Smart Attendance Management System using Face Recognition

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Abstract: With the vast enhancements in telecommunication technologies, processing of audio and video has turned out to be an essential prerequisite. Human face owing to its uniqueness has become a more viable method of distinguishing one person from another. Hence it has emerged to be one of the most popular and preferred system for security and commercial applications. Attendance management by conventional means has proven to be tedious and time consuming. Hence the need for a more efficient means of smart attendance management system has become prominent. This work proposes a new methodology in which attendance of each individual student in a class room is automatically updated in a database by analyzing their faces and comparing them with the predefined images by means of face recognition module. The proposed system is achieved an accuracy of 93% to 95% for face recognition.

Keywords: Face Recognitions, Attendance Management System, Neural Network and Convolutional Neural Network.

I. INTRODUCTION

In the recent years the field of computer vision has seen an extraordinary advancement radically changing how machines interact with the real world. It is now being used in almost every field of application ranging from a convenience store to military applications [1, 2, 3, 4]. Computer vision is the ability of a computer to perceive the visual input as a human being does [5]. Recent developments in the concepts of deep learning and neural networks have greatly enhanced the way computer vision is implemented. In deep learning, artificial neural networks are employed to enable a computer to identify an object in the visual data provided. It facilitates the process of predicting the output for a given input data.

Neural networks that were inspired by the neurons in a human brain, use multi-layer processing to produce the desired output [6,7,8,9]. The input layer to which the input is given produces an output that is then passed on to the next layer and its output, which is based on the weight assigned to each input, is passed on to the next layer as the

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input [10]. This process continues through all the hidden layers in the network and finally, the output is produced at the output layer. By employing this neural networks deep learning has started to dominate the field of computer vision. From educational institutes to industries attendance marking process is done in many places. As the world is moving on to automation in every field, the process of attendance marking is still being done manually. Convolutional Neural Network (CNN) is used to recognize a person's face. CNN is computationally efficient when compared to other networks [11]. Hence by using deep learning and neural networks, the process of marking attendance has been easy and the results obtained have proven this method to very accurate.

II. REVIEW OF LITERATURES

This section reviews the existing works available for the attendance management systems. Smart attendance system described Purohit et al. described an attendance management system using biometric scanning techniques [12]. In their work, a fingerprint sensor is used to identify a person's fingerprint and then store it in a database for processing. The main disadvantage of the traditional methods for taking attendance is that it takes a large amount of time and requires more human resources. Their smart attendance management using a fingerprint sensor that not only ensures minimal human involvement but also restricts any manipulation of attendance data. Further, their work also reduces the processing time.

RFID based students attendance management system developed by Arulogun et al. emphasizes the use of Radio Frequency Identification (RFID) to implement an attendance management system [13]. A RFID system is capable of detecting and registering a student's data by just scanning student's identification card. The use of RFID is very effective and less tedious. The data scanning rate by RFID is more efficient than traditional methods of taking attendance. They have discussed in detail regarding the use of RFID to manage and run an attendance system effectively with nominal amount of time consumption and reduced human resources. Their system also ensures that the data collected is precise and accurate. The major drawback of their system is that it is prone to manipulation and expensive to implement when compared to other attendance management systems.

Kardy and Smaili utilized iris recognition for their wireless attendance management system [14]. They described the implementation of an attendance management system with the help of a person's iris. A wireless iris detection system is capable of scanning and detecting a student's iris. Like fingerprint, everyone has unique iris in eyes. They used iris scanner which scans the student's iris and is much secure compared to RFID system. The major drawback of her system is that, it is more expensive than the biometric fingerprint systems and the RFID based systems. Her method also reduced the time consumption compared to the traditional methods of taking attendance.

Since the present methods for attendance management systems are tedious and time-consuming, we have come up with a smart attendance system in which does not require any human interaction and also very time efficient. In the proposed system, a picture of the class is captured with a camera and then it is processed using facial recognition technology to identify the people present and the attendance status is then updated in the attendance records.

III. PROPOSED METHOD

The proposed solution for attendance system starts with capturing the image of the class for identifying the students present in the class. The camera is fixed at the middle center of the class to get a clear picture of everyone in the class. The captured picture is then stored in a local server on which the python script is run upon.

The proposed smart attendance management system makes use of face recognition of the students who are present in the class. The proposed system has Convolutional Neural Network (CNN) for this purpose. The CNNs are special kind of neural architectures that have been specifically designed to handle large image data. CNNs have their own structure and properties compared to Artificial Neural Network (ANN), but both have hidden layers, weights, biases, hidden neurons, activation functions and back propagation. The proposed CNN uses deep learning approach which consists of input layer, convolutional layer, max pooling layer, hidden layer and output layer. The deep learning proposed here, because, the machine Learning is not capable of handling high dimensional data that is where input and output is quite large. Handling and processing such type of data becomes very complex and time consuming. In machine learning, the feature are extracted through some algorithms which utilized for the classification of images/objects. However, in deep learning, features are automatically recognized by the network for the classification of images/objects.

The CNN need not limited with only one convolution layer and may have many convolution layers. The structure of deep neural network is shown in figure 1. The convolutional layer is responsible for capturing color, edges etc i.e low level features. After performing the convolution on images by convolution layer, the size of convolved features are reduced by the max pooling layer. This process greatly reduces the computational time required process the data. Further, it extracts the dominant features which can be used effectively to train the network.
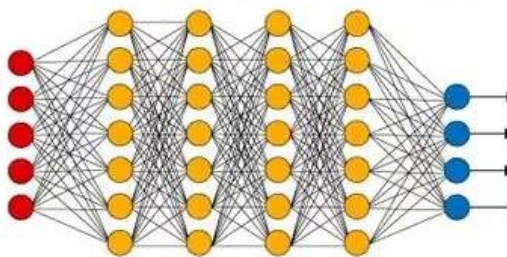

Fig. 1: Deep learning neural network

The convolutional network is formed together by using convolutional layer and pooling layer. The number of convolutional layers may increase in order to capture low level features better with much reduced computational power. After performing pooling operation on the convolutional layer, input image is converted to appropriate form for the multi-level perceptron. The pooled feature map is flattened into a column vector and fed to a feed forward neural network with back propagation. During the training process, weights and biases are adjusted to get the optimum results. The network error is reduced by back propagating error and adjusting the weights and biases. The face

recognition library is then used to compare the detected faces in the image with the student's images from the student's database. Based on the outcome of this comparison the attendance is marked for a student. This attendance record is then converted to a CSV file to create an attendance sheet. This is then uploaded to the cloud where the attendance records are stored.

IV.   RESULTS AND DISCUSSION

The faces of the students present in a class room is given in figure 2. The faces are capture by the camera and fed to the CNN. The faces are first identified by comparing with the student's data base. Each student in the database is then compared with the identified faces and correspondingly attendance status is generated as shown in figure 3. Finally, the attendance is updated in the attendance record which gets uploaded to the cloud as shown in figure 4.

Fig. 2: Facial images of students in a class room

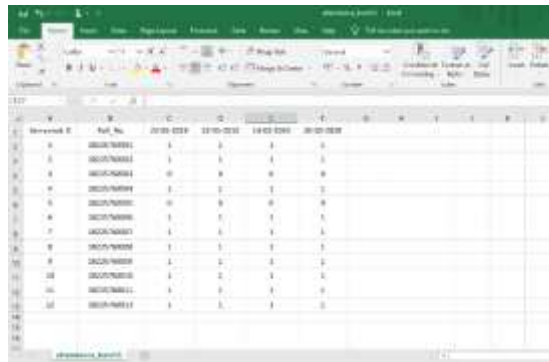**Fig 3:** Attendance report of students

Fig. 4: Attendance database of students

The proposed system is achieved an efficiency of 93% to 95% for the face recognition and may considered to be the optimum solution for the use in smart attendance management system.

V.   CONCLUSION

Smart attendance management is important to reduce the time consumption and human resources for attendance monitoring. This system is mainly developed for maintaining student's attendance. The primary objective of this system is to overcome the shortcomings faced in the conventional method of attendance management which has proven to be a taxing and laborious process. The drawbacks including manipulation of data have been resolved in the proposed system for attendance management. This method of attendance system will prove to be more cost efficient. Thus, the developed system has provided a very reliable and effective way of attendance management as opposed to the conventional method.

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