Enhance Security of the Multi -model Biometric Authentication System using Classification

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Abstract: A biometric-based substantiation is fundamentally a sample acknowledgment issue which settles on an individual distinguishing proof choice so as to attention the power taking into account of specific physiological or behavioural elements. Most biometric frameworks that are right now being used normally utilize a solitary biometric characteristic. Such frameworks are called unibiometric frameworks. Multimodal biometric frameworks are those which use or are equipped for using, more than one physiological or behavioural trademark for enrolment, confirmation, or ID. An assortment of multimodal biometrics methods have been proposed and broke down in writing. In these works, the joining of different biometric elements is proposed for accomplishing more exact accurate rate. In this proposed work, a brand new multimodal biometric system is developed i.e. using iris and ear. Initially, Iris and Face recognition systems developed by edged detection followed by extracting their features from SIFT (Scale Invariant Feature Transformation) technique and then again using SIFT technique in hybridization with GA (Genetic Algorithm) for optimization has been used. Later, the face and iris traits area unit combined along using score level fusion, afterward that matching will be complete on the basis of fusion and its performance is verified throughout authentication. The performance evaluation of proposed method is done using FAR, FRR, Accuracy and Recognition rate in MATLAB environment.

Keywords: Biometric Authentication, Multi-model, SIFT (Scale-Invariant Feature Transformation), Genetic Algorithm and Classification.

I. INTRODUCTION

Biometrics is the science and technology used for measuring, analysing the biological data. In information technology, biometrics usually refers for measuring and analysing human body characteristics such as fingerprints, eye retinas and irises, voice patterns, facial designs, and hand measurements, expressly for authentication purposes. Biometric is used for extracting a feature set from the acquired information, and comparing this set alongside to the template set in the database. Biometric fusion can be defined as the use of multiple types of biometric data for improving the performance of biometric systems. A perfect biometric should be single, universal, & permanent above time that is easy to measure also cheap in costs, and have high user acceptance. No single biometric can fulfils all these requirements simultaneously. For instance, fingerprints & retina are known to be highly exclusive, but they require dedicated sensors and are not user friendly. On the other hand, voice & facial geometry are not as exclusive, but they require only a cheap microphone or a camera as a sensor, and they are unobtrusive. Therefore combination of several complementary biometrics can provide higher recognition accuracy than any individual biometric alone. Multimodal biometric systems perform better than uni-modal biometric systems as it removes the limitations of single biometric system. The most used identification used in criminology is personal identification. The personal identification makes it possible to arrest the criminal in accurate way. In our work we have choose iris and ear biometric trait.

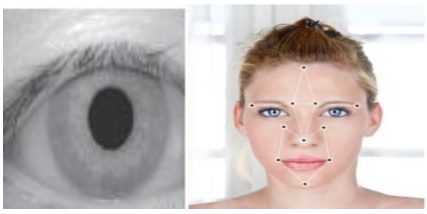


Fig.***Error! No text of specified style in document.*** : Iris Sample and Face Sample

Use of multiple biometrics indicators for identifying individuals is known as multimodal biometrics. In the multimodal biometric systems firstly individual biometrics systems are run then fusion is complete using various algorithms to improve the performance of the system. There are two parameters named FAR and FRR. There rate can be reduced if the negative results are less than the positive results. There are many levels at which fusion takes place like sensor level, extraction level, matching score level and decision level [2]. Biometric features are classified into two parts like physiological (face, iris, hand, veins etc.) and behavioural (speech, writing style, signature, gait etc.). If fusion of physiological and behavioural features is done then performance rate can be enhanced. They can be used as biometric verifier if they can satisfies the following requirement:

1. Universality. No two persons has same traits
2. Distinctness. Two persons must have different features
3. Performance. FAR/FRR rates must be low.
4. Collectability. Biometrics can be quantitatively measured.
5. Acceptability. Acceptability of biometrics by user.

6. Resistant. Avoidance of fraud.

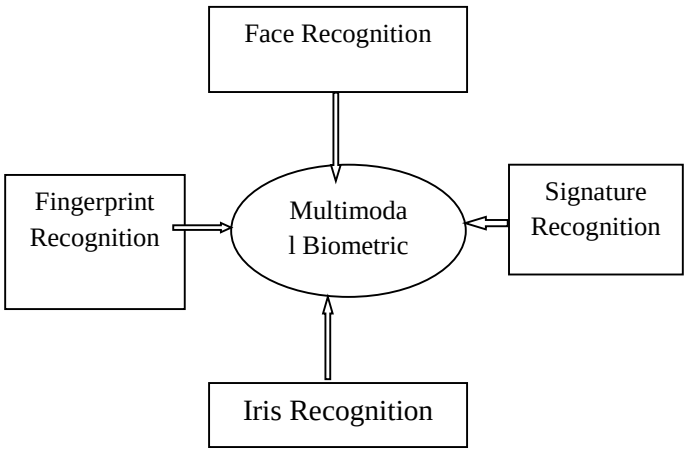


Fig.2: Recognition system

The fusion of biometric traits leads to the development of the performances by decreasing the undesirable results. E.g. fusion of iris and face is more effective in accordance to the use of only iris or ear modalities. Main profits of using multimodal systems are decrease in cost & complexity. This is due to the following features[3]:

- Fusion of modalities must takes place in synchronous manner.
- Fast processing time fusion strategy must have been adopted.
- Modalities are independent to each other.
- Different confidence level: like to recognize the crying voice is much easier in video than in audio.
- The cost may be incurred in units of time, money or other units of measure.

There are number of ways of fusion as mentioned below:

1) Fusion prior to matching
2) Fusion after matching [4]

II. IRIS RECOGNITION

Recently, iris localization has been the focused by many researchers since the impressive analysis of iris pattern. Iris pattern has been proven as a tool to recognize person identification, health status and types of disease. Previous researchers analysed the texture and colour of iris and relate the analysis with cases. To extract iris pattern, circular iris is segmented first by localizing boundaries of inner (pupil-iris) and outer (iris sclera) iris as shown in Fig. 3. The segmented iris is unwrapped into polar form in normalization process. Then, features are extracted and analysed.

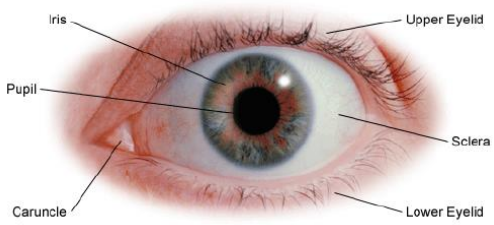


Fig.3 Human iris

Of these processes, localization is a crucial process. Miss [5] localization of inner and outer boundaries of iris causes inaccurate iris segmentation and then failure in further analysis. The most common algorithm used in iris localization is Circular Hough Transform (CHT). It has been proven as the best algorithm in localizing iris.

III. FACIAL RECOGNITION

The human face plays a significant role in our social [6] interface, conveying people's identity. With the human face as a key to safety, biometric face recognition expertise has received significant attention in the past few years due to its possible for a wide variability of applications in both law enforcement and non-law enforcement. As likened with other biometrics schemes by fingerprint/palm print and iris, face recognition has distinct benefits because of its non-contact procedure. Face images can be caught from a distance without touching the person being identified, & the documentation does not require interrelating with the person. In addition, face recognition serves the crime warning determination because face pictures that have been verified and archived can later help identify a person.

Most present facial appreciation systems exertion with numeric codes called face prints. Such schemes identify 80 nodal facts on a human face. In this situation, nodal points are end points used to measure variables of a person's face, such as the coldness or width of the nose, the complexity of the eye sockets and the shape of the cheekbones. These structures work by capturing information for nodal points on a digital image of an entity's face and storing the resulting information as a face print. The face pattern can then be used as a basis for assessment with data captured from faces in an picture or video.

Facial recognition structures based on face prints can rapidly and accurately identify target individuals when the conditions are favourable [7].

Fig.4 face recognize

IV. FEATURE EXTRACTION

In this section, we used the sift algorithm for feature extraction in iris and face biometric. We extract the Unique Properties. The SIFT approach[8], for picture highlight era, takes a picture and changes it into an "extensive gathering of neighbourhood highpoint vectors" (From "Article Recognition from Local Scale-Invariant Features", David G. Lowe). Each of these highlight vectors is invariant to any scaling, revolution or interpretation of the picture [9]. This methodology offers numerous highlights with neuron

reactions in primate vision. To help the extraction of these highlights the SIFT calculation applies a 4 stage separating methodology:[10]

- Scale-Space Extreme Detection

This phase of the separating endeavours to recognize those areas and scales that are identifiable from diverse perspectives of the same item. This can be proficiently accomplished utilizing a "scale space" ability. Further it has been established below sensible suppositions it must be in light of the Gaussian capacity.

- Key point Localisation

This stage endeavours to take out more focuses from the rundown of key points by discovering those that have low difference or are inadequately restricted on an edge. This is accomplished by computing the Laplacian, realize math domain.wolfram.com/Laplacian.html for subtle elements, esteem for every key point found in stage 1.

- Introduction Assignment

This step intends to relegate a predictable introduction to the key points taking into account nearby picture properties. The key point descriptor, depicted underneath, can then be spoken to with respect to this introduction, attaining to invariance to pivot.

- Key point Descriptor

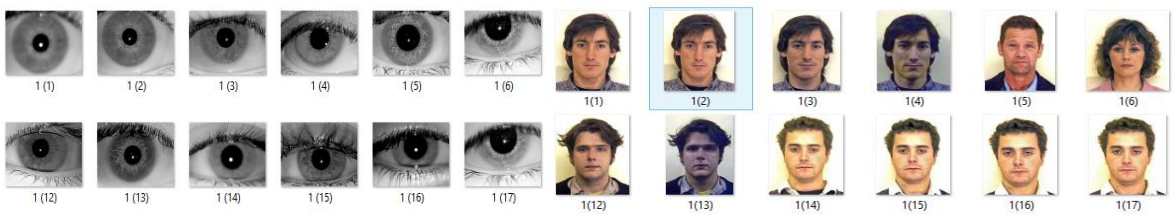
The nearby inclination information, utilized above, is additionally used to make key point descriptors. The slope data is pivoted to line up with the introduction of the key point and after that weighted by a Gaussian with change of 1.5 * key point scale. This information is then used to make an arrangement of histograms over a window focused on the key point.

V. RELATED WORK

K, Mahesh, Patil1, Prof. Dr.(Mrs.) L.S. Admuthe2 , Prashant P. Zirmite3, "Isolated Digit Recognition Using in Ear Microphone Data Using MFCC,VQ &HMM,"2014[11] have explained the ordered & compressed ways to deal with ear discovery and acknowledgment in 2D and 3D pictures. At that point, they gave a viewpoint over conceivable future research in the field of ear acknowledgment, in the setting of shrewd observation and measurable picture investigation, which they considered to be the most critical use of ear acknowledgment trademark sooner rather than later. Aboshosha, Ashraf, M. Hassan, M. Ashour, and M. El Mashade. "picture denoising based on spatial filters, an logical study." (2009) [12] described that there was many problems in single biometric system such as spoof attacks, noisy data and non-universality. To solve these types of problems multiple biometric systems was used. Multimodal biometric system uses two or more distinct modalities. They used three traits iris, fingerprint and face. Then score level fusion take place for fusion to recover the accurateness. Min-max normalization is use to normalize the scores obtained from classifiers. To acquire fusion sum, product and weighted sum rules are used. After investigational results it was proved that multimodal biometric systems overtake uni-modal biometric systems and best results are given by weighted sum rule as compared to sum/product method. Kumar A, Wu Chenye, "Automatic human identification by ear imaging. Pattern Recognition", (2012) [13] presented that the biometric ID structures that utilized physical individualities to acknowledge an individual's identity, ensures much greater security than number systems as well as passwords. Multi-modal biometric structure is being progressively deployed in much large scale application as they provide lesser error rate, large population coverage compared to uni-biometric. Multi-biometric identification system aim to fused iris n fingerprint traits. During enrolment stage system generate iris n fingerprint template separately n deposited in database. Methodology intended for fingerprint acknowledgement be there to excerpt minutiae from fingerprint pictures. It made conceivable to accomplish extremely high robust finger-print recognition for low-quality fingerprints. In the course of iris recognition, pictures are normalized, features as well as segmented are taken out by utilizing Log-Gabor filter. As a final point, matching was completed utilizing assistance of hamming-distance. As soon as both of the iris n fingerprint template were matched separately scores were combined by using sum rule-based score level fusion which increase the rate of recognition. As a result, this will enhance system accurateness as well as reliability. Nadheen M. Fathima, Poornima S, "Fusion in multimodal biometric using iris and ear" 2013 [14] introduced a remarkable bacterial Foraging Optimization technique for the acknowledgment of unique finger impression on the premise of the minutia removed focuses whose component has been elucidated in the sub sections of the paper. They additionally introduced an investigation of the examination of precision of BFO and SVM classifier.

VI. PROPOSED WORK

Step 1: Firstly search the dataset face recognition and iris recognition from the uci machine learning site. Select the 15 images in particular database [15].



(i) (ii)

Fig.5 (i) Iris Recognition and Facial Recognition Dataset Image

Step 2: Upload the face image and iris and convert the original image to gray scale image. In gray scale image reduce the original pixel and output image represents that the black and white image. After converting in gray scale image, apply the edge detection technique using canny property. In canny property detect the maximum, minimum and average values in the edge image.

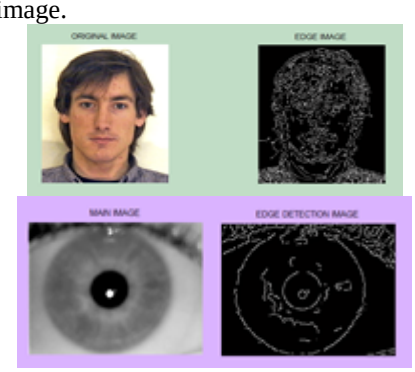


Fig.6(i) Facial Image Upload and Edge Detector and 6(ii) Iris Image Upload and Edge Detector

Step 3: In iris recognition using Hough Circle Transformation for calculate the inner and outer radius of the original image. The determination of the technique is to find circles in defective image inputs. The circle candidates are twisted by "voting" in the Hough parameter space and then select the local maxima in a so-called accumulator matrix.

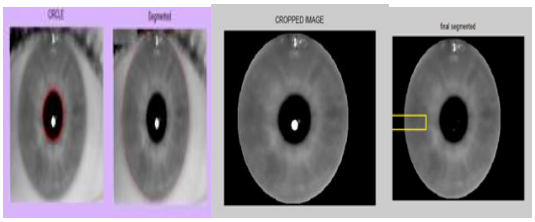


Fig.7 Hough Circle Output

Step 4: Apply the feature extraction algorithm using Sift algorithm to detect the key points. Similar features across changed images in a common problematic in computer vision. When all images are similar in nature i.e. same scale, orientation, etc., simple corner detectors can work. But when you have images of different scales and rotations, you need to use the Scale Invariant Feature Transform. SIFT isn't impartial scale invariant. You can change the subsequent, and still get good results:

- Scale form
- Rotation
- Illumination
- Viewpoint

Now that's some real vigorous image matching going on. The big squares mark matched images. The smaller rectangles are for individual structures in those regions. Note how the big squares are skewed. They follow the direction and standpoint of the object in the scene.

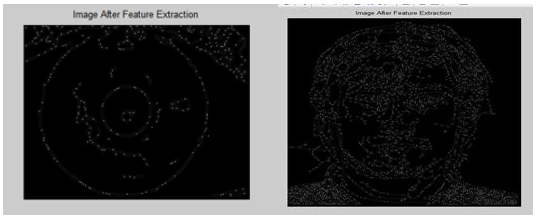


Fig.8 Iris and Face Feature Extraction Image using (SIFT)

Step 5: After feature extraction, applied the genetic algorithm for feature reduction. The Genetic Procedure is a model of machine knowledge which derives its performance from image of the processes of Evolution in environment. This is done by the creation within a machine of a Populace of Individuals represented by Chromosomes, in spirit a set of character strings that are similar to the base-4 chromosomes that we realize in our own DNA. The persons in the populace then go through a process of evolution.

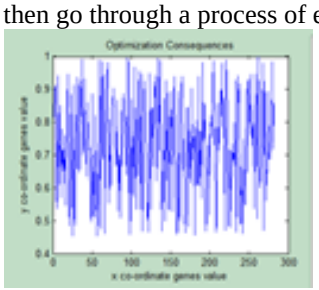


Fig.8 Optimized Output (GA)

Step 6: Apply score level Fusion: Fusing the scores of several biometric systems is a very promising approach to improve the overall system's accuracy. Despite many works in the literature, it is surprising that there is no coordinated effort in making a benchmark database available.

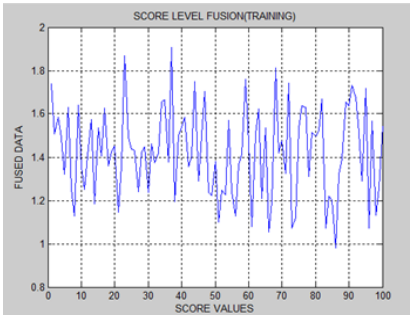


Fig.9 Score Level Fusion

Step 7: Apply for matching Euclidean Distance means the most of these image separation techniques are based on classical (e.g. Euclidean) metrics. Using "faster" distance function with lower edge levels and "slower" distance function with a higher one, similar results can be obtained.

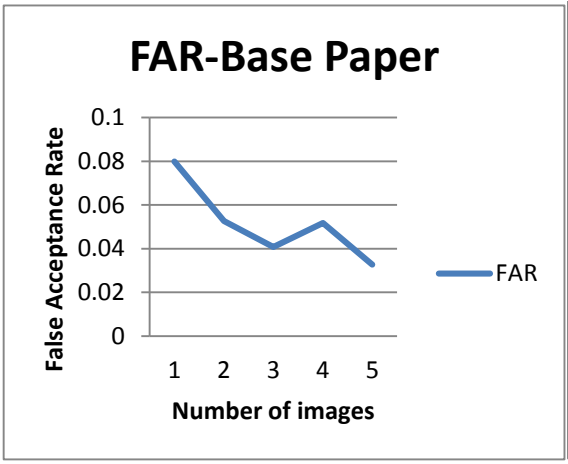
Step 8 : After the matching process, classify using Back propagation Neural Network. Then calculate the performance parameters like false acceptance rate, false rejection rate and accuracy. Step 9: After that we compare the existing performance parameters with proposed work parameters i.e accuracy.

VII. RESULT AND DISCUSSIONS

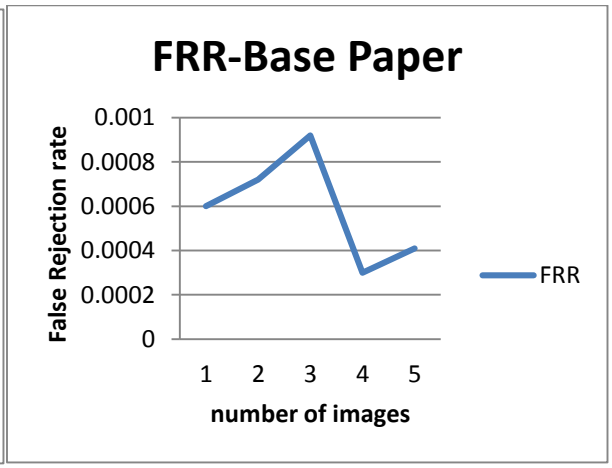
The below table defined that the Iris recognition and Ear Recognition fusion of the Biometric authentication. It shows that the comparison between the different-different performance parameters like Far, Frr . According to the similar multi-model biometric authentication system.

Table 1 : Fusion Iris and Ear (Base Paper)

Iris and Ear	FAR	FRR
Image 1	0.0799	0.00060
Image 2	0.0527	0.00072
Image 3	0.0407	0.00092
Image 4	0.0517	0.00030
Image 5	0.0327	0.00041



(i)



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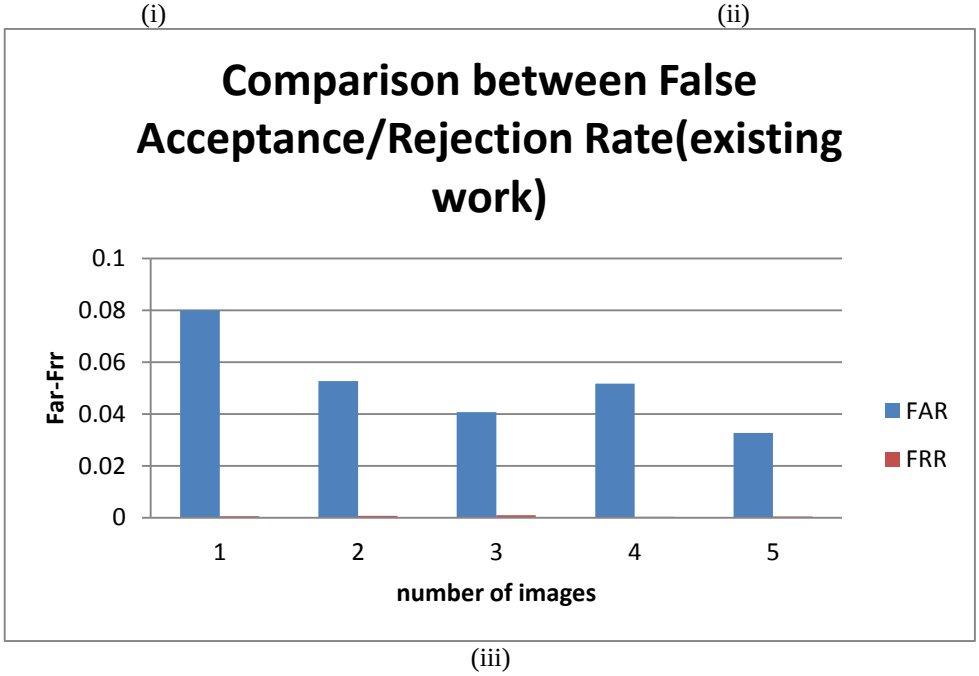


(iii)

Fig.10 (i) False Acceptance Rate (Base Paper), (ii) False Rejection Rate (Base Paper) and (iii) Comparison Between Existing and Proposed Work (Far and Frr)

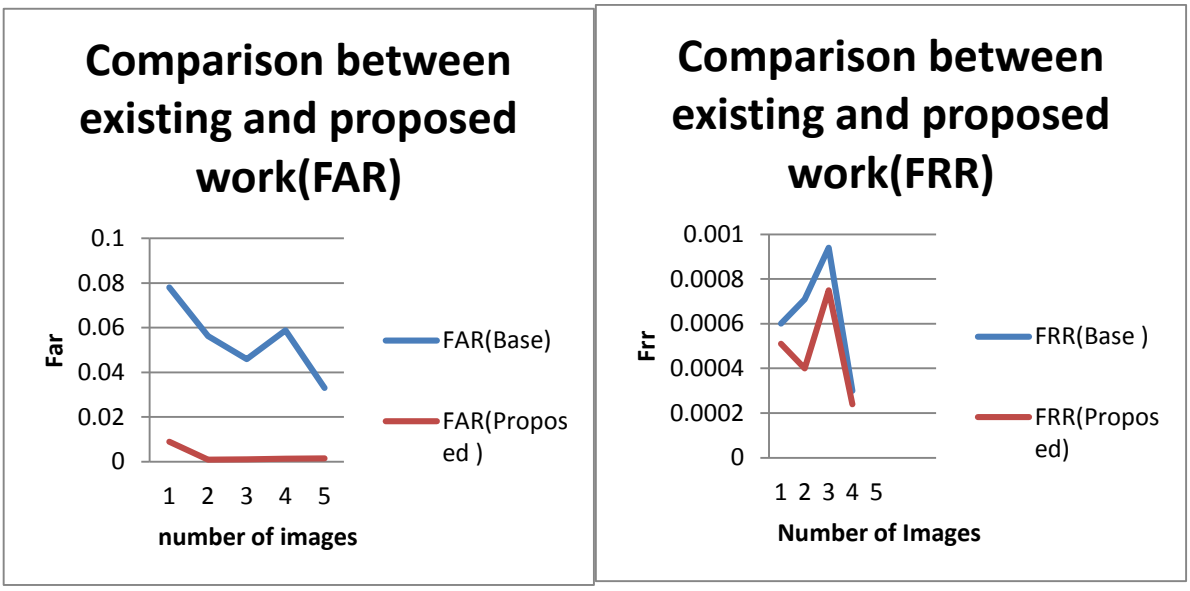
The above figure 10(i) shows that the existing False acceptance rate. The above figure 10(ii) shows that the existing false rejection rate. The above figure 10(iii) define the false acceptance and false rejection case in the comparison stage (Previous Work).False acceptance means identify the acceptable error and false rejection reject the non-acceptable error.

Table 2 : Comparison between Existing Work and Proposed Work in Fusion FAR

Iris and Ear, Face	FAR(Base)	FAR(Proposed)
Image 1	0.0781	0.0090
Image 2	0.0562	0.0010
Image 3	0.046	0.0011
Image 4	0.0589	0.0013
Image 5	0.0331	0.0015

Table no: 3 Comparison between Existing Work and Proposed Work in Fusion in FRR

Iris and Ear, Face	FRR(Base)	FRR(Proposed)
Image 1	0.00060	0.0081
Image 2	0.00071	0.0090
Image 3	0.00094	0.0095
Image 4	0.00030	0.0014
Image 5	0.00044	0.0037



(i) (ii)

Fig.11(i) Comparison between Existing and Proposed Work (False Acceptance Rate) and (ii) Comparison between Existing and Proposed Work (False Rejection Rate)

The above figure 11(i) shows that the Comparison between Existing and Proposed Work in False Acceptance rate. We improve the performance between Previous and Proposed Work. The above figure 11(ii) shows that the Comparison between Existing and Proposed Work in False Rejection rate. We improve the performance between Previous and Proposed Work.

VIII. CONCLUSION AND FUTURE SCOPE

This paper has proposed verification system based on iris and face. In the proposed system a new technique is generated at score level fusion to increase the performance of the iris and ear authentication system. In this firstly multimodal system is developed using SIFT and GA only. After that FAR, FRR and accuracy has been evaluated in which SIFT performs good having results like For SIFT Accuracy = 99.97 %, FAR= 0.0013, FRR= 0.00051. From the graphs it has been concluded that SIFT technique works well. Future works could go in the direction of using Genetic algorithm or ICA in hybridization with BFO. Independent Component Analysis (ICA) is a computational method to get hidden values of random variables. ICA basically designed for multivariate data. The data used for analyzing using ICA can be originated from many fields like economics, digital images, document databases etc. Also EGA optimization Algorithm is more powerful for the problems with several amounts of variables given. EGA is very well organized in discovering the whole search space or any of the solution space, which is very large and difficult. The Enhanced Genetic algorithm is executed using computer simulation, hiring residents of individuals, which is the solution space. The individuals undergo the selection process by evaluating the fitness function, using several operators such as mutation and crossover.

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