Face Recognition System using Deep Face and Neural Network

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Abstract— The process of face recognition involves the determination of facial features in an image, by recognizing those features and comparing them to one of the many faces in the database. There are many algorithms capable of performing face recognition; such as: PCA, Discrete Cosine Transform, 3D recognition methods, Gabor Wavelets method etc. There were many issues to consider when choosing a face recognition method. With these in mind the PCA based method of face recognition has found to be better because: Simplest and easiest method to implement, Very fast computation time. PCA has the ability to recognizing a face with a different background is difficult. In this research paper, the face recognition system proposed the Detection time, false negative in missed faces and optimality of the face. This proposed research work has been focused on optimality features of the neural network for the face images and detection time. In this paper, we have applied the neural network for three parameters such – detection time, false acceptance rate, successful rates, no. of failure, and cross correlation

Key words: Deep Face, Neural Network

I. INTRODUCTION

Face detection is a computer technology that determines human faces in terms of locations and size. It detects facial features and ignores other things, such as buildings, trees and bodies. Various government agencies are now actually more motivated to improve security data systems centered on body or behavioral characteristics, often called biometrics. The most frequent biometrics is fingerprints, very common and also iris, but many other characteristics of human have been already studied in last year's such as finger/palm geometry, voice, signature, and face.

Face recognition is basically useful for two primary authenticity modes. Verification is generally described as one to 1 matching system because the machine tries to match the image presented the in-patient against a specific image already on file. Identification verifies and check the image presented against all others in the database. Identification systems are referred to as a 1-to-n matching system, where n is the total amount of images in the database.

There are many application areas by which face recognition could be exploited for those two purposes. Security in access control to buildings, airports/seaports, ATM machines and border checkpoints. Other application is surveillance as a big amount of CCTVs could be monitored to look for known criminals, drug offenders, etc. and authorities could be notified when one is located. General identity verification in Electoral registration is in various forms like , banking, electronic commerce, IDs, passports proof, licenses, employee IDs is application.

II. EXISTING WORK

H. Josh et al. [1] observed that the human face is inherently symmetric and they wish to exploit this symmetry in face recognition. The average-half-face has been previously shown to accomplish just that for a set of 3D faces when utilizing eigenfaces for recognition. They build upon that work and present a contrast of the utilization of the average-half-face to the utilization of the initial full face with 6 different algorithms placed on two- and three-dimensional (2D and 3D) databases. The average-half-face is made of the full frontal face image in two steps; first the facial skin image is centered and divided in two and then the two halves are averaged together (reversing the columns of one of the halves).

In among research reviews, the few researchers are working with different methods, Yamin Taigman et al. in 2014 have presented closing the gap to human level performance in face verification which is based on conventional pipeline. The conventional pipeline consist detection, alignment, representation and classification to face images. This pipeline methodology was used for the 3D face image to fill the gap for the better performance. Wang et al. in 2008 proposed to inspect a correlation matrix constructing a bank of Bayesian Networks with the goal of selecting such various filter parameters used in filters comprising the filter bank would be as uncorrelated as possible. The same methodology can also be used to visualization and found difference between the classical and the principal Bayesian Networks. John Canny et al. in 2010 have presented a novel computational approach to edge detection proposed in their paper the basics of image processing concepts

S. Mallat et al.[22] in 2010 has presented Singularity detection and image processing, learning in machine, networks, fractals, genetic algorithms, wavelets, and data mining for better performance. In his journal, he suggested a min-max composition rule to measure the similarity in various types of images.

J. Canny et al. in 1998 studied on a computational approach to edge detection, and proposed the image denoising using multimodal keywords. Rishi R. et al. in 1979 has presented to research interests including pattern recognition, regression techniques, image processing, and data mining. These are responsible for the analytics and models required to reduce the risk factor of the American Express credit card business.

Aditi Verma and Meha Khera "Comparative Study on Biometrics: a review" International Journal of Advanced Research in Computer Science and Software Engineering, Vol. 4, Issue 5, pp 233-236, 2014.In this paper it is discussed that biometric System operates by getting biometric information from a personal that extracts a feature set from the data which is acquired, and helps in comparing this feature set against the template stored in the database. There are biometric technologies which could either be physiological or behavioral. Face Recognition is having the importance to provide biometric authentication with easy image acquisition that can be used for online and offline applications. There are number of existing approaches for biometric facial recognition and classification. This paper

gives a review on some of the common and reliable approaches which include PCA, LDA, and SVM, SIFT, SURF, etc.

Yamin Taigman et al. in 2014[23] have presented closing the gap to human level performance in face verification which is based on conventional pipeline. The conventional pipeline consist detection, alignment, representation and classification to face images. This pipeline methodology was used for the 3D face image to fill the remaining difference for the efficient and best accurate performance.

III. METHDOLOGY

By this research, it is proposed that face recognition system using neural network and PCA. The flow of process has mentioned in the following flow charts:

A. Step 1: Subtract The Mean Of The Data From Each Variable (Our Adjusted Data):

The Eigen Face Recognizer class applies PCA on each image, the results of which will be an array of Eigen values that a Neural Network can be trained to recognize.

The method of which PCA is applied can vary at different stages so what will be demonstrated is a clear method for PCA application that can be followed. It is up for individuals to experiment in finding the best method for producing accurate results from PCA.

B. Step 2: Calculate And Form A Covariance Matrix:

The basic Covariance equation for two dimensional data is:

$$cov(x,y) = \frac{\sum_{i-1}^{n}(x_i - \bar{x})(y_i - \bar{y})}{(n-1)}$$ Eq.1 [6]

Which is similar to the formula for variance however, the change of x is in respect to the change in y rather than solely the change of x in respect to x. In this equation x represents the pixel value and $\bar{x}$ is the mean of all x values, and on the total number of values.

C. Step 3: Calculate Eigen Vectors And Eigen Values From The Covariance Matrix:

Eigen values are a product of multiplying matrices however they are as special case. Eigen values are found by multiples of the covariance matrix by a vector in two dimensional space (i.e. an Eigenvector). This makes the covariance matrix the equivalent of a transformation matrix

D. Step 4: Choose A Feature Vector (A Fancy Name For A Matrix Of Vectors):

Now a usually the results of Eigen values and Eigenvectors are not as clean as in the example above. In most cases the results provided are scaled to a length of 1. Once Eigenvectors are found from the covariance matrix, the next step is to order them by Eigen value, highest to lowest. This gives you the components in order of significance. Here the data can be compressed and the weaker vectors are removed producing a lossy compression method, the data lost is deemed to be insignificant.

E. Step 5: Multiply The Transposed Feature Vectors By The Transposed Adjusted Data:

IV. FACE RECOGNITION STAGES

Face recognition is implemented using various stages main stages are shown in Fig 1

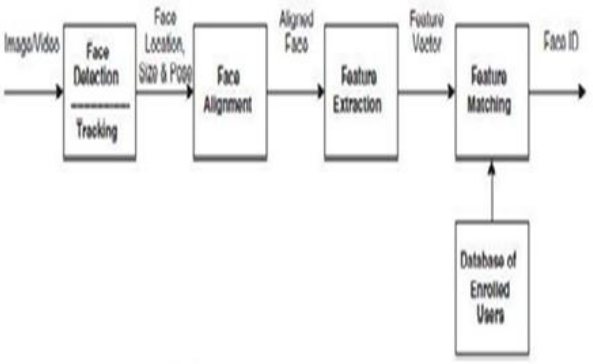

Fig. 1: Procedure for Face Recognition [6]

Detection [10]: In this step the face is detected whether the human face appears in given image or where these faces are located [23].

Align: After the face is detected the alignment is done to justify the scales and orientation of patches. In this the face is need to be turned at 360 degrees [23].

Represent: After the normalization is done of the face by using light the system converts the data into the unique code [23].

Classification: This is the last step in this the new facial which is acquired is compared to the stored data and it compare whether it match or not [23].

V. PROPOSED APPROACH

The Eigen Face Recognizer class applies PCA on each image, the results of this will be in the form of an array of Eigen values that a Neural Network can be trained to recognize.

The method of PCA can be applied at various different stages so what will be explained that it is a clear method for PCA application that can be followed. It is up for individuals to experiment in finding the best method for producing accurate results from PCA.

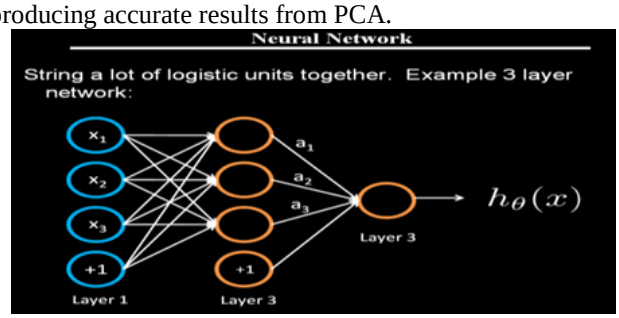

Fig. 2: Working of neural network in first stage

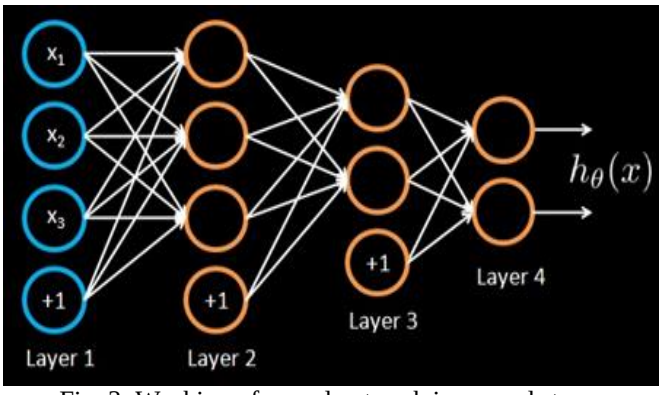

Fig. 3: Working of neural network in second stage

A. *Covariance Matrix:*

The equation of Covariance for two dimensional data is as follow:

$$cov(x,y) = \frac{\sum_{i-1}^{n}(x_i - \bar{x})(y_i - \bar{y})}{(n-1)} \quad (1)$$

Which is similar to the formula for variance however, the change of x is in respect to the change in y rather than solely the change of x in respect to x. In this equation x represents the pixel value and ¯x is the mean of all x values, and on the total number of values.

B. *Eigen Values Vector:*

Eigen values are a product of multiplying matrices however they are as special case. Eigen values are found by multiples of the covariance matrix by a vector in two dimensional space (i.e. a Eigenvector). This makes the covariance matrix the equivalent of a transformation matrix

C. *Feature Vector:*

Now a usually the results of Eigen values and Eigenvectors are not as clean as in the example above. In most cases the results provided are scaled to a length of 1.

VI. Results and Discussion

In this research paper the face recognition has focused on different techniques including the parameters such as time, false acceptance rate and cross correlation. These parameter increases the value of research work on the basis of previous work and the proposed work.

A. *False Acceptance Rate:*

The false acceptance rate, or FAR, is the measure of the likelihood that the biometric security system will incorrectly accept an access attempt by an unauthorized user. The results are shown in table 2.

	Methodology	Preet	.	m
FAR	Previous	0.68	0.58	0.23
	Proposed	0.1	0	0

Table 2: FAR Results

B. *Cross Correlation:*

The cross correlation is used for accurate measurements of changes in face images. Table 3 represents the results of cross correlation parameter of previous and proposed method.

	Methodology	Preet	.	m
Cross Correlation	Previous	0.565	0.726	0.907
	Proposed	0.876	0.892	0.988

Table 3: Comparison of Cross Correlation

VII. Conclusion

Face detection is widely used in many applications. So, it is necessary to establish a suitable method for face detection. The literature survey has shown the various face detection algorithms. It is the availability of trade-off that exists between accuracy versus computation time. This algorithm provide most possible accurate and matching details .In the foreseeable future new face detection will soon be proposed which could increase the accuracy of face detection in addition to which comes up with less computational complexity.

The proposed methodology is more successful and provides the better optimality in face recognition pattern and shows the better detection time as compared to previous research work.

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