Multimodal Biometrics for Person Authentication using Palm print Images

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Abstract- **Implementation of multimodal person authentication system using single input image with efficient features. Integrating the features increases robustness of the system. Discrete Wavelet Transform (DWT) is used for feature extraction and Support Vector Machine (SVM) is proposed for classification. The final decision is made by fusion at matching score level.**

Key words- **DWT, Palm print, SIFT, SVM, Fusion, ROI.**

1. Introduction

This work has the following notable contributions. First, it for the first time shows that the left and right palm print of the same subject are somewhat correlated, and it demonstrates the feasibility of exploiting the crossing matching score of the left and right palm print for improving the accuracy of identity identification. Second, it proposes an elaborated framework to integrate the left palm print, right palm print, and crossing matching of the left and right palm print for identity identification. The rapid growth in the use of e-commerce, computer network login, national ID card, criminal investigation, reliable and secure access control is must for user identification. Everyone has multiple accounts and passwords on an ever-increasing online transaction. Maintaining and managing access while protecting both the user's identity and the computer's data and systems has become increasing difficult. Everywhere security is the concept of authentication - verifying that the user is who he claims to be. Biometrics be the most secure and convenient method to satisfy the need for identity recognition of individual in the society. For automatic identification of an individual, physiological or behavioural characteristics of person are used. Many types of single modal biometric systems have been developed, for example fingerprint, face, speech, palm print and hand geometry verification systems. To improve the performance of various biometric recognition systems by using better feature representation techniques and matching algorithms. Multi-biometrics is another technique to improve the biometric recognition performance by combining multiple biometric traits. It aims to effectively fuse the salient information among the individual biometric traits which translates into better recognition performance. Single biometric systems are only capable to provide low to middle range of security feature. Thus for higher security, multimodal biometrics system is required. In addition, the industry is currently exploring the characteristics of multimodal biometric that are reliable, able to provide high security features, non-intrusive and widely accepted by the public. Multimodal system also provides anti-spooling measures by making it difficult for an intruder to spool multiple biometric traits simultaneously. Due to its promising applications as well as the theoretical challenges, multimodal biometric has drawn more and more attention in recent years. Fusion of Hand geometry and palm print is user friendly and well accepted system with better performance. Feasibility and advantage over uni-modal system and future direction of biometrics system are discussed. Several types of biometric features can be extracted from hand images: (i) hand geometry features, such as hand shape, palm area, width and length of fingers and other measurements; (ii) palm print characteristics, like principal lines, wrinkles, feature points, and skin texture. The hand modality has a number of advantages in that it is user-friendly, hand-imaging devices are not intrusive, template storage costs are small and imaging conditions are less complex, relatively simple digital camera or flatbed scanner would suffice Several systems have been developed using the hand modality. Two kinds of biometric indicators can be extracted from the low-resolution1 hand images; (i) palm print features, which are composed of principal lines, wrinkles, minutiae, delta points, etc., and (ii) hand geometry features which include area/size of palm and length and width of fingers. Palm print based personal identification is a new biometric modality which is getting wide acceptance and has all the necessary traits to make it a part of our daily life.

1.1 LITERATURE SURVEY

The common practice is to first project images to some feature spaces palm print, based on The SMCC method first defines a filter bank of second derivatives of

Gaussians with different orientations and scales, and then uses the l1-norm sparse coding to obtain a robust estimation of the multiscale orientation field [6] .In biometric processing including 2-D and 3-D systems. Focus is on the achievements of scientists who decided to experiment with fusion algorithms for identification in a single-modal system [1]. Object recognition systems are still largely unable to handle the extraordinary wide range of appearances assumed by common objects [including human faces] in typical images [2] .Online palmprint identification system employs low-resolution palmprint images to achieve effective personal identification. The system consists of two parts: a novel device for online palmprint image acquisition and an efficient algorithm for fast palmprint recognition [5] .Finally, a generalized competitive code is used to encode the dominant orientation. Biometrics-based personal identification is regarded as an effective method for automatically recognizing, with a high confidence, a person's identity. This paper presents a new biometric approach to online personal identification using palmprint technology. In contrast to the existing methods, our online palmprint identification system employs low-resolution palmprint images to achieve effective personal identification [5]. A comparative analysis listing the benefits and deficits in the established methods would give a clear and concise idea of the method to be approached for building a system that is more efficient and overcomes major faults present in the systems. This paper gives the general view of the concept of five different approaches used to implement a palm print recognition system and the comparative conclusion of the methods on the basis of specific parameters such as False Acceptance rate(FAR),false Rejection Rate(FRR), Equal Error Rate(ERR),etc.

1.2 RELATED WORK

The principal lines and texture are two kinds of salient features of palmprint. The principal line based methods and coding based methods have been widely used in palmprint identification. In addition, sub-space based methods, representation based methods and SIFT based methods can also be applied for palmprint identification.

2. EXISTING SYSTEM

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2.1 Line Based Method

Lines are the basic feature of palmprint and line based methods play an important role in palmprint verification and identification. Line based methods use lines or edge detectors to extract the palmprint lines and then use them to perform palmprint verification and identification. In general, most palms have three principal lines: the heart line, headline, and lifeline, which are the longest and widest lines in the palmprint image and have stable line shapes and positions. Thus, the principal line based method is able to provide stable performance for palmprint verification.

2.2 SIFT METHOD

SIFT key points of objects are first extracted from a set of reference images and stored in a database. An object is recognized in a new image by individually comparing each feature from the new image to this database and finding candidate matching features based on Euclidean distance of their feature vectors. From the full set of matches, subsets of key points that agree on the object and its location, scale, and orientation in the new image are identified to filter out good matches. The determination of consistent clusters is performed rapidly by using an efficient hash table implementation of the generalized Hough transform. Each cluster of 3 or more features that agree on an object and its pose is then subject to further detailed model verification and subsequently outliers are discarded. Finally the probability that a particular set of features indicates the presence of an object is computed, given the accuracy of fit and number of probable false matches. Object matches that pass all these tests can be identified as correct with high confidence.

2.3 DRAWBACKS

- This SIFT method is quite slow.
- Generally doesn't work well with lighting changes and blur

3. PROPOSED SYSTEM

Nowadays, wavelets have been used quite frequently in image processing. They have been used for feature extraction, de-noising, compression, face recognition, and image super-resolution. Wavelet transformations are a method of representing signals across space and frequency. The decomposition of images into different frequency ranges permits the isolation of the frequency components introduced by "intrinsic deformations" or "extrinsic factors" into certain sub-bands. This process results in isolating small changes in an image mainly in high frequency sub-band images. Hence, discrete wavelet transform (DWT) is a suitable tool to extract the feature vector of a palm image. Support vector machines (SVMs) are a set of related supervised learning methods that analyze data and recognize patterns, used for classification and regression analysis. A classification task usually involves with training and testing data which consists of some data instances. Each instance in the training set contains one "target value" (class labels) and several "attributes" (features). SVM has an extra advantage of automatic model selection in the sense that both the optimal number and locations of the basic functions are automatically obtained during training. Propose wavelet function as a kernel function, the performance of SVM largely depends on the kernel. A SVM classifier can predict or classify input data belonging to two distinct classes. However, SVMs can be used as multiclass classifiers by treating a K-class classification problem as K two-class problems.

3.1 ADVANTAGES

- SVMs are helpful in text and hypertext categorization as their application can significantly reduce the need for labeled training instances in both the standard inductive and transductive settings.
- Classification of images can also be performed using SVMs. Experimental results show that SVMs achieve significantly higher search accuracy than traditional query refinement schemes after just three to four rounds of relevance feedback.
- SVMs are also useful in medical science to classify proteins with up to 90% of the compounds classified correctly.
- Hand-written characters can be recognized using SVM.

3.2 BLOCK DIAGRAM

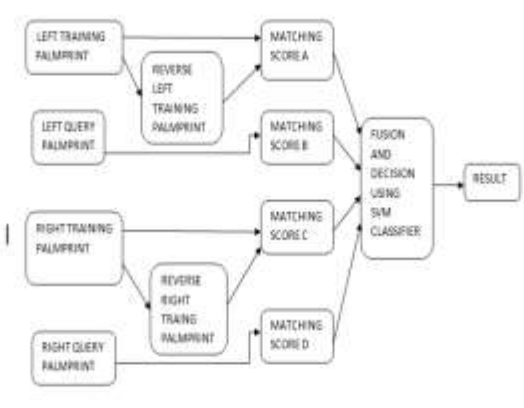


Fig 1: Operation of block diagram

4. ALGORITHM

One or more biometric traits combine to provide new independent information that gives the opportunity to greatly improve recognition performance. The fusion of two modalities allows reducing the impact of system failure than uni-modal biometrics. Multimodal biometrics has many advantages, such as providing greater universality to the system, to overcome spoof attacks. The multi biometric system includes four principal modules: the sensor module, the feature extraction module, the matching module, where parameters are compared to the template database, and the decision module. Information fusion can occur in any of the aforementioned modules: data normalization followed by a concatenation of the biometric data vectors in pixel or feature fusion ; combination of the matching scores to produce a single new score in score fusion ; combining the decisions of the different classifiers according to certain rules to give the final decision in decision fusion.

A wavelet transform algorithm designed to overcome the lack of translation-invariance of the discrete wavelet transform (DWT). Translation-invariance is achieved by removing the down samplers and up samplers in the DWT and up sampling the coefficients by a factor. This process results in isolating small changes in an image mainly in high frequency sub-band images. Hence, discrete wavelet transform (DWT) is a suitable tool to extract the feature vector of a palm image.

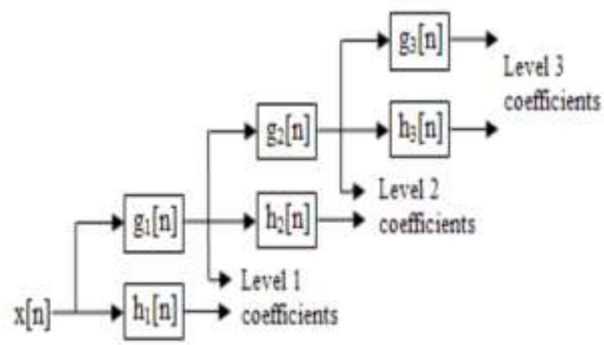
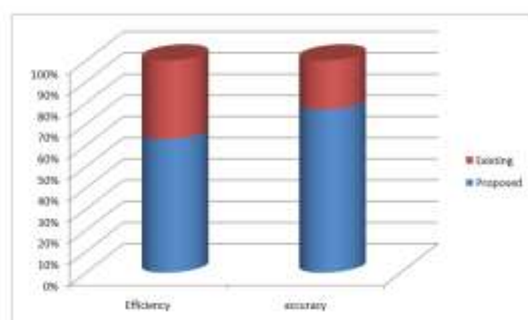


Fig 2: Structure and implementation of palmprint algorithm

4.1 GRAPH



4.2 DWT (DISCRETE WAVELET TRANSFORM)

In numerical analysis and functional analysis, a discrete wavelet transform (DWT) is any wavelet transform for which the wavelets are discretely sampled. As with other wavelet transforms, a key advantage it has over Fourier transforms is temporal resolution: it captures both frequency and location information. The discrete wavelet transform has a huge number of applications in science, engineering, and mathematics and computer science. Most notably, it is used for signal coding, to represent a discrete signal in a more redundant form, often as a preconditioning for data compression. Practical applications can also be found in signal processing of accelerations for gait analysis [6] in digital communications and many others.

It is shown that discrete wavelet transform (discrete in scale and shift, and continuous in time) is successfully implemented as analog filter bank in biomedical signal processing for design of low-power pacemakers and also in ultra-wideband (UWB) wireless communications.

4.3 SVM CLASSIFIER

In machine learning, support vector machines (SVMs, also support vector networks) are supervised learning models with associated learning algorithms that analyze data used for classification and regression analysis. Given a set of training examples, each marked for belonging to one of two categories, an SVM training algorithm builds a model that assigns new examples into one category or the other, making it a non-probabilistic binary linear classifier. An SVM model is a representation of the examples as points in space, mapped so that the examples of the separate categories are divided by a clear gap that is as wide as possible. New examples are then mapped into that same space and predicted to belong to a category based on which side of the gap they fall on.

In addition to performing linear classification, SVMs can efficiently perform a non-linear classification using what is called the kernel trick, implicitly mapping their inputs into high-dimensional feature spaces.

5. MODULE DESCRIPTION

5.1 Image sensing level

Initially the keywords are extracted from the database. It is used to create a dictionary of keywords, which can be used in training. Text mining can be defined as a technique that attempts to extract meaningful information from natural language text. It can be characterized as the process of analyzing text to extract information that is useful for a particular purpose. Compared with the kind of data stored in databases, text is unstructured, amorphous, and difficult to deal with algorithmically. However, text is the most common vehicle for the formal exchange of information. The phrase “text mining” is generally used to denote any system that analyses large quantities of natural language text and detects lexical or linguistic usage patterns in an attempt to extract meaningful information.

5.2 Feature level

The first step in automatic classification of images is to extract visual low-level features of image. Images in AIA system is represented by low-level features like colour, shape and texture Feature Extraction is based on Global and Local features. Global feature includes all the pixels of an image. This extraction is used to represent the global colour of an image. There are two strategies for extracting local features. The first one is to partition a set of fixed sized blocks or tiles and the second for a number of variable shaped regions of interest. After performing block and/or region based segmentation, low-level features can be extracted from the tiles or regions for local feature representation.

5.3 Matching score level

Match scores output by multiple matchers are consolidated. Two approaches exist in the context of verification: A feature vector is constructed using the match scores; feature vector is assigned to one of two classes: “genuine” or “impostor”. Scores output by individual matchers: Non-homogeneous: distance or similarity. Ranges may be different and Distributions may be different. Generally, a multi-biometric system based on the matching score level fusion works as follows: each subsystem of the multi-biometric system exploits one biometric trait to produce a matching score. Then these matching scores are normalized and integrated to obtain the final matching score or final decision for personal authentication. Studies on the basis and potential of score level fusion are very helpful for us to understand and implement fusion at the score level.

5.4 Decision level

A combination of the matching scores to produce a single new score in score fusion; combining the decisions of the different classifiers according to certain rules to give the final decision in decision fusion. The decision is made by fusion at matching score level.

6. IMPLEMENTATION AND RESULTS

The experiment of the proposed system consists in the evaluation of palmprint images, selective window size palm print and fusion of palm prints and selective window size palm print in score level. The experimental results show that the used algorithm clearly extracted the ridges of the palmprint using ROI method, wavelet transform. At last the palmprint images are classified using SVM classifier with comparing the original images and query palmprint images.

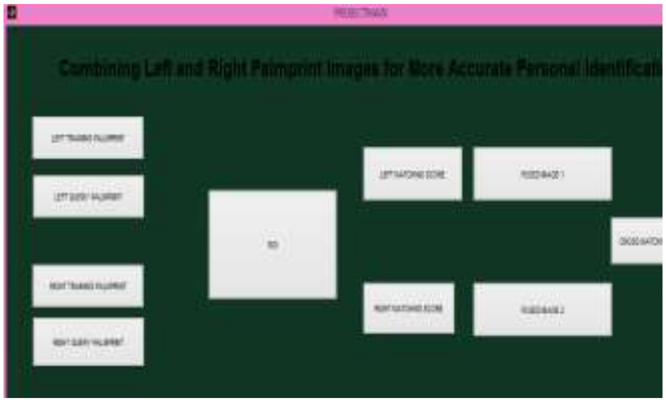


Fig 3: Implementation screen

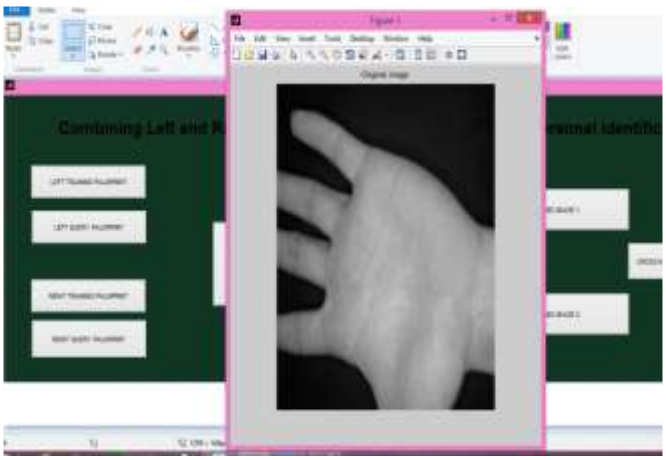


Fig 4: Extraction of left training palm print

Fig 5: Extraction of left query palm print

Fig 6: Extraction of right training palm print

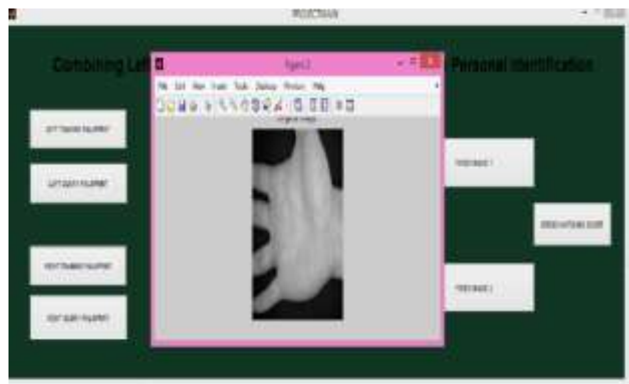


Fig 7: Extraction of right query palm print

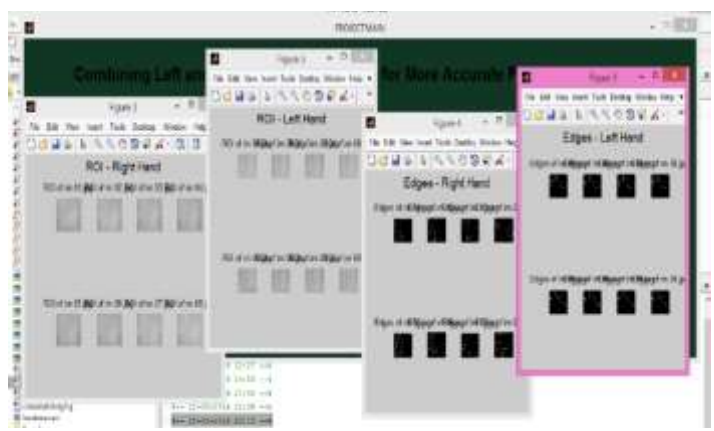


Fig 8: Extraction of ROI

Fig 9: Matching score of left palm print

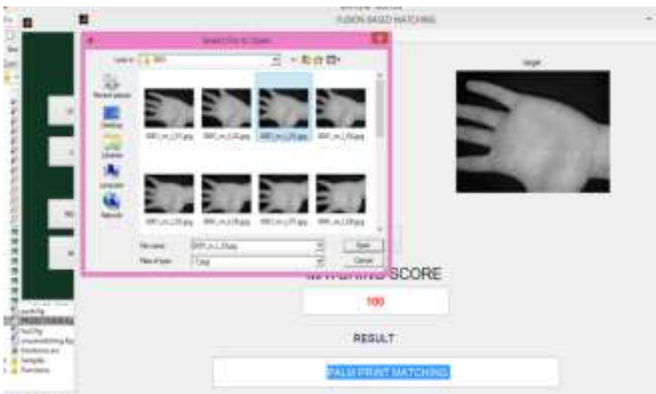


Fig 10: Input image taken from the dataset

Fig 11: If palm print not matching score

Fig 12: Matching score of right palm print

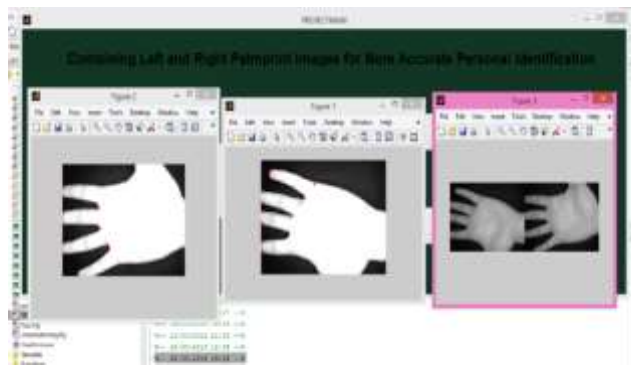


Fig 13: Fused image1

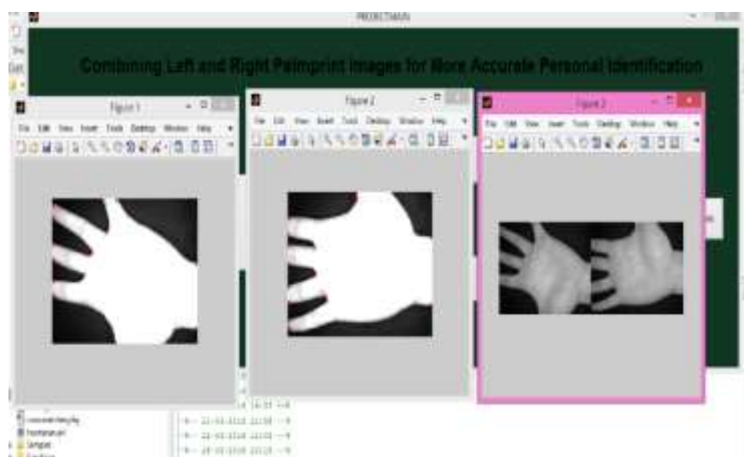


Fig 14: Fused image2

Fig 15: Final output comparing the result of both fused image1 and fused image2

7. CONCLUSION

Multimodal biometric system is implemented using two palm prints of the person. This process is implemented with discrete wavelet transform and SVM classifier. The features used for matching are the fingers length, width, palm width and palm features. The objective of this work was to investigate the integration of palm print and hand geometry features, and to achieve a better performance that may not be achievable with single biometric indicator alone.

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