in the lecture room and recognize them during lectures then mark their attendance daily to keep a record of their presence and also maintain and manage it for the management staff of the institution for future by using web services.

[6] Uses the concept of Convolutional Neural Networks to extract relevant facial features. The system can be trained to recognize a set of people, and to learn in an on-line way, by integrating the new people. Face recognition system is one of the biometric information process its applicability is easier and working range is larger than others. The face recognition is live acquired images without any application field in mind .process utilized in the system are White Balance correction ,skin like region segmentation .facial feature extraction and face image extraction on a face Candidate .The face one of the easiest ways to distinguish the individual identify each other

[4] have used three algorithms which are CNN, FaceNet, LSVM. Combining these three algorithms the whole system will work smoothly. Moreover, the Basic of FaceNet model is dependent on CNN and LSVM is a Classifier. The input picture will be scanned and if there is a face it will be detected by CNN After Detecting face, the images pass through the FaceNet algorithm and FaceNet learns a mapping from face images to a compact Euclidean Space, where distances correspond directly to a measure of face similarity LSVM Classifier along with CNN decides if a student can or cannot enter the classroom. If he belongs to the class then his or her picture will be in the database and if not then it will not match and the system will deny access to the class.

[3] performs face recognition-based student attendance system. The methodology flow begins with the capture of image by using simple and handy interface, followed by pre-processing of the captured facial images, then feature extraction from the facial images, subjective selection and lastly classification of the facial images to be recognized. Both LBP and PCA feature extraction methods are studied in detail and computed in this proposed approach in order to make comparisons. LBP is enhanced in this approach to reduce the illumination effect. An algorithm to combine

enhanced LBP and PCA is also designed for subjective selection in order to increase the accuracy. The project is completely built in MATLAB with OpenCV libraries implemented in it.

[2] The original database containing the images of the students is created by taking a live real time video of the students, and splitting the video into thirty frames, converting them to gray scale and storing only the faces of the students as images. The software used for splitting the video into frames is Open-CV. The professor will capture a real time video of the class room or lecture hall by means of their own mobile device and making use of the Droid Cam application. once the video has begun capturing, simultaneously the Haar Cascade algorithm is applied to the video to get individual faces of the students and obtaining the distinct features of their face only the regions of interest or important features will be stored rest will be cropped out. The comparison of the captured image against the stored images in the database is done by making use of the LBPH algorithm (Local Binary Pattern Histogram), each image stored in the database has its histogram value calculated and is cross checked against the calculated Histogram value of the images extracted from the captured video feed. The name of the student appears above and the number indicates the confidence. Lower the confidence number higher is the accuracy. If the uploaded image matches the image stored in the database, then the attendance is marked present for that lecture and saved, but if any student goes unrecognized then that particular image is stored in the secondary database and an alert is generated for the admin

III. METHODOLOGY

The implementation of face recognition technology includes the following stages

A) Image acquisition

We need to collect pics of every individual belonging to that particular class. This can either be done by a external webcam or system cam present in the individuals laptop. A separate subdirectory is made for each individual under the training, testing and validation parent directory. We have used OpenCV to help us with the process of collecting the pics. The number of pics of every individual can be explicitly set more the pics the better it will be for building the model. The individual is encouraged to take pics from different angles so that accuracy of our model can be better. When the individual is present in front of the webcam. The system must start taking his pic. Only if the face is present the pic should be taken and stored in the directory. This detection of face is done by a pretrained model called HaarCascade.A Haar classifier, or a Haar cascade classifier, is a machine learning object detection program that identifies objects in an image and video.

The algorithm can be explained in four stages:

1)Calculating Haar Features

The first step is to collect the Haar features. A **Haar feature** is essentially calculations that are performed on adjacent rectangular regions at a specific location in a detection window. The calculation involves summing the pixel intensities in each region and calculating the differences between the sums.

2)Creating Integral Images

integral images essentially speed up the calculation of these Haar features. Instead of computing at every pixel, it instead creates sub-rectangles and creates array references for each of those sub-rectangles. These are then used to compute the Haar features faster

3)Using Adaboost

A majority of these features won't work well or will be irrelevant to the facial features, as they will be too random to find anything. So here they we needed a Feature Selection technique, to select a subset of features from the huge set which would not only select features performing better than the others, but also will eliminate the irrelevant ones.so for selection of essential features and rejection we have made use of Adaboost

4)Implementing Cascading Classifiers

Now comes the Cascading part. The subset of all features extracted from Adaboost will again run on the training images to detect if there's a facial feature present or not

We can load a pre-trained Haar cascade from disk using the cv2.CascadeClassifer function: Once the Haar cascade is loaded into memory, we can make predictions with it using the detect Multiscale function: The result is a list of bounding boxes that contain the starting x and y coordinates of the bounding box, along with their width (w) and height (h) only this bounding box is stored in the directory of the individual person and not the entire pic.

B) Image pre processing

The pixels are normalized to range from 0-1 and the image is converted from 3d to 2d by making use of reshape to improve the speed and to get better accuracy.

3)Image recognition

We have made use of CNN to recognize and map the human face to the name. We have made use of sequential model. There are 3 convolution layers and 3 maxpooling layers used consecutively. We have made use of more convolution and maxpooling layers to extract higher dimensional features. This is then fed into a

Neural network having 2 hidden layers 1 layer having 500 and the next layer having 64 neurons.

The output layer as SoftMax as activation function. The output will Give us the probability of the image belonging to each of the classes present in the training directory. We train the model by using categorical_crossentropy as loss function and Adam as optimizer.

Data augmentation is done by making use of imagedatagenerator. This will help us to increase the training set and make the model View image as viewed by a human eye. This increase in training set will prevent the model from overfitting. Dropout as also been added with probability of 0.5 prior to flattening and again ones more prior to the output to prevent overfitting. We have also used the concept pertaining to callbacks to stop the model earlier than epochs mentioned in case there is a overfit. We plot the graph for training and validation loss as well as for their respective accuracy and choose the one which has the lowest loss and highest accuracy in case of overfitting, we need to choose the

one point where both training as well has validation accuracy is max. This trained CNN model will be than used for recognizing the individual. After the person has been successfully recognized with probability greater than 0.99 than his name will be marked in the csv file along with the time. If the person is not recognized properly than he will be labeled as unknown.

IV. Conclusion

The performance measure is accuracy and the loss measure is categorical_crossentropy.
The results obtained for images belonging to 6 classes.
The accuracy for training data is: 0.9773
The loss for Training data is: 0.0804
The accuracy for validation data is: 0.9937
The loss for validation data is: 0.0564
The accuracy for test data is: 93.87755393981934
The loss for test data is: 0.49356546998023987
The model is able to recognize multiple faces simultaneously And works really when for real time face detection using web cam more the images taken for each class during training better will be the accuracy. The main drawback of this model Is that there is no way to distinguish between a picture and actual human which may lead to proxy attendance.

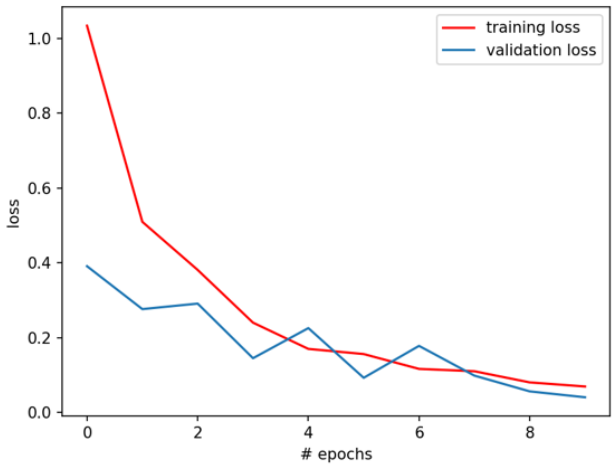

Fig: loss vs number of epochs

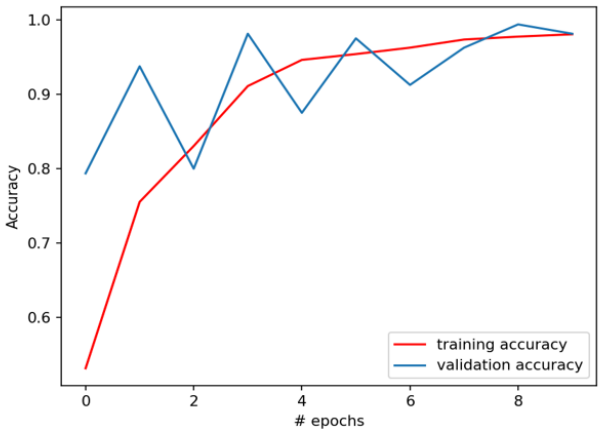

Fig: Accuracy vs number of epochs

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References

[1] (PDF) A Review of Student Attendance System Using Near-Field Communication (NFC) Technology (researchgate.net)

[2] https://www.itmconferences.org/articles/itmconf/abs/2020/02/itmconf_icacc2020_02001/itmconf_icacc2020_02001.html

[3] http://eprints.utar.edu.my/2832/1/EE-2018-1303261-1.pdf

[4] (PDF) Automatic Attendance System Using Facial Recognition (researchgate.net)

[5] https://www.researchgate.net/publication/328018773_Automatic_Attendance_Management_System

[6] https://www.researchgate.net/publication/347048613_FACE_RECOGNITION_FOR_THE_AUTOMATIC_ATTENDANCE_MANAGEMENT_SYSTEM

[7] https://www.researchgate.net/publication/360642343_IoT_-_based_Automatic_Attendance_Management_System_using_Middleware

[8] https://www.researchgate.net/publication/343114802_Automatic_Attendance_Management_Sy stem_based_on_Deep_One-Shot_Learning

[9] https://www.researchgate.net/publication/354536646_Automatic_Attendance_Management_System_Using_Face_Detection_and_Face_Recognition