International Journal on Recent and Innovation Trends in Computing and Communication ISSN: 2321-8169
Volume: 3 Issue: 7 4719 - 4723

Feature Level Fusion of Iris and Fingerprint Biometrics for personal identification using Artificial Neural Network

Er. Prabhjot Kaur Saini, Dr. Rakesh Chandra Gangwar, Er. Inderjit Singh

Dept. of Computer Science and Engineering, Beant College of Engg & Technology Gurdaspur

***Abstract*—** This research presents the multi –modal biometric system for iris and fingerprint This paper presents the Feature level fusion using wavelet for combining two unimodal biometric system. Gabor transform is used for feature extraction and wavelet transformation for fusion of iris and fingerprint. The system applied artificial neural network technique for recognizing whether the user is genuine (accepted) or impostor (rejected). The proposed system is for multimodal database comprising of 20 samples. The performance of the system is tested on a database prepared to find accuracy, false acceptance rate and false rejection rate.

***Keywords*—** *Biometric, Unimodal, Multimodal, Security, Spoofing Attack, Wavelet, Gabor,False Rejection Rate,Falese Acceptance Rate .*

*****

I. INTRODUCTION

The biometric system is basically divided into two modes i.e., unimodal biometric system and multimodal biometric system. In case of unimodal biometric system the individual trait is used for recognition or identification. The system performs better under certain assumptions but fails when the biometric data available is noisy. The system also fails in case of unavailability of biometric template. Thus in such a situation multimodal biometric systems are used where more than one classifier is used to arrive at a final decision. The multimodal system could be, for instance, a combination of fingerprint verification, face recognition, voice verification and keystroke dynamics or any other combination of biometrics. This enhanced structure takes advantage of the proficiency of each individual biometric and can be used to overcome some of the limitations of a single biometric. A multimodal system can combine any number of independent biometrics and overcome some of the limitations presented by using just one biometric as the verification tool. This is important if the quality scores from individual systems are not very high. A multimodal system, which combines the conclusions made by a number of unrelated biometrics indicators, can overcome many of these limitations. Also it is more difficult to forge multiple biometric characteristics than to forge a single biometric characteristics.

This paper proposes an efficient multimodal biometric identification method which involving two biometric traits namely fingerprint and iris. Combining the fingerprint and iris enhances the sturdiness of the individual authentication. Multimodal biometric system is developed through combination of fingerprint and iris recognition.

2. CHOICE OF MODALITY

A number of biometric characteristics exist and are in use in various applications (see Fig. 1). Each biometric has its strengths and weaknesses, and the choice depends on the application. In this work an iris verification system and fingerprint verification system are combined as these modalities are widely accepted and natural to produce. Although this combination of multimodal enhances security and accuracy, yet the complexity of the system increases due to increased number of features extracted out of the multiple samples . So these days the key issue is at what degree features are to be extracted and how the cost factor can be minimized, as the number of features increases the variability of the intra-personal samples due to greater lag times in between consecutive acquisitions of the sample also increases. Increase in variability of the system will further increase FAR. Thus to resolve these issues an effective feature fusion level is required.

Biometric identifier	Universality	Distinctiveness	Permanence	Collectability	Performance	Acceptability	Circumvention
DNA	H	H	H	L	H	L	L
Ear	M	M	H	M	M	H	M
Face	H	L	M	H	L	H	H
Facial thermogram	H	H	L	H	M	H	L
Fingerprint	M	H	H	M	H	M	M
Gait	M	L	L	H	L	H	M
Hand geometry	M	M	M	H	M	M	M
Hand vein	M	M	M	M	M	M	L
Iris	H	H	H	M	H	L	L
Keystroke	L	L	L	M	L	M	M
Odor	H	H	H	L	L	M	L
Palmprint	M	H	H	M	H	M	M
Retina	H	H	M	L	H	L	L
Signature	L	L	L	H	L	H	H
Voice	M	L	L	M	L	H	H

Fig 1 Choice of Modality

2.1 Level of Fusion

Multi biometric system can be integrated in several different levels as described below .

- Sensor level
- Feature level
- Match score level
- Rank level
- Decision level

 ISSN: 2321-8169
4719 - 4723

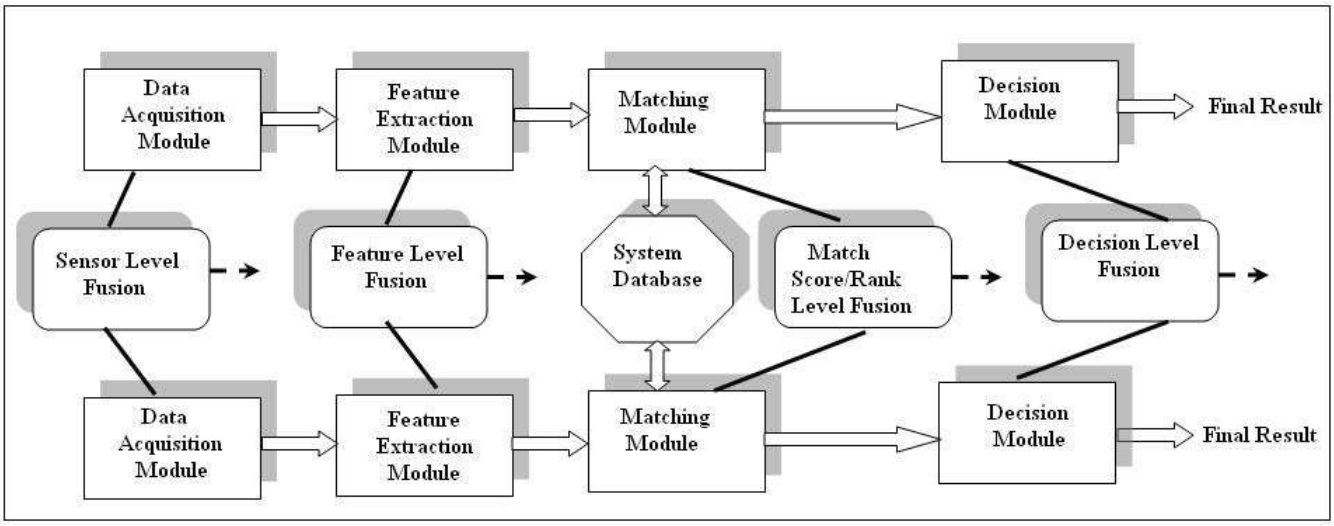


Fig 2 Level of fusion

Fusion at the match score, rank and decision levels have been extensively studied in the literature. Fusion at the feature level, however, is a relatively understudied. Fusion at this level involves the integration of feature sets corresponding to multiple information sources. Since the feature set contains richer information about the raw biometric data than the match score or the final decision, integration at this level is expected to provide better authentication results. This proposed work presents a novel user authentication system based on a combined acquisition of iris and fingerprints. Feature level fusion is used as it is better and gives the optimal identification results. But there are some difficulties if the feature sets originate from multiple biometric traits.

3. DESIGN & IMPLEMENTATION

This work focuses to implement the Multimodal Biometric System that provides accuracy at limited cost . Each biometric system must perform four basic tasks i.e. acquisition, feature extraction, matching and decision making. Among these the major consideration is on feature extraction. As the number of features increases, the intrapersonal model variability issue arises, which is detrimental to system performance and chances of forgery will also increase.

This paper mainly discusses the fusion of iris and fingerprint biometric.

3.1 Proposed methodology, algorithm and block diagram

3.1.1 Methodology**:-** The Methodology of Wavelet Fusion includes Gabor filter and training for recognition by using Artificial neural Network. it we can get accuracy as false acceptance ratio and false rejection ratio. Below is the stepwise procedure of wavelet fusion using Gabor filter and training for recognition by using Cascading Artificial neural Network.

- first we are loading fingerprint data sets as input.
- Similarly, along with fingerprint; iris are also loaded as input.
- After this we need to create a dummy Gabor filter for fingerprint data set.
- Similarly, we need to create a dummy Gabor filter for iris too.
- Now, after creating dummy Gabor filters for both fingerprints and iris we need to calculate them as fingerprint image to Gabor filter.
- Exactly same as fingerprint we need to calculate iris to Gabor filter.
- Now we need to get array of Gabor feature (fingerprint) extracted.
- Same as fingerprint we need to get array of Gabor feature (iris) extracted.
- Now, both the extracted features of fingerprint and iris are applied to wavelet fusion.
- After this we have to create Neural Network.
- After creating Neural Network we need to train them accordingly.
- Now evaluate the parameters.
- Besides all the above procedure testing sample is created.
- Features are extracted from the testing sample.
- Now the extracted features of this testing sample are applied for fusion wavelet
- Therefore, Now Evaluate the parameters of testing sample along with the parameters of trained neural network parameters.

- At last we can get accuracy as false acceptance ratio and false rejection ratio.

Our methodology focuses on the feature level fusion. the proposed multimodal biometric system overcome the limitations of individual biometric system and also meets the accuracy requirements .

3.1.2 Algorithm for proposed work**:**

STEP 1: Input the Sample of fingerprints and sample of iris

STEP 2: Extract the Gabor Feature of iris and fingerprints.

STEP 3: Apply Wavelet Fusion on Extracted Feature.

STEP 4: Apply neural Network's Cascaded feed forward Back propagation Algorithm to Train Neurons for recognition .

STEP 5: Evaluate the parameters of testing sample along with the parameters of trained neural network parameters.

STEP 6: Display the results obtained

3.1.3 Proposed Multimodal Biometric Recognition Block Diagram:

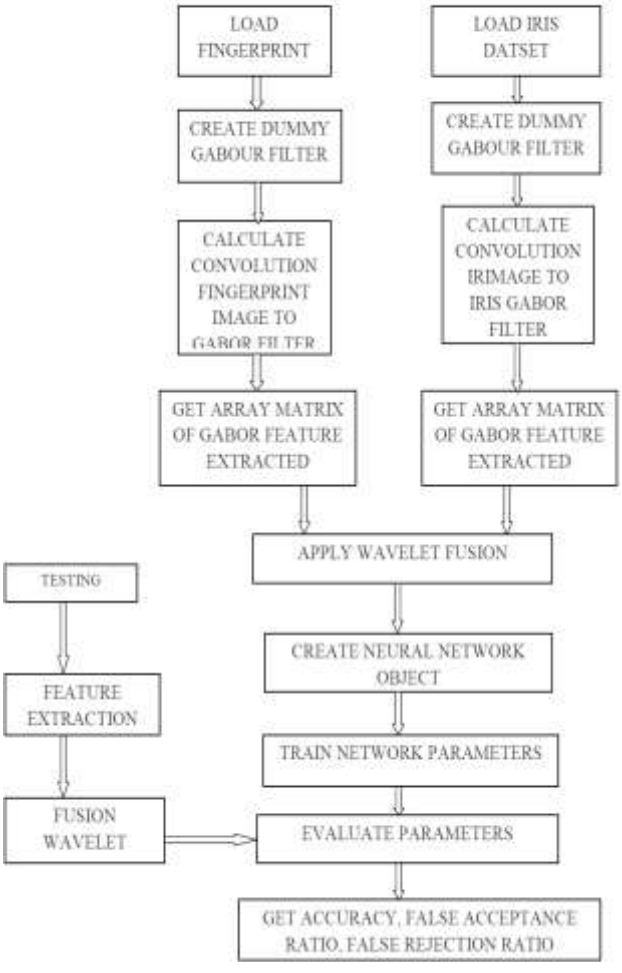


Fig 3 Multimodal Biometric Recognition system

4. Gabor filter

Dennis Gabor proposed the famous "Window" Fourier Transform (also known as short-time Fourier transform, STFT) in the paper "Theory of Communication" in1946 , which was later called Gabor transforms. Gabor transformation use to extract the feature from images. there are following Equation use for extract the gabor feature.

1) xprime = (x-((m+1)/2))*cos(tetav)+(y-((n+1)/2))*sin(tetav)

2) yprime = -(x-((m+1)/2))*sin(tetav)+(y-((n+1)/2))*cos(tetav);

3) gFilter(x,y)=(fu^2/(pi*gama*eta))*exp(((alpha^2)*(xprime^2)+(beta^2)*(yprime^2)))*exp(1i*2*pi*fu*xprime);

5. Wavelet Fusion

To fuse two images using wavelet fusion the two images should be of same size and is should be associated with same colour. decomposition of fingerprint and signature image and the respective fused image of signature and fingerprint..

6. Neural Network

Train ANN for the purpose of recognition using Cascaded feed forward Back propagation Algorithm .

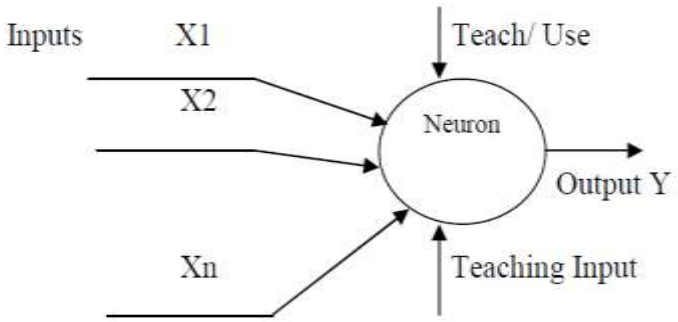


Figure 4 Simple ANN

Back Propagation Algorithm

It is a supervised learning method, and is an abstraction of the delta rule. It depends upon a dataset of the required output for various inputs, making up the training set. It is most advantageous for feed-forward networks (networks that have no response, or simply, that have no connections that loop). The phrase is an abbreviation for "backward propagation of errors". Back propagation desires that the activation

 ISSN: 2321-8169
4719 - 4723

function applied by the artificial neurons (or "nodes") be differentiable.

Phase 1: Propagation Every propagation requires the following steps:

- Forward propagation of a training pattern's input over the neural network in order to produce the propagation's output activations.
- Backward propagation of the propagation's output activations over the neural network applying the training pattern's target in order to produce the deltas of entire output and hidden neurons.

Phase 2: Weight update For each weight-synapse follow the following steps:

- Multiply its output delta and input activation to obtain the gradient of the weight.
- Bring the weight in the opposite direction of the gradient by deducting a ratio of it from the weight.

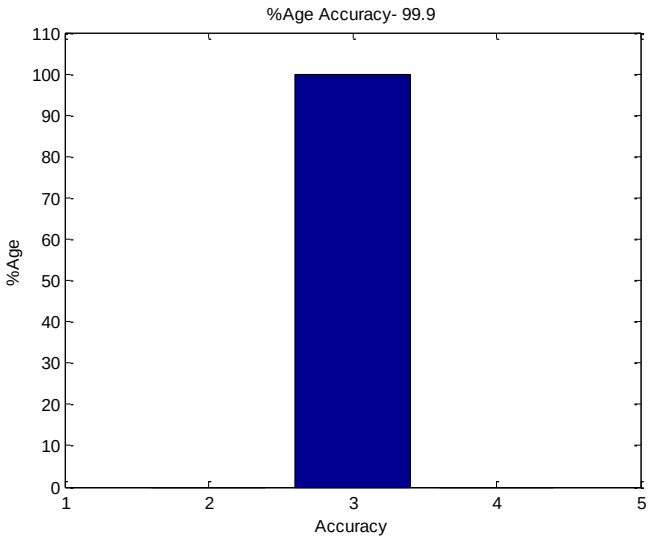
This ratio impacts the speed and quality of learning; it is called the learning rate. The sign of the gradient of a weight marks where the error is increasing. This is why the weight must be amended in the reverse direction. Repeat phase 1 and 2 until the efficiency of the network is satisfying.

7. Experiment and Result

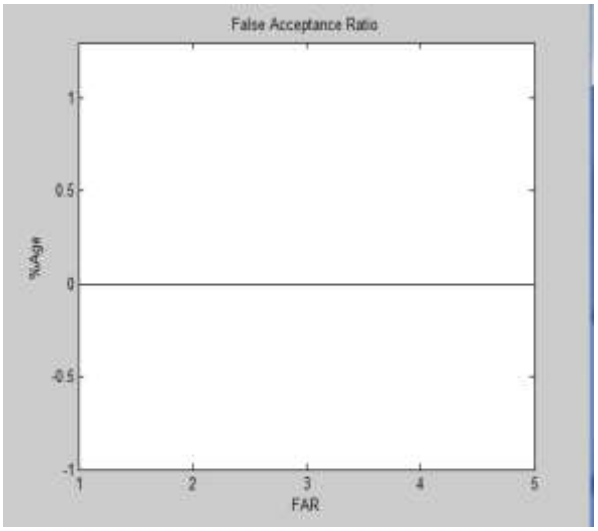
The proposed algorithm have been evaluated on virtual database of iris and fingerprints of 20 different persons. The experiments are conduct matlab with image processing toolbox and on machine core 2 Duo CPU Processor. Table 8.1 explain the comparison of various modalities combinations and their respective recognition percentage. From the above comparison we can conclude that proposed feature level wavelet fusion train by neural network is comparable with all the methods mentioned.

Methode	Recognition Percentage	Modalities
PCA	79.79	Face and Palmprint
Single scale LBP	81.46	Face and Palmprint
Multiscale LBP	94.79	Face and Palmprint
DICA	95.83	Face and Palmprint
Modified multiscale LBP	96.67	Face and Palmprint
Feature fusion	95	Face and Palmprint
Multiple feature extraction	98.82	Fingerprint and Palmprint
Wavelet fusion and train by neural network	99.8	FingerPrint and signature
Proposed algorithm using feature extraction using gabor transformation and fusion using wavelet fusion and train by artificial neural network	99.9	Iris and Fngerprint

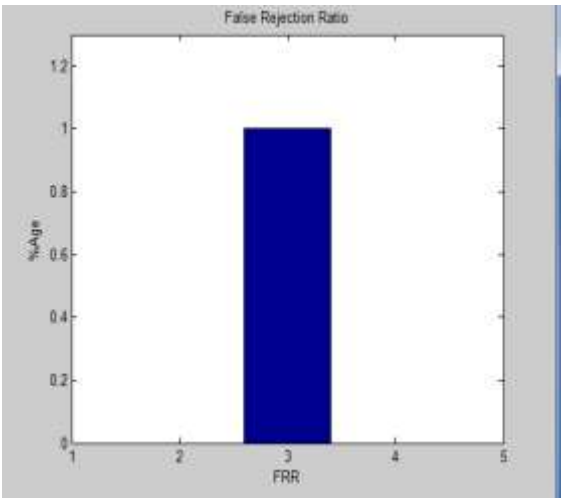
Table 1 : Comparison Table



Accuracy=Accuracy=((length(actual result)/TestSamp)*100)-.1;



FAR=1-Frr;




```
FRR=length(find(Numb==Fr))/TestSamp;
```

8. Conclusion

In this paper, I have presented a multimodal biometric system using iris and fingerprint biometric identifiers. To combine the information from these two biometric identifiers, I introduced new feature level fusion After investigating different feature level fusion approaches, I proposed feature level fusion using wavelet which satisfies the Condorcet criteria essential for any fair process. This feature level fusion approach significantly enhances recognition performance of the multimodal biometric system. The extensive experimentations with virtual multimodal databases indicate that the proposed multimodal system outperforms other commonly used methods and can help government or public/private sectors to protect valuable property or information, as well as can ensure the overall security of the region or country

REFERENCES:

[1] AlMahafzah, Harbi., Imran, Mohammad and Sheshadri S H., "Multibiometric: Feature level fusion" Published in IJCSI International Journal of Computer Science Issues, Vol. 9, Issue 4, No 3, 2012.

[2] Camlikaya, Eren, Kholmatov,Alisher and Yanikoglu, Berrin, "Multi-Biometric Templates Using Fingerprints and Voice" Published in Biometric Technology for Human Identification V, edited by B. V. K. Vijaya Kumar, Salil Prabhakar, Arun A. Ross Proc. of SPIE Vol. 6944, 69440I, 2008.

[3] Gayathri, R. , Ramamoorthy, P. , " Feature level fusion of palmprint and iris" Published in IJCSI International Journal of Computer Science Issues, Vol. 9, Issue 4, No 1, 2012.

[4] G. Feng, K. Dong, D. Hu & D. Zhang," When Faces Are Combined with Palmprints: A Novel Biometric Fusion Strategy", Published in IJCSI International Journal of Computer Science Issues, Vol. 7, Issue 3, No 3, 2004.

[5] Ibrahim, A. , Laheeb,M., " Decision Level Fusion of Iris and Signature Biometrics for Personal Identification using Ant Colony Optimization" Published in International Journal of Engineering and Innovative Technology (IJEIT) Volume 3, Issue 11, May 2014 .

[6] Jain, K, Anil. , Ross, Arun. , and Prabhakar,Salil. , "An Introduction to Biometric Recognition", Published in IEEE Transactions on Circuits and Systems for Video Technology, Special Issue on Image- and Video-Based Biometrics, Vol. 14, No. 1, pp.1782-1793, 2004.

[7] Kaur, Mandeep. , Girdhar, Akshay. , and Kaur, Manvjeet. , Published in "Multimodal Biometric System using Speech and Signature Modalities" IJCA International Journal of Computer Application,Volume 5- No. 12, 2010.

[8] Mehrotra,Hunny., Rattani, Ajita., Gupta, Phalguni., "Fusion Of Iris And Fingerprint Biometric For Recognition" IJCSI International Journal of Computer Science Issues, Vol. 11, Issue 2, No 1, 2013.

[9] Gupta, Phalguni., Rattani, Ajita, Rattani., Mehrotra,Hunny., Kaushik, Anil Kumar., " Multimodal Biometrics System for Efficient Human Recognition" IJCA International Journal of Computer Application,Volume 2- No. 12, 2013.

[10] Connaughton, Ryan., W. Bowyer, Kevin., Flynn, Patrick., "Fusion of Face and Iris Biometrics" Published in International Journal of Engineering and Innovative Technology (IJEIT) Volume 8, Issue 12, june 2013.

[11] Selvi, P.Tamil., Radha,N., "Multimodal Biometrics Based Authentication Against Dictionary Attacks" International Journal on Computer Science and Engineering (IJCSE) Volume 5, Issue 17, July 2011.

[12] Tieniu Tan,Wang Yunhong., Jain, Anil K.., "Combining Face and Iris Biometrics for Identity Verification" IJCA International Journal of Computer Application,Volume 7- No. 13, 2011.