

# ATTENDANCE MANAGEMENT SYSTEM USING FACE RECOGNITION

## Project Report

Submitted in partial fulfilment of the requirements for the award of the degree

Of

Bachelor of Technology

In

Computer Science Engineering

Under the supervision

Of

Dr. Pankaj Dhiman

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## **DECLARATION**

I hereby declare that the work presented in the Project report entitled “ATTENDANCE MANAGEMENT SYSTEM USING FACE RECOGNITION” submitted for partial fulfilment of the requirements for the degree of Bachelor of Technology in Computer Science Engineering at Jaypee University of Information Technology, Waknaghat is an authentic record of my work carried out under the supervision of (Dr.Pankaj Dhiman) .This work has not been submitted elsewhere for the reward of any other degree/diploma.

I am fully responsible for the contents of my project report .

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## **Certificate**

This is to certify that the work which is being presented in the project report titled “ATTENDANCE MANAGEMENT SYSTEM USING FACE RECOGNITION ” in partial fulfilment of the requirements for the award of the degree of Bachelor of Technology in Computer Science Engineering submitted to the Department of Computer science Engineering, Jaypee University of Information Technology, Waknaghat is an authentic record of work carried out by Ishan Verma (181312) and saurabh shukla (181343) during a period from July 2021 to May , 2022 under the supervision of Dr. Pankaj Dhiman Assistant professor), Department of Computer science Engineering, Jaypee University of Information Technology, Waknaghat. The above statement made is correct to the best of our knowledge.

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## **Acknowledgement**

The success and final outcome of this project requires a lot of guidance and assistance from many people and we are extremely privileged to have got this all along the completion of our project. All that we have done is only due to such supervision and assistance and we would not forget to thank them. We would like to express our sincere gratitude to Dr. Pankaj Dhiman (Assistant Professor) for his valuable guidance. We would like to extend our sincere thanks to sir. We are highly indebted to all of them for their guidance and constant support

## ABSTRACT

A face is the representation of one's identity. For this reason, our experts have proposed a computerised student participation unit based upon face acknowledgment. Image recognition devices are actually really helpful in life requests particularly in protection control devices. The flight terminal security device makes use of image identification to determine suspects and also FBI (Federal Bureau of Investigation) utilises face recognition for unlawful examinations. In our suggested approach, first of all, an online video framework is actually carried out by triggering the cam with a user-friendly user interface. The face ROI is sensed and fractional from the video recording frame by using Viola-Jones protocol. In the pre-processing phase, scaling of the size of graphics is actually performed if important if you want to prevent loss of relevant information. The typical filtering is actually put on clear away noise adhered to through sale of colour pictures to grayscale photos. After that, contrast-limited flexible pie chart equalisation (CLAHE) is actually implemented on images to boost the contrast of graphics. In the image recognition phase, enhanced regional binary style (LBP) as well as major component analysis (PCA) is administered likewise if you want to draw out the functions from facial photos. In our proposed method, the improved regional binary norm outmatch the authentic LBP through minimising the enlightenment effect and also improving the awareness rate. Next off, the attributes extracted from the examination photos are compared with the functions removed from the instruction graphics. The facial pictures are classified and recognized based on the most effective result secured from the blend of formula, improved LBP and also PCA. Lastly, the appearance of the realised trainee will definitely be marked and saved in the excel data. The trainees that are actually misthreaded are going to also have the ability to register on the spot and also notice will definitely be actually offered if pupils sign in greater than the moment. The ordinary accuracy of recognition is 100 % forever premium images, 94.12 % of low-quality images as well as 95.76 % for Yale face data source when 2 graphics per person are actually educated.

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# Chapter 1

## INTRODUCTION

The major objective of this venture is to build face recognition based automated pupil participation devices. So as to obtain far better functionality, the exam pictures and also instruction pictures of this proposed strategy are actually restricted to frontal and also ethical facial images that consist of a singular face just. The examination photos as well as training pictures need to be grabbed through using the exact same gadget to ensure no quality distinction. On top of that, the students have to register in the database to be identified. The enrolment may be carried out on the location via the uncomplicated user interface.

### 1.1 Background

Image identification is actually important in everyday lifestyle in order to determine family, close friends or even a person we know along with. Our company could certainly not identify that a number of steps have actually consumed purchase to determine human faces. Human intelligence enables our team to receive information as well as translate the relevant information in the acknowledgment procedure. Our experts get relevant information with the picture forecasted into our eyes, through particularly retina in the form of lighting. Light is a kind of electromagnetic surges which are actually radiated from a resource onto an item and forecasted to individual vision. Robinson-Riegler, G., & Robinson-Riegler, B. ( 2008) pointed out that after graphic handling carried out due to the individual graphic device, our experts in fact categorise shape, dimension, curve and the texture of the object in instruction to evaluate the information. The analysed relevant information will definitely be compared to various other portrayals of objects or even faces that exist in our mind to identify. In simple fact, it is actually a challenging problem to construct an automated system to possess the same capability as an individual to identify. faces. Having said that, our company needs big moments to identify various faces. For example, in the Universities, there are actually a bunch of students along with various ethnicities and genders, it is impossible to keep in mind every face of the person without helping make oversights. So as to get over individual

constraints, computers with almost unlimited mind, high refining rate and also electrical power are utilised in face awareness devices.

The human face is actually a distinct depiction of specific identification. Therefore, face identification is specified as a biometric technique in which the identity of an individual is performed through reviewing real-time capture images with saved images in the data bank of that person (Margaret Rouse, 2012). Nowadays, the face awareness unit is popular because of its own simplicity and also awesome efficiency. As an example, airport terminal security devices and FBI make use of face awareness for unlawful examinations through tracking suspects, overlooking children as well as drug tasks (Robert Silk, 2017). Aside from that, Facebook, which is actually a prominent social networking web site, carries out image awareness to allow the users to mark their buddies in the image for amusement purposes (Sidney Fussell, 2018). Additionally, Intel Business makes it possible for the customers to utilise face awareness to receive access to their online account (Reichert, C., 2017). Apple permits the consumers to open their cellular phone, apple iphone X. by utilising face acknowledgment (deAgnia, M., 2017).

The work with face awareness started in 1960. Woody Bledsoe, Helen Chan. Wolf and also Charles Bisson had offered a unit which called for the supervisor to. situate eyes, ears, nose and also oral cavity coming from images. The range and also proportions in between the. located functions as well as the typical recommendation points are actually after that determined and also compared. The research studies are better boosted through Goldstein, Harmon, and also Lesk in 1970 through using. various other features including hair colour as well as lip fullness to automate the acknowledgment. In 1988,. Kirby and Sirovich initially recommended principal part review (PCA) to resolve the problem. acknowledgement issue. Numerous researches on face acknowledgment were then performed. constantly until today (Ashley DuVal, 2012).

## **1.2 Problem Statement**

Typical student presence noting procedure is frequently dealing with a great deal of trouble. The face acknowledgment trainee attendance device stresses its own simpleness through getting rid of classical pupil appearance indicating strategy such as calling trainee names or

even checking respective identification cards. There are actually certainly not only agitating the training method however additionally triggers disturbance for trainees throughout exam sessions. Other than knowing as titles, appearance slabs are actually circulated the classroom throughout the sermon sessions. The sermon course particularly the class with a multitude of trainees could find it complicated to have the participation piece being actually passed around the class. Thereby, face recognition pupil appearance system has actually popped the question so as to change the manual finalising of the existence of students which are challenging and also creates students who are distracted so as to authorise their appearance. In addition, the face identification based automated student presence unit is capable of getting rid of the trouble of illegal approach and also teachers certainly do not need to await the number of students several opportunities to make sure the presence of the pupils.

### 1.3 Objectives

The objective of this particular job is actually to develop a face acknowledgment located in an automatic student attendance system. Anticipated success to meet the objectives are actually:

- To detect the face sector from the online video structure.
- To remove the helpful attributes coming from the face detected.
- To classify the functions if you want to acknowledge the face found.
- To document the attendance of the determined trainee.

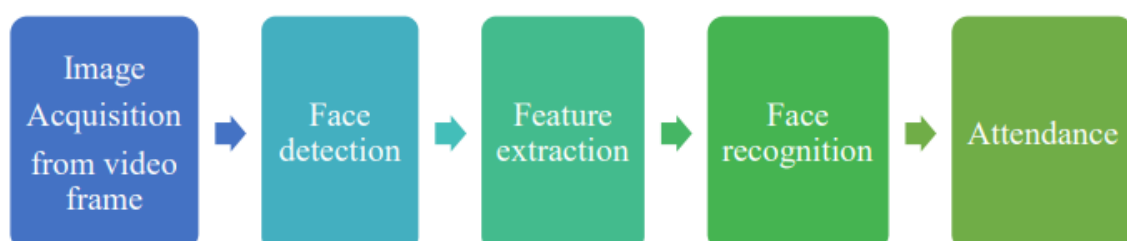


Figure 1.1 Block Diagram of the General Framework

## 1.4 METHODOLOGY

The strategy conducts a face recognition based student participation unit. The methodology circulation begins with the squeeze of image by utilising basic as well as handy interface, followed by pre-processing of the grabbed face photos, then function removal from the face pictures, subjective selection and last but not least category of the facial images to become recognized. Both LBP and also PCA attribute extraction methods are researched carefully and computed within this recommended technique to help make contrasts. LBP is enriched in this particular approach to reduce the enlightenment result. A protocol to combine boosted LBP and also PCA is actually likewise created for very subjective selection in order to increase the accuracy. The details of each phase will certainly be actually discussed in the observing parts.

The flow graph for the proposed device is actually categorised into pairs of parts, first training photos adhered to by screening images (recognize great beyond input picture). shown in Figure 3.1 as well as Figure 3.2 respectively.

## Training database

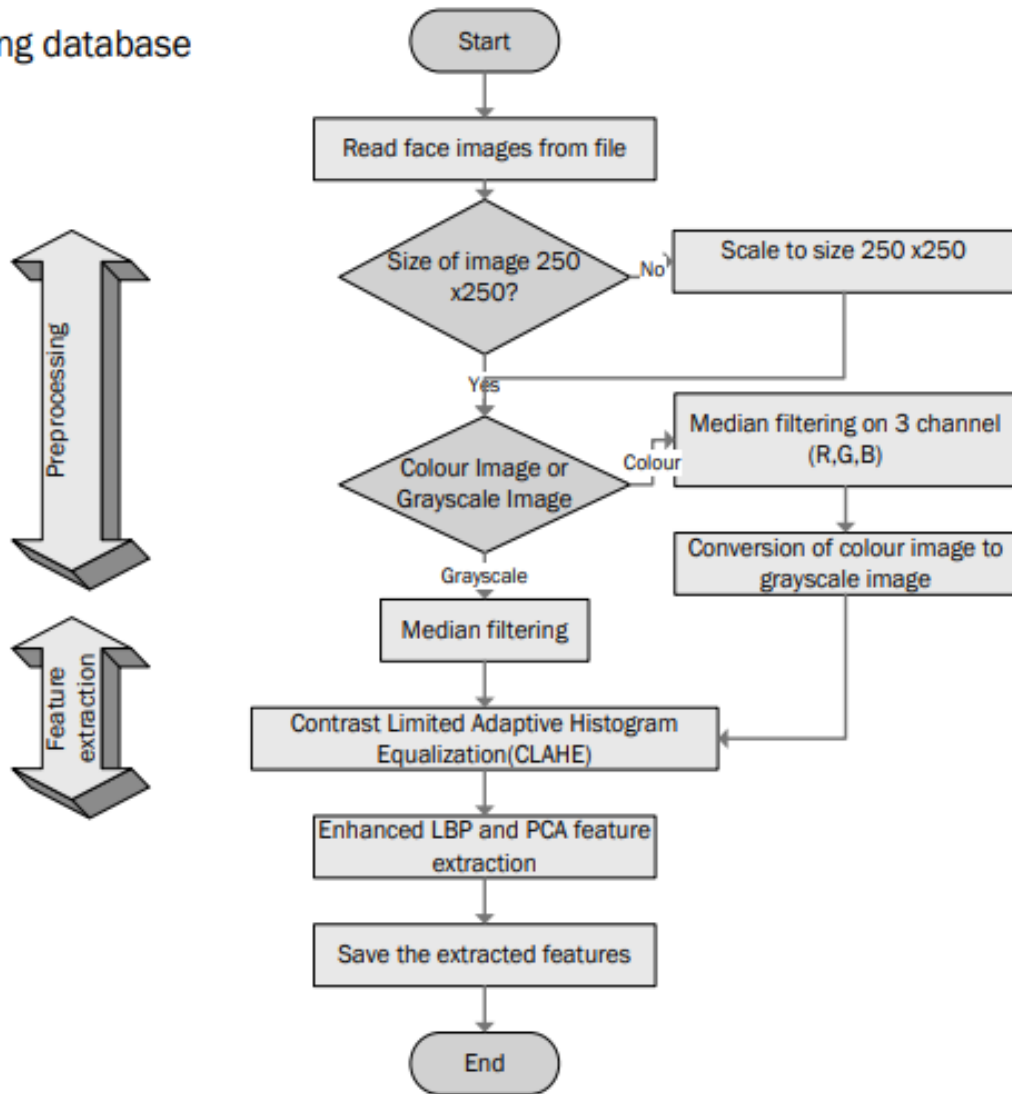


Figure 1.2 Flow of the Proposed Approach (Training Part)



## Recognition

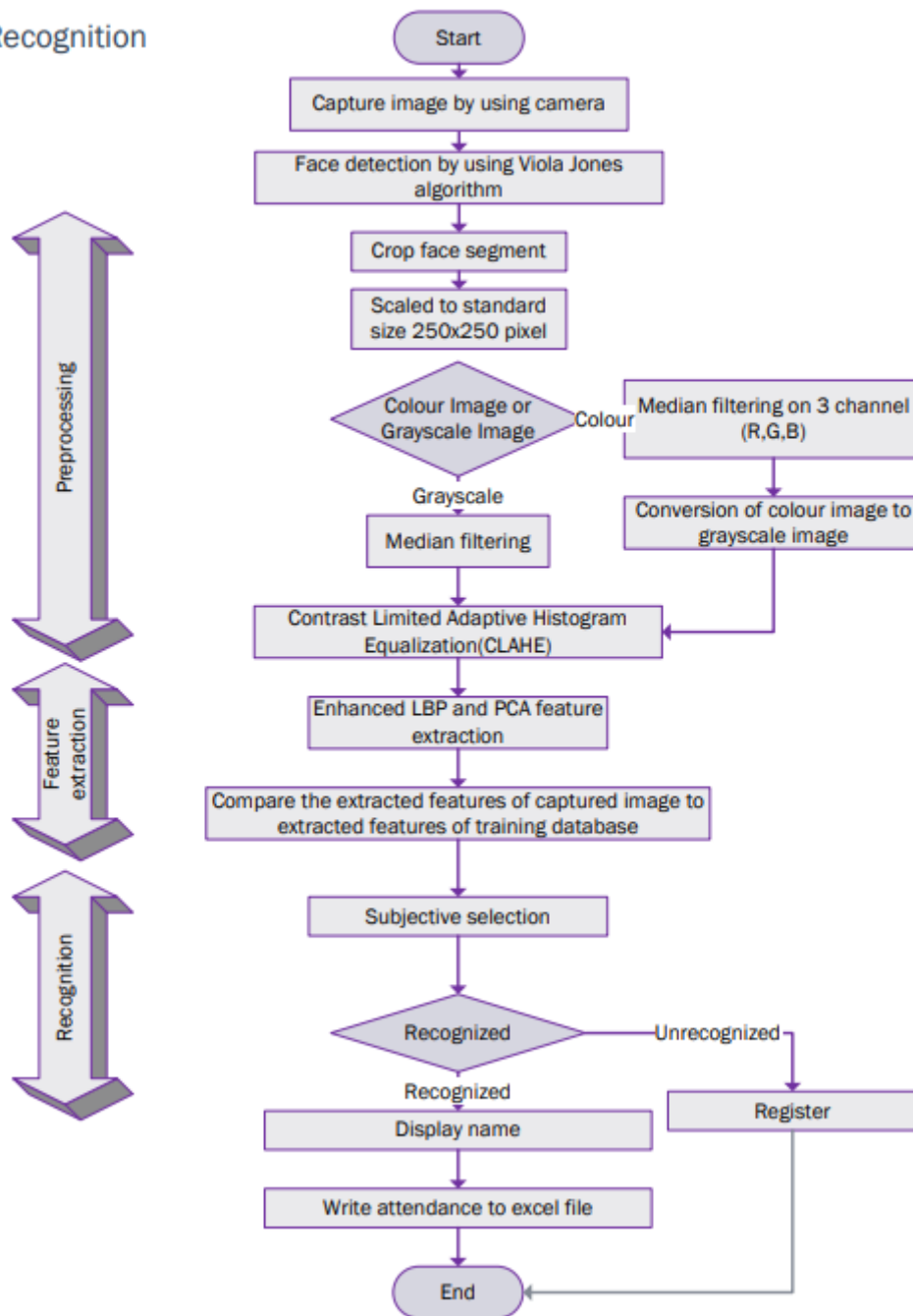


Figure 1.3 Flow of the Proposed Approach (Recognition Part)

## **Chapter 2**

### **LITERATURE REVIEW**

#### **2.1. INTRODUCTION**

Face Recognition is just a technique for recognising someone by matching some aspects of stored models of their face to each and every specific aspect inside a group of people. Face recognition is considered the most natural strategy to understand and authenticate some body. Face recognition plays a significant role in people's day-to-day communication and lifestyles. In any business or location, an individual's security and verification are crucial. As a result, there is lots of interest in automated facial recognition using computers or products for identity confirmation around the clock and periodically remotely in today's world. Face recognition has actually emerged as one of the most challenging and interesting subjects in design recognition and image handling.

#### **2.2 NEED FOR THE FACE RECOGNITION**

RFID (Radio Frequency Identification) card systems, fingerprint systems, and iris recognition systems all have drawbacks, Card with RFID due to the simplicity, the operational system happens to be implemented. Nonetheless, the consumer is more likely to assist others. So long as they actually have their friend's ID card, friends can sign in. The fingerprint recognition system is effective, but not that useful, as the procedure takes time. The user must line up and execute each verification individually; however, the human face is always visible and contains less information when it comes to recognition of the iris as a result. A far more detailed iris recognition system could be a block on user's privacy. Although vocal recognition is accessible, it is less accurate than the other method. Hence, face recognition system is recommended to be used in the pupil attendance system.

## 2.3 ADVANTGES & DISADVANTAGES OF BIOMETRIC SYSTEM

System type	Advantages	Disadvantages
RFID card system	Simple	Fraudulent usage
Fingerprint system	Accurate	Time-consuming
Voice recognition system	-	Less accurate compared to others
Iris recognition system	Accurate	Privacy Invasion

Table .2.1. Advantages & Disadvantages On Biometric System

Cheng, et al. [1] created a method that makes use of note PCs for all students to handle the context regarding the pupils for the classroom lecture. The attendance and position associated with the pupils are obtained since this method uses each student's note PC. However, comprehending the lecturer's specific circumstances is challenging . A great deal of face recognition algorithms have now been proposed within the last decade [2], but the majority of those works just deal with a solitary image of a face at a time. Our approach can tackle the difficulty of face detection and increase the accuracy of face recognition by continuously learning face information.

[3] also introduces an ear-based approach, The image is exposed to edge detection. a guide line is drawn with this detected edge, against which other characteristics are identified. These features are extracted and saved in the shape of a vector in a database, with every vector matching to an image in the database. The feature vector obtained through the test image is contrasted to those in the vector database. The connecting of MATLAB and some information bases via ODBC Drivers is completed for the reason of generating databases that are maintaining individual records and feature vectors, which are employed for comparison and decision making .

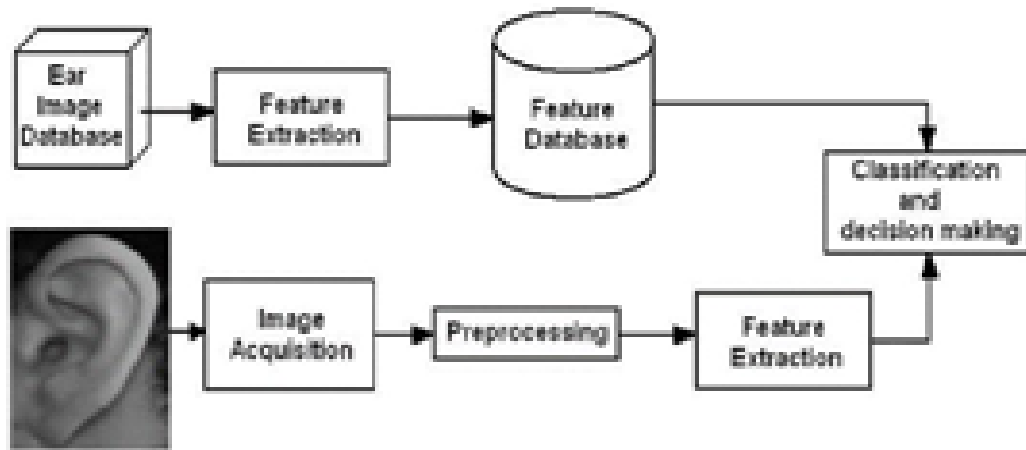


FIG.2.1. Ear Based Approach

[4] suggested a three-module framework for a fast embedded facial detection system. One high-speed and high-detection-rate rapid face detection approach based on an optimised AdaBoost algorithm, one SOC hardware framework to speed up detection operations, and one software distribution strategy to optimise the memory sub-system .

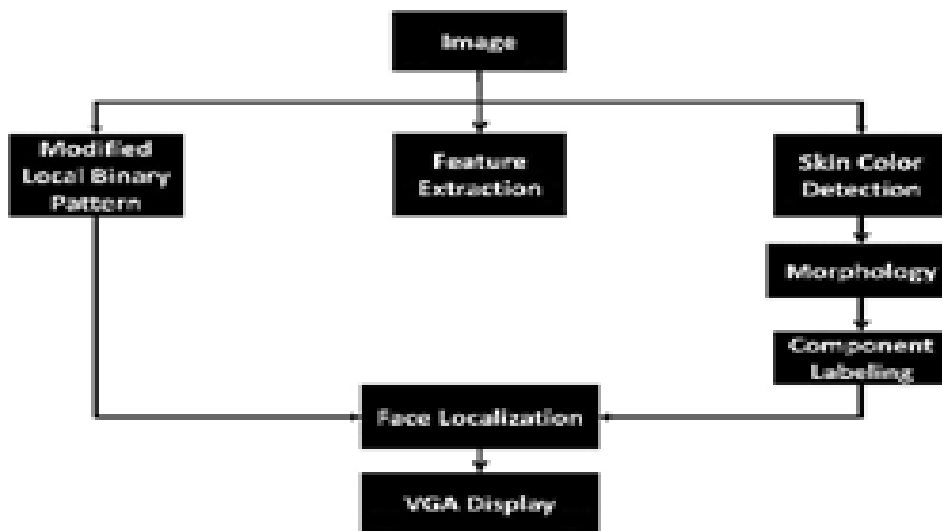


FIG. 2.2. Face Localization

## 2.4 FACE DETECTION

[5] outlines a Real-Time Multi-Face Detection System. Because the majority associated with the system hinges on software algorithms. The proposed option would be based on hardware design in order to improve speed that is processing. Face colour detection, morphology, Fast labelling that is connected-component, Implementation of the Fast connected-component labelling algorithm, Lip feature extraction, and Horizontal side detection are among the list of phases of this equipment design.

[6] suggested a method for real-time surveillance system face and head detection that uses four directional features (FDF) and linear analysis that is discriminant. FDF is one of the most reliable identifying habits. The FDF represents the input image's four edges that are directional (vertical, horizontal, and both diagonals). The proposed technique reached a detection performance of over 10 frames per second for implementation, nonetheless it still needed a lot of work. The face detection problem [10] has been solved in 2 ways for a sequence of images, commonly in movies. Initial technique involves detecting faces in each frame without using information that is temporal. Another option is to determine a face within the first frame and abide by it throughout the video. In line with the method

that is initial this research proposes an advanced face detection system in video subsequence.

Provides an adaptive face colour model to achieve a more practical face definition and reduce the ramifications of lighting changes due to the camera's autofocus. The geometric condition of the face that is human, the absurdity of the face. Alternatively, you can avoid tardiness through the use of a face patch that is oval. Probably the most promising candidates are then considered prospects for that position. We present a modified lbp that takes into account both local spatial textures and default neighbourhood shapes.subsequence.

Provides an adaptive face colour model to achieve a more realistic face definition and reduce the effects of lighting changes caused by the camera's autofocus. The geometric condition of the human face eliminates the absurdity regarding the face. Instead, you can avoid tardiness by making use of an oval face patch. The most promising candidates are then considered candidates for that place. We present a modified LBP that takes into account both local spatial textures and default local shapes.The facial representation is a histogram of modified LBP coefficients. The classification process employs a mix of template matching and approaches that are appearance-based. To find out whether face prospects are human faces, LBP histogram matching and eHMMs are merged into a hierarchical classifier .

Background	Variation of background and environment around people in the image which affect the efficiency of face recognition.
Illumination	Illumination is the variation caused by various lighting environments which degrade the facial feature detection.
Pose	Pose variation means different angle of the acquired the facial image which cause distortion to recognition process, especially for Eigen face and Fisher face recognition method.
Expression	Different facial expressions are used to express feelings and emotions. The expression variation causes spatial relation change and the facial-feature shape change.
Occlusion	Occlusion means part of the human face is unobserved. This will diminish the performance of face recognition algorithms due to deficiency information.
Rotation, scaling and translation	Transformation of images which might cause distortion of the original information about the images.

Table .2.2. Features Causing Face Detection Difficulties

## 2.5. FEATURE EXTRACTION

The feature is a set of information that provides the information in an image. Extraction of the facial function is vital for face recognition. However, selection of features could be a difficult task. Feature removal algorithms should be consistent across a variety of changes in order to provide high accuracy results. There are a few methods for face recognition. Within the paper they proposed PCA for real face recognition. D. Nithya (2015) also utilised PCA in face recognition based student attendance system. PCA is famous for its robust and speedy computation. Essentially, PCA keeps data variation and removes unnecessary existing

connections among the list of features that are original. PCA is really a dimension reduction algorithm. It compresses each facial image which is represented by the matrix into a single column vector. Furthermore, PCA removes the value that is the average of the image to centralise the image information. The principal distribution of facial images is known as Eigen faces. Every single image that is facial the training set rewarded Eigen faces. Being an outcome, Eigen face encodes the variation that is best among known facial images. Training images and test images are then projected onto the Eigenface room to obtain projected images that are training projected test images respectively. Euclidean distance is computed by comparing the distance between projected training images and projected test image to perform the recognition. PCA feature extraction process includes all trained facial pictures. Hence, the removed feature contains correlation between facial pictures within the training set and the result of recognition of PCA highly is determined by training set image.

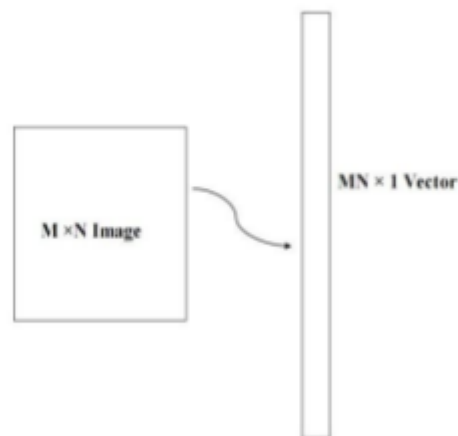


FIG.2.3. Feature Extraction

### 2.5.1 LDA

Linear Discriminant Analysis (LDA) is another face that is a popular algorithm, Suman Kumar Bhattacharya and Kumar Rahul (2013) proposed LDA for face recognition. LDA extracts features by grouping images of the class that are the same individual images of various classes. The LDA also works well with a range of facial expressions, lighting and



poses due to its class separation. The same class is defined as face images regarding the exact same individual () however with different facial expressions, lights, or poses, whereas face images of people with different identities are categorised into different classes . Images of the same class give the scatter matrix within the class, while pictures of the various class () provide the scatter matrix between classes. The LDA manages to maximise the ratio of the determinant for the dispersion matrix between classes () to the determinant of the dispersion matrix within the class (). LDA is considered to possess a lesser error rate compared to PCA only if more than examples per class are trained as well as the other course sizes are tiny.

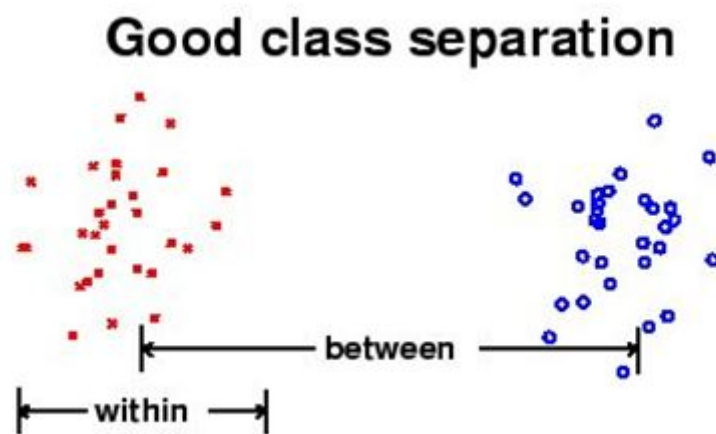


FIG.2.4. Lda (Linear Discriminant Analysis)

### 2.5.2 LBP

The LBP (Local Pattern) operator was initially introduced by paper by Timo Ojala et al. (2002 year). In the content by Md. Abdur Rahim et al. (2013), they propose that LBP extract both texture and contour details to represent face images. LBP divides each image that is facial smaller regions therefore the histogram of each and every region is extracted. The histogram for every area is concatenated in to a feature vector. This particular feature vector is representative of face pictures and statistics that are

chi-square used to measure the similarity between facial pictures. The minimum screen size of each

The region is 3 x 3. . The neighbourhood over the specified limit value is from 0 to 1 as the neighbourhood below the specified threshold value is 0. The ensuing binary pixels will likely then form a byte value representing the central pixel.

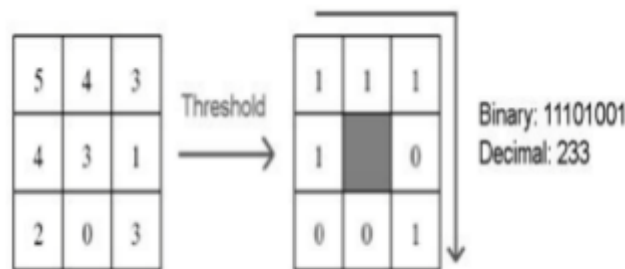


FIG.2.5. LBP

LBP has a few advantages which make it popular to be implemented. It has high tolerance against the monotonic illumination changes and it is able to deal with a variety of facial expressions, image rotation and ageing of persons. These overwhelming characteristics cause LBP to be prevalent in real-time applications.

### 2.5.3 ANN

Neural networks were initially only used in face recognition. It ended up being then studied in increased detail than to be implemented in facial recognition. Within the article by Manisha M.Kasar et al. (2016), artificial networks that are neuralANNs) are studied for face recognition. ANN contains

artificial networks that are neural "nodes". The nodes work like a human brain in for recognition and category. These nodes are connected together, and also the values assigned in their mind indicate the strength of these ties. A high value suggests a connection that is strong . The neurons have already been classified into three kinds of nodes or classes where

are input nodes, hidden nodes and the output nodes. Input nodes are weighted according to their impact. Hidden nodes include maths function and threshold function to perform deterministic prediction or probability and block unnecessary inputs and outcomes produced

in production nodes. Hidden nodes can have one or more layer. Multiple inputs create one output at the production node.

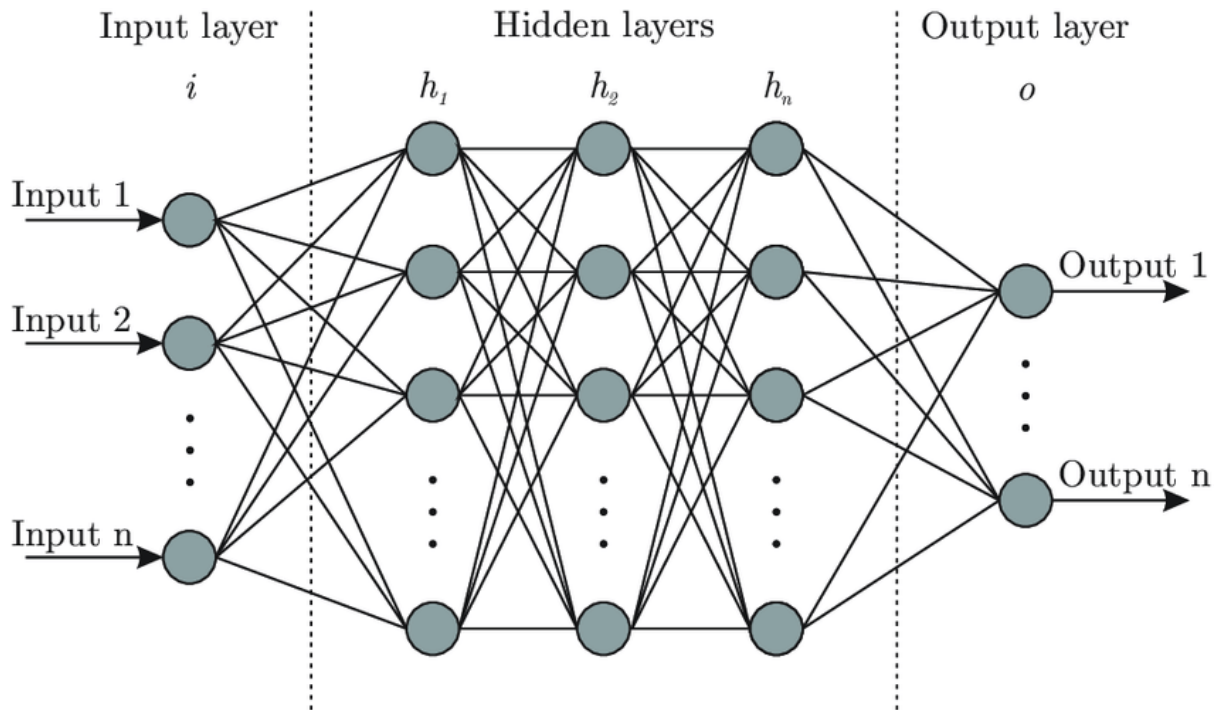


FIG.2.6. Artificial Neural Network (Ann's)

### 2.5.4 CNN

Another neural network approach to face recognition is just a cumulative neural network (CNN). CNN, like ANN, has an input layer, a layer that is hidden and an output layer. Transformation layers, grouping layers, completely connected layers, and normalised levels are examples of concealed layers in CNN. Nonetheless, as Facebook's Deepface has shown, for CNN to run 20 properly, a huge number of an incredible number of face pictures must be taught and trained in a time-consuming way. Convolution is a kind of mathematical procedure widely used in image processing. Convolutional results may be categorised into three modes (Bengio et al., 2016), namely Full, Same, and Valid, which can be utilised in different situations. Valid mode, for instance, is frequently used in forward propagation to aid picture extraction, while complete mode is often found in back propagation to have optimal weights. Edge zeroing is implemented for the input image in the convolution process,

where in fact the layer quantity of this edge can be computed in line with the size of the convolution kernel (Lawrence et al). The purpose of advantage zeroing is to make certain that the system is logical.

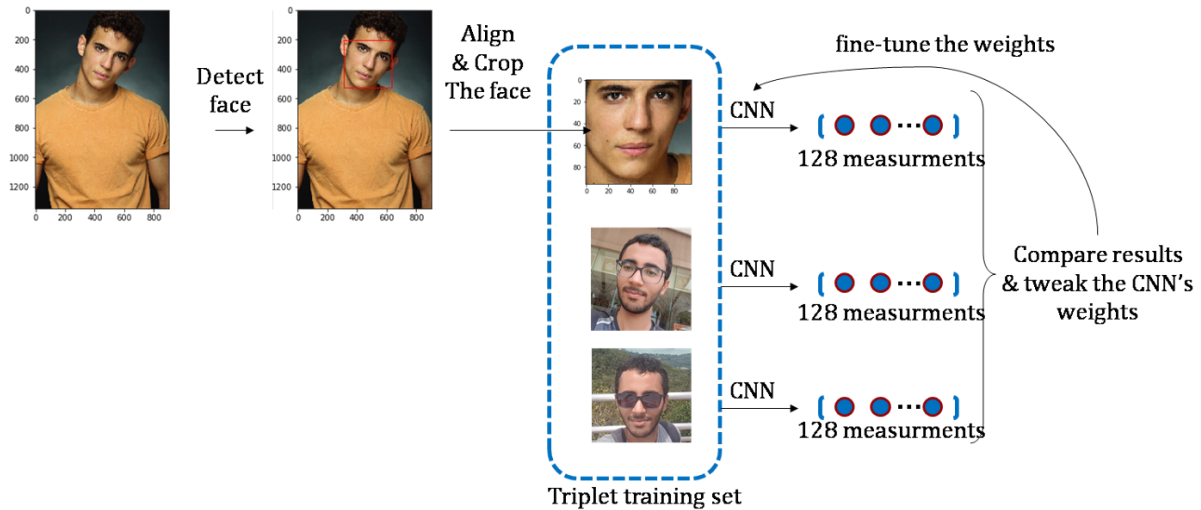


Fig.2.7 .Face Recognition Using CNN

## 2.6 Feature Classification on Face Recognition

Classification related to the facial recognition process. The distance classifier finds distances between the test image and the train image on the basis of the features that are extracted. The smaller the length between the input feature points and the features that are formed the greater amount of similarity has between the test image and the training image. In other words, face images with minimum/minimum distance are going to be grouped into the same person. Deepesh Raj (2011) mentioned a few types of distance classifiers such as Euclidean distance, city block distance and Mahalanobis distance for face recognition. MD The Chi Square statistic was used as a distance classifier for the LBP operator by Abdur Rahim et al. (2013)..

Chi square distance is defined as

(2.1)

$$\chi^2 = \sum \frac{\text{observed frequency} - \text{expected frequency}}{\text{expected frequency}}$$

Chi-square statistic is usually used to compare between two bins of histogram. The City Block Distance or Manhattan Distance is known as L1-norm which is defined in

(2.2)

$$\chi^2 = \sum \frac{\text{observed frequency} - \text{expected frequency}}{\text{expected frequency}}$$

The Euclidean distance is known as L2-norm which is defined in

(2.3)

$$d(x, y) = |x - y|^2$$

where, X is the input feature points and Y is the trained featured points.

The Mahalanobis distance is defined in

(2.4)

$$d(x, y) = \frac{(y - m_x)}{S_x} (y - m_x)^T$$

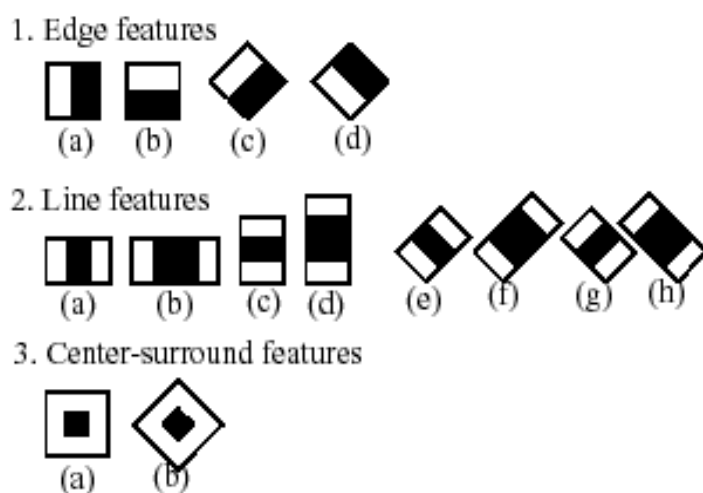
where  $m_x$  is mean of x and  $S_x$  is covariance matrix of x.

After executing the LBP feature removal, Md. Abdur Rahim et al. (2013) advise utilising the Chi-Square statistic as being a dissimilarity measure for histograms to look for the distance between two images. After PCA function extraction, Abhishek Singh and Saurabh Kumar (2012) proposed using Euclidean distance to calculate the exact distance between two pictures. A threshold can be set for the distance estimated by the classifier. A face is only categorised as belonging to a course if its distance is less than the set threshold; otherwise, it is classed as unknown.

## 2.7. VIOLA JONES ALGORITHM

The Viola-Jones strategy, manufactured by P. Viola and M. J. Jones (2001), is the commonly used means for finding the face part in fixed photo or movie frames.

The Viola-Jones algorithm consists of four pieces as an entire. The portion that is first called a Haar element, the 2nd part is how an important image is created, the following role is where Adaboost are applied, also the last part is the cascade procedure .



Viola-Jones algorithm analyses a given image using Haar features consisting of multiple rectangles (Mekha Joseph et al., 2016). Figure 2.1 demonstrates several types of Haar characteristics. The features carry away as screen purpose mapping on the graphics. a value that is single, which signifies each ability is calculated by subtracting the rectangle( that is white) from the amount associated with black colored rectangle(s) (Mekha Joseph et al., 2016).

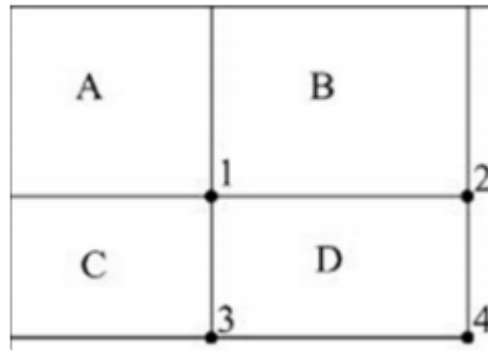


Fig.2.8 Integral of Image

The worthiness of integrating graphics on a location that is specific the sum of pixels on the leftover furthermore the location that is particular. To enable you to demonstrate clearly, the vital graphics at venue 1 is the amount of the pixels in rectangle A. The philosophy of fundamental photos at a remaining portion of the places becomes collective. The worth at location 2 is actually summation of an and B,  $(A + B)$ , at venue 3 was summation of an and C,  $(A + C)$ , and also at area 4 are summation of all the regions,  $(A + B + C + D)$  (Srushti Girhe et al., 2015) by way of example. Consequently, the amount in the D region are computed with merely choice and subtraction of diagonal at area  $4 + 1 - (2 + 3)$  to eliminate rectangles A, B and C. Burak Ozen (2017) and Chris McCormick (2013), have pointed out that Adaboost which is also called ‘Adaptive maximising’ is a promoting method that is greatest in which multiple “weak classifiers” are merged into a “strong classifier”. The training is chosen for every single classifier that is brand new with all the link between the previous classifier and find exactly just how much weight that is given every single classifier so that you can make it significant. However, false recognition might occur and yes it is essential to pull manually centred on real sight. Figure 2.3 reveals a good instance of false face detection (group with bluish).

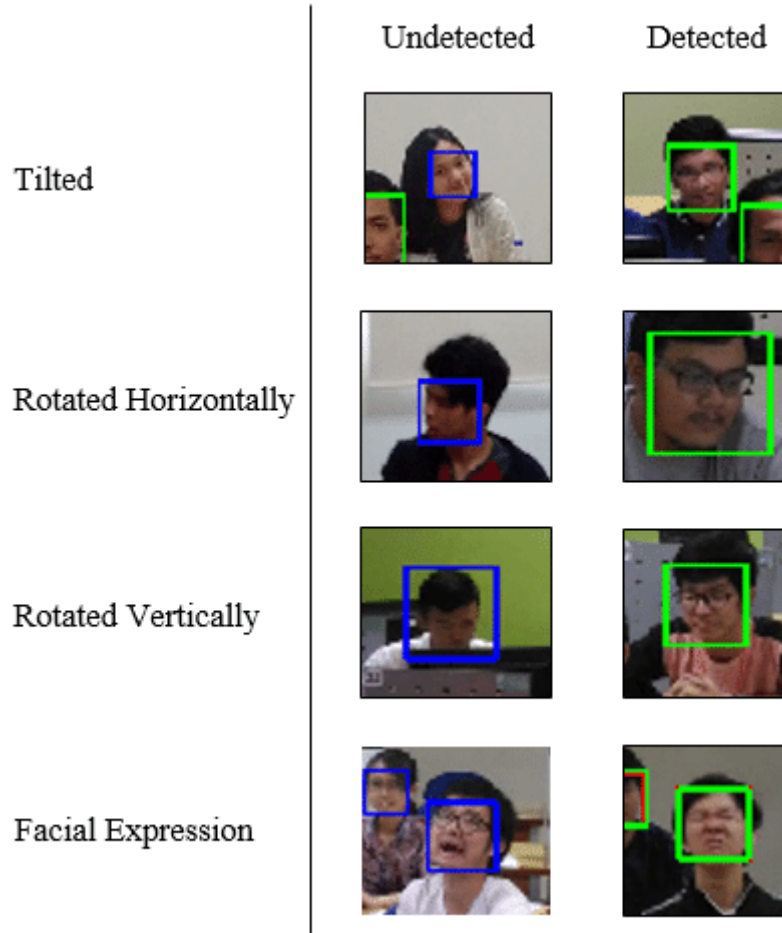


Fig.2.9 false face detection

## 2.8 EVALUATION

Different databases are utilised in order to measure the system performance. The database provided by past scientists with various conditions that are variable as an example, lighting and look are used to justify the system as well in terms of study function.

Also, our database that is own will used to analyse the unit for realtime Application . The common from the literature summary of the researchers that are previous



method to justify the performance for the system is through finding the precision of Recognition

The formula for accuracy or recognition rate is defined below:

$$accuracy = \frac{\text{total matched images}}{\text{total tested images}} \times 100 \quad (2.5)$$

Method	Advantages	Disadvantages	Accuracy (ATT database)
Eigen face/ Kernel PCA (Principal component Analysis)	High speed in training and recognition.	Face recognition is depend on training database.	77.97 %
Fisher face/ LDA (Linear Discriminant Analysis )	Images of individual with different illumination, facial expressions able to be recognized if more samples are trained.	<ol style="list-style-type: none"> <li>1. Bigger database is required because images of different expression of the individual have to be trained in same class.</li> <li>2. It depend more on database compared to PCA.</li> </ol>	82.45 %
LBP(Local Binary Pattern)	It is able to overcome variety of facial expressions, varying illumination, image rotation and aging of person.	Training time is longer than PCA and LDA.	90.93 %
Neural network	High accuracy only if large database is trained.	<ol style="list-style-type: none"> <li>1. Required long time to train.</li> <li>2. Database is extremely large to have high accuracy.</li> </ol>	N.A

Table.2.3. Summary of Feature Extraction

## Chapter-3

# SYSTEM DEVELOPMENT

### 3.1 Images Used

Although our own data source ought to be used to make actual time face awareness trainee appearance, the databases that are actually provided due to the previous analysts are additionally used to develop the unit much more successfully, effectively as well as for analysis purposes.

Yale face data source is made use of as both instruction collection as well as screening readied to analyse the performance. Yale image data source includes one hundred as well as sixty-five grayscale images of fifteen individuals. There are actually eleven graphics for every individual; each graphic of the person is in a different problem. The problems featured centre-light, along with glasses, satisfied, left-light, without glasses, normal, right-light, unfortunate, drowsy, surprised as well as wink. These different variations offered by the database has the capacity to ensure the unit to become run continually in variety of conditions as well as states.



Figure 3.1 Sample Images in Yale Face Database (Cvc.cs.yale.edu, 1997)

For our very own database, the pictures of trainees are caught by making use of a laptop computer constructed in a video camera and also cellphone video camera. Each trainee gave 4 photos, 2 for the training set as well as 2 for the testing set. The images captured by utilising laptop computer built-in electronic cameras are categorised as low quality images, whereas smartphone camera captured photos are categorised as high top quality pictures. The excellent quality pictures include seventeen trainees while low quality pictures are composed of twenty-six students. The acknowledgment price of poor quality photos as well as top quality images will be contrasted in Chapter 4 to draw a verdict in regard to performance in between picture collections of different quality



Figure 3.2 Images from mobile (high quality)

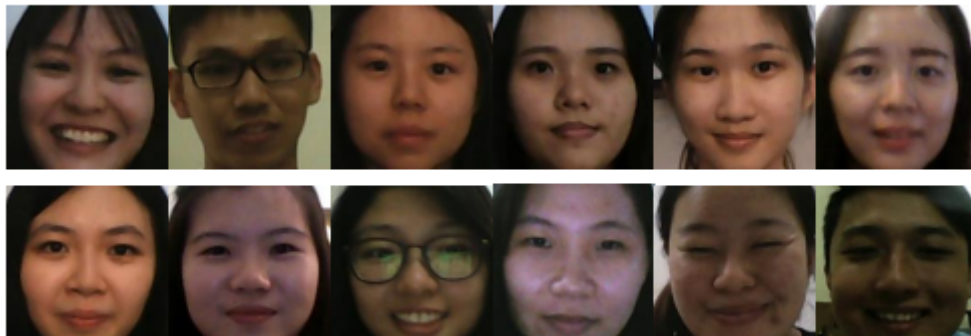


Figure 3.3 images from webcam (low Quality)

### 3.1.1 Limitations of the Images

The input image for the proposed method has to be frontal, upright and only a solitary face. Although the system is made to be able to identify the trainee with glasses and also without

glasses, students need to supply both face images with as well as without glasses to be educated to raise the accuracy to be identified without glasses. The training image and also screening photo ought to be recorded by utilising the same tool to prevent quality difference. The trainees need to register in order to be recognized. The enrollment can be done instantly via the easy to use interface. These problems need to be satisfied to make sure that the suggested technique can carry out well.

## **3.2 Detection of Faces**

Viola-Jones item discovery structure will be used to identify the face from the video electronic camera recording structure. The working principle of Viola-Jones algorithm is stated in Chapter 2. The limitation of the Viola-Jones structure is that the facial picture has to be a frontal upright photo, the face of the individual has to point towards the electronic camera in a video clip framework.

### **3.2.1 Pre-Processing of images**

Testing collection and training established photos are caught utilising a video camera. There are undesirable sounds and unequal illumination exists in the photos. As a result, several pre-processing actions are needed before proceeding to include extraction.

Pre-processing actions that would certainly be accomplished consist of scaling of picture, average filtering, conversion of colour pictures to grayscale images as well as adaptive histogram equalisation. The details of these actions would certainly be gone over in the later areas.

#### **3.2.1.1 Scaling of Image**

Scaling of pictures is among the regular jobs in picture handling. The dimension of the images needs to be thoroughly adjusted to protect against loss of spatial details. ( Gonzalez, R. C., & Woods, 2008), In order to perform face recognition, the dimension of the image has to be equalised. This has come to be important, specifically in the attribute removal procedure, the test photos and also training photos have to be in the very same size as well as

measurement to make certain the precise result. Hence, in this suggested technique examination pictures and train pictures are standardised at dimension  $250 \times 250$  pixels.

### 3.2.1.2 Median Filtering

Average filtering is a long lasting noise decline method. It is widely used in various applications because of its capacity to do away with unfavourable noise in addition to maintaining valuable info in photos. Considering that the colour photos video taped by utilising a camera are RGB images, a typical filtering system is done on 3 different networks of the photo. fig 3.4 reveals the photo before as well as also after sound removal by typical filtering system in 3 networks. If the input photo is a grayscale image, after that the mean filtering system can be carried out straight without dividing the networks.



Figure 3.4 Median Filtering (On Three Channels)



Figure 3.5 Median Filtering (On Single Channels)

### 3.2.1.3 Grayscale image

Electronic cameras catch shade pictures, nonetheless the proposed contrast improvement technique CLAHE can only be carried out on grayscale photos. After boosting the comparison, the lighting effect of the images was able to be decreased. LBP extracts the

grayscale features from the contrast improved images as 8 little bit structure descriptors (Ojala, T. et al., 2002). As a result, colour images need to be converted to grayscale pictures previously continuing to the later steps. By converting shade pictures to grayscale pictures, the complexity of the calculation can be decreased leading to higher speed of calculation (Kanan as well as Cottrell, 2012). Figure 3.6 reveals the conversion of images to grayscale image



Figure 3.6 Normal Image To Grayscale Image

### **3.2.1.4 Adaptive Histogram Equalisation With Limited Contrast**

Histogram equalisation is a technique of photo contrast improvement. (Pratiksha M. Patel, 2016). The contrast improvement is normally performed on the grayscale photos. Photo comparison is boosted by stretching the variety of its pixel intensity values to span over the preferred array of values, between 0 and 255 in grayscale. The factor that Contrast Limited Adaptive Histogram Equalisation (CLAHE) is used rather than histogram equalisation is due to the fact that histogram equalisation depends upon the international data. Hence, it triggers over improvement of some parts of image while various other components are not boosted appropriately. This misshapes the functions of the image. It is a serious problem due to the fact that the features of the photo have actually to be drawn out for the face recognition. Thus, CLAHE which is dependent on neighbourhood statistics is used. The outcome of CLAHE will certainly be discussed in Chapter 4.



Figure 3.7 Contrast Improvement

### 3.3 Feature Extraction

Various facial photos indicate there are adjustments in textural or geometric details. In order to execute face acknowledgment, these features need to be extracted from the facial images and also identified suitably. In this job, improved LBP and PCA are used for face recognition. The concept originates from the nature of human aesthetic perception which performs face acknowledgment depending on the local statistic as well as worldwide statistical attributes. Enhanced LBP removes the regional grayscale features by performing feature removal on a tiny region throughout the whole picture. On the other hand, PCA removes the global grayscale features which indicates feature extraction is executed on the overall image.

#### 3.3.1 Working of LBP (original)

LBP is essentially a structure based descriptor which inscribes neighbourhood primitive right into binary string. (Timo Ojala et al., 2002). The original LBP operator services a  $3 \times 3$  mask dimension. The  $3 \times 3$  mask dimension consists of 9 pixels. The centre pixel will be utilised as a threshold to transform the surrounding pixels (the various other 8 pixels) right into binary numbers. If the bordering pixel worth is larger than the facility pixel worth, then it is appointed to 1, otherwise it is appointed to 0. After that, the neighbourhood's pixel little bits are concatenated to a binary code to form a byte worth standing for the centre pixel. Number 3.8 shows an instance of LBP conversion.

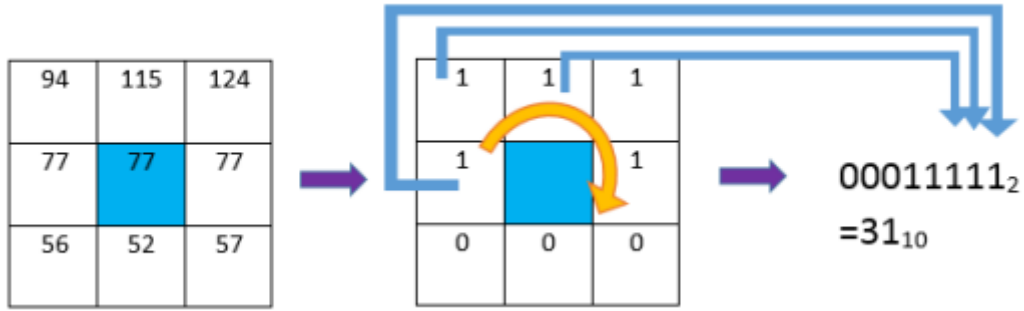


Figure 3.8 LBP conversion

(3.1)

$$LBP = \sum_0^7 f(P_n - P_c) \cdot 2^n$$

where  $P_c$  is the centre pixel and  $P_n$  ( $n = 0, \dots, 7$ ) are 8 of its neighbouring pixels.

The beginning stage of the encoding system can be any of adjoining pixels however long the development of parallel string is following the request either in clockwise or anticlockwise turn. The thresholding capacity  $f(y)$  can be composed as follows

(3.2)

$$f(y) = \begin{cases} 0 & y < 0; \\ 1 & y \geq 0; \end{cases}$$

### 3.3.2 Working of LBP (Purposed)

The initial LBP driver consists of  $3 \times 3$  filter dimensions along with 9 pixels. As opposed to the round pattern, it appears a lot more rectangle-shaped in shape. The 9 pixels adjacent to one another ways every detail are going to be actually taken as testing factors even the non-essential particulars. It is actually even more influenced through jagged lighting fixtures health condition considering that the little filter size highlights tiny scale detail (Lee and also Li, 2007), also the shadow developed by non-uniform lights ailment. In our proposed technique, a much larger distance dimension,  $R$  is actually executed in LBP operator. In the paper of Md. Abdur Rahim et.al (2013), the equation of changing the distance measurements



has been actually launched. Nevertheless, the newspaper certainly not mention the result of modifying the distance size. In the suggested method, evaluation is performed on different span measurements in order to enhance the system and reduce the illumination result.

Through raising the distance measurements, the filter measurements will certainly be actually boosted. R signifies distance coming from the centre pixel, shows the viewpoint of the sampling factor relative to the facility pixel and also P signifies the number of testing aspects almost the circle needed to compare with the centre pixel. Given the neighbouring's symbols (P, R,) is actually implemented, the coordinates of the centre pixel ( $X_c, Y_c$ ) and the teams up of the P neighbours ( $X_p, Y_p$ ) on the edge of the cycle with distance R could be calculated with the sines as well as cosines. displayed in the formula (Md. Abdur Rahim et.al,2013):.

(3.3)

$$X_p = X_c + R \cos(\theta/P)$$

$$Y_p = Y_c + R \sin(\theta/P)$$

The span has been actually enhanced, a total of 8 sampling points are actually taken which resembles the authentic LBP operator. In the method, CLAHE is actually carried out on the grayscale input face graphics to boost the comparison. The contrast enhanced graphics stay as grayscale pictures. The proposed LBP driver draws out the grayscale components from the contrast improved grayscale pictures which requires merely 8 bit estimation. After that, the pixels at the testing factors will definitely be actually encoded as 8 little bit binary strings similarly as an authentic LBP driver inscribing process. Improved LBP along with span dimension two, do far better contrasted to initial LBP as well as have much more steady acknowledgment rate contrasted to other span sizes. Boosted LBP with span dimension 2 will certainly be used as a recommended method. The suggested LBP operators are going to be additional detailed in Phase 4 (result and discussion).

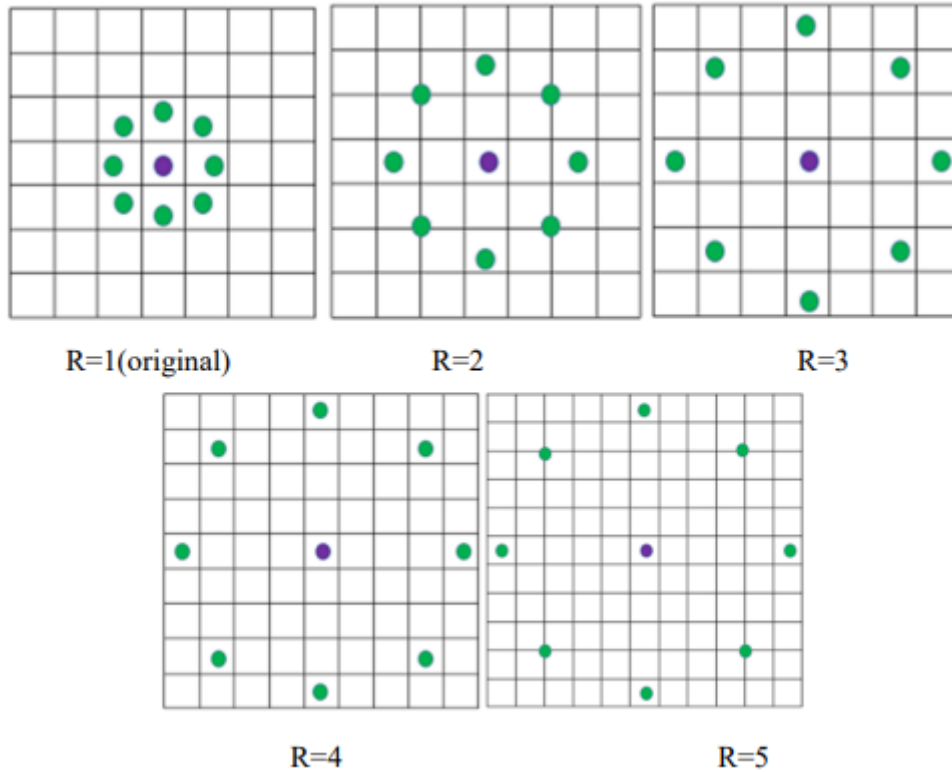


Figure 3.9 LBP (with Different Radius Sizes)

Basically, the increasing in the dimension of the distance suggests extending the circular pattern of LBP outwardly. The environment-friendly spots within the blocks show the sampling pixels to become encrypted into binary strands. For the sampling pixel situated in between the blocks, it signifies the average pixel market value is actually computed from the adjacent pixels (angled).

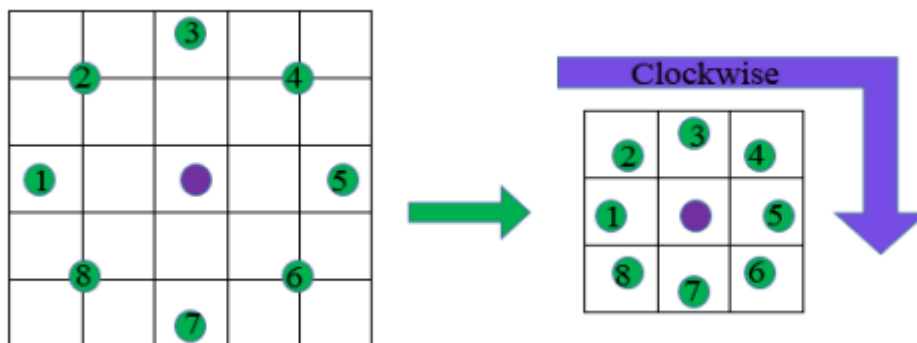


Figure 3.10 LBP (with Radius 2)

The feature angle of the photo is constructed after the Nearby Binary Norm of every pixel is figured out. The pie chart of the attribute angle picture is actually figured out in order to be classified by range classifier. It reduces spatial information considering that pie chart

depiction certainly does not include spatially relevant information yet merely distinct details. (Gonzalez, R. C., & Woods, 2008). In order to beat this concern, the feature vector graphic is actually after that arranged right into blocks. A pie chart is actually designed in each location specifically. Every bin in a pie chart stands for a pattern and also includes the frequency of its own look in the region. The attribute vector of the entire picture is then designed through coupling the local histograms in the sequence to one pie chart. (Md. Abdur Rahim et al., 2013). This pie chart stays its own local spatial info as well as embodies the identification of singular graphics which is actually at that point categorised to carry out the recognition.

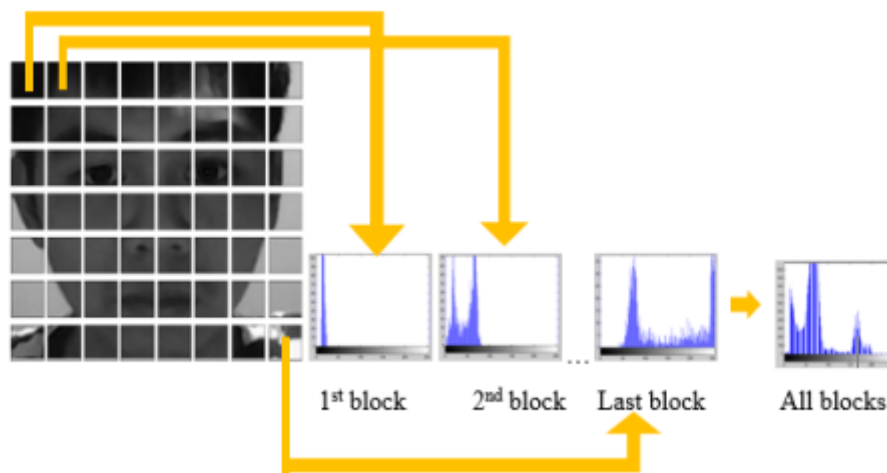


Figure 3.11 Histogram (of Image Blocks)

### 3.3.3 Working Principle of PCA

In this approach, PCA face recognition is examined, since it is among the most well-known face recognition techniques that was suggested and employed by the earlier researchers. PCA's accuracy is calculated to determine its accuracy in comparison to the more accurate LBP. PCA involves a number of steps that will be briefly detailed in the following paragraphs. For PCA it is important to consider the image's scale size, length ( $M$ ) and the size ( $M$ ) are not as significant. This is due to the fact that PCA typically deals with the total number of images, rather than  $M$ . But, the same dimensions of the test image and the training image is required to ensure a smooth PCA calculation. The same length and height of the image are taken into consideration in the equation below to illustrate. In the case of a training set comprising  $N$  images of dimensions  $M \times M$  The initial step in PCA involves converting two-dimensional vectors into a single dimensional vector. The vector that is one dimensional

can be a column vector, or a row vector. This is how the conversion of column vectors is performed. Each facial image that has an X-shaped matrix, the notation of  $Mx$  is converted to column vector  $G_i$  with dimensions  $M \times 1$ . There is a total of  $N$  facial pictures, each face is represented in columns  $G_1, G_2$  and  $G_3 \dots$  and the  $G_N$ . The feature vector for each face is stored within the column vector. Face matrix with reduced dimension is created by concatenating each column vector.

PCA is explained by using the equation in the following steps :

Step1: Preparing the data,

(3.4)

$$\begin{array}{ccccccc}
 & \Gamma_1 & \Gamma_2 & \Gamma_3 & & \Gamma_N & & \text{Dimension reduced matrix} \\
 & & & & & & & \Gamma_1 & \Gamma_2 & & \Gamma_N \\
 \begin{bmatrix} a_{11} \\ a_{12} \\ a_{13} \\ \vdots \\ a_{M^2} \end{bmatrix} & \begin{bmatrix} a_{11} \\ a_{12} \\ a_{13} \\ \vdots \\ a_{M^2} \end{bmatrix} & \begin{bmatrix} a_{11} \\ a_{12} \\ a_{13} \\ \vdots \\ a_{M^2} \end{bmatrix} & \dots & \begin{bmatrix} a_{11} \\ a_{12} \\ a_{13} \\ \vdots \\ a_{M^2} \end{bmatrix} & = & \begin{bmatrix} a_{11} & a_{12} & \dots & a_{1N} \\ a_{21} & a_{22} & \dots & a_{2N} \\ a_{31} & a_{32} & \dots & a_{3N} \\ \vdots & \vdots & \vdots & \vdots \\ a_{M^2 1} & a_{M^2 2} & \dots & a_{M^2 N} \end{bmatrix}
 \end{array}$$

Step 2: Find the mean/average face face vector.

Next step is to calculate an average vector of the face, which is also referred to as the mean. The mean is calculated row by row in between those vectors in the columns. The equation for mean face can be seen below.

(3.5)

$$\varphi = \frac{1}{N} \sum_{i=1}^N \Gamma_i$$

Mean face,  $\varphi$

(3.6)

$$= \begin{bmatrix} \frac{a_{11} + a_{12} + \dots + a_{1N}}{N} \\ \frac{a_{21} + a_{22} + \dots + a_{2N}}{N} \\ \vdots \end{bmatrix}$$

Step3: The mean/average face vector should be subtracted

From each column vector, the mean face is subtracted, so that we can ensure the image data is centred at the origin.

(3.7)

$$\Phi_i = \Gamma_i - \varphi \quad i=1,2,\dots,N$$

(3.8)

$$\begin{array}{c} \text{Dimension reduced matrix} \\ \left[ \begin{array}{cccc} a_{11} & a_{12} & \dots & a_{1N} \\ a_{21} & a_{22} & \dots & a_{2N} \\ a_{31} & a_{23} & \dots & a_{3N} \\ \vdots & \vdots & \ddots & \vdots \\ a_{M^2 1} & a_{M^2 2} & \dots & a_{M^2 N} \end{array} \right] \end{array} - \begin{array}{c} \text{Mean face, } \varphi \\ \left[ \begin{array}{c} \frac{a_{11} + a_{12} + \dots + a_{1N}}{N} \\ \frac{a_{21} + a_{22} + \dots + a_{2N}}{N} \\ \vdots \end{array} \right] \end{array}$$

matrix A,  $\Phi$

$$= \left[ \begin{array}{cccc} b_{11} & b_{12} & \dots & b_{1N} \\ b_{21} & b_{22} & \dots & b_{2N} \\ b_{31} & b_{23} & \dots & b_{3N} \\ \vdots & \vdots & \ddots & \vdots \\ b_{M^2 1} & b_{M^2 2} & \dots & b_{M^2 N} \end{array} \right]$$

Step 4: Calculate covariance matrix

(3.9)

$$C = \frac{1}{N} \sum_{i=1}^N \Phi_i \Phi_i^T = AA^T, (M^2 \times M^2)$$

$$A = [\Phi_1 \Phi_2 \dots \Phi_N], (M^2 \times N)$$

In which A may be the matrix manufactured from the concatenation of the line vectors after removing the skin that is facial. The purpose of the covariance matrix to be constructed is always to compute the eigenvectors and eigenvalues. However, AA<sup>T</sup> have dimension M2 ×

$M^2$  which is incredibly large to be determined.  $AA^T$ , and  $ATA$  have the exact same eigenvalues,  $\lambda$  and their eigenvectors could be related as  $u_i = Av_i$ . Hence  $ATA$  which have dimension  $N \times N$  is determined in the place of  $AA^T$  because  $N \ll M$ , less computational time is required.

Step 5: Calculating the eigenvalues and eigenvectors.

(3.10)

$$u_i = Av_i \quad i=1,2,\dots,N-1$$

$u_i$  will be the eigenvector of  $AA^T$  whereas  $v_i$  was eigenvector of  $ATA$ . Eigenvalues of  $ATA$ , were computed and arranged. Eigenvalues not as much as 1 are eradicated therefore the true wide range of non-zero eigenvectors may be significantly less than  $(N-1)$ . (Kalyan Sourav Dash, 2014). The eigenvectors of  $AA^T$ ,  $U = [u_1 \dots u_{N-1}]$  is named Eigen face. Eigen face is the ideal ingredient for submission of facial image.

Step 6: facial image Projection to Eigen face.

(3.11)

$$\Omega_i = U^T(\Gamma_i - \varphi) \quad i=1,2,\dots,N-1$$

The image that is face projected from the Eigen face by using the formula to search for the projected image  $\Omega$ .  $\Gamma_i - \varphi$  may be the vector that will be concentrated that the face that is mean eliminated.

Strategies 1 to 6 are acclimatised to teach the training graphics set. For the examination image only move 1, 2, 3 and 6 is. Step and 5 tend to be perhaps not necessary for test image due to the fact Eigenface is important just to calculate the moment while training. The distance that will be euclidean then used as length classifier to discover the quickest distance amongst the estimated image and estimated test image for identification.

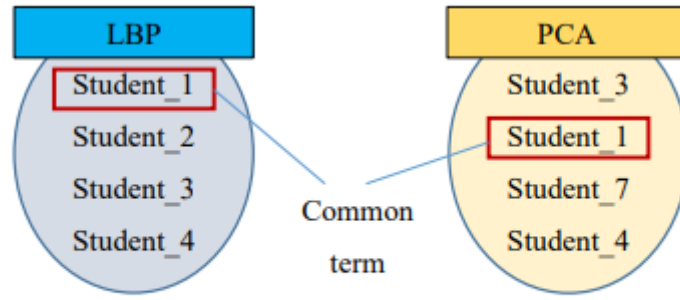
### 3.3.4 Feature Classification

Chi-square fact is used just like a dissimilarity assessment for LBP to discover the quickest distance between tuition graphics while the assessment picture. Having said that, Euclidean length is utilised to compute the quickest distance between trained and test image after PCA feature extraction. Both classifiers, Chi-square statistics and distance that is euclidean discover the nearest or nearest feasible tuition image to your tests image for face recognition. But, the nearest lead may well not be genuine. Therefore, an algorithm to mix boosted LBP and PCA is actually applied to be able to improve the precision associated with the system.

### 3.3.5 Face Recognition and Subjective Selection Algorithm

The feature classification that has been performed in the previous parts provides the result that is closest however total. The false recognition rate, an algorithm to combine enhanced LBP and PCA, is designed in this proposed approach in order to increase the accuracy and suppress.

The best five results are obtained from enhanced LBP and PCA in this proposed approach. Which means that five individuals that have the closest range according to the feedback picture can be determined. LBP and PCA are two various formulas which may have a different sort of working concept. Ergo, LBP and PCA will not have exactly the same five people identified. So that you can ensure the program power to suppress the bogus acceptance, a person is best categorised as recognized if and simply she is the first common individual that is identified by both LBP and PCA if he or. From part 2, LBP reveals larger reliability when compared with PCA. Thus, LBP was created to possess larger consideration when compared to PCA. This really is revealed in Figure 3.12, Student\_1 is actually known in the place of Student\_3 because LBP try prioritised. The first common individual is selected from PCA with respect to LBP and classified as recognized as a result. If there's no common term between LBP and PCA then a system will not recognize any subject matter. This subjective choice formula is designed to feel automated for the system.



The input image will be recognized as Student\_1.

Figure 3.12 Subjective Selection Algorithm



# Chapter 4

## Performance Analysis

### 4.1 Result

Contained in this proposed method, a face recognition attendance program with a user-friendly screen is created simply by using MATLAB GUI(Graphic graphical user interface). Several keys were created when you look at the screen, each provides function that is specific for sample, beginning switch is actually to initialise the camera and also to play face identification immediately according to the face area recognized, register option enables enrolment or registrations of children and modify option try to train the newest pictures that have actually come signed up in the database. Finally, browse key and recognize switch would be to browse facial images from picked databases and identify the picked graphics to check the functionality associated with the program correspondingly.

Contained in the right parts, increased LBP with radius two are chosen and utilised as proposed formula. The testing of selecting the distance size shall be further explained in the topic.



Figure 4.1 main screen (GUI Interface)

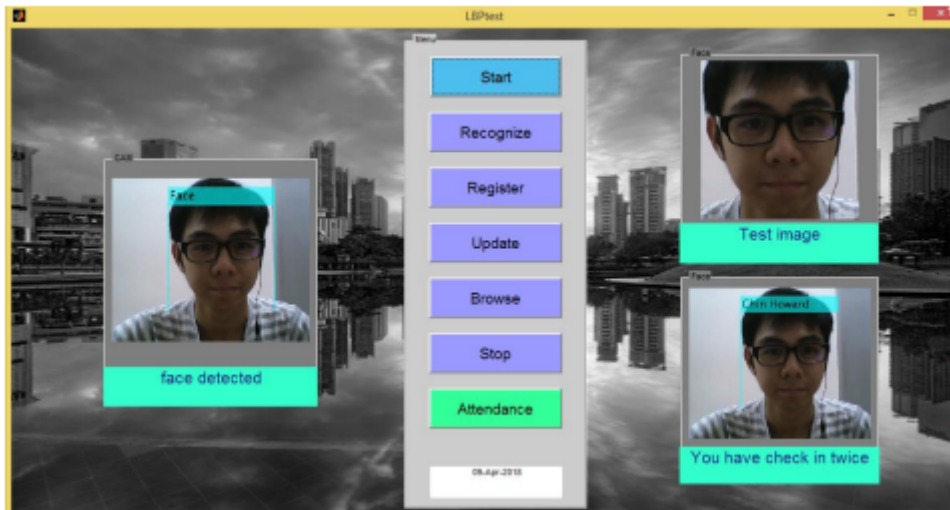


Figure 4.2 Automated Face Recognition (In Real Time)

Figure 4.2 shows the start button is pressed, the process is automated. The face area graphics is seized through the video tracking framework plus the face acceptance is performed.



Figure 4.3 Face Recognition and Image Browsing

Figure 4.3 shows scanning of this image additionally the operation of this face acceptance.

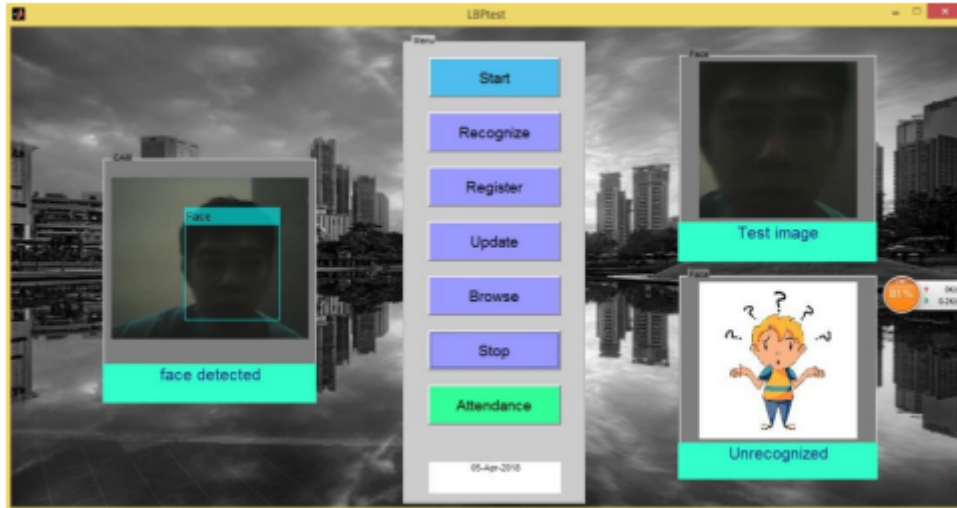


Figure 4.4 Detecting false user

Figure 4.4 shows selection that is subjective is made to stop bogus identification when the camera light is not yet ready.

	A	B	C
1	Name	3-Apr-18	
2	Chng Shu Fen		
3	Chan Wei Jia	1	
4	Cheng Michelle		
5	Chew Gaik Cheng		
6	Chin Eleen		
7	Chin Howard	1	
8	ChowCheeTheng		
9	Chua Jia Ling		
10	Chua Yu Shuang		
11	Chum Yong Qi		
12	Cindy Yang		
13	Dr Yeap		
14	Dr nisar		
15	Foong Suk Yi		
16	Kiew Guilbin	1	
17	Kong Jye Yng		
18	Lee pey Yen		
19	Leong Wei Xin		
20	Lim Kah Weng	1	
21	Lim Siew Yong		
22	Loh Pui Yan		
23	Ng Li Yun		

Figure 4.5 Stored Attendance

In Table 4.1. Performance is evaluated by using subjective evaluation.

## 4.2 Discussion

This suggested method gives a strategy to carry out face awareness for trainee presence bodies, which is based upon the structure located attributes of facial images. Image recognition is actually the id of a person by contrasting his/her real-time recorded image along with stored photos in the database of that individual. Thereby, instruction set must be chosen based upon the latest appeal of a specific apart from taking essential variables for instance lighting into factor.

The suggested method is actually being educated as well as assessed on various datasets. Yale image data bank which contains one hundred as well as sixty-five photos of fifteen people with multiple disorders is actually implemented. Having said that, this database features merely grayscale pictures. As a result, our personal database with shaded images which is further grouped into top quality sets and also the low quality collection, as photos are actually various in their high quality: some images are actually blurred while some are actually clearer. The data of each record set has been gone over in the earlier phase.

Viola-Jones object discovery framework is actually applied within this method to discover and localise the face provided a face graphic or supplied a video clip framework. From the detected face, an algorithm that can easily remove the vital features to carry out skin awareness is designed.

Some pre-processing measures are actually carried out on the input face image before the features are actually drawn out. Median filtering system is actually made use of given that it is able to protect the upper hands of the graphic while removing the picture sounds. The facial photo will definitely be actually sized to an ideal measurements for normalising function as well as transformed to grayscale image if it is certainly not a grayscale image due to the fact that CLAHE and LBP driver service a grayscale graphic.

Some of the variables that are actually usually a stumbling stone for image recognition functionality are actually uneven lighting fixtures problems. As a result, lots of options have actually been administered in this proposed strategy so as to minimise the non-uniform

illumination condition. Before function extraction takes place, pre-processing is conducted on the chopped face photo (ROI) to lessen the illumination complication.

In the previous phases, Comparison Limited Adaptive Pie Chart Equalisation (CLAHE) is actually suggested in pre-processing to strengthen the graphic contrast and also reduce the enlightenment impact. Many of the previous researchers have implemented pie chart equalisation in their approach. In order to study the difference between the CLAHE as well as histogram equalisation, contrast is actually created and charted in table 4.2.

For the comparison, our own data bank and Yale skin data source are utilised. From the end result arranged, CLAHE seems to do much better reviewing histogram equalisation. From the image of our very own data source, the left palm edge of the original picture looks darker compared to the right hand edge. Pie chart equalisation certainly does not improve the contrast effectively, which creates the picture remains darker at night side by hand. Unlike histogram equalisation, CLAHE seems to enhance the contrast more evenly throughout the whole face picture. This could possibly assist to reduce unequal illumination. In the Yale face data source, CLAHE stops some regions that seem washed out in addition to decrease over improvement of sound. Besides, CLAHE presents a clear side and curve matched up to pie chart equalisation. Additionally, through describing the pie charts, the pixel is actually widely stretched over the magnitude range centre 0 to 255 for CLAHE whereas for pie chart equalisation the pixel period coming from 0 to only about 200 over the intensity range axis. It may be actually pointed out that the comparison of the photo is actually extra uniformly strengthened throughout the graphic through CLAHE contrasted to histogram equalisation located on the result secured.

After pre-processing, a useful component is extracted by utilising enhanced LBP (nearby Binary design). Unlike the authentic LBP driver, an enriched LBP operator consisting of different radius measurements is suggested as discussed in previous sections. This different radius measurement improved LBP operator is actually much less influenced through uneven lights matched up to authentic LBP drivers. The extracted attribute for different spans is presented and arranged in Table 4.3. The results present when the radius is enhanced, the images are smoothen.

For analysis function, Yale image database along with different ailments is used for contrast. The normal face picture of each person in Yale face data bank is actually trained as well as the face photos along with varying problems are actually input as the examination image. The awareness fee along with the different radius dimension of LBP driver is figured out and also arranged in Table 4.4.

From the Table 4.4, when the span size boost, simply facial images with ailments ideal light, left behind light as well as centre lighting are actually impacted whereas for the other ailments the acknowledgment rate continues to be constant. This shows that through boosting the distance, jagged lights impact can be reduced without misshaping the particular of the picture. From Body 4.6, the line graph presents that the reliability of different light problems boost when span boosts. Furthermore, it presents that among the different lights problems, the system operates the greatest in left lightweight disorder adhered to through facility light condition and the final corrects light condition.

The recognition rate of LBP drivers along with different distances is after that calculated by utilising our personal data bank. Having said that, LBP drivers along with various distances certainly do not give notable outcomes because there is actually no vital illumination problem that exists in the images of our personal data source. For this reason, the pixels of good quality images of our very own data bank are actually tweaked to generate the lighting impacts so as to find out the effect of different size LBP drivers. Character 4.7 programs health conditions I, II, III and also IV which emphasise different lighting effects.

Through boosting the radius size, the detail information is simplified and also the contour or design of the face is actually emphasised. This illustrates that a number of the ineffective or even redundant details are actually removed as well as even more emphasis is on the crucial information for recognition.

As it is verified any type of improving radius LBP conducts far better compared to original by lessening illumination result, uniformity of the system is likewise emphasised apart from accuracy of the system. Coming from the table 4.5, although span three and radius 4 possess greater common reliability reviewed to radius 2, radius two is more constant toward different problems. As the disorders I, II, III as well as IV are self-simulated problems, in real time skin acknowledgment, the lighting condition is erratic. Radius two provides a regular end

result which is actually (94.12 %) in ailment I, health condition III and also health condition IV is actually opted for and used as a proposal algorithm.

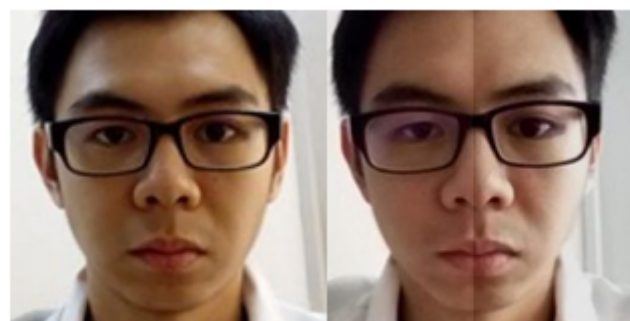
The fact that the radius could not be actually the much larger the much better due to the fact that larger radius relative to much larger filter dimension emphasises corresponding info to small range information but at the same time it reduces discriminative information. The discriminative relevant information is essential, for instance to identify trainees with glasses free of charge ailment.



Figure 4.6 Student with and without glasses.

It shows that the enriched LBP operator with boosted radius carries out far better matched up to authentic LBP in case of lighting result reduction. The radius measurements of the LBP operator has to be prudently chosen in order to lower the lighting result without giving up a lot of the awareness rate.

From the end result, disorder II appears to have actually lower precision contrasted to others. This is because of the illumination effect of the training image. The training images have its own remaining side reasonably darker contrasted to its appropriate edge which is directly opposite of the test graphic (problem II).



**Training Image**

**Test Image**

**(Condition II)**

Figure 4.7 Training VS Testing Image

Coming from the outcome of popped the question LBP in table 4.6, data bank along with high quality colour images, attains the best reliability (one hundred %) either one photo or two graphics every individual is qualified whereas data source along with poor quality different colours graphics have common precision of (86.54 %) when a single picture per individual is actually trained and also normal reliability of (88.46 %) when 2 graphics per individual are educated. It could be stated that the method works better along with good quality images, and crappy photos could degrade the efficiency of the formula. Bad graphics were actually recorded by using Laptop cam. The crappy photos may consist of the pretty darker photos, blur photos or even possessing a lot of undesirable sound. In tarnished pictures, the image is tarnished out. Unnecessary sound could be reduced by administering a typical filtering system, but for those tarnished pictures there are no appropriate ways to eliminate it.

### **4.3 Comparison Between PCA and LBP**

Within this proposed method, PCA image identification is actually executed in order to determine the distinctions relative to LBP by using the very same database. From the end result acquired in Table 4.7, allegedly PCA ought to have functioned a lot better with premium pictures which is similar to enhanced LBP. However, it provides slightly lesser reliability in recognition in high quality pictures matched up to poor quality images. This is because of various size of the database are actually made use of in the designed approach. For excellent quality graphics there are actually only seventeen students in the data source, whereas poor quality graphics entail twenty-six trainees, which is actually just about ten students more than excellent quality images. It is the PCA's nature to become much more affected due to the size of the database compared to LBP. Consequently, the much larger the dimension of the data bank which implies the extra trainees feature in the data source, the lower the identification price of PCA. Additionally, the enriched LBP is compared with the PCA face acknowledgment, by using the exact same pre-processing technique and very same photo enhancement approach. From the Table 4.6 as well as Table 4.7, the average precision of PCA is actually lower matched up to the LBP in every the data sources, our personal data



bank along with high and low high quality pictures and also Yale skin data source is actually made use of respectively. Hence, it may be stated that improved LBP functions better contrasted to the PCA skin acknowledgment provided the very same dataset is actually used for training as well as testing. A computerised subjective option formula entail both enhanced LBP and PCA is designed for face recognition. The greatest come from boosted LBP and PCA correspondingly are actually compared to obtain a common result. This common end result are going to be identified as identified person. By accomplishing this, the system ends up being a lot more trustworthy, stable and steady not only in different expression but also in numerous lighting condition. This is because two algorithms can be used for generalisation, one work as a mention of someone else. Especially within the digital camera stage that is initialising your camera is actually begun quicker than the light supply, a dark image being caught. But the image that is dark and meaningless is respected. The blend of enhanced LBP and PCA is able to prevent the meaningless image from being recognized. As a whole, reliability with and without a mix of LBP and PCA is tabulated in Table 4.8. It implies that with high top quality graphics, make no change with or with no formula. But, for poor quality images, it shows significant enhancement in the accuracy of making use of formula.

#### 4.4 Comparing with various Researches

Paper/difference	Automated Class Attendance System based on face recognition using PCA Algorithm(D. Nithya, 2015)	Proposed algorithm	Automated Attendance Management System Based On Face Recognition Algorithms(Shireesha Chintalapati, M.V. Raghunadh ,2013)
Noise removal	None	Median filtering	None
Image enhancement	None	Contrast Limited Adaptive Histogram Equalization	Histogram equalization
Featured based	PCA	Enhanced LBP and PCA	PCA/LDA/LBPH

Table 4.1 Comparing with various Researches

Database	Own database	Own database and Yale face database	NITW-database
Attendance	Write attendance to Excel file	Subjective selection by enhanced LBP and PCA, and write attendace to Excel file	Write attendance to Excel file

From Table 4.10, the recommended formula was compared with face recognition student attendance programs suggested by past experts. The skills utilised by the previous researchers to undertake the photographs tried compared contained in this proposed method. In terms of image improvement, the report published in 2013 made use of histogram equalisation to enhance the graphics comparison, while other papers failed to incorporate any strategy to improve picture comparison. In this suggested algorithm, CLAHE is utilised to enhance the graphics distinction. Histogram equalisation, that will be usually used in x-ray programs, provides bone construction a sharper see. However, histogram equalisation will have a tendency to trigger over improvement for some associated with parts and lead it to be beaten up while other regions commonly improved correctly. Ergo, CLAHE is actually applied instead of histogram equalisation to avoid over enlargement and help the distinction more evenly through the entire graphics. The essential difference between CLAHE and histogram equalisation was tabulated in the outcome of the part that is previous.

The analysis, posted when you look at the 2015 used PCA for feature extraction year. As the report released for the 12 months 2013 utilised several function removal algorithms. These function removal algorithms are PCA, LDA and LBPH. Contained in this proposed method, apart from increased LBP algorithm, PCA is computed in order to make evaluation and also to understand their home and gratification correspondingly. During the report of season 2013, each one for the feature removal strategies PCA, LDA and LBPH

is employed everytime. In this approach that is proposed, enhanced LBP and PCA are both utilised as a combination to make certain constant results.

The past researcher who published the paper in 2015 utilised their databases of images in study. The paper posted in 2013 utilised a graphic database of 80 individuals (NITW-database) with 20 pictures of each individual, while the paper uses multiple image databases, including Yale face database with various lighting and phrases for training and testing. In reality, Yale face database enables the research of performance of the proposed algorithm in uneven lighting and variety of background, therefore our very own database with colour images is additionally used in real time application to execute face recognition. the distance that is closest between test image and train image. Hence, the quality of pictures plays an important part in the performance of face recognition.

Blurred images due to movement tend to produce the after image which can degrade the performance. Also, the test pictures captured in acutely bright or condition that is dark degrade the performance as well because it reveals a big variation with the train image supplied train image is captured in moderate lighting. Each one of these facets need to be studied into account when selecting images for testing and training purposes. It will always be easier to use more images for training, so that the total result obtained provides a much better generalisation and in consequence provides better performance.

In addition, both documents did perhaps not use a way of elimination of image sound. In the proposed algorithm, Median filtering is used to filter out noises in the image. If the noises regarding the pictures are perhaps not removed, the algorithm might recognize the noises as elements of the features that are crucial. These will probably affect the performance of the overall algorithm.

Lastly, both papers write facel attendance to Excel file as post-processing. In the proposed approach, a subjective collection formula is made to have a usual result of better LBP and PCA. This typical result from enhanced LBP and PCA are classified as respected individuals and written to succeed documents. This formula is in a position to minimise false acceptance, especially in camera initialising phase, whenever camera light isn't ready to work. Ergo, the recommended algorithm helps to make the program more dependable by providing the constant outcome.

## 4.5 Comparing To Luxand Face Recognition Application

Algorithm	Individual	Accuracy	Training time	Testing time
Proposed algorithm	5	100 %	30 to 40 seconds	Average 10 seconds
Luxand Face Recognition	5	100 %	Almost instantaneous	Almost instantaneous

Table 4.2 Comparing To Luxand Face Recognition Application

Luxand Face Recognition (Luxand.com, 2018) is definitely a software that is used to execute real-time face recognition. Luxand Face Recognition demonstration version is set up in the laptop. This is to match up against the proposed algorithm simply by using the camera device that is the same. Five individuals contained in this approach proposed Luxand Face identification and proposed formula to acknowledge their particular face to make evaluations.

From Table 4.11, both of the algorithms have the capacity to recognize all the 5 people. The recommended formula is to revise the database, whenever an individual is newly registered and put into the database. The waiting opportunity is actually about 30 moments for each and every knowledge. On the other hand, Luxand Face Recognition app permits the brand-new people to go through the face recognized from inside the videos framework to incorporate their own term for enrollment. This technique lasts about 10 more seconds.

In addition to that, Luxand Face Recognition apps need practically the recognition time that is instantaneous. Contrary to Luxand Face Recognition, the suggested formula has a popularity opportunity, which is mostly about 10 mere seconds. When it comes to a video that is a real-time caught facial image, in fact it is not able to feel acknowledged within 15 mere seconds is likely to be labelled as unrecognised. But, the five specific discussions were all able to be respected within 15 mere seconds. Simply speaking, it can be asserted that the Luxand Face Recognition app has shorter classes testing and energy time when compared to the recommended formula.

## 4.6 Algorithms Weakness

The proposed algorithm may simply team up with a solitary face. Multiple faces seeming in the exact same picture triggers each of them to become tiny. Little face location provides imprecise features, this will decrease the efficiency of the system. Whenever even more than a face is identified, the system will certainly not execute the recognition.

The LBP formula is actually strongly sensitive to photo top quality as well as extremely influenced by the tarnished image. LBP is actually the texture based descriptor which draws out the local area grayscale components through conducting component extraction on a little area throughout the entire photo. For this reason, test graphics as well as learning images need to coincide with high quality and grabbed due to the exact same unit to have higher reliability.

The notebook built in cam is actually the default device in this suggested method to capture photos. The webcam and also lighting fixtures resource of the laptop pc possess reduced functionality which cause the caught images to appear to be darker and also tarnished. This results in the system to work only the greatest if the test image and also the learning picture are both caught at the very same area under approximately the very same illumination.

False recognition occurs when the facial image is blurred. The tarnished picture triggered by the after picture made by action will certainly deteriorate the functionality. The image function removed from the blurred image would certainly be actually absolutely various compared to the learn image leading to incorrect acknowledgment. Furthermore,

if a specific person uses makeup in the photo for face awareness, the crucial features will certainly be actually covered. Face regions need to certainly not be actually covered next to hair, beard or even any accessories to make sure much better execution. A girl supplies a face picture with her face covered through hair, it creates incorrect recognition to develop if the girl ties her hair. This is actually considering that everything dealing with the face region will certainly be actually assumed as a face component. This creates a pretty sizable difference in between test image as well as train image.

Different degrees of illumination or lighting could be a tough complication for skin awareness. For this reason, constraints of the proposed protocol are examined as well as

evaluation is actually carried out through changing the pixels of excellent quality images in order to adjust the illumination of the facial photos. The acknowledgment price of facial pictures under different levels of illumination is actually calculated and also arranged.

Figure 4.12 shows graphics with various magnitudes by including different constants to pixels. The efficiency of the planned formula is actually tabulated in Table 4.9.

From the table 4.9, the suggested formula functionality is the best when the intensity boost through a constant at the range of 25 and fifty. Additional enhancing or reducing the magnitude degree away from this variety will lead to the recognition fee to go down to (94.12 %). As a result, it could be stated that the system works much better in a pretty brighter image after that a darker image.

## **4.7 Problems and Solutions**

One of the problems in real-time face acknowledgment is the difficulty to get enough and ideal images for training and testing purpose. It is difficult to acquire in real-time databases with a range of variables, and it is difficult to obtain publicly offered databases. Yale face database is one of the databases that could be downloaded by the public. Yale face database is adopted and utilised in this proposed technique. Nevertheless, Yale face database includes just grayscale images with no background. Hence, our own database includes colour images which are classified to high- quality images and low quality-images are likewise used.

It is extremely challenging to obtain an open source or the complimentary face recognition software application in order to make comparisons. In this proposed technique, Luxand FaceSDK window demonstration version software application is downloaded and carried out in the laptop computer. By utilising a laptop integrated in a webcam to acknowledge faces, the proposed algorithm and Luxand Face SDK demo were able to be compared.

From the Luxand Face acknowledgment site (Luxand.com, 2018), they discussed that the Face SDK is a high performance, multi-platform face recognition, recognition and facial feature detection option. For Luxand Face Recognition software, the self-learning AI makes it possible for video-based recognition and the enrolment can be done at any time as basic as

putting a name tag in a video, the system will recognize that subject in all past, present and future videos. As a video-based recognition software, it is believed to work much better than key-frame based recognition. The in-depth details of its working concept is unable to be obtained from their sites.

Viola-Jones algorithm can cause false face detection. This can be resolved by increasing the detection threshold (Mathworks.com, 2018). The limit indicates the variety of detections required to state a final detection around an item. By utilising MATLAB integrated in function, MergeThreshold, the detection limit can be adapted to minimise the false face detection.



## **CHAPTER 5**

### **CONCLUSIONS**

#### **5.1 Conclusion**

A face recognition based automated student attendance system is thoroughly described in this approach. The approach proposed is a method to identify the people by comparing their input image acquired from tracking movie frames with regards to train image. This recommended strategy is able to detect and localise faces from a feedback facial picture, that will be acquired through the recording video frame. Besides, a method is provided by it in the pre-processing phase to improve the image contrast and lessen the illumination result. Removal of functions from the facial image is carried out by using both LBP and PCA. The algorithm is built to combine LBP and PCA in a position to stabilise the system by giving results that are consistent. The accuracy of the suggested method is 100 percent for high-quality images, 92.31 per cent for low-quality images and 95.76 percent of Yale face database when two images per person tend to be trained.

Like a conclusion for evaluation, the extraction of facial features could possibly be difficult particularly in various illumination. In the pre-processing stage, Contrast Limited Adaptive Histogram Equalisation (CLAHE) is in a position to decrease the lighting impact. CLAHE performs better in comparison to histogram equalisation with regards to contrast enhancement. improved LBP with bigger radius dimensions specifically, radius dimensions two, perform better when compared with the original LBP operator, with less affliction with illumination and more consistent in comparison to other distance sizes.

## **5.2 limitations And Future Scope.**

The proposed method has certain limitations. The first is that the input image must be a frontal, straight single face image. In addition, the accuracy may decrease in the case of extreme lighting problems. Thirdly, false recognition could be a result if the image blurred. Additionally, LBP is textural based descriptor that extracts local characteristics. Thus, test images as well as the train image should be identical in quality and are recorded using the same camera to ensure high-quality accuracy. In addition, if a person wears makeup to identify their face, crucial features will be included.

In actual fact, a higher quality camera that has a higher-quality light source will be able to lessen the issue of illumination and be able to stop the possibility of capturing blurred images. This is the proposed method. The built-in camera on laptops is the default camera. But the lighting source of this laptop's camera can be extremely dim, which causes the system to become unstable. In the future it is recommended to use a higher quality camera as well as a superior lighting source could be utilised for superior outcomes. This could reduce the dependence to the lighting of an surroundings and, in particular, the areas to take test and training images. Additionally the face recognition system that has more faces than one facial image could be developed. This will increase the efficiency that the technology can provide. The test and the train image of this approach is closely related to one as well as extremely dependent on that is captured by the device. The device that captures the image needs to be identical for this method to be more effective. This means that other algorithms can be used in lieu of LBP for instance, an A.I (artificial intelligence) algorithm, which is used to do face recognition. CNN (Convolution Neural Network) , which has been an ongoing hot topic, is a machine deep-learning algorithm that can identify faces without relying on a specific train image with a large database. It is, however, CNN requires an extremely large database to improve its efficiency or have smaller class sizes to be able to provide the highest performance.

At the time of pre-processing the algorithm like affine transformation could be used to align the face image with the coordinates that are between the eyes. This could be helpful, particularly with the PCA algorithm that uses test images to create images to do face recognition.

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