Dorsal Hand Vein Authentication System: A Review

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ABSTRACT

The dorsal hand vein pattern is unique biometric identity of the human beings. The dorsal hand vein recognition is a recent biometric technique which is used for authentication purposes in various applications. Different techniques used for designing the system has discussed here. A dorsal hand vein recognition system consists of the following steps: Image acquisition from the database and pre-processing, finding of region of interest, extraction of dorsal hand vein pattern features and recognition. The aim of this paper is just to review the ideas published earlier. This model is used to improve the accuracy and response time of dorsal hand vein authentication and use neural networks for the final evaluation of the testing sample and training samples to recognize the person.

Keywords *- Biometrics, Dorsal hand Vein, Region of Interest, Feature Extraction.*

I. INTRODUCTION

Nowadays, automatic personal identification based on biometric feature plays a significant role in applications of public security, access control, banking, and so on. Liukiu Chen, Zheng, Li (2007) [2] states in contrast to some other image acquirements of personal identification, the dorsal hand vein image has three strong points: firstly, no physical contact is needed, so it will not make the subject displeasure, better than fingerprint and iris scanning. Secondly, it has forceful universality and uniqueness, for adults, less change following the growth of age and different people have different vein patterns. Meanwhile, it is very hard to forge, better than fingerprint.
Lastly, the state of skin, temperature and humidity have little effect on the vein image, unlike fingerprint and facial feature acquirement. Ajay Kumar, Prathyusha (2009) [1] detailed as hemoglobin in the blood of vein absorbs the near infrared light wavelengths 720nm – 1100nm), the pattern of veins in the dorsal hand can be captured as a pattern of shadows.

II. DORSAL HAND VEIN PATTERN

Vein pattern is the network of blood vessels beneath person's skin. The idea using vein patterns as a form of biometric technology was first proposed in 1992. According to Li Xueyan and Guo Shuxu (2008) Vein patterns are sufficiently different across individuals, and they are stable unaffected by ageing and no significant changed in adults by observing. It is believed that the patterns of blood vein are unique to every individual, even among twins.

Contrasting with other biometric traits, such as face or fingerprint, vein patterns provide a really specific that they are hidden inside of human body distinguishing them from other forms, which are captured externally. Veins are internal, thus this characteristic makes the systems highly secure, and they are not been affected by the situation of the outer skin (e.g. dirty hand).

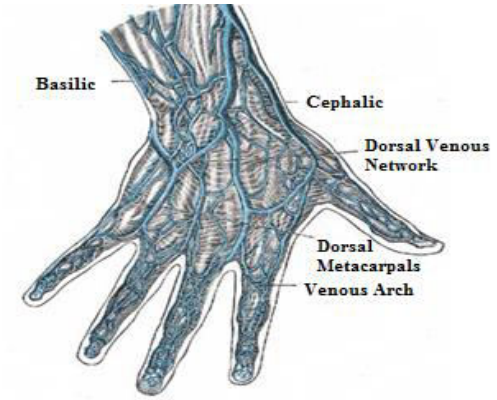


Fig 1: Drawing of the vascular network in the hand. Obtained from [09]

At the same time, vein patterns can be acquired by infrared devices by two ways, noncontact type and contact type. In the case of non-contact method, there is no need to touch the device, and therefore it is friendly to individuals in the target population who utilize the systems. In the contact type, the collection type is the same as fingerprint which has already been accepted by most people.

The figure 1 illustrates the generic vascular map found on the dorsum of the hand. There are mainly two types of hand veins found on the dorsum of the hand, namely cephalic and basilic. The basilic veins are the group of veins attached with surface of hand. It generally consists of upper limb of the back of hand. Cephalic veins are the group of veins attached with the elbow of the hand.

III LITERATURE REVIEW

Biometrics authentication is a growing field in which civil liberties groups express concern over privacy and identity issues. Today, biometric laws and regulations are in process and biometric industry standards are being tested. Maleiki et al. (2006) [4] have considered two main features namely ending points and bifurcation points to extract vein features. The features of the vein namely the length, thickness, shape and distribution of the veins were investigated to find the most appropriate representation for the vein patterns. In this model, the length and distribution were taken into consideration. During preprocessing, Zhao et al. (2007) have used Match filter, Wiener filter and Smoothing filter to enhance the quality of dorsal hand vein images. Reillo et al. (2007) have investigated on false acceptance rate (FAR), False Non-Match Rate (FNMR), False Match Rate (FMR), false rejection rate (FRR), Failure to acquire (FTA) and Failure to enroll (FTE).

Xiangqian Wu (2010) [8] have used SVM which can represent the largest separation as the classifier. He obtained five distances between each pair: one matching distance between dorsal veins, and one between palm veins and three between finger veins and provided as input to SVM.

Heenaye and Mamode Khan (2011) [4] have applied Independent Component Analysis (ICA) to the vein features to reduce the dimension of the vein matrix. To test the performance of biometric security system, performance measures are used. Sanchez-Chih-Bin Hsu et al. (2012) have used PCA and LDA. The aim of this approach is to combine local and global information for vein recognition. Inshirah Rossan et al.(2014) has used different preprocessing techniques that causes well defined extracted vein pattern that gives better performance and leads to a more secure biometric authentication system. R. Raghavendra et al. (2015) [6] have used a DMK 22BUC03 monochrome CMOS camera with a resolution of 744 × 480 pixel for image capture. The camera is equipped with a T3Z0312CS lens with a focal length of 8mm. To obtain the vein pattern, a region of interest (ROI) was defined using eight different feature extraction schemes that schemes include both local and global feature representation. Yiding wang et al. (2015) [7] have explored the vein preprocessing phase. In this work the vein pattern was segmented based on simple Thresholding using gray-level distribution.

Table 1. Summary of subspace approach

Author	Aspect / Subspace	Remark on Aspect
Liukiu chen et al. 2007 [2]	Grayscale Morphology	Grayscale Morphology used to Calculating local threshold is better for Image segment than average on noise-removing, and OSTU on time-resuming.
W.Deng et al. 2008 [11]	Unsupervised discriminant Project, Classifier : Euclidean, cosine	Cosine measure used for classification purpose
Maleika Heenaye et al. 2009 [12]	Cholesky decomposition, PCA	Cholesky decomposition, an efficient algorithm which gives lower triangular matrices, was integrated with PCA to reduce the Process time of the patterns.

Xiangqian Wu (2010) [8]	SVM represent the largest separation as classifier.	He obtained five distances between each pair: one matching distance between dorsal veins, and one between palm veins and three between finger veins and given as input to SVM.
Sanchez-Chih-Bin Hsu et al. (2012)	PCA and LDA	The aim of this approach is to combine local and global information for vein recognition.
Asmaa Merouane, Sarah Benzian (2013) [13]	Hybrid binary PSO and Hu's invariant moments,	PSO and Hu's Invariant Moment makes the algorithm high robust to noise and minimize the errors of FAR and FRR.
Yiding wang et al. (2015) [7]	Gray level distribution	In this work the vein pattern was segmented based on simple Thresholding using gray-level distribution.
Inshirah Rossan et al. (2015)	CLAHE, Wellner's adaptive thresholding	Proved that the more vein patterns are connected and extracted, the much reliable, secure and accurate the Biometric system is.

IV IMAGE DATABASE

The University of Las Palmas de Gran Canaria, Spain. Miguel A. Ferrer, et al. (2009) [3] has been developed GPDS 100 Veins CCD Cylindrical database. The database consists of 10 different acquisitions of 102 people. The samples were acquired in two separated session one week: five the first time and other five samples the second session. The 1020 images have been taken from the user's right hand. The system to capture near infrared images of the hand dorsum consists of two arrays of 64 LEDs in the band of 850nm, a CCD gigabit Ethernet PULNIX TM3275 camera with a high pass IR filter with 750nm as cutoff frequency, and a handle with two pegs for positional reference.

The Bosphorus Hand Vein Database [15] is intended for research on biometry based dorsal vein patterns of the hand. The hand vein data is acquired using NIR imaging technology with a monochrome NIR CCD camera (WAT-902H2 ULTIMATE) equipped with an infrared lens. The back of the hand is irradiated by two IR light sources. The images have 300×240 pixel size with a gray-scale resolution of 8-bit.There are overall 1575 images of the left hands of 100 subjects distributed as:

Three left-hand images per subject taken under normal conditions (N: Normal), Three left-hand images per subject after having carried a bag weighing 3 kg. for one minute (B: Bag), Three left-hand images per subject after having squeezed an elastic ball repetitively (closing and opening) for one minute (Activity: A), Three left-hand images per subject after having cooled the hand by holding an ice pack on the surface of the back of the hand (Ice: I).

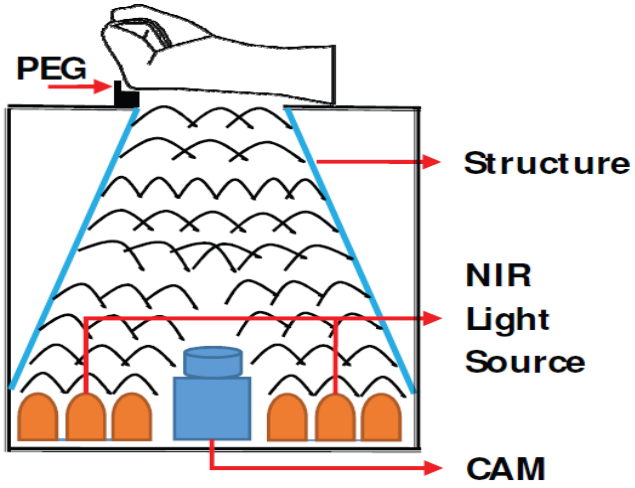
Three right-hand images per subjects under normal conditions. Images of the left hands of 25 subjects after a time lapse ranging from two months to five months.

Mohamed Shahin, Ahmed Badawi, and Mohamed Kamel proposed fig.2 [14], they designed a system a near IR cold source to provide back-of-hand illumination. The IR cold source is a solid-state array of 24 LEDs (light emitting diodes). The diodes are mounted in a square shape, 6 LEDs in each side, on a designed and assembled PCB (printed circuit board) and made housing and an attachment for fixing the LEDs around the CCD lens.

V. CONCLUSION

After studying many research articles, we came to know about the overall description of dorsal hand Vein Authentication and its corresponding method. Further in literature, each technique is summarized with the advantages and shortcomings. Besides a number of Dorsal hand vein recognition techniques are already been developed, there is still a scope of further improvements. Many authors obtained Global and Local feature by using different methods like PCA, LBP and many more, In future we are try to use Global feature for

research.



VI. ACKNOWLEDGMENT

The authors want to thank the anonymous reviewers and the volunteers from whom we collect our database.

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