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Face Recognition Using Deep neural network

Karthik.P
DepartmentofECE
SRM Institute of Science andTechnology
Chennai, Indiakp911@srmist.edu.in

B. Manoj Kumar
DepartmentofECE
SRM Institute of Science andTechnology
Chennai, Indiabm9084@srmist.edu.in

J.K.KasthuriBha
Department of ECE
SRM Institute of Science and Technology
Chennai, India
kasthurj@srmist.edu.in

Shailendra Sudakar
DepartmentofECE
SRM Institute of Science andTechnology
Chennai, Indiass6339@srmist.edu.in

***Abstract* — Face image processing applications include face recognition systems, which are becoming more and more important as a study field. Criminal justice reform video monitoring, identity verification, and other security measures are put in to practice using this system.Using MATLAB software, faces are detected and attendance is marked based on tracking. To develop a real-time application, like identifying the human face with the stored information.The face detection algorithm has been developed on the MATLAB platform. The methodology used to detect a face using some parameters of the image and tracking of the detected image are clearly demonstrated in this system. The main goal of this project work is to use a deep learning classification algorithm for an automated face recognition system .The primary algorithm that is implemented utilizing the gradient-boosted technique is XGBOOST .Gradient boosting is a supervised learning processs that combines the predictions of a number of weaker, simpler models to attempt to properly predict a target variable.**

Keywords—MATLAB,Face recognition ,XGBOOST, supervised learning.

I INTRODUCTION

A facial recognition attendance management system produces accurate time records,limiting expensive errors .Accurate data helps management ensure there is no proxy, as a result.A machine learning model that implements face recognitionand tracing makes use of CNN- XGBoost architecture and offers greater accuracy than other machine learning models.The proposed descriptors are 107 times faster than the closes trivalin terms of speed up in execution time.The system normally involves an involuntary attendance marking mechanism that does not cause any disruption to the regular teaching process. The model eliminates the classical student identification procedure. To improve the accuracy of facial identification, the system might also incorporate photographs taken from different perspectives.

The model records attendance together with the date and time as soon as the system recognizes the person.Overall,the model works more efficiently along with improved accuracy .This project satisfies the time management standards as well as the demands for modernizing the way attendance is handled. Information about the students, including their names, rollnumbers ,classes,secs, and photographs, is trained.The images are Extracted using Open CV. The image is processed as follows:first, faces are identified using a Haar cascade classifier, then faces are recognized using the LBPH (Local Binary PatternHistogram) Algorithm, histogram data is checked against an established dataset, and the device automatically labels attendance. A spreadsheet is created and updated hourly with attendance data.

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II LITERATUREREVIEW

Qingyan Duan and Lei Zhang [1] introduced an end-to-end BoostGAN model that allows for the creation of photorealistic yet identity-preserving frontal view faces from a variety of positions and occlusions. The proposed BoostGAN overstate-of-the-art (SOTA) methods under both constrained and unconstrained scenerios. Hai-Duong Nguyen, Sun-Hee Kim, Guee-Sang Lee, Hyung-Jeong Yang, In-Seop Na, and Soo-Hyung Kim [2] Studied the contribution of the features in a CNN to the final classification, a general CNN concatenating features from different levels ofthe network. It was proposed to provide alot of data for facial expression detection while keeping themodel straightforward forprocessing inrealtime.

JaeYoung Choi and Bum ShikLee [3] Studied the contribution of the features in aCNN to the final classification, a general CNN concatenating features fromdifferent levels of the network. The model should be kept basic to allow for real-time processing while producing a lot of data for facial expression identification.
Hongli Zhang, Alireza Jolfaei, MamounAlazab [4] proposed the AdaBoost algorithm is used to train the Haar classifier using Haar-like tiny features and an integral graph method.The CNN is a feed forward neural network that can identify features in a two-dimensional picture and use a back propagation algorithm to optimize network parameters. Zhihong Zhang, Xu Chenn, Beizhan Wang, Guosheng Hu,WangmengZuo, Edwin R. Hancock [5] as part of frontal view synthesis, Face Frontalization attempts to create afrontal face from a face image with arbitrary position variation. A strong non-linear learning capacity. Thedecoder begins with numerous decoder blocks and aconvolution layer before accepting the encoder's output as input.

I. DATASET DESCRIPTION

In order to ensure high accuracy, our proposed model uses images of faces taken in proper lightning conditions. Information about the students, including their names, rollnumbers, classes, secs, and photographs is trained

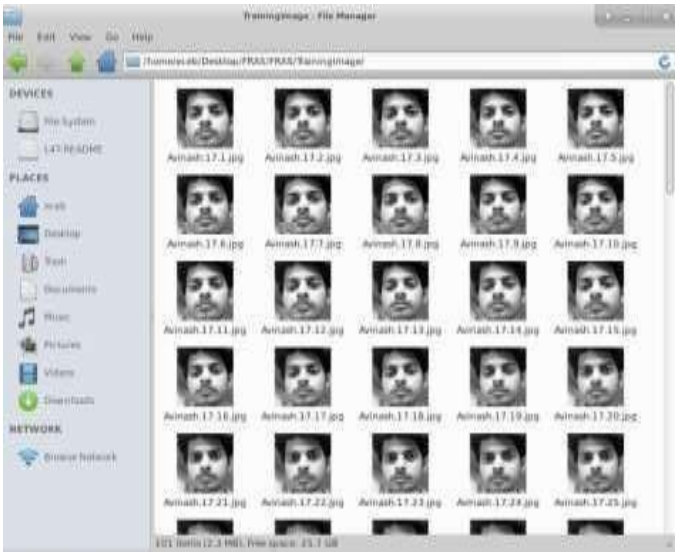

Fig 1. Representation of a database of 1 person with slight angle differences with ample light conditions.

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Face Orientations	Detection Rate	Recognition Rate
0° (Frontal face)	98.7 %	95%
18°	80.0 %	78%
54°	59.2 %	58%
72°	0.00 %	0.00%

Fig 2. Demonstrates the efficiency of the model detected by the ExtractFace() function using Paul-Viola Face extracting Framework detection method.

III MODEL AND METHODOLOGY

A. METHODOLOGY

i. Obtain the images and preprocess it in to the required facial images.
ii. Input facial images into CNN for training.
iii. Input the face features extracted into XGBoost for training ,to obtain the probability.
iv. Motion recognition are fused with face recognition systems.
v. Based on the specifics of the data set and the nature of the issue,choose the best machine learning algorithm.
vi. After the model has been trained using the training data, assess its effectiveness using the validation data.
vii. To increase the precision of the model,fine-tune the algorithm and modify the hyper parameters.
viii. Evaluate the performance of the final model using the appropriate metrics after testing it on the testing set.

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ix. Deploythemodelasawebapporintegrateitintoalargersystemtomakepredictionsonnewdatainreal-time.

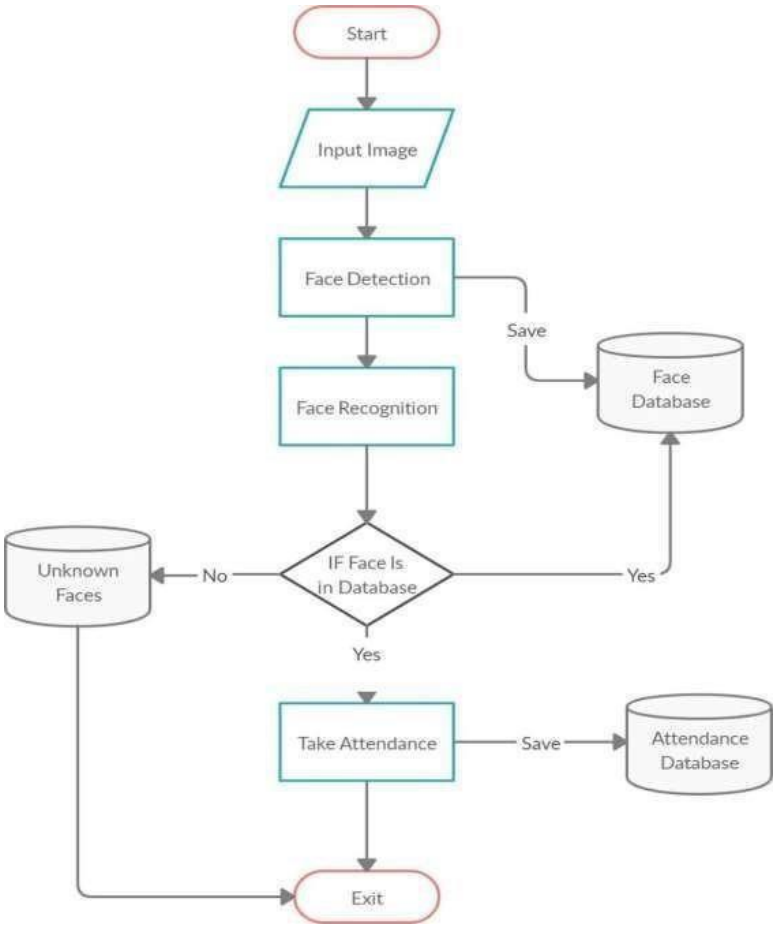

Fig3.Flowchart Of Methodology

The main components used in the implementation approach are open-source computer vision library (Open CV). One of the Open CV's goal is to provide a simple-to-use computer vision infrastructure that helps people build sophisticate division applications quickly. The primary technology behind Face recognition is Open CV. The user stands in front of the camera keeping a minimum distance of 50 cm and his image is taken as input. The frontal face is extracted from the image then converted into gray scale and stored. The Principal Component Analysis (PCA) algorithm is performed on the images and the Eigen values are stored in an xml file. When auser requests for recognition the frontal face is extracted from the capture dvide of frame through the camera .

The eigen value is re-calculated for the test face and It matched with the stored neighbor.

Supported functions in Open CV:

Derivation: Gradient computing.

Hough transforms: segments, geometrical shapes detection. Histograms: equalization, object localization with back propagation.

Segmentation, Filtering, Cascade detectors ,Interest points, Video Processing for optical flow,

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B. ALGORITHM USED

The algorithm used in this model is XGBoost under which two main implementations are used such as KLT(Kanade-Lucas-Tomasi) and Viola-Jones for face detection which detects human faces using the Haar cascade classifier. The CNN keeps both its feature flattening layer and all its feature extraction layers. The fully connected neural network (NN) is replaced by the XGBoost model, which will carry out the classification task using the features extracted.

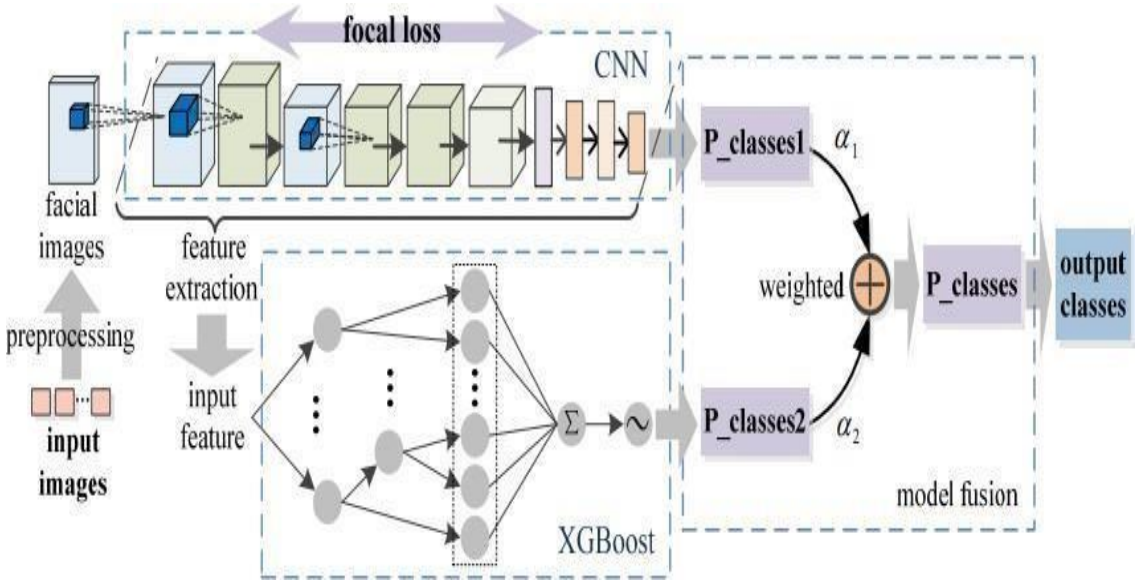
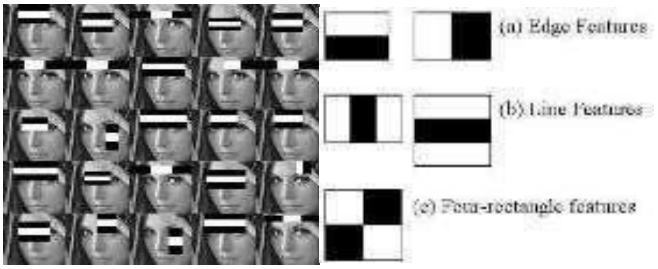


Fig-4-CNNXG BOOST architecture

i.VIOLA-JONESALGORITHM

The most widely used technique to localize the face segment from static images or video frames is the viola-Jones algorithm, which was developed by P. Viola and M.J. Jones in 2001. The Viola-Jones algorithm is based on a four-part concept. The first part is called as the Haar feature, the second part is where the integral image will be created, followed by the implementation of Adaboost and lastly the cascading process. The Viola-Jones method evaluates a given image using Haar features made up of several rectangles.

Fig-5- Haar features function as an image window function mapping. Subtracting the sum of the white rectangle(s) from the sum of the black rectangle(s) yields a single value result that represents each feature.



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The total of the pixels in the appropriate location's left and top determines the value of integrating an image there. In order to illustrate, the value of the integral image at location 1 is the sum of the pixels in rectangle A. The integral image values atthe remaining sites are cumulative. For instance, the value at location2 is the summation of A and B,(A+B),at location3 is the total of A and C, (A+C) and at location of all the regions,is the total, (A+B+C+D).

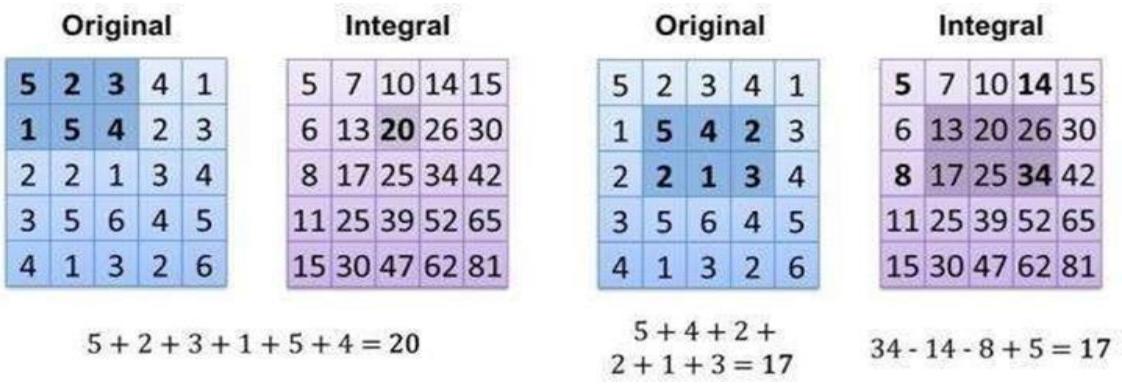

Fig-6-Integral of the image

As a result, to eliminate rectangles A, B, and C, the sum in the D region can be calculated using simply addition and subtraction of the diagonal at location 4 +1 (2+3).

ii. LOCAL BINARY PATTERN HISTOGRAM ALGORITHM

A texturing operator called Local Binary Pattern (LBP)label seach pixel in an image by thresholding its surrounding area and treating the result as a binary number. On some data sets,LBP combined with histograms of oriented gradients (HOG) descriptors significantly enhances the detection performance. The facial images can be represented with a simple straightforward data vector by combining the LBP with histograms.

LBPH uses 4 parameters:

Radius: used to create the circular local binary pattern and stands for the pixel's radius around the centre.

Neighbors: the quantity or the number of sample points needed to create the circular local binary pattern.

Grid X: the amount of horizontally oriented cells. The resulting feature vector has a higher dimensionality the more cells, the finer the grid,and the more cells there are Grid Y: the amount of vertically oriented cells. The resulting feature vector has a higher dimensionality the more cells there are in the grid and the finer the grid is training the Algorithm :need to train the algorithm using a dataset that contains the target subjects' facial photographs. Further more, an ID must be specified.(it may be a number or the name of the person)for each image.Therefore, the algorithm will make use of this data to identify an input image and provide an output. The sameID must appear on all images of the same person.

Applying the LBP operation: Making an intermediate image that more accurately describes the original image is the first computational phase of the LBPH ,by highlighting facial characteristics. The algorithm does this by basing its decision on the radius and neighbors of a sliding window.

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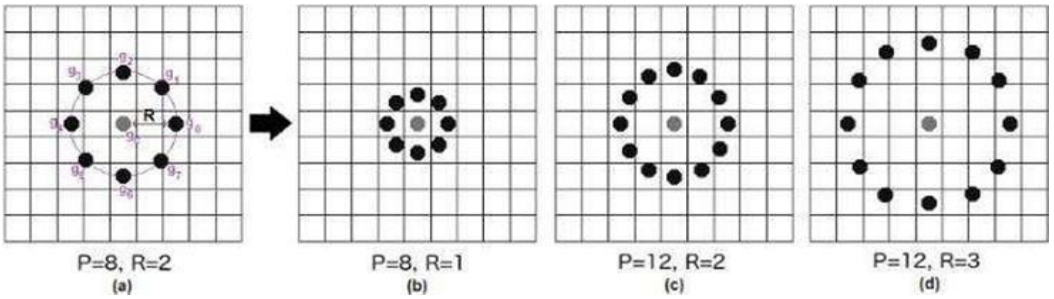

Fig-7-LBP operation radius change

Extracting the histograms: The Grid X and GridY parameters can be used to divide the picture produced in the l into several grids.

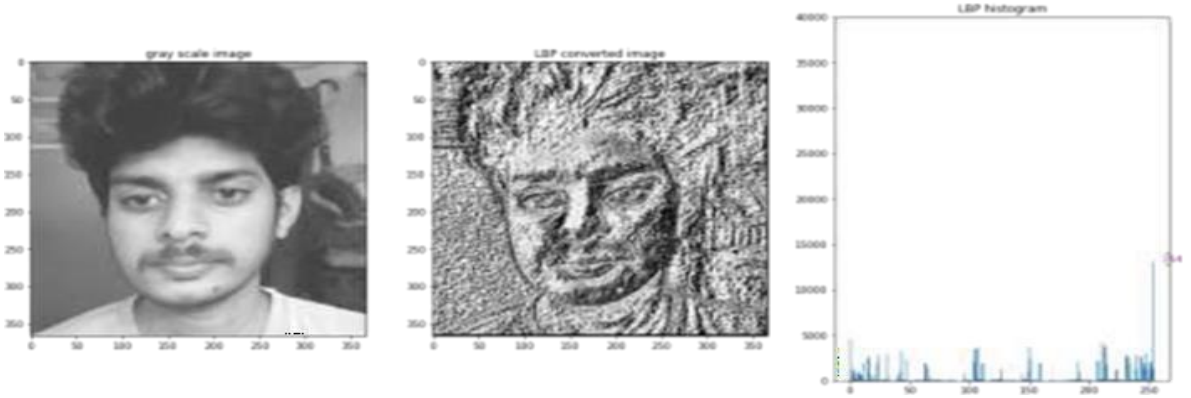

Fig-8: Extracting the histogram

Only 256 positions (0–255) representing the occurrences of each pixel intensity will be present in each histogram (from each grid). Create a new, larger histogram by concatenating each histogram .If we use 8x8 grids, the final histogram would have 16.384 positions because 8x8x256. The resulting histogram displays the attributes of the original image.

Performing face recognition: The algorithm has already been trained in this step. Every histogram made represents every image from the training dataset. So, given an input image, repeat the process to create a new image, and the new image will serve as the basis for the creation of the histogram.

Compare two histograms and return the image with the closest histogram to identify the image that corresponds to the input image. Different approaches can be used to compare an histogram (Calculate the distance between tw o histograms),forexample:Absolutevalue,chi-square,Euclideandistancecanbeusedinthisinstance:

$$D = \sqrt{\sum_{i=1}^{n}(hist1_i - hist2_i)^2}$$

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The ID from the image with the closest histogram is thealgorithm's output. The calculated distance, which can be utilized as a"confidence"metric,should also be returned by the algorithm. If the confidence is lower than the threshold defined, the algorithm is assumed to have correctly recognized the image. If the confidence is higher than the threshold defined, the method has failed.

Figures and Tables

Several baseline CNN models, including CNN, CNNSVM, CNN-KNN, and CNN-XG Boost, were tested for Facial recognition. According to Table 1 and Fig 9, CNN-XG Boost algorithm outperformed the others, achieving anaccuracyrateof89%.

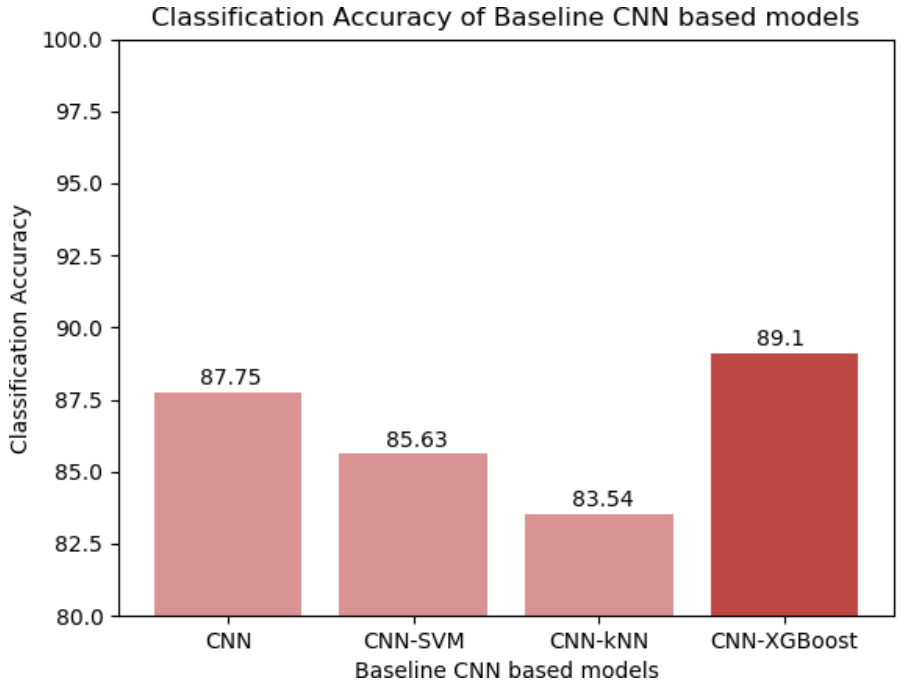

Fig-9.Accuracy comparison between training And Test Parameters Of Different models Algorithm Comparison

S.NO	ALGORITHM	ACCURACY
1	CNN	87.75%
2	CNN-SVM	85.63%
3	CNN-KNN	83.54%
4	**CNN-XGBOOST**	**89.1%**

Fig 10. Comparison Of Algorithms Used In Facerecognition

II. CONCLUSION

Applications for facial image processing that include face recognition systems have grown in importance recently. Crime prevention, video monitoring, identity verification, and other comparable security measures are implemented with the system. The face recognition system implantation can be part of universities for digital environment. The idea behind a face recognition-based attendance system is to cut down on the inaccuracies those canaries with a regular (manual) system. The goal is to automate and create a system that will benefit accompany, like an institute. The traditional manual techniques of taking attendance can be replaced with the modern, precise method in an office setting. The overall security, availability, dependability, and accessibility of this strategy are good. The suggested approach has a high degree of face detection accuracy, and the system's performance is good.

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