International Journal of Engineering Applied Sciences and Technology, 2016
Vol. 1, Issue 10, ISSN No. 2455-2143, Pages 89-94
Published Online August - September 2016 in IJEAST (http://www.ijeast.com)

THE SURVEY OF MULTI-MODEL BIOMETRIC AUTHENTICATION SYSTEM DESIGN BASED ON HAAR WAVELETS AND SUPPORT VECTOR MACHINE

Sheenam Kochar
Computer Science & Engineering
SVIET, Banur, Punjab, India

Er.Amarinder Kaur
Computer Science & Engineering
SVIET, Banur, Punjab, India

Abstract— **Biometrics is the science and technology used for measuring, analyzing the biological data. In information technology, biometrics usually refers for measuring and analyzing human body characteristics such as fingerprints, eye retinas and irises, voice patterns, facial designs, and hand measurements, expressly for authentication purposes. Biometric is used for extracting a feature set from the acquired information, and comparing this set alongside to the template set in the database. The fusion of biometric traits leads to the development of the performances by decreasing the bad results. E.g. fusion of iris and ear is extra effective in accordance to the use of only iris or ear modalities. Main benefits of using multimodal systems are reduction in cost and complexity.**

Keywords—**Biometric system, Fusion process, Iris Recognition, Ear Recognition, Existing Filters**

I. INTRODUCTION

Biometric system has now been used in the various commercial and 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 [1].

Fig. 1. Different types of biometric trait

Biometric system has now been used in the various commercial and 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 [1].

The uni-modal biometric systems are not much reliable due to following reasons. They basically work son single biometric trait. So these have following limitations:

- Non-universality: Because of weak fingerprint impressions, few people like 6-7% are not able to get their fingerprints matched.
- Noisy sensor data: Due to various environmental conditions like humidity, pressure, dust etc. Sometimes noisy signals are captured only.
- Lack of individuality: Due to genetic factors few persons like son and father can have similar features. So they cannot easily distinguish if only one biometrics has been used.
- Lack of representation: The data collected for verification/ testing must not match the data for training.
- Susceptibility: As it is not easy to steal someone's characteristics but sometimes spoofed characteristics like signature and voice can be used to match such criminal attacks.
- Recognition performance is restricted up to certain limits.
- High error rates for unmoral biometric systems.
- Lack of variability in time of the biometric characteristics.
- Cloning of biometric characteristics [2].

Biometric Systems

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

International Journal of Engineering Applied Sciences and Technology, 2016
Vol. 1, Issue 10, ISSN No. 2455-2143, Pages 89-94
Published Online August - September 2016 in IJEAST (http://www.ijeast.com)

- 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

Multi-Modal 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.

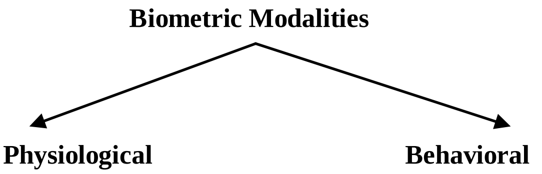

Table 1. Different Types of Biosmetric Modalities

Fingerprint	Signature
Veins	Voice
Hand	Gait
Eye	Keystroke

Biometric features are classified into two parts like physiological (face, iris, hand, veins etc) and behavioral (speech, writing style, signature, gait etc). If fusion of physiological and behavioral features is done then performance rate can be enhanced. They can be used as biometric verifier if they can satisfies the following requirement:

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

II. FUSION PROCESS

The different modalities used in a fusion process needs to be understood. So mean to find the optimum feature sets necessary for fusion. If the most apposite subset is unavailable, can one use alternative streams short of much loss of cost-effectiveness & confidence. Fusion of multimodal biometric systems is very difficult. Fusion must takes place in timely manner.

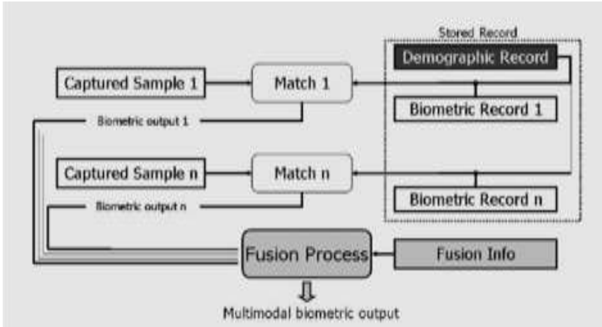

Fig. 2. Fusion Process

The timely completion of tasks makes it much easier for fusion. Due to non-synchronous the level of difficulty in fusion increases. There are numerous ways of fusion of modalities. It can be done using feature level, decision level etc.The fusion of biometric traits leads to the development of the performances by decreasing the negative results. E.g. fusion of iris & ear is extra effective in accordance to the use of only iris or ear modalities. Main benefits of using multimodal systems are reduction in cost and complexity [3].

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.

There are number of ways of fusion as mentioned but we are discuses iris and ear fusion.

A. Iris Recognition

The iris is a meagre round anatomical structure in the eye. The iris' capacity is to control the breadth and size of the students and consequently it controls the measure of light that advances to the retina. A front perspective of the iris is demonstrated in Figure 1 To control the measure of light entering the eye, the muscles connected with the iris (sphincter and dilator) either extend or contract the inside opening of the iris known as the student.

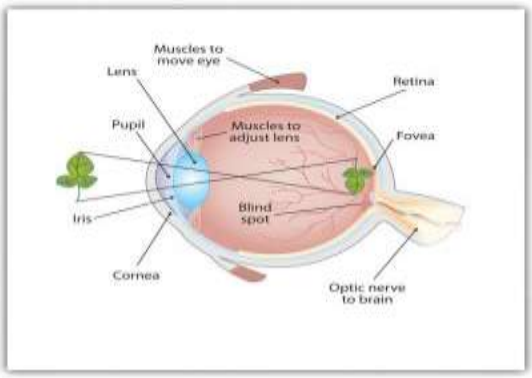

Fig. 3. Iris recognition

The iris comprises of two layers: the pigmented front fibro vascular called as stoma and underneath it are the pigmented epithelial cells. The stoma is associated with the sphincter muscle which is in charge of the [4] withdrawal of the student furthermore to the arrangement of dilator muscles, in charge of the extension of the understudy which it does by heaving the iris centrifugally. The iris is isolated into two fundamental locales: the pupillary zone, whose edges shape the limit of the understudy and the colliery zone which constitutes whatever is left of the iris. The iris is an all-around ensured organ that is remotely unmistakable and whose epigenetic examples are exceptionally exceptional and stay stable all through a large portion of an individual's life. Its high uniqueness and soundness makes it a decent biometrics that can be utilized for recognizing people. These special examples can be removed utilizing picture preparing strategies utilized on a digitized picture of the eye and after that the outcomes can be encoded into a biometric format which can later be put away in a database for future examinations. The biometric layout is normally made utilizing numerical operations. On the off chance that an individual needs to be recognized by the framework, then first a digitized picture of their eye is initially created, and afterward a biometric layout is made for their iris district. This biometric layout is contrasted and the various prior formats in the database utilizing certain coordinating calculations as a part of request to get the distinguishing proof of the person.

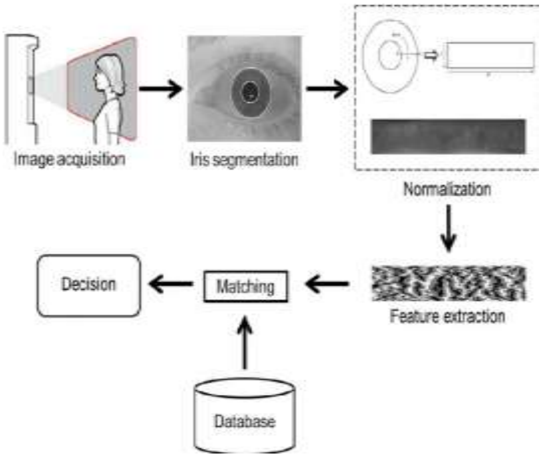

Fig. 4. Process of iris segmentation

It is the methodology of getting top quality iris pictures either from iris scanner or pre-collected pictures. These pictures ought to obviously demonstrate the whole eye particularly iris and student part.

B. Ear Recognition

The human ear is personal authentication despite its significant role in forensic science. The ear is quite attractive biometric candidate mostly due to its

I. rich & stable structure that is preserved since birth and is quite unique in individuals,
II. being invariable to the variations in pose & facial expression, and
III. Relatively immune from anxiety, privacy, & hygiene problems with several new biometric candidates. Therefore automated personal identification using ear images has been gradually studied for probable commercial applications.

The accuracy of automated ear identification approach is highly partial by the nature of extracted features & the employed matching process. In this work, we investigated 3 new feature extraction & matching approaches for the identification of automatically segmented ear images [6].

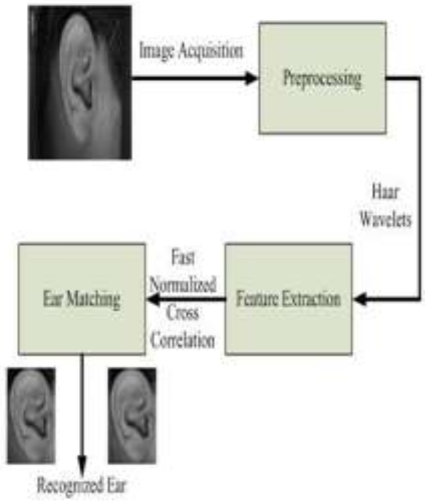

Fig. 5. Ear Recognized

III. RELATED WORK

K, Mahesh, Patil1, Prof. Dr.(Mrs.) L.S. Admuthe2,2014work 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 [6].

Kumar A, Wu Chenye et al., 2012work the biometric ID structures that utilized physical features to acknowledge an individual's identity, ensures much greater security than number systems as well as passwords. Multi-modal biometric structure is being progressively deployed in much large scale application for they provide lesser error rate, large population coverage compared to uni-biometric. Multi-biometric identification system aim to fused iris n fingerprint traits. During enrolment stage system generate iris n fingerprint template separately n deposited in database. Methodology intended for fingerprint acknowledgement be there to excerpt minutiae from fingerprint pictures. It made conceivable to accomplish extremely high robust finger-print recognition for low-quality fingerprints. In the course of iris recognition, pictures are normalized, features as well as segmented are taken out by utilizing Log-Gabor filter. As a final point, matching was completed utilizing assistance of hamming-distance. As soon as both of the iris n fingerprint template were matched separately scores were combined by using sum rule-based score level fusion which increase the rate of recognition. As a result, this will enhance system accurateness as well as reliability [7].

Mishra, A et al,2010 work the explained to think about component extraction calculation taking into account PCA, Log Gabor Wavelet and Gabor Wavelet. They utilized these techniques to produced highlight vectors that could speak to iris effectively. Conclusions taking into account examinations could give helpful data to further research. Execution of these calculations was examined utilizing CASIA database [8].

IV. RPREVIOUS PROBLEMS

From the survey we have found the problem or future work in which we are going to continue our work of Fusion in Multimodal Biometric using Iris & Fingerprint.

Research Gap/Problem:

Multimodal biometrics is the combination of two or more modalities such as iris and ear modalities. In this proposed work a face recognition system and iris [2] verification system are combined as these modalities are widely accepted and natural to produce. Although this grouping of multi-modal improves security & accuracy, yet the complexity of the system increases due to increased number of features removed out of the multiple samples and suffers from additional cost in terms of acquisition time. So these days the key problem is at what degree features are to be extracted and how the cost factor can be minimized, as the quantity of features upsurges the variability of the intra-personal samples due to greater lag times in between consecutive acquirements of the illustration also increases. Increase in variability of the system will further increase FAR. Thus to determination these issues an effective fusion level and fusion mode is required [2].The proposed work tires to present a novel user authentication system based on a combined acquisition of face and Iris with high accuracy rate, false acceptance rate and false rejection rate.

V. EXISTING FILTERS

A. *Haar wavelet*

A Haar wavelet is the simplest type of wavelet [10]. In discrete form, Haar wavelets are related to a mathematical operation called the Haar transform. The Haar transform assists as a prototype for completely other wavelet transforms. Like all wavelet transforms, the Haar transform decomposes a discrete 1 into 2sub signals of half its length. One sub signal is a running average or trend; the new sub-signal is a running change or fluctuation. The Haar wavelet transform has a number of advantages [10]:

- It is conceptually easy.
- It is fast.
- It is recollection efficient, since it can be calculated in place without a short-term Array.
- It is exactly reversible lacking the edge effects that are a problem with other Wavelet transforms. The Haar transform similarly has limits [11], which can be a problem with for some applications. In generating each of averages for the following level and every set of coefficients, the Haar transform performs an average and difference on a pair of values. Then the procedure shifts over by 2 values

and calculates another average and difference on the next pair. The great frequency coefficient range should reflect all high frequency changes. The Haar window is only 2 elements wide. If a big modification takes place from an even value to an odd value, the change will not be reflected in the high frequency coefficients.

if we try to use the Haar wavelet for threshold compression of audio signal, we get reduced results. So Haar wavelet transmutes is not valuable in compression and noise removal of audio signal processing. Haar 2-tap wavelet can be castoff to make the Haar wavelet transforms. The filters coefficients corresponding to this wavelet type are shown in below table

Table 2- HAAR 2-TAP WAVELET COEFFICIENTS [9]

H0	H1	G0	G1
0.5	1	1	0.5
0.5	-1	1	-0.5

B. *Daubechies wavelet transform*

The Daubechies wavelet transforms are defined in the same way as the Haar wavelet transform by computing the running means& differences via scalar products with scaling signals and wavelets the only difference between them contains in how these scaling signals & wavelets are defined[10]. The Daubechies wavelet is more complicated than the Haar wavelet. Daubechies wavelets are nonstop; thus, they are more computationally expensive to use than the Haar wavelet. This wavelet kind has stable frequency responses but non-linear phase responses. Daubechies wavelets use overlying windows, so the high frequency constant spectrum reflects all high frequency changes.

TABLE 3 DAUBECHIES 4-TAP WAVELET COEFFICIENTS [9]

H0	H1	G0	G1
0.4830	0.1294	-0.1294	0.4830
0.8365	0.2241	0.2241	-0.8365
0.2241	-0.8365	0.8365	0.2241
-0.1294	0.4830	0.4830	0.1294

C. *Gabor filter*

The Gabor filter based phase encoding of localized gray level data has shown to offer outstanding results for texture segmentation, fingerprint identification& iris recognition [13]. Therefore the Gabor filter reply from the even and the odd Gabor filters were also employed in this work to determine the presentation. The Gabor filtered output is demodulated to extract the phase information which is quantized to 4 levels for every possible quadrant in complex plane using the convolution response from the normalized ear picture. The encoding of the phase data from the complex Gabor filters H(y,F,s) into the feature map F(x, y) is achieved as follows:

$$F(x,y)r = 10 \text{ if } Re\{H(\theta f, \sigma)E(x,y)\} \geq 0$$
$$F(x,y)r = 10 \text{ if } Re\{H(\theta f, \sigma)E(x,y)\} < 0 \quad (1)$$
$$F(x,y)i = 10 \text{ if } Im\{H(\theta f, \sigma)E(x,y)\} \geq 0$$
$$F(x,y)i = 10 \text{ if } Im\{H(\theta f, \sigma)E(x,y)\} < 0$$

Each of the normalized ear images is used to generate binarized feature map using Eq. (1). The normalized Hamming distance between the query and the template feature map is computed in a manner. In order to account for the further possible translation in the normalized ear images, bitwise shifting of ear patterns, five pixels left & five pixels right, is employed to generate the best possible matching distance.

VI. EXISTING FILTERS

This paper has proposed 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. The Haar transform assists as a prototype for completely other wavelet transforms. Like all wavelet transforms, the Haar transform decomposes a discrete 1 into 2 sub signals of half its length. The Gabor filter based phase encoding of localized grey level data has shown to offer outstanding results for texture segmentation, fingerprint identification & iris recognition.

VII. REFERENCES

[1] Aboshosha, A, Kamal A. El Dahshan, Eman A. Karam, “Score Level Fusion for Fingerprint, Iris and Face Biometrics”, International Journal of Computer Applications, Vol 111 – No 4, 2015.

[2] Jain, Anil, KarthikNandakumar, and Arun Ross. "Score normalization in multimodal biometric systems." Pattern recognition 38.12 (2005): 2270-2285.

[3] Sumner, Roy L. "Data fusion process for an in-vehicle traffic congestion information system." U.S. Patent No. 5,173,691. 22 Dec. 1992.

[4] M. Ramya, A. Muthukumar and S. Kannan, “Multibiometric based authentication using feature level fusion”.IEEE-International Conference on Advances in Engineering, Science and Management (ICAESM -2012) March 30, 31, 2012.

[5] Young, Andrew W., and Hadyn D. Ellis. "An experimental investigation of developmental differences in ability to recognise faces presented to the left and right cerebral hemispheres." Neuropsychologia 14.4 (1976): 495-498.

[6] K, Mahesh, Patil1, Prof. Dr.(Mrs.) L.S. Admuthe2 , Prashant P. Zirmite3, "Isolated Digit Recognition Using in Ear Microphone Data Using MFCC,VQ and HMM," in International Journal of Engineering Trends and Technology (IJETT) – Volume 12 Number 7 - Jun 2014.

[7] Kumar A, Wu Chenye, "Automated human identification using ear imaging. Pattern Recognition", vol. 45, pp. 956–968.2012

[8] Mishra, A, "Multimodal Biometrics it is: Need for Future Systems", International Journal of Computer Applications (0975 – 8887), Volume 3 – No.4, June 2010.

[9] Nick, K. and Julian, M. 1997. Wavelet Transform in Image Processing. Signal Processing and Prediction I, Eurasip, ICT press, 23-34.s

[10] James S. Walker. 1999. A Primer on Wavelets and Scientific Applications.

[11] Applying the Haar Wavelet Transform to Time Series Information