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FACE RECOGNITION TECHNOLOGY BASED AUTOMATED ATTENDANCE SYSTEM

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Abstract-*Face recognition is one of most popular technology in the recent times.It is implemented over a wide range of applications.In this paper,we are giving insight to an automated attendance system which uses face recognition technology.The system uses Raspberry Pi with a camera interfaced to it andOpenCV(Open Source Computer Vision) library. It uses Haar Cascade algorithm for detecting face and PCA(Principal Component Analysis) for recognising faces from an existing database of images.*

Keywords-*Face recognition, Detection, Raspberry Pi, OpenCV, Haar cascade, PCA*

I. INTRODUCTION

Recently, face recognition is a boom in the field of research and recognised lot of efforts due to the progresses of local descriptors and thereby growing hugeacceptance in the real-time applications, such as security systems as well as face recognition on the laptop or the Internet. Face recognition basically involves two most important procedures:

A. Detection of a face (determining whether the recorded or clicked picture is that of a face or some other body part) and;

B. Face verification (confirmation of the face from the face stored in the database which is pre-dominantly stored by the user). In this paper, welay down our focus on the second task more since it has a more applicable usage and is also the founding father of the several identification task. Sincethis procedure is a binary defined problemon a given face pair, there are basically two major components of this second approach: Representation of a face and recognition of the face.

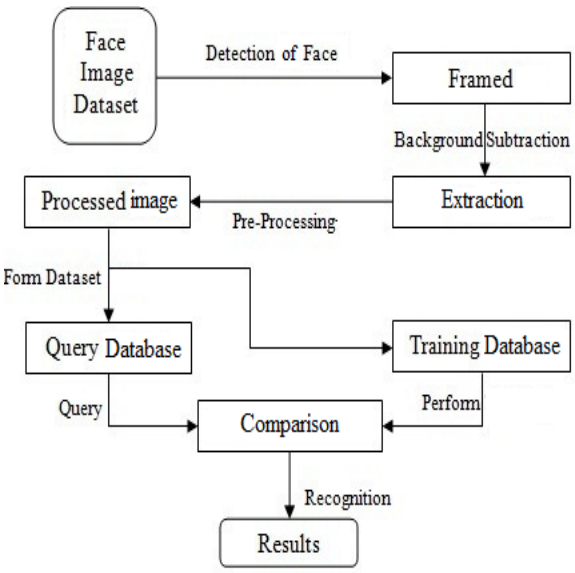

Figure 1. System overview

The carved out feature (descriptor) should notonly exclusive in nature but also barred to robust and sudden changesalong with noise. The recognitionshould be selective in terms of pose, expression, andocclusion. These requirements render face verification a challengingproblem.

The computational model can be used for research as well as application purposes. It can provide us with lot of theoretical insights which help us in gathering lot of data and engage in applications such as monitoring of crowd, surveillance, user interface image database management, access control et cetera.

In this paper we developed a model for automated attendance using real time face recognition and verification from pre-determined database.

II. LITERATURE REVIEW

The topic of face recognition is comparatively aged as that of computer visual, reason being primarily the practical importance of the subject and interest of cognitive researchers in a hypothesis. Though other methods of identification also exist (retina scan, thumb impression and so on), face recognition has always been an attraction for researchers due to several factors, primarily face being the only exclusive factor of person identification and also because of it's never changing nature.

As far as the history on face recognition goes it can be very well traced back at least to the 1960s in engineering theoretical journals [1] and to the 1950s even in the psychology branch [2].

In the mid-1960s, Bledsoe, along with his colleagues Helen Chan and Charles Bisson, tried determining human faces using a basic computer (Bledsoe 1966a, 1966b; Bledsoe and Chan 1965). Due to funding options from a private institution Bledsoe was unable to publish most of his work and hence very little amount of work came out to be known to people at that time.The basic problem that occurred was identifying a small photograph and verifying it from a pool of thousands of photographs which we in turn also call as image database. The result and proper observation of the method could be determined in terms of the ratio of the answer list to the number of records in the database.

It would be a disaster if we don't link the oldest face recognition techniques and methods to Kohonen [3], who explained and performed that a simple neural network could carry out face recognition for normalized and aligned images of various faces. He designed this type of network in a way that it computed a description of face by approximating the eigenvectors of the face image's autocorrelation matrix; and further these eigenvectors came to be known as eigenfaces.

Though Kohonen's system was an impractical endeavour, nevertheless, reason being precise alignment and accurate normalisation. In the concurrent years scientists tried face recognition on the basis of several measures such as inter-feature distances, edges as well as various neural networks. Even though several were practically working on set of small databases of images and that too aligned images, none of the methods were successfully aimed at the more realistic issue of large databases where it was evident that location and space of the image would be unknown.

Very few of the earliest studies talk about work on facial expression as well as emotions by Darwin [4]. But research on automated machine recognition of faces started in the 1970s [5] and after the basic work of Kanade [6].

Kirby and Sirovich in 1989 [7] introduced an algebraic equation which made extremely easy to calculate the eigenfaces, and proved that less than 100 were essentially required to accurately decode carefully normalized and aligned face images. Turk and Pentland (1991) [8] then explained that the residual error during coding using the eigenfaces could be used both to determine faces in cluttered natural imagery, and results in determining the precise location and scale of faces in an image. Further both of them demonstrated that by coupling this procedure for detection and localization faces with the eigenface recognition method, we could easily achieve a reliable, real-time recognition of faces in an extremely reduced and constrained environment. This demonstration proved that highly simple and real-time pattern recognition methodscan be brought together to create a useful method which can result in spark and explosion of interest in the topic of face recognition industry.

In 1995, a research paper [9] gave a combined survey of face recognition technologies used at that time. However, video-based face recognition was still taking birth. During the past several decades, face recognition has gainedamplified attention and has advanced both technically and commercially. Many industrialsystems for still face recognition are now readily available. However these days more focus is being given to video-based face verification /tracking, recognition and system integration. Evaluations are being carried out on the basis of new databases that are created using pre-verified images and these databases contain a large amount of images both still and moving. Now, the face recognition has become one of the most interesting and active applications of image analysis, pattern recognition and understanding.

III.METHODOLOGY

Principal component analysis is used for face recognition in the system. It was invented by Karl Pearson in 1901. It is a procedure of variable reduction. It is beneficiary when obtained data is redundant.Redundancy ends up reducing variables into less number of variables. Thesevariables are known as principal components which are accountable for most of the variance in the variable observed. There are issues when we look to perform recognition in

high dimensional space. The objective of PCA is to reduce the data dimensionality. It is done by retaining as much as variation possible in our original data set. On the other side of coin, dimensionality reduction also implies loss of information. The determination of the best lower dimensional space is done by best principal components.

The biggest advantage of PCA is use of eigenface approach which results in reduction of the size of the database for recognisingthe input images. The storage of images is in the form of feature vectors in the database and these vectors are projecting each and every trained image to the set of eigenfaces obtained. Eigenface approach is used in PCA for the reduction of the dimensionality of a huge data set.

The steps involved in the implementation starts with the training set of total M face images each of size N×N. Then each of these images is converted into a face vector of $N^2 \times 1$.All the face vectors of the input images are represented using $\boldsymbol{\tau_i}$ where i = 1,2,3,….,M in a face vector space. Now, after this each face vector is normalised that means the common features among all the face vectors gets eliminated from each face vector by subtracting the average face vector $\boldsymbol{\psi}$of the training set. It results in normalised face vectors represented as $\boldsymbol{\Phi_i} = \boldsymbol{\tau_i} - \boldsymbol{\psi}$where i = 1,2,3,….,M. The next step is to calculate covariance matrix $C=A.A^T$ where $A=\{\Phi_1,\Phi_2,\Phi_3,\ldots,\Phi_M\}$ which results in higher dimensional matrix of order $N^2 \times N^2$. So a lower dimensional matrix is calculated by $C=A^T.A$ which is of order M×M. Now K eigenfaces are selected from M eigenfacessuch that they can represent each face image of the training set. Each face image is represented as combination of each eigenface multiplied by its weight $w_i$where i = 1,2,3,….,K (K< M)and average face vector $\boldsymbol{\psi}$. For each image the weight of each eigenface as elements of column matrix gives eigenvector Ω_i. Now, as the system is trained, it follows the steps as shown for an input image.

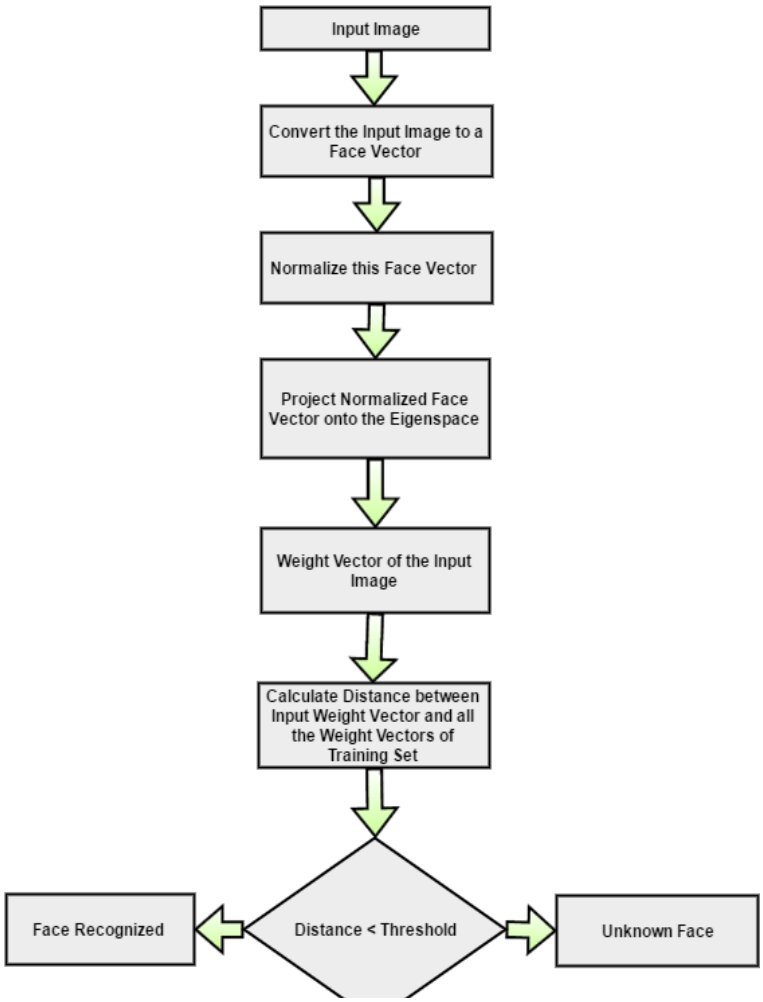

Figure 2. *Steps in face recognition using PCA*

IV. EXPERIMENTATION AND RESULTS

We implemented system using the hardware as Raspberry Pi and a camera interfaced to it, but software part consisted of using OpenCV. The very first step in face recognition is to detect a face in given image and then if a face is there it proceeds to the recognition step. The system used Haar Cascade Classifier for the detection of the face and PCA for the recognition of face. The various commands used in the OpenCV are tabulated below.

Table 1. *OpenCV Functions used during implementation.*

Command	Expected Output	Observed Output
OpenCAM_CB()	It starts the interfaced camera with Raspberry Pi.	Camera turns on and starts streaming.
LoadHaar Classifier()	Haar Classifier Cascade files get loaded.	It gets ready for extraction operation.
ExtractFace()	It starts face extracting frame work.	Face gets extracted.
Learn()	It starts PCA algorithm.	It updates the contents of facedata.xml.
Recognize()	It performs comparison between the input face and the pre-determined database of images.	Recognises the face.

V.CONCLUSION

We successfully implemented face recognition technology based automated attendance system which used PCA algorithm for face recognition and Haar cascade for face detection.PCA algorithm provides huge reduction for high dimensional space. In the current era, everything is getting automated which leads to need of security and authentication. In such systems, face recognition plays a vital role, as face is the most basic distinguishing tool. These systems can be made more intelligent and efficient by means of interactive and learning platforms.

REFERENCES

[1] Bledsoe W. W., The model method in facial recognition. Tech. rep. PRI:15, *Panoramic research* Inc., PaloAlto, CA,1964
[2] Bruner, I. S. and Tagiuri, R. *The perception of people.In Handbook of Social Psychology*, Vol. 2, G. Lindzey,Ed., Addison-Wesley, Reading, MA, 634–654,1954
[3] T. Kohonen, *Self-organization and Associative Memory*, Springer-Verlag, Berlin, 1989.
[4] Ekman, P. Ed., *Charles Darwin's The Expression of the Emotions in Man and Animals*, Third Edition, withIntroduction, Afterwords and Commentaries by PaulEkman. Harper- Collins/Oxford University Press, NewYork, NY/London, U.K.1998
[5] Kelly M. D., Visual identification of people by computer Tech. rep. AI-130, Stanford AI Project, Stanford, CA. 1970
[6] Kanade T., Computer recognition of human faces. Birkhauser, Basel, Switzerland, and Stuttgart, Germany 1973
[7] M. Kirby and L. Sirovich, "Application of the Karhunen-loeve procedure for the characterization of human faces", *IEEE Pattern Analysis and Machine Intelligence*, vol. 12, no. 1, pp. 103-108, 1990
[8] M. Turk and A. Pentland, "Eigenfaces for recognition", *J. Cog. Neuroscience*, vol. 3, no. 1, pp. 71-86, 1991
[9] Chellapa, R., Wilson, C. L., and Sirohey S., Human and machine recognition of faces: A survey. *Proc. IEEE*,83, 705–740,1995

