IRIS Recognition System Based on Mode Decomposition and Fractal Dimensional

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Abstract- Biometrics deals with the verification of original behavioural and physical features of an individual for the purpose of PI (Personal identification). It is a recognition process a person verifies by studying her or his characteristics that is iris, fingerprints, etc. creating it more suitable and highly secure than authentication techniques. All current authentication techniques, the less error recognition rate have been attained by iris recognition, which has received enhancing attention in current years. The recognition system normally, comprises 4 phases:- (i) Image Assessment (ii) Pre-processing (iii) Feature Extraction and (iv) Matching. The major issues are retina surface distortion and normalization. Among the four stages in Iris recognition system that are: Acquisition, Segmentation, Feature extraction and Feature comparison. Segmentation is one of the most significant steps in the iris recognition system. An iris quality of image plays an essential role in the performance of an efficient method of iris recognition. Because, a less quality image can, importantly, not good quality the performance of recognizing the iris system. The goal of assessment of a retina image is to attain high enough image quality to support iris recognition. Iris recognition to detect the region using segmentation method, then performed to evaluate localize the inner and outer region of the iris area using an image processing method. Extents hidden by specular reflection, eyelids, lashes, etc. It should be detected and rejected to enhance performance. Now FD used for feature extraction to identify the unique features in the iris recognition system with the database to verify the users. The MATLAB simulation Tool 2016a using the designed enhance the security rate and performance parameters like as a FAR, FRR, Error Rate, Accuracy and comparison between the existing methods (HCT and FE) method and performance metrics.

Keywords- Iris Recognition, Feature Extraction, BEMD and FD (Fractal Dimensional), NN (Neural Network), MATLAB 2016a.

I. INTRODUCTION

In the world of technology, several systems required recognition schemes for detection and verifying the stored data with the existing data and they need only access to the particular authorized user. This identification method is known as the biometric recognition. The applications of biometric recognition are used in several fields as the access to buildings, cellular phones, computer applications, ATM machines. The basic biometric methods of identification prefer to the automatic recognition of humans. It is fully dependent upon the characteristics of the individual own features. The main purpose of biometrics is the ID cards as identity cards and the passwords. The categories of biometric consist of the face recognition, fingerprints, iris recognition, palm prints and hand prints[1]. Any security system has a basic function which is the privacy. So, biometric recognition fulfil the need of those systems by identifying the individual through their physical and behavioural features.

Iris is the greatest recognition prefers for the highly secure system. Feature matching and the feature extraction techniques are used for the iris recognition. When these techniques are applied the image must be of good texture and the good data sets, but in the case of bad quality of image its performance disgraced. The options for changing the detection image of iris recognition is as bellow:-

A. The human assisted System
B. An acquisition System
C. High security, computer vision applications.

The various phases of processing added in the implement of iris recognition system are [2]:-

A. Localization of retina (iris)
B. Boundary Segmentations of Retina or Iris and Pupil.
C. Normalization
D. Local Feature Extraction and
E. Matching and compare.

Iris recognition systems take high-resolution images of the iris of individual's eye and then use a design recognition for reading and matching iris designs against stored in biometric dataset. It is used for the image acquisition and comparing/matching process. Most of the recognition system uses a 750 nm wavelength light source to design near infrared imaging. It enables the iris recognition system to block-out the light reflection from the cornea and thus, generate images which high-light the intricate model of the iris[3].

The Iris recognition procedure consists of following distinct phases [19]:

A. Image Capture.
B. Locating the iris and optimizing the image.

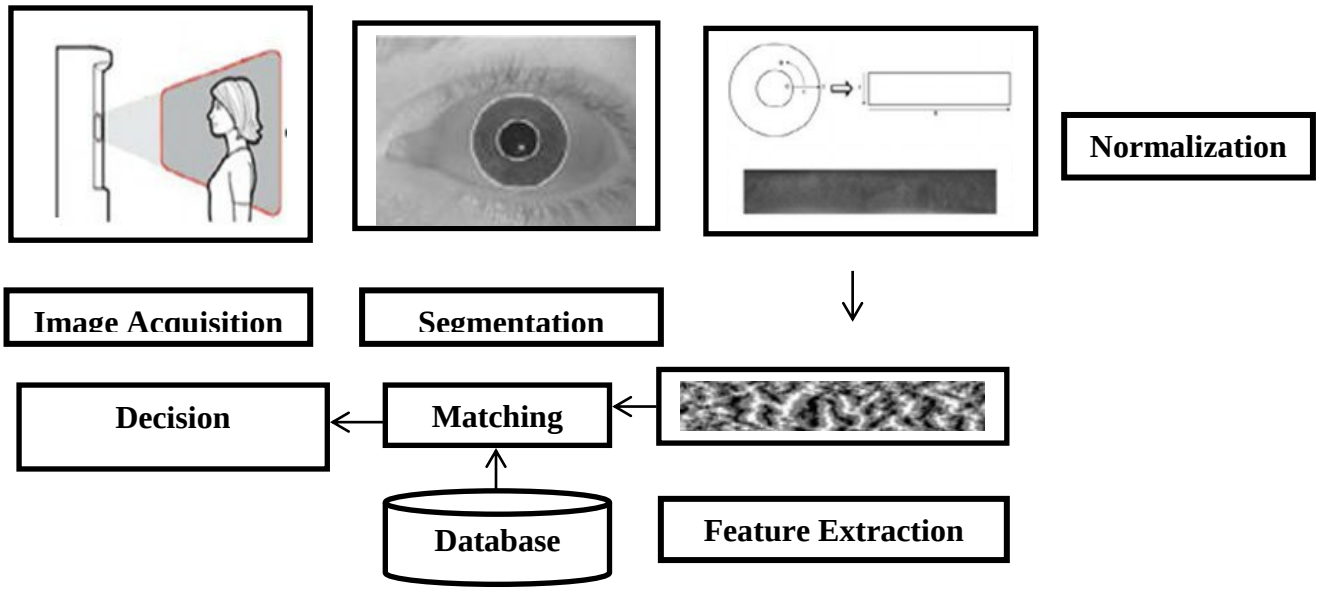

Fig.1: Process of Biometric Authentication

This biometric system is extremely used in various computer vision applications and in the high security areas. The applications of this system are as follows-

(i) E-commerce: these biometrics recognitions are recommended in the E-commerce, which consists of online banking, online data communications, and online businesses.
(ii) Healthcare (Medical record protection): to save the medical information in a secure system is only accessible to the authorized users and these systems use the automatic iris recognition.
(iii) Insurance and Brokerage transactions: to make the transactions, highly confidential it uses the iris recognition to save the large amount of data in a secure system [4].

II. LITERATURE SURVEY

Literature review related to the iris recognition using Fractal and Bi-dimensional Methods used to improve the security and performance metrics. A research given by (Statistical Feature Extraction based Iris Recognition System) found that the various problems like as an error rate increases and accuracy decreases [14].

The existing work, a fractal dimensional is providing an SI (Statistical Index) difficult comparing how explains in a design modifies with the scale at which it is considered. It has also been featured as a considered in the space completely capacity of a pattern that tells how fractal dimension (FD) different from the space it is embedded in a fractal dimensional doesn't have to be an integer [15,16].

In the paper [5] proposed and implemented a statistical technique for feature extraction depending on correlation among adjacent pixels. Iris recognition framework was initiated by many researchers using distinguished techniques for perfect and reliable authentication. Metric based hamming distance was used for matching. Performance of proposed Irisframework was calculated by recording false acceptance rate (FAR) and false rejection rate (FRR) at different levels in distance metric. Framework execution has been assessed by registering factual highlights along two headings, in particular, the out spread course of a roundabout iris locale and precise bearing stretching out from the student to the sclera [17]. Tests have additionally been led to think about the impact of number of measurable parameters on FAR and FRR. Results acquired from the trials in view of various arrangements of measurable highlights of iris pictures demonstrate that there is a huge change in break even with the mistake equal error rate (EER) when number of factual parameters to include extraction is expanded from three to six. Further, it has likewise been discovered that expanding outspread/rakish determination, with standardization set up, enhances EER for the proposed iris acknowledgment framework [13].

The researchers of [6] proposed a code level approach for heterogeneous iris recognition in comparison to existing solution to minimize the difference between heterogeneous images in filtered features and pixel intensities. Matching heterogeneous iris images in the least compelling implementation of the iris is challenging task. The non-direct connection between twofold component codes of heterogeneous iris pictures is displayed by an adjusted Markov arranges. This model changes the quantity of iris layouts in the test in a homogenous iris format relating to the display test. Also, a weight delineate the unwavering quality of double codes in the iris layout can be gotten from the model. The learnt iris format and weight delineate together utilized as a part of building a hearty iris. Matcher against the varieties of imaging sensors, catching separation and subject conditions [12]. Broad exploratory after effects of coordinating cross-sensor, high-determination versus low-determination and clear versus obscured iris pictures show the code-level approach can accomplish the most noteworthy exact in contrasted with the

current pixel-level, include level and score-level arrangements [18].

Authors of [7] evaluated a new set of bi-spectral Iris recognition framework that concurrently receives visible and close infrared images with pixel to pixel resemblance. Iris recognition is widely deployed for large-scale implementations like national ID programs that acquire countless iris images to maintain its identity. However, with the accessibility of an assortment of iris sensors that are conveyed for the iris imaging under various brightening/condition, huge execution corruption is normal while coordinating such iris pictures procured under two distinct spaces (either sensor-particular or wavelength-particular). This paper builds up a space adjustment structure to address this issue and presents another calculation utilizing Markov Arbitrary Fields (MRF) model to fundamentally enhance cross-area iris acknowledgment. The proposed area adjustment system in light of the credulous Bayes closest neighbour order utilizes a genuine esteemed element portrayal which is fit for learning space information. Our way to deal with evaluating relating unmistakable iris designs from the union of iris fixes in the close infrared iris pictures accomplishes beating comes about for the cross-spectral iris acknowledgment. The authors of [11] introduce reproducible exploratory outcomes from three freely accessible databases. PolyU cross-spectral iris picture database, IIITD CLI (IIIT-Delhi Contact Lens Iris) and UND (United Iris) database, and accomplish beating comes about for the cross-sensor and cross-spectral iris co-ordinating. The research work of [8] presented demonstration an extension of a famous simple global color standard and obtained results from two iris databases i.e. UPOL and UBIRIS (Noisy Database). All tests were improved the situation three diverse shading spaces, RGB (Red, Blue and Green), HSV (Hue, Saturation and Value) and LAB (Lab Color Space), and two discriminative classifiers, k-NN (k - Nearest Neighbour) and SVM (Support Vector Machine) were utilized as a part of our examinations. For the k-NN, three great separations, Canberra, Euclidean and Manhattan and other two new separations we proposed were utilized as a part of the examinations. The outcomes got utilizing the augmentation shading standard are contrasted and the ones got with the first foundation [9,10].

III. METHODOLOGY

The aim of this research work, to design an Iris Recognition System based on feature extraction. To study the various dissimilar methods and designs of iris recognition system. In this work, to improve the security system using iris biometric traits. To improve the accuracy rate, decrease the error rates in the research work. Pre-processing of an image dataset to improve quality of the input image and feature extraction using discrete wavelet transform (DWT) and Hough Circle Transformation (HCT). Evaluate the performance of work using various parameters such as FAR, FRR. Different steps of the methodology are:-

Step 1: Database: To collect the iris dataset from the UCI machine learning site .Upload the original image, to convert the original image to gray scale form in 2D transformation.

Step 2: Localization: The Iris Localization Unit Contains Three Sections (i) Pupil Detection and Iris Boundary Detection (ii) Eyelid Detection and (iii) Eyelash Detection.

Step 3: Normalization: Iris may be captured in different size with varying imaging distance. Due to illumination variations the radial size of the pupil may change accordingly. The resulting deformation of the Iris texture will affect the performance of subsequent feature extraction and matching stages. Therefore, the Iris region needs to be normalized to compensate for these variations.

Step 4: Feature Extraction: BEMD to analyze the iris image, the idea being to decompose the iris image into its 2D IMFs, from which fractal dimension is calculated as a feature vector. In addition, we propose a local feature extraction method to reduce the amount of data and improve performance. Finally, different similarity measures are used to recognize a given iris image from the iris database. The EMD (empirical mode decomposition) method can decompose any complicated signal into a finite and often small number of IMF components that are then used as a set of basic functions to represent the signals. Fractals provide a mathematical framework which can be applied to describe self-similarity and irregularity using fractal dimension. Iris images include abundant information such as freckles, stripes and textures that are self-similar.

Step 5: Classification: The input/output training data is fundamental for these networks as it conveys information which is necessary to discover the optimal operating point. Basically, NN is a system. A system is a structure that receives an input, process the data, and provides an output. The neural network is used to classify the extracted vectors.

Step 6: Feature Matching: To establish a precise correspondence between characteristic structures across the two images. Both of the systems under discussion compensate for image shift, scaling, and rotation. For both systems, iris localization is charged with isolating an iris in a larger acquired image and thereby accomplishes alignment for image shift. In pattern matching of pixels with the databases will be done using hamming distance.

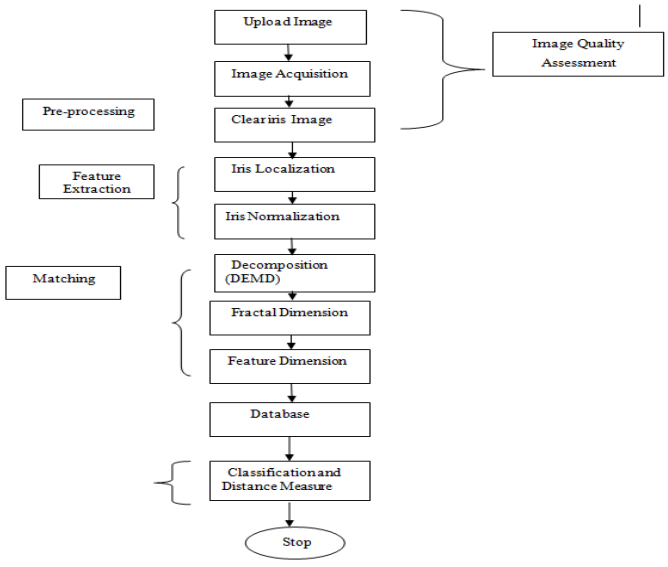

Fig.2: Proposed Flow Chart

Step 7: Performance Parameters: To evaluate the performance parameters, i.e. accuracy and recognition rate. The different performance evaluation metrics used in this work are:

a. False Acceptance Rate: The false acceptance rate, or FAR, is the measure of the likelihood that the biometric security system will incorrectly accept an access attempt by an unauthorized user. A system's FAR typically is stated as the ratio of the number of false acceptances divided by the number of identification attempts.

FAR = (N – FA)/N ……..(1)
where
N = Total no. of Illustrations and
FA = No. of Illustrations Falsely accepted

b. False Rejection Rate: The false recognition rate, or FRR, is the measure of the likelihood that the biometric security system will incorrectly reject an access attempt by an authorized user. A system's FRR typically is stated as the ratio of the number of false recjections divided by the number of identification attempts.

FRR = (N – FR)/N ……..(2)
where
N = Total no. of Illustrations and
FR = No. of Illustrations Falsely rejected

c. Accuracy: The accuracy of a test is its ability to differentiate the patient and healthy cases correctly. To estimate the accuracy of a test, we should calculate the proportion of true positive and true negative in all evaluated cases. Mathematically, this can be stated as:

Accuracy=TP+TN/ TP+TN+FP+FN …… (3)

Where TP is True Positive, TN is True Negative; FP is False Positive and FN Is false negative.

d. Error Rate: It is considered of the image quality of an estimator and it is always non-negative and values close to 0 are better value.

$$ER = \frac{1}{n}\sum_{i=1}^{n}(Y1 - Y2)^2 \quad \text{..... (4)}$$

IV. RESULT AND DISCUSSION

The section is devoted to the information about the technology used in implementation of proposed work, dataset description to identification the research method and validate the results of the proposed method in verification of uni-model biometric using traits images. Iris Recognition is done by using the different algorithms for the feature extraction. The algorithm such as canny edge detector is used for detecting the image, as it can detect the thick images also very easily. BEMD algorithm is used after detecting the edges for finding out the shapes of iris circle. After applying the Fractal Dimensional algorithm is applied for feature extraction and then matching of the result of the database and proposed technique result is matched by using hamming distance. The main framework described that the training and testing sections in the iris recognition. Train the dataset from the training folder in the knowledge base. In testing case analyse the image feature then matching the closest features in the original image. The graphical user interface panel with different user interface controls like panel, pushbuttons which are executed by clicking on the pushbuttons. Every pushbutton is having different functions at call back. The database panel will be obtained after clicking on the upload button. The two folders are having iris images and the window contains training folder and testing folder. After that the panel in which iris image is uploaded and its grey scale image which is plotted will be there after clicking on the upload pushbutton. It will be having static text also which contains minimum value, maximum value and average value. These are the values which are extracted after applying Fractal Dimensional and BEMD algorithms and according to it the next step will proceed to make the system accurate.

Fig.3: Upload Image

Fig 3 defines the original image is uploaded and its grey scale image which is plotted will be there after clicking on the upload pushbutton. It will be having static text also which contains minimum value, maximum value and average value.

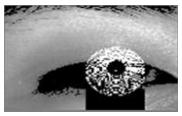

Fig.4: Normalized Image

Figure 4 defined that an iris may be captured in different size with varying imaging distance. Due to illumination variations the radial size of the pupil may change accordingly. The resulting deformation of the Iris texture will affect the performance of subsequent feature extraction and matching stages. Therefore, the Iris region needs to be normalized to compensate for these variations.

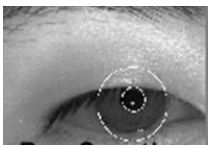

Fig.5: Region Image

The figure 5 shows that the region of iris image. The region means average of the region calculated in the iris recognition system.

Fig.6: Edge Detection

The above figure (Fig. 6) shows the edge image of the uploaded image which symbolizes the edges on the boundary. These edges which are detected help to simplify the image and extract their features. The edge detector is of different types like canny edge detector, Sobel, prewitt etc. and we have used

canny edge detection because more edges are obtained after clicking on the edge detection pushbutton. Canny edge detector is being used for the edge detection as it takes out the thick edges of images very easily. The detected image is further used for applying the other algorithms on it, such as FD and BEMD. According to the whole the matching is done.

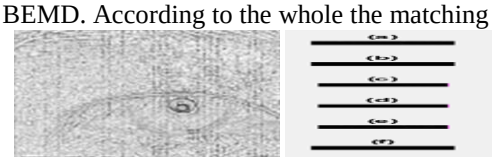

Fig.7: Fractal Dimensional and BEMD

It defined that the BEMD to analyse the iris image, the idea being to decompose the iris image into its 2D IMFs, from which fractal dimension is calculated as a feature vector. In addition, we propose a local feature extraction method to reduce the amount of data and improve performance. Finally, different similarity measures are used to recognize a given iris image from the iris database. The EMD method can decompose any complicated signal into a finite and often small numbers of IMF components that are then used as a set of basic functions to represent the signals. Fractals provide a mathematical framework which can be applied to describe self-similarity and irregularity using fractal dimension. Iris images include abundant information such as freckles, stripes and textures that are self-similar. It defined that the BEMD dimension generated by 6*5 phases. All are equal size and dimensions in the Image.

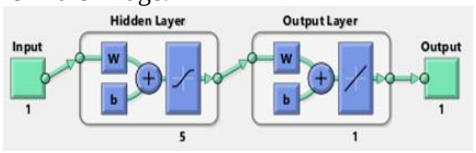

Fig.9: Neural Network

Every intelligent system needs knowledge base for similarity calculations. Here a unique feature set extracted in the feature extraction phase is used to train the system. Classifier process the feature set and store in their knowledge base in terms of encoded calculations. These calculations are useful at the time of similarity calculations and other operations with the knowledgebase. The above figure shows that the training state divide into three phases:

A. Gradient
B. Mutation and
C. Validation Failure

In gradient means expected outcome, mutation means changes required in the NN and validation failure to refractor the information into different phases in the NNs (Fig. 9).

TABLE 1 PROPOSED RESULTS

Performance Parameters	Proposed Work
Error Rate	$2*10^{-4}$
False Acceptance Rate	0.01
False Rejection Rate	1

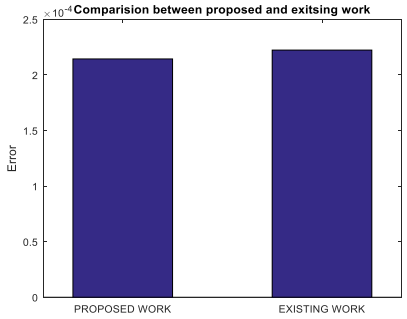

Fig.10: Comparison – Error Rate

The above figure (Fig. 10) defined that the comparisons between proposed and existing work in error rate. The proposed work in neural network using BEMD algorithm to reduce the error rate and existing work error rate value is highly rate in BEMD and NN (Neural Network).

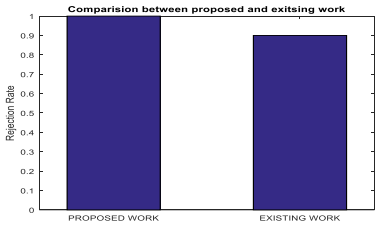

Fig.11: Comparison - Rejection Rate

The above figure (Fig. 11) described that the proposed work to enhance the value of the false rejection rate in BEMD and FD in Neural Network using in iris recognition system.

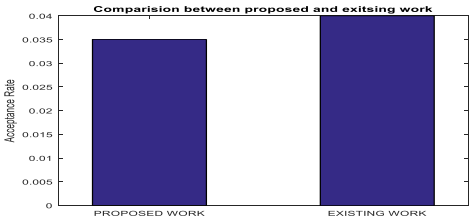

Fig.12: Comparison - False Acceptance Rate

The above figure (Fig. 12) described that the proposed work to reduce the value of the false acceptance rate in BEMD and FD in Neural Network using in iris recognition system.

TABLE 2: COMPARISON

Performance Parameters	Proposed Work	Existing Work
Error Rate	$2*10^{-4}$	$2.2*10^{-4}$
False Acceptance Rate	0.03	0.04
False Rejection Rate	1	0.9

V. CONCLUSION AND FUTURE SCOPE

In this FD and BEMD algorithm used to feature extraction for iris, the normalization of iris templates are completed using Normalization Method and then comparing the feature or

matching the features using HD (hamming distance). In this research work, reduce the False Acceptance Rate, False Rejection Rate and Error Rate and reduces the NN (Neural Network) methods used and system performance on the given databases. Iris Localization system unit Contains Three Sections (i) Pupil Detection and Iris Boundary Detection (ii) Eyelid Detection and (iii) Eyelash Detection.

Iris may be captured in different size with varying imaging distance. Due to illumination variations the radial size of the pupil may change accordingly. The resulting deformation of the Iris texture will affect the performance of subsequent feature extraction and matching stages. Therefore, the Iris region needs to be normalized to compensate for these variations. We propose a local feature extraction method to reduce the amount of data and improve performance. Finally, different similarity measures are used to recognize a given iris image from the iris database. Basically, NN is system. A system is a structure that receives an input, process the data, and provides an output. Neural network is used to classify the extracted vectors. Both of the systems under discussion compensate for image shift, scaling, and rotation. For both systems, iris localization is charged with isolating an iris in a larger acquired image and thereby accomplishes alignment for image shift. In pattern matching of pixels with the databases will be done using hamming distance. The result also defined to enhance the performance metrics Error rate, FAR, FRR and Accuracy in iris recognition system. Result experiment with varying radius resolution that 200 bits feature vectors for feature extracted along redial directions. Comparison between test image template and templates stored in the database is carried out using Hamming distance. Results also show that statistical feature extraction based technique creates compact iris code and takes less time for feature extraction.

The Future work could go in the direction of using more robust modelling techniques (Symmetric and Asymmetric) against forgeries and hybrid fusion level can be used. Multi-modal modalities can be used together to make forgeries more difficult. Also, the system should be tested on a larger database to validate the robustness of the model.

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