Using Machine Learning Analysis of an Automatic Facial Attendance and Emotion

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Abstract
Face recognition is one of the mostly used biometrics. It can used for security, authentication, identification, and has got many more advantages. Despite of having low accuracy when compared to iris recognition and fingerprint recognition, it is being widely used due to its contactless and non-invasive process. Furthermore, face recognition system can also be used for attendance marking in schools, colleges, offices, etc. This system aims to build a class attendance system which uses the concept of face recognition as existing manual attendance system is time consuming and cumbersome to maintain. And there may be chances of proxy attendance. Thus, the need for this system increases. This system consists of five phases- database creation, face detection, face recognition, attendance, temperature check and updation.

Keywords
Face detection, Attendance system, Temperature monitoring, mlx90614

I. Introduction

The human-computer interaction is believed to produce a high impact effect when the machine could positively communicate and interact with a human. Computer vision is actually the study of visual data. With a large number of sensors around the world, the amount of visual data has been growing exponentially. So it's critical for us to develop algorithms that can utilize and understand the data. Vision is one of the most important and prioritized senses we human beings have. We can constantly look at the world around us and quickly identify what we see. Traditional method of attendance marking is a tedious task in many schools and colleges. It is also an extra burden to the faculties who should mark attendance by manually calling the names of students which might take about 5 minutes of entire session. This is time consuming. There are some chances of proxy attendance. Therefore, many institutes started deploying many other techniques for recording attendance like use of Radio Frequency Identification (RFID), iris recognition, fingerprint recognition, and so on. However, these systems are queue based which might consume more time and are intrusive in nature. Face recognition has set an important biometric feature, which can be easily acquirable and is non-intrusive. Face recognition based systems are relatively oblivious to various facial expression. Face recognition system consists of two categories: verification and face identification. Face verification is an 1:1 matching process, it compares face image against the template face images and whereas is an 1:N problems that compares a query face images [1]. The purpose of this system is to build a attendance system which is based on face recognition techniques. Here face of an individual will be considered for marking attendance. Nowadays, face recognition is gaining more popularity and has been widely used. In this paper, we proposed a system which detects the faces of students from live streaming video of classroom and attendance will be marked if the detected face is found in the database. This new system will consume less time than compared to traditional methods.

The goal of this article is to provide an easier human-machine interaction routine when user authentication is needed through face detection and recognition. With the aid of a regular web camera, a machine is able to detect and recognize a person's face; a custom login screen with the ability to filter user access based on the users' facial features will be developed. In this digital era, face recognition system plays a vital role in almost every sector.

II. Literature Survey

Daniel LlatasSpiers (2016) proposed a pure convolutional neural network approach outperformed other statistical methods' results achieved by other authors that include feature engineering. Utilizing convolutional networks involves feature learning; which sounds very promising for this task where defining features is not trivial. Moreover, the network was evaluated using two different corpora: one was employed during network's training and it was also helpful for parameter tuning and for network's architecture definition. This corpus consisted of facial acted emotions. The network providing best classification accuracy results was tested against the second dataset. Even though the network was trained using only one corpus; the network reported auspicious results when tested on a different dataset, which displayed facial non-acted emotions. While the results achieved were not state-of-the-art; the evidence gathered points out deep learning might be suitable to classify facial emotion expressions. Thus, deep learning has the potential to improve human-machine interaction because its ability to learn features will allow machines to develop perception. And by having perception, machines will potentially provide smoother responses, drastically improving the user experience.

Luis Antonio BeltránPrieto (2017) et al. presented emotions represent feelings about people in several situations. Various machine learning algorithms have been developed for emotion detection in a multimedia element, such as an image or a video. These techniques can be measured by comparing their accuracy with a given dataset in order to determine which algorithm can be selected among others. This paper deals with the comparison of two implementations of emotion recognition in faces, each implemented with specific technology. OpenCV is an open-source library of functions and packages mostly used for computer-vision analysis and applications. Cognitive services is a set of APIs containing artificial intelligence algorithms for computer-vision, speech, knowledge, and language processing. Two Android mobile applications were developed in order to test the performance between an OpenCV algorithm for emotion recognition and an implementation of Emotion cognitive service. For this research, one thousand tests were carried out per experiment. Our findings show that the OpenCV implementation got a better performance than the Cognitive services application. In both cases, performance can be improved by increasing the sample size per emotion during the training step.

Mrs.Madhuram.M (2018) et al. presented face detection and recognition from an image or a video is a popular topic in

biometrics research. Face recognition technology has widely attracted attention due to its enormous application value and market potential, such as real-time video surveillance system. It is widely acknowledged that the face recognition has played an important role in surveillance system as it doesn't need the object's co-operation. We design a real-time face recognition system based on IP camera and image set algorithm by way of OpenCV and Python programming development. The system includes three parts: Detection module, training module and recognition module.

NitishaRaut (2018) proposed face detection has been around for ages. Taking a step forward, human emotion displayed by face and felt by brain, captured in either video, electric signal (EEG) or image form can be approximated. Human emotion detection is the need of the hour so that modern artificial intelligent systems can emulate and gauge reactions from face. This can be helpful to make informed decisions be it regarding identification of intent, promotion of offers or security related threats. Recognizing emotions from images or video is a trivial task for human eye, but proves to be very challenging for machines and requires many image processing techniques for feature extraction. Several machine learning algorithms are suitable for this job. Any detection or recognition by machine learning requires training algorithm and then testing them on a suitable dataset. This paper explores a couple of machine learning algorithms as well as feature extraction techniques which would help us in accurate identification of the human emotion.

RaghavPuri (2019) et al. proposed a face detection and recognition system using python along with OpenCV package. This system contains three modules which are detection, training and recognition. Basically, the detection module detects the face which gets into the field of vision of the camera and saves the face in the form of an image in JPG format.LDA is a method to find a linear combination of features which characterize or separate two or more classes of objects or events. Linear classifier can be obtained from the resultant. Large number of pixels are used to represent face in computerized face recognition. Before classification Linear discriminant analysis is used to reduce features and makes it more manageable. New dimensions are a linear combination of pixel values which forms a template.

Dr.ShaikAsifHussain (2019) et al. presented deep learning algorithms used in facial recognition for accurate identification and detection. The main objective of facial recognition is to authenticate and identify the facial features. However, the facial features are captured in real time and processed using haar cascade detection. The sequential process of the work is defined in three different phases where in the first phase human face is detected from the camera and in the second phase, the captured input is analyzed based on the features and database used with support of keras convolutional neural network model. In the last phase human face is authenticated to classify the emotions of human as happy, neutral, angry, sad, disgust and surprise. The proposed work presented is simplified in three objectives as face detection, recognition and emotion classification. In support of this work Open CV library, dataset and python programming is used for computer vision techniques involved. In order to prove real time efficacy, an experiment was conducted for multiple students to identify their inner emotions and find physiological changes for each face. The results of the experiments demonstrates the perfections in face analysis system. Finally, the performance of automatic face detection and recognition is measured with Accuracy.

III. Methodology

The task of the proposed system 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 to be detected. There is no need for the teacher to manually take attendance in the class because the system records a video and through further processing steps the face is being recognized and the attendance database is updated. This system is developed using python opencv.

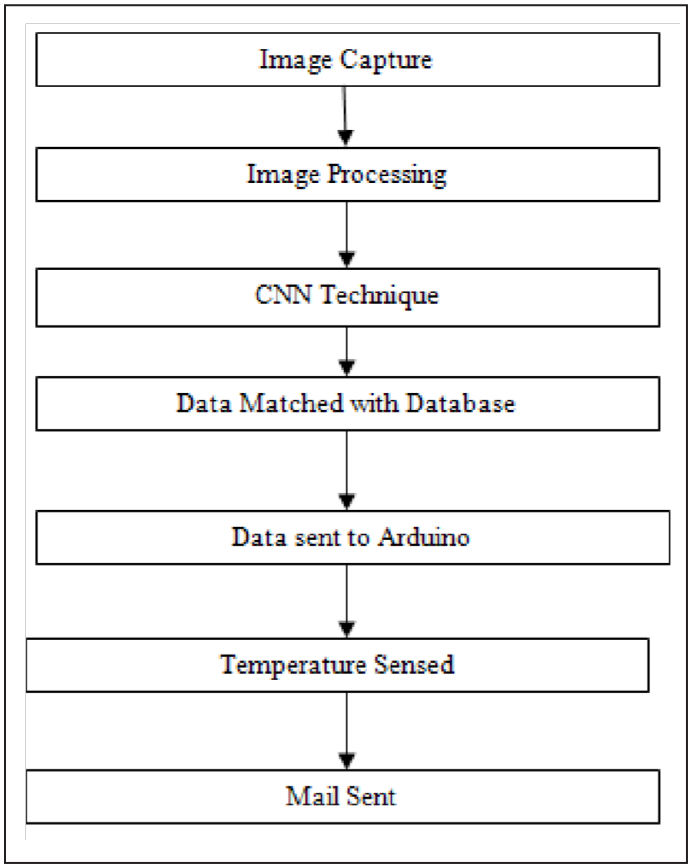

Fig. 1: Flowchart of the process

Database is created by the images of the students in class. Face detection and recognition is performed using Haar-Cascade classifier and Local Binary Pattern Histogram algorithm respectively. Faces are detected and recognized from live streaming video of the classroom. Attendance will be mailed to the respective faculty at the end of the session. The proposed system combines image preprocessing and Convolutional Neural Network (CNN) to build the facial expression recognition model. In pre-processing, the HaarCascade is implemented for face detection. The trained CNN model is saved for real-time face recognition. All the computing algorithms are performed on the eCamera.

A. Dataset Creation

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.

B. Face Detection

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 filehaarcascade_frontalface_default. Here we are using detectMultiScale module from OpenCV.

C. Face Recognition

Face recognition process can be divided into three stepsprepare training data, train face recognizer, prediction. Here training data will be the images present in the dataset. They will be assigned with a 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. Later, during recognition process histogram of the face to be recognized is calculated and then compared with the already computed histograms and returns the best matched label associated with the student it belongs.

D. Attendance Updation

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.

E. Temperature Monitoring

The MLX90614 is an infrared thermometer for non-contact temperature measurements. Both the IR sensitive thermopile detector chip and the signal conditioning ASIC are integrated in the same TO-39 can. Integrated into the MLX90614 are a low noise amplifier, 17-bit ADC and powerful DSP unit thus achieving high accuracy and resolution of the thermometer. The thermometer comes factory calibrated with a digital SMBus output giving full access to the measured temperature in the complete temperature range(s) with a resolution of 0.02°C.

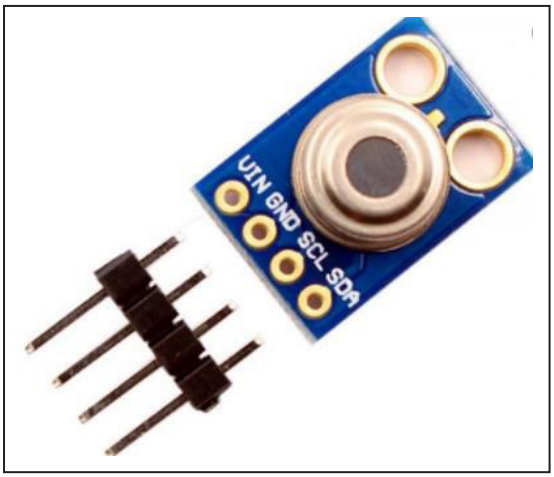

Fig. 2: Temperature module mlx90614

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 samples are collected. These images then will be pre-processed and stored in training 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.

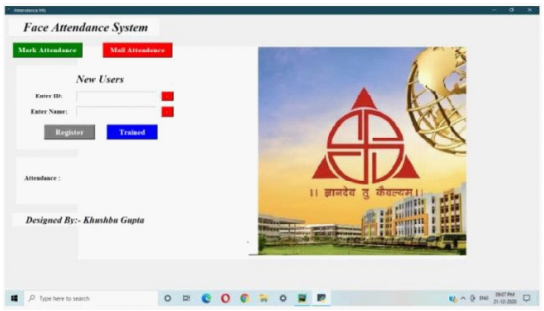

Figure 3: GUI of the attendance system

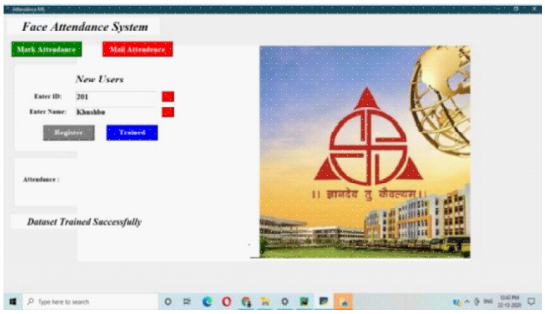

Figure 4: Student registration

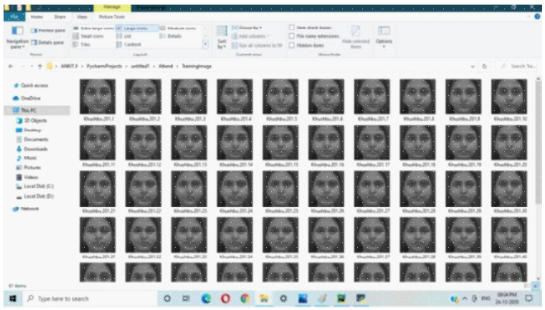

Figure 5: Student image capture and database creation

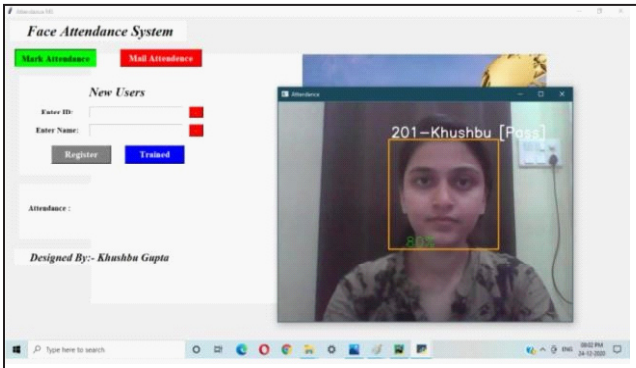

Figure 6: Student image check with database

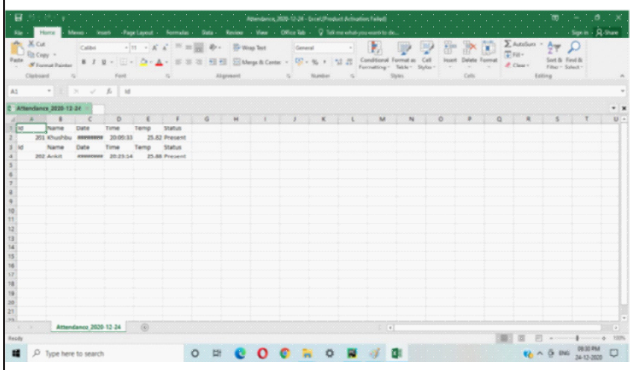

Figure 7: Registering attendance in excel sheet

IV. Result

The project is successfully implemented by making the database of the students pictures and student details, marking the attendance of the registered student along with the temperature check and then mailing the taken attendance to the respective authority. In reference with our base paper [3], they have used LBPH (Local Binary Pattern Histogram) for face detection and eigen face recognition method that bears some common disadvantages due to its ``appearance-based'' nature. First, learning is very timeconsuming, which makes it difficult to update the face database. Second, recognition is efficient only when the number of face classes is larger than the dimensions of the face space; otherwise, the projection of an unknown image requires pixel-by-pixel multiplication of the input image by all eigenfaces, which is equivalent to or worse than template-matching with respect to computation time since an extra distance calculation is needed in the subspace. However, the occurrence of class overlapping increases when more face classes are represented by the same face space, thus lowering the recognition rate.

In our project we have used convolution neural network and haar cascade classifier. Haar Cascade is a machine learning-based approach where a lot of positive and negative images are used to train the classifier. Positive images – These images contain the images which we want our classifier to identify. Negative Images – Images of everything else, which do not contain the object we want to detect. The cascading of the classifiers allows only the sub-images with the highest probability to be analyzed for all Haarfeatures that distinguish an object. It also allows one to vary the accuracy of a classifier. One can increase both the false alarm rate and positive hit rate by decreasing the number of stages.

V. Conclusion

This system aims to build an effective class attendance system using face recognition techniques. The proposed system will be able to mark the attendance via face Id. It will detect faces via webcam and then recognize the faces. After recognition, it will mark the attendance of the recognized student and update the attendance record.

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