International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056
Volume: 04 Issue: 05 | May -2017 www.irjet.net p-ISSN: 2395-0072

REVIEW OF FACE RECOGNITION TECHNIQUE USING PCA AND BPNN

Shalu Kansal[1], Assistant Professor Er. Suchitra[2]

[1,2]*Department of Computer Science and Engineering*

Galaxy Global Group of Institution Dinarpur, Ambala, India

Abstract - *Face recognition is one of the interesting research areas in past many years. The reason behind this is its numerous ranges of applications like information security, law enforcement & surveillance, access control, and smart cards etc. It is gaining so much attention in public due to network access via multimedia. Network access with the help of face recognition and verification make recognition system difficult to hack by hackers virtually. It is impossible for them to steal someone password. Face recognition can be done in public security systems by comparing selected face feature of candidate and available face database. This paper focuses on highlighting the strengths and limitations of the earlier proposed classification techniques. The paper provides an insight into the reviewed literature to reveal new aspects of research.*

Keywords: Biometric, PCA , BPNN, Neural Network**.**

I. INTRODUCTION

Biometric is a technique for identification and verification of a person based on their behavioural and physiological characteristics. It is an emerging area. The definition of biometrics comes from Greek word: Bio means life &metry means to measure. There are two types of biometric characteristics: behavioural and physiological. Physiological biometrics includes: face, fingerprint, and hand geometry, retina & iris recognition. Behavioural biometrics includes: signature and voice [1].

A biometric system can works in two ways: verification and identification.

- Verification: it is a process of one to one comparison to verify the individual. Its performance is better and faster than identification.

II. PCA

The core of face feature extraction is Eigen face also known as Principal Component Analysis (PCA).

PCA represents face data in terms of mean square error (MSE). The samples of face data are easily handled with the help of orthogonal component analysis. PCA is a type of feature reduction method that reduce large face feature into small face feature indicators that represents the face feature effectively [6].

Let us assume there is N number of face samples. By measuring each face sample, we get K number of indicators, means total no of data is NK. It is process to find small number of face indicators called principal components from large data set. The two main property offer by principal components is that they must be independent of each other, they represents the original face information data as much as possible. There is projection of higher dimensional subspace into lower dimensional subspace with the criteria of minimum reconstruction error. The subspace created by these face feature indicators must be relevant to the largest Eigenvectors obtained by covariance matrix. For classical face feature extraction & facial data representation, PCA is widely used. It is also called dimensionality reduction technique. Starting with L number of face features, to obtain a new sample set Z, we use linear transformation procedure. In this, components of Z are uncorrelated. In next stage, we select the significant components.

Existing PCA depended facial recognition systems have high computational cost & memory too. Because of this, it is difficult to scale up. In training stage, all the training data are prepared for calculation of projection matrix, this type of operational mode is called batch mode [2]. It stops when all the training data have been operated. There is a case, if we want to add some training data in existing data; we have to retrain all the collected data. This means that it is difficult to scale up the recognition systems.

III. Linear Discriminant Analysis

Another technique for face feature extraction is Linear Discriminant Analysis (LDA). By finding suitable projection vectors, there is projection of higher dimensional subspace into lower dimensional subspace [3]. The major problem faced by LDA is small sample size. This arises when the number of face samples is smaller than dimension of the face samples which results in computational difficulty. LDA is affected by small sample size problem which is major problem in face recognition which results in low recognition rate of test data.

In face recognition, 2D face image is converted into 1D long face vector which is then transformed into high-dimensional face vector space. This face vector space results in many advantages. It also results in problems like dimensionality dilemma & sample size issue. This further result in series of problems like how to increase the accuracy, how to handle numerical instability in face recognition, how to reduce down the computational complexity, how to reduce storage requirement, how to improve image quality, how to lower down the transmission time in face image transmission and so on [4].

IV. Independent Component Analysis

In recent years, Independent Component Analysis (ICA) is a method to observe data with linear decomposition, in such a way that it can be decomposes into independent components statistically. Hidden statistical model is the basic idea behind using ICA. This model is known as ICA model; it shows observation data are calculated by mixing of independent components. These components cannot be examined directly that is why they are called hidden variables [6]. Only thing that can be observed is random vectors should be estimated under assumed conditions. The components in ICA are independent statistically & they must not posses Gauss distribution. There are uncertainties of ICA: (a) cannot ensure of variance of components; (b) not sure about order of components. The principle of ICA algorithms are: to extract face feature vectors, to do face recognition, for face feature compression.

V. Artificial Neural Network

ANN is very useful in sensor data processing, extraction of features, automated signal recognition, medical diagnosis, information & signal processing, decision making, and speech processing. Face recognition has emerged as a new area in ANN because network structure is suitable for task as same as biological systems, such as brain. It is made up of large number of highly interconnected processing elements (neurons) working in unison to solve specific problems. Advancement in neural network is simultaneous optimization of network architecture & synaptic weights to obtain desirable performance.

Neural network have two types of layers: (a) Single weight layer where input units are directly connected to output units; (b) Multiple layers where hidden units are used to connect input units to output units. Hidden units are used to represent the internal architecture of input units. There are two types of ANN algorithms: supervised learning and unsupervised learning. Supervised learning incorporates an external teacher so that each output unit is told what it is desired response to input signals ought to be. During learning process, global information may be required. Examples are error-correction learning, reinforcement learning. The aim is designing of the weights with minimum error by using least square method. Un-supervised learning has no external teachers and based upon local information.

The architecture of neural network can be divided into two parts: (a) Feed-forward neural network; (b) Re-current neural network. In feed-forward neural network, information flow in unidirectional mode. Information processing is parallel and distributed. In re-current neural network, information flow in multi-directional mode[9]. Nodes connect back to other nodes and themselves. The advantage of using ANN is (a) parallel processing; (b) fault tolerance mean damage to few units and weight may not be fatal to the overall network. The disadvantage is that they are complicated algorithms.

VI. Block Diagram of Face Recognition System

The face recognition technique normally consists of four following steps:

(1) Detection of face.
(2) Normalization of face.
(3) Feature extraction.
(4) Facial recognition and verification.

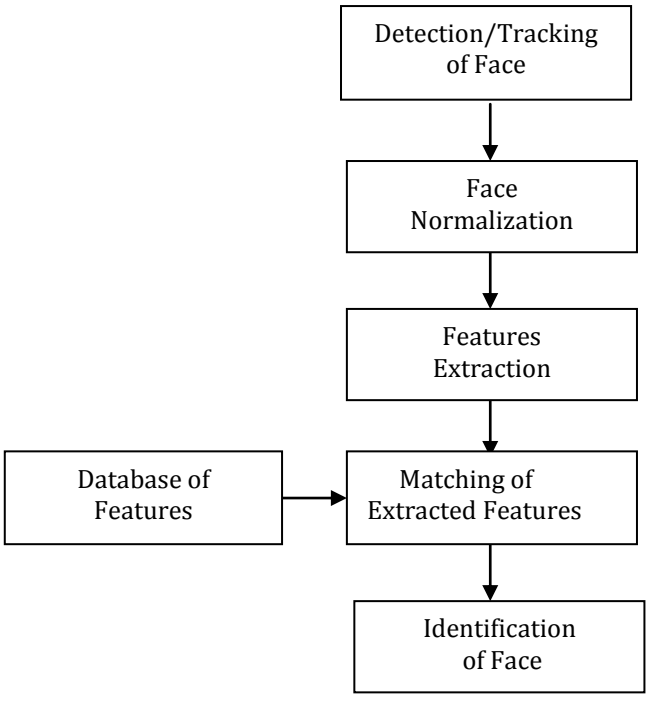

Figure 6.1: Face recognition processing flowchart [4]

The capturing of a face image is first step in the face recognition technique. It can be done with the help of a still or video camera.

A. Detection of Face:

Traditionally, Detection of face in an image can be done with the help of facial features (ex. Eyes, lips, nose etc).

B. Normalization of Face:

After the detection of face, face should be normalized. Normalization means extracting the unique feature of an image by subtracting the common features. It means that face image should be standardized in factors like pose [8], occlusion, size & illumination compare to the face images in reference or gallery database. Recognition process can only be successful if the gallery images and probe image are same in terms of rotation, pose, size, scale, and orientation etc.

C. Feature Extraction:

After the normalization of face, extraction of features takes place. This features must be unique for each and every probe image. In this, a mathematical model called face template is generated. Then it is stored in test database. With the help of this template, we can do our recognition task.

D. Face Recognition & Verification:

In last of face recognition technique, the template of test face is compared with the template of each and every face of the database. We recognize and verify a face if we got a hit

between these faces. Sometimes, face does not support well in recognition of a person even we have developed many facial recognition techniques with high recognition rates.

The facial nodal points that are measured by the face recognition software are listed below:

1) Sides of the mouth
2) Distance between pair of eyes
3) Eye socket depth
4) Nose width
5) Chin
6) Shape of the cheekbones
7) Measurement of position of relative features.
8) Jaw line

Table 2.1: Comparisons of FR techniques

Technique	Merits	Demerits
Principal Component Analysis (PCA)	• Recognition process is simple and efficient • No knowledge of geometry of faces is required • Low dimensional subspace representation used for data compression • Raw intensity data are used directly for learning	• It is highly sensitive to scale, therefore, pre-processing is still required for scale normalization • Recognition rate decreases for recognition under varying pose and illumination • Experiments were conducted only with frontal views
Local Binary Pattern (LBP)	• Effective to represent image texture feature • Moving objects detection via background subtraction • Simple approach • Features tolerance against changes of illumination	• Low sensitive to small changes in the face localization • Using larger local regions increases the errors • For binary and grey images only
Neural Network	• When an element of NN fails, it can work without any problem by their parallel structure • A neural network learns & need not to be reprogrammed • NN can be used in any applications	• Complex process • Detection process is slow

*Linear Discriminant Analysis (*LDA)	• Illumination problem solved by maximizing the ratio of within-class scatter to between-class scatter	• When all scatter matrices are singular, it fails • Small sample size problem when pixels are of large number, but the total number of training samples is less than the dimension of the feature space

Independent Component Analysis (ICA)	• Performance is good in noise reduction, data reduction, and pattern recognition • Independents components or features are extracted by an iterative procedure hence there is a little variation in answer at different times	• Assume para-meters of source remain stat-ionary in time, which is not really true
Back Propagation Neural Network (BPNN)	• Computationally effectively method for weights changes in feed forward neural network, to learn training set of input-output data • Minimizes the total mean squared error of the output calculated by the net • Non linear face images can be verified easily • Execution time is less in terms of seconds	• Complex technique
Elastic Bunch Graph Matching (EBGM)	Face recognization with feature change(like nose and ear)	• Sensitive to change in light-ening condition. Memory usage required is high

VII. CONCLUSION

The study shows that recognition system using PCA and BPNN provides high recognition rate and fast execution time. PCA is used for feature extraction and space dimension reduction. BPNN is used for image classifications. Recognition rate and execution time are two main parameters, which are measured during implementation of PCA and (PCA+BPNN). With PCA, we achieve faster execution time but rate of recognition decreases as number of subjects' increase.

REFERENCES

[1] S.O. Ojo, T. Zuva, S.M. Ngwira, Survey of Biometric Authentication for E-", IEEE International Conference on Computing, Communication and Security, pp. 1-4, 2015

[2] Dr. S. Ravi1, Dattatreya P. Mankame, Sadique Nayeem, "Face Recognition using PCA and LDA: Analysis and Comparison", IEEE Transactions on Circuits and Systems for Video Technology, pp. 6-16, 2013

[3] Swarup Kumar Dandpat, Prof. Sukadev Meher, "Performance improvement for face recognition using PCA and two-dimensional PCA", IEEE Computer Communication and Informatics, pp. 1-5, 2013

[4] Abhishek Bansal, Kapil Mehta, SahilArora, "Face Recognition Using PCA & LDA Algorithms", IEEE Computer Communication and Informatics, pp. 1-5, 2012

[5] Erwin Hidayat, FajrianNur A., AzahKamilahMuda, Choo Yun Huoy, Sabrina Ahmad, "A Comparative Study of Feature Extraction Using PCA and LDA for Face Recognition", IEEE International Conference on Security, pp. 354-355, 2011

[6] NareshBabu, AnnisFathima, V. Vaidehi, "An Efficient Face Recognition System using DWT-ICA features", IEEE International Conference on Digital Image Computing: Techniques and Applications, pp. 146-151, 2011.

[7] Akrouf Samir, Sehili Med Amine, Chakh choukh Abdesslem, "Face Recognition using PCA and DCT", IEEE International Conference on Systems, pp. 15-19, 2009

[8] Swati jadon, Mahendra Kumar, YogeshRathi, "Face Recognition using Neural Network with DDCT Facial Feature Extraction Techniques", IEEE Communication and Signal Processing, pp. 1070-1074, 2015

[9] M. Hassaallah, SalehAly, "Face recognition: challenges, achievements and future directions", IEEE IET Computer vision, vol. 9, pp. 614-626, October 2014.