International Journal of Research in Engineering, Science and Management
Volume-3, Issue-2, February-2020
www.ijresm.com | ISSN (Online): 2581-5792

Automatic Student Attendance Marking System Using Facial Recognition

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***Abstract*: An automated attendance marking and management system is proposed based on face detection and recognition algorithms. Identification of human faces by the unique characteristics or features of their face is known as Face recognition. Instead of using the traditional methods, the proposed system aims to develop an automated system that records the student's attendance by using facial recognition technology to mark the students present during lecture hours. The primary objective of the proposed system is to make the attendance marking and management system fully automatic, simple and easy. The facial recognition is done through image processing techniques using algorithms like Dlib. The processed image is used to match with the existing stored record and then attendance is marked in the database during every lecture hour. When compared to existing system traditional attendance marking system, proposed system reduces the workload of people and also saves times.**

***Keywords*: Machine Learning, Deep Learning, Neural Network, Convolutional Neural Network, Facial Recognition.**

1. Introduction

Attendance is considered important for both the teacher and student of an educational organization to understand the physical presence of the students inside the classrooms during lecture hours. In Traditional approach, the faculty calls either roll number or name of the student which consumes a portion of the lecture hour and energy of the faculty. So, an automatic attendance system can solve all above problems.

There are some automatic attendances making system which are currently used in many institutions. One of such system is biometric technique which is automatic and a step ahead of traditional method which fails to meet the time constraint. The student has to wait in queue for giving attendance, which is time taking.

This project introduces an involuntary attendance marking system, devoid of any kind of interference with the normal teaching procedure. The system can be also implemented during exam sessions or in other teaching activities where attendance is highly essential. This system eliminates classical student identification such as calling name of the student, or checking respective identification cards of the student, which cannot only interfere with the ongoing teaching process, but also can be stressful for students during examination sessions.

2. Related Work

The purpose of the work is to analyze the solutions given by others and considering the shortcomings of the facial recognition, attendance validation systems, bring out a better solution. One is face database that contains the picture of the students and the other is the attendance database. Attendance database is used to mark attendance of the student when camera takes a picture of the class and then removes the background and noise from the image. Afterwards the skin is classified and the detected face is matched with it the image stored in the face database. After matching and recognition of the image, attendance is marked in the attendance database. The basic approach taken to tackle the hindrances of attendance marking through facial recognition is to match the images taken recently with those images deliberately captured and placed in the central database. The system will continuously observes the attendance although video service streaming was also available in many systems but they used face detection technique and capturing images for continuous observation. They also posed that they estimate the seating arrangement of the students by using different mathematical calculations. The architecture of the system is very simple as two cameras are used; one is sensing camera and the other is capturing camera. Moved on to a better technique for face recognition by using statistical techniques PCA & LDA plus also matching the image taken and the stored image for attendance marking. They addressed the lengthy and error prone process of attendance making which if compromised may affect the student drastically.

Inference:

- Accuracy would be high.
- Better results are obtained because of using eyes and nose similarity.
- Computation cost is high.
- If students are in large numbers then the images would be more which leads to the difficulty in handling database.

CNN is a category of Neural Networks that have proven very effective in areas such as image recognition and classification. CNNs are a type of feed forward neural networks made up of many layers. CNNs consist of filters (kernels or neurons) that have learnable weights or parameters and biases. Each filter takes some inputs, performs convolution and optionally follows it with a non-linearity. The structure of CNN contains Convolutional, pooling, Rectified Linear Unit (ReLU), and Fully Connected layers. Pooling layer reduces the dimensionality of each activation map but continues to have the most important information. The input images are divided into a set of no overlapping rectangles. Each region is down-sampled by a non-linear operation such as average or maximum. This layer achieves better generalization, faster convergence, robust to translation and distortion and is usually placed between convolutional layers. Convolutional layer performs the core building block of a Convolutional Network that does most of the computational heavy lifting. The primary purpose of Convolution layer is to extract features from the input data which is an image. Convolution preserves the spatial relationship between pixels by learning image features using small squares of input image. The input image is convoluted by employing a set of learnable neurons. This produces a feature map or activation map in the output image and after that the feature maps are fed as input data to the next convolutional layer. ReLU is a non-linear operation and includes units employing the rectifier. It is an element wise operation that means it is applied per pixel and reconstitutes all negative values in the feature map by zero.

Inference:

- CNN does automatic feature extraction.
- CNN does weight sharing which gives good accuracy.
- CNN out performs all other neural networks in image recognition process.
- CNN requires lot of training data.
- It is difficult to detect small object.
- It only predicts a label, not a segmentation box.

Knowledge-based methods are encoding our knowledge of human faces. These are rule-based methods. They try to capture our knowledge of faces, and translate them into a set of rules. It's easy to guess some simple rules. For example, a face usually has two symmetric eyes, and the eye area is darker than the cheeks. Facial features could be the distance between eyes or the color intensity difference between the eye area and the lower zone. The big problem with these methods is the difficulty in building an appropriate set of rules. There could be many false positives if the rules were too general. On the other hand, there could be many false negatives if the rules were too detailed. A solution is to build hierarchical knowledge-based methods to overcome these problems. These methods show themselves efficient with simple inputs. But, what happens if a man is wearing glasses? There are other features that can deal with that problem. For example, there are algorithms that detect face-like textures or the color of human skin. These algorithms compare input images with stored patterns of faces or features. Template matching methods try to define a face as a function. In general, appearance-based methods rely on techniques from statistical analysis and machine learning to find the relevant characteristics of face images Eigen face based Methods - PCA Algorithm Principal Component Analysis (PCA) is well-organized method for face recognition. It is one of the most usable methods for a face image. It is used to reduce the dimensionality of the image and also holds some of the variations in the image data. It is 7 projecting face image data into a feature space that covers the significant variations among known facial images. Those significant features are known as "Eigen faces", because they are the eigenvectors or Principal Component of the set of faces. That is not necessary to correspond to the features such as eyes, ears, and noses. The projection operation characterizes an individual face by a weighted sum of the Eigen faces features. So to recognize a particular face, it is necessary only to compare these weights to those individuals.

Inference:

- Automated System.
- Easy integration.
- High success rate.
- When biometric facial methods are used, we get better security.
- Can't work well with high dimension.
- It cannot achieve good results with variations in pose and shape

First step in every biometric system is the enrollment of persons using general data and their unique biometric features as templates. This work uses the enrollment algorithm as shown in the Image is captured from the camera and then it is enhanced using histogram equalization and noise filtering. In the second step face is detected in the image and features are extracted from it. These unique features are then stored in the face database with certain id of that person. The system consists of a camera that captures the images of the classroom and sends it to the image enhancement module. After enhancement the image comes in the Face Detection and Recognition modules and then the 8 attendance is marked on the database server. At the time of enrollment templates of face images of individual students are stored in the Face database. Here all the faces are detected from the input image and the algorithm compares them one by one with the face database. If any face is recognized the attendance is marked on the server from where anyone can access and use it for different purposes. This system uses a protocol for attendance. A time table module is also attached with the system which automatically gets the subject, class, date and time. Teachers come in the class and just press a button to start the attendance process and the system automatically gets the attendance without even the intensions of students and teacher. In this way a lot of time is saved and this is highly securing process no one can mark the attendance of other. Attendance is maintained on the server so anyone can access it

for it purposes like administration, parents and students themselves.

Inference:

- This paper introduces more accurate method of attendance marking that can replace old methods.
- This method is secure enough and available for use.
- It can be constructed using a camera and computer.
- There is a need to use some algorithms that can recognize the faces in veil to improve system performance.

CNNs are trained and the first one classifies each pixel according to whether it is part of a face, and the second one determines the exact face position given the output of the first step. It present a rationally connected neural 10 network for face detection, which determines whether each sliding window contains a face. A CNN is trained to perform joint face detection and pose estimation. Since 2012, deeply trained neural networks, especially CNNs, have revolutionized many computer vision tasks, including face detection, as witnessed by the increasingly higher performance on the Face Detection Database and Benchmark (FDDB). It introduced a deformable part model based on normalized features extracted from a deep CNN. A CNN cascade is presented in which operates at multiple resolutions and quickly rejects false positives. Following the Region CNN, proposed a two-stage approach for face detection. The first stage generates a set of face proposals base on facial part responses, which are then fed into a CNN in the second stage for refinement. a fully convolutional neural network to detect faces at different resolutions. In a recent paper, a convolutional neural network and a 3D face model are integrated in an end-to-end multi-task discriminative learning framework. Compared with non-neural based methods, which usually rely on hand-crafted features, the Faster R-CNN can automatically learn a feature representation from data. Compared with other neural based methods, the Faster R-CNN allows end-to-end learning of all layers, increasing its robustness. Using the Faster R-CNN for face detection have been studied in . In this paper, we don‟t explicitly address the occlusion as in . Instead, it turns out the Faster RCNN model can learn to deal with occlusions purely form data. Compared with, we show it is possible to train an off-the-shelf face detector and achieve state-of-the-art performance on several benchmark datasets. a region-based CNN (RCNN) for object detection. The pipeline consists of two stages. In the first, a set of category-independent object proposals are generated, using selective search. In the second refinement stage, the image region within each proposal is warped to a fixed size (e.g., 227 × 227 for the AlexNet) and then mapped to a 4096-dimensional feature vector. This feature vector is then fed into a classifier and also into a regressor that refines the position of the detection. The significance of the RCNN is that it brings the high accuracy of CNNs on classification tasks to the problem of object detection. Its success is largely due to transferring the supervised pre-trained image representation for image classification to object detection.

J. D. Tiamai Guo, “Simple convolution neural Network on Image Classification”, IEEE,2017. In recent years, deep learning has been used in image classification, object tracking, pose estimation, text detection and recognition, visual saliency detection, action recognition and scene labeling. In this paper they build a simple Convolution neural network on image classification. This simple Convolution neural network completed the image classification. On the basis of the Convolution neural network, we also analyzed different methods of learning rate set and different optimization algorithm of solving the optimal parameters of the influence on image classification.

3. Methodology

Each input image is preprocessed to generate new data from the existing data. The model is trained with the new data which is being generated. The activation function is used to introduce non-linearity, so that the network can learn non-linear functions also. The cost function is used to calculate the difference between the predicted output and actual output. The gradient descent algorithm is used for weight optimization. Finally, the optimized weights will give better results.

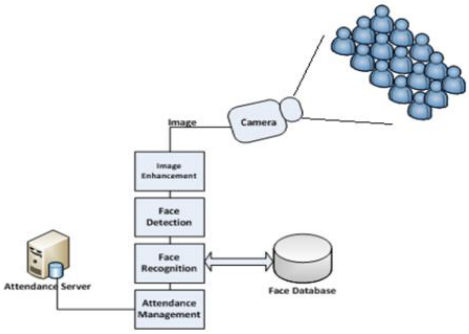

Fig. 1. Block diagram of attendance marking system

A. *Preprocessing of Input Data*

During the process, the first step is to collect the images of all the students present in the classroom. Data augmentation techniques are used to identify the number of images of the particular person in the data set is increased. An image of a person is rotated in different angles to create more input data which can be used to train the model. In second step, labeling the images of the student with his/her respective unique IDs issued by the college. Data preprocessing techniques like data cleaning and data normalization are done. Image processing could be simple task if the images are resized to a common dimension. Normalization is used to bring features in a data set to the same scale.

B. *Convolutional Neural Network*

A Convolutional Neural Network (ConvNet/CNN) is a Deep Learning algorithm which can take in an input image, assign importance (learnable weights and biases) to various aspects/objects in the image and be able to differentiate one

from the other. The pre-processing required in a ConvNet is much lower as compared to other classification algorithms. While in primitive methods filters are hand-engineered, with enough training, ConvNets have the ability to learn these filters/characteristics.

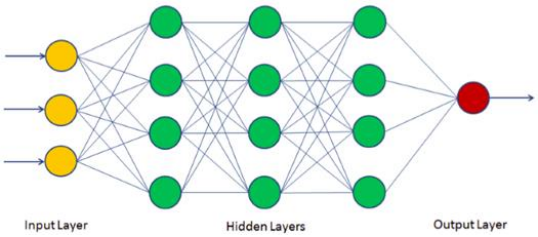

Fig. 2. Layers of neural network

C. *Architecture of Convolutional Neural Network*

FaceNet is a start-of-art face recognition, verification and clustering neural network. It is 22-layers deep neural network that directly trains its output to be a 128-dimensional embedding. The loss function used at the last layer is called triplet loss.

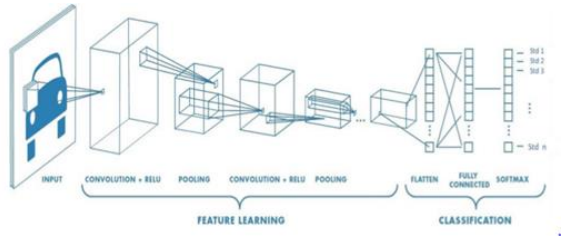

Fig. 3. CNN architecture

D. *Gradient Descent Algorithm and Activation functions*

The gradient descent algorithm, along with the back-propagation technique, is used to optimize the weights of the neural network. During the forward pass, the network uses the weights to predict the output. The “cost” or error value i.e. the difference between the actual and predicted output is back propagated through the network and the gradients are used to update the weight matrices. During epochs the neural network trains itself through weights in each node in network. The gradients then slop to the bottom of the curve and converges. Denotes the error values of nodes in layer l. denotes the weight matrix from layer l to layer l+1. g is the activation function, denotes the input values to layer l, and is the activation at layer.

4. Results and Discussion

Recognizing the images of different people in different angles, comparing low quality image and high-quality images of the same person and checking whether they are producing desired results or not and finally identifying people’s faces separately from a whole image. For the high-quality images, we obtain a better accuracy but for low quality images the accuracy isn’t good.

The accuracy is also getting reduced if images of the same person with two different face angles are compared. And also, modification in face also reduces the accuracy of the model (i.e.) comparing images of a person with beard and without beard. If the images are pre-processed and converted to the same size, then it will give better results.

5. Conclusion and Future scope

Automating the process of attendance marking system reduces the errors that are occurring in manual attendance entry and also the proof of student present in the class will be in the form of an image so tapering wouldn’t be easy.

References

[1] M. Sajid, R. Hussain and M. Usman, "A conceptual model for automated attendance marking system using facial recognition," *Ninth International Conference on Digital Information Management (ICDIM 2014)*, Phitsanulok, 2014, pp. 7-10.

[2] M. Coşkun, A. Uçar, Ö. Yildirim and Y. Demir, "Face recognition based on convolutional neural network," *2017 International Conference on Modern Electrical and Energy Systems (MEES)*, Kremenchuk, 2017, pp. 376-379.

[3] Kamini Solanki and Prashant Pittalia. Article: Review of Face Recognition Techniques. International Journal of Computer Applications 133(12):20-24, January 2016.

[4] Naveed Khan Balcoh, M. Haroon Yousaf, Waqar Ahmad and M. Iram Baig, “Algorithm for Efficient Attendance Management: Face Recognition based approach,” IJCSI International Journal of Computer Science Issues, Vol. 9, Issue 4, No 1, July 2012.

[5] J. D Tiamai Guo, “Simple convolution neural network on image classification”, IEEE 2017.