Face Recognition using Deep Neural Network

Research Student Amritpal Kaur, Asst.Prof. Shaveta Bala
Dept. of ECE,   Dept. of Electrical Engineering
Universal Institute of Engineering & Technology, Universal Institute of Engineering & Technology
Lalru, Punjab, India, Lalru, Punjab, India

Abstract– Face recognition is one of the fundamental challenges in the various application of computer vision and in the pattern recognition. First step of this process is to detect the facial feature in a video or in digital images. Next step is to recognize the person present in the frame by comparing its facial features with the features present in the database. For this step various types of classifiers are used for extraction and reducing the number of facial features. Various types of learning techniques were built in last two decades for face detection and recognition. Holistic learning, local handcraft learning and shallow learning are few examples of these techniques. In the last decade deep learning has shown the great improvement in the field of face recognition. Here convolutional neural network is used to learn the features of the object. In this paper a novel deep neural network technique with back propagation is proposed to identify and recognize the faces of various famous persons. Various objective parameters like precision, recall and F1 score is used to evaluate the performance of the proposed technique.

Keywords – **Face recognition, deep neural network, back propagation, recall, precision, accuracy, image processing.**

I. INTRODUCTION

With the day by day advancement in technology the need of security of data is getting more crucial. Usually our software applications are stored by encrypted passwords or complex patterns. Face recognition is one of the other ways of securing the applications. Here prime aim of this technology is to first detect the human face in the live video stream and then extract facial features from the video frames and after analyzing those frames give authentication to the application for accessing the data of the application.

In India government has developed a huge dataset in which persons biometric details with its eyes data, face data and fingerprints details are stored while registering for the aadhar card. This kind of data base can be used for identifying the person with the help of face recognition system. In a core face recognition system there are various kinds of algorithms are used for detection, extraction and matching of the various facial features of a person.

First of all face is detected in the video frames and after this various face features are extracted and stored in the database and finally this set of features are matched with the features present in the database so that a particular face can be recognized. In this paper a novel approach of face detection and recognition is proposed which can be used for detecting facial features for extracting face of the person and then matching it with the database for person details extraction. All the work is carried out with OpenCV library using Python programming language.

II. LITERATURE SURVEY

M. Geetha et al. [1] in 2019 used machine learning for developing face detection and recognition system. The application of this system was used for monitoring students in an online examination. Author used the support vector machine classifiers with the Eigen face algorithms to extract the features of the human face and these features were saved in the database and while on live camera feed the candidate could be investigated. In order to increase the accuracy of the proposed system author increased the number of features with increase in the number of faces in the database. Author was able to achieve 61 percent accuracy from the proposed system.

L. Fu et al. [2] in 2020 proposed a face detection, recognition as well as tracking system. Author divided the proposed model into the four different modules. Four different modules were the video detection, face model, face recognition and user interface. Author used OpenCV library with Python language. Author used three databases with different number of images in each dataset which had different number of images. Some images were used for training sets and finally after comparison author showed that if the training set was small then Eigen faces showed remarkable set while if the training set was large then local binary pattern showed good results.

A. V. Sripriya et al. [3] in 2020 proposed a real time human face detection and recognition system. Author used local binary pattern with histogram and well known convolutinal neural network for feature extraction. Author

used three types of datasets namely ORL, FEI and own dataset. Author had used Matlab for simulation purposes. Author used 50 percent of the images for the training and remaining 50 percent of the images for the testing purposes. Author used precision, recall and F1-score as objective parameters. From the results it was showed that convolutional neural network algorithm results were much better than local binary pattern with histogram approach.

M. Khan et al. [4] in 2019 proposed a face detection and recognition system using well known Prinicipal Component Analysis algorithm. The purpose of using this algorithm was to reduce the number of features that were available from the face detection system. Benefit of it was that by limiting the features author tried to get those features which were in real valuable for face recognition. Authors used the OpenCV library with the other known algorithms like spectral graph wavelet transform for face feature extraction. Author proposed the algorithm and provided some insights of it.

III. METHODOLOGY AND PROPOSED ALGORITHM

In this section research methodology and the proposed algorithm steps are discussed.

1. Methodology
Here are the important steps which will be performed to complete this research work.
Step 1. Apply image preprocessing steps
Step 2. Apply Haar and Adaboost classifier to detect face and facial features
Step 3. Train SVM model to extract features of the face
Step 4. Train LBPH model to extract features of the face
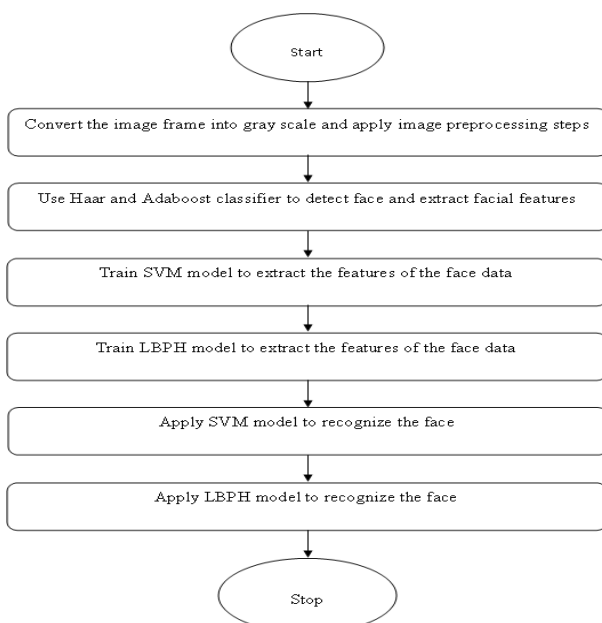**Step 5.** Apply models to recognize the face

2. Proposed Algorithm

Fig.1. Proposed Algorithm

3. Objective Parameters

Precision, Recall, F1 measure are taken as the objective parameters for evaluation.

1. Precision

$$Precision = \frac{True\ Positive}{True\ Positive + False\ Positive}$$

2. Recall

$$Recall = \frac{True\ Positive}{True\ Positive + False\ Negative}$$

3. F1 Score

$$F1\ Measure = 2\ X\ \frac{precision\ X\ recall}{Precision + recall}$$

IV. RESULTS

Fig. 2: Results of the standard face recognition technique on image set 1
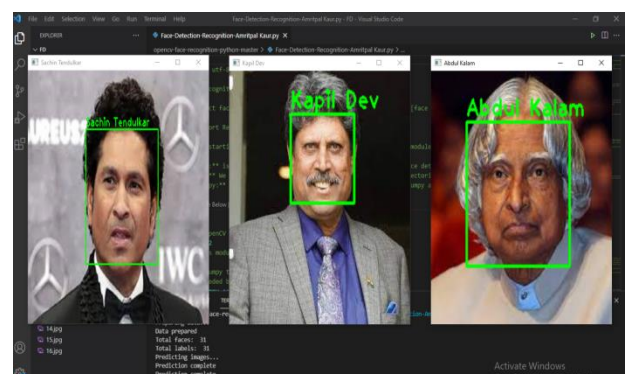

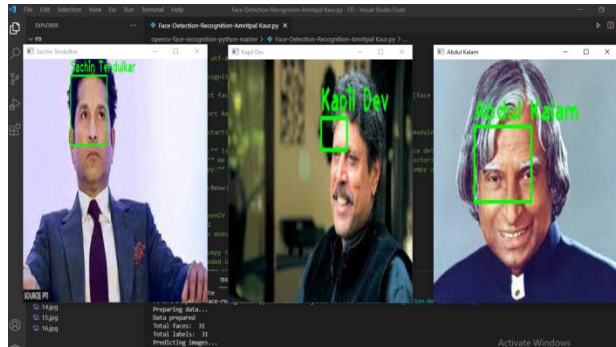Fig. 3: Results of the proposed face recognition technique on image set

Fig. 4: Results of the standard face recognition technique on image set 2
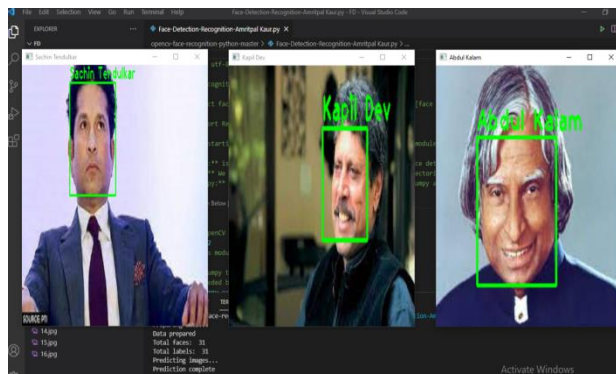

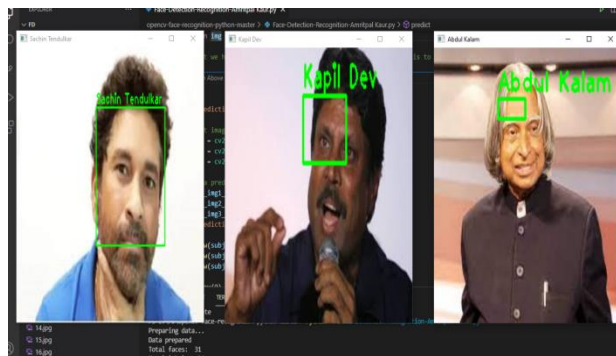Fig. 5: Results of the proposed face recognition technique on image set 2.

Fig. 6: Results of the standard face recognition technique on image set 3
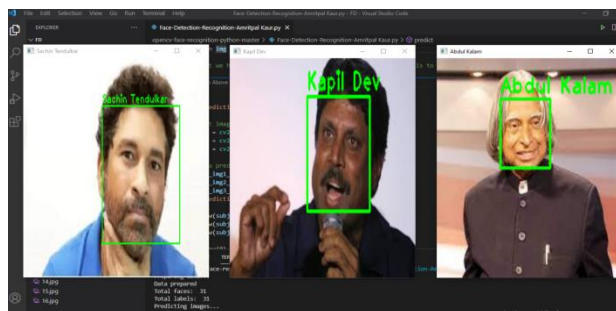

Fig. 7: Results of the proposed face recognition technique on image set 3

Fig. 8: Results of the standard face recognition technique on image set 4

Table I: Characteristics of the labeled training and test set

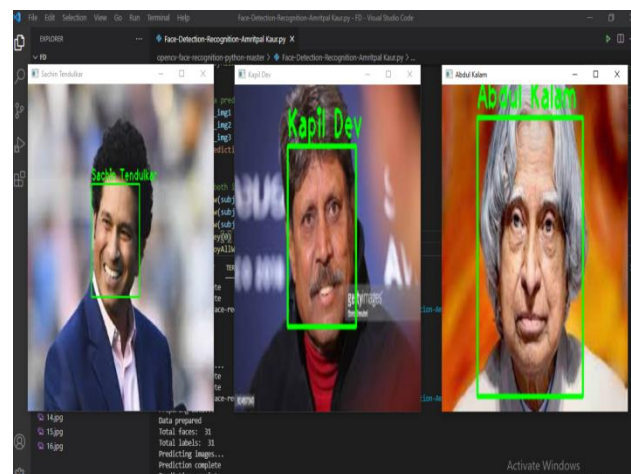| Database	Classes	Total Images	Face Images	Rest Images
1	3	200	150	50
2	3	400	320	80

Fig. 9: Results of the proposed face recognition technique on image set 4

Table II: Result obtained on the test set by proposed face recognition model.

DB	TP	FN	TN	FP	Precision	Recall	F1 Score
1	195	1	3	1	0.99	0.99	0.99
2	380	6	6	8	0.97	0.98	0.97

Table III: Result obtained on the test set by standard face recognition model.

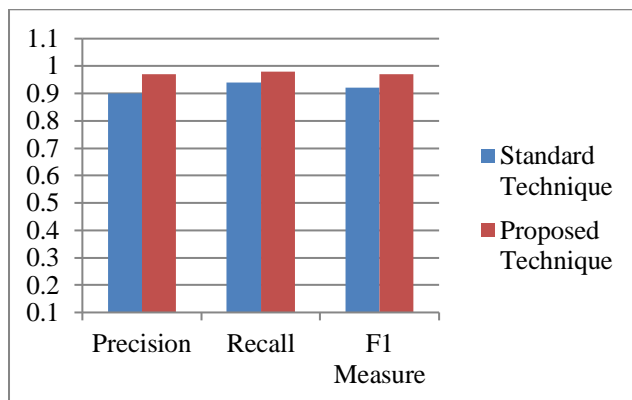| DB	TP	FN	TN	FP	Precision	Recall	F1 Score
1	155	18	1	26	0.86	0.90	0.88
2	340	21	1	38	0.90	0.94	0.92

Fig. 10: Graph of precision, recall and F1 measure of both techniques for the database
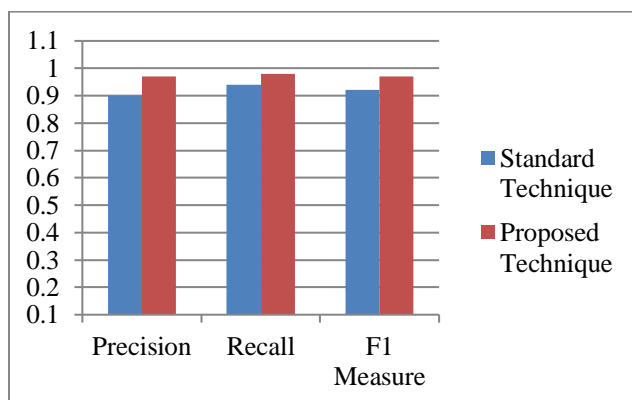

Fig. 11: Graph of precision, recall and F1 measure of both techniques for the database 2.

V. CONCLUSIONS

From the results of the research it is clear that the proposed algorithm performs better in comparison to standard face recognition algorithm. Value of objective parameters precision, recall for the proposed methodology is always better in comparison to standard method. Further F1 score is always higher in case of proposed methodology for face recognition. Also in case of proposed methodology face is detected completely although the algorithm is taking more time for execution against standard face recognition algorithm. In the future more objective parameters can also be taken for performance evaluation of the proposed algorithm. Also algorithm can be improved further by considering various feedbacks or improving the model at time of training.

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