# A REVIEW ON FACE RECOGNITION TECHNIQUES

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**ABSTRACT**

*In real-time applications, security is most important part. For security purpose, face recognition methods are widely used. In last few decades, a various numbers of face recognition techniques has been developed. Face recognition is related to the field of the machine learning, computer vision & image analysis. Face recognition comprehensively uses a wide range of methods which are mentioned in this paper. This review is of present methodology of face recognition techniques like Principle Component Analysis(PCA), Linear Discriminant Analysis(LDA), Local Binary Pattern(LBP), Haar cascade classifier, etc.*

***Keywords– face recognition, Local Binary Pattern(LBP), Linear Discriminant Analysis(LDA), machine learning, Principle Component Analysis(PCA)***

## I. INTRODUCTION

The face detection is the indivisible part of the face recognition. The face detection is important to determine the position of the face in the image, the position & the attitude of the process. Face recognition is one of the most popular biometric authentication techniques which are an interesting & successful application of the pattern recognition & image analysis. Various biometric features of human recognition like fingerprints, iris and face are used but face recognition has a high recognition rate.

Face recognition is from the face detection. Face recognition has main two task- verification & identification. Face verification means a 1:1match that compares a face image against a template face image. Face identification means a 1: N problems that compare a query face image against all image templates[1].
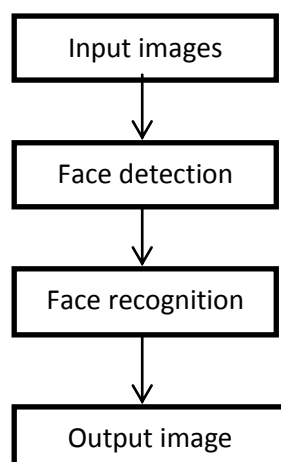


Figure.1 – Face Recognition Technique

Face recognition technique is defined in mostly of two steps as shown in figure.1. Human faces are positions similar in global properties including size, aspect ratio & location of main features but varies in the details across individuals, gender & facial expression[2].

## II. RELATED WORK

### Face Detection

Face detection detects the faces in the images. This detection of faces is of four methods-

A knowledge base analyses the extracted face components from its domain knowledge & makes final decision[3].For example, it detects the relative position of eyes, mouth and nose, etc. Template matching method, the input images are linked with stored pattern in the database which are evaluated for detection[2].Appearance based recognition uses pixels of light for recognition process[4].In a block rank pattern, a face'sroughly detected by generating a 3x3 block by dividation of images into two gradient magnitude[2].

### Face Recognition-

**Linear Binary Pattern(LBP) -** Linear binary pattern is visual description of an image used for face recognition put forth by *Ojala*for texture classification. Linear binary pattern operates on the image as it assigns or divides the image into number of small blocks. The linear binary pattern operator gives a notation to each pixel of the image with centre value of 3x3 neighborhood thresholding and gives the binary values as output [5]. This linear binary pattern works by comparing the pixels with the centre pixels. At the end, it gives a binary number which will be converted into decimal format. For this, we eight neighbor pixels, so for comparison we use the following formula,

$$LBP(x_c, y_c) = \sum_{n=0}^{7} s(i_n - i_c)2^n$$

Where,

$$s(x) = \begin{cases} 1 & \text{if} \quad x \geq 0 \\ 0 & \text{if} \quad x < 0 \end{cases}$$
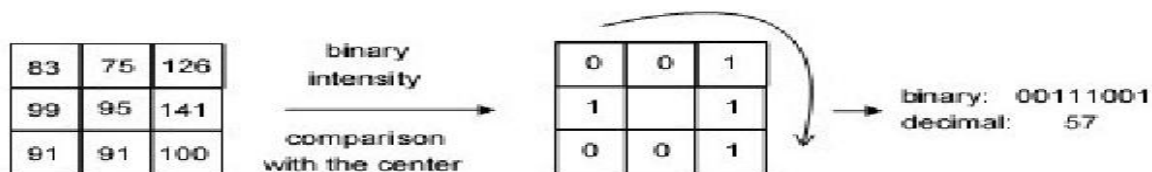
These formulas applied on the images as,

Figure.2. Linear Binary Pattern

The linear binary pattern method shown in above figure.2 has various advantages such as robustness improvement, it is capable to choice various numbers of neighbors from the images, it enhances the inequitable ability[6].

**Principal Component Analysis(PCA) -** Karhunen - Loeve method is known as a principal component analysis[7]. *Karl Pearson* invented the principal component analysis in 1991[8]. Orthogonal transformation is the part of statical procedure which make a set of uncorrelated linear variables known as principal components. In principal component analysis recognition, feature space given eigenfaces, the reduction in dimensionality of original image data takes place. But principal component analysis has large computation and low discrimination power problems which gets eliminated in linear discriminant analysis[9]. These principal components analysis algorithm is as follows-
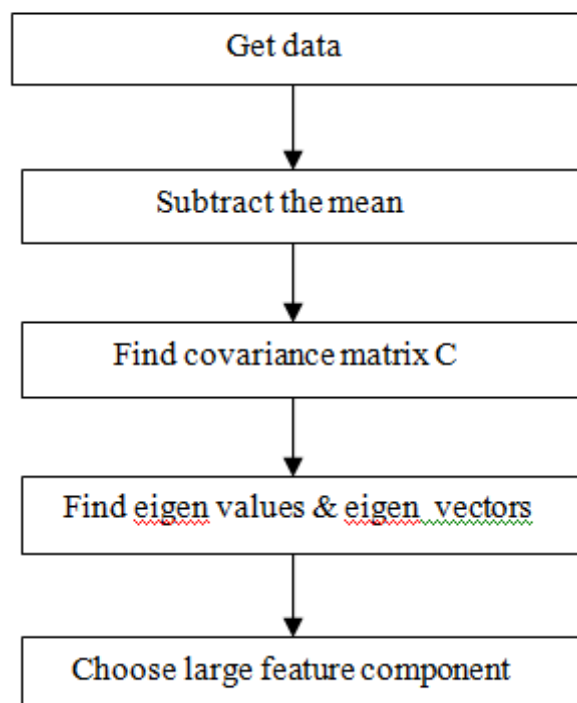


Figure.3. Principal Component Analysis Algorithm

Principal component analysis is lower dimensionality feature vector technique used for the face recognition.

**Linear Discriminant Analysis(LDA) -** *Ronald Fisher* invented this concept.Linear discriminant analysis (LDA) is a generalization ofFisher's linear discriminant, a method used in statistics, pattern recognition and machine learning.Linear Discriminant Analysis groups the image with the help of the features and the class. It determines the features of images are low-dimensional to high-dimensional. This linear discriminant differentiates the images of the different class and groups the images of the same class[10]. Linear discriminant analysis related to regression analysis and ANOVA(analysis of variance), it gives a linear combination of various measurements as a dependent variable[11][12].
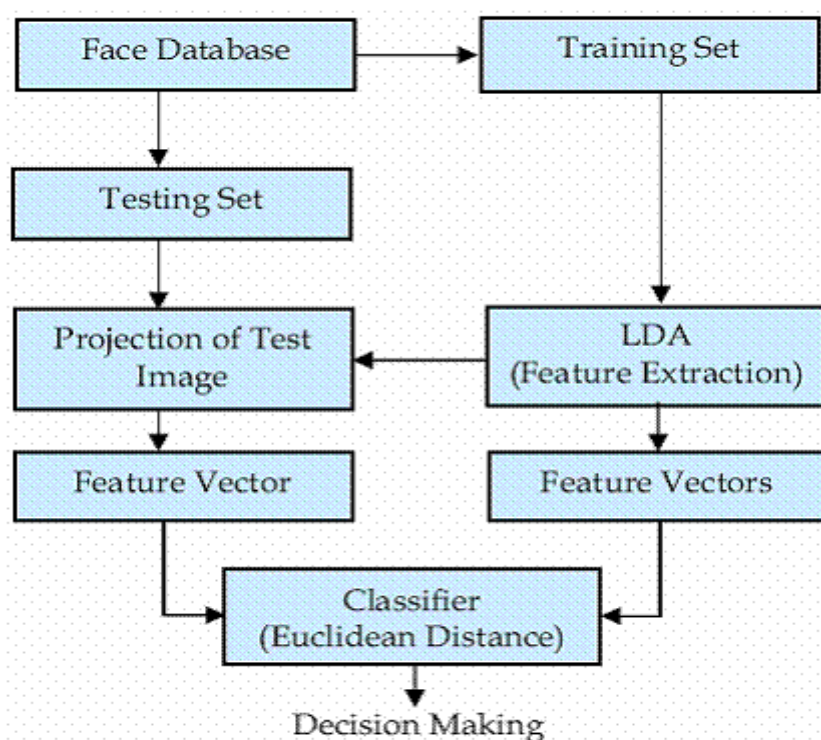


Figure.4. LDA approach for face recognition

LDA works when the measurements made on independent variables for each observation are continuous quantities.

**Haar Feature Based Cascade Classifier-**The Haar feature based cascade classifier invented by *Paul Viola* and *Michael Jones* in 2001. This figure shows the how the Haar cascade classifiermethod works with a various numbers of positive images and negative images to train it's cascade function where it is based on machine learning. This Haar cascade classifier recognizes the face via skin color i.e. color of eye pupils is darker than skin color so identifies the faces.
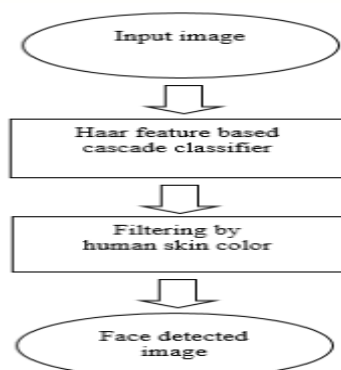
Figure.5. Flow Chart of Haar Cascade Classifier

## III.APPLICATIONS

**Payments –**Now-a-days, face recognition system is already used in mall but next concept is to use for online payments which human being free from the cards and cash.

**Access & Security –**Face recognition is used as a security for our smart phones to access that. In recent, this is great level security access.

**Criminal Identification –**FaceTech can be used to keep unauthorized person out of facilities. It requires a machine learning algorithm to identify that particular person.

**Verification –**Aadhar card, banking, passport ID verification[13], etc.

**Healthcare –** There are some patient types who cannot properly talk but person authentication is must. For these patient, face recognition is important, only looking at the cameras will authenticate the patient easily and simply.

## IV.CONCLUSION

Face recognition technique is a vast research and development topic today. This paper covers the recent face recognition technique after significant reviews of various numbers of papers related to face recognition field. According to requirement & application orientation, suitable techniques are used which are PCA, LDA, LBP, Haar cascade classifier, etc.

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