ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

Face Detection System based on Gaussian Mixture Model and Local Binary Pattern using Machine Learning Approach

Koteswara Rao M
Research Scholar, ECE Department
JNTUH Hyderabad, Telangana.
koteshproject@gmail.com

K Veera Swamy
Professor, ECE Department
Vasavi college of Engineering
Hyderabad
k.veeraswamy@staff.vce.ac.in

K Anitha Sheela
Professor, ECE Department
JNTUH Hyderabad, Telangana.
kanithasheela@gmail.com

***Abstract*—**Face Recognition is an automated process implemented by using various tools and techniques, which is capable of detecting and identifying human faces from any image or video stream. Machine learning is an approach, which involves in training a machine for prediction and decision making. It simulates the function of a brain through proper training. In this paper, a machine learning approach is used to predict the faces of Indian freedom fighters from any video stream given as an input. To accomplish this task, the system must be trained before with an appropriate and adequate numbers of facial dataset. The training dataset is also created from a video stream, which is named as training video. Provided, that particular video stream must contain only one specific freedom fighter's images of different stages and different styles. From the training video stream, image frames consist of their face were identified, extracted and stored for each person. Then these frames of faces were used to train the machine. After proper training, a model was created and this model was used for prediction. In this work, Indian freedom fighters' images were used for training and prediction. The same approach could be utilized for the prediction of any person or list of persons from a video stream after procuring proper training.

***Keywords*—**Face recognition, Freedom fighters Dataset, Training, Model creation, Prediction

I. INTRODUCTION

Facial recognition is a method, which is used to recognize human faces from images and/or video streams. The recognition method is a vital application of technology. This could be achieved by machine learning. The Eigen face method is one of the generally used algorithms for face recognition. The same method is implemented by determining the variance of each faces among the complete collection of facial images. Further this variance is used in machine learning to train the machine. In machine learning, the face variance was used to encode and decode a face. Face recognition and identification of specific person from a stored dataset or from a live video stream is becoming a mandatory task in the current technical world. Identifying more persons or one person with the help of pre trained dataset is used in numerous applications. Faces could also be used in biometric authentication. To use face in authentication, the machine must have been properly trained with the large set of data.

Cite this article as: Koteswara Rao M, K Veera Swamy & K Anitha Sheela," Face Detection System based on Gaussian Mixture Model and Local Binary Pattern using Machine Learning Approach", International Journal & Magazine of Engineering, Technology, Management and Research, Volume 5 Issue 12, 2018, Page 156-163.

ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

Machine learning could be able to produce a model by using a large dataset as a training dataset. The applications of facial recognition ranges from unlocking a phone, Tracking missed person in a dense area with the help of surveillance camera, protect law, acting as an aid for forensic investigations, identifying people in social media, protect any campus, implement automated attendance, etc. Thus by applying the discussed methodology implemented by Eigen face and machine learning, face recognition will become a facile and accelerated task. Here Eigen faces are used for feature extraction.

II. REVIEW OF RELATED LITERATURE

Face recognition is an ever blooming research field. Abundant research papers are available in this topic. Few of them were presented here. Bah and Ming [1] published a paper which presents an improved strategy utilizing an algorithm named as Local Binary Pattern (LBP) calculation joined with cutting edge picture handling methods, for example, Contrast Adjustment with the alpha value of 1.5 and beta value of 0.0, Bilateral Filter, Histogram Equalization and Image Blending to address a portion of the issues hampering face acknowledgment exactness in order to improve the LBP codes, consequently improved the precision of the general face acknowledgment framework. Then the improved face recognition algorithm was applied in attendance management system.

Ali Elmahmudi and Hassan Ugail [2] utilized fractional facial information. They investigated it by applying novel examinations to test the exhibition of AI utilizing incomplete appearances and different controls on face pictures, for example, rotation and zooming. They studied the pace of acknowledgment subject to the different pieces of the face, for example, the eyes, mouth, nose and the cheek. They also considered facial recognition subject to zooming out of the facial pictures. Their methodology based on CNN along with the pre-trained VGG-Face model. Then they utilized two classifiers cosine similitude and linear SVM. Maheen, Fatima, Muhammad and Khurram [3] discussed a CNN based face recognition framework which distinguishes faces in an info picture utilizing Viola Jones face locator and consequently separated facial highlights from recognized faces, which utilized a pre-trained CNN. Yassin, Maher, Ayman and Mohamed [4] discussed the performance of three face recognition approaches named local, holistic and hybrid. They were also analyzed the results produced by various techniques like LBP, HOG, correlation filters, key-points-based like SIFT, FREAK, etc. They were also discussed about Eigen faces. Fisher faces, CNN and different transforms.

Meenakshi, Siva Jothi and Murugan [5] built up an architecture for face recognition, utilizing deep neural network. CNN was trained to perceive the face images. The created strategy was tried on ORL database by fluctuating feature maps to locate the best design. Their results indicated that the proposed technique, utilizing 15-90-150 architecture gave better outcomes contrasted with the current strategies.

Kranthikiran and Padmaja [6] used Eigen face technique and PCA for face detection and suggested to implement the technique in the

ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

areas like Law Requirement and Equity Arrangements, Identification Supports, Immigration, Access Control, etc. Gaurav, Sanket, Shashwat and Shubham [7] introduced a new approach. The approach that has been embraced is by consolidating more than one algorithms. The feature identification capacity of harr cascade alongside Ada boost to bring to Bilinear CNN so that on a near smaller dataset can create relative outcome as on greater dataset.

Zhao, Hang, Yanning, Min, and Yee-Hong [8] addressed the issue of small sampling by utilizing data augmentation over geometric transformation. They also changed the brightness of the image. In addition to that, they applied different filter operations. They stated that the best data augmentation method is the one based on orthogonal experiments. At long last, the presentation of their participation strategy was exhibited in a class room contrasted with PCA and LBPH strategies with information expansion and VGG-16 system. Ashu, Amandeep and Munish [9] deliberated the performance of Features based approaches in various color models like Active shape model, HSV color model, YCbCr color model, etc. They also analyzed the features like LBP, Ada Boost and Gabor features. The performance of Linear sub-space method was also depicted in their paper.

III. METHODOLOGY

The prime advantage of Machine learning is its improved efficiency and accuracy. Here algorithms are used for feature extraction. Machine learning could be able to work with large dataset. With respect to face recognition, the algorithms implemented by using non-machine learning methods has a lower rate of recognition when compared to the algorithms implemented using machine learning methods. Also research proves that the machine learning face recognition method is able to produce greater performance for large dataset with high dimensionality. With respect to complexity, non- machine learning methods could not be able to solve the problems which are having high complexity, whereas machine learning and deep learning methods can be able to solve [10]. The Eigen face algorithm is also having so many advantages. Unsophistication is the primary benefit among all. This algorithm is also very fast and it is insensitive for the minute changes in the face [11]. Principal Component Analysis (PCA) is playing a vital role in extracting significant information from a very high dimensional space. This technique is employed in Eigen face recognition method. Principal Component Analysis is one of the main statistical tool. This tool is used in predictive modeling. This particular technique is also identified as Karhunen-Loeve transform. This method could also be used to perform dimensionality reduction. PCA is the technique, which is essentially employed for face recognition. This technique is an efficient and easy technique because in a very short period of time, PCA reduces the dimension size of a given image. In addition to that, PCA has high correlation between the training data set with the recognition data [12].

In the proposed method, a machine learning approach is used to recognize the faces of Indian Freedom Fighters from any training video stream. After recognizing the faces of

ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

various freedom fighters, using training dataset, a model is created and then the model could be utilized for identifying the specific personalities from any image source.

A. Face Recognition from the Video Stream

This entire technique first applies face recognition using Haar feature-based cascade classifiers. This cascade classifier is an effectual method proposed by Paul Viola and Michael Jones, which is highly suitable for object detection. This cascade function is trained using more number of positive and negative images. Then it could be used for recognition. Here positive images mean the images which contain one or more faces and negative images means images which doesn't contain any faces. These images are needed to train the classifier. After training, features must be extracted from this. These extracted features are known as Haar features. Haar features are like convolutional kernel. To obtain these features, sum of pixels in the white triangle must be subtracted from the sum of pixels in the black triangle. This subtracted single value is the feature used for recognition. Three different types of features must be extracted and used as shown in Fig.1. Thus with the help of the various features, the faces of different freedom fighters are identified. Here the video contains only the images of one freedom fighter. This video is used for extracting various images of one freedom fighter so that it could be used for training. The same process is applied to the individual videos of all the freedom fighters one by one.

Before applying the cascade classifier, the input video is divided into frames. All the frames are resized into a specific width. Then the color space of individual frames was converted from BGR to GRAY. After these simple preprocessing procedures, Haar cascade classifier is applied for individual face recognition. When individual faces were captured, the same frame which contains the particular face is resized into a rectangle of specific width. All the frames wereresized with the same width. While resizing, a bicubic interpolation over 4x4 pixel neighborhood is applied for better performance. All the individual frames of one person was stored as a JPEG file inside a folder. The folder is named with the same name of that specific freedom fighter. The usage of same folder name sophisticate the training phase. The procedure is applied to each and every individual freedom fighter one by one. Here instead of using a video, cascade classifier could also use images. But all the images should be resized and converted into the GRAY color space. In this method maximum of 300 frames were extracted from the video of one freedom fighter and a total of 25 freedom fighters' individual videos were trained.

B. Training and Model Creation

All the extracted face frames were read from the specific folder. After reading the frames, it is trained using Eigen Face Recognizer with appropriate label. The label is the name of the folder, which is same as the name of the freedom fighter. In general, any specific face recognizer could be able to perform four essential tasks. The four tasks are train, write, read and predict.

ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

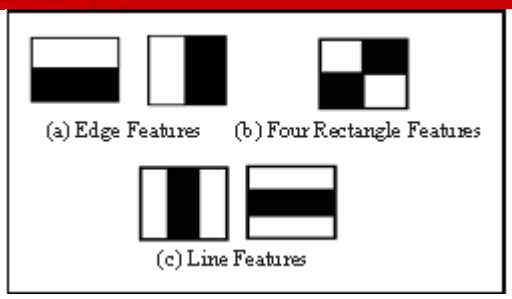


Fig. 1. Types of Features

Training of a face recognizer is the primary task which trains the machine by using the given set of images. The set of images is also referred as image database. In this method, the face recognizer trains by implementing Eigen face recognizer. Training the machine using deep learning approach is a bit time consuming procedure. Writing/Saving is the process of creating an XML file or YAML file. This file is used as a model for future prediction. Once the model is created then it could be used at any time for prediction. Here totally 25 different folders each with the maximum of 300 image frames consumed a little while for training and model creation. The XML file or the model is written or saved in a secondary storage. The steps involved in feature extraction and model creation is depicted in Fig. 2.

C. *Prediction*

After the successful creation of the model, it could further have used for prediction. This method used video stream as an input. The model, which is in the form of an XML file read from the secondary storage and used to predict the specific name of the particular freedom fighter. The identification is implemented by drawing a frame, which covers the face of a specific freedom fighter. The name of the freedom fighter is also displayed above the frame. Fig. 3 demonstrates theprocedure of prediction.

IV. THE EXPERIMENTAL RESULTS

As discussed above, 25 different Indian freedom fighters' datasets were used for training. Fig. 4 describes an example of 3 freedom fighters' training dataset, consists of 300 frames of same size. Fig. 5 illustrates the screen shot of the video stream while prediction. The predicted freedom fighters' faces were displayed along with their names. These persons were already trained along with their names while creating the model.

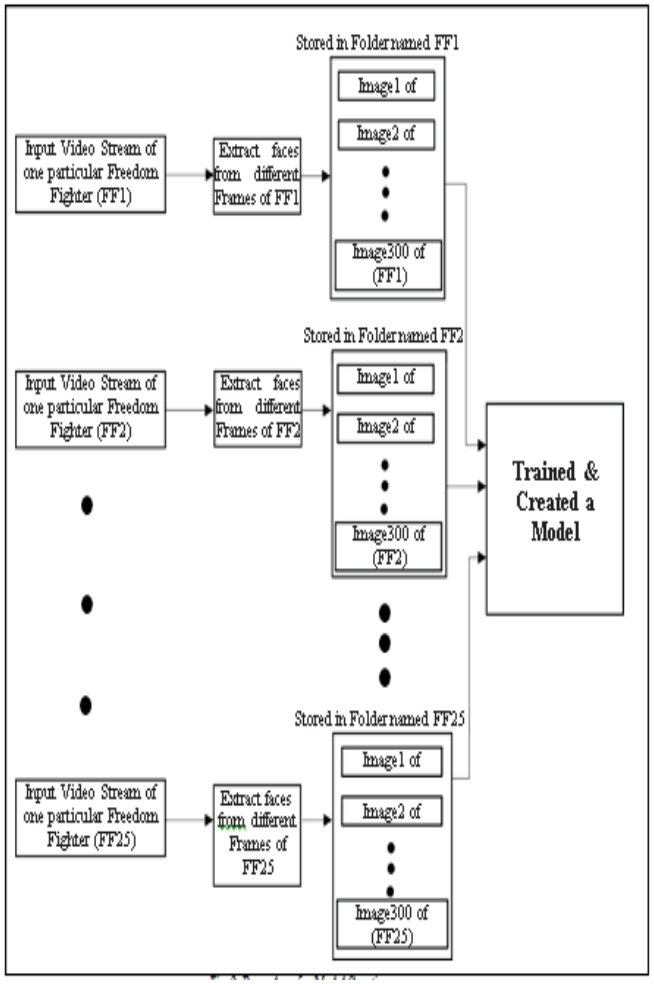


Fig. 2. Procedure for Model Creation

The untrained freedom fighters' faces in the video stream were predicted as unknown,

ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

which is shown in Fig. 6. is an example of untrained human faces, which were predicted with the label "unknown". Since Eigen face recognizer is used, sometimes the noise in the video stream was also predicted as unknown face. To overcome this problem, the testing video stream must be preprocessed.

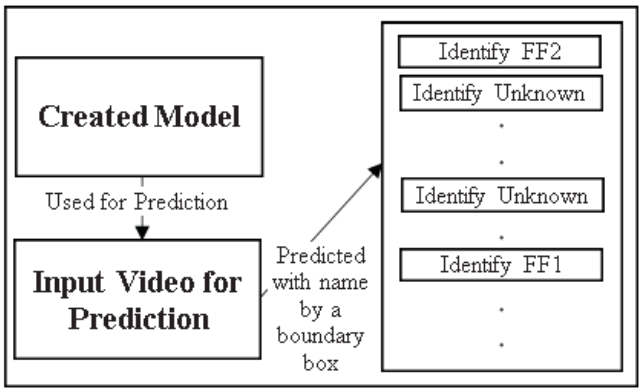
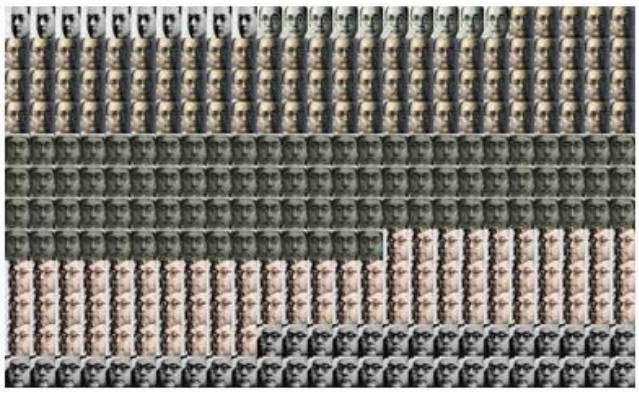
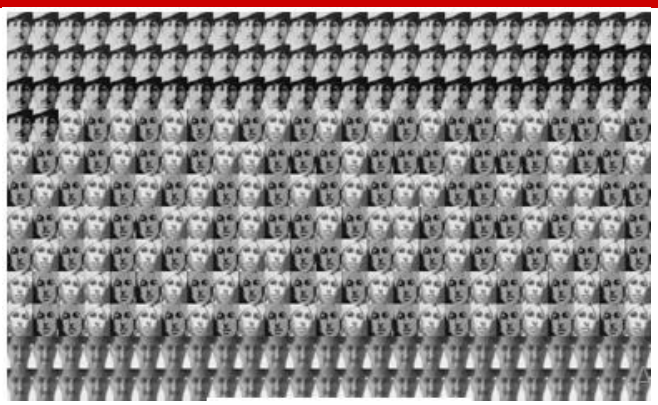


Fig. 3. Procedure of Prediction

(a) Dataset of "Mahatma Gandhi"



(b) Dataset of "Nethaji"



(c) Dataset of "Bhagat Singh" Fig. 4.

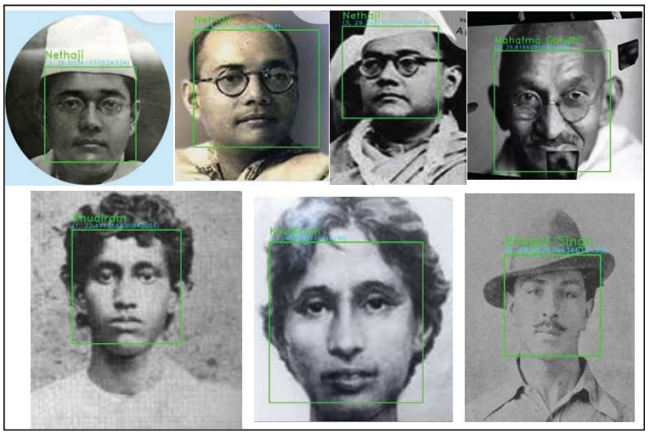


Fig. 5. Example of trained freedom fighters predicted from the Video stream with their names

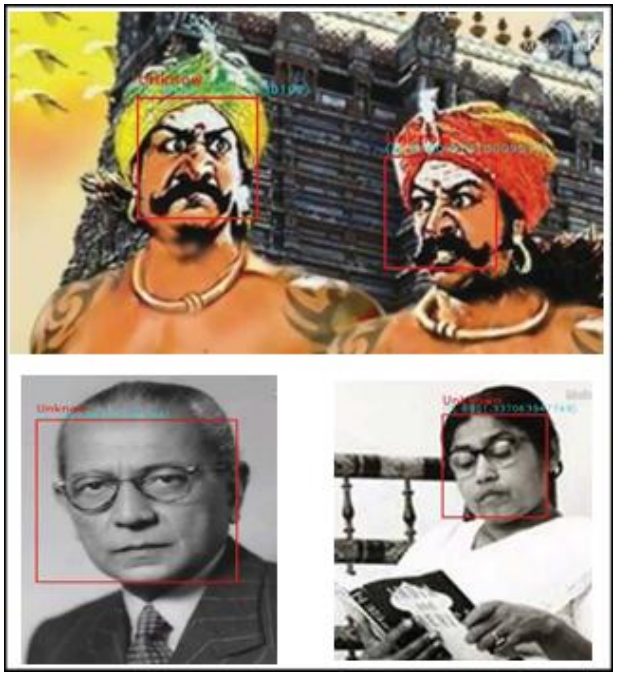


Fig. 6.Example of Untrained freedom fighters predicted as Unknown

ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

V. CONCLUSION

The performance of this proposed methodology is also relied on the quality of the image or video stream used for training and testing. Here the value of the model score ranges from 0.76 to 0.91 depending on the quality of the frames used in the training video stream and testing video stream. As discussed above if the training video contains a noise like Eigen face, then the same could be treated as one of the frame in training dataset. So the clarity of the training dataset is playing a vital role in prediction. In this paper, video streams with high quality frames were used as a training video to achieve the high level of prediction. Similarly, if the video, for which the faces to be predicted could be preprocessed to attaina high level of prediction.

ACKNOWLEDGMENT

My sincere gratitude to the Almighty for bestowing on me his everlasting love. I would like to render my thanks to my Parents and family members for their constant encouragement. Last but not the least I want to express my gratefulness to all the public domains, from which the image datasets are created and used for this work.

REFERENCES

[1] Serign Modou Bah and Fang Ming, "An improved face recognition algorithm and its application in attendance management system," Array, Open access article published by Elsevier, vol. 5, Mar 2020.

[2] Ali Elmahmudi and Hassan Ugail, "Deep face recognition using imperfect facial data," Future Generation Computer Systems, Elsevier Publications, vol. 99, pp. 213-225, Oct 2019.

[3] Maheen Zulfiqar, Fatima Syed, Muhammad Jaleed Khan and Khurram Khurshid, "Deep Face Recognition for Biometric Authentication," Proc. of the 1st International Conference on Electrical, Communication and Computer Engineering (ICECCE), Swat, Pakistan, Jul 2019.

[4] Yassin Kortli, Maher Jridi, Ayman Al Falou and Mohamed Atri, "Face Recognition Systems: A Survey", Sensors, vol.20, Jan 2020.

[5] S. Meenakshi, M. Siva Jothi and D. Murugan, "Face Recognition using Deep Neural Network Across Variations in Pose and Illumination," International Journal of Recent Technology and Engineering (IJRTE), vol.8, pp. 289-292, Jun 2019.

[6] B. Kranthikiran and Padmaja Pulicherla, "Face Detection and Recognition for use in Campus Surveillance," International Journal of Innovative Technology and Exploring Engineering (IJITEE), vol.9, pp. 2908-2913, Jan 2020.

[7] Gaurav Dubey, Sanket Sharma, Shashwat Pal and Shubham Agrawal, "Facial Recognition using Deep Learning," International Journal of Engineering and Advanced Technology (IJEAT), vol.8, pp. 367-371, Jun 2019.

[8] Zhao Pei, Hang Xu, Yanning Zhang, Min Guo and Yee-Hong Yang, "Face Recognition via Deep Learning Using Data Augmentation Based on Orthogonal Experiments," Electronics, vol.8, Sep 2019.

[9] Ashu Kumar, Amandeep Kaur and Munish Kumar, "Face detection techniques: a review," Artificial Intelligence Review, Springer, vol.52, pp. 927–948, Aug 2019.

[10] Sulis Setiowati, Zulfanahri, Eka Legya Franita and Igi Ardiyanto, "A Review of Optimization Method in Face Recognition: Comparison Deep Learning and Non-Deep Learning

Methods," 2017 9th International Conference on Information Technology and Electrical Engineering (ICITEE), Phuket, Thailand, UTC from IEEE Xplore, Jan 2018.

[11] Sunil Aryala, Rachhpal Singh, Arnav Sooda and Gaurav Thapaa, "Automatic Attendance System Using Deep Learning," International Conference on Sustainable Computing in Science, Technology & Management (SUSCOM) Hosting by Elsevier SSRN, pp. 505–513, Feb 2019.

[12] Lerato Masupha, Tranos Zuva, Seleman Ngwira and Omobayo Esan, "Face Recognition Techniques, their Advantages, Disadvantages and Performance Evaluation," International Conference on Computing, Communication and Security (ICCCS), Pamplemousses, Mauritius, IEEE Publisher, Jan 2016