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To detect the Face Recognition using integration of BPNN and PCA algorithm

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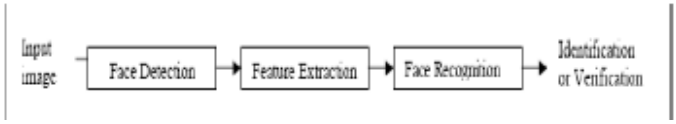
Abstract: In this paper we are representing various face recognition algorithm which integrates the principal component analysis, back propagation neural network (BPNN) to improve the performance of face recognition algorithms. PCA is used to reduce the dimensionality of face image and the recognition is done by the BPNN for efficient and robust face recognition. With data and information accumulating in abundance, there is a crucial need for high security. Face recognition has been a fast growing, challenging and interesting area in real time applications. A large number of recognition algorithms have been developed in last decades. In this paper an attempt is made to review a wide range of methods used for face recognition comprehensively. This include PCA, LDA, ICA, SVM, Gabor wavelet soft computing tool like ANN for recognition and various hybrid combination of this techniques. This review investigates all these methods with parameters that challenges face recognition like illumination, pose variations, facial expressions.
Keywords: PCA, Face Recognition, BPNN

I. INTRODUCTION

Face recognition has received significant attention in the past decades due to its potential applications in biometrics, information security, law enforcement, etc. By far, numerous methods have been suggested to address this problem. Among them, principal component analysis (PCA) turns out to be very effective. Recently, a PCA closely-related method, independent component analysis (ICA) [3], has also been applied to face recognition. ICA can be viewed as a generalization of PCA since it concerns not only second-order dependencies but also high-order dependencies between variables.



Block diagram of Face Recognition

Fig. 1. (a) Input Image (b) Preprocessed Image.

Face recognition can be partitioned into Face identification, Face classification, sex determination, people surveillance in crowded areas, video content indexing, Personal identification (e.g. Driver's License) and Entrance security. Developing a computational model of face recognition is quite difficult, because faces are complex, multi-dimensional visual stimuli. Therefore, face recognition is a very high stage computer visualization task, in which many early visualization techniques can be implicated.

II. PCA(PRINCIPAL COMPONENT ANALYSIS)

PCA commonly referred to as the use of eigen faces, is the technique pioneered by Kirby and Sirivich in 1988. With PCA, the probe and gallery images must be the same size and must first be normalized to line up the eyes and mouth of the subjects within the images. The PCA approach is then used to reduce the dimension of the data by means of data compression basics and reveals the most effective low dimensional structure of facial patterns. This reduction in dimensions removes information that is not useful and precisely decomposes

the face structure into orthogonal (uncorrelated) components known as eigen faces. Each face image may be represented as a weighted sum (feature vector) of the eigen faces, which are stored in a 1D array. A probe image is compared against a gallery image by measuring the distance between their respective feature vectors. The PCA approach typically requires the full frontal face to be presented each time; otherwise the image results in poor performance. The primary advantage of this technique is that it can reduce the data needed to identify the individual to 1/1000 th of the data presented.

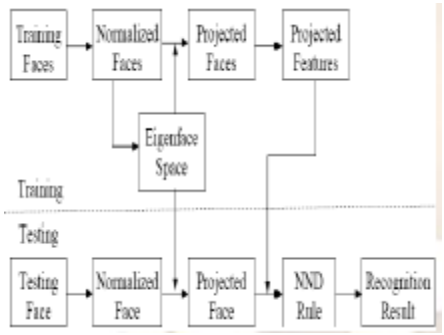


Fig 3. Flow Chart of PCA processing

The algorithm used for principal component analysis is as follows.

(i) Acquire an initial set of *M* face images (the training set) & Calculate the eigen-faces from the training set, keeping only *M'* eigenfaces that correspond to the highest eigenvalue.

(ii) Calculate the corresponding distribution in *M'*-dimensional weight space for each known individual, and calculate a set of weights based on the input image.

(iii) Classify the weight pattern as either a known person or as unknown, according to its distance to the closest weight vector of a known person

III. NEURAL NETWORK

Neural Network: A successful face recognition methodology depends heavily on the particular choice of the features used by the pattern classifier .The Back-Propagation is the best known and widely used learning algorithm in training multilayer perceptrons (MLP) .The MLP refer to the network consisting of a set of sensory units (source nodes) that constitute the input layer, one or more hidden layers of computation nodes, and an output layer of computation nodes. The input signal propagates through the network in a forward direction, from left to right and on a layer-by-layer basis. Back propagation is a multi-layer feed forward, supervised learning network based on gradient descent learning rule. This BPNN provides a computationally efficient method for changing the weights in feed forward network, with differentiable activation function units, to learn a training set of input-output data. Being a gradient descent method it minimizes the total squared error of the output computed by the net. The aim is to train the network to achieve a balance between the ability to respond correctly to the input patterns that are used for training and the ability to provide good response to the input that are similar.

IV. FACE DETECTION TECHNIQUE

Face detection

Face detection is a technology to determine the locations and size of a human being face in a digital image. It only detects facial expression and rest all in the image is treated as background and is subtracted from the image. It is a special case of object-class detection or in more general case as face localizer. Face-detection algorithms focused on the detection of frontal human faces, and also solve the multi-view face detection problem. The various techniques used to detect the face in the image are as below:

Face detection as a pattern-classification task:

In this face detection is a binary-pattern classification task. That is, the content of a given part of an image is transformed into features, after which a classifier trained on example faces decides whether that particular region of the image is a face, or not.

Controlled background:

In this technique the background is still or is fixed. Remove the background and only the faces will be left, assuming the image only contains a frontal face.

By color:

This technique is vulnerable. In this skin color is used to segment the color image to find the face in the image. But this has some drawback; the still background of the same color will also be segmented.

By motion:

The face in the image is usually in motion. Calculating the moving area will get the face segment. But this too have many disadvantages as there may be backgrounds which are in motion.

Model-based:

A face model can contain the appearance, shape, and motion of faces. This technique uses the face model to find the face in the image. Some of the models can be rectangle, round, square, heart, and triangle. It gives high level of accuracy if used with some other techniques.

V. FACE RECOGNITION TECHNIQUE

Neural Networks

A neural network learning algorithm called Backpropagation is among the most effective approaches to machine learning when the data includes complex sensory input such as images, in our case face image. Neural network is a nonlinear network adding features to the learning system.

Geometrical Feature Matching

This technique is based on the set of geometrical features from the image of a face. The overall configuration can be described by a vector representing the position and size of the main facial features, such as eyes and eyebrows, nose, mouth, and the shape of face outline

Graph Matching

Graph matching is another method used to recognize face. M. Lades et al presented a dynamic link structure for distortion invariant object recognition, which employed elastic graph
matching to find the closest stored graph.

Eigenfaces

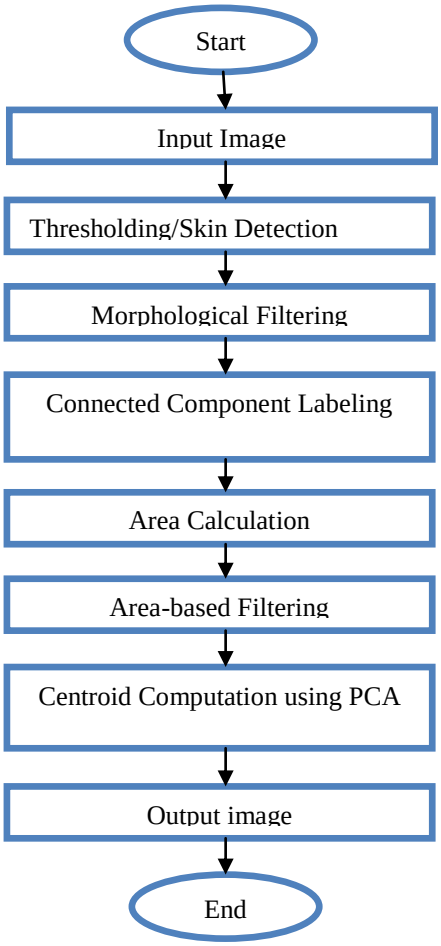
Eigenface is a one of the most thoroughly investigated approaches to face recognition. It is also known as Karhunen-Loeve expansion, eigenpicture, eigenvector, and principal component.

VI. RELATED STUDY

Agarwal et al. [1] has proposed a methodology for face recognition based on approach of coding and decoding the face image. Proposed methodology is connection of two stages : Feature extraction using principle component analysis and recognition using the feed forward back propagation Neural Network. The space dimension can be reduced from 2576 to 50 by choosing PCA as a feature selection method. Test results of the algorithm gave a recognition rate of 97.018%. Dashore et al. (2012) [2] has proposed an algorithm for realtime human face tracking. The system functions by projecting face image onto a feature space that spans the important variations among known face images. These features are known as “Eigen faces”, because they are the eigenvectors (Principal Component) of the set of faces they do not necessarily correspond to the features such as eyes, ears, and noses. Mamta Dhanda (2012) [3] has presented an overview of the design and development of a real-time face recognition system .The design of the face recognition system is based upon “eigenfaces”. The original images of the training set are transformed into a set of eigenfaces E. Then, the weights are calculated for each image of the training set and stored in the set W. Upon observing an unknown image Y, the weights are calculated for that particular image and stored in the vector WY. Afterwards, WY is compared with the weights of images, of which one knows for certain that they are facing. Kashem et al.(2011) [4] in their paper presented a face recognition system for personal identification and verification using Principal Component Analysis with Back Propagation Neural Networks .The dimensionality of face image is reduced by the PCA and the recognition is done by the BPNN for efficient and robust face recognition. Prasad et al. (2011) [5] has proposed a Neural and PCA based algorithm for efficient and robust face recognition. Holistic approach is used in which the whole face region is taken as input data which is based on Principal Component Analysis technique to simplify a dataset into lower dimension while retaining the characteristics of dataset. Preprocessing, Principal component analysis and Feed Forward Neural Algorithm are the major implementations of the paper of Prasad et al. Kekre et al. (2010) [6] has proposed an algorithm based on Principal Component Analysis and verify the results of this algorithm on a training database of images. This algorithm is also used to recognize the gender of the test image by evaluating the Euclidian distance of the test image from the images in the database. Karim et al. (2010) [7] has presented a paper to implement a reliable PCA-based face recognition technique and study its performance using standard face databases. MATLAB based programs are implemented to identify the faces using Indian databases and the Face recognition data, University of Essex, UK. Tungathurthi et al.(2009)[8] has presented a paper in which face recognition system detects the faces in a picture taken by web-cam or a digital camera, and these face images are then checked with training image dataset based on descriptive features. Descriptive features are used to characterize images. For the analysis, the main focus is on principal component analysis and the implementation is done in free software, Scilab Sandhu et al. (2009) [9] has presented a paper in which PCA features for Feature extraction are used and

matching is done for the face under consideration with the test image using Eigen face coefficients. The crux of the work lies in calculating Euclidean distances between the projected test image and the projection of all centered training images and paving the way to test the same algorithm using Matlab which is an efficient tool having powerful user interface along with simplicity in representing complex images. Ruprah et al. [10] has proposed the face recognition system using PCA with neural network back propagation learning algorithm in the context of face verification and face recognition using photometric normalization for comparison. For recognition, E.D. (Euclidean Distance) classifier gives the highest accuracy using the original face image. Shaik et al. [11] examined the PCA appearance-based (holistic) approach for face recognition observed by using Eigen vectors. The features are extracted from the original image to represents unique identity used as inputs to the system to measure similarity in classification and recognition. The principal components have proven the capability to provide the significant features and reduce the input size of the images.

VII. METHODOLOGY



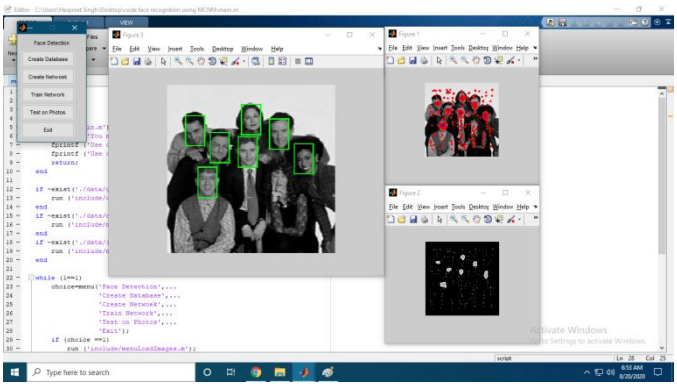


Fig 1: Face recognition Results

In fig 1results are produced using the PCA and BPNN based approach. From the figure it is cleared that the proposed technique produce results better as compared to existing one because it includes all the facial features along with the expressins.

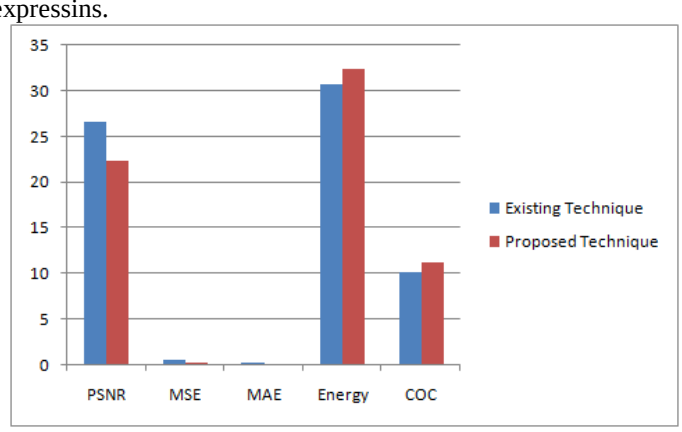


Fig 1: Comparative Study of Existing and proposed Approach

From the above figure it is cleared that proposed approach is better as compared to existing approach. As shown in fig 1 PSNR, MSE, MAE, Energy is compared and proposed solution is better as compared to existing one.

VIII. CONCLUSION

In this research, the goal of implementing a technique to detect and track human faces in real time was achieved. A software implementation of the algorithm was examined in MATLAB to verify its accuracy. The technique used to achieve this is PCA because it is a mathematical procedure that uses an orthogonal transformation to convert a set of observations of possibly correlated variables into set of values of linearly uncorrelated variables called Principal Components. Principal component analysis is applied to find the aspects of face which are important for identification. Eigenvectors (eigenfaces) are calculated from the initial face image set. New faces are projected onto the space expanded by eigenfaces and represented by weighted sum of the eigenfaces. These weights are used to identify the faces. Face tracking was achieved by computing the centroid of each detected region, although it only worked in the presence of at most two people. The results using proposed technique is well defined and validated on the matching scale and the other factors like mse and psnr etc. From the various factors defined above it is validated the proposed scheme is much better than that of existing scheme. There is approximately 8% improvement in the matching scale in proposed technique.

Future Scope: In the future scope the drawbacks in the PCA based face detection may be reduced like scalability in terms of angled faces. These parameters may be overcome in the future.

IX. REFERENCES

[1] Mayank Agarwal, Nikunj Jain, Mr. Manish Kumar, Himanshu Agrawal, "Face Recognition using Principle Component Analysis, Eigenface and Neural Network", ISSN: 1790-5117 ISBN: 978-960-474- 135-9

[2] Gunjan Dashore, Dr. V.Cyril Raj, "An Efficient method for face recognition using Principal Component Analysis(PCA)", International Journal of Advanced Technology & Engineering Research (IJATER), ISSN NO: 2250-3536 VOLUME 2, ISSUE 2, MARCH 2012

[3] Mamta Dhanda , "Face Recognition Using Eigenvectors from Principal Component Analysis (PCA)", International Journal of Advanced Engineering Research and Studies E-ISSN2249–8974, IJAERS/Vol. I/ Issue II/January-March, 2012/37-39

[4] Mohammod Abul Kashem, Md. Nasim Akhter, Shamim Ahmed, and Md. Mahbub Alam, "Face Recognition System Based on Principal Component Analysis (PCA) with Back Propagation Neural Networks (BPNN)", International Journal of Scientific & Engineering Research Volume 2, Issue 6, June-2011 ISSN 2229-5518

[5] M.S.R.S. Prasad, S.S. Panda, G. Deepthi and V. Anisha, "Face Recognition Using PCA and Feed Forward Neural Networks", International Journal of Computer Science and Telecommunications ,Volume 2, Issue 8, November 2011, ISSN 2047-3338

[6] Dr. H. B. Kekre, Sudeep D. Thepade , Tejas Chopra , "Face and Gender Recognition Using Principal Component Analysis", (IJCSE) International Journal on Computer Science and Engineering Vol. 02, No. 04, 2010, 959- 964, ISSN : 0975-3397

[7] Tahia Fahrin Karim, Md. Lushanur Rahman, MollaShahadat Hossain Lipu, Faria Sultana, "Face Recognition Using PCA-Based Method", 978-1-4244-6932-1110/2010 IEEE

[8] Prof. Y. Vijaya Lata, Chandra Kiran Bharadwaj Tungathurthi, H. Ram Mohan Rao, Dr. A. Govardhan, Dr. L. P. Reddy, "Facial Recognition using Eigenfaces by PCA", International Journal of Recent Trends in Engineering, Vol. 1, No. 1, May 2009

[9] Parvinder S. Sandhu, Iqbaldeep Kaur, Amit Verma, Samriti Jindal, Inderpreet Kaur, Shilpi Kumari , "Face Recognition Using Eigen face Coefficients and Principal Component Analysis", International Journal of Electrical and Electronics Engineering 3:8 2009

[10] Taranpreet Singh Ruprah, "Face Recognition Based on PCA Algorithm", Special Issue of International Journal of Computer Science & Informatics (IJCSI), ISSN (PRINT) : 2231–5292, Vol.- II, Issue-1, 2, IETDAVV, Indore, India

[11] Aman R. Chadha, Pallavi P. Vaidya, M. Mani Roja, "Face Recognition Using Discrete Cosine Transform for Global and Local Features", Proceedings of the 2011 International Conference on Recent Advancements in Electrical, Electronics and Control Engineering (IConRAEeCE) IEEE Xplore: CFP1153R-ART; ISBN: 978-1-4577-2149-6