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A REVIEW PAPER ON AN ENHANCED FACE RECOGNITION SYSTEM USING CORRELATION METHOD AND ABPSO

Ms. Navpreet Kaur*, Ms. Rasleen Kaur

* M. Tech Scholar, Department of Computer Science & Engineering, Global Institute of Management & Emerging Technologies, Amritsar(Punjab), India

Assistant Professor, Department of Computer Science & Engineering, Global Institute of Management & Emerging Technologies, Amritsar(Punjab), India

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ABSTRACT

Face Recognition is one of the problems which can be handled very well using Hybrid techniques or mixed transform rather than single technique. This paper deals with using of Particle Swarm Optimization techniques for Face Recognition. Feature selection (FS) is a global optimization problem in machine learning, whichreduces the number of features, removes irrelevant, noisy and redundant data, and results inacceptable recognition accuracy. It is the most important step that affects the performance ofa pattern recognition system. This paper presents a novel feature selection algorithm basedon PCA [1] [2] Subspace using Accelerated Binary Particle Swarm Optimization. ABPSO is a computational paradigm based on the ideaof collaborative behavior inspired by the social behavior of bird flocking or fish schooling. This paper proposes a novel method of Binary Particle Swarm Optimization called Accelerated Binary Particle Swarm Optimization (ABPSO) by intelligent acceleration of particles. Together with Image Pre-processing techniques such as Resolution Conversion, Histogram Equalization and Edge Detection, ABPSO is used for feature selection to obtain significantly reducedfeature subset and improved recognition rate. The performance of ABPSO is established by computing the recognition rate and the number of selected features on ORL database. For the implementation of this proposed work we use the Image Processing Toolbox under Matlab software.

KEYWORDS: Face Detection, Face recognition, pattern recognition, PSO, PCA, Correlation method.

INTRODUCTION

Face recognition [1] is one of the most important biometrics which seems to be a good compromise between actuality and social reception and balances security and privacy well. It has a variety of potential applications in information security law enforcement and access controls. Face recognition systems fall into two categories: verification and identification. Face verification is 1:1 match that compares a face images against a template face image. On the other hand face identification is 1: N problem that compares a probe face image against all image templates in a face database. Face recognition is a very difficult problem due to a substantial variations in light direction (illumination) , different face poses , diversified facial expressions , Aging (changing the face over time) and Occlusions (like glasses, hair, cosmetics). So the building of an automated system that accomplishes such objectives is very challenging. In last decades many systems with recognition rate greater than 90% has been done however a perfect system with 100% recognition rate remains a challenge. Face recognition algorithms are divided by into three categories as follows:

1. Holistic methods: These methods identify a face using the whole face images as input and extract the overall features.
2. Feature [3] based methods: these methods used the local facial features for recognition (like eyes, mouths, fiducial points. etc.).
3. Hybrid methods: these methods used both feature based and holistic features to recognize a face. These methods have the potential to offer better performance than individuals.

Face Recognition System is one of the most successful applications of enhanced computational ability and image processing. Automatic face recognition is intricate primarily because of difficult imaging conditions, ageing, facial

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expression, occlusion etc. Thus, image preprocessing is used to resize (to reduce the dimensionality of feature subset), adjust contrast, brightness and filter the noise in an image. Face Recognition (FR) has evolved drastically over the last decade and has found innumerable applications in various fields. Major advancements in the recent past have propelled FR technology into the spotlight. FR is used for both verification and identification. In this paper we propose Accelerated Binary Particle Swarm Optimization (ABPSO) algorithm [8] based on an intelligently updated velocity equation. We apply ABPSO for feature selection and establish its improved performance over the basic Binary PSO algorithm. The set of selected features are found to be significantly reduced. This causes a reduction in the memory space required for storing face features in the face feature gallery of the proposed FR system. The experiments are conducted for ORL databases.

Image Pre-processing

Among the various pre-processing techniques, the three techniques of relevance are Bi-Cubic interpolation, Histogram equalization and Edge detection using Laplacian of Gaussian (LoG). Image interpolation provides a technique of producing high-resolution image from its low-resolution counterpart. Interpolation basically, is the process of estimating intermediate values of a continuous event from discrete samples. It is a type of approximating function whose value must coincide with the sample data at the interpolation nodes or sample points. Bi-Cubic interpolation is a resolutionconversion method preserving finer details of images with increased sharpness, better than bilinear algorithm. Whenever an image is resample, there will be a loss of focus within the image, but bi-cubic interpolation, among various methods, provides maximum sharpness. Histogram equalization is a nonlinear process aimed to highlight brightness in a way particularly suited to human visual analysis. This tries to transform the distribution of pixel intensity values in the image into a uniform distribution and consequently improves the image's global contrast.

Particle Swarm Optimization:

Particle Swarm Optimization (PSO) [8] is a swarm intelligence technique developed by Dr. Eberhart and Dr. Kennedy in 1995. In PSO, the swarm consists of particles which move around the solution space of the problem. These particles search for the optimal solution of the problem in the predefined solution space till the convergence is achieved.

Accelerated Binary PSO:

For binary discrete search space, Kennedy and Eberhart have adapted the PSO to search in binary spaces by applying a sigmoid transformation to the velocity component in the equation to squash the velocities into a range [0,1] and force the component values of the positions of the particles to be 0's or 1's. The sigmoid expression is given by:

$$\text{sigmoid}(p_{id}^k) = \frac{1}{1 - e^{-v_{id}^k}}$$

where $$p_{id}^k = \begin{cases} 1, \text{if rand}(\ ) < \text{sigmoid}(p_{id}^k) \\ 0, \text{otherwise} \end{cases}$$

Feature Extraction:

In pattern recognition and in image processing, feature extraction [2] is a special form of dimensionality reduction. When the input data to an algorithm is too large to be processed and it is suspected to be notoriously redundant (e.g. the same measurement in both feet and meters) then the input data will be transformed into a reduced representation set of features (also named features vector). Transforming the input data into the set of features is called feature extraction. If the features extracted are carefully chosen it is expected that the features set will extract the relevant information from the input data in order to perform the desired task using this reduced representation instead of the full size input. The first step in any face recognition system is the extraction of the feature matrix. A typical feature extraction algorithm tends to build a computational model through some linear or nonlinear transform of the data so that the extracted feature is as representative as possible.

Feature selection using accelerated binary PSO:

Feature selection is performed to reduce the dimensionality of facial image so that the features extracted are as representative as possible. Method employed here is Accelerated Binary PSO. Consider a database of L subjects or classes, each class W1, W2, W3… WL with N1, N2, N3,…NL number of samples. Let M1, M2, M3... ML is the

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individual class mean and M0 be mean of feature vector. Fitness function is defined so as to increase the class separation equation. By minimizing the fitness function, class separation is increased. For iteration the most important features are selected. Binary value of 1 of its position implies that the feature is selected as a distinguishing feature for the succeeding iterations and if the position value is 0 the feature is not selected. The expressions for class, individual mean and mean of feature of feature vector are shown below.

$$W_j^{(i)}, \text{ for } j = 1, 2, \ldots, N_i$$

$$M_i = \frac{1}{N_i} \sum_{j=1}^{N_i} W_j^{(i)}, \quad \text{for} \quad i = 1, 2, \ldots, L$$

$$M_0 = \frac{1}{N} \sum_{i=1}^{L} N_i \times M_i$$

Principal Component Analysis (PCA):
PCA is a de-correlation technique in statistical signal processing used pervasively in pattern recognition. By transforming the image data set into PCA domain and preserving only the desired components the noise and other trivial information can be removed considerably.

Matching:
Matching is done by calculating minimum of Euclidean distances of features of the test image with feature of each image in the database using the equation:

$$\sqrt{\sum_{i=1}^{N} (fI - fT)^2}$$

Where fI and fT are the feature vectors of database image I and test image T respectively. Minimum Euclidean distance gives the closest matching image from the database.

METHODOLOGY

To verify the effectiveness (qualities and robustness) of the proposed Face Recognition we conduct several experiments with this procedure on several images. The methodology of our proposed work is given below:

Phase1: Firstly we develop a code for the loading the face image in the database of the Matlab. This is done for the loading the face image value in the workspace of the Matlab.
Phase2: We develop a code for the correlation method then PCA to extract the feature of the image.
Phase3: After that we develop a code for the Accelerated Binary Particle Swarm Optimization (ABPSO). We generate the formula of the ABPSO in the Matlab using the code.
Phase4: After that we do code for the recognition of the loaded face image and develop a code for the decision on the base of the matching points for the loaded face image. For the matching purpose we develop the code.

CONCLUSION

In this paper we propose “An Enhanced Face Recognition System Using Correlation Method And ABPSO”. This paper deals with using of Particle Swarm Optimization techniques for Face Recognition. Feature selection (FS) is a global optimization problem in machine learning, whichreduces the number of features, removes irrelevant, noisy and redundant data, and results inacceptable recognition accuracy. It is the most important step that affects the performance ofa pattern recognition system. we use PSO for optimization and use correlation method . In this method there are no

limits for dataset and we can use any dimension of image, processing time will be very less by the use of PSO matching is more accurate. Using correlation methodwe use any dimension of image and many number of images. Accuracy is increase to great extent.

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