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# Smart Attendance System using Face Recognition

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**ABSTRACT:** Attendance is a ritual followed in every class every day. In the present academic system, regular class attendance of students' plays a significant role in performance assessment and quality monitoring. The conventional methods practiced in most of the institutions are by calling names or signing on papers, which is highly time-consuming and insecure. Taking attendance manually can be a great burden for teachers. With the advent of technology the manual attendance system can be applied with help of computer vision. Computer vision plays a major part in recognizing facial parts of students for putting up automated attendance without use of paper and pen. This attendance is managed properly and for longtime with help of automation. The attendance can be accessed by teachers, students and parents from anywhere anytime. Image Processing with deep learning is applied to easier assessment of attendance which is time-consuming and cost saving.

**KEYWORDS:** Face detection, Deep learning, Attendance.

## I. INTRODUCTION

Attendance is a ritual followed in every class every day. In the present academic system, regular class attendance of students' plays a significant role in performance assessment and quality monitoring. The conventional methods practiced in most of the institutions are by calling names or signing on papers, which is highly time-consuming and insecure. Taking attendance manually can be a great burden for teachers. With the advent of technology the manual attendance system can be applied with help of computer vision. Computer vision plays a major part in recognizing facial parts of students for putting up automated attendance without use of paper and pen. This attendance is managed properly and for longtime with help of automation. The attendance can be accessed by teachers, students and parents from anywhere anytime. Facial Recognition can be done using two methods first is Appearance based and other is feature based. Feature based recognizes features of faces such as nose, eyes etc. while Appearance is based on dimension and distances. Eigen Face, LDA and PCA are different accessible strategies for face recognition which can be used for face attendance system. The initial face recognition research based on feature-based, that study uses the Geometrical Features and Template Matching method in identifying a person's face.

## II. LITERATURE SURVEY

### A. Face Recognition using Dimensions and Distances.

The system proposes a face recognition-based mobile attendance management which is flexible and can be used anytime anywhere. The system performs in real time with a smart user-friendly device which helps to reduce the cost of equipment to be used in the system. User end consists of Teachers, Students as well Parents which gives monitoring of attendance in real time. This also saves time and money used for attendance in a regular manual system. Main objective in this system is recognition of faces for attendance. Facial Recognition can be done using two methods first is Appearance based and other is feature based. Feature based recognizes features of faces such as nose, eyes etc. while Appearance is based on dimension and distances. In this system authors have used filtering, based on Euclidean distances calculated by Eigenfaces, Fisher faces, and LBP (Local Binary Pattern). The system fails when the distance between face and camera is increased, thus showing the limitations. [5]

### B. Facial Recognition with Feature Extraction.

This system encourages use of feature detection for facial recognition. Attendance is a ritual in the classroom which consumes time and money on equipment used for taking attendance. The system proposes attendance to

be taken from a video capture during regular class so that students are not disturbed, the video first goes through a process of face detection, and then feature extraction. Pose estimation of student, image size, resolution, brightness are also considered as part of research. Deep Learning is applied after a quality assessment of face recognition to apply the attendance to the student. This system sometimes fails to recognize the face depending on more light or darkness in the room.[6]

**C. Strategy of Face recognition with Eigenface, PCA**

PCA, LDA, Eigen face hybrid algorithm are different strategies which are used for face recognition. Marking attendance of students with automated face recognition is a great model towards advancement in technology. Proxies and fake attendance which are common in traditional attendance can be overcome in this system. As the world advances with many technology, attendance system is done in different ways and biometrics also include as one but face attendance gives more accurate results with less intervention from human side. The system is developed to efficient security and apply attendance system for face with multiple face in one instance. The Smart Attendance system is built with minimal hardware requirement of high pixel good quality camera, PC and database servers.[7]

**D. Mahalanobis method for classification of extracted facial feature**

The use of reconstruction algorithms from 2D images to 3D forms that are used as a database in face recognition. In this study, a study of facial recognition using an approach to the development of 2D to 3D image reconstruction models using Convolutional Neural Network (CNN) and the use of PCA are used as the feature extraction method. The CNN method is used to produce a 3D face image from a 2D face image. The PCA method used as a feature extraction method and the Mahalanobis method used as a classification method on the proposed face recognition-based attendance system can work well. The proposed method can produce a face recognition that has a high accuracy of up to 98%. [8].

**E. Multi-scale feature extraction for single face recognition.**

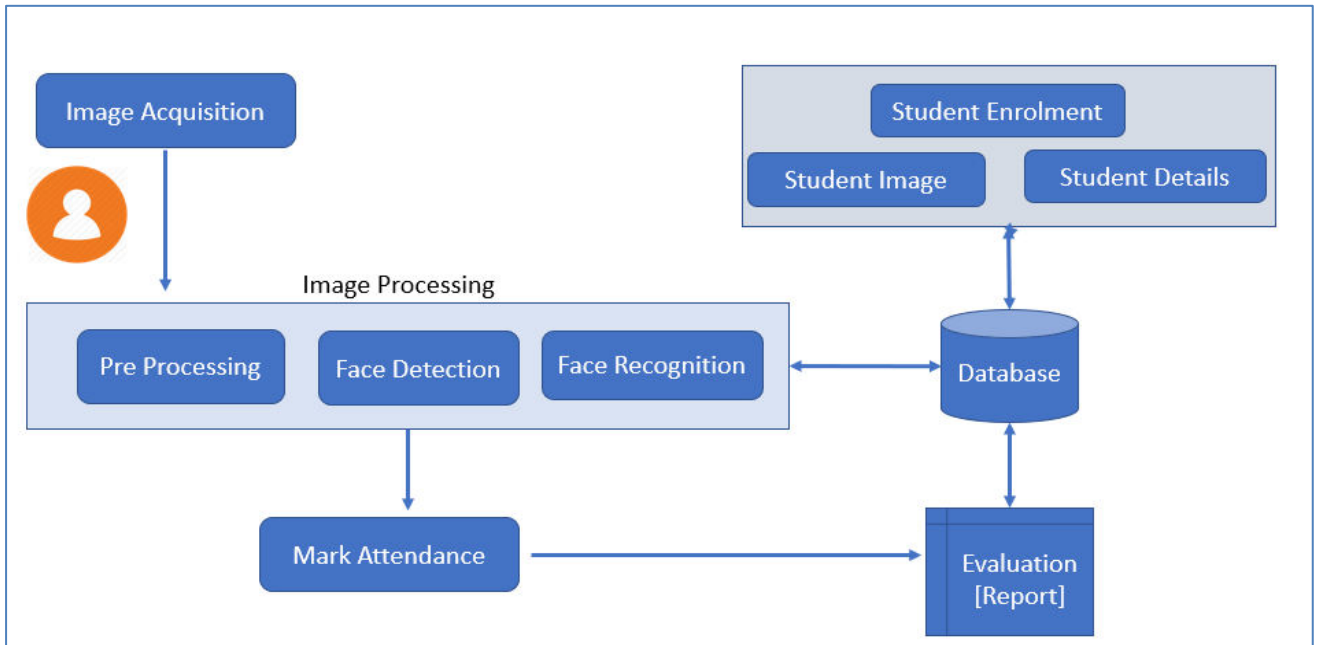
Single sample face recognition has always been a hot but difficult issue in face recognition. The existing methods solve this issue from selecting robust features or generating virtual samples. By considering selecting robust features and generating virtual samples simultaneously, the paper proposes a multi-scale support vector transformation (MSSVT) based method to generate multi-scale virtual samples for single image recognition. The methods to solve problems are divided into two categories. One is to look for and select features that are robust to the number of samples, from the point of view of feature selection, such as PCA and 2DPCA. But when each person has only one face to be trained, the feature information extracted from the feature extraction algorithm will also be very limited, resulting in a bad recognition performance. The other is to generate multiple virtual samples from the point of view of the extended sample, thus reducing the impact of the sample size. [10]

**F. Face recognition method based on sparse representation and feature fusion.**

The authors propose a multi-feature fusion face recognition method based on sparse representation. The core idea is to find the sparseness through training, and then use the sparse coefficient and training samples to represent the test samples, and then the optimal sparse solution is obtained by solving the  $l_1$ -norm problem. The recognition results of feature fusion methods are better than any single feature algorithm under the condition of non-occlusion or occlusion. When there are less than 10 pictures of each category of people in the training sample and the occlusion type is not controllable, our algorithm can still obtain a high recognition rate. [11]

### III. SYSTEM ARCHITECTURE

Fig: System Architecture



### IV. METHODOLOGY

Smart Attendance system is developed to enable automated attendance of students . To carry out the task of automated attendance some steps needs to be followed.

1. Enrollment
2. Image Acquisition
3. Image processing
4. Attendance marking
5. Report

#### 1. Enrollment

The students who are new to the course or school are enrolled in this step. The step take care to note students basics details such as name , phone number, enrollment Number, Class, and Section are given to student and stored in the database. This information form the details of student. Separate pictures of the student's face appearing in the camera window are captured .Pictures along with student information is stored in the student database. Face Recognition is performed on all the images of students present in database .

#### 2. Image Acquisition

In smart attendance system ,attendance is marked when student is present in the class. Camera is used to acquire images of students in class. High pixel good camera is used to get high quality and high accuracy images. The face of students are captured who are present in the class.

#### 3. Image Processing:

Images captured through camera are used for image processing. Image processing consists of three steps namely Image Pre-processing, Face Detection, Face Recognition.

##### a)Preprocessing:

The images are cleaned and noise is removed to obtain clarity in images.

##### b) Face Detection:

Face detection is done based on landmark present on persons face. Viola and Jones algorithm[1] is applied on preset 68 landmarks on persons face. Constrained local model and face bounding box detection is used forface landmarksearch and face tracking. After Face detection , image is passed to next phase.

c) Face Recognition:

Deep learning is implemented for face recognition. The image captured through camera and students enrolled images from database are matched to give result of attendance. The deep learning is engaged for its speed, ease of use and not limiting itself over changes in face.

4. Attendance Marking

Face recognition successfully allows to judge the presence of student in class and mark his attendance. Intrusion of using camera at start and end of class might allow to evaluate the students presence throughout class and also reduce proxies.

5. Report

Report is made which can be used of evaluation of students attendance in class these reports are collectively made with of marked attendance and database. Further performance evaluation can be done for whole student management system.

## V. MODULES

### Face Detection

In a classroom, Image is captured with the help of a camera and the faces in images are detected. Testing set and training set images are captured earlier during the process of enrollment using a camera. There is unwanted noise and uneven lighting exists in the images. Therefore, several pre-processing steps are necessary before proceeding to feature extraction. Pre-processing steps that would be carried out include scaling of image, median filtering, conversion of colour images to grayscale images and adaptive histogram equalization. The details of these steps would be discussed in the later sections. Scaling of images is one of the frequent tasks in image processing. The size of the images has to be carefully manipulated to prevent loss of spatial information. (Gonzalez, R. C., & Woods, 2008), In order to perform face recognition, the size of the image has to be equalized. This has become crucial, especially in the feature extraction process, the test images and training images have to be in the same size and dimension to ensure the precise outcome. Thus, in this proposed approach test images and train images are standardized at size 250 250 pixels. Deep Learning is used for face recognition.

### Performance Analysis

In this module, an algorithm for predicting performance of next semester based on previous semesters record as well as previous 2 years record for the same course and behavioral analysis is proposed. As per performance of students in the written exam of all previous semesters, gradient of all semesters is calculated. This is then saved in the database for further evaluation. The impact factor calculated using the different parameters. Previous 2 years data of students studying in the same class is obtained from a database. An exponential moving average and linear regression is calculated and fed to marks prediction.

## VI. EXISTING SYSTEM

The very earlier systems designed have taken statistical methods to determine distances for facial recognition. The later system has used feature extraction as a technique for facial recognition. The paper [10] and [11] multiple feature extraction is used with sparse representation.

The traditional neural network is not capable of dealing with images. Consider in case of the regular network, imagine each pixel is connected to one neuron and there will be thousands of neurons which will be computationally expensive. Convolutional Neural Network (CNN) handles images in different ways, but still, it follows the general concept of Neural Network. In constructing the CNN, it mainly consists of three parts – Convolution, Pooling, Flattening. The fundamental purpose of convolution is to select characteristics from the input image. It conserves the spatial relationship between pixels by learning image characteristics using small squares of input data. The output obtained is a matrix known as the feature map. A further operation called ReLU is used after every convolution operation. The next step is of Pooling which is also known as sub-sampling or down-sampling. Pooling reduces the length of each feature map but maintains the most important information. In Max Pooling, it defines a spatial neighbourhood and takes the biggest element from the rectified feature map within that window. The other method is to take the average of all elements in that window. After pooling, the next stage comes is flattening. In this step, the matrix is converted into a linear array so that to input it into the nodes of the neural network. The full connection is

connecting a convolutional network to a neural network and then a compiling network. The usage of CNN helps in minimizing the number of parameters needed for images. It also helps to do the parameter sharing as it can possess translation invariance.

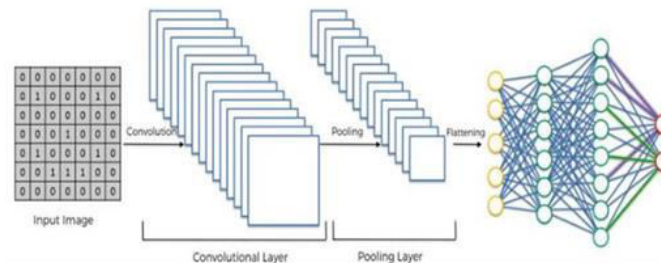


Fig: CNN (Source Medium)

## VII. CONCLUSION AND FUTURE WORK

The survey shows study of the attendance system using facial recognition as a major factor used for counting the presence of students in class. The system is the perfect solution for manual attendance used decades back. It saves time as well equipment cost used for prior. Different methods used for facial recognition are studied. The study of [5],[6] shows the use of statistical methods to determine facial features. Whereas others use feature extraction as a major for face recognition. Feature extraction with classification method when applied gives more accurate results [8]. The Proposed system goes one step further where facial recognition and performance analysis is implemented with Deep Learning method thus giving new identity to smart attendance systems.

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