# Multi-Biometric Recognition for Iris and Ear Images by using ICA, GA, Hamming Distance

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**Abstract – The integration of different biometric sources, often termed as biometric fusion. The design issue is one of the major concerned while choosing the properties of the biometrics. The fusion scheme can be classified into sensor level, feature level, score level and decision level. The choice of fusion depends on the type of information from the biometric sources namely, raw biometric samples, feature sets, match score and decision labels. In this work two behavioral biometric traits, Iris and Ear are integrated for identification using ICA feature extraction method, followed by Genetic Algorithm for the optimization of the feature dataset. The whole simulation has been taken place in MATLAB environment. This paper overall presents a dynamic scheme of combination of IRIS and EAR optimized feature and the accuracy checked by hamming distance.**

**Index Terms – Iris Recognition, Ear, Feature Extraction, ICA, GA, Hamming Distance**

## 1. INTRODUCTION

Biometrics is always developing innovation which has been generally utilized as a part of numerous official and business distinguishing proof applications. Biometrics first came to spotlight in 1879 when Alphonse Bertillon (1853–1914), a French Criminologist, presented his anthropometrical signalman or Bertillon age system for recognizing sentenced offenders.

The most utilized recognizable proof movement as a part of criminology and in like manner common applications is the particular case that has as its point individual ID. The recognizable proof of an individual that has perpetrated a wrongdoing has been set aside a few minutes by utilizing logical and otherworldly components. The requirement for dependable client confirmation systems has expanded in the wake of increased worries about security and fast headways in systems administration, correspondence and versatility. Biometrics, depicted as the investigation of re meditation individual, in view of her physiological or behavioral attributes. Biometric frameworks have now been sent in dissimilar business, regular citizen and legal applications as a method for building personality. These frameworks depend on the proof of fingerprints, hand geometry, iris, retina, face, hand vein, facial thermo gram, mark, voice, and so forth to either accept or focus a personality. Most biometric frameworks sent in certifiable applications are uni-modular.

## 2. BIOMETRIC FUSION

A biometric framework is programmed means by which physical attributes are utilized to perceive an individual, or check an individual's singularity. An arrangement of such frameworks have been actualize and utilized gainfully through the years, checking ones in view of fingerprints, irises, facial pictures, hand and storyteller acknowledgment, among others. The enthralling fruitions of biometric frameworks oblige address various issues, tallying precision, fitness, durability, materialness, and comprehensiveness. A solitary strategy for trade with a hefty portion of the issues goes up against biometric frameworks is to amass more information from every center, and breaker the information, or the results of handling that information. A biometric combination can be positive generally as the utilization of a few sorts of biometric information or strategy for giving out to enhance the show of biometric frameworks.

The speculation at the back combination is not fragmented to biometrics: Biometric based choices are a specific instance of classification in the field of arithmetical example acknowledgment, and biometric combination comparably can be watchful an uncommon instances of join numerous classifiers in example credit. Combination system is utilized as a part of such differed fields as web indexes, investigation of settlement symbolism, and investigation of medicinal test results. Biometric combination is not another thought: for a considerable length of time, a mixture of part of combination has been essential piece of the vanquishing execution of biometric frameworks, basically vast scale finger impression frameworks.

2.1 Multi-Biometric Systems

A multi-biometric framework is one in which various classes of information are created and utilized for a scope of reason, checking yet not inadequate to combination [13]:

- Selection: In which the best or the greater part valuable information is hold for utilization, while the other information is surreptitiously or superfluous. Combination is frequently in view of value measurements.
- Validation: In which an amount of the information is utilized to check the genuineness of the other information.
- Fusion: which is based on join information at an assortment of levels?

2.2 Purposes of Fusion

Fusion has been used successfully for years in large-scale automated many identification system. Today, various forms of fusion are used in a number of different types of biometric systems. Fusion can be used to address a number of issues faced by the designers, implementers, and operators of biometric systems:

•Accuracy: Fusion can be used very effectively to improve overall accuracy. Biometric system accuracy is generally stated in terms of maximizing the True Accept Rate1 (TAR) while minimizing the False Accept Rate (FAR): maximizing the ability to recognize those subjects who have already been enrolled, without incorrectly identifying them as other subjects.

• Efficiency: Fusion can be used to increase efficiency, or to allow tradeoffs between efficiency and accuracy. System efficiency can be stated in terms of throughput (processing time), computational requirements, and financial cost.

• Robustness: The inherent redundancy in a fused system increases the system's robustness. Robustness refers to the ability of a system to continue to function as accurately as possible despite problems such as poor sample (image) quality and data integrity errors.

• Applicability: Applicability relates to the appropriateness of a system for a task: the need to work with legacy data often dictates the biometric modalities that can be used. A multimodal system is more applicable to a broad variety of uses than a uni-modal system, because it can be used in conjunction with multiple sources of legacy data. For example, a multimodal fingerprint and face system can conduct both fingerprint-only background checks and face-only watchlist checks.

• Universality: Universality refers to whether all people can use a given biometric system. Some people cannot provide usable biometric samples, for reasons such as amputations, injury, or disease. Multi-modal and multi-instance systems can provide alternatives so that all people can use a system.

2.3 Advantages of MultiBiometric Systems

1. A dry finger keep her from gainfully select into a unique mark framework, then the usability of one more biometric quality, say iris, can help in the expansion of the individual in the biometric framework. A beyond any doubt level of suppleness is attained to when a client selects into the framework utilizing a few distinct practices while just a subset of this conduct is solicitation amid check in light of the regular universe of the application under consideration and the practicality of the client [15].

2. It gets to be more and harder for an impostor to farce various biometric attributes of a legitimately enlisted individual. In the event that every subsystem demonstrates the probability that a demanding quality is a 'satire', then suitable combination plan can be locked in to finish up if the client, indeed, is a fake.

3. Multi-biometric frameworks additionally effectively address the issue of loud information. At the point when the biometric sign secure from a solitary trait is contaminated with commotion, the usability of other conduct may support in the unfaltering determination of qualities.

4. A multi-biometric framework might likewise be view as a misstep tolerant framework which keeps on controlling notwithstanding when certain biometric sources get to be variable because of sensor or programming breakdown, or computed client course.

2.4 Characteristics of Biometric System

1. *Universality*: All individuals ought to have the biometric highlight.
2. *Uniqueness:* No two individuals ought to be the same in states of the biometric highlight.
3. *Changelessness:* The biometric trait ought to be invariant over the long haul.
4. *Collectability*: The biometric highlight ought to be assessable with some sense gadget [16].
5. *Acceptability:* The picky client occupants and the general population taking all things together reason ought to have no complaint to the measure and gathered of the biometric highlight.
6. *Performance*: Alludes to the level of exactness and pace of appreciation of the framework given the readied and biological variable concerned.
7. *Resistance to Circumvention*: Alludes to the level of multifaceted nature important to beat or by pass the framework.

## 3. LITERATURE SURVEY

Nazmeen Bibi Boodoo [1] proposed that this study investigates the use of ear as a biometric for authentication and shows experimental results obtained on a newly created dataset of 420 images. Images are passed to a quality module in order to reduce False Rejection Rate. The Principal Component Analysis ("eigen ear") approach was used, obtaining 90.7 % recognition rate. Improvement in recognition results is obtained when ear biometric is fused with face biometric. The fusion is done at decision level, achieving a recognition rate of 96 %.

P. D. Garje1 [2] proposed that the biometric identification systems, which use physical features to check a person's identity, ensures much greater security than password and number systems. MultiBiometric system is being increasingly deployed in much large scale application because they provide lower error rate, large population coverage compared to unibiometric. During iris recognition images are segmented, normalized and features are extract by using Log-Gabor filter. Finally matching is done with help of hamming-distance. Once both iris n fingerprint template are match separately scores are combined by using sum rule-based score level fusion which increase the recognition rate. Thus improve system accuracy and dependability

Mr. P.P.Chitte [3] proposed that it is very important for the performance evaluation of iris recognition algorithms to construct very large iris databases. However, limited by the real conditions, there are no very large common iris databases now. In this paper, an iris image synthesis method based on Principal Component Analysis (PCA), Independent component analysis (ICA) and Daugman's rubber sheet model is proposed. Iris Recognition is a rapidly expanding method of biometric authentication that uses pattern-recognition techniques on images of iris to uniquely identify an individual. Algorithms have proven to be increasingly accurate and reliable after over 200 billion comparisons. The aim of this group project is to implement a working prototype of the techniques and methods used for iris recognition.

Daniela Sánchez [5] proposed that this paper we present the application of a Modular Neural Network (MNN) for iris, ear and voice recognition for a database of 77 persons. The proposed MNN architecture with which we are working consists of three modules; iris, ear and voice. Each module is divided in other three sub modules. Each sub module contains different information, which, the first 26 individuals are considered in module 1, the following 26 individuals in module 2 and the last 25 in module

## 4. PROPOSED METHODOLOGY

The accompanying steps will demonstrate the working of proposed framework highlight are concentrate by new calculation and highlight vectors are gotten .The highlight vectors are combined utilizing a proposed method & acquire another highlight vector which can be put away in database. In the wake of putting away all information, matcher can be utilized to match the new information with existing database & gives the outcomes.

Algorithm Level Design

• Data Procurement

• Feature Extraction -Improvement

• Fusion

• Matching & are talked about in this work.

### 3.1 Data Procurement

Iris and Ear: Ear pictures are gathered from IIT Delhi Ear Database (Version1.0) and iris pictures from IIT Delhi Iris Database (Form 1.0). The proposed framework is tried with 50 subject's various specimens (more or less 2 every each).

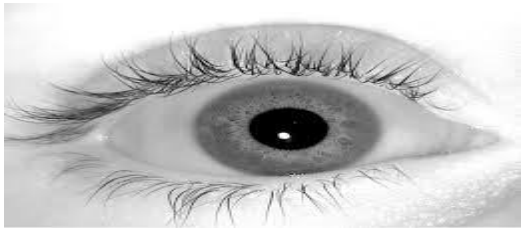

Figure 1 Iris database sample

Figure 2 Ear database

### 3.2 Feature Extraction method is same for both Ear and IRIS

The highlight extraction of both the biometric has been done through the ICA algorithm.

*Independent component analysis (ICA*) is a measurable system that speaks to a multidimensional source vector as a direct blend of non-Gaussian irregular free variables called free segments. It expects to catch the free sources keeping in mind the end goal to examine the basic haphazardness of the watched signs.

All in all terms ICA grabs the free segments of the pictures. This procedure is done in diverse cycles and every emphasis has distinctive arrangement of parts and every segment can be dealt with as highlight. Despite the fact that when the highlight extraction part is finished, we don't get every one of those segments which are obliged to the methodology in the framework additionally those parts which are not needed. Subsequently to go before the removed segment we have to upgrade the list of capabilities which could be possible either by any advancement calculation o0r by straightforward threshold method.

Figure 3 Original Image Edge of the Image

*Genetic Algorithm for optimization*

- ✓ Initialize GA parameters i.e., population size, determination, change and hybrid.
- ✓ Create fitness function.
  Where Fs= feature, Ft=total number of feature, e=characterization error rate (enhancement parameter).
- ✓ Call GA functions with the fitness function.
- ✓ If the yield is 1 then the feature is chosen else dismissed.
- ✓ Write the lessened features to excel file.

*Hamming Distance for matching*

At the point when there is no x and y coordinate over a quality and still it is obliged to discover the likenesses between both the focuses, Hamming separation is an advantage. In Mat lab 2010 Hamming (x, y) and it would give you 1 or 0. On the off chance that the worth is 0 then both the focuses are indistinguishable if not, both the qualities are diverse.

## 5. SYSTEM FRAMEWORK

Firstly the picture of iris is transferred and it will be standardized by changing over the picture from rgb (red, green, blue) to dim scale through which its measurement will be diminished and after that we apply the highlight extraction calculation i.e. Free Part examination for highlight extraction technique and we will get the highlights vector and afterward we apply hereditary calculation for the highlight streamlining and after that we will spare it in the database of MATLAB. The same methodology will be petitioned the ear database. First and foremost we transfer picture from ear database and the histogram is made for that transferred picture and afterward the edge discovery of the current transferred picture happens. After edge recognition we apply the highlight extraction methodology utilizing Free Part Examination and afterward we spare both the highlight vector in database. At that point we apply fusion level methodology and the preparation of iris and ear is finished with the aforementioned procedure. At that point we spare the melded information set in MATLAB database and we stack that database to the testing area and we will assess the execution parameters like False Acknowledgement rate, False Dismissal rate and precision.

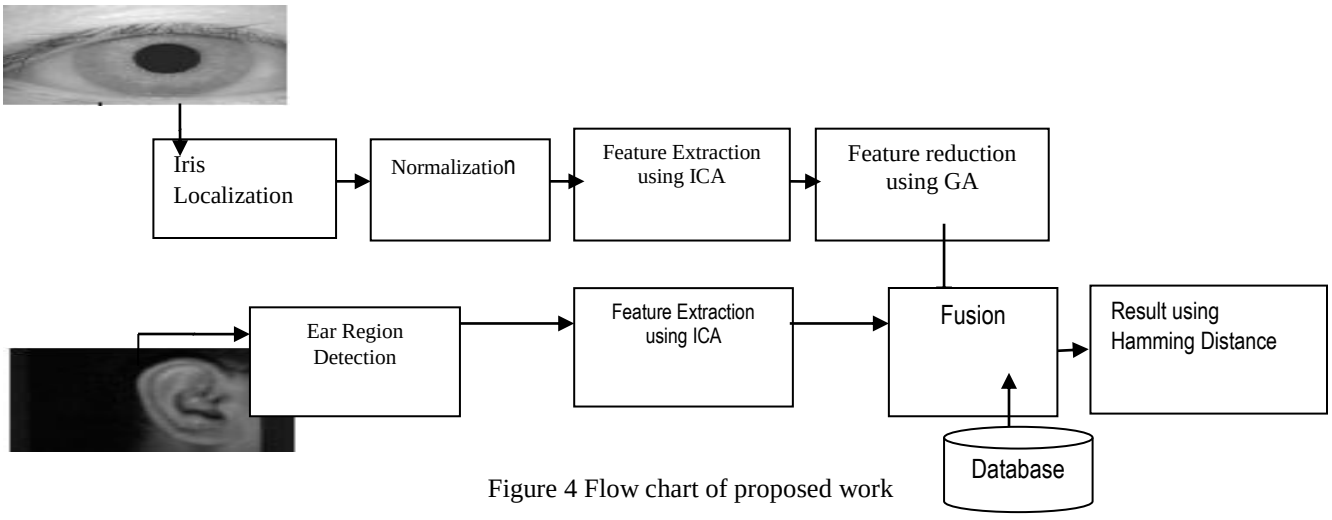


Figure 4 Flow chart of proposed work

## 6. RESULTS AND IMPLEMENTATION

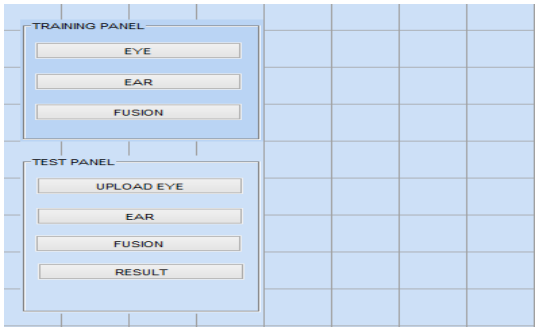


Figure 5 Training and Testing Panel

The above figures demonstrates the preparation and testing board in which acknowledgment of the combination of iris and ear happens utilizing MATLAB Graphical client interface

Figure 6 Edge Detection of IRIS

The above figure demonstrates the careful edge recognition of iris at which the picture splendor changes forcefully. We can likewise utilize other edge identification sorts like sober, pewit and so on.

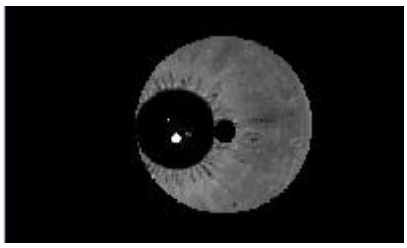

Figure 7 Segmented Image

The above figure demonstrates the last fragmented picture in the wake of applying the Hough roundabout Change HCT is system to discover the limit of the understudy i.e. internal circles and external circles of the retina.

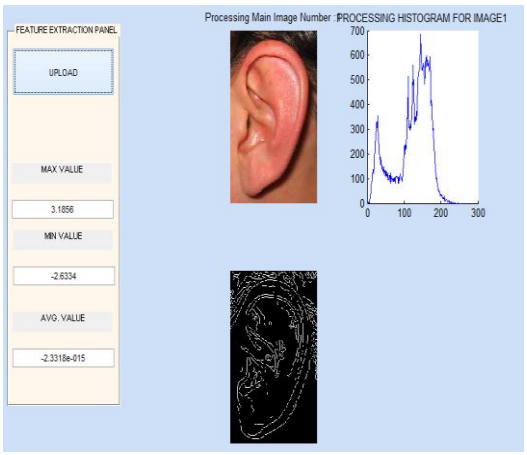


Figure 8 Ear panel Database

The above figure demonstrates the board of the ear in which we transfer the ear picture from the database and afterward the histograms is demonstrated of the current transferred picture and after that edge recognition of the picture is done and after edge discovery Autonomous part examination is petitioned highlight extraction.

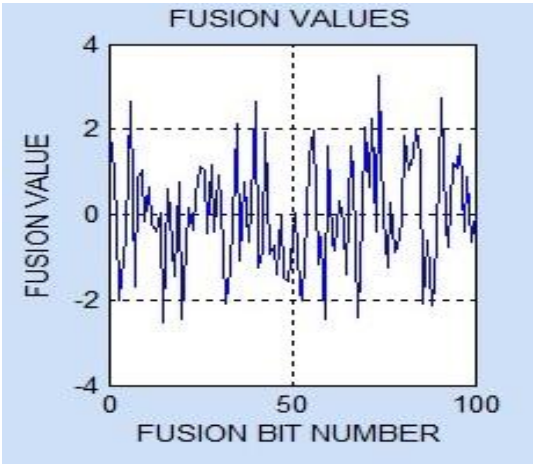


Figure 9 Fusion graph

The above figure demonstrates the combination of the iris and ear which demonstrates the chart between combination quality and combination bit number.

| **Metric** | **Fusion of Iris and Ear** |
|---|---|
| **FAR** | .0015 |
| **FRR** | .0018 |
| **Accuracy** | 99.67 |

Table1 Performance metrics for Fusion of Iris and Ear

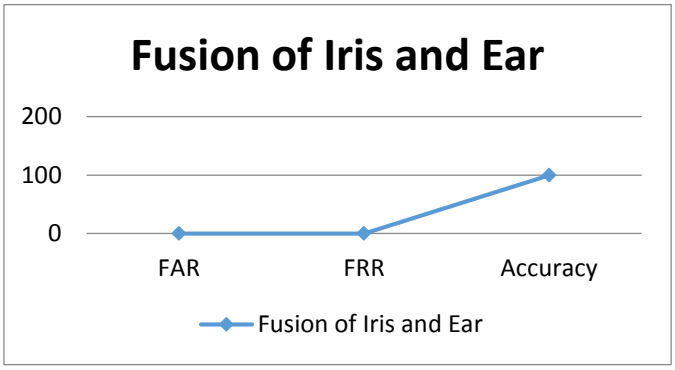


Figure 10: Graph shows the FRR, FAR and Accuracy values of our work

## 7. CONCLUSION

Multimodal biometric frameworks richly address a few of the issues show in unimodal frameworks. By consolidating various wellsprings of data, these frameworks enhance coordinating execution, build populace scope, prevent caricaturing, and encourage indexing. Different combination levels and situations are conceivable in multi-model framework. Combination at the highlight level is the most well-known because of the simplicity in getting to and uniting coordinating scores. Execution addition is proclaimed when uncorrelated qualities are utilized as a part of a multimodal framework. Consolidating client particular parameters can further enhance execution of these frameworks. In the proposed framework another system is created at highlight level for highlight extraction and combination of iris and ear expand the precision of the confirmation frameworks. In this ICA highlights are separated for iris and ICA for ear. This proposed technique diminished the FAR and in addition FRR, & has builds the framework execution on the given information set.

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