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TO IMPROVE THE SECURITY IN BIOMETRIC AUTHENTICATION BASED ON MULTI-MODEL FUSION SYSTEM

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Abstract **-Biometrics is constantly evolving invention which has been broadly utilized as a part of numerous official and business individual proof applications. The prolonged concerns in security amid late years have basically brought about additional deliberation actuality given to biometric-based validation methods. A biometric-based verification is fundamentally a sample greeting issue which settles on an individual distinguishing proof choice so as to focus the power taking into account of particular physiological or behavioural elements. Most biometric frameworks that are right now being used normally utilize a solitary biometric characteristic. Such frameworks are called uni-biometric 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 paper, a brand new multimodal biometric system is developed i.e. using iris and ear. Initially, Iris and Ear recognition systems developed by edged detection followed by extracting their features from PCA (Principal Component Analysis) technique has been used.**

Keywords: **Biometric Authentication, Iris recognition, Ear recognition and Feature Extraction using PCA.**

I. INTRODUCTION

Biometrics is the science and technology used for measuring, analysing the biological data. In information technology, biometrics frequently mentions for measuring and analysing human body characteristics such as fingerprints, eye retinas and irises, voice decorations [1], facial patterns, and hand measurements, especially for authentication purposes. Biometric is used for extracting a feature set from the acquired data, and comparing this set in contradiction of to the pattern 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 unique, universal, and permanent over time that is easy to measure also cheap in costs, and have high user acceptance. No single biometric can fulfils all these requirements simultaneously.

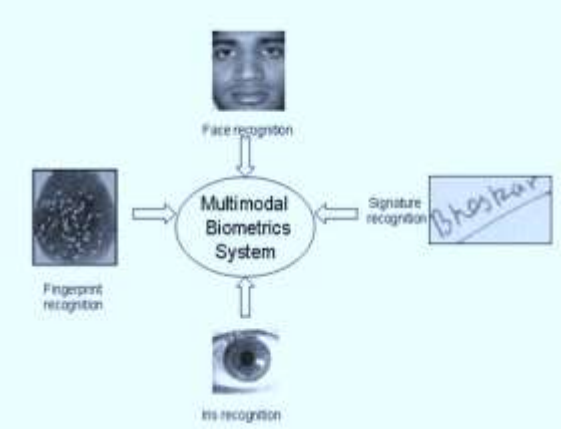

Fig 1: Biometric Authentication Trails

For instance, fingerprints and retina are known to be highly [2] unique, but they require dedicated sensors and are not user friendly. On the other hand, voice and facemask geometry are not as single, 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. Defining the identification of human being that is criminal is very difficult. Biometric system has now been used in the various commercial and

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forensic applications. These biometrics highly based on the fingerprints, speech, ear, gestures, hand geometry, iris, retina, face, hand vein etc. Earlier most of the biometric systems are uni-model[3].

1. Biometric System

Generally, any typical authentication biometric system comprises of the following units:

- Data acquisition unit: consist of acquiring the biometric signal with a special sensor and then converting the signal to a digital form.
- Feature extraction unit: extraction of features is done using various classifiers like SVM, Neural network, HMM and feature extraction methods like GA, PCA, and ICA etc.
- Matching unit: matching of testing and training samples is done using various distances like hamming, Euclidean distances.
- Decision making unit: this final step issues a binary decision whether to accept or reject the claimed identity [4].

2. Multi-Model Biometric System

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 made using various algorithms to enhance 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 [5].

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 [6]:

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.

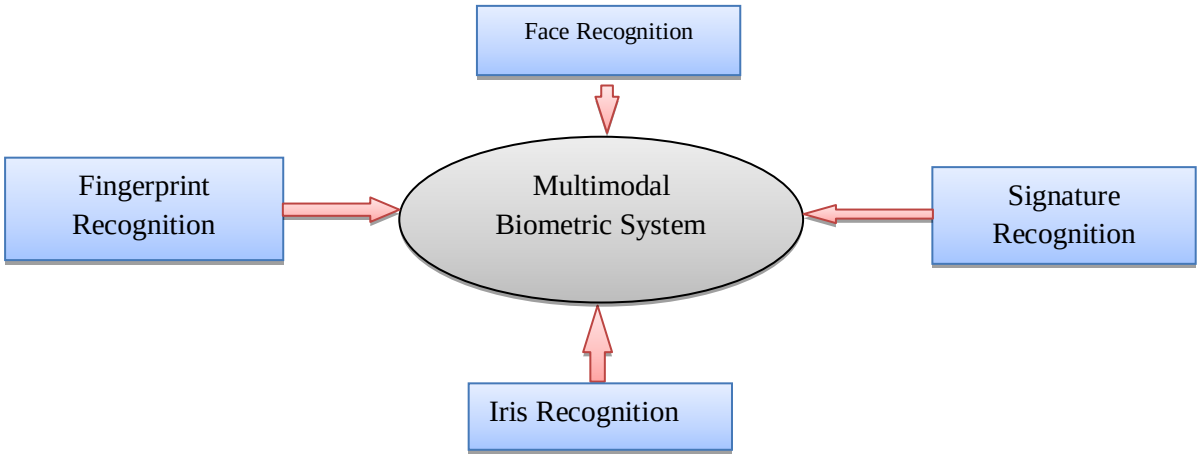

Fig 2: Recognition system [7]

The synthesis of biometric traits leads to the development of the performances by reducing the negative results. E.g. fusion of iris and ear is more actual in agreement to the use of only iris or ear modalities. Main benefits of using multimodal systems are reduction in cost and complexity. This is due to the following characteristics:

- 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.

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There are number of ways of fusion as mentioned below:[8]

3. Levels of Fusion:

Categorized into 2 types

1) Fusion prior to matching
2) Fusion after matching

II. RELATED WORK

Kumar et. al. (2012)[9]explored a fresh method for the programmed human identification utilizing 2D ear imaging. Here, they demonstrated an entirely automatic method meant for the robust subdivision of the rounded area of interest utilizing morphological workers as well as Fourier descriptors. They also investigated a dissimilar feature abstraction methodology planned for ear identification utilizing localized orientation data as well as also examine local gray-level stage data utilizing assorted Gabor filters. Their research work created a computationally smart as well as effective extra to demonstrate the spontaneously segmented ear images utilizing a couple of log-Gabor filters. The investigational outcomes reached typical rank-one recognition accuracy of 96.27% and 95.93%, respectively, on the publicly available database of 221 as well as 125 subjects. Their experimental outcomes commenced the certification experiments and false confident identification verses false negative identification also suggested the advantage of the planned method over the other popular feature extraction method considered in this work.

Anikaet. al. (2012) [11] have explained the ordered and 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.

Ashraf Aboshoshaet. al. (2015) [16] 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 system 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 unimodal biometric systems and best results are given by weighted sum rule as compared to sum/product method.

D. Garje1 et. al. (2012) [12] presented that the biometric ID systems that utilized physical characteristics 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 request because they deliver lower 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.

III. MOTIVATION AND DESIGN ISSUES

There are various reasons that lead to the development of the multimodal authentication approaches. These are discussed below:[10]

1. Biometric features values are different at every time.
2. Quality of traits can be changed over time.

There are several limitations that are overcome by the multimodal biometric systems. But the multimodal biometric systems are more expensive than the uni-modal biometric systems. This is the only disadvantage that relies heavy on the multimodal systems. Also if proper fusion does not take place of multiple traits then, it can also leads to worse biometric system.[11]

A. Design Issues

There are lots of issues that arise in designing of the multimodal biometric systems.

1. Number of traits.
2. Choice of fusion of traits.
3. Level of integration of multiple traits.
4. Processing time of biometric system.

5. Cost reduction.
6. Matching performance trade-off.[13]
7. No. of overheads.

IV. PREVIOUS TECHNIQUES

A. Principle Component Analysis for Feature Extraction

Principal component analysis is a classic method used for compress higher dimensional data sets to lower dimensional ones for data analysis, apparition, feature extraction, or data compression. PCA involves the calculation of the Eigen value rottenness of a data covariance medium or singular value decay of a data matrix, usually after mean centring the data for each attribute [14].

Step 1: Get normalizes data from the iris regions. 2-D iris image is represent as 1-D Vector by concatenating each row (or Column) into a long vector

Step 2: Take away the mean image from each image vector. Mean should be row wise.

Step 3: For calculating the eigen vectors and eigen values, Compute the covariance matrix.

Step 4: Analyse the eigenvectors and Eigen values of the covariance matrix.

Step 5: The eigenvectors are sorted from high to low according to their corresponding Eigen values. Choose components and forming a feature vector.

Step 6: Derive the new data set once we have chosen the machineries, we simply take the transpose of the path and increase it on the left of the original data set, transposed. [15]

B. Edge Detection

It is technique of finding and locating the discontinuities in the image. The discontinuities or gaps are the changes in the pixel intensity values in an image [23]. Earlier there are many methods like 2-D Filter, in which gradients are constructed to get the edges of an image. Operators can be optimized to get vertical, diagonal and horizontal edges. Mainly operators are used for noise removal application. Various numbers of variables are used for edge detection like Edge orientation, Noise environment and Edge structure. Edges characterize boundaries and are therefore aunruly of important standing in image processing. Edges in images are areas with strong intensity contrasts – a jump in concentration from one pixel to the succeeding. Edge detecting an image significantly reduces the amount of data and filters out useless information, while protective the imperative structural properties in an image. The Canny edge detection algorithm is known to many as the optimal edge detector.[16]

V. CONCLUSION

This paper has analysed verification system based on iris and ear. 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 PCA only. 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 GA optimization Algorithm is more powerful for the problems with several amounts of variables given.

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