PCA Algorithm for Efficient Face Recognition System

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Abstract: The Security is the main aspect to protect the confidential information from the intruder. The features are initially required for recognize any object. Feature extraction technique is used for extract the face features. Face Recognition is a term to describe the feature selection, detection and image processing to analyze and classification. In the past years, feature selection techniques have been proposed to make the possible for classification using neural network, supervised Learning and Un-supervised learning. In this work, the PCA technique has been proposed and training will be initial points for train the proposed algorithm and this complete work has been chosen for analyze and improve the efficiency of algorithm. The complete steps will be implementing in MATLAB for simulation of work and accuracy will be calculated by providing the different training images to the learning algorithm and then detection of face will be analyzed.

Keywords: Face Recognition, Neural Network, Face Recognition, PCA.

I. INTRODUCTION

Biometric face recognition, otherwise known as Automatic Face Recognition (AFR), is a particularly attractive biometric approach, since it focuses on the same identifier that humans use primarily to distinguish one person from another: their "faces".

One of its main goals is the understanding of the complex human visual system and the knowledge of how humans represent faces in order to discriminate different identities with high accuracy. The face recognition problem can be divided into two main stages: face verification (or authentication), and face identification (or recognition).

Biometrics is the emerging area of bioengineering; it is the automated method of recognizing person based on a physiological or behavioral characteristic. There exist several biometric systems such as signature, finger prints, voice, iris, retina, hand geometry, ear geometry, and face.

Among these systems, facial recognition appears to be one of the most universal, collectable, and accessible systems. The detection stage is the first stage; it includes identifying and locating a face in an image. The recognition stage is the second stage; it includes feature extraction, where important information for discrimination is saved, and the matching, where the recognition result is given with the aid of a face database.

The following is one possible high-level classification:

a. Holistic Methods: The whole face image is used as the raw input to the recognition system. An example is the well-known PCA-based technique.

b. Local Feature-based Methods: Local features are extracted, such as eyes, nose and mouth. Their locations and local statistics (appearance) are the input to the recognition stage. An example of this method is Elastic Bunch Graph Matching (EBGM).
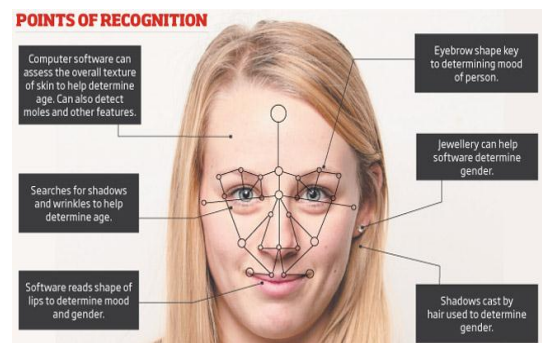

Fig. 1 Face Recognition Points

Among the different biometric techniques facial recognition may not be the most reliable and efficient but it has several advantages over the others: it is natural, easy to use and does not require aid from the test subject.

Properly designed systems installed in airports, multiplexes, and other public places can detect presence of criminals among the crowd. Other biometrics like fingerprints, iris, and speech recognition cannot perform this kind of mass scanning. However, questions have been raised on the effectiveness of facial recognition software in cases of railway and airport security. Humans are very good at recognizing faces and complex patterns. Even a passage of time doesn't affect this capability and therefore it would help if computers become as robust as humans in face recognition.

Face recognition system can help in many ways:

1. Checking for criminal records.
2. Enhancement of security by using surveillance cameras in conjunction with face recognition system.
3. Finding lost children's by using the images received from the cameras fitted at some public places.
4. Knowing in advance if some VIP is entering the hotel.

210

5. Detection of a criminal at public place.
6. Can be used in different areas of science for comparing a entity with a set of entities.
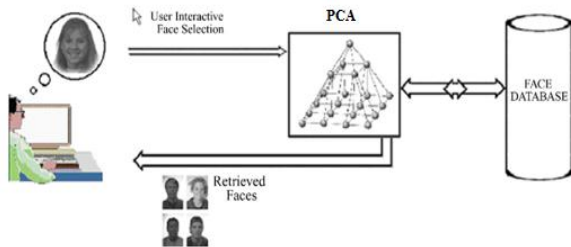7. Pattern Recognition.

Fig 2 Face Recognition Procedure

Working of Biometric System

The following four-stage process illustrates the way biometric systems operate:

a. Capture - a physical or behavioral sample is captured by the system during enrollment
b. Extraction - unique data is extracted from the sample and a template is created
c. Comparison - the template is then compared with a new sample
d. Matching - the system then decides if the features extracted from the new sample are matching or not when the user faces the camera, standing about two feet from it.

The system will locate the user's face and perform matches against the claimed identity or the facial database. It is possible that the user may need to move and reattempt the verification based on his facial position. The system usually comes to a decision in less time. The processing stages would be:

1. Detect face positions
2. Normalize the faces
3. Collect features for each detected face
4. Feed the features to a machine learning algorithm

The faces found in step 1 may have different brightness, contrast and different sizes. To simplify processing, they are all scaled to the same size and exposure differences are compensated (e.g. using histogram equalization). Early face detectors tried to find specific positions (center of the eyes, end of the nose, end of the lips, etc.) and use geometric distances and angles between those as features for recognition.

Image Processing

Image processing is a method to convert an image into digital form and perform some operations on it, in order to get an enhanced image or to extract some useful information from it. It is a type of signal dispensation in which input is image, like video frame or photograph and output may be image or characteristics associated with that image. Usually Image Processing system includes treating images as two dimensional signals while applying already set signal processing methods to them. It is among rapidly growing technologies today, with its applications in various aspects of a business. Image Processing forms core

research area within engineering and computer science disciplines too. Image processing basically includes the following three steps.

a. Importing the image with optical scanner or by digital photography.
b. Analyzing and manipulating the image which includes data compression and image enhancement and spotting patterns that are not to human eyes like satellite photographs.
c. Output is the last stage in which result can be altered image or report that is based on image analysis.

Feature Extraction

Feature extraction involves reducing the amount of resources required to describe a large set of data. When performing analysis of complex data one of the major problems stems from the number of variables involved. Analysis with a large number of variables generally requires a large amount of memory and computation power or a classification algorithm which over fits the training sample and generalizes poorly to new samples. Feature extraction is a general term for methods of constructing combinations of the variables to get around these problems while still describing the data with sufficient accuracy.

II. LITERATURE REVIEW

[1] Shamla Mantri, Kalpana Bapat "Neural Network Based Face Recognition Using Mat-lab", IJCSET,2011.

In this paper, they propose to label a Self-Organizing Map to measure image similarity. To manage this goal, they feed Facial images associated to the regions of interest into the neural network. At the end of the learning step, each neural unit is tuned to a particular Facial image prototype. Facial recognition is then performed by a probabilistic decision rule. This scheme offers very promising results for face identification dealing with illumination variation and facial poses and expressions. This paper presents a PCA Algorithym for face recognition. The PCA method is trained on images from one database. The novelty of this work comes from the integration of Images from input database, Training and Mapping. Among the architec-tures and algorithms suggested for artificial neural network, the Self-Organizing Map has special property of effectively creating spatially organized "internal representation' of various features of input signals and their abstractions. One develops realistic cortical structures when given approximations of visual environment as input, and is effective way to model the develop-ment of face recognition capability.

[2] Jawad Nagi, Syed Khaleel Ahmed, Farrukh Nagi "A MATLAB based Face Recognition System using Image Processing and Neural Networks", 2008.

Automatic recognition of people is a challenging problem which has received much attention during recent years due to its many applications in different fields. Face recognition is one of those challenging problems and up to date, there is no technique that provides a robust solu-tion

to all situations. This paper presents a new technique for human face recognition. This technique uses an image-based approach towards artificial intelligence by removing redun-dant data from face images through image compression using the two-dimensional discrete cosine transform. The DCT extracts features from face images based on skin color. Feature vectors are constructed by computing DCT coefficients.

A self-organizing map using an un-supervised learning technique is used to classify DCT-based feature vectors into groups to identify if the subject in the input image is "present" or "not present" in the image database. Face recognition with PCA is carried out by classifying intensity values of gray scale pixels into different groups. Evaluation was performed in MATLAB using an image database of 25 face images, containing five subjects and each subject having 5 images with different facial expressions. After training for approximately 850 epochs the system achieved a recognition rate of 81.36% for 10 consecutive trials. The main advantage of this technique is its high-speed processing capability and low computational requirements, in terms of both speed and memory utilization.

[3] Priyanka Dhoke, M.P. Parsai" A MATLAB based Face Recognition using PCA with Back Propagation Neural network", An ISO 3298,2014.

Automatic recognition of people is a challenging problem which has received much attention during recent years due to its many applications in different fields. Face recognition is one of those challenging problems and up to date, there is no technique that provides a robust solu-tion to all situations. There are many techniques used for this purpose. Face recognition is an effective means of authenticating a person. In this paper, a face recognition system for per-sonal identification and verification using Principal Component Analysis (PCA) with Back Propagation Neural Networks (BPNN) is proposed. The dimensionality of face image is re-duced by the PCA and the recognition is done by the BPNN for face recognition. The system consists of a database of a set of facial patterns for each individual. The characteristic fea-tures of pca called eigenfaces" are extracted from the stored images, which is combine with Back Propagation Neural Network for subsequent recognition of new images.

[4] Omaim N. A. AL-Allaf" REVIEW OF FACE DETECTION SYSTEMS BASEDARTIFIIAL NEURAL NETWORKS ALGORITHMS", The International Journal of Multimedia & Its Ap-plications (IJMA),2014.

Face detection is one of the most relevant applications of image processing and biometric systems. Artificial neural networks (ANN) have been used in the field of image processing and pattern recognition. There is lack of literature surveys which give overview about the studies and researches related to the using of ANN in face detection. Therefore, this research includes a general review of face detection studies and systems which based on different ANN approaches and algorithms. The

strengths and limitations of these literature studies and systems were included also.

III.PROPOSED METHODOLOGY

In research of Face Recognition, there are issues in detection and matching of face with the trained images. Our main goal is to detect the image by different perspectives.
a. To analyze the existing techniques of Face Recognition.
b. To identify the issues in existing system.
c. Research on new parameters for improves the efficiency.
d. Implement PCA Algorithm to improve the efficiency of face detection.
e. Analyse the improved efficiency.
f. Analyse the results and accuracy.

Problem Statement
In face recognition system, the face detection and feature mapping is core concern to analyze the face. There is need of training for detection of faces from different perspective. The efficiency is the main concern for feature selection and multiple algorithm proposed for solve the accuracy problems. In the past techniques, there is need to provide the large test or training images to detect and assign the particular class means efficient image processing. Automatic recognition of people is a challenging problem which has received much attention during recent years due to its many applications in different fields. Face recognition is one of those challenging problems and up to date, there is no technique that provides a robust solution to all situations.
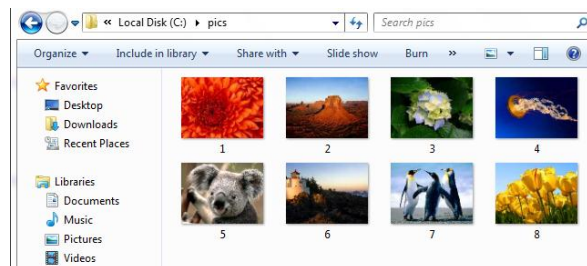
IV.RESULTS
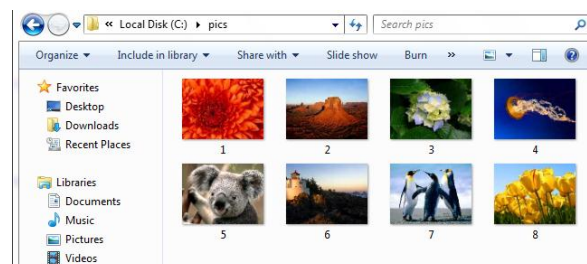

Fig 3 Two Clusters before Normalization on Data

Fig 4 Testing Data

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>> facerecog('C:\pics','C:\testing\Lighthouse.jpg')

ans =

6.jpg
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Fig 4 Test 1

As shown in Fig. 4, result is accurate.

We have performed 14 tests.
Accurate results: 12, wrong: 2
Efficiency: 85%

V. CONCLUSION

The paper has presented a face recognition system using PCA with neural networks in the context of face verification and face recognition using photometric normalization for comparison. The experimental results show the N.N. Euclidean distance rules using PCA for overall performance for verification. However, for recognition, E.D. classifier gives the highest accuracy using the original face image. Thus, applying histogram equalization techniques on the face image do not give much impact to the performance of the system if conducted under controlled environment.

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