INTERNATIONAL JOURNAL OF ADVANCE RESEARCH, IDEAS AND INNOVATIONS IN TECHNOLOGY

ISSN: 2454-132X
Impact factor: 4.295
(Volume3, Issue3)
Available online at www.ijariit.com

Combining Left and Right Palm Print Images for more Accurate Personal Identification

Shruthi .N
Cambridge Institute of Technology, Bangalore
n.shrth@gmail.com

Abstract: Recognition of a person by means of the biometric characteristic is very important technology as biometric identifiers can't be shared and they intrinsically represent individual's bodily identity. Palm print is one of the important biometric characteristics with high user acceptance and it has gained much attention because of its good performance. Biometric characteristics are used to identify a person by measuring the behavioural and physiological characteristics. In single biometric technology, there are a number of chances for fraudulent activities. Multi-biometric system provides high accuracy than any other technologies. Combining left and right palm print images to perform multi-biometrics is easy to implement and can provide better results. Here an SVM method is used as the identification time of this system is higher than others. By feature extraction, LMR PCA IDA is extracted and these features don't depend upon iteration method and hence the computation time is reduced and SVM works on a clustering based method which reduces the computation time.

Keywords: ***Palm Print, Feature Extraction, BioMetrics.***

INTRODUCTION

In today's geographically mobile, electronically weird, information society to achieve highly accurate automatic personal identification is a crucial problem that needs to be properly solved. E-commerce applications are growing rapidly and it requires personal identification for effective security control. Biometrics refers to the metrics related to human characteristics. Biometric authentication is used as a form of authentication and access control in the computer science applications. Biometric identifiers are used to label and describe individuals which are distinctive and measurable characteristics. Biometric identifiers are classified as physiological versus behavioral characteristics. Physiological characteristics refer to the shape of the body like a fingerprint, palm veins, face recognition, palm print, iris recognition, retina etc. Behavioural characteristics relate to the pattern of behaviour of a person. A biometric authentication system works by acquiring the data from the user and comparing it with the template data stored in the database to identify a person or to claim the identity of the person. Among various biometric systems, palm print recognition is the most promising one due to its simplicity, feature extraction, matching feature, high precision, real-time computation and the resolution of used images.

Palm lies between the wrist and the hand and its inner surface containing a huge number of features such as principal lines, wrinkles, and texture. The palm print contains principled curves and wrinkles along with rich texture and masculine points and hence palm print identification achieves high accuracy. Palm print features are considered promising in identifying people. There are two types of the palm print features such as principal lines and wrinkles in the first type of features which can be extracted from the low-resolution images and find their use in the identification in the commercial applications. The singular point, ridges and minutiae point refer to the second type of features which are extracted using high-resolution images and are used in the forensic applications such as law enforcement applications. Palm print recognition system has four parts

1. A palm print scanner
2. Pre-processing
3. Feature extraction
4. Matcher

A palm print scanner gathers the palm print images, pre-processing arranges the coordinate system to align the palm print images and segments a fraction of the palm print for feature extraction. The biometric system which obtains and uses only a single source of information or data to recognize an individual is known as the unimodal biometric system. Though these systems are safe and perfect they suffer from several problems such as noise, lack of individuality and sensitivity to attack. The multimodal biometric

system is used to overcome these challenges which combine two or more biometric traits of the same person. In these systems, the left and right palms of a person are used, which use two biometrics of the same person to identify the person. The palm print of every person has three distinct lines namely the heart line, the headline and the life line which is the longest and widest line in the palm print image that has a stable shape and position which is used in the recognition. Feature extraction level is used to extract the features from the palm print images that are stored in a specific database. The palm print images are captured though the biometric sensors which are stored in a specific database. The biometric systems are much safer and they can be more secure and unique to a single user by using OTP. The images obtained from the database are raw images that need to be processed before gaining information from them. The images contain noises like dust particles or irregular background because of which accurate extraction is not possible. Hence the enhancement technique is applied to enhance palm print impressions for feature extraction. There are two important interesting properties of biometric identification.

1. The person to be identified is required to be present physically at the point of identification.

2. Identification is based on the biometric technique that does not depend on a user to remember the password or carry a token.

Conventional ID card and password based identification methods which were very popular are no more reliable because of the use of several advanced techniques of forgery and password hacking.

LITERATURE SURVEY

Rowe. Et.al [1] proposed a multispectral whole-hand biometric system whose main objective is to collect palm print information with clear fingerprint features and pre-processing done with image resolution was set up to 500 dps. However, the low speed of the feature extraction and feature identification makes it unsuitable for real-time applications. The less accuracy of the system can be enhanced by using other palm print techniques. S.Hao [2] has developed contact free multispectral palm sensor architecture for identifying the palm printing for security and authentication. In this system, the image quality is very much limited and hence the recognition accuracy is not so high. Quishi Zhao.et.al[3] have proposed SIFT-based image alignment for contactless palm print verification which aims at solving the security-based problem, they proposed a contactless palm print recognition method with a precise palm print image alignment. The original contactless palm print images are first aligned using a projective transformation model that is estimated from matched SIFT features. From the obtained images the competitive code is extracted and matched. Finally, the matching scores from SIFT and the competitive scores are fused together to improve the accuracy. Experiments show that after the image alignment, the verification accuracy of the image alignment, the verification accuracy of the competitive code has increased dramatically and the result is further enhanced by fusing the matching scores of competitive code and SIFT features. FCM based orientation selection for competitive coding based palm recognition achieves higher verification accuracy while compared to that of original competitive code and another state of art methods. Feng Yea.et.al [4] proposed FCM based orientation selection for competitive coding based method. Here they concentrated on the security issues and tried to overcome all the issues. In this perceptive, they used statistical orientation distribution, orientation separation principle and modified fuzzy means cluster algorithm to determine the orientation of the filters. This method achieves higher verification accuracy.Luk.Forman.sulem.et.al [5] used multispectral images in the multimodal authentication system. They used the desktop scanner and thermal camera which makes their system very costly. The image resolution is also too high to meet the practical biometric system. Huanaga Jiaa and Zhang [6] have proposed the palmprint authentication system based on the principle line extraction.

EXISTING MODEL

A. Similarity between Left and Right palm print images

Here we illustrate the concept of similarity between the left and right palm prints. Fig 1 shows the palm prints of four subjects. Fig represents the left palm prints and fig1.1 (a)-(d) shows the four right palm print images. Fig 1.1(e)-(h) are the reverse palm prints of the right palm prints. It can be seen that the left palm print images and the reverse right palm print images are somewhat similar. Fig fig1.2 (a)-(d) depicts the principle line images of the left palm print images shown in fig1.1 (a)-(d). Fig1.2 (e)-(h) shows the principle lines of the reverse right palm print images of fig1.1 (i)-(l). Fig 1.2(i)-(l) represents the principle matching lines of fig1.2 (a)-(d) and fig1.2 (e)-(h) respectively. Fig 1.2(m)-(p) are the matching images between the left and reverse right palm print principle lines from different subjects. This demonstrates that the left and reverse right palm print images can be used for verification and identification of the subject.

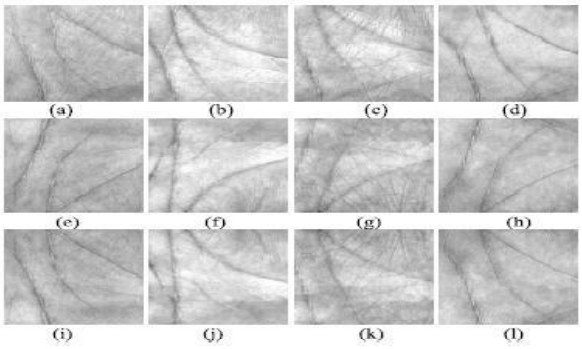


Fig1.1. Palm print images of four subjects. (a)- (d) are four left palm print images; (e)-(h) are four right palm print corresponding to (a)-(d); (i)-(l) are the reverse right palm print images of (e)-(h).

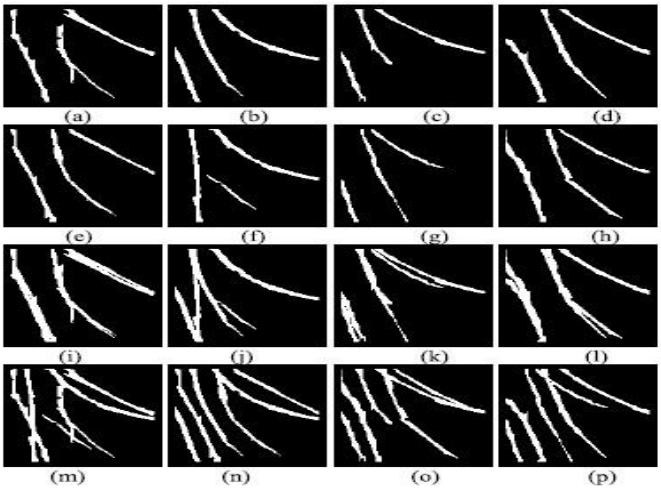
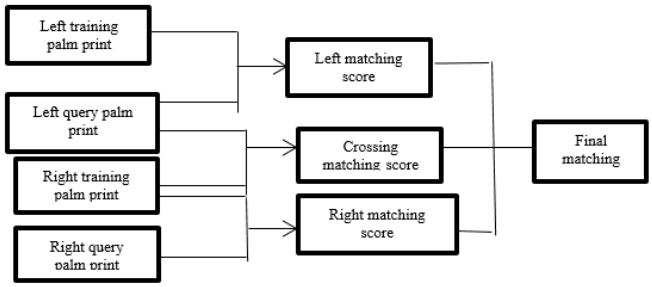


Fig1.2. Principal lines images. (a)-(d) are four left palm print principal lines images, (e)-(h) are four reverse right palm print principal lines image, (i)- (l) are principal lines matching images of the same people, and (m)-(p) are principal lines matching images from different people.

B. Matching Score Level Fusion



Figs 1.2 Fusion at the matching score level.

The final decision is based on three kinds of information (1) Left palm print (2) Right palm print and (3) Correlation between the left and right palm print.The fusion in the multimodal biometrics is performed in four stages

- Image level fusion- Different sensors are used to capture the image. The left and the right palm print images are captured using contact-based sensors which are stored along with the specified user information into the database. These are the training images which will be further used in the biometric palm print system.
- Fusion at feature level- The images obtained are primarily converted into the gray scale images which are further represented as the binary images as 0's and 1's are preserved. Here ones are converted as zeros and zeros are converted as ones. This makes the darker area of the image into lighter and the lighter area into darker.
- Fusion at Score Level- the principle lines obtained is used to calculate the matching scores. The principle line in the right palm print are reversed and then the matching scores of the left palm print and the left query palm prints, the left query palm print and the reverse right palm print and finally the reverse right palm print image and right query palm print image are computed and they are combined together to form a single combined matching scores.

The strength of the individual matches can be highlighted by assigning specific weights to each matching score. The weighted sum matching score level is most preferable due to ease with which the three matching scores can be combined. Fig 3.2 shows the basic procedure of the matching score level. The final matching score is obtained by three values. The first and the second matching scores are obtained from the left and right palm prints respectively and the third matching score is obtained based on the cross-matching between the left and the right. Differing the conventional matching score level fusion, the method uses the cross matching score of the fusion strategy. The performance of the proposed method is as good as or even better than the conventional matching score level fusion. This method carefully takes the nature of the left and right palm print images into consideration and develops an algorithm to find the similarity between the two. Hence it has to perform one more identification than the conventional method and hence it requires 1.5 times of the conventional method.

PROPOSED MODEL

A. Methodology

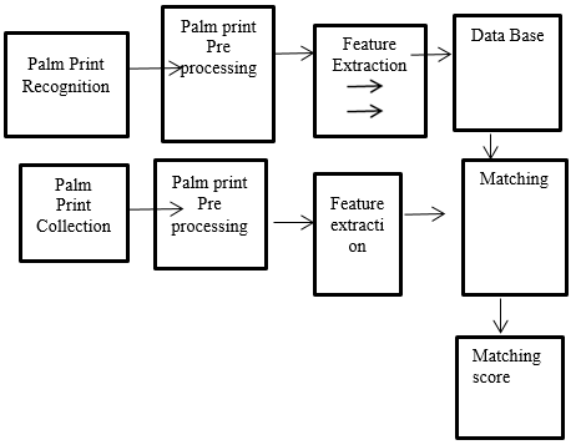


Fig 4.1: Block diagram of palm print recognition System

The left and the right palm print images are collected with the help of palm print scanner for personal identification. The figure above represents the proposed architecture. Palm prints are collected in two different such as touch-based and contactless. Digital cameras and video cameras are two ways to collect the palm print without any contact and for the touch based we use digital scanner and CCD. Fingers must be clearly separated from each other in the image in order to clearly obtain the complete hand shape. The architecture first starts working from the left palm print and then the same procedure is followed for the right palm print images and this system uses the palm print identification method to calculate the score of the test samples of each class. In order for the noise portion to be removed and the image to be enhanced pre-processing is very essential. During pre-processing of an image several operations like Orientation, masking, filtering normalization and edge detection are applied on the images to extract the features. Gaussian filtering is used for image enhancing as it is known for smoothening and sharpening the image. Gaussian filtering is not particularly effective for salt and pepper noise. For image enhancement which is required to extract the principle lines of the palm print operations like morphological masking and segmentation are applied. Normalization is the process that changes the range of the pixel intensity values. The image is then subjected to binarization having an average threshold value. Even after the image enhancement some of the distortions are still present in the background of the image, so it is very essential to remove the unwanted portions of the image ad to extract the palm region only. This process is known as Region of Interest (ROI) extraction.

C.Pre-processing

Pre-processing is used to crop the ROI for feature extraction and this is done in five steps

- Binarization of the palm print
- Boundary Tracking
- Key Points Detection
- Establishing a coordinate system
- Establishing the central part

The goal of the digital image pre-processing is to increase both the accuracy and the interpretability of the digital data. The left and right palms are given as the input and there will be a lot of distortion and noise in the images, hence pre-processing is required. Normalization is a process changes the range of the pixel intensities. Here the image is subjected to binarization with an average threshold value where each pixel in an image is converted into one bit and a value of 0 and 1 are assigned depending on the mean value of the pixel. 1 is assigned a value greater than the threshold value and 0 is assigned to a value less than the threshold value. Binarization converts an image of up to 256 gray levels to black and white images. Here raises the problem of selecting the correct threshold. Hence the adaptive image binarization is needed where an optimal threshold is chosen for each value.

B. Boundary Extraction

The image obtained after elimination of the noise contains the region of black and white pixels. In order to obtain the geometric features, it is required to extract only the images that contain edges. Consequently, it is required to convert the region of the white pixels into an image containing only the boundary of white pixels. This is done by using the edge detection algorithm where the algorithm converts all the pixels excluding those at the boundary of the black and white pixels into black pixels. It also ensures that the thickness of this boundary is as low as possible as the thickness of the boundary adversely affects the accuracy of the system. It is very important that no edges are determined as edges and also very critical for the edge detection algorithm to not to miss any of the edges. These two criteria define the error rate of the edge detection algorithm. The distance between the edge located by the filter and the actual edge should be as low as possible and also the filter should provide multiple responses to the single edge. Canny edge detection algorithm is chosen for the important qualities such as robustness, works irrespective of the palm placement effects and gives a continuous and very good quality boundary.

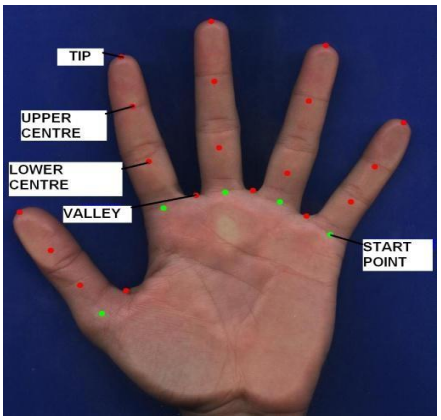


Fig 4.6 Special Reference points

Feature extraction requires the image to be segmented into several relevant regions of the reference. Fig 3.4 shows the set of the reference points marked in colour.

Tip of the finger- The tip of the middle, index, ring and the small finger are computed as a first white pixel from the edge detected image as the tips are required to find the length.

Upper center- Upper center is the representative of the upper side of the finger and it is computed as the second white pixel in the same column of the finger. It is used for finding the width of the finger.

Lower center- It is the representative of the lower center of the finger and is taken as the third white pixel which lies in the same column of the finger.

Start point- It is the fourth white pixel of each point.

D. ROI extraction

A central part of the palm print identification system is the comparison of similarity between the known template and the feature vectors. This improves the accuracy of the authentication system. There have been considerable efforts for determining the suitable region known as the Region of Interest (ROI) before implementing the feature extraction methods. Sobel and Morphological operations are found best suitable for most of the palm print identification systems. The effectiveness of the ROI extraction system has been examined by comparing the identification accuracy before and after the ROI extraction. The new approach of ROI extraction is based on the principle of selecting a region with rich texture patterns. In other words, the parts of the acquired palm print image that don't contribute to the textural features have to be discarded. Following steps are used for cropping palm print ROI

Two key points are selected from the set of the key points identified. The valley point between little finger and ring finger is considered as the first point and the valley point between the middle finger and index finger is considered as the second point. These two points are considered as the anchor points.

A rectangle region is selected as the ROI of the palm print using the anchor points. The distance between anchor points and left top corner of the rectangular region is considered as the width of the ROI which is selected as 30 pixels just below the first anchor point.

ROI segmentation algorithm for pal print recognition has several schemes to be used. There are three main stages in the algorithm for segmenting palm print ROI from palm print Binarizing the original palm print images by using thresholding algorithm. Noise deleting by using morphological segmentation. Aligning the palm print to standard pose and extracting the palm print ROI

E. Feature Extraction

Features can be extracted for matching once the central part is being segmented. The features extracted are used to create a master template which is used stored in the system database. Here the matching score is obtained by matching the identification template against the master template. If the score is less than a given threshold the user is authenticated. Many features of the palm print can be used to uniquely determine the individual. In the feature extraction low-resolution palm print images are classified into

three main categories holistic based, feature based and hybrid methods. The holistic methods use the original palm print image as a whole to extract the holistic features which are further divided into subspace based, invariant moment based and transform based methods. In the feature-based approach, the local features of the palm print are extracted for efficient palm print recognition. The palm lines and textures are two classes of stable and distinctive local features. The hybrid approach uses both holistic and feature based methods to improve the recognition accuracy. Another method for the feature extraction are the approaches like principle component analysis (PCA), Fischer discriminates analysis (FDA), and Independent Component Analysis (ICA). PCA in the palm print recognition finds a set of orthogonal basis vectors which describes the major variations among the training images. The bases have the same image as the palm images and are also called as Eigen Palms. PCA can only separate pairwise linear dependencies between the pixels. ICA is used to decompose an observed signal into a set of linearly independent signals. Coding based methods are one class of the local feature extraction methods. It encodes the responses of a bank of filters into bitwise feature code. Due to the bitwise representation coding, based method requires less memory and has fast matching speed and has been very successful in palm print recognition and matching. Among various schemes, the orientation based methods have the highest accuracy, robustness and fast implementation. In the transform based feature extraction methods discrete cosine transform (DCT), Discrete Fourier Transform (DFT) and wavelet transform are used. The orientation of the Palm lines is stable and can provide enough information for personal identification. Some of them are competitive Code (Comp code), Palm Print Orientation Code (POC), and the Robust Line Orientation Code (RLOC). These algorithms use a different filter and masks like Gabor filters for comp code, self-designed masks for POC and modified finite radon transform for RLOC to estimate the orientation feature of each region. TO overcome the problems associated with the competitive code method Fuzzy C-Means (FCM) method was introduced. Sparse Multiscale Competitive Code (SMCC) method was introduced for multi-scale palm line orientation

CONCLUSION

Here we have demonstrated that the left and the right palm print of the same subject are almost similar and the performance improvement of the palm print identification systems have also been demonstrated in the paper. The proposed paper carefully takes into account the characteristics of the left and the right palm print images and uses various algorithms at different stages to identify the actual data. The different algorithms are canny edge detection algorithm, Gabor wavelet transform, SIFT algorithm, morphological segmentation. Experimental results show that the proposed method provides a high-level accuracy due to the use of these algorithms. Single palm biometrics have already been used for the identification but here multi-biometrics have been used for the identification of both left and right palm print images.

REFERENCES

[1] R. K. Rowe, U. Uludag, M. Demirkus, S. Parthasaradhi, and A. K. Jain, "A multispectral whole-hand biometric authentication system," in Proc. Biometric Symp., Biometric Consortium Conf., Baltimore, MD, pp. 1–6, 2007

[2] Y. Hao, Z. Sun, and T. Tan, "Comparative studies on multispectral palm image fusion for biometrics," in Proc. Asian Conf. Comput. Vis, pp. 12–21, 2007.

[3] Qiushi Zhao, Wei Bu and Xiangqian Wu, " SIFT -based Image Alignment for Contactless Palm print Verification", Harbin Institute of Technology Harbin, P.R. China, 2014.

[4] Feng Yue, Wangmeng Zuo and Kuanquan Wang, "FCM-based Orientation Selection for Competitive Coding-based Palm print Recognition", Biocomputing Research Centre, School of Computer Science and Technology, Harbin Institute of Technology, Harbin, China, 2010

[5] D. S. Huang, W. Jia, and D. Zhang, "Palmprint verification based on principal lines," Pattern Recognition., vol. 41, no. 4, pp. 1316–1328, Apr. 2008

[6] D. Zhang, W.-K. Kong, J. You, and M. Wong, "Online palmprint identification," IEEE Trans.PatternAnal.Mach.Intell., vol no. 9, pp. 1041–1050, Sep. 2003.

[7] D. Zhang, W.-K. Kong, J. You, and M. Wong, "Online palmprint identification," IEEE Trans.PatternAnal.Mach.Intell., vol. 25, no. 9, pp. 1041–1050, Sep. 2003.

[8] D. Han, Z. Guo, and D. Zhang, "Multispectral Palmprint recognition using wavelet-based image fusion," in Proc. IEEE 9th Int Conf. Signal Process., Oct. 2008, pp. 2074–2077.

[9] A. Kumar, D. C. M. Wong, and H. C. Shen, "Personal Verification using palmprint and hand geometry biometric," in Audio- and Video-Based Biometric Person Authentication (Lecture Notes in Computer Science). Berlin, Germany: Springer-Verlag, 2003, pp. 668–678

[10] A. Morales, M. A. Ferrer, and A. Kumar, "Towards contactless palmprint authentication," IET Comput. Vis., vol. 5, no. 6, pp. 407–416, Nov. 2011.

[11] J. Dai and J. Zhou, "Multifeature-based high-resolution palmprint recognition," IEEE Trans. Pattern Anal. Mach. Intell., vol. 33, no. 5, pp. 945–957, May 2011.

[12] A. Morales, M. A. Ferrer, and A. Kumar, "Towards contactless palmprint authentication," IET Comput. Vis., vol. 5, no. 6, pp. 407–416, Nov. 2011

