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RECOGNITION OF PALMPRINT FUSION LEVEL BY USING DISCRETE WAVELET TRANSFORM

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Abstract:

Most real-life biometric systems are still unimodal. Unimodal biometric systems perform person recognition based on a single source of biometric information. Such systems are often affected by some problems such as noisy sensor data, non-universality and spoof attacks. Multibiometrics overcomes these problems. Multibiometric systems represent the fusion of two or more unimodal biometric systems. Such systems are expected to be more reliable due to the presence of multiple independent pieces of evidence. In this paper, we present a multibiometric recognition system using two types of biometrics Iris and Palm print. The fusion is applied at the matching-score level. The experimental results showed that the designed system achieves an excellent recognition rate.

Keywords:

Biometric Fusion, Iris, Multibiometrics, Palm print.

I. Introduction:

A biometric system is essentially a pattern recognition system that performs recognition based on some features derived from measurements of physiological or behavioural characteristics that an individual has. Biometric characteristics, including fingerprint, facial features, iris, voice, signature, and palm print, finger-knuckle, gait etc. are now widely used in security applications. These unimodal biometric systems are faced with a variety of problems, noise in sensed data, non universality, inter-class similarities, and spoof attacks. Multibiometrics are a relatively new approach to overcome those problems. Besides enhancing matching accuracy, the multibiometric systems have many advantages over traditional unibiometric systems [1]. They address the issue of non-universality. It becomes increasingly difficult (if not impossible) for an impostor to spoof multiple biometric traits of an individual. A multibiometric system may also be viewed as a fault tolerant system.

Multibiometric systems depend on representing each client by multiple sources of biometric information [1]. Based on the nature of these sources, a multibiometric system can be classified into one of six categories, Multi-sensor systems; Multi-algorithm systems, Multi-instance systems, Multi-sample systems, Multi-modal systems, Hybrid systems. Multimodal biometric system has the potential to be widely adopted in a very broad range of civilian applications: banking security such as ATM security, check cashing and credit card transactions, information system security like access to databases via login privileges. A decision made by a multimodal biometric system is either a "genuine individual" type of decision or an "imposter" type of decision.

Modules of multimodal biometrics

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Multimodal biometric system has four modules - sensor module, feature extraction module, matching module and decision making module respectively.

• **Sensor module:** At sensor module biometric modalities are captured and these modalities are given as inputs for feature extraction module.

• **Feature extraction module:** At feature extraction module features are extracted from different modalities after pre-processing. These features yields a compact representation of these traits or modalities and these extracted features are then further given to the matching module for comparison.

• **Matching module:** In matching module extracted features are compared against the template(s) which is (are) stored in database.

• **Decision making module:** In this module user is either accepted or rejected based on the matching in the matching module.

The advantages of using multimodal biometric [2] are

- Addresses the issue of non-universality encountered by uni-biometric systems.
- Spoofing multiple biometric traits of a legitimately enrolled individual is difficult.
- Addresses the problem of noisy data effectively.
- Possess fault tolerant as the system can operate even when certain biometric sources are not reliable.
- Facilitates filtering or indexing of large-scale biometric databases.
- Enables continuous monitoring or tracking of an individual in situations when a single trait is not sufficient.

The biometric system has the following two modes of operation:

Enrolment mode: In this mode the system acquires the biometric of the users and stores the required data in the database. These templates are tagged with the user's identity to facilitate authentication.

Authentication mode: This mode also acquires the biometric of the person and uses it to verify the claimed identity. For recognition, features form the basic unit for processing and thus feature extraction plays a major role in the success of the recognition system. When the quality of the input image deteriorates the performance of the recognition algorithms also get affected, which is not desirable in real time applications. To make the system performance invariant to input image quality, techniques for determining the quality of images are incorporated in the system. Quality of each of the biometrics images (Iris and palm print) are determined and based on these metrics a decision level fusion strategy is proposed.

II. Proposed Work:

This research work is aimed at developing a framework for multi-modal biometric verification system using multiple sensors, database, multiple matching algorithms and decision processes. The main contribution of the paper is the design of decision level fusion using dynamic weighted average fusion for combined palm print and iris biometrics to authenticate and identify a person. The influence of environmental conditions and the quality of the input data have been considered for assigning dynamic weights in decision level fusion. The whole system has been implemented using fusion frame work and found to give better

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accuracy rates. The application demands very fast execution of the image processing algorithms.

- IRIS Feature extraction
  - IRIS Recognition.
  - IRIS Enhancement.
  - IRIS Decomposition by wavelet transforms
- PALM PRINT Feature extraction.
  - PALM PRINT detection.
  - PALM PRINT Enhancement.
  - PALM PRINT Decomposition by wavelet transforms

Iris recognition is an automated method of biometric identification that uses mathematical pattern-recognition techniques on video images of the iris of an individual's eyes, whose complex random patterns are unique and can be seen from some distance. Iris recognition is a method of biometric authentication that uses pattern recognition techniques based on high-resolution images of the irides of an individual's eyes. The iris image is enhanced by means of local histogram equalization and removes high-frequency noise by filtering the image with a median filter.

(A) Iris Image Decomposition Process:

In wavelet decomposing of an image, the decomposition is done row by row and then column by column. For instance, here is the procedure for an N x M image. You filter each row and then down-sample to obtain two N x (M/2) images. Then filter each column and subsample the filter output to obtain four (N/2) x (M/2) images of the four sub images obtained as seen in Fig.1, the one obtained by low-pass filtering the rows and columns is referred to as the LL image.

The one obtained by low-pass filtering the rows and high-pass filtering the columns is referred to as the LH images. The one obtained by high-pass filtering the rows and low-pass filtering the columns is called the HL image. The sub image obtained by high-pass filtering the rows and columns is referred to as the HH image. Each of the sub images obtained in this fashion can then be filtered and sub sampled to obtain four more sub images. This process can be continued until the desired sub band structure is obtained.

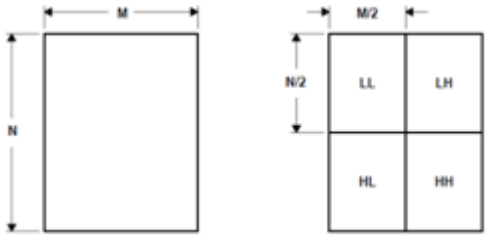

Fig 1: Wavelet Decomposition

(B) Palmprint DWT Process:

Palm print identification had been introduced a decade ago. It is defined as the measurement of palm print features to recognize the identity of a person. Palm print is universal because everyone has palm print. It is easy to capture using digital cameras. Palm print does not change much across time. Palm print has advantages compared to other biometric systems.

Iris scanning biometric system can provides a high accuracy biometric system but the cost of iris scanning devices is high. Palm print biometric system can captures hand images using a conventional digital camera. Palm print biometric system is user-friendly because users can grant the access frequently by only presenting their hand in front of the camera.

In face recognition system, users are required to remove their accessories such as spectacles or ear pendant during acquisition. Palm print biometric system can achieve higher accuracy than hand geometry biometric system, because the geometry or shape of the hand for most of the adults is relatively similar. Palm print contains geometry features, line features, point features, statistical features & texture features. The palm print geometry features are insufficient to identify individuals. This is because the palm print geometry features such as palm size, palm width and others for adults are relatively similar. The palm print line features include principal lines, wrinkles and ridges. Ridges are the fine lines of the palm print. It requires high-resolution image or inked palm print image to obtain its features. Wrinkles are the coarse line of the palm print while the principle lines are major line that is available on most of the palm(headline, lifeline & heart line).The separation of wrinkles & principle line are difficult since some wrinkles might be as thick as principle lines. Palm print point features use the minutiae points or delta points to identify an individual. Point features require high resolution hand image because low-resolution hand image does not have a clear point's location.

Palm print statistical features represent the palm print image in a statistical form to identify and individual. Some of statistical methods available are Principle Component Analysis (PCA) and Independent Component Analysis (ICA). Palm print texture features are usually extracted using transform-based method such as Fourier Transform and Discrete Cosine Transform. Besides that, Wavelet transform is also used to extract the texture features of the palm print. In this work, a sequential modified Haar wavelet is proposed to find the Modified Haar Energy (MHE) feature. The sequential modified Haar wavelet can maps the integer- valued signals onto integer-valued signals without abandoning the property of perfect reconstruction shows the proposed palm print identification using sequential "S-transform" modified Haar transform. In this work, ten images from the right hand of 100 individuals are acquired using a digital camera. The hand image is segmented and the key points are located. By referring to the key points, the hand image is aligned and the central of the palm is cropped. The palm print image is enhanced and resized. The energy features of the palm print are extracted using sequential Haar wavelet. The Haar (HW) is represented using feature vector and compared using Euclidean distance with the feature vectors stored in the database.

Fig 2: (a) Palm image (b) Enhanced palm image

(C) Flow Diagram:

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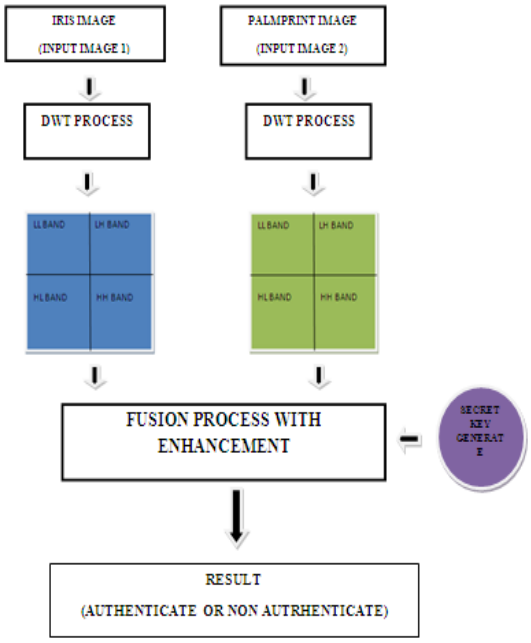
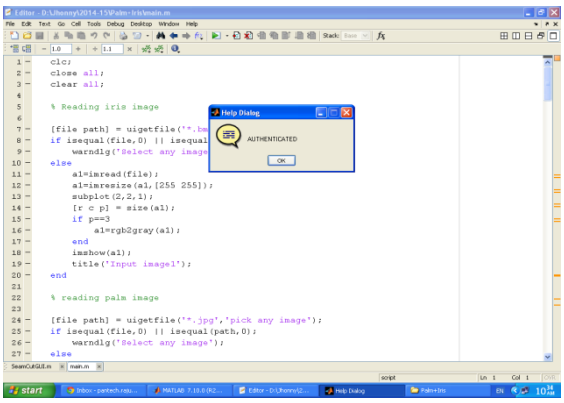


Fig 3: Block Diagram of Proposed system

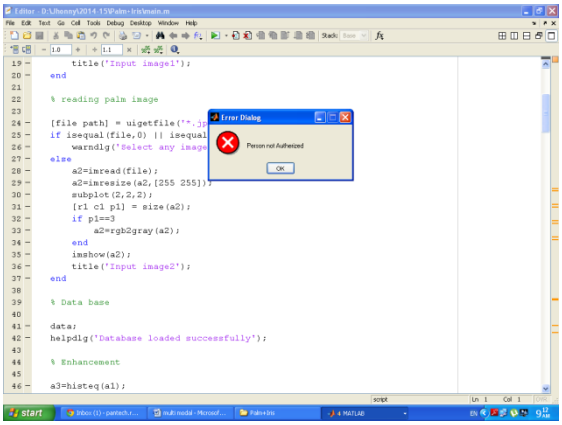
Fusion is the process of combining relevant information from two or more images into a single image. The resulting image will be more informative than any of the input images. In remote sensing applications, the increasing availability of space borne sensors gives a motivation for different image fusion algorithms. Several situations in image processing require high spatial and high spectral resolution in a single image. Most of the available equipment is not capable of providing such data convincingly. The image fusion techniques allow the integration of different information sources. The fused image can have complementary spatial and spectral resolution characteristics.

III. Results:

(a) Authentication



(b) Un-authentication



IV. Conclusion:

A multimodal biometric technique which combines multiple biometrics in making person identification can be used to overcome the limitation of individual biometrics. We have developed a multimodal biometric system which integrates decisions made by iris and palm print to make person authentication. In order to demonstrate the efficiency of such an integrated system, experiments which simulate the operating environment on a small data set which is acquired in a laboratory environment were performed. The experimental results show that our system performed well. However, the system needs to be

tested on a large dataset in a real operating system.

In future, we may include other biometric features like voice, finger knuckle for identification to achieve better security.

V. Acknowledgement:

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