

Face Recognition And Its Different Algorithms

Rakshit P

VI Sem, MCA

Department of MCA

RV College of Engineering,

Bengaluru

Mr. Prashant K

Assistant Professor

Department of MCA

RV College of Engineering,

Bengaluru

Abstract

Face recognition is one of the most used applications for analysis of image. To build an automated system which recognizes faces with human recognition accuracy is real work. The computers, with an almost limitless memory and computational speed, should overcome human limitations. Face detection was included as an unavoidable preprocessing step for face recognition, and as an issue by itself. Thus facial recognition calls out researchers from different domains and attracts diverse disciplines. Thus the problem is not only effected to one stream. Face recognition is a relevant subject in pattern recognition, neural networks, computer graphics, image processing and psychology.

Keywords-Convolution neural network (CNNs), Radial Basis Function Neural Network (RBFN), Principal Component Analysis (PCA)

I. INTRODUCTION

Image recognition is useful in various diverse fields that is computer vision, neural networks, image processing and sample recognition. There are variety of challenges in image recognition process. Image recognition is done by two types of algorithmic program – appearance-based and model-based. Because computerized facial recognition involves the measurement of a human's physiological characteristics facial recognition systems are categorized as bio-metrics. Although the accuracy of facial recognition systems as a biometric technology is lower than iris recognition and fingerprint recognition, it is widely adopted due to its contact less process. A person can be identified using his Bio metric features. Bio metrics is a method to identify an individual from a huge group of people. Bio metric is divided into two categories as: Behavioral and Physiological. Face Recognition is a technology in Computer Science used to identify or verify the identity of a person using their facial characteristics from an image or video. Recognizing a Human Face for a system is very challenging task as it's a complicated multidimensional model hence it needs a stout recognition technique. The accuracy of the system depends upon collection of datasets along with mainly two approaches namely human face detection and feature extraction, its more challenging because it uses bio metrics to map geometric facial features (like the distance between the eyes, the length of the nose, shape of lip and eyebrow, the distance between forehead and chin), and some of the major key challenges in the face recognition are pose variation, change in the expression captured, ageing of the face, variation in orientation, modularity and resolution, blur image. All the above-

mentioned challenges have to be mainly addressed to make the face recognition system to perform well. Here in this paper will be discussing about; how face recognition process takes place along with few commonly used algorithms' along with the architecture of the face recognition system and its applications also mentioned. A method is proposed to overcome the occlusion condition have been proposed.

I. LITERATURE SURVEY

Experimentation on automatic face recognition has been started early 60s of 19th century, and its still topic having unresolved problems. There has been notable amount of progress in this area in last decade owing to development in face modelling and evaluating techniques. Even though systems have been developed for face detection and tracking, dependable face recognition still offers a grand challenge to computer vision and sample recognition researchers. There're some reasons for current doubled interest in face recognition, adding rising public difficulty for security, the require for identity verification in the digital world, face analysis and modelling strategies in multimedia information management and computer entertainment. Using skin colour segmentation with three different models like RGB, YCbCr and HSV helps to remove non skin colour pixels from the image and later those regions are tested with face feature extraction method to get assured it's a human face or not. Human face has small loops like eyes, lips, eyebrows, moustache if any skin region doesn't have these loops then those will be easily rejected and reduces time to track the face, such kind of rejection is done by Euler number .

Real-time face detection in video footage became possible with the Viola-Jones object detection framework for faces. Paul Viola and Michael Jones combined their face detection method with the Haar-like feature approach to object recognition in digital images to launch AdaBoost, the first real-time frontal-view face detector. Viola-Jones algorithm had been implemented using small low power detectors on handheld devices and embedded systems.

It has four features namely Haar feature extracts common features from face are calculated using algorithm and later searched in the image, Creating an integral image to calculate very fast features of an image , AdaBoost training is a classifier used to discard the unnecessary features and Cascading classifiers used to reject false positive detection in early stage only. This method achieves high detection rate of 15 frames per sec. By combining Adaboost with motion detection method which contains face excluding the still background will result better than traditional method. It has lower false detection rate and higher correct detection rate of face is 92.7% with average processing time is 86ms.

Convolution neural network cascade (CNNs) method learns features by itself unlike other method learns features by itself unlike other methods, this method is good when we have large set of data which runs parallelly.

Eigenface method was established by Sirovich and Kirby. Principal Component Analysis (PCA) has been commonly used in Face Recognition problems, here PCA is used to extract features from face image. PCA reconstruction is done to illustrate the feasibility of using Eigen feature to fulfil expression classification as

preliminary evaluation. Radial Basis Function Neural Network (RBFN) classification for facial expression. To improve the classification, hierarchical RBFN model (HRBFN) has been proposed where the action of eyes, lips and eyebrows can significantly discriminate the changes of various expressions using this on three different scenarios experiments have been performed.

In this paper face recognition is defined, along with its background work. Workflow of the entire process have been mentioned with an image and explained it. Some of the applications have been mentioned for face recognition like law enforcement, security purpose and surveillance along with some common problems that originate with face recognition system.

II. Face Detection Algorithms

The primary aim of face detection algorithms is to see whether or not there's any face in a picture.

- **Viola Jones** - is a framework proposed by Paul Viola and Michael Jones for detecting faces. It has four features namely Haar feature, Creating an integral image, AdaBoost training and Cascading classifiers. This method achieves high detection rate of 15 frames per sec.
- **Skin colour segmentation** - It takes three different models like RGB, YCbCr and HSV to remove non skin colour pixels from the image and later those regions are tested with face feature extraction method to get assured it's a human face or not.
- **Hausdorff Distance** - Robust Face Detection using Hausdorff Distance is model based algorithm which works on grey scale still images with two stages Coarse detection and refinement and is insensitive for exposure changes and brightness.
- **Convolution neural network cascade (CNNs)** - This method learns features by itself unlike other methods, this method is good when large set of data which runs parallelly. Its speed is 14 Fps on single core processor.
- **Eigenface method** - It was established by Sirovich and Kirby. Initially were every face having common features like mouth, eyes, nose etc are called eigenfaces, it can extract these features by Principal component Analysis method. This method is not suitable to capture expression changes .

Feature extraction Methods

Texture feature based method

Texture refers to surface characteristics and appearance of an object or image given by the size, shape, density, arrangement, proportion of its elementary parts. Texture segmentation makes a partition of an image into a set of disjoint regions based on its properties. Some of the techniques using texture feature-based method are Local Directional Number (LDN), Local Directional Ternary Pattern (LDTP), KL- transform Extended LBP (K-ELBP) and Discrete Wavelet Transform (DWT).

Edge based method

Edge based method initially converts the image into grey scale or gradient image. Edges typically refer to points in the image where the Gray value changes significantly from one pixel to the next. Some of the techniques used for Edge based method are Local Binary Pattern (LBP), Line Edge Map (LEM), Graphics processing unit based Active Shape Model (GASM) and Histogram of Oriented Gradients (HOG).

Global and Local feature based method

Global feature represents image as whole with single vector whereas local feature represents as images as patches and with local computes with multiple points on the image thus making it more robust. Some of the common techniques used for Global and Local feature based method are Principal Component Analysis (PCA)

Geometric feature based method

Geometry based feature extraction method help in identifying the shape of the face and its components, such as the mouth or the eyebrow. In this method the primary step is to localize and track a dense set of facial points.

III. APPLICATION

- Advertising
This is new way of marketing in the present industry, where the system is installed in the mall or shop and the image is taken of the walking person near the system and age of a person is evaluated and according the age of person ads is displayed on the digital advertising board.
- Health Care
Face recognition technology can also be used in hospitals instead of tracking devices for patients. It also used to identify a rare genetic disorder like DiGeorge Syndrome.
- IoT Home Application
Face recognition technique is widely used in IOT applications to provide security to open the door lock, car lock or deposit box to keep all important documents.
- Mobiles
Now a days it's seen that all screen touch mobiles have an app lock opener which uses face recognition to open the applications to provide security.
- Retail shop
Face Recognition technology is used at retail stores, where retailers can greatly reduce shoplifting before the shoplifter steals goods, this can be achieved by matching their face from Database using face recognition technology.

- Payment

Face recognition method can also be used to make quicker payments. In this system user need not have to carry anything not even mobile nor any physical card or cash, the face of the user is used to make the payment.

- Attendance management

This technology can also be used as attendance management systems in schools, hospitals and organizations.

IV. Tools and Technologies

V. MATLAB

MATLAB is one of the most prominent tools used for face recognition, enrich with libraries for performing all kind of operations like create histograms, and manipulate regions of interest . It provides libraries like Image Processing Toolbox, multiple models inbuilt in it. It also helps in removal of noise, adjust contrast, performing convolution and correlation, enhancing multispectral colour composite images, colour blurring caused by out-of-focus. It can also perform well when the dataset is huge

Python 3

Python supports libraries like matplotlib, pandas, numpy, scikit-learn which helps in template matching using match template function, image filtering. numpy is for masking the image, PIL/Pillow contains basic image processing functionality, removing noise, color space conversion, dlib library is used for face recognition process by keeping constructing face embeddings.

OpenCV

OpenCV for Image Processing, includes multiples processes like changing colour spaces, changing RGB to binary format, smoothing the image like blurring the image all such functionalities are supported by OpenCV. Face Recognizer class is used to recognition face it also have inbuilt algorithms for Eigenfaces, Fisherfaces and Local Binary Pattern Histograms.

VI. CONCLUSION

Face recognition system is popular these days and its widely used in real time environment so it's necessary to have good face recognition system. This paper highlights on the steps required to recognize and match the face but as mentioned earlier there are some challenges like pose variation, change in expression, cluttered or blur image occlusion and illumination. Here a method had been reviewed that can overcome occlusion and help to build a better model that can help to recognize faces in varying condition. Some of the real time

applications have been mentioned along with tools like MATLAB, Python and OpenCV that can be used to build a system.

VII. REFERENCES

- [1] Xianxing and Jieyu Zhao, "Curvelet Feature Extraction for Face Recognition and Facial Expression Recognition", Sixth International Conference on Natural Computation (ICNC 2010)
- [2] Chongliang Wu et al, Multi-Instance Hidden Markov Model for Facial Expression Recognition, 2015 11th IEEE International Conference and Workshops on Automatic Face and Gesture Recognition (FG)
- [3] Nazir, M., Jan, Z. and Sajjad, M. "Facial expression recognition using histogram of oriented gradients based transformed features", Cluster Comput 21, 539-548 (2018)
- [4] Daw -Tung Lin, Facial Expression Classification Using PCA and Hierarchical Radial Basis Function Network, JOURNAL OF INFORMATION SCIENCE AND ENGINEERING 22, 1033-1046 (2006)
- [5] Divyarajsinh N. Parmar¹ , Brijesh B. Mehta² "Face Recognition Methods & Applications", Divyarajsinh N Parmar et al ,Int.J.Computer Technology & Applications,Vol 4 (1),84-86
- [6] Paramjit Kaur¹ , Kewal Krishan² , Suresh K. Sharma³ and Tanuj Kanchan⁴, "Facial- recognition algorithms: A literature review", Volume: 60 issue: 2, page(s): 131-139 , January 2020
- [7] A. Samal, P.A. Iyengar, Automatic recognition and analysis of human faces and facial expressions: A survey Pattern recognition, 25 (1) (1992), pp. 65-77
- [8] V. Govindaraju, et al. Locating human faces in newspaper photographs Computer Vision and Pattern Recognition, 1989, Proceedings CVPR'89., IEEE Computer Society Conference on (1989), pp. 549-554
- [9] S. Edelman, et al. A system for face recognition that learns from examples Proc. European Conf. Computer Vision (1994), pp. 787-791
- [10] I.MichaelRevinaW.R. SamEmmanuel , A Survey on Human Face Expression Recognition Techniques, 10.1016/j.jksuci.2018.09.002, Journal of King Saud University - Computer and Information Sciences 2018
- [11] G.Kavitha, Dr.I.LaurenceAroquiara, " Face Detection in Surveillance using modified Viola Jones Algorithm" , International Journal of Research and Analytical Reviews (IJRAR), E-ISSN 2348-1269, December 2018
- [12]Lijing Zhang, YingliLiang , "A fast method of face detection in video images" 2nd International Conference on Advanced Computer Control 2010
- [13] Prashanth Kumar G. and Shashidhara M, "Real Time Detection and Tracking of Human Face Using Skin Color Segmentation and Region Properties", International Journal of Signal Processing Systems Vol. 2, No. 2, December 2014