A Review on Real Time Application of Face Recognition System

[1]Miss.Prajakta B Patil, [2]Prof. Dr. Manasi R Dixit

[1]Student, [2]Professor
[1]Department of Electronics and Telecommunication Engineering,
[1]KIT's College of Engineering (Autonomous), Kolhapur, India

Abstract: Face recognition is most important in recent years as human face plays major role in conveying identity. Face recognition is one of the biometric methods used to identify individuals by features of faces. It is mostly used in many applications of face recognition such as criminal identification, security system, image and film processing etc.. Face recognition still is a challenging task since faces are highly dynamic and may be affected by changes in scene, such as in head pose, face expression or illumination. Face pattern representation also requires several dimensions which are additional challenges for face recognition. This paper gives review on different techniques of face recognition. Analysis of face images can be done by using various algorithms and software.

Index Terms – **face recognition, image processing, feature extraction, image representation**

I. INTRODUCTION

Face recognition is mainly based on still or video images which captured either by digital camera or by webcam. Using pre stored image database the face recognition system is able to identify one or more persons from the database .Face identification is one to many matching process that compares a query face image against all the template images in a face database to determine that has highest similarity with test image. Image processing is prior step for image analysis process. Image processing part consists of face image acquisition through scanning, image enhancement, image clipping, filtering, edge detection and feature extraction.

II. LITERATURE REVIEW

Sudha Sharma et.al [1] introduced a method for automatic face detection of a person. The suggested work uses linear discriminant analysis (LDA) principal component analysis (PCA), Naive Bayes Classifier, Multilayer Perceptron Classifier, Support Vector Machine Classifier, and Multilayer Perceptron Classifier. The experiment is carried out on ORL dataset. The dataset is segmented into two sections in three different configurations A (60:40), B (70:40), and C (90:10). The first section is utilized for learning purposes and the second section is utilized for system evaluation. The information is extracted from the input images by using PCA algorithm. It is experimented by using linear discriminant analysis, multilayer perceptron, naive Bayes, and support vector machine. The authors achieved recognition accuracy of 97% on configuration B & 100% on configuration C by using PCA and Linear Discriminant Analysis.

Serhiy Sveleba et.al [2] proposed different modifications of local binary templates for real time face recognition system. The authors concluded that histograms of centrally symmetric local binary templates are an effective feature for the classification of individuals in real time. Viola-Jones method and local binary templates in the Python programming language using the Open CV library was developed for recognizing aces in video streams. Viola-Jones method is used to detect persons in the video footage. Centrally symmetric local binary templates are used or classification of detected persons. The testing of the developed system gives approximately 93% accuracy.

Amal Adouani et al. [3] presented a review of face detection approaches which are Oriented Gradient Histogram, hair-like cascade Oriented Gradient Histogram with Linear Binary Pattern cascade and Support Vector Machine. The recommended methods have been developed using Dlib and OpenCV libraries in Python language. The authors concluded that the HOG+SVM approach is more robust and efficient than LBP and haar approaches with a 92.68 percent total recognition score.

Sharmila et.al [4] analyzed the performance of face detection using modified Haar Cascades method. The three algorithms are implemented independently and analyzed the performance with respect to the accuracy. These are Eigen face, Fisher face and Linear Binary Pattern Histograms (LBPH) algorithms are implemented and analyzed the performance with respect to accuracy. Open CV library is used to implement these methods. The author concluded that LHBP having high accuracy as compared with the fisherface and Eigen faces.

Samadhi Wickrama Arachchilage et.al [5] presented a framework for real-time face recognition. The suggested work uses DLIB and Open Face. The proposed system uses Multi-task Cascaded Convolutional Networks (MTCNN) detection algorithm which performed joint implementation of face alignment and detection.

Xiao Han and Qingdong Du [6] introduced the deep learning based on the face recognition method, which is used to extract facial features, so that the complex extraction process becomes simple. The softmax classifier is used to classify the extracted features. The author concluded that Deep learning has a key advantage over machine learning for other face recognition techniques. First advantage is that low-level features can be learned from raw data that is almost no processing. Second advantage is, complex interactions can be detected from the features. So the deep learning can not only learn to get more useful data, but also to build a more accurate model

Zied Bannour Lahaw et al. [7] introduced a method for face recognition using linear discriminant analysis, independent component analysis, principal component analysis, and support vector machine algorithms. The experiment is carried out on AT & T Database. The authors achieved recognition accuracy of 96 % by implementing a hybrid method depending on the Discrete Wavelet Transform (DWT) and principal component analysis (PCA) or linear discriminant analysis (LDA) method which reducing dimension and support vector machine is used for classification of faces.

Teddy Mantoro et.al [8] proposed face recognition process using hybrid process of Haar Cascades and Eigenface methods. In which multiple faces (55 faces) can be detected in single detection process. This improved face recognition approach recognized multiple faces with 91.67% accuracy level. The proposed ace recognition process is able to detect and recognize the face both during the day and night (with good light) results. Along with this it is able to detect the face when it is facing to the side until about 15o (degrees).

Sourabh Hanamsheth et.al [9] developed fast computational method for face recognition using Histogram of Oriented Gradients (HOG) features. The HOG provides robustness to facial detection. The suggested work compared the HOG feature with other existing methods like PCA, LDA, etc.

Neel Ramakant Borkar et.al [10] proposed face recognition system based on PCA and LDA. Using these two combinations of methods have given accuracy of 97% by using raspberry pi 3 module. The proposed algorithm is evaluated on AT&T dataset of images.

Suad Haji et.al [11] developed face recognition system using Eigen Faces and LBP algorithms. EmguCV library with C# programming language was used in developing the application. The developed application shows recognition accuracy of more than 97% under the normal conditions such as light, distance from camera.

Huu-Tuan Nguyen and Alice Caplier [12] presented the Local Patterns of Gradients (LPOG), a novel feature extraction method for Face identification. LPOG uses block-wised elliptical local binary patterns (BELBP), a refined variant of ELBP, and local phase quantization (LPQ) operators directly on gradient images for capturing local texture patterns to build up a feature vector of a face image. Based on LPOG descriptor, the author proposed a novel face recognition system in which whitened principal component analysis (WPCA) for dimension reduction and weighted angle-based distance for classification. Experimental results on three large public databases (FERET, AR, and SCface) proved that LPOG WPCA system is robust against a wide range of challenges, such as illumination, expression, occlusion, pose, time-lapse variations, and low resolution.

John Soldera et.al [13] proposed face recognition system using the orthogonal locality preserving projection (OLPP2) locality definition and the trained SVM (support vector machines) which can provide higher correct face recognition rates than the typical OLPP method. The experimental results are based on PUT, FEI, and FERET face databases

Xingjie Wei et.al [14] proposed a novel approach; Dynamic Image-to-Class Warping (DICW) for face recognition DICW calculates the Image to-Class distance for classification. The experimental results are based on the FRGC, AR, TFWM and LFW face databases which show that DICW achieves good results.

Muhammet Baykara and Resul Das [15] described Principal Component Analysis (PCA) algorithm for real time face recognition. System is developed by taking Model-View-Controller (MVC) architectural pattern.

Kandla Arora [16] proposed real time application of face recognition system using Principal Component Analysis using Eigen faces. In suggested work test conducted in different environment have certain limitations over the size, light and the head orientation.

Literature Review Table

Sr.No	Author	Journal	Year Of Publication	Method Used
1	Sudha Sharma et.al	2020 5th International Conference on Communication and Electronics Systems (ICCES) ISBN: 978-1-7281-5371-1	June 10-12, 2020	Linear discriminant analysis (LDA) ,principal component analysis (PCA), Naive Bayes Classifier, Multilayer Perceptron Classifier, Support Vector Machine Classifier, Multilayer Perceptron Classifier.
2	Serhiy Sveleba et.al	2019 3rd International Conference on Advanced Information and Communications Technologies (AICT) ISBN:978-1-7281-2399-8/19	July 2-6,2019	Histograms of centrally symmetric local binary templates ,Viola-Jones method in the Python programming language using the Open CV library
3	Amal Adouani et al.	2019 16th International Multi-Conference on Systems, Signals & Devices (SSD)	March 21-24,2019	Oriented Gradient Histogram, hair-like cascade Oriented Gradient Histogram with Linear Binary Pattern cascade and Support Vector Machine,HOG+SVM
4	Sharmila et.al	2019 4th International Conference on Internet of Things: Smart Innovation and Usages (IoT-SIU) ISBN:978-1-7281-1253-4/19	April 18-19,2019	Eigen face, Fisher face and Linear Binary Pattern Histograms (LBPH) algorithms .Open CV library is used to implement these methods
5	Samadhi Wickrama Arachchilage et.al	2019 IEEE Visual Communications and Image Processing (VCIP) ISBN: 978-1-7281-3723-0/19	December 1-4,2019	DLIB and Open Face,Multi-task Cascaded Convolutional Networks (MTCNN) detection algorithm
6	Xiao Han and Qingdong Du	2018 Sixth International Conference on Digital Information, Networking, and Wireless Communications (DINWC) ISBN: 978-1-5386-3903-0/18	April 25-27 ,2018	Deep learning method, softmax classifier is used to classify the extracted features
7	Zied Bannour Lahaw et al.	2018 41st International Conference on Telecommunications and Signal Processing (TSP), Athens, 2018	July 4-6,2018	Linear discriminant analysis, independent component analysis, principal component analysis, and support vector machine algorithms. Hybrid method depending on the Discrete Wavelet Transform (DWT) and principal component analysis (PCA) or linear discriminant analysis (LDA) method
8	Teddy Mantoro et.al	2018 6th International Conference on Multimedia Computing and Systems (ICMCS) 978-1-5386-6220-5/18	May 10-12,2018	Hybrid process of Haar Cascades and Eigenface methods.
9	Sourabh Hanamsheth et.al	International Journal of Advance Research in Computer Science and Management Studies	Vol. 6, issue 1, January 2018.	Histogram of Oriented Gradients (HOG) features.

10	Neel Ramakant Borkar et.al	Proceedings of the IEEE 2017 International Conference on Computing Methodologies and Communication	July 18-19,2017	PCA and LDA with raspberry pi 3 module
11	Suad Haji et.al	4th international symposium on digital forensics and security (ISDFS'16),	April 25-27,2016.	Eigen Faces and LBP algorithms
12	Huu-Tuan Nguyen and Alice Caplier	IEEE Transactions on Information Forensics and Security	VOL. 10, NO. 8, AUGUST 2015	Local Patterns of Gradients (LPOG), whitened principal component (WPCA)
13	John Soldera et.al	IEEE Transactions on Instrumentation and Measurement	Vol. 64, Issue: 9, Sept. 2015	orthogonal locality preserving projection (OLPP2),SVM (support vector machines)
14	Xingjie Wei et.al	IEEE Transactions on information forensics and security	Vol. 9, No. 12, December 2014	Dynamic Image-to-Class Warping (DICW)
15	Muhammet Baykara and Resul Das	2013 International Conference on Electronics, Computer and Computation (ICECCO), 978-1-4799-3343-3/13	November 7-9,2014	Principal Component Analysis (PCA) algorithm, Model-View-Controller (MVC) architectural pattern
16	Kandla Arora	International Journal of Soft Computing and Engineering (IJSCE) ISSN: 2231-2307	Vol.2, Issue-5, November 2012.	Principal Component Analysis using Eigen faces

III .BLOCK DIAGRAM

Input Image	→	Face detection	→	Feature Extraction	→	Face Recognition	→	Output Image
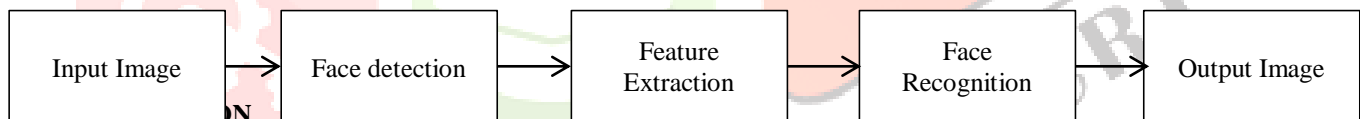
This paper reviews various methods of face recognition system. face recognition accuracy could be obtained by implementing various Image Processing Algorithms in combinational manner. In recent years many techniques has been invented which are based on various image processing algorithms which offers satisfactory results and can be implemented for real time face recognition system by using various algorithms.

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