Volume-8,Issue-6,(Dec-17)
ISSN (O) :- 2349-3585

COMPARATIVE ANALYSIS OF BIOMETRIC AUTHENTICATION SYSTEM BASED ON PSO AND BFO OPTIMIZATION METHODS

Manpreet Kaur[1],Gurwinder Singh Jatana[2]
Computer science engineering, Rayat and Bahra group of institute, Patiala campus Patiala, India

ABSTRACT: A biometric system gives automatic identification for an individual dependent on a unique characteristic or feature possessed by the individual. Unlike another biometric like fingerprints and face recognition, the dissimilar aspect of iris comes from arbitrarily distributed features. Iris recognition is considered as the most accurate and reliable biometric identification system available. In this thesis, an efficient feature extraction algorithm based on optimized SIFT (Scale Invariant feature transformation) that detects the steady feature points of an object so that the similar object could be predictable with invariance to illumination, scale, rotation with affine transformations and optimization approaches are presented for iris recognition. The SIFT filters are optimized by tuning the parameters with the particle swarm optimization and BFO (Bacterial foraging optimization) Algorithm method known as AI (Artificial Intelligence) dependent optimization algorithm and helps in the relevant features selection after feature selection so that matching can be executed with more accuracy rate. Moreover, the matching technique based on hamming is proposed. In the pre-processing step, the lower part of the iris image is unwrapped and normalized to a rectangular block which is then decomposed by the optimal SIFT feature extraction algorithm using HCT (Hough Circular Transform). Experimental results show that the performance of the proposed method is encouraging.

KEYWORDS: Iris Recognition, BFO Algorithm, Particle Swarm Optimization, Fusion, SIFT

I. INTRODUCTION

Biometric authentication systems verify a person's claimed identity from behavioral traits (signature, voice) or physiological traits (face, iris, and ear). Biometric systems can be Unimodal or Multimodal.

The Unimodal biometric systems include only one biometric feature at a time for authentication or identification. Unimodal systems may give inaccurate results due to noise, or feature similarity to some extent. Multimodal biometric system overcomes the limitations of unimodal biometric systems such as non-universality, noise in sensed data, spoofing, intra-class variability, inter-class variability.

A normal biometric framework comprises of four principle segments specifically sensor, extractor, matcher and decision modules. In the existing world of smart applications, biometric systems are being used in the number of places for efficiency, security, performance etc. Different systems use different type of operations according to the required output and convenience.

There are mainly two types of operations:
i. Verification phase
ii. Identification phase

Authentication or verification is the basic process of positively identifying the user. This is also referred to as one-to-one match as the uploaded template is matched with every biometric record stored in the database.

Identification, on the other hand, is a process of distinguishing an individual from a larger set of existing individual records by comparing the uploaded biometric data with all entries in the system database.

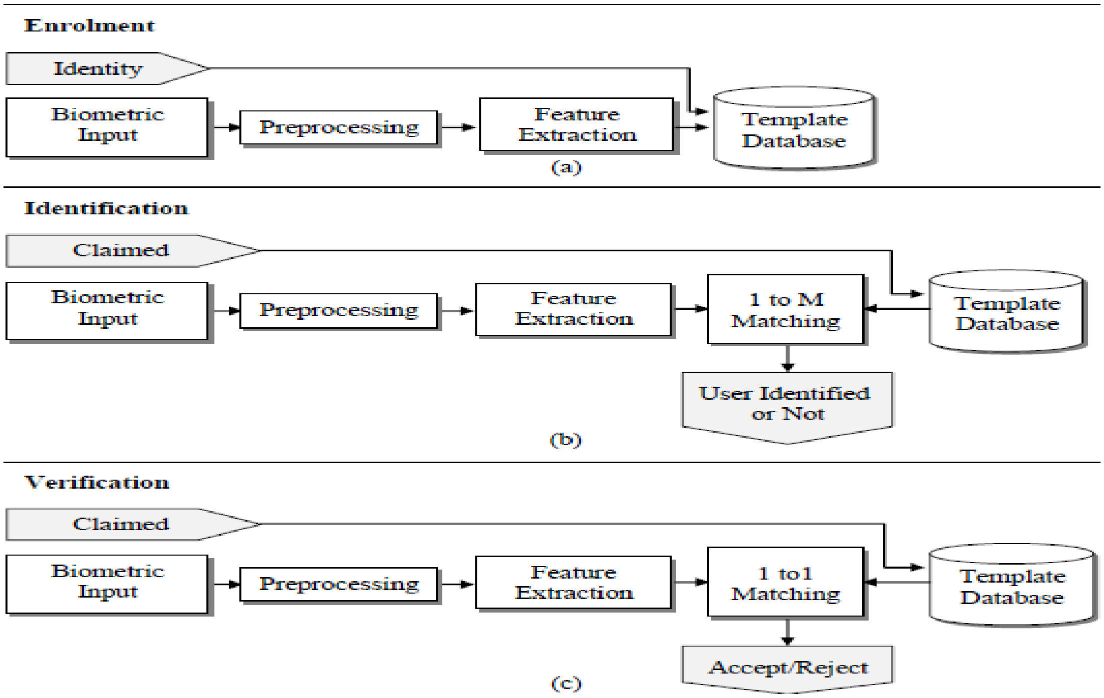

Fig. 1Biometric Operations

A. IRIS AS A BIOMETRIC

There are some features that make iris recognition highly effective and accurate like: stable, unique, flexible, reliable, and non-invasive. Iris is widely accepted for recognition because of its unique and random pattern for every single individual. Iris is a region between the sclera and the pupil, which is rich in unique textural information that consists of genetic composition, and it is protected from external environments.

Fig. 2 Detection of Human Iris

In this proposed work, a unique trait iris is used to obtain a better performance and high security.

B. PROPOSED TECHNIQUES

i. Canny Edge Detection

The Canny edge detection algorithm is known to many as the optimal edge detection algorithm. Canny's intentions were to enhance the many edge detectors already out at the time he started his work. Canny Edge detection usually worked as follows:The first and most obvious is low error rate. It is important that edges occurring in images should not be missed and that there is no responses to non-edges. The second criterion is that the edge points should be well localized. In other words, the distance between the edge pixels as found by the detector and the actual edge should be least. A third criterion is to have only one response to a single edge detected.This was implemented as the first two were not substantially enough to completely eliminate the possibility of multiple responses to an edge.

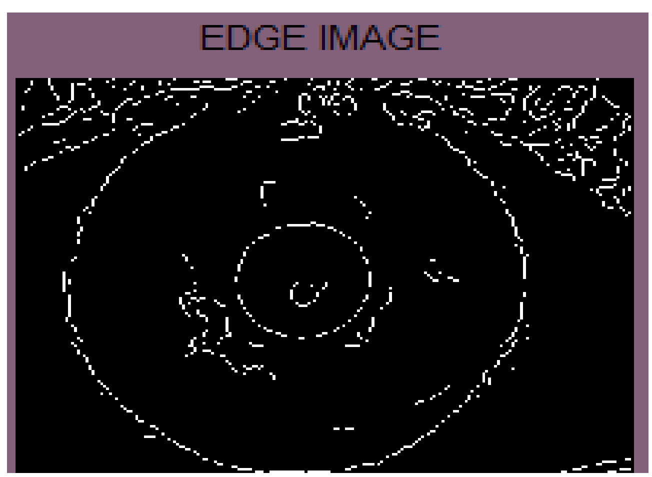

Fig. 3 Image obtained after edge detection

Based on the above discussed criteria's, the canny edge detector first smooth the image to eliminate noise and then it finds the image gradient to highlight regions with high spatial derivatives. The algorithm then tracks these regions and suppresses any pixel that is not at its maximum. The gradient array is then further reduced by method called hysteresis. Hysteresis is used to track the remaining pixels that have not been suppressed. Hysteresis uses two threshold values. If the magnitude is below the first threshold value, it is set to zero which means it is made a non edge. If it is above the threshold then it is made an edge.

ii. HOUGHMAN CIRCULAR TRANSFORM (HCT)

In automated analysis of digital images, a sub problem often arises of detecting simple shapes, such as straight lines, circles or ellipses. In many cases an edge detector can be used as a pre-processing stage to obtain image points or image pixels that are on the desired curve in the image space. Due to imperfections in either the image data or the edge detector, however, there may be missing points or pixels on the desired curves as well as spatial deviations between the ideal line/circle/ellipse and the noisy edge points as they are obtained from the edge detector. For these reasons, it is often non-trivial to group the extracted edge features to an appropriate set of lines, circles or ellipses. The purpose of the Hough transform is to address this problem by making it possible to perform groupings of edge points into object candidates by performing an explicit voting procedure over a set of parameterized image objects.

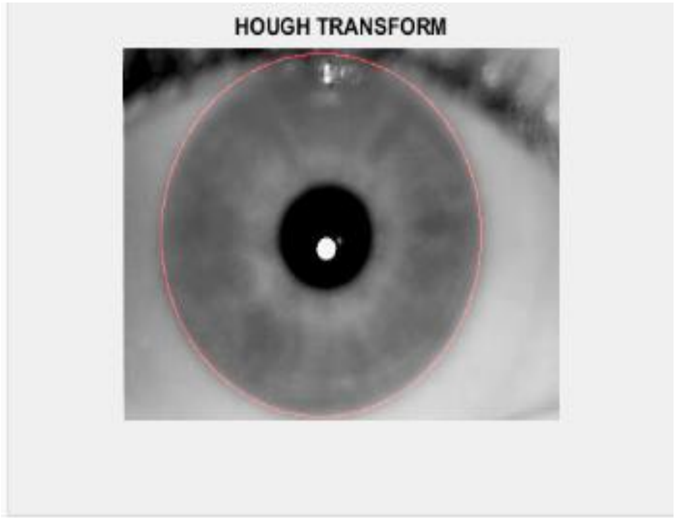

Fig. 4 HCT Application

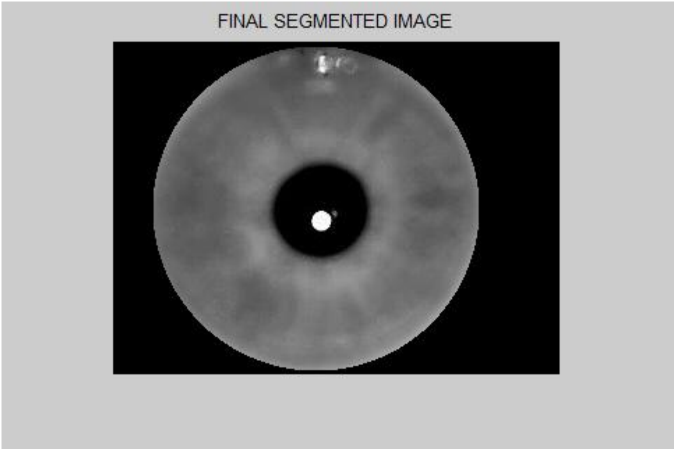

Fig. 5 Final segmented image for further processing

iii. SIFT METHOD

Scale Invariant Feature Transform (SIFT) was proposed by David Lowe that has the capacity to distinguish and depict neighbourhood picture elements positively. The necessary SIFT appraisal comprises of five noteworthy stages:

- Scale-space local extreme detection
- Key-point localization
- Orientation assignment
- Key-point descriptor
- Trimming of false matches

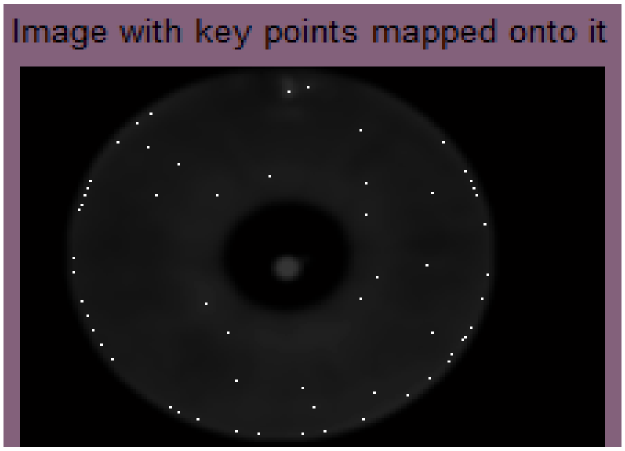

Fig. 6 SIFT feature extraction points

iv. PARTICLE SWARM OPTIMIZATION (PSO)

Particle Swarm Optimization is evolutionary algorithm inspired by social behaviour of birds and fishes. PSO shares many features with other evolutionary algorithms. The system is initialized with number of populations. The searching for optimum value is done. PSO has no operators like mutation, fitness etc. In PSO, there are potential solutions. Each particle in PSO moves after another particle in its space for searching for new solutions. Each particle has its own coordinate and velocity and the entire particles move through the search space. The algorithmic steps for implementing PSO are described below:

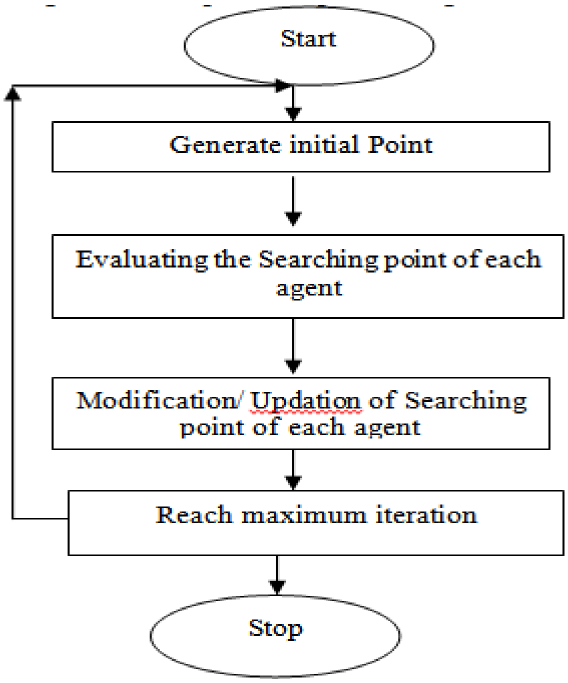

Fig.6 SIFT Working flowchart

v. BACTERIAL FORAGING OPTIMIZATION (BFO)

Bacterial Foraging Optimization Algorithm is an optimization algorithm which reduces the noise, features selected, unnecessary data and gives the high accuracy. It is basically a feature selection algorithm that led to following objectives;

• bound storage necessities, increase speed of processing

• Performance enhancement to achieve high correctness

• Exploitation of full resources.

• Improving identification rate

The BFO process can be divided into mainly three parts; a. chemotaxis b. reproduction and c. elimination and dispersal.

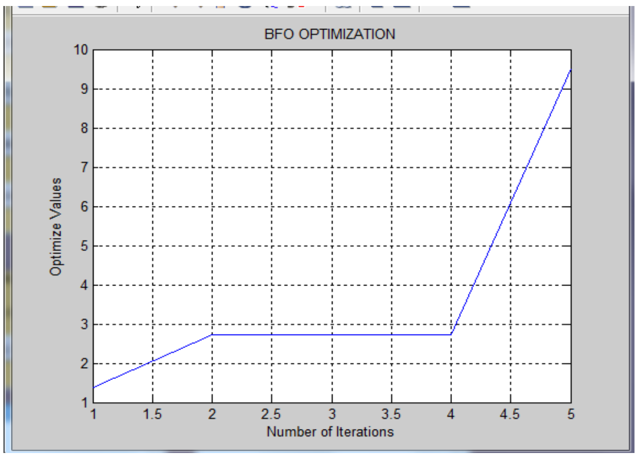

Fig. 7 BFO Optimization

II. SIMULATION MODEL

Security is one of the key issues for consideration. Any mismanagement in security phase can lead to great loss and can depreciate the performance level. Some of the common problems related to identity establishment of an individual are listed below:

• Proof can be cheated.

• Proof can be misplaced.

• It can be mishandled.

• It can be shared knowingly.

• It can be stolen.

• Same proof can be used by more than one person.

• Mishandling can prohibit a person from undertaking fixed privileges.

At times these issues might not be so serious but sometimes they may even lead to major problems. In all the above listed cases loosing identity may lead to problems or criminal acts and thus poses a great threat in security related issues. Thus, we need to find such an identification metric that cannot be overpowered by any means and cannot be challenged easily.

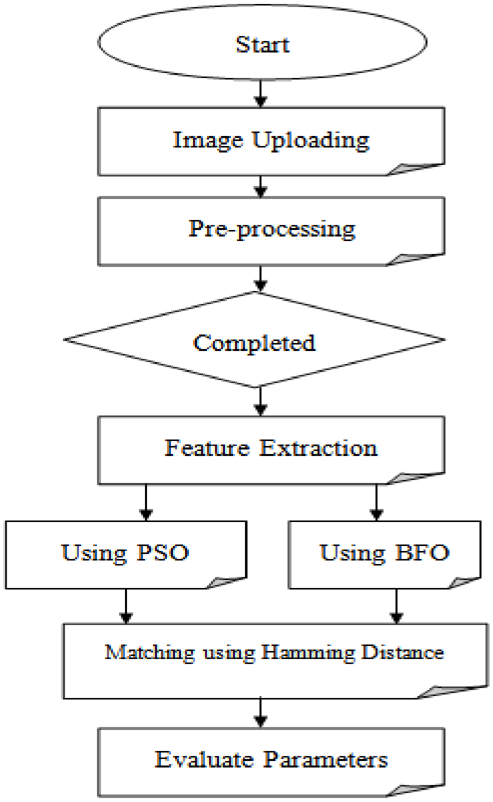

Fig. 8 Simulation Model

Among various recognition systems, biometric recognition systems prove to be of great importance as it is impossible or

ISSN:-2349-3585 |www.ijrdt.org

very tough to share, stole or misuse the biometric traits.

A novel iris recognition system is proposed that makes use of the sequential steps and an efficient encoding scheme to extract the required iris features. First of all, the iris image is localized and unwrapped to a rectangular block of a fixed size. Then, the irrelevant part of the obtained iris block is detected and removed. Finally, SIFT features are used to decompose the normalized iris block, and a relative analysis method is adopted to generate the iris code which is used later for identification/ authentication processes.

III.SIMULATION RESULTS

The system is tested on 50 iris images from the database. Iris localization using Hough transform performs better as compared to other localization techniques in case of occlusion due to eyelids and eyelashes. The detection of eyelid boundary fails in case of images taken under intensive light conditions. The feature vector should be properly optimised for increasing the efficiency of the system. Thus the image of iris should be taken under controlled lightening and illumination condition. Comparison of both the optimization techniques is done by taking three parameters which are FAR, FRR and accuracy rate.

A. COMPUTATION PARAMETERS

FAR means False Acceptance Ratio. It gives the value of falsely accepted cases out of the total samples and thus a good identification system will give this value to its minimum. (FAR=Total number of samples-Falsely accepted samples)/(Total number of samples) FRR means False Rejection Ratio. It gives the value of falsely rejected cases out of the total samples and thus a good identification system will give this value to its minimum. (FRR=Total number of samples-Falsely rejected samples)/(Total number of samples) Accuracy gives the efficiency and correctness of the system results. Accuracy=100-(FAR+FRR)%

B. SIMULATION RESULTS

In this section, we report the performance of the proposed iris recognition system in the verification and the identification scenarios. In addition, we carry out an experiment to evaluate and reduce the influence of the eyelid occlusion. Simulations show that our iris recognition system can have comparable performance to most of the well-known systems. In the iris verification, the receiver operating characteristic curve that is a curve of FAR versus FRR is used to evaluate the performance of the proposed system. The FAR is the probability of accepting an imposter, and the FRR is the probability of rejecting a genuine user. The smaller values of FAR and FRR indicates the better performance of a biometric verification system.

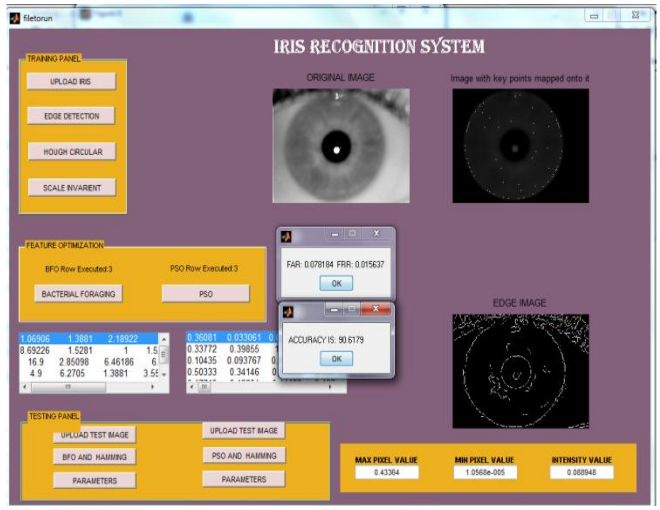

Fig.9 Parameter values for BFO testing

When iris recognition system is implemented using the BFO optimisation technique, the parameters give better results. FRR and FAR values are promising. Values of parameters obtained by testing the image optimised using BFO algorithm are shown in figure 9.When tested by using PSO, the values of the parameters are comparatively less promising than BFO. Values of parameters obtained by testing the image using Particle Swarm Optimisation technique are as shown below:

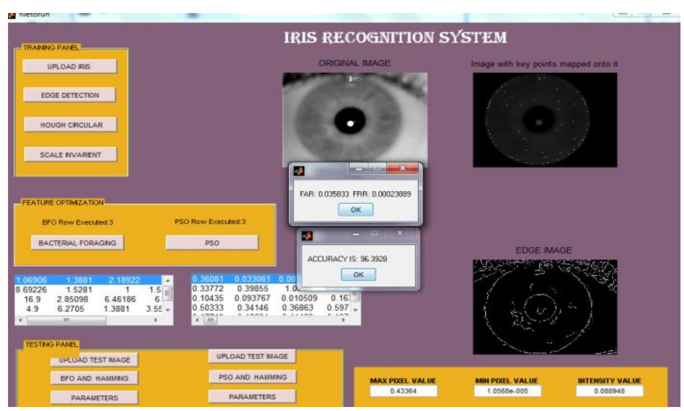

Fig.10 Parameter values for PSO testing

On evaluating the 50 images from the database, the parameter values so obtained are compared and it is seen that the values for PSO are more convincing than BFO. All the three parameters FAR, FRR, Accuracy give higher correctness for the system proving PSO to be a promising algorithm.

ISSN:-2349-3585 |www.ijrdt.org

Table 1: Parametric Values

Parameters	Using BFO	Using PSO
FAR	.078	.035
FRR	.016	.0002
Accuracy	90.41	96.36

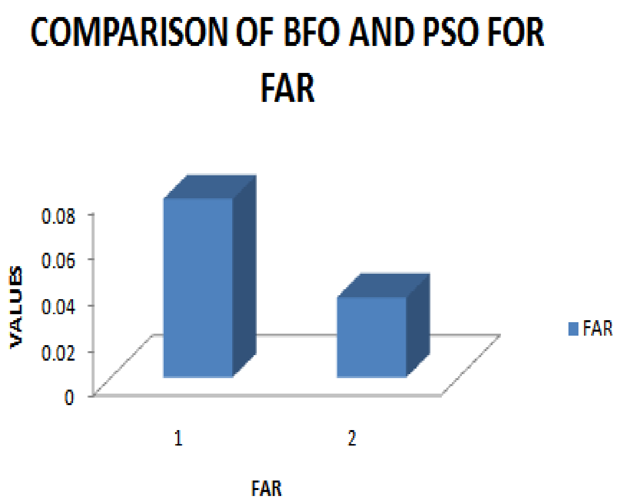

Fig.11 Comparison Graph between BFO versus PSO for FAR

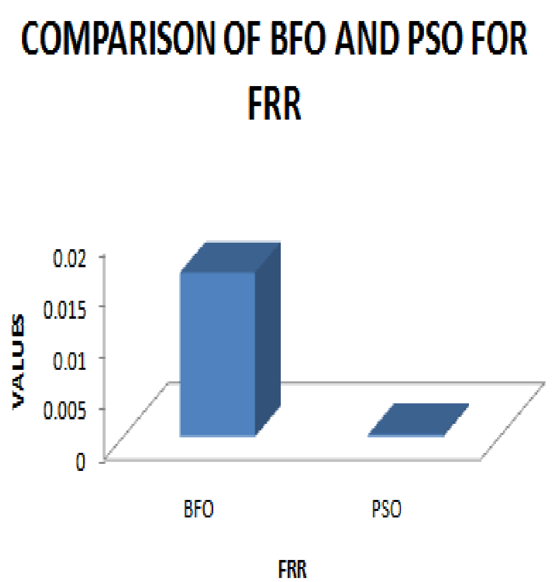

Fig. 12 Comparison Graph between BFO versus PSO for FRR

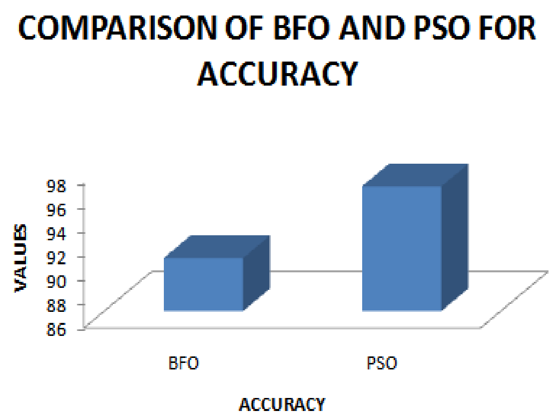

Fig. 13 Comparison Graph between BFO versus PSO for Accuracy

From the simulation graphs, it can be observed that PSO has better results than BFO on the basis of selected parameters because of the optimal solution measurement based on fitness function. Thus, when the comparison between the two optimisation techniques is taken place in iris recognition system, PSO has shown more promising result than BFO.

IV. CONCLUSION AND FUTURE SCOPE

Biometrics based individual authentication systems have recently gain intensive investigate interest due to the untrustworthiness and inconvenience of traditional authentication systems. Biometrics newly became a vital component of any victorious person identification solutions as biometric character that cannot be stolen, shared or even beyond. Among biometric technologies, iris based verification systems bear more compensation than any other biometric technology as it offers an outstanding recognition performance. Iris patterns are invented to be exceptional due to the complexity of the fundamental environmental and genetic processes that influence the generation of iris pattern. In the proposed system, comparison between BFO and PSO technique is generated at feature level for feature reduction and iris verification system to increase the accuracy of the authentication systems. In this SIFT features are extracted for iris, and then classification of iris templates is done using hamming distance. This proposed method decreased the FAR as well as FRR, & has increases the system performance on the given data set using PSO as compared to BFO. Future scope lies in the use of any other techniques for increasing the efficiency of the system. Other optimisation or matching

ISSN:-2349-3585 |www.ijrdt.org

techniques like Euclidean distance can be used to decrease the FAR and FRR values. Also, the ongoing discoveries in multimodal systems can be designed considering more than one biometric feature for human identification. Multimodal systems consider more than one existing biometric trait and club the basic unique features to obtain more promising environment and result. Thus, multimodal systems can prove to be great help in terms of accuracy and can thus provide integrity in security related issues.

REFERENCES

[1] L. Birgale and M. Kokare, “Iris Recognition without Iris Normalisation”, Journal of Computer Science 6, pp. 1042-1047, 2010.

[2] J. L. Wayman, “Fundamentals of Biometric Authentication Technologies”, International Journal of Image and Graphics, Vol. 1, No.1, pp.93-113, 2011.

[3] P. J. Philips, P. Grother, R. J. Michaels, D.M. Blackburn, E. Tabassi and J.M. Bone, “FRVT 2009:Overviw and Summary”, 2009.

[4] E. Sridevi, B. Aruna, P.Sowjanya, “An Exploration of Vascular Biometrics”, International Journal of Electronics & Communication Technology, Vol.2, pp.181-184, 2011.

[5] J. Cui, Y. Wang, J. Zhou Huang, T. Tan and Zenan Sun, “An Iris Image Synthesis Method Based on PCA and Super-resolution”, IEEE CS Proceedings of the 17th International Conference on Pattern Recognition, Cambridge, UK, Vol.4, pp.471-474, 2004.

[6] Elgamal, Mahmoud and Naseer AL-Biqami, “An Efficient Feature Extraction method for Iris Recognition Based on Wavelet Transformation”, International Journal of Computer and Information Technology, 2013.

[7] K. Fan, Q. Pei, W. Mo, X. Zhao, Q.Sun, “An efficient Automatic Iris Image Acquisition and pre-processing system”, Proceedings of the IEEE International Conference on Mechatronics and Automation, Luoyang, China, pp.1779-1784, 2006.

[8] Raja, Kiran, R. Raghavendra, and C. Busch, “Binarized statistical features for improved Iris and particular recognition in visible spectrum”, international workshop on Biometrics and Forensics (IWBF) IEEE, 2014.

[9] L. W. Liam, A. Chekima, L. C. Fan and J. A. Dargham, “ Iris Recognition using Self Organising Neural Network”, IEEE Student Conference on Research and Development Proceedings, Malaysia, pp.169-172, 2002.

[10]L. Ma, T. Tan, Y. Wang and D. Zhang, “Personal Identification based on Iris analysis”, IEEE Transactions on Pattern Analysis and Machine intelligence, 25(12), pp. 1519 - 1533, 2003.

[11] J. Beveridge, K. She, B. Draper and G. Givens, “A Nonparametric statistical Comparison of Principal Component and Linear Discriminant subspaces for face recognition”, Proceedings of IEEE Conference on Computer Vision and Pattern Recognition, pp.535-542, 2001.

[12] L. Masek, “Recognition of Human iris Patterns for Biometric Identification”, University of Western Australia, Perth, Australia, 2003.

[13] V. Dorairaj, N. Schmid and G. Fahmy, “Performance Evaluation of Iris based recognition system implementing PCA and ICA techniques”, in Proceeding of the SPIE 2005 on Defence and Security, Conference 5779, Orlando, 2005.

[14] Jin-Xin Shi, and X. Feng-Gu., “The Comparison of Iris Recognition using Principal Component Analysis, Independent Component Analysis and Gabor Wavelets”,3rd IEEE International Conference on Computer Science and Information Technology (ICCSIT), pp. 61-64, 2010.

[15] A.K. Jain, A. Ross and Prabhakar, “An Introduction to Biometric Recognition”, IEEE Transactions On circuits and systems for Video technology, Special Issue on Image and Video based Biometric, Vol. 14, No. 1, pp. 4-20, 2004.

[16] John Daugman, “How Iris Recognition Works”, IEEE Transactions on Circuits and Systems for Video Technology, Vol.14, No.1, pp. 21-30, 2004.

[17] Supriyanti and Retno, “Detecting pupil and Iris under uncontrolled Illumination using fixed Hough Circular Transform”, International Journal of Signal Processing, Image Processing and Pattern Recognition (IJSIP), pp. 175-188, 2012.

[18] C. Boyce, A. Ross, M. Monaco, L. Hornak and Xin Li, “Multispectral Iris Analysis: A Preliminary Study”, Conference on Computer Vision and Pattern Recognition Workshop (CVPRW’06), New York, USA, pp. 51-51, 2006.

[19] Proenca and Alexandre, “Iris Recognition: An Analysis

ISSN:-2349-3585 |www.ijrdt.org

of the Aliasing Problem in the Iris Normalization Stage", IEEE International Conference on Computational Intelligence and Security, Vol. 2, Guangzhou, China, pp. 1771-1774, 2006.

[20] Z. Sun, Y. Wang, T. Tan and J. Cui, "Improving Iris Recognition Accuracy via Cascaded Classifiers", IEEE Transactions on Systems, MAN, and CYBERNETICS, Vol. 35, Issue 3, pp. 435-441, 2005.

[21] K. Miyazawa, K. Ito, T. Aoki, K. Kobayashi and H. Nakajima, "An Efficient Iris Recognition Algorithm Using Phase-Based Image Matching", IEEE Image Processing Conference (ICIP), Vol. 2, pp. II- 49-52, 2005.

[22] Pan Lili and Xie Mei, "The Algorithm of Iris Image Pre-processing," Fourth IEEE Workshop on Automatic Identification Advanced Technologies (AutoID'05), Buffalo, New York, USA, pp. 134-138, 2005.

[23] W. J. Ming and D. Runtao, "Iris Image Denoising Algorithm Based on Phase Preserving", Sixth IEEE International Conference on Parallel and Distributed Computing Applications and Technologies, PDCAT, Dalian, China, pp. 832-835, 2005.

[24] W. Yuan, Z. Lin and Lu Xu, "A Rapid Iris Location Method Based on the Structure of Human Eyes", 27th Annual Conference of the IEEE Engineering in Medicine and Biology Society, Shanghai, China, pp. 3020-3023, 2005.

[25] K. P. Hollingsworth, K. W. Bowyer and P. J. Flynn, "Improved Iris Recognition through fusion of Hamming Distance and Fragile Bit Distance", IEEE Transactions on Pattern Analysis and Machine Intelligence, Vol. 33, No. 12, pp.2465 -2476, 2011.

[26]S. Roy and A. Biswas, " A Personal Biometric Identification Technique based on Iris Recognition", International Journal of Computer Science and Information Technologies, Vol. 2, Issue 4, 2011.

[27] Xingguang Li, Z. Sun and T. Tan, "Comprehensive assessment of Iris Image Quality", 18th IEEE International Conference on Image processing, China, pp.3117-3120, 2011

[28] U. M. Chaskar, M.S. Sutaone, N. S. Shah and Jaison T, "Iris Image Quality Assessment for Biometric Application", International Journal of Computer Science Issues, Vol.9, issue 3, 2012.

[29] Minakshi, R. Rajput and L. M. Waghmare, " Iris feature Extraction and Recognition based on Different Transforms", International Journal of Advances in Science Engineering and Technology, Vol. 1, issue 1, 2013.

[30] P. Dabbas and P. Soni, "An Algorithm for Measurement of Quality of Image", International Journal of Advanced Research in Computer Science and Software Engineering, Vol. 3, issue 3, 2013.

[31] Sachin Gupta and AshishGagneja, "Proposed Iris Recognition Algorithm through Image Acquisition Technique", International Journal of Advanced Research in Computer Science and Software Engineering, Vol. 4, issue 2, 2014.

[32] Sanjay Kumar and Dr.EktaWalia, "Analysis of Various Biometric Techniques", International journal of Computer Science and Information Technology, Vol.2, issue 4, 2011.

[33] HimanshuSrivastava, "Personal Identification using Iris Recognition System", International Journal of Engineering, Research and Applications, Vol. 3, issue 3, 2013.

[34] Adam, W. K. Kong, D. Zhang and M.S. Kamel, "An Analysis of Iris code", IEEE Transactions on Image Processing, Vol. 19, No. 2, 2010.

[35] E. Sung, X. Chen, J. Zhu and J. Yang, " Towards non-cooperative Iris Recognition systems", Seventh International Conference on Control, Automation, Robotics and Vision (ICARCV'02), Singapore, pp. 990-995, 2002.

[36] W. Yuan, Z. Lin and Lu Xu, "A Rapid Iris Localisation method based on structure of Human Eyes", 27th Annual Conference of IEEE Engineering in Medicine and Biology Society, Shanghai, China, pp. 3020-3023, 2005.

[37]https://www.google.co.in/#q=images+of+iris+in+eye