IJIRCCE

e-ISSN: 2320-9801 | p-ISSN: 2320-9798

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING

Volume 10, Issue 7, July 2022

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 8.165

9940 572 462 | 6381 907 438 | ijircce@gmail.com | www.ijircce.com

International Journal of Innovative Research in Computer and Communication Engineering

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.165

|| Volume 10, Issue 7, July 2022 ||

| DOI: 10.15680/IJIRCCE.2022.1007021 |

Automated Attendance System Using Face Recognition

Dr. Sheshappa S.N , Gopal Gaur , Ritesh kumar , Shivanshu Sharma , Shubham Shree Agrawal

Associate Professor, Department of Information Science and Engineering, Sir M. Visvesvaraya Institute of Technology, Bengaluru , Karnataka, India

Student, Department of Information Science and Engineering, Sir M. Visvesvaraya Institute of Technology, Bengaluru , Karnataka, India

ABSTRACT:. Face identification has been considered an interesting research domain in the past few years as it plays a major biometric authentication role in several applications including attendance management and access control systems. Attendance management systems are very important to all organization though they are complex and time-consuming for managing regular attendance log. There are many automated human identification techniques such as biometrics, RFID, eye tracking, voice recognition. Face is one of the most broadly used biometrics for human identity authentication. This paper presents a facial recognition attendance system based on deep learning convolutional neural networks. We utilize transfer learning by using three pre-trained convolutional neural networks and trained them on our data. The three networks showed very high performance in terms of high prediction accuracy and reasonable training time.

KEYWORDS: Machine Learning , Deep Learning , video module , OpenCV

I. INTRODUCTION

The main objective of this project is to develop face recognition based automated student attendance system. In order to achieve better performance, the test images and training images of this proposed approach are limited to frontal and upright facial images that consist of a single face only. The test images and training images have to be captured by using the same device to ensure no quality difference. In addition, the students have to register in the database to be recognized. The enrolment can be done on the spot through the user-friendly interface.

II. BACKGROUND

Face recognition is crucial in daily life in order to identify family, friends or someone we are familiar with. We might not perceive that several steps have actually taken in order to identify human faces. Human intelligence allows us to receive information and interpret the information in the recognition process. We receive information through the image projected into our eyes, by specifically retina in the form of light. Light is a form of electromagnetic waves which are radiated from a source onto an object and projected to human vision. Robinson-Riegler, G., & Robinson-Riegler, B. (2008) mentioned that after visual processing done by the human visual system, we actually classify shape, size, contour and the texture of the object in order to analyse the information. The analysed information will be compared to other representations of objects or face that exist in our memory to recognize. In fact, it is a hard challenge 2 to build an automated system to have the same capability as a human to recognize faces. However, we need large memory to recognize different faces, for example, in the Universities, there are a lot of students with different race and gender, it is impossible to remember every face of the individual without making mistakes. In order to overcome human limitations, computers with almost limitless memory, high processing speed and power are used in face recognition systems. The human face is a unique representation of individual identity. Thus, face recognition is defined as a biometric method in which identification of an individual is performed by comparing real-time capture image with stored images in the database of that person (Margaret Rouse, 2012). Nowadays, face recognition system is prevalent due to its simplicity and awesome performance.

For instance, airport protection systems and FBI use face recognition for criminal investigations by tracking suspects, missing children and drug activities (Robert Silk, 2017). Apart from that, Facebook which is a popular social networking website implement face recognition to allow the users to tag their friends in the photo for entertainment

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.165

|| Volume 10, Issue 7, July 2022 ||

| DOI: 10.15680/IJIRCCE.2022.1007021 |

purposes (Sidney Fussell, 2018). Furthermore, Intel Company allows the users to use face recognition to get access to their online account (Reichert, C., 2017). Apple allows the users tounlock their mobile phone, iPhone X by using face recognition (deAgonia, M., 2017). The work on face recognition began in 1960. Woody Bledsoe, Helen Chan Wolf and Charles Bisson had introduced a system which required the administrator to locate eyes, ears, nose and mouth from images. The distance and ratios between the located features and the common reference points are then calculated and compared. The studies are further enhanced by Goldstein, Harmon, and Lesk in 1970 by using other features such as hair colour and lip thickness to automate the recognition. In 1988, Kirby and Sirovich first suggested principle component analysis (PCA) to solve face recognition problem. Many studies on face recognition were then conducted continuously until today (Ashley DuVal, 2012).

III. THE PROBLEM STATEMENT

Traditional student attendance marking technique is often facing a lot of trouble. The face recognition student attendance system emphasizes its simplicity by eliminating classical student attendance marking technique such as calling student names or checking respective identification cards. There are not only disturbing the teaching process but also causes distraction for students during exam sessions. Apart from calling names, attendance sheet is passed around the classroom during the lecture sessions. The lecture class especially the class with a large number of students might find it difficult to have the attendance sheet being passed around the class. Thus, face recognition student attendance system is proposed in order to replace the manual signing of the presence of students which are burdensome and causes students get distracted in order to sign for their attendance. Furthermore, the face recognition based automated student attendance system able to overcome the problem of fraudulent approach and lecturers does not have to count the number of students several times to ensure the presence of the students. The paper proposed by Zhao, W et al. (2003) has listed the difficulties of facial identification. One of the difficulties of facial identification is the identification between known and unknown images. 2 3 In addition, paper proposed by Pooja G.R et al. (2010) found out that the training process for face recognition student attendance system is slow and time-consuming. In addition, the paper proposed by Priyanka Wagh et al. (2015) mentioned that different lighting and head poses are often the problems that could degrade the performance of face recognition based student attendance system. Hence, there is a need to develop a real time operating student attendance system which means the identification process must be done within defined time constraints to prevent omission. The extracted features from facial images which represent the identity of the students have to be consistent towards a change in background, illumination, pose and expression. High accuracy and fast computation time will be the evaluation points of the performance.

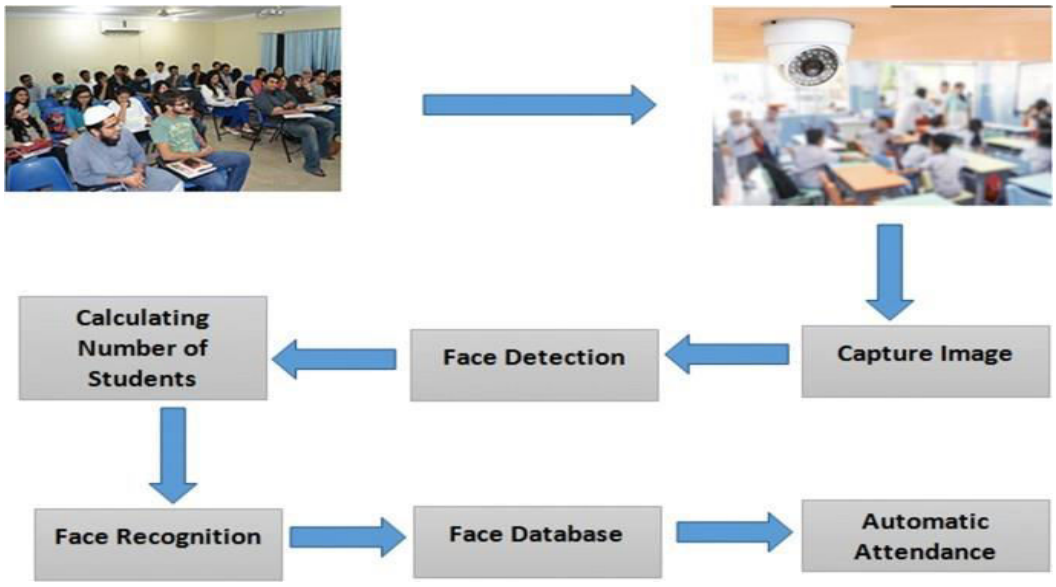


Figure1. Face Recognition System Workflow.

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.165

|| Volume 10, Issue 7, July 2022 ||

| DOI: 10.15680/IJIRCCE.2022.1007021 |

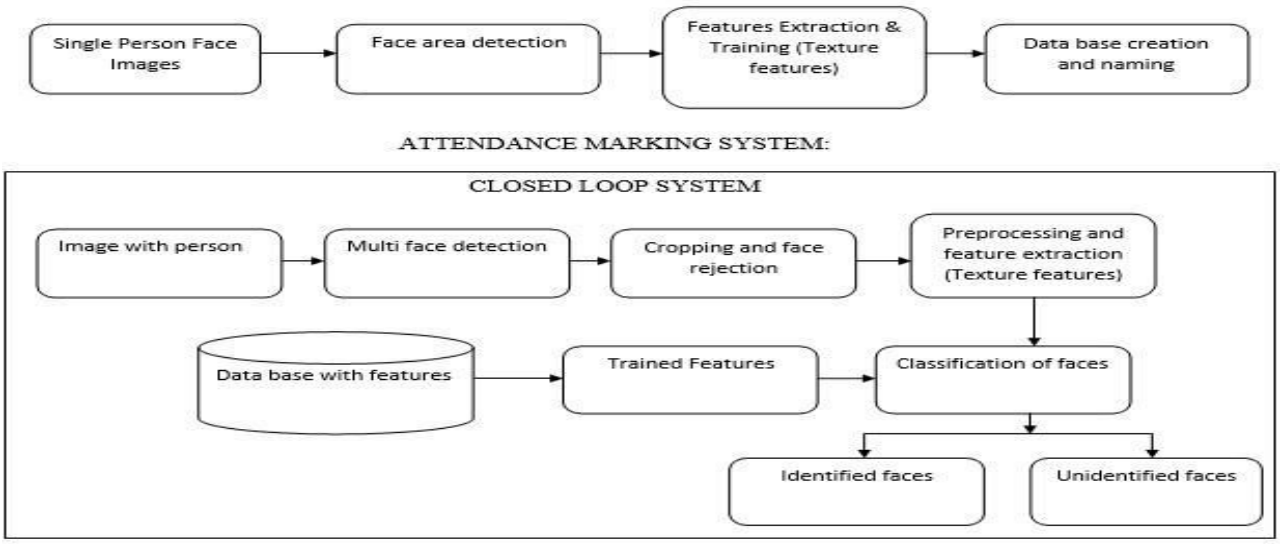


Figure2. Uniquely identifying the faces.

IV. PROPOSED WORKING PRINCIPLE

The approach performs face recognition based student attendance system. The methodology flow beginswith the capture of image by using simple and handy interface, followed by pre-processing of the capturedfacialimages,thenfeatureextractionfromthefacialimages,subjectiveselectionandlastlyclassificationof the facial images to be recognized. Both LBP and PCA feature extraction methods are studied in detailandcomputedinthisproposedapproachinordertomakecomparisons.LBPisenhancedinthisapproachto reduce the illumination effect. An algorithm to combine enhanced LBP and PCA is also designed forsubjective selection in order to increase the accuracy. The details of each stage will be discussed in thefollowing sections. The flow chart for the proposed system is categorized into two parts, first training ofimagesfollowed bytestingimages(recognizethe unknown input image).

Input Images

Although our own database should be used to design real time face recognition student attendance system,the databases that are provided by the previous researchers are also used to design the system moreeffectively, efficiently and for evaluation purposes. Yale face database is used as both training set andtesting set to evaluate the performance. Yale face database contains one hundred and sixty-five grayscaleimages of fifteen individuals. There are eleven images per individual; each image of the individual is indifferent condition. The conditions included centre-light, with glasses, happy, left-light, without glasses,normal, right-light, sad, sleepy, surprised and wink. These different variations provided by the database isableto ensurethesystem to beoperatedconsistentlyin varietyof situations and conditions.. Each student provided four images, two for training set and two for testing set. The imagescaptured by using laptop built in camera are categorized as low quality images, whereas mobile phonecamera captured images are categorized as high quality images. The high quality images consists ofseventeen students while low quality images consists of twenty-six students. The recognition rate of lowquality images and high quality images will be compared in Chapter 4 to draw a conclusion in term ofperformancebetween imagesets of different quality.

Figure3.1Sample ImagesinYale FaceDatabase

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.165

|| Volume 10, Issue 7, July 2022 ||

| DOI: 10.15680/IJIRCCE.2022.1007021 |

Limitations of the Images

The input image for the proposed approach has to be frontal, upright and only a single face. Although thesystem is designed to be able to recognize the student with glasses and without glasses, student shouldprovide both facial images with and without glasses to be trained to increase the accuracy to be recognizedwithoutglasses.The training image andtesting image shouldbe capturedby using thesamedevice toavoid quality difference.The students have to register in order to be recognized. The enrolmentcan bedoneon the spot throughthe user-friendlyinterface.

FACE DETECTION STEPS

Viola-Jones object detection framework will be used to detect the face from the video camera recordingframe. The working principle of Viola-Jones algorithm is mentioned in Chapter 2. The limitation of theViola-Jones framework is that the facial image has to be a frontal upright image, the face of the individualmustpoint towards thecamerain a video frame.

Pre-processing

Testing set and training set images are captured using a camera. There are unwanted noise and unevenlighting exists in the images. Therefore, several pre-processing steps are necessary before proceeding tofeatureextraction.Pre-processingstepsthatwouldbecarriedoutincludescalingofimage,medianfiltering, conversion of colour images to grayscale images and adaptive histogram equalization. The detailsofthesesteps would bediscussed in thelater sections.

Scaling of Image

Scaling of images is one of the frequent tasks in image processing. The size of the images has to becarefullymanipulatedtopreventlossof spatialinformation.(Gonzalez,R.C.,&Woods,2008),Inorderto perform face recognition, the size of the image has to be equalized. This has become crucial, especially inthe feature extractionprocess,the testimagesandtrainingimageshave tobe inthe same size anddimension to ensure the precise outcome. Thus, in this proposed approach test images and train images arestandardizeatsize250 ×250 pixels.

Median Filtering

Median filtering is a robust noise reduction method. It is widely used in various applications due to itscapability to remove unwanted noise as well as retaining useful detail in images. Since the colour imagescaptured by using a camera are RGB images, median filtering is done on three different channels of theimage. Figure 3.3 shows the image before and after noise removal by median filtering in three channels. Iftheinputimageisagrayscaleimage,thenthemedianfilteringcanbeperformeddirectlywithoutseparatingthechannels.

Figure3.2Median Filtering Doneon Three Channels

Conversion to Grey Scale Image

Camera captures color images, however the proposed contrast improvement method CLAHE can only beperformed on grayscale images. After improving the contrast, the illumination effect of the images able tobe reduced.LBPextractsthegrayscalefeatures from thecontrastimproved imagesas 8bittexturedescriptor (Ojala, T. et al., 2002).Therefore, color images have to be converted to grayscale images beforeproceeding to the later steps. By

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.165

|| Volume 10, Issue 7, July 2022 ||

| DOI: 10.15680/IJIRCCE.2022.1007021 |

converting color images to grayscale images, the complexity of thecomputationcan bereducedresultingin higherspeed of computation(Kananand Cottrell,

Figure3.4Conversion of Image to Gray scaleImage

Contrast Limited Adaptive Histogram Equalization

Histogramequalizationorhistogramstretchingisatechniqueofimagecontrastenhancement.(Pratiksha M. Patel, 2016). The contrast improvement is usually performed on the grayscale images. Image contrast isimproved by stretching the range of its pixel intensity values to span over the desired range of values,between 0 and 255 ingrayscale. The reason that ContrastLimited Adaptive Histogram Equalization(CLAHE)isusedinsteadofhistogramequalizationisbecausehistogramequalizationdependsontheglobal statistics. Hence, it causes over enhancement of some parts of image while other parts are notenhanced properly. This distorts the features of the image. It is a serious issue because the features of theimage have to be extracted for the face recognition. Thus, CLAHE which is depend on local statistic isused.

Fig 3.5 increasing the image quality

Feature Extraction

Different facial images mean there are changes in textural or geometric information. In order to performface recognition, these features have to be extracted from the facial images and classified appropriately. Inthis project, enhanced LBP and PCA are used for face recognition. The idea comes from nature of humanvisual perception which performs face recognition depending on the local statistic and global statisticfeatures. Enhanced LBP extracts the local grayscale features by performing feature extraction on a smallregion throughout the entire image. On the other hand, PCA extracts the global grayscale features whichmeansfeatureextractionis performed on thewholeimage.

WorkingPrincipleofOriginalLBP

LBP is basically a texture based descriptor which it encoded local primitive into binary string. (Timo Ojalaet al., 2002). The original LBP operator works on a 3 × 3 mask size. 3 × 3 mask size contains 9 pixels. Thecenter pixel will be used as a threshold to convert the neighboring pixels (the other 8 pixels) into binarydigit.Iftheneighboringpixelvalueislargerthanthecenterpixelvalue,thenitisassignedto1,otherwiseit is assigned to 0. After that, the neighborhoods pixel bits are concatenated to a binary code to form a byte value representing the centerpixel. Figure3.6 shows an example of LBP conversion.

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.165

|| Volume 10, Issue 7, July 2022 ||

| DOI: 10.15680/IJIRCCE.2022.1007021 |

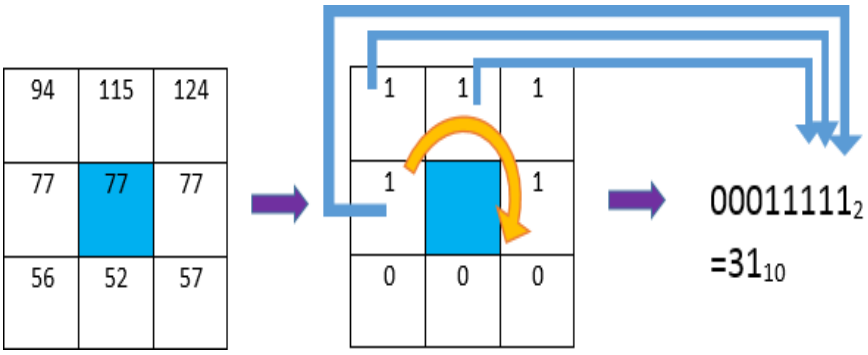
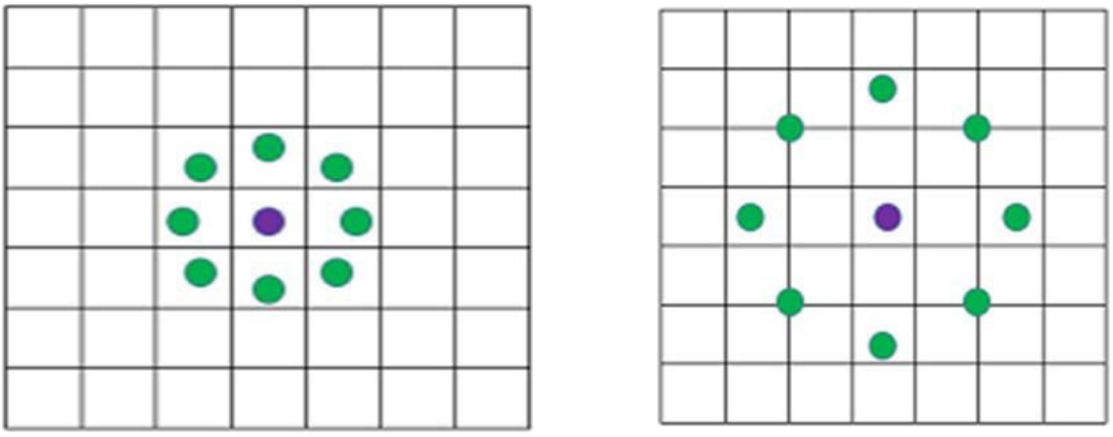


Figure3.6 Example of LBP Conversion

Working Principal of Proposed LBP

The original LBP operator is composed of 3 × 3 filter size with 9 pixels. Instead of the circular pattern, itlooks more rectangular in shape. The 9 pixels adjacent to each other means every detail will be taken assampling points even the non-essential details. It is more affected by uneven lighting condition because thesmall filter size emphasizes small scale detail (Lee and Li, 2007), even the shadow created by non-uniformlighting condition. In our proposed approach, a larger radius size, R is implemented in LBP operator. In thepaper of Md. Abdur Rahim et.al (2013), the equation of modifying the radius size has been introduced.However, the paper did not mention the effect of changing the radius size. In the proposed approach,analysis is done on different radius sizes in order to enhance the system and reduce the illumination effect.By increasing the radius size, the filter size will be increased. R indicates radius from the centre pixel, θindicates the angle of the sampling point with respect to the center pixel and P indicates number ofsampling points on the edge of the circle taken to compare with the centre pixel. Given the neighbouring'snotation (P, R, θ) is implemented, the coordinates of the centre pixel (Xc, Yc) and the coordinates of the Pneighbours (Xp, Yp) on the edge of the circle with radius R can be computed with the sines and cosinesshown in the equation (Md. Abdur Rahim et.al,2013): (3.3) $Xp = Xc + Rcos(\theta/P)$ $Yp = Yc + Rsin(\theta/P)$ 35Although the radius has been increased, total 8 sampling points are taken which is similar to the originalLBP operator. In the approach, CLAHE is performed on the grayscale input facial images to improve thecontrast. The contrast improved images remain as grayscale images. The proposed LBP operator extractsthe grayscale features from the contrast improved grayscale images which requires only 8 bit computation.After that, the pixels at the sampling points will be encoded as 8 bit binary string in the same way asoriginal LBP operator encoding process. Enhanced LBP with radius size two, perform better compared tooriginal LBP and has more consistent recognition rate compared to other radius size. Hence, enhanced LBPwithradius sizetwo willbeused as proposed approach



R=1 R=2

Figure 3.7 LBP with Different Radius Sizes

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.165

|| Volume 10, Issue 7, July 2022 ||

| DOI: 10.15680/IJIRCCE.2022.1007021 |

The feature vector of the image is constructed after the Local Binary Pattern of every pixel is calculated.The histogram of the feature vector image is computed in order to be classified by distance classifier.However, it loss spatial information because histogram representation does not include spatial informationbut only discrete information. (Gonzalez, R. C., & Woods, 2008). In order to overcome this problem, thefeature vector image is then divided into blocks. A histogram is constructed in each region respectively.Everybininahistogramrepresentsapatternandcontainsthefrequencyofitsappearanceintheregion.The feature vector of entire image is then constructed by concatenating the regional histograms in thesequence to one histogram. (Md. Abdur Rahim et al., 2013). This histogram remains its regional spatialinformationand represents theidentityofsingleimagewhich is thenclassified to perform therecognition.

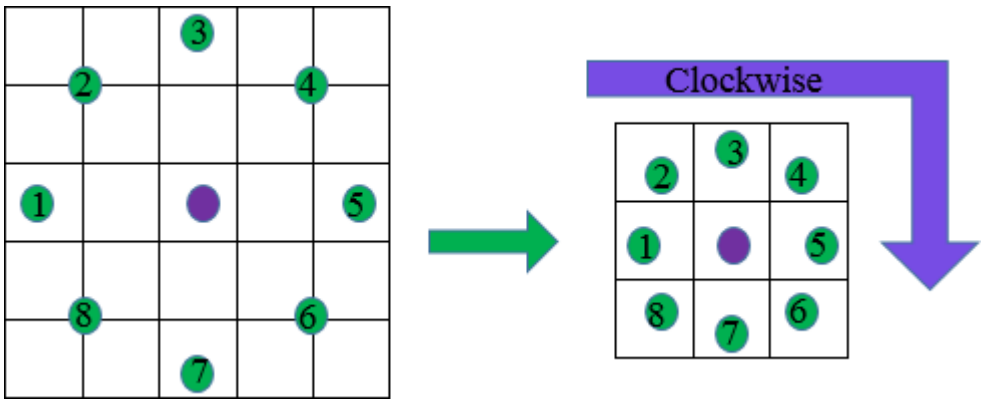


Figure3.8 Proposed LBP Operator with Radius2andItsEncoding Pattern

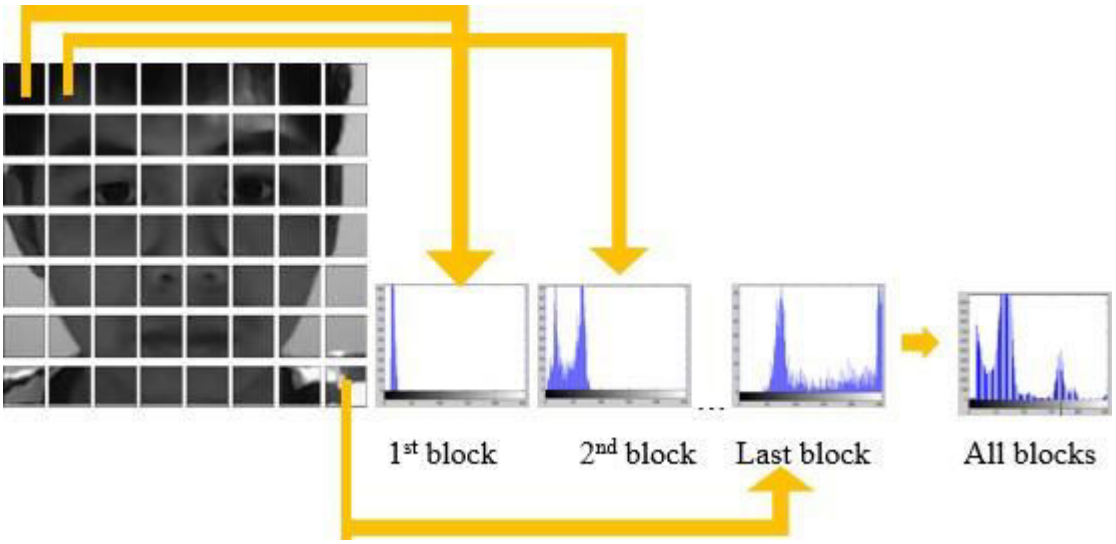


Figure 3.9 Histogram of Image Blocks

Working principle of PCA

In this proposed approach, PCA face recognition is studied, as it is one of the popular face recognitionmethods that was suggested and used by the previous researchers. The accuracy of PCA is computed inorder to compare with the enhanced LBP. PCA includes a few steps which will briefly be described in thefollowing paragraphs. For PCA, the image scale, length (M) and height (M) is not so important. This isbecause PCA is mostly dealing with number of total images, N instead of M. However, same size of testimage and training image is a must for PCA computation. Same length and height of the image is assumedin the following equation for illustration. Given a training set of N images with size $M \times M$, the first step ofPCA is to convert two dimensional vectors to one dimensional vector. The one dimensional vector can beither column vector or row vector. In this approach, the column vector conversion is done. For each facialimage with matrix notation $M\times M$will be converted to column vector Γi, with dimension $M2 \times$

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.165

|| Volume 10, Issue 7, July 2022 ||

| DOI: 10.15680/IJIRCCE.2022.1007021 |

1.Thereare N facial images, each face is represented by column vector .Feature vector of each face is stored in thiscolumn vector. The dimension reduced face matrix is constructed by concatenating every single columnvector. PCA is brieflyexplained byusingtheequation in thefollowingsteps:
Step1:Preparethedata
Step2:Obtainthemean/averagefacevectorNext,theaveragefacevectorwhichisalsoknownasmean face is calculated. The mean is computed row by row between the column vectors. The equationofmean face
Step 3: Subtract the mean/average face vector In order to ensure the image data is centred at the origin,themean faceis subtracted from each column vector.
Step4:Calculate thecovariancematrix
The purpose of covariance matrix to be constructed is to compute the eigenvectors and eigenvalues.However, $AA\ T$ have dimension $M2 \times M2$ which is extremely large to be calculated. $AA\ T$,and$A\ TA$have the same eigenvalues, $\lambda$and their eigenvectors can be related as $ui= Avi$.Hence ATAwhichhave dimension $N\ 2xN\ 2$ is calculated instead of $AA\ T$ because $N\ 2 \ll M2$, less computational time isrequired.
Step 5: Calculate the eigenvectors and eigenvalues from the covariance matrix.Step6: Projection offacial imageto Eigenface.
The facial image is projected on the Eigen face by using the equation to obtain the projected image $\Omega.\Gamma i- \varphi$is the centered vector, which the mean face is removed. Steps 1 to 6 are used to train thetraining image set. For test image only step 1,2, 3 and 6 is required. Step 4 and 5 are not required fortestimageastheEigenfaceisneededonlytocomputeoncewhiletraining.TheEuclideandistanceis then used asdistance classifier to calculate the shortest distance between the projected image andprojectedtest imageforrecognition

Feature Classification

Chi-square statistic is used as a dissimilarity measure for LBP to determine the shortest distancebetween training image and the testing image.On the other hand,Euclidean distance is usedtocompute the shortest distance between trained and test image after PCA feature extraction. Bothclassifiers,Chi-squarestatisticandEuclideandistancedeterminetheclosestornearestpossibletraining image to the testing image for face recognition. However, the nearest result might not bealways true. Therefore, an algorithm to combine enhanced LBP and PCA is applied in order to increasethe accuracyof thesystem.

Subjective Selection Algorithm and Face Recognition

The feature classification that has been performed in previous part gives the closest result but notabsolute. In order to increase the accuracy and suppress the false 41 recognition rate, an algorithm tocombine enhanced LBP and PCA is designed in this proposed approach. In this proposed approach,best five results are obtained from enhanced LBP and PCA. This means that five individuals whichhave closest distance with respect to input image will be identified. LBP and PCA are two differentalgorithms which have a different working principle. Hence, LBP and PCA will not have exactly thesamefiveindividualsidentified.Inordertoensurethesystemcapabilitytosuppressthefalserecognition, one is only classified as recognized if and only if he or she is the first common individualthat is identified by both LBP and PCA. From chapter 2, LBP shows higher accuracy compared toPCA. Thus, LBP is designed to have higher priority compared to PCA. This is shown in the Figure3.14, Student_1 is recognized instead of Student_3 because LBP is prioritized. As a result, the firstcommon individual is selected from PCA with respect to LBP and classified as recognized. If there isnocommontermbetweenLBPandPCAthenthesystemwillnotrecognizeanysubject.Thissubjectiveselection algorithm is designedto be automated in thesystem.

IV. PURPOSE AND SCOPE

Allkindsoforganisationsneedarobustattendancesystemtoensuretheefficiencyofalltheoperations.Maintenance of accurate attendance records of students and employees in schools can helphandle discrepancies and disparities. Present-day, technology has leveraged everything by automation.Manual processes for taking attendance are quite insufficient. There is a huge scope of errors in data.Smartattendancesoftwarewithuniquebiometric featuresis the best waytomark attendance.
Asmartattendancesystemallowsyoutoenhancetheorganizationethics.Thesoftwareusebiometricssuch as fingerprint, facial, and iris recognition to detect the presence of an individual and mark theattendance.Theinformationis maintainedin thedatabase andyoucaneasilyobtain the results.
Someofthe benefitsof usingsmartattendancesoftwareare:

1. **Track in real-time**: The school administration can keep a tab on the student and employee attendance inreal-

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.165

|| Volume 10, Issue 7, July 2022 ||

| DOI: 10.15680/IJIRCCE.2022.1007021 |

timeandfurtherinspect if theyfind anyvariations.

2. **Reduced errors:** Digital attendance systems such as finger attendance help in providing unique andaccurateresults. Humanintervention ishighlyreduced. Sotherearefewerchancesof redundanterrors.
3. **Easily manage large volumes of data:** Schools with huge students and employees can easily managementthe huge amount of data using smart attendance software. All the records are stored in highly-robustdatabasesand can beeasilyaccessed wheneverrequired.
4. **Highly secure:**The smart attendance systems require biometrics which is unique for every person.Therefore there is complete confidentiality of all the records. No one can tamper the information stored inthedatabase.Thusstrongauthenticationandsecurityaretheaddedadvantagesofsmartattendancesoftware.

Generate Reports: The admin of the school can easily login to the software and check the attendancedetails.He/shecaneasilyfindoutwhenthestudentsandemployeeslogged-inandloggedoutofthesystem.You can check thecount of absent studentsand takethe right remedialaction

V. CONCLUSIONS

This system aims to build an effective class attendance system using face recognition techniques. The proposed system will be able to mark the attendance via face Id. It will detect faces via webcam and then recognize the faces. After recognition, it will mark the attendance of the recognized student and update the attendance record.
Things to keep in mind before using this system :

1. . If the resolution ofthe said image is not high enough, it can cause cameras to be tricked into believing that the person beingscanned is not the same as in the photo
2. a system would need an appropriate amount of storage
3. Many non-premium facial recognition systems cannot account for faces that are captured at angles otherthan straight into the capturing camera. The disadvantage of this is that it makes the attendance markingprocessslower and less efficient

REFERENCES

1. Hapani,Smit,etal."AutomatedAttendanceSystemUsingImageProcessing."2018FourthInternational Conference on Computing Communication Control and Automation (ICCUBEA). IEEE,2018.
2. Akbar, Md Sajid, et al. "Face Recognition and RFID Verified Attendance System." 2018 InternationalConferenceonComputing,Electronics&Communications Engineering (iCCECE).IEEE, 2018.
3. Okokpujie, Kennedy O., et al. "Design and implementation of a student attendance system using irisbiometricrecognition."2017InternationalConferenceonComputationalScienceandComputationalIntelligence (CSCI).IEEE,2017.
4. Rathod, Hemantkumar, et al. "Automated attendance system using machine learning approach." 2017InternationalConference onNascent TechnologiesinEngineering(ICNTE). IEEE, 2017.
5. Siswanto, Adrian RhesaSeptian, AntoSatriyo Nugroho, and MaulahikmahGalinium. "Implementationof face recognition algorithm for biometrics based time attendance system." 2014 International ConferenceonICTFor SmartSociety(ICISS). IEEE,2014.
6. Lukas, Samuel, et al. "Student attendance system in classroom using face recognition technique." 2016International Conference on Information and Communication Technology Convergence (ICTC). IEEE,2016.
7. Salim,OmarAbdulRhman,RashidahFunkeOlanrewaju,andWasiuAdebayoBalogun."Classattendance management system using face recognition." 2018 7th International Conference on ComputerandCommunicationEngineering(ICCCE). IEEE,2018.

INNO SPACE
SJIF Scientific Journal Impact Factor

Impact Factor: 8.165

doi cross ref

ISSN INTERNATIONAL STANDARD SERIAL NUMBER INDIA

निस्केयर NISCAIR

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING

9940 572 462 6381 907 438 ijircce@gmail.com

www.ijircce.com

Scan to save the contact details