



A Comprehensive Review on Face Recognition System

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1.ABSTRACT

In recent times, face detection and recognition has emerged as authentic real time application which is useful in varied fields. It is an implementation of AI typically employed to authenticate user through verification process. This paper reviews few techniques used in face recognition system like HAAR cascade, PCA, CNN, SVM, etc. It also reviews a wide range of related research work published in recent times. The scope of application of face recognition is spread over varied field from law enforcement agencies, security and defense check in etc., to log in into personal devices like mobile and tablets etc.

2.INTRODUCTION

Face detection and recognition has become the most important biometrics techniques in today digitized era. A facial recognition system is a prove technology that is capable of matching a human face from a digital image or a video frame against a database of faces. It works by identifying and measuring facial features in an image. Facial recognition can identify human faces in image or videos, determine if the face in two images belongs to the same person or search for a face among a large collection of existing images. Research on face recognition process has been done for a quite long time and continue to be developed until now [1].

In present situation facial recognition is more safety because in this system uses unique mathematical patterns to store biometric data. So, they are the secure and successful identification methods in biometric technology. Face recognition embraces a variety of services and applications, beginning from human identification and surveillance and coming as far as e-marketing for the interested customers (Evangelos 2020) [2] In facial recognition we get so many benefits that are efficient security, improved accuracy, easier integration etc. Facial recognitions are used in many places like – Smart attendance system, Smart voting system, home security system, social media and Apps, Heath services etc. in face recognition and face detection applications, computer vision plays a vital role. It is the technology that allows computers and machines to match images of people's faces and their specifications.

computer vision consists of many components including co-ordinations, memory, retrieval, reasoning, estimation, recognition and more. system with only one of this ability is not qualified as a vision. Computer vision is actually mimicking human systems. Since our world is in three dimensions but our visual sensor usually provides only two-dimensional images which it increases the difficulty for computer to analyses an object in 3D. there are various complexity such as low resolution, occlusion, illumination, variation etc. These factors highly affect the accuracy of the computer to recognize the face more effectively, so expert system & algorithms are used to make it correct.

3.HOW DOES FACIAL RECOGNITION WORKS?

Many people are familiar with face recognition technology through the face id used to unlock iPhone. Beyond unlocking phones, facial recognition works by matching the faces of people walking past special cameras [3] they can operate as follows:

Step 1: Face detection

The camera detects the location of the image of the face that the face is alone either in crowd. The image also shows the person looking starting ahead or on profile. Detection is the process of finding a face in an image, it identifies and detect the individual faces from image through many people's faces. Step 2: Analysis

The facial recognition system then analyses the image of the face. It maps and reads face geometry and facial expression. The facial recognition looks for the following-

- Distance between the eyes.
- Space between the forehead to the jaw.
- Shape of the cheekbones.
- Contour of the lips and ears.

Then it converts the face recognition data into a character of numbers and each person has a distinctive faceprint, as like as fingerprint.

Step3: Recognition

Recognition of a person can be done through balancing the faces in two or more images in the face recognition technology. For example, it can verify that the faces shown in a selfie taken by a mobile camera matches the faces in an image of a government issued ID like driver license as well as identify the face.

The methods we use for facial recognition are classified as geometry based or template-based algorithms.

Geometry based:

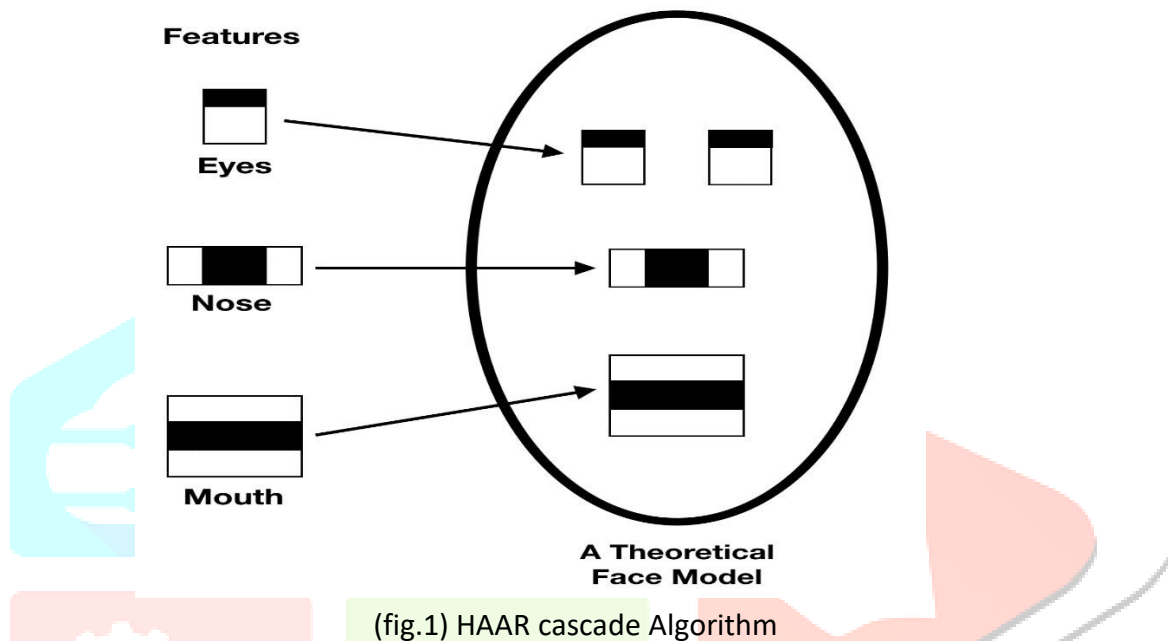
The geometric features-based methods analyze local facial features and their geometric relationship. It is also called as feature-based technique.

Template based:

The template-based methods can be manufactured using mathematical tools like SVM (Support Vector Machines), PCA (Principal Component Analysis), LDA (Linear Discriminant Analysis), Kernel methods or Trace transforms.

HAAR cascade classifier:

The HAAR cascade classifier is a machine learning approach where a cascade function is trained from a lot of positive and negative images, positive images are those images that consists of faces and negative images are without faces.

SVM Algorithm:

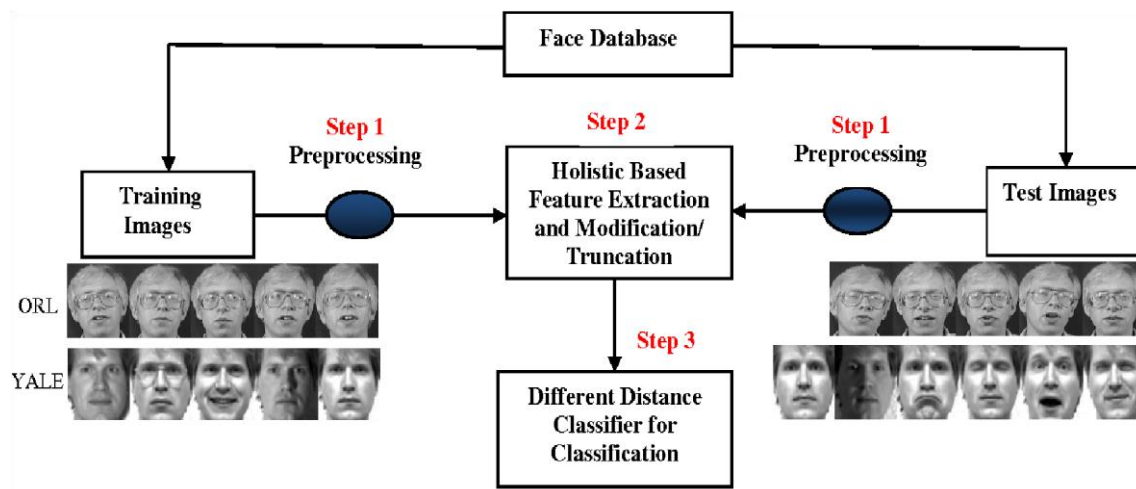
Support vector machine is a popular supervised learning algorithm and it is used for classification and regression. This algorithm used for webpages, face detection, intrusion detection, email classification, hand writing recognitions worked for separating data points and it supports binary classification. From the training data, SVM takes out the related discriminatory information [4]. For face recognition SVM can be applied individually or can be used with the other techniques [5] like hybrid method and independent Component analysis (ICA).

CNN Algorithm:

Convolution Neural Network algorithm is a multilayer perceptron. It is the special design for discovery of two-dimensional images details. It has more layers i.e., input layer, convolution layer and sample layer can have multiple. These are used for image classification and recognition due to its high accuracy. Scientist Yann Lecun had proposed this in the late 90s when he was inspired from the human visual perception of recognizing things.

PCA Algorithm:

PCA (Principal Component Analysis) is a statistical approach used for reduce the huge number of datasets in facial recognition by transforming a large set of variables into small datasets containing with information. PCA is used to preprocess the data before other analyzes [6]. In PCA based feature extraction algorithms, the eigen face is one of the classical algorithms [7].



(fig.2) PCA Algorithm

Facial recognition related work is recent times:

Sl. No	Author	Date	Title	Objective	Methods/ Tools	Findings
1.	KH Teoh, RC Ismail, SZM Nazari, R Hussein, MNM Isa, MSSM Baser	19 th august 2020	Face recognition and identification using Deep learning.	It aims in designing and developing a face recognition system through OpenCV and Python.	Deep learning, CNN, Haar feature based cascade classifiers, Tensor flow.	It is verified that with the large number of face images being trained into a classifier can achieve accuracy of 91.7% in recognizing image and 86.7% in real time video.

2.	Zhogang Yu, YunYun Dong, Jihong Cheng, Feng Su	5 th January 2022	Research on face recognition classification based on improved Google Net.	New face technology using Google Net.	IMDB WIKI Face dataset.	In this paper the proposed model developed the Google net and obtained the Google net -M network to improve the grouping convolution method under multi-GPU application and used regularization and migration learning techniques to improve model performance.
3.	Yuheng Guo	2 nd December 2021	Effect on biometric recognition systems of covid 19.	A detailed study of the impact of covid 19 on different biometric systems.	CNN, L2SR, LSTM, DeepSignDB Database.	In this paper, it is found that real masked faces are more suitable for training than simulated faces. It also proposed that deep learning models are expected to produce better result with the help of more pictures of masked faces in real scenarios.

4.	L. Vetrivendan, Dr.R. Viswanathan J. AngelinBlessy	4 th April, 2018	Smart Voting System Support Through Face Recognition.	In this paper is used to maintain high level biometrics security. The details data of voters are stored in the database server. In this voting system the voter stands in front of the PC and the camera reads the image of the voter and the micro controller sends the details to the web	Eigen face algorithm (using PCA projections.	It is found that the proposed model in this paper uses three labels of security for facial authentication for a person to vote.
				application through the serial port. The web application software maintains the person data base.		

6.	Nandan Gowda S H, Jayam Haresh Tharun, Ashik B N, Deepak Lamani, Priyadarshini J Patil A.	8 th August 2020	Smart Voting System using Face Recognition.	In this paper is used to maintain high level biometrics security. The server database stores the voter details. In this voting system the voter stands in front of the PC and the camera reads the image of the voter details and the microcontroller sends the details to the web Application.		In this paper the proposed model developed a secure internet voting system which omits the requirement of manual voting system.
7.	Pranav KB, manikandan J,	2020	Design and evaluation of a real time face recognition system using convolutional neural network.	In this paper design and evaluation of a real time face recognition system using convolution neural network proposed details about the tuning of CNN parameters to assess and	HOG, RVM, PCA, MDC, KNN, ICA.	In this paper the maximum accuracy of 98.75% and 98.00% is obtained from the proposed system on using AT&T and real time inputs respectively.
				enhance the recognition accuracy of the proposed system are also reported.		

8.	Xudong sun, Peng chena Wu, Steven C.H. hoi,	28 th January 2017	Face detection using deep learning: An improved faster RCNN approach.	In this report, it presents a new face detection scheme using deep learning and achieve the state-of-the-art detection performance on the wellknown FDDB.	Feature concatenation, hard negative mining, multiscale training, model pretraining.	In this paper they extended the state - ofthe -art faster RCNN frame work for generic object detection and achieved the state-of-theart results.
9.	Preeti nagrath, Rachna jain, agam madan, rohan arora, Piyush kataria, jude Hemanth	31 st December 2020	Areal time DNN based face mask detection system using single shot multi box detector and mobile Net V2.	The proposed approach in this paper is used deep learning. This paper uses single shot multi box detector as face detector and mobile Net V2 architecture as frame work.	Dep learning, tensor flow, keras.	In this paper it helps the concerned authorities in this great pandemic situation and other resources provide advanced models such as face recognition, facial land mark.
10.	Serign modou Bah, Fang Ming	26 th December 2019	An improved face recognition algorithm and its application in attendance management system.	In this paper experiment show that the method is very accurate, reliable and robust for face recognition system that can be practically implemented in real life	LBP, SVM, DCP, PCA	In this paper the LBP code improve and the experiment result shows that the method is very accurate and robust for facial recognition
				environment as an automatic attendance management system.		system in attendance management system.

11.	Jamal Hussain shah, Muhammad sharif, mudassar raza, marryam murtaza and saeed-urrehman	13 th February 2015	Robust face recognition technique under varying illumination.	This paper addresses the issues.	PCA, ICA, SVM, LDA	In this paper the recognition rate increases which minimizes the within class scatter and achieve almost 35% to 50% recognition rate.
12.	V.Sathiyarayanan, R. Karthick, R. Gokul Nath, Yogesh kumar	2020	Automatic attendance system using face recognition.	In this paper we apply facial recognition into an attendance checking system that uses faces of registered people to check their attendance.	HAAR Cascade, LBPH, PCA	In this paper the facial recognition technique used for the purpose of making attendance and the record of the student is maintained correctly.
13.	Nik ruslawati, Nik Mustapha, Nur athikah	30 March 2022	Library reservation system using face detection.	In this paper the user can easily reserve room without going to the library and don't have any skin contact.	HAAR Cascade.	In this paper 100% of the respondents understand the system and 70% of the respondents answered good to register the face into the system and 10% respond poor answer.

3.CONCLUSION:

In recent years face detection has achieved considerable attention from researchers from in biometrics, paper recognition and computer vision groups. There is countless security and forensic applications requiring the use of face recognition technologies. As you can see, face detection and recognition system are the most accurate. In this paper, we have presented a survey of face recognition techniques and related work. We hope that this survey paper will further encourage researchers in this field to participates and pay more attention to use of local techniques for face recognition system.

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