ANALYSIS OF ALGORITHM USED IN FACE RECOGNITION SYSTEM

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Abstract - Face recognition is one of the most challenging aspect in the field of image analysis. Face recognition has been a topic of active research since the 1980's, proposing solutions to several practical problems. Face recognition is probably the biometric method that is used to identify people mainly from their faces. However, the recognition process used by the human brain for identifying faces is very challenging. In this paper, a Genetic Algorithm (GA) based approach is proposed for face recognition. The proposed algorithm recognizes an unknown image by comparing it with the known training images stored in the database and gives information regarding the person recognized. The proposed algorithm is then compared with other known face recognition algorithms viz: Principal Component Analysis(PCA) and Linear Discriminate Analysis (LDA) algorithms. It has been observed that the recognition rate of the proposed algorithm is better.

Keywords - Face Recognition; UMIST; ORL; PCA; LDA; Genetic Algorithm.

I. INTRODUCTION

Face recognition is a task of pattern recognition that is specifically performed on faces .In other words, it can be described as classifying a face either known or unknown by comparing a face with stored known individuals in the database. It is also desirable to have a system that has the ability of learning to recognize unknown faces. People have a good ability to recognize and distinguish between faces but recognizing human face automatically by computer is very difficult.

The main goal of face recognition technology is to match a given face image against the stored database of images. Face recognition technique uses several other disciplines such as image processing, computer vision, pattern recognition, neural networks and psychology. With the current perceived world security situations, governments as well as businesses require reliable methods to accurately identify individuals, without overly infringing on rights to privacy or requiring significant compliance on the part of the individual being recognized.

Face recognition is a technique that takes the image of a person (query image) and compares it with the previously recorded images in the database. This is done by comparing the invariant features obtained from the techniques that capture the representative variability of the faces or the structure, the shape and the face attributes like distance between the eye centers and nose, upper outlines of the eyes, width of eyebrows, etc.

Face recognition has the benefit of being a passive, non intrusive system to verify personal identity in a natural and friendly way. The main benefit of this technique over other biometric approaches is that the face images can be taken from a distance even without the knowledge of the individual being observed as might be required in identifying the presence of the criminals in a bank or government etc.

Biometric-based techniques have emerged as the most promising option for recognizing individuals in recent years, instead of authenticating people and granting them access to physical and virtual domains based on passwords, PINs, smart cards, plastic cards, tokens, keys and so forth, these methods examine an individual's physiological and/or behavioral characteristics in order to determine and/or ascertain his identity. Passwords and PINs are hard to remember and can be stolen or guessed; cards, tokens, keys and the like can be misplaced, forgotten, purloined or duplicated; magnetic cards can become corrupted and unreadable. However, an individual's biological traits cannot be misplaced, forgotten, stolen or forged.

Biometric-based technologies include identification based on physiological characteristics (such as face, fingerprints, finger geometry, hand geometry, hand veins, palm, iris, retina, ear and voice) and behavioral traits (such as gait, signature and keystroke dynamics).

The Major contributions of this paper are:

- The originality of the approach lies in applying the Genetic Algorithm (GA) based approach to recognize the face.
- An evaluation procedure based on the concept of chromosomes or genomes is proposed to

recognize the face. The proposed method in compared with existing PCA, LDA techniques for face recognition.

- The results of the proposed method have been calculated for different facial images taken from ORL, UMIST and Indbase benchmarked datasets.

II. LITERATURE REVIEW

Steven Fernandes et al. in 2013 presented the performance analysis of different face recognition techniques like Principal Component Analysis (PCA) and Linear Discriminant Analysis (LDA) . This analysis was carried out on various current PCA and LDA based face recognition algorithms using standard public databases.

Soma Biswas et al. in 2013 proposed the approach that uses multidimensional scaling to transform the features from the poor quality probe images and the high quality gallery images simultaneously.

Ali Javed in 2013 proposes a work which develops a computer system that can recognize a person by comparing the characteristics of face to those of known individuals in the stored database.

Mrs. Sunita Roy et al. in 2013 describes important aspects of face detection, which are very much useful in many applications like face recognition, facial expression recognition, face tracking, facial feature extraction, gender classification, identification system, document control and access control, clustering, biometric science, human computer interaction (HCI) system, digital cosmetics and many more.

Navneet Jindal et al. in 2013 demonstrated the face detection system of colored face images which is invariant to the background and acceptable illumination conditions. A threshold level is set to reject the non-human face images and the unknown human face images which are not present in the input database of face images. In this paper, a new approach to face recognition is proposed which analyses the face recognition results using different databases and results in better recognition rate. In the proposed system, face recognition task is completed with improved accuracy and success rate even for noisy face images.

III. PROBLEM FORMULATION

The recognition of faces through face recognition technique relies on detecting the individuals features such as the eyes, nose, mouth, and head outline, and defining a face model by the position, size, and relationships among these features. Such approaches to face recognition are di cult to extend to multiple views and often been quite fragile, requiring a good initial guess to guide them.

Research related to human strategies in the field of face recognition has shown that individual features and their immediate relationships comprise an insufficient representation to account for the performance of adult human face identification. In this paper, the proposed Genetic method is compared with the Principal Component Analysis (PCA) and Linear Discriminate Analysis (LDA) algorithms for face recognition and analyzed the face recognition results using various databases such as ORL, UMIST and Indbase. The main purpose of research is to improve the recognition rate using the proposed method.



Fig. 1. Recognition rate for the Genetic Algorithm

IV. METHODOLOGY FOR THE PROPOSED WORK

The proposed Genetic Algorithm is characterized by a search technique as described in the Darwin's evolutionist theory which adapts selection mechanism where individuals, that is the chromosomes, more adapted of a population are the ones that have more survival chances and can be used easily according to changes that occur in its environment. This makes the algorithm strong and fast in those situations where the search space is too big and the conventional methods become inefficient.

The output from the genetic algorithm results in a set of solutions and not only one solution for better recognition. In the genetic algorithm, the problem to be solved is represented by a list of parameters which drives an evaluation procedure, called chromosomes or genomes. Chromosomes can be defined as simple strings of data and instructions. In the first step of the algorithm, such chromosomes are generated randomly or heuristically to form an initial pool of possible solutions called first generation pool.

The proposed algorithm can be described as:

1. Firstly suppose we have a population of N size, with chromosomes generated randomly;
2. Apply fitness to each chromosome or genomes of population;

3. Make new chromosomes or genomes through crossings of selected chromosomes of this population. Apply recombination and mutation in these chromosomes;
4. Eliminate old population members , so that there is enough space to insert new chromosomes, keeping the population with the same N chromosomes.

The different steps to implement the PCA, LDA and GA for Face Recognition are:

Step1. To train the data set and select the appropriate databases from the selection.

Step2. After training, it will produce the Eigen vector for the images.

Step3. Next we need to browse the image from the ORL, UMIST and Indbase data bases

Step4. Then select the recognize button to recognizing the facial image.

Step5. Finally select the Result button to compute the final recognition rate for PCA, LDA and GA.

V. RESULTS AND DISCUSSIONS

Figures 1-3 represents the recognition rate of Genetic, PCA and LDA methods. From these figures, it is clear that the recognition rate for the Genetic method is higher than the PCA and LDA. The genetic algorithm reduces the training images due to its optimality principle which is not possible in PCA and LDA methods.



Fig. 2. Recognition rate for the PCA Method



Fig. 3. Recognition rate for the LDA Method

The compiled results for all databases are shown in Table 1-3. The results clearly shows that the recognition rate of Genetic algorithm are better than the PCA and LDA in case of ORL, UMIST and Indbase databases. Genetic algorithms has higher face recognition rate than the PCA and LDA. Although PCA method has recognition rate are better than LDA. But overall the Genetic algorithms have shown the better recognition rate from PCA and LDA.

Table-1 shows the recognition rate using Genetic method for all the databases. It clearly shows that the genetic method has higher recognition rate from all databases in different number of classes and different number of test cases.

Table 1. Recognition rate using Genetic method

Method	Database	Number of Classes	Number of Test Cases	Recognition Rate
Genetic Algorithm	ORL	10	3	98.58
		20	4	97.50
		30	8	95.00
		40	7	92.50
	UMIST	10	6	97.50
		10	7	100.00
		20	7	91.66
	Indbase	10	4	98.33
		10	5	98.00
		20	6	96.00

Table 2: Face recognition rate using PCA method from all available databases

Method	Database	Number of Classes	Number of Test Cases	Recognition Rate
PCA	ORL	10	3	97.14
		20	4	91.44
		30	3	87.60
		40	2	81.87
	UMIST	10	2	73.75
		20	2	70.62
		20	4	84.16
	Indbase	10	3	58.71
		10	4	60.00
		10	5	70.00

Table 3: Face recognition rate using LDA method from all the available databases

Method	Database	Number of Classes	Number of Test Cases	Recognition Rate
LDA	ORL	10	2	76.25
		20	4	55
		30	4	42.70
		40	2	36.25
	UMIST	10	2	28.75
		20	2	63.12
		20	4	60.83
	Indbase	10	2	52.50
		10	3	70.00
		10	4	33.33

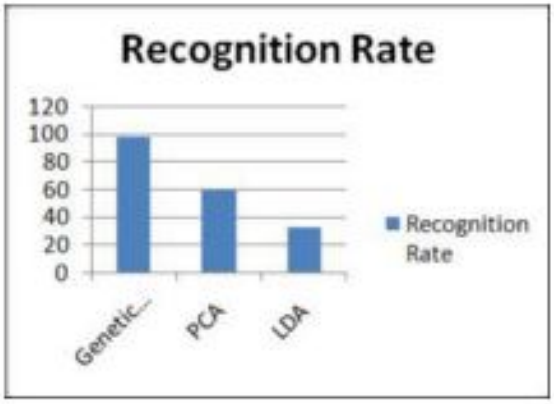


Fig. 4. Recognition rate for ORL database



Fig. 5. Recognition rate for UMIST database.

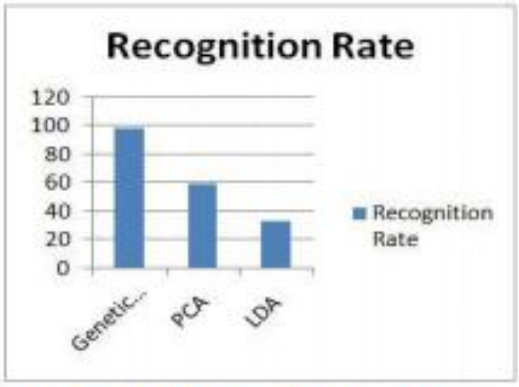


Fig. 6. Recognition rate for Indbase database.

VI. RESULT ANALYSIS

Case 1: Recognition rate for ORL database
When the number of classes is 4 and Number of test cases are 40 Figure 4 clearly shows that the recognition rate of genetic algorithm is higher than the both PCA and LDA method.
Case 2: Recognition rate for UMIST database
When the number of all classes are 10, the genetic algorithm shows the 100% recognition rate and also shows the better result than both PCA and LDA method in case of UMIST database as shown in Figure 5.

Case 3. Recognition rate for Indbase database
When the number of classes is 10 and number of test cases are 4 Figure 6 clearly shows that when the data bases are Indbase, the proposed Genetic method again shows the better recognition rate than the PCA and LDA method. Overall recognition rate of Genetic method are better than the PCA and LDA method in case of ORL, UMIST and Indbase databases.

The main objective of the research work is fulfilled because the proposed method shows the better recognition rate than the existing method of the base paper. We are also testing the proposed method for three different databases. And the result of proposed Genetic method shows the better outcome in all three databases than the PCA and LDA.

CONCLUSION AND FUTURE SCOPE

Face recognition is one of the challenging aspect in the field of image analysis and computer vision. The focus towards the face recognition has been increased in the last few years due to its enormous applications in different domains. The research conducted in this field for the past four decades leads to encouraging results but still we are unable to find the face recognition technique which is able to perform e ciently in the various situations commonly encountered in daily life. The algorithms related to face recognition technique are thoroughly studied taking a number of test images and varying the conditions and variables.

Proposed Genetic algorithm based method is applied on three different benchmarked databases: ORL (Olivetti Research Laboratory), UMIST and Indbase. The ultimate objective of the research work is to improve the recognition rate.

The proposed method gives better recognition rate as com-pared to existing PCA and LDA methods. It has been observed that the proposed Genetic algorithm based method has achieved the 98.57 % face recognition rate with ORL database, 100 % recognition rate with UMIST database and 98.33 % recognition rate with Indbase database which is far better than the existing techniques PCA and LDA. The proposed work can further be improved using other optimization algorithms and can also be applied on other benchmarked databases.

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