Approach to Increase Accuracy of Multimodal Biometric System for Feature Level Fusion

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Abstract: Biometric System *are alternates to the traditional identification system. The Paper provides the multiple features based on the biometric system including Physiological and behaviouralchractersitics.like Fingerprints and iris which is used to identify the Fake and Genuine Users.*.In this paper we propose a Multimodal Biometric System for feature level fusion that combines the information to investigate the integration of fingerprints and Iris . This Proposed system extracts Gabor texture from the preprocessed fingerprints and Iris sample. The feature vectors attained from different methods are in different sizes and the features from equivalent image may be correlated. Therefore proposed the wavelet-based fusion techniques. Finally apply neural network's Cascaded feed forward Back propagation Algorithm to Train Neurons for recognition.This approach is authenticated for their accuracy of Fingerprints virtual database fused with Iris virtual database of 16 users. The experimental results demonstrated that the proposed multimodal biometric system achieves a accuracy of 99.53% and with false rejection ratio (FRR) of = 1%

Keywords*—Biometric, Unimodal, Multimodal, Security, Spoofing Attack, Wavelet, Gabor.*

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I. INTRODUCTION

A biometric system is also known as Human Recogniser or Human identifier.Every human beings can be uniquely identify on the basis of physiological and behaviouralchractersitics Like 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.

II. CHOICE OF MODALITY

In this work an signature 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**. [8]**

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

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 signatures 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.[8]

III. 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.

3.1 Basic block diagram

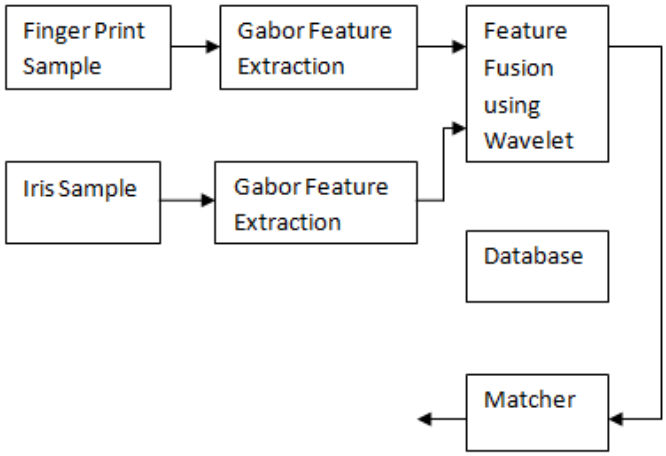


Fig 1 Block diagram of a Multimodal biometric

This paper mainly discusses the fusion of s Iris and fingerprint biometric.

3.2 Proposed methodology, algorithm and block diagram

3.2.1 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(eye) 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(eye) too.
- Now, after creating dummy Gabor filters for both fingerprints and iris(eye)we need to calculate them as fingerprint image to Gabor filter.
- Exactly same as fingerprint we need to calculate iris(eye) 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 (eye) extracted.
- Now, both the extracted features of fingerprint and iris(eye) 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.

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

3.2.2 Algorithm for proposed work:-

STEP 1: Input the Sample of fingerprints and sample of iris(Eye).

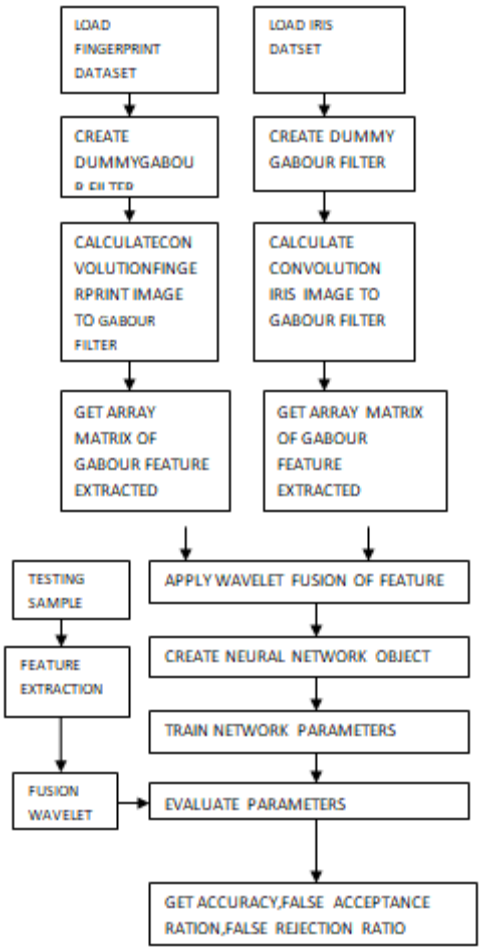
STEP 2: Extract the Gabor Feature of iris(eye) andfingerprints.

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 withthe parameters of trained neural network parameters.

STEP 6: Display the results obtained



Proposed Multimodal Biometric Recognition Block Diagram

IV. 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.[3]

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

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

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

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..[3]

VI. NEURAL NETWORK

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

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 function applied by the artificial neurons (or "nodes") be differentiable.[9]

Phase 1: Propagation Every propagation requires thefollowing 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 thefollowing 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.

V. WAVELET FUSION

The proposed algorithm have been evaluated on virtual database of fingerprint and Iris(eye) of sixteen different persons. The experiments are conduct matlab with image processing toolbox and on machine core 2 Duo CPU Processor.From the above comparison we can conclude that

VII. EXPERIMENT AND RESULT

proposed feature level wavelet fusion train by neural network is comparable with all the methods mentioned.

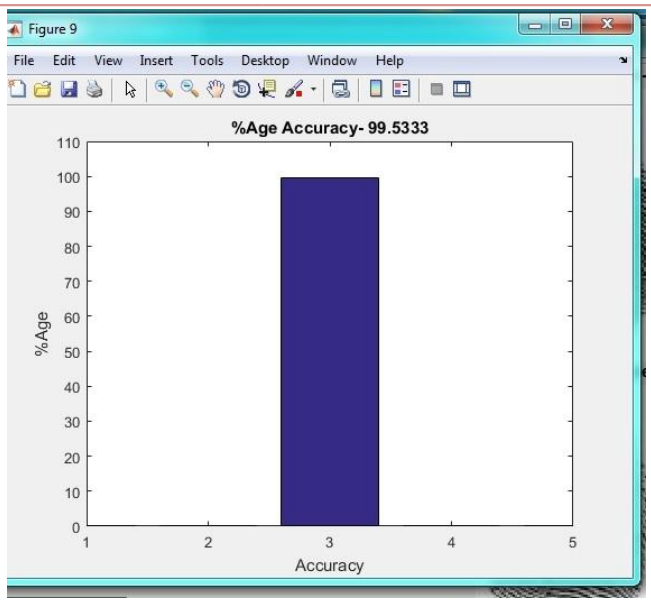
Methode	Recognition Percentage	Modalities
PCA	79.79	Face and Palmprint
Single scale LBP	81.46	Face and Palmprint
Multiscale LBP	94.79	Face and Palmprint
DICA	95.83	Face and Palmprint
Modified multiscale LBP	96.67	Face and Palmprint
Feature fusion	95	Face and Palmprint
Multiple feature extraction	98.82	Fingerprint and Palmprint
Proposed Wavelet fusion and train by neural network	99.53	FingerPrint and Iris

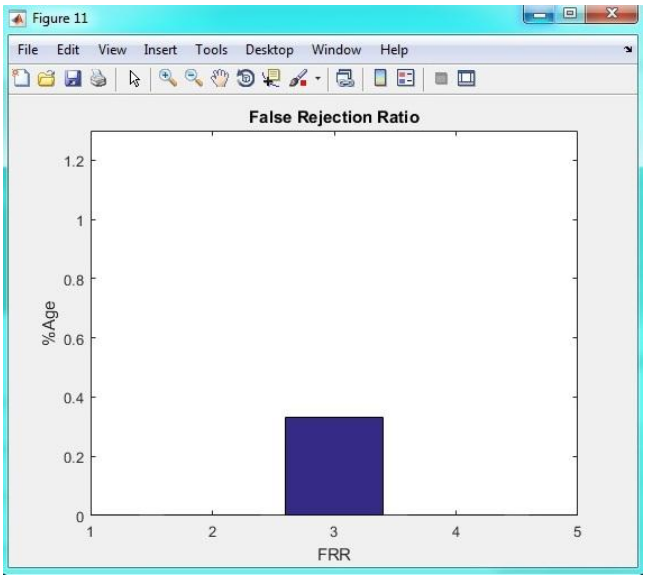
Table 1 : Comparison Table

VIII. CONCLUSION

In this work,user verification System based on the Fingerprint and Iris has been developed. This Technique is very essential to identify the Genuine or Fake users. 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 main objective of the system to enhance the security of biometric Recognition System

Tables shows the Accuracy and False Rejection Rate of Proposed system:





False Rejection Ratio about 1%

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