Face Recognition System Genetic with PCA and LDA

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ABSTRACT

Face recognition is one of the most challenging aspects 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.

1.1. Framework for Face Recognition

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.

1.2. Applications of Face Recognition System

It has become one of the most active research areas especially in recent years as it has a variety of wide applications in the areas:

➢ Public security
➢ Law enforcement and commerce
➢ Credit card verification
➢ Criminal identification
➢ Access control
➢ Human-computer intelligent interaction
➢ Digital libraries and information security

### 1.3. Challenges in the Field of Face Recognition

The challenges associated with face recognition can be attributed to the following factors:

☐ Presence or absence of structural components: Facial features such as beards, mustaches, and glasses may or may not be present and there is a great deal of variability among these components including shape,
Color and size.

☐ Pose: The images of a face vary due to the relative camera-face pose (frontal, tilted, profile, upside down).

☐ Facial expression and emotions: The appearance of faces is directly acted by a person's facial expression and emotions.

☐ Occlusion: Faces may be partially occluded by other objects. For an example, in an image with a group of people, some faces may partially occlude other faces (face identification).

☐ Image orientation: Face images directly vary for different rotations about the camera's optical axis.
 imaging conditions: When the image is formed, factors such as lightning and camera characteristics an etc. The appearance of a face.

☐Age: Images taken after one or two year's gap may not match with the images in database.

1.4. Problem Formulation

The recognition of faces through face recognition technique relies on detecting the individual's 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 difficult 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.
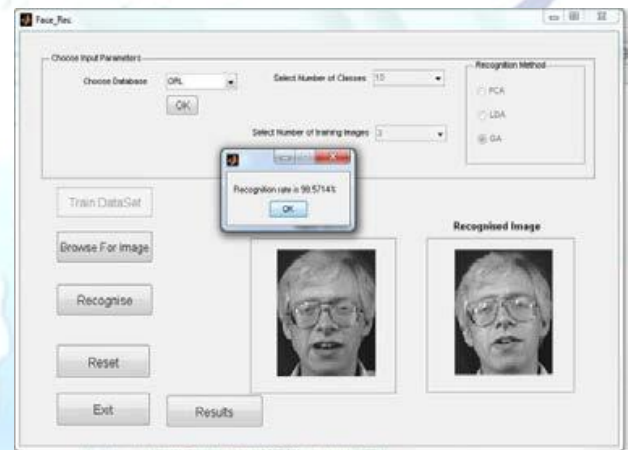
II. PROPOSED WORK

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. (4) 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 databases

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.

III. 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.
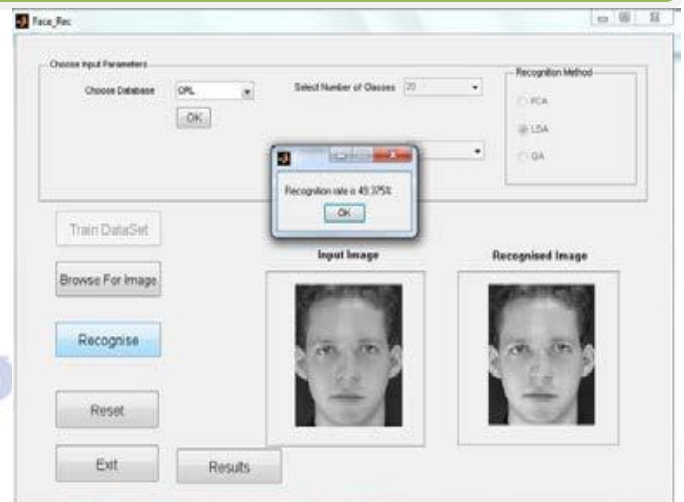

Fig: Recognition rate for the PCA Method

Fig. Recognition rate for the LDA Method

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.
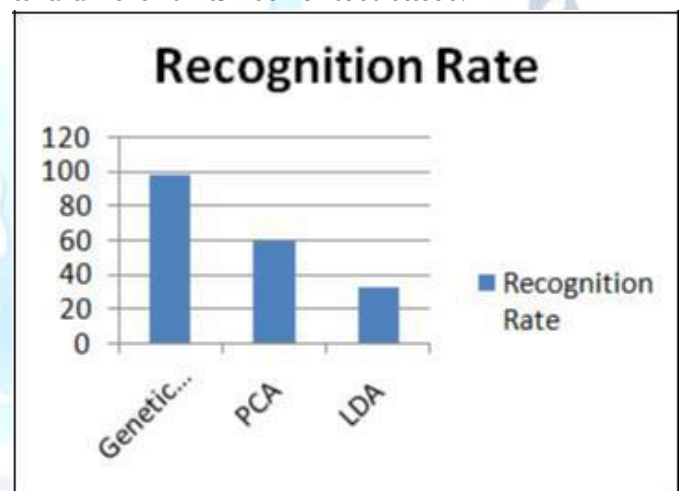

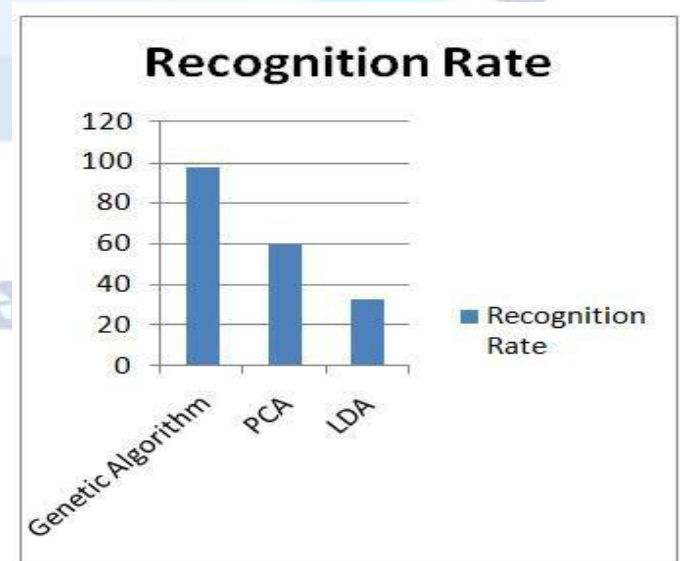*Fig. 1 Recognition rate for ORL database*

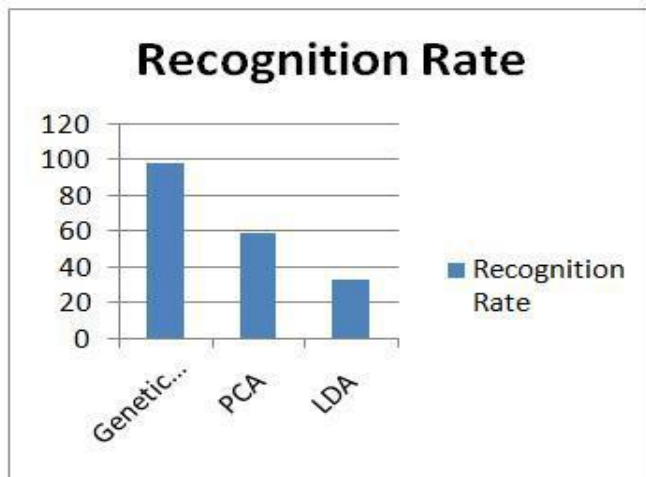*Fig. 2 Recognition rate for UMIST database*

Fig. 3 Recognition rate for Indbase database.

IV. 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 is 10, the genetic algorithm shows the 100% recognition rate and 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.

V. CONCLUSION AND FUTURE SCOPE

Face recognition is one of the challenging aspects 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 efficiently 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 be applied on other benchmarked databases.

VI. REFERENCES

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