# IJLTEMAS

# Passive Continuous Authentication System Using Artificial Bee Colony

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Abstract-The two most important steps that can affect the performance of a Face Recognition system are Feature Extraction and Feature Selection. The contemporary paper describes a peculiar method of implementation of a speculative development technique for the face recognition problem. Artificial Bee Colony (ABC) is one of the latest swarm algorithm based on the intelligent foraging behaviour of honey bees .ABC algorithm is introduced by Karaboga in the year 2005. From 2005 itself, it has been used for the escalation of various elucidations. Now it is freshly introduced for processing and analysis of images such as segmentation, image recognition and image repossession. The artificial bee colony optimization method, a modern problematic optimization algorithm, is used for the image classification. Also this paper proposes using matrices to grab such data and algorithms using SVD approach for facial feature extraction. The cumulative classification results of all plots in an image are used to determine the overall recognition outcome for the given image.

*Key Words*— Face Recognition; ABC; ACO; Feature Selection; SVD; NII.

# I. INTRODUCTION

Face Recognition is performed by humans as a chore and uncomplicatedly. Humans hold a opulent expertise in identifying faces. We aim at implementing or flourish systems with same kind of dexterity. Face recognition has been a leading research topic in modern years. It canvas a wide variety of application areas including biometric verification in security systems, image and picture processing, personnel-computer interaction, multimedia administration and video surveillance.

A. Feature Extraction

To recognize a human face, some special features such as eyes, nose, mouth, hair and chin along with shape of face need to be extracted. Image features are local,meaningful and detectable part of an image.Therefore feature information is crucial for face recognition. Image features can be divided into Global properties and local properties.If we go through the literature study,we can find out various feature extraction approaches like. DWT, DCT, EI PCA ,.But this contemporary paper proposes SVD(Singular value Decomposition),which is a mathematical approach for facial feature extraction. Image pre-processing will not improve information content in the image.

**B.** Feature Selection

The detected fundamentals, positions(areas) and

distances through feature extraction are used to process the aspects of the face. Hence selection of relevant feature becomes an intense task. Feature selection can be described as a process of finding a subspace of features, from the authentic set of features forming arrangements in a given data set, ace according to the given goal of processing. We attain the task of face recognition in 3 stages. The primary stage is Feature Extraction, secondary stage is Feature Selection based on the selected features. In this current paper Feature Selection has been done using the approach of Artificial Bee Colony Optimization based on the normalized correlation coefficient used for pattern matching.

The paper has five sections. Section 2, following the Introduction provides a basic analysis of the techniques. In section 3 deals with the prospective algorithm. Results are examined in section 4 and finally the paper is concluded in section 5, with the forthcoming scope of our work.

## II. AN OVERVIEW OF TECHNOLOGIES USED

The current paper describes how SVD is implemented to problems containing image processing.in specific,how Singular value decomposition assists the calculation of so called eigen faces, which provide an efficient representation of facial images in face recognition. Singular value decomposition expresses an m-by-n matrix A as A U\*S\*V'. The matrix columns of the m\*m matrix U are the left singular vectors for corresponding singular values. The columns of the nxn matrix V will be the right singular vectors for corresponding singular values. V' is the Hermitian transpose (the complex conjugate of the transpose) of V. The singular value decomposition the value of M is the product of three different matrices M=U\*S\*V, so w=U\*S\*V\*v. U and V are both orthogonal and normalized matrices. From a geometric transformation point of view (acting upon a vector by multiplying it), they are merging of successions and backscatterings that do not change the length of the vector they are multiplying. Actually,S is a diagonal matrix (Daigonal matrix means all other elements except diagonal elements are zero)which constitute scaling or squashing with different scaling factors (the diagonal terms) along each of the n axes.So the effect of leftmultiplying a vector v by a matrix M is to rotate/reflect the value V by M-s both orthogonal and normalized factor V, then scale or squash the result by a diagonal factor S, then rotate or reflect the result by using M's orthonormal factor

## Volume III, Issue V, May 2014

U.One of the reason SVD is desirable from a numerical standpoint is that multiplication by both orthogonal and normalized matrices is an inevitable and incredibly stable operation (criteria number is 1). SVD captures any illconditionness in the diagonal scaling matrix S.Eventhough the eigen face method was developed for traditional grayscale(a range of grey shades from white to black) images, the technique is not limited to these images. Think about an image where the different different shades of grav mention the physical 3D structure of a face region. Although the eigen face technique can again be implemented, the main problem is related to finding the three dimensional picture in the first place. Therefore we also express, how Singular Value Decomposition can be used to rebuild three dimensional objects from a 2-D video streaming.SVD provides a new method for extracting algebraic features from face.SVD has been used in many domains such as data contraction, signal processing and pattern analysis

#### A. Nature Inspired Intelligence

By using the Nature Inspired Intelligent Algoritms and methods, we can handle a numerous complex realworld problems with great success. These are particularly applied, primarly on difficult and rigorous optimization problems, highlighting their upcoming importance in the wider area if Artificial IIntelligence. Nature Inspired Intelligence methods are builded based on the way how biological systems dealing with true world situations. If we say precisely, the use of simulation of biological systems such as the human brain, ant colony, nectar search of honey bees work, participating In the complex real world situation. A lot of journals are available which precisely describes a lot of selected Nature Inspired Intelligence.

## 1) Artificial Bee Colony

Artificial Bee Colony (ABC) is an optimization algorithm developed by Davis Karaboga in 2005. It is actually based on the agile behavior of honey bees in food searching ABC provides better solutions to development problems as compared with genetic algorithms (GA), and particle swarm optimization (PSO) Artificial Bee Colony as a development tool, which provides a population-based search procedure in which individuals called foods positions are modified by the artificial bees with time and the bee's aim is to discover the places of food sources with high nectar amount and finally the one with the highest food source. In Artificial Bee Colony system, artificial bees will fly around in a multidimensional search space and some (employed and onlooker bees) select food sources depending on their own experience of themselves and their hive mates, and adjust their positions. Some (scouts) fly and choose the food sources arbitarly without having experience. If the nectar amount of a new source is higher than that of the former one in their memory, they memorize the fresh position and ignore the previous one. Thus, Artificial Bee Colony system combines local search methods, which are carried out by both employed and onlooker bees, with universal or global search methods, managed and maintained by onlookers and scouts, attempting to balance both exploration and exploitation process.

## 2) Ant Colony Optimization

Ants are intelligent ethnic social creatures that work as a

team to find food. In Ant Colony Optimization, which was developed by Margo Dorigo, a number of simulated ants creates solutions to optimization problems and it exchange message or information on the quality of these solutions via a communication method that is redolant of the one adopted by original ants.ACO is a repetitvie algorithm. In each repetition or we can say iteration, a lot of ants move from their nests for searching food. Each of these ants makes a solution by walking from apex(highest point) to apex on the graph with the intention of not visiting any vertex that it has already been visited in its tour. At each step of the solution buildup, every ant selects the following highest point(vertex) to be visited based to a mechanism that is detected by the pheromone. At the last of an iteration/repetition, depending upon the quality of the solutions builded by the ants, the pheromone values are refined in order to bias ants in upcoming repetitions to build-upt solutions identical to the good ones previously constructed. In this paper we are using artificial bee colony(ABC) for image classification.

## III. PROPOSED ALGORITHM

The algorithm consists of two parts: in the first part contains Singular value decomposition(SVD) technique is used to choose features from the picture and matching it with the database images, in the later part Artificial Bee colony(ABC) algorithm is used for the face recognition based on the features that has been selected in the first part. The following figure shows the steps that are followed in the proposed algorithm.

#### A. Feature Selection Using SVD



Fig 1:Proceeding Steps in Proposed Algorithm

SVD has been defined as one method used to effectively decrease the amount of data processed. The basic concept of singular value decomposition is to represent an image of size mXn as 2Diamensional mxn matrix..Singulat Value Decomposition is then applied to this particular matrix to obtain U,D & V values.U represents upper triangular Matrix,D represents a Diagonal Matrix The singular value based image equalization (SVE) method is based on equalizing the singular value matrix obtained by singular value decomposition (SVD). SVD of a image, which can be elucidated as a matrix, can be written as follows:

$$A = Ua * Ea * Va \tag{1}$$

Where  $U_A$  is an orthogonal matix called hanger and  $V_A$  is orthogonal square matrix called aligner. and the matrix  $X^A_A$ contains the segregated singular values on its main diagonal portion. The concept of using SVD for picture equalization comes from this reason that  $J^A_A$  contains the information regarding intensity of any given image.

So,In view of the above,a method is proposed to pact with illumination performance using SVD. In this method it will

## Volume III, Issue V, May 2014

**IJLTEMAS** 

use the ratio of the biggest singular value of the generated normalized matrix, with mean value as zero and variance value as one, over a normalized image which we will calculate by

$$\max(^{N}_{N}=0, var=1)$$
(2)

 $max(T,_A)$ 

Where  $S_{N=0,var=1}$ ) is the singular value matrix of the fabricated intensity matrix. This coefficient can be applied to reproduce an equalized image using

 $^{P}Equallized_{A} \_^{U}A (C ^{A})^{V}A$ 

The singular value based image equalization technique face recognition face specifically, singular valued decomposition (SVD) method had functioned as a new method for excerpting algebraic features from a picture. Thus, this method has been introduced and been used in many fields such as data and voice compression, Digital signal processing and image pattern analysis. Among the properties which made Singular Value Decomposition approach advance towards favorably in defining the face recognition and identification process is defined as follows; The Singular value Decomposition of a face image which has good amount of stability in which it can be defined that whenever a small agitation is added to a face image, a large variance related to its singular values (SVs) did not occur. Previously, it has been stated that singular values represents algebraic properties of an image. Hence, Singular Value features possess both algebraic and geometric invariance as instances of the method. There are Several theorems which all are related to properties of SV Decomposition have been defined previous researched, in which it explained mathematically the characteristic nature on why this method is promoted in face recognition process specifically in the face extraction part by using feature extraction procedure.

## B. Recognition Using Artificial Bee Colony

Before we select features using Artififial Bee Colony technique we will assume that:

- A. All the pixels of an image are represented by Bees.
- B. A food source is nothing but an extracted Feature.
- C. Number of food sources is equal to number of

employed bees.(that is,one bee will look upon on each food source)

- D. Number of onlookers shall be one.
- E. Number of scout bees shall be one.
- F. Hive is the dancing area of bees ie, the image available and collection of information.

In the proceeding paper we have taken image ie, face to be identified ,with almost pure white background and normal lightening conditions as input and following are the most important Steps Involved in Feature Selection of ABC Algorithm are:

Step No-l (Initialization Phase): Initialize the population of solutions or features. This simply means food sources. Deploy an employed bee on each nectar source.

Step No-2 (Quality Assessment of available Food Source): By using normalized correlation coefficient, evaluate the quality of nectar sources.

Step No-3 (Greedy selection method by Onlooker Bees): For all nectar Sources calculate the probability that of values of each solution (nectar source) and onlooker bee will select nectar source with maximum of Pi value and follow the employed bee to the selected nectar source.

Step No-4 (Selection of feature): Find the average of correlation value obtained by each onlooker bee for a particular food source. If average of correlation co efficient value obtained is equal to or greater than zero then select the feature.

Step No-5 (Re-Selection): generate a candidate eatable position from the old one in memory which might have been abjured while doing feature extraction. After each candidate source position is accomplished or we can say,produced and then reviewed by the artificial bee, its total performance is distinguished with that of its old one. If the new food source has equal or better nectar than the old nectar source, it is replaced with a new ovne in the memory. Otherwise, the old one is retained in the memory. In other words, a greeedy selection procedure is employed as the selection operation amoung the old and the candidate one.

Step No-6 (Fitness Calculation): Calculate the fitness average correlation co-efficient attained for selected features pheromone trial associated with any path among features. (i.e. read the distances among features for a given image and calculate the distance threshold and also discuss maximum number of repetitions allowed.

# C. Recognition Using ACO

Before feature selection using Ant ColonyOptimization technique we assume that:

1. Nodesor Food source do represent features which have been selected.

2. Ants are represented by the picxels of the image. Steps that are Involved in Recognition using Ant Colony Optimization Algorithm are:

Step-1(Initialization): Determine the population of ants(equal to the number of features) and set the intensity of pheromone trials associated with

Step-2 (Generation of Ants): Place one ant on each selected feature. Any ant (Ai, i=1:N) is randomly assigned to a feature it should visit all features and build solutions completely.

Step-3 (Evaluation Criterion): In this step the evaluation criterion is the Euclidean distance among the features and the comparison of distances with the distances in the original image. If the distances among the features meet the requirements with not more than a deviation of 40% for all the paths then EXIT.

Step-4 (Check the stopping criterion): If ants have visited all the features/nodes and paths (reached the maximum number of iterations allowed) then EXIT otherwise continue.

Step-5 (Pheromone updating): For features that are selected in Step-3 pheromone intensity is updated (mark the path as

# Volume III, Issue V, May 2014

verified and node as visited.

#### IV. RESULTS AND DISCUSSION

In order to check the algorithm efficiency two pictures of size 250X200 are chosen.All the database images are matched with each of these images.By using Discrete wavelet Transform, the features from all the test images are extracted.According to the Artificial Bee colony algorithm for feature selection, The correlation co-efficient values of each feature extracted from the test images are calculated in accordance with the pre-defined features in the system database images. Afterthat, the correlation coefficeient values of ten onlooker bees for the matched features are calculated based on the previous step.Later, the fitness value of each solution is reviewed. For those test images who has fitness value >1 are rejected and those test images that have fitness value<1 are selected for face recognition.After choosing that image for face recognition, the face reconition algotithm using Ant Colony Optimization method is applied on that test image.since the pheromone values for all the facial features are  $\geq 2$  that test image is selected

#### CONCLUSION

AN advanced Face recognition technique using Particle swarm optimization is suggested. Feature Selection from face has much improved by selecting Artificial Bee colony optimization technique.ABC algorithm repetitively matches the facial features with those in the image database and ultimately face recognition is finalized by using Ant colony optimization method. This is done by comparing the distance between the features of test image and the train images belonged to image database. Analysis reports indicates that the suggested system can be certainly used for face recognition as well as identification technologyOur future job mainly focus on side face recognition and recognizing images that are produced under poor luminance(poor light conditions) .The suggested algorithm will definitely give better results if the image feature extraction techniques are intensified.

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