GA based Enhanced Irislet for IRIS Recognition

Kulvir Mahi	Naresh Kumar	Sarvjit Singh
Research Scholar	Assistant Professor	Assistant Professor
Department of ECE, UIET	Department of ECE, UIET	Department of ECE, UIET
PU, Chandigarh	PU, Chandigarh	PU, Chandigarh

ABSTRACT
Now a day's Biometrics is the most acceptable to identify any person. It is an authentication technique which place confidence in measurable individual and physiological characteristics that will be mechanically verified. A biometric system could operate either in identification mode or verification mode. Because the level of security breaches and dealings fraud have increased, the necessity of technologies for extremely secure identification and private verification is changing into apparent. In this paper, different methods have been used which recognizes the iris samples. This work uses 50 samples of Iris which were collected by 25 known people where each includes 2 samples. For this Irislet and GA based Irislet is used which shows that GA based Irislet recognizes efficiently all the samples even when samples are noisy. Because irislet fails to recognize noisy samples accurately. This proposed GA-based Irislet achieve 100% accuracy for noisy samples also.

Keywords
ICA, SVM, CR, MR

1. INTRODUCTION
A picture is a visual representation of something. It is a 2-D signal prepared by the human visual framework. The signs that speak to a picture are in simple structure. For their preparing, stockpiling and transmission by PC applications they should be changed over into advanced signs. An advanced picture can be characterized as a variety of pixels.

Design acknowledgment is the task of a name to a given data esteem. A case of example acknowledgment is characterization which endeavors to appoint every data worth to one of a given arrangement of classes (for instance, figure out if a given email is "spam" or "non-spam"). Be that as it may, design acknowledgment is a more broad issue that includes different sorts of yield also. Different samples are relapse which allocates a genuine esteemed yield to every information arrangement marking which doles out a class to every individual from a grouping of qualities grammatical form and parsing which relegates a parse tree a data sentence, portraying the syntactic structure sentence. Pattern acknowledgment calculations for the most part plan to give a sensible response to every conceivable info and to perform "probably" coordinating of the inputs, considering their factual variety. This is against the example coordinating calculation which searches for careful matches in the data with previous examples. A typical illustration of an example coordinating of customary expression. which searches for examples of a given sort in literary information and is incorporated into the inquiry abilities of numerous content manager and word processor as opposed to example acknowledgment, design coordinating is by and large not considered a kind of machine learning, despite the fact that example coordinating calculations (particularly with genuinely broad, painstakingly custom-made examples) can

now and then succeed in giving comparative quality yield to the sort gave by example acknowledgment calculations.

A biometric framework gives programmed acknowledgment of an individual taking into account some kind of one of a kind element or trademark controlled by the person. Biometrics is utilized as a part of software engineering as a type of distinguishing proof and get to control. Biometric frameworks have been produced taking into account fingerprints, facial elements, voice, hand geometry, penmanship, the retina and the one displayed in this theory, the iris Biometric frameworks work by first catching a specimen of the element, for example, recording an advanced sound sign for voice acknowledgment, or taking a computerized shading picture for face acknowledgment. The example is then changed utilizing some kind of numerical capacity into a biometric format. The biometric layout will give a standardized, proficient and profoundly separating representation of the component, which can then be impartially contrasted with different formats all together with decide character. Most biometric frameworks permit two methods of operation.

Because of defective imaging, changes in the client's physiological or behavioral attributes surrounding conditions and clients association with the sensors two specimens from the same individual are not precisely the same. Two sorts of mistakes happens in biometric confirmation framework [1]

- Recognizing the biometric estimation of two distinct persons as the same called false acknowledgment. Parameter used to gauge this blunder is False Acceptance/Match Rate (FAR/FMR).

- Recognizing the two diverse biometric parameters of the same individual as the parameters of two unique persons called false dismissal. The parameter used to quantify this is False Rejection Rate/False Non Match Rate (FRR/FNMR).

1.1 Iris recognition
We are living in the age, in which the interest on security is expanding extraordinarily. Thusly, biometric acknowledgment, which is a sheltered, dependable and helpful innovation for individual acknowledgment, shows up. This innovation makes utilization of physiological or behavioral attributes to distinguish person.. A biometric framework is an example acknowledgment framework including obtaining the biometric highlight from individual, removing the element vector from the crude information and contrasting this component vector with someone else's element vector. Unique finger impression, palm-prints, face, iris, stride, discourse and mark are generally utilized biometric highlights. Biometric acknowledgment can be utilized as a part of PC system login, web access, ATM, Mastercard, national ID card, driver's permit et cetera. These days, unique mark acknowledgment is utilized generally and effectively. Face acknowledgment is considered by numerous researchers

and specialists. Iris acknowledgment is a generally new branch of biometric acknowledgment. The human iris is the annular part in the middle of student and sclera. It has particular element, for example, spots, crowns, stripes, wrinkles et cetera.

Comparing iris recognition with other biometric techniques iris having following merits:

- Uniqueness: The likelihood of two persons' irises being the same is lower than $10{-}35$. Despite the fact that they are twins, their irises are very distinctive. This is the motivation behind why we utilize iris to perceive individual personality.

- Reliability: iris is an inward organ in our eyes and secured by eyelid, lash and cornea. Not at all like finger and palm, it is rarely harmed and the blunder of acknowledgment created by scar will never happen. In this sense, iris acknowledgment is vastly improved than unique finger impression and palm-print acknowledged.

1.1.1 Steps of iris recognition
Real strides of iris acknowledgment are given after:

- •Segmentation: A system is required to confine and bar the ancient rarities and additionally finding the roundabout iris district. The internal and the external limits of the iris are computed.

- Normalization: Iris of various individuals might be caught in various size, for the same individual likewise size might fluctuate in light of the variety in enlightenment and different elements. The standardization procedure will create iris districts, which have the same consistent measurements, with the goal that two photos of the same iris under various conditions will have Characteristic components at the same spatial area.

- Feature extraction: The noteworthy elements of the iris must be encoded so that correlations between formats can be made. Most iris acknowledgment frameworks make utilization of a band pass decay of the iris picture to make a biometric layout. Iris gives plentiful composition data. an element vector is shaped which comprises of the requested grouping of components removed from the different representation of the iris pictures.

- Matching of an Image: To verify by means of distinguishing proof (one-to-numerous layout coordinating) or check (balanced format coordinating), a format made by imaging the iris is contrasted with a put away esteem layout in a database. In the event that the Hamming separation is underneath the choice edge, a positive recognizable proof has successfully been made e.g. a hamming separation of 0 would bring about an impeccable match.

- Localization: Iris confinement is a particularly imperative stride in the entire iris acknowledgment framework. Just when we section iris effectively from the first iris picture, we can acquire a precise coordinating result. Iris restriction, by definition, intends to distinguish the area of iris' internal and extern

1.1.2 Methods of iris recognition system
Major methods of iris recognition are following:

1.1.2.1 Phase based method:
- Daugman integrodifferential operator

The stage based technique perceive iris designs in light of stage data. Stage data is free of imaging complexity and enlightenment. J.Daugman composed and protected the primary complete, financially accessible stage based iris acknowledgment framework in 1994. The eye pictures with determination of 80-130 pixels iris sweep were caught with picture center evaluation performed continuously. The student and iris limit was discovered utilizing integro differential administrator. The acknowledgment in this technique is the disappointment of a test of measurable autonomy including degrees of opportunity. Iris codes are diverse for two unique examples. The test was performed utilizing Boolean XOR administrator connected to 2048 piece stage vectors to encode any two iris designs, veiled by both of their bit vectors. From the resultant piece vector and cover piece vectors,

The uniqueness measure between any two iris examples is processed utilizing Hamming Distance (HD). The channel reaction vectors were bunched utilizing vector quantization calculations like k-means. The tests were directed on CASIA-Bios cure iris database comprising of pictures caught from Asian and non-Asian race bunches. The bolster vector machine was utilized for the two class ethnic grouping. In Martin's technique, the iris outline parameters are acquired by boosting the normal power contrasts of the five continuous boundaries. In Masek's technique, the division depended on the Hough change. The stage information from 1D Log-Gabor channels was extricated and quantized to four levels to encode the interesting example of the iris into somewhat shrewd biometric layout. Xiaomei reimplemented Masek's calculation in C that was initially composed in Matlab. Proceeding with the Daugman's strategy, Karen has added to various procedures for enhancing acknowledgment rates. These strategies incorporate delicate piece covering, signal-level combination of iris pictures, and recognizing nearby twists in iris surface. The bits close to the tomahawks of the perplexing plane move the channel reaction from one quadrant to contiguous quadrant in vicinity of clamor. In the delicate piece veiling strategy, such bits called as the delicate bits are distinguished and conceal to enhance the exactness. The sign level combination technique utilizes picture averaging of chose edges from a video clasp of an iris. Nearby composition contortions happens with contact lenses with a logo, poor-fit contacts and edges of hard contact lenses, division mistakes and shadows on the iris. These are recognized by investigating iris code coordinating results. The 20x240 standardized pictures were secured with 92 windows each of size 8x20. Partial HD was processed for every window. The area of windows with most noteworthy partial HD was recognized and expelled from further counts. The impact of expansion was considered by gathering datasets of pictures with fluctuating degrees of enlargement. The information was partitioned into subsets with little understudies, medium students and huge students. The subset of information with extensive students demonstrated most noticeably bad execution with EER at a request of size more prominent contrasted with that of little understudy information set. The perceivability in the iris territory is lessened and larger piece of iris is impeded by eyelids which give less data to iris code era.

- Zero crossing representation method:

The technique created by Boles speaks to components of the iris at various determination levels in view of the wavelet

change zero-intersection. The calculation is interpretation, revolution and scale invariant. The data pictures are prepared to get an arrangement of 1D signs and its zero intersection representation taking into account its dyadic wavelet change. The wavelet capacity is the primary subsidiary of the cubic spline. The inside and distance across of the iris is figured from the edge-recognized picture. The virtual circles are built from the middle and put away as round cushions. The data extricated from any of the virtual circles is standardized to have same number of information focuses and a zero intersection representation is produced. The representation is occasional and autonomous from the beginning stage on iris virtual circles. These are put away in the database as iris marks. The disparity between the irises of the same eye pictures was littler contrasted with the eye pictures of various eyes. The upside of this capacity is that the measure of calculation is lessened subsequent to the measure of zero intersections is not exactly the quantity of information focuses. Be that as it may, the downside is that it requires the contrasted representations with have the same number of zero intersections at every determination level.

1.1.2.2 Texture analysis based method:

A Laplacian pyramid is built with four diverse determination levels to produce a conservative iris layout. The technique for iris ID by Emine Krichen utilize a cross breed strategy for iris division, Hough change for external iris limit and integro-differential administrator for internal iris limit. The iris code was delivered utilizing wavelet parcels. The entire picture is investigated at various resolutions. 832 wavelets with 4 scales are utilized to produce 1664 bits code. The iris database comprised of 700 pictures obtained with obvious light. A change of 2% FAR and 11.5% FRR was acquired in respect to Daugman strategy. It was watched that by considering shading data, general change of 2% to 10% was acquired by worth.

1.1.2.3 Approach based on intensity variation:

The Hough change is a standard PC vision calculation that can be utilized to decide the parameters of straightforward geometric articles, for example, lines and circles, present in a picture. The roundabout Hough change can be utilized to derive the span and focus directions of the student and iris areas. A programmed division calculation taking into account the round Hough change is utilized by Wildes et al. Kong and ZhangTissi and Ma Firstly, an edge guide is produced by computing the primary subordinates of force qualities in an eye picture and after that thresholding the outcome. From the edge map, votes are thrown in Hough space for the parameters of circles going through every edge point. These parameters are the inside directions XC and Yc, and the span r, which can characterize any circle as per the mathematical statement:

$$Xc2 + Yc2 - r2 = 0$$

In performing the previous edge recognition step, Wildes inclination the subordinates in the flat bearing for distinguishing the eyelids, and in the vertical heading for identifying the external roundabout limit of the iris. The inspiration for this is the eyelids are normally evenly adjusted, furthermore the eyelid edge guide will degenerate the round iris limit edge map if utilizing all angle information. Taking just the vertical inclinations for finding the iris limit will decrease impact of the eyelids when performing round Hough change, and not the majority of the edge pixels characterizing the circle are required for fruitful confinement. Not just does this make circle confinement more precise, it likewise makes it more effective, since there are less edge focuses to cast

votes in the Hough space. There are various issues with the Hough change technique. Above all else, it requires edge qualities to be decided for edge location, and this might bring about basic edge focuses being evacuated, bringing about inability to distinguish circles/curves. Also, the Hough change is computationally serious because of its beast force 'approach, and subsequently may not be suitable for continuous application.

1.1.2.4 Approach using independent component analysis

The iris affirmation structure made by Hamed Ranjzad grasps Independent Component Analysis (ICA) to focus iris surface components. Picture securing is performed at different illumination and fuss levels. The iris repression is performed using integrodifferential manager and metaphorical curve fitting. From the inside to outside furthest reaches of iris, modified number of concentric circles n with m tests on each circle is obtained. This is identified with as a structure n x m for a specific iris picture which is invariant to upheaval and size. The free parts are uncorrelated, chosen from the segment coefficients. The component coefficients are non-Gaussian and regularly free. The reason limit used is kurtosis. The self-sufficient portions are evaluated and encoded. The point of convergence of each class is managed by centered learning framework which is secured as the iris code for a man. The typical Euclidean detachment classifier is used to see iris plans.

1.1.2.5 Approach based in iris authentication dynamic programming:

Understudy extraction starts by recognizing the most elevated crest from the histogram which gives the edge to lower power estimations of the eye picture. All the associated parts in test eye picture not as much as limit power quality are marked. By selecting the most extreme range part we touch base at understudy zone of the eye. Standardized bouncing rectangle is actualized utilizing focal point of understudy to yield iris. Nonstop dynamic writing computer programs is utilized with the idea of looking at shape attributes part shrewd. The speeding up plot is portioned and parts of quickening bend are utilized to confirm with info's increasing speed bend. For iris tests, rate of progress of dim level intensities inside bouncing box shapes quickening highlight plot. The usage is based the idea of aggregated least nearby separations between a reference format and data test. The reference layout is gotten utilizing forget one technique. The separation measure is the inclusion of directional changes increasing speed plot. The neighborhood separations are directional changes.

1.1.2.6 Approach based on new inverse laplacian filter bank:

Execution of this new channel bank is like Laplacian pyramid in inverse heading in recurrence area it is named as Inverse Laplacian channel bank. In Laplacian channel bank the data transfer capacities of band pass channels are expanded with expanding the recurrence focus of them. Since surface subtle element data exists in high frequencies more than in low frequencies, these channel banks can't investigation composition data precisely. In these channel banks high recurrence data of surface can't be separated precisely.

1.1.2.7 Multiclass SVM based approach:

The bolster vector machine (SVM) is an all around acknowledged methodology for example order because of elements and promising execution. Bolster vector classifiers devise a computationally proficient method for adapting great

isolating hyper plane in a high dimensional component space. In this work, we apply multi class SVM to arrange the iris design because of its remarkable speculation execution. Here, the SVM is utilized as an iris design classifier in view of its invaluable components over other arrangement plan furthermore as a result of its promising execution as a Multiclass classifier. In a SVM, a couple of imperative information point called bolster vectors (SV) are chosen on which a choice limit is only reliant.

1.2 Genetic Algorithm

GA is a populace based pursuit system that keeps up populaces of potential arrangements amid hunts. Keeping in mind the end goal to assess every potential arrangement, GA require a result (or remunerate, objective) work that doles out scalar result to a specific arrangement. Once the representation plan and assessment capacity is resolved, and afterward GA begins looking. At first, hereditary calculation characterizes a specific number, called the populace size, of strings to make the original. Next, the result capacity is utilized to process every arrangement in this original. Better arrangements procure higher adjustments. At that point, on the premise of these assessments, some hereditary operations are done to create the cutting edge. The techniques of assessment and era are iteratively performed until the best arrangement is found or the time distributed for calculation closes. Fig 1 demonstrates a development stream of hereditary calculation.

Before a genetic algorithm performs, it must have the following five components:

• A chromosomal representation of solutions to the problem.

As a rule, there are two parts of hereditary calculation are issue subordinate: the representation and assessment capacities. Representation is a key hereditary calculation issue since it controls coded representations of issues. Any character set and coding plan can be utilized. Be that as it may, twofold character set is ideally utilized on the grounds that it yield the biggest number of schemata for any given parameter determination.

• A function that evaluates the performances of solutions.

Alongside the representation conspire, the assessment capacity is issue subordinate. Hereditary calculation is a hunt system which utilizes the criticism got from their investigation of arrangements. The judge of the hereditary calculation investigation is called an assessment capacity. The thought of assessment and wellness are in some cases switch. Notwithstanding, it is essential to distinction between the assessment capacity and the wellness capacity. An assessment capacities gives a measure of an individual's execution, where as wellness capacities give a measure of an individual's generation opportunities.

• A population of initialized solutions.

Picking a suitable populace size for a hereditary calculation is a fundamental thing however it is a troublesome undertaking for every single hereditary calculation clients. On the one side, if the populace size is too little, the hereditary calculation will meet effortlessly to locate the ideal arrangement. What's more, if the populace size is too extensive, the calculation expense might be restrictive.

• Genetic operators that evolve the population.

A hereditary calculation is an iterative procedure in which every cycle has two stages, assessment and era. In the

assessment step, area data is utilized to decide the nature of a person. The era step includes a choice stage and a recombination stage. In the determination stage, wellness uses to manage the multiplication of new possibility for taking after emphases. The wellness capacity speaks to a person to a genuine number that is utilized to find what number of posterity that individual is required to breed. High wellness people are given more center in a few eras since they are chosen all the more much of the time. In the recombination stage, hybrid and change performs blending. Hybrid restores a couple of chose people to make two new posterity. Transformation is utilized for re-presentation unintentionally "lost" quality qualities. Transformation: When people are spoken to as bit strings, change reverses of an arbitrarily picked bit.

• Parameters that determine the probabilities by which these genetic operators are applied.

Running a hereditary calculation require the settings of various parameter values. In any case, discovering great settings that function admirably on one's issue is a troublesome undertaking. There are two essential parameters which clarifies the conduct of hereditary calculations: Crossover Rate (CR) and Mutation Rate (MR).
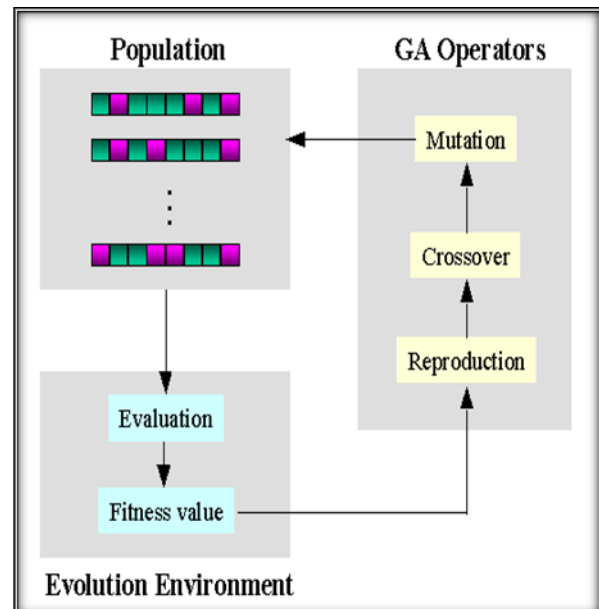

Fig 1: Evolution flow of genetic algorithm

2. IRISLET BASED RECOGNITION SYSTEM FOR NOISY SAMPLES

Development of the iris starts in the third month of incubation. The novel example of the iris surface is framed by the eight month, however the color gradual addition can proceed up to first postnatal years. Iris example is a one of a kind example and can contain numerous unmistakable components, for example, edges, rings, crown, spots, and crisscross collarette.

Iris acknowledgment is the procedure of analyzing so as to perceive the personality of the individual the extraordinary Iris design. In all the example acknowledgment frameworks the key issue is connection between entomb class and intra class variability that is items in a picture can be dependably arranged if and just if the variability between various occasions of a given class is not exactly the variability between various classes. For instance, in face

acknowledgment biometric framework for example acknowledgment trouble emerges from the way that the face is alterable organ with various demeanors, edge, and posture, light and so forth. So the intra class (same face) variability is higher that the bury class variability on the grounds that distinctive countenances have the same essential arrangement of components, in the same geometry.

For the above reasons iris example is an intriguing methodology since iris design variability in various persons is gigantic. Alongside that the inner part of the eye, the iris is all around ensured. As a planer the picture of iris is coldhearted to edge of light. Despite the fact that model frameworks had been proposed before, it was not until the mid nineties that Cambridge analyst, John Daugman, executed a working mechanized iris acknowledgment framework. The Daugman framework is licensed and the rights are currently claimed by the organization Iridian Technologies. Despite the fact that the Daugman framework is the best and most understood, numerous different frameworks have been created.

2.1 Basic Design of the System

To Implement Irislet based recognition system, MATLAB based GUI system has been designed. In this, a database of 50 iris samples comprising of a Training Set and Test Set is utilized. Preparing Set comprises of 50 bona fide iris from 25 known persons. Every Person contributes 2 tests. Test Set comprises of 50 noisy iris impression tests which comprise of 25 bona fide specimens. The outcome acquired has diminished the FAR and in addition FRR and has expanded the framework execution. The exactness of the biometric framework has been expanded. The basic design of this recognition system is as shown in Figure 2. Where samples are first trained and then testing is done on the basis of training dataset. The design prepared in MATLAB is as shown in figure 3.
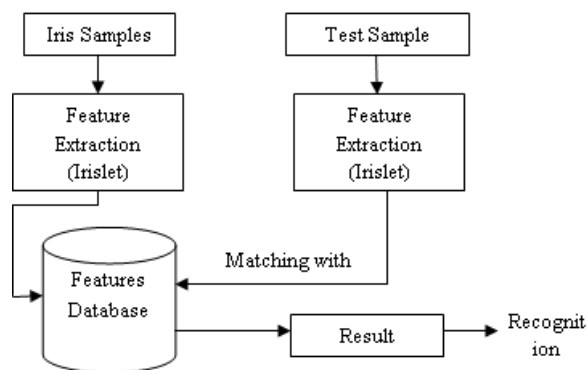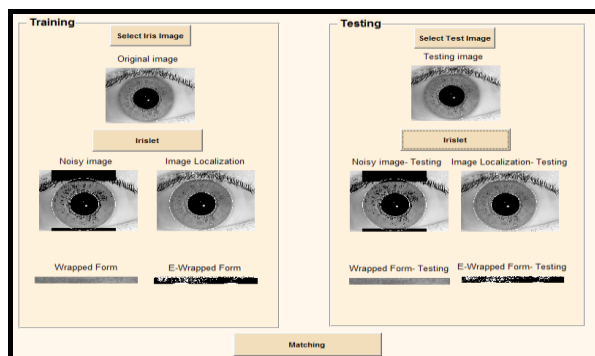

Fig 2: Basic Design of Irislet

Fig 3: GUI designed in MATLAB

2.2 Result Analysis for Noisy Samples using Irislet

Irislet based recognition system gives 100% accuracy. So, in this work, noisy samples has been used as a test set. Recognition accuracy for this system when tested with noisy samples in 56%. The analysis is as shown in table 1.

Table 1. Recognition Accuracy

Total Number of Samples	50
Matched Samples	28
Accuracy	56%

2.3 Problem Statement

In this time of innovation security is the principle issue. To upgrade security Biometrics frameworks were presented in which we utilize distinctive biometric attributes E.g. Iris, palm print, unique mark, DNA etc. In this work we consider Iris attributes since Iris has an extraordinary example. The previous work which takes under consideration proposed a Irislet which works on 19 different steps [3]. According to this new wavelet theory the recognition rate for limited samples was 100% but when this Irislet is tested with noisy samples, the recognition rate decreases and it is only 56%. It means there is depreciation in recognition rate so, it can be improved by using optimization technique proposed in this work which achieve better recognition rate for noisy samples also.

3. PROPOSED GA BASED IRISLET

The main phase of iris acknowledgment is to segregate the genuine iris locale in a computerized eye picture. The iris area can be approximated by two circles, one for the iris/sclera limit and another, inside to the to start with, for the iris/understudy limit. The eyelids and eyelashes ordinarily impede the upper and lower parts of the iris district. Additionally, specular reflections can happen inside of the iris locale undermining the iris design. A procedure is required to confine and reject these curios and additionally finding the round iris area. The accomplishment of division relies on upon the imaging nature of eye pictures. Pictures in the CASIA iris database don't contain specular reflections because of the utilization of close infra-red light for enlightenment. Be that as it may, the pictures in the LEI database contain these specular reflections, which are brought about by imaging under common light. Additionally, persons with obscurely pigmented irises will introduce low complexity between the student and iris locale if imaged under normal light, making division more troublesome. The division stage is basic to the achievement of an iris acknowledgment framework, since information that is dishonestly spoken to as iris example information will degenerate the biometric formats created, bringing about poor acknowledgment rates. GA is a populace based hunt system that keeps up populaces of potential arrangements amid ventures. Keeping in mind the end goal to assess every potential arrangement, GA require a result (or remunerate, objective) work that doles out scalar result to a specific arrangement. Once the representation plan and assessment capacity is resolved, and afterward GA begins looking. At first, hereditary calculation characterizes a specific number, called the populace size, of strings to make the original. Next, the result capacity is utilized to process every arrangement in this original. Better arrangements procure higher settlements. At that point, on the premise of these assessments, some hereditary operations are done to create the cutting edge. The methods of assessment and era are iteratively performed until

the best arrangement is found or the time distributed for calculation closes.

In this work, feature extracted by Irislet is optimized using Genetic Algorithm. This GA based Irislet selects only the best features or unique features which identify the samples from the database either they are noisy samples.

3.1 Basic Design of GA based Irislet

To Implement GA based Irislet recognition system, MATLAB based GUI system has been designed. In this, a database of 50 iris samples comprising of a Training Set and Test Set is utilized. Preparing Set comprises of 50 bona fide iris from 25 known persons. Every Person contributes 2 tests. Test Set comprises of 50 noisy iris impression tests which comprise of 25 bona fide specimens. The outcome acquired has diminished the FAR and in addition FRR and has expanded the framework execution. The exactness of the biometric framework has been expanded. The basic design of this recognition system is as shown in Figure 4. Where samples are first trained and then testing is done on the basis of training dataset. The design prepared in MATLAB is as shown in figure 5.
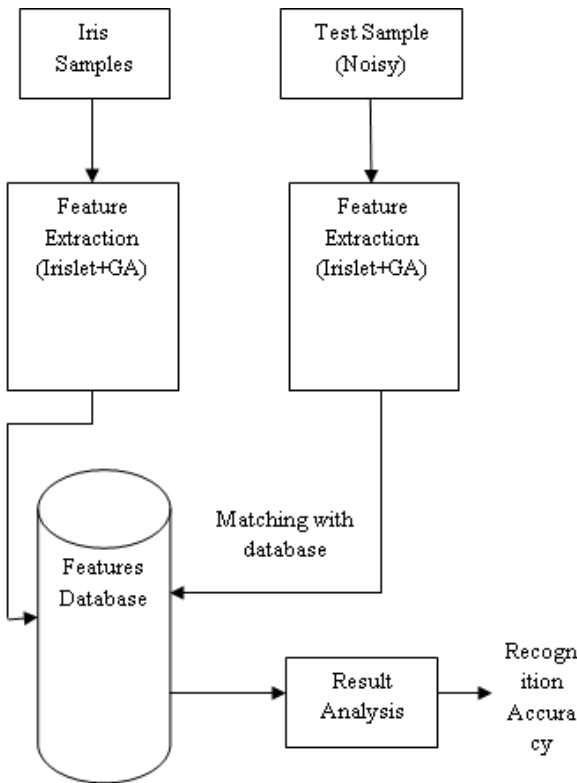

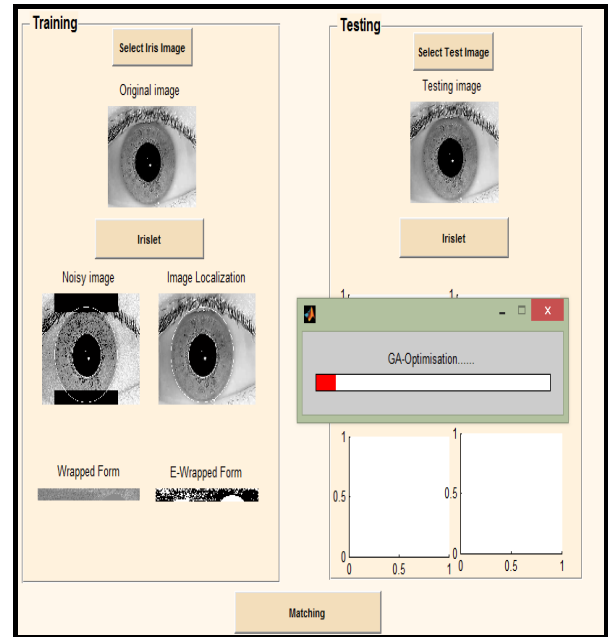**Fig 4: Basic Design of GA based Irislet**

Fig 5: GUI designed in MATLAB

3.2 Result Analysis for Noisy Samples using GA based Irislet

GA-Irislet based recognition system gives 100% accuracy for noisy samples. The analysis is as shown in table 1.

Table 2. Recognition Accuracy

Total Number of Samples	50
Matched Samples	50
Accuracy	100%

3.3 Comparative Analysis

The results of all these techniques have been compared and found that GA based Irislet works efficiently for noisy samples. It means if a person's sample while authentication affected with any kind of external noise then GA-based Irislet is able to recognize that sample/person.

Table 3. Comparative Analysis

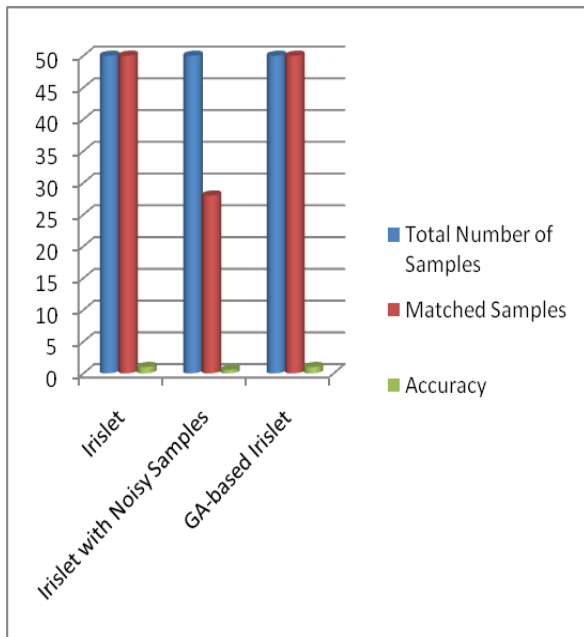|	Irislet	Irislet with Noisy Samples	GA-based Irislet
Total Number of Samples	50	50	50
Matched Samples	50	28	50
Accuracy	100%	56%	100%

Fig 6: Comparative Analysis

4. CONCLUSION AND FUTURE WORK

In this paper, different methods have been used which recognizes the iris samples. This work uses 50 samples of Iris which were collected by 25 known people where each includes 2 samples. For this Irislet and GA based Irislet is used which shows that GA based Irislet recognizes efficiently all the samples even when samples are noisy. Because irislet fails to recognize noisy samples accurately. The results show that Irislet gives 100% accuracy with original samples but 56% accuracy with noisy samples which decreases its performance. This proposed GA-based Irislet achieve 100% accuracy for noisy samples also. It means if a person's sample while authentication affected with any kind of external noise then GA-based Irislet is able to recognize that sample/person. Future works could go in the direction of using more robust modelling techniques against forgeries. Robust technique can be used 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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