Analysis of Multispectral Palm vein Image Using Enhancement Operations

Mr. S.D. Raut[1]
[1]Department of Computer Science and Applications
School of Computational Sciences
Maharashtra, India.
profraut@ymail.com

Dr. V.T. Humbe[2]
[2]Department of Computer Science,
School of Technology,
S.R.T.M. University, Nanded, Sub-Campus, Latur
vikashumbe@gmail.com

Abstract*:* Nowadays Biometric is playing a key role in the field of forensic and commercial applications. This paper discusses image enhancement operations and there result when applied on multispectral palm vein image. The image enhancement operations are much helpful to extract the vein pattern as features. The experiments can be used to highlight or trace a vein pattern lies at palm region of hand. The proposed work gains vein pattern and can be considered as the stepping stone towards feature extraction.

Keywords- Multispectral, histogram, feature extraction, vein pattern, near infrared.

I. INTRODUCTION

Biometrics is automated methods of recognizing a person based on a physiological or behavioral characteristic; among the features measured akin to face, fingerprints, hand geometry, handwriting, iris, retinal, palm vein, and voice etc. However Palm vein biometric systems are superior because they provide a nontransferable means of identifying people not just cards or badges. A key advantage of palm vein biometric authentication is that biometric data is based on human vein characteristics that stay constant throughout one's lifetime and are difficult to fake or change. The inspiration of our work is from Huan Zhang, Dewen Hu [1], paper; which presents a palm vein recognition system that uses blood vessel patterns as a personal identification factor. This paper discusses about an image preprocessing and feature extraction of palm vein pattern.Vein pattern identification uses an infrared light source at 760nm to scan for hemoglobin in the blood [2] [4]. A palm vein is a new member of biometrics family and attracts much of the today's research attention. It has been found that light in the 700 to 1000 nm (infrared light) ranges can penetrate human skin, whereas 880–930 nm provides a good contrast [3] of subcutaneous veins. As the palms have more complex vascular patterns than fingers and provide more distinct features for pattern matching and authentication.

However with other biometric identification approaches, vein patterns are considered to be time invariant and sufficiently distinct to clearly identify an individual. The human vascular structure is individually distinct. Even the Identical twins have different and distinct vascular patterns [7]. The vein patterns are not easily spoofed, observed, damaged, obscured or changed and also vein pattern technology is perceived as secure as it incorporated "aliveness" detection. A vein pattern technology has a high degree of usability with some research showing 99.98 percent usability [2]. As per the discussion in paper the shape and texture features [6] can be considered for parameter for image enhancement. An image enhancement is one of the key stages of digital image processing. Various to enhance operation of it can be applied on the image. It is useful to give the image analysis too.

A. PALM VEIN PATTERN

Vein pattern identification uses an infrared light source to scan for hemoglobin in the blood. De-oxygenated hemoglobin appears as a black pattern with the hand or finger showing as a lighter color or white. The device then captures an image of vein patterns in wrist, palm, back of the hand, finger or face. This is similar to the technique used to capture retinal patterns. The backs of hands and palms have more complex vascular patterns than fingers [5] and provide more distinct features for pattern matching and authentication.

As with other biometric identification approaches, vein patterns are considered to be time invariant and sufficiently distinct to clearly identify an individual. In this paper the biometric palm vein based recognition system is developed on the basis statistical properties of palm vein pattern. As it is found physiological biometric can be easily forged by undergoing medical operation and resulted into the medical identity loss of the person. So a strong and robust biometric feature such as palm vein can be studied and is adopted for person

identification and it is very difficult to forge and is application for the living being as it monitors the blood fluctuation in the vein as heart pump.

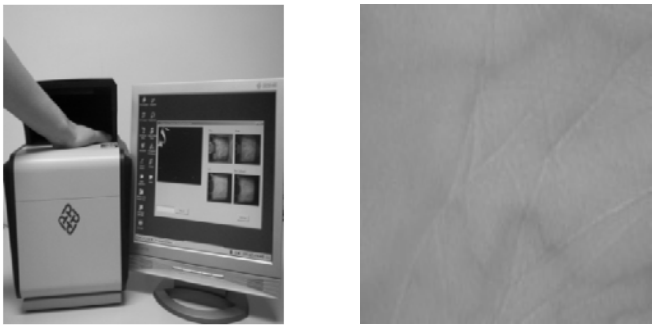
Fig.1 Palm Vein Pattern

Thus we state the biometric palm vein and its measurement in terms of statistical pattern recognition can lead us to form a robust person recognition system in modern era.

II. IMAGE DATABASE

The Biometric Research Centre (UGC/CRC) at The Hong Kong Polytechnic University has developed a real time multispectral palm print capture device which can capture palm print images under blue, green, red and near-infrared (NIR) illuminations, and has used it to construct a large-scale multispectral palm print database [3].

Multispectral palm print images were collected from 250 volunteers, including 195 males and 55 females. The age distribution is from 20 to 60 years old. They have collected samples in two separate sessions. In each session, the subject was asked to provide 6 images for each palm. Therefore, 24 images of each illumination from 2 palms were collected from each subject. In total, the database contains 6,000 images from 500 different palms for one illumination. The average time interval between the first and the second sessions was about 9 days. And also provide the extracted ROI images using our ROI extraction algorithm from 500 different palms for one illumination.



(a) (b)

Fig.2(a) an outlook of multispectral palm print image acquisition device. (b) Palm vein Image (image captured under Near Infrared illumination).

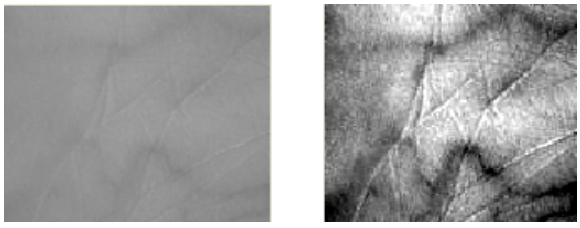
The average time interval between the first and the second sessions was about 9 days. Each part of database is named as “nnnn”. “nnnn” represents the identity of the person (range from 1 to 500). In each folder, the first 6 images (1_mm) were captured in the first session and the latter 6 images (2_mm) were captured in the second session, "mm" represents the image index for give session (range from 1 to 6). The database contains all the original palm print images collected with our device by blue, green, red and NIR illumination [3]. In our study we have worked out on the NIR illuminated palm print multispectral image and related statistical measurements.

III. EXPERIMENT AND RESULTS

An experiment is carried out at MATLAB; which is software computing tool. In our experiment we have read palm vein image; which is a multispectral image captured under near infrared illumination. An experiment is focused on enhancement of image. Fundamental image enhancement operations are performed on multispectral palm vein image. These operations are useful to extract palm vein pattern from an image.

The experimental work and image enhancement result can be summarized as follows-

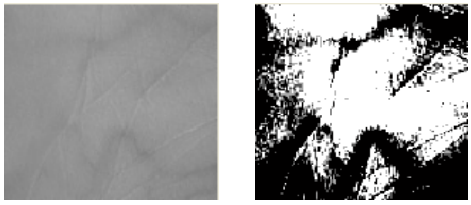
1. When we apply adjust color map operation then vein pattern and principal lines are quite visible.



(a) (b)

Fig.3 (a) Original image; (b) color map adjusted image.

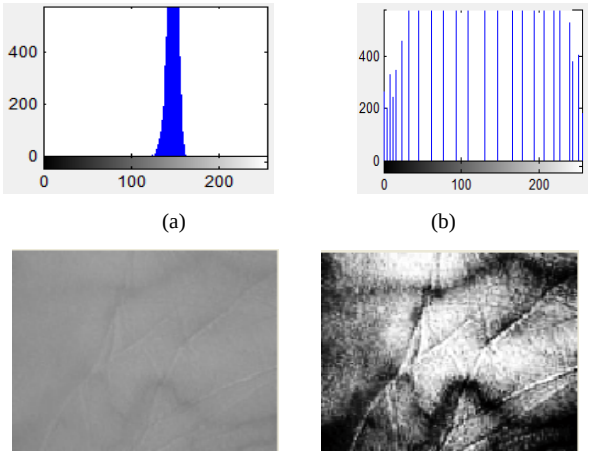
2. A de-correlation stretch image enhancement can be performed. An image resulting has a dark shaded region i.e. actually vein pattern



(a) (b)

Fig.4 (a) Original image; (b) visually enhanced image.

3. We have enhanced contrast of original image using histogram equalization.

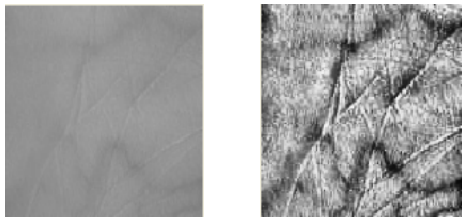


(a) (b)

(c) (d)

Fig.5 (a) Histogram of original; (b) equalized histogram; (c) original image; (d) enhanced image.

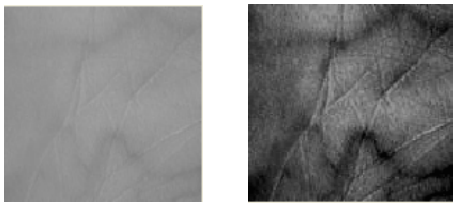
4. The contrast limited adaptive histogram equalization (CLAHE) is performed on an image.



(a) (b)

Fig.6 (a) Original image; (b) CLAHE resultant image.

5. Apply contrast stretch operation by specifying lower and upper limits that can be used for contrast stretching image



(a) (b)

Fig.7 (a) Original image; (b) contrast stretched resulting image.

IV. CONCLUSION

A palm vein is a new member of pattern recognition and biometrics family, has attracted much of the research attention. De-oxygenated hemoglobin appears as a black pattern with the hand or finger showing as a lighter color or white. The image preprocessing operations such as image enhancement are performed. The result shows how fundamental image enhancement operations are useful so as to trace or highlight the vein pattern that lies at palm of hand. The result also shows enhancement in an image that shows palm features such vein structure as well as palm principal lines. These features are useful for pattern matching or simply classification of an individual. So the objective of experiment is successful and leads to extract the palm vein pattern from a multispectral image; which are not easily spoofed, observed, damaged, obscured or changed and also vein pattern technology is perceived as secure as it incorporated “aliveness” detection.

REFERENCES

[1] Huan Zhang, Dewen Hu, "A Palm Vein Recognition System”, International Conference on Intelligent Computation Technology and Automation, Vol. 1, pp.285-288, IEEE Computer Society, 2010.

[2] Ishani Sarkar1, Farkhod Alisherov, Tai-hoon Kim, and Debnath Bhattacharyya, “A Palm vein Authentication: Review”, International Journal of Control and Automation, Vol. 3, No. 1, 2010.

[3] David Zhang, Zhenhua Guo, Guangming Lu, Lei Zhang, Wangmeng Zuo, “An Online System of Multispectral Palm print Verification”, IEEE Transactions On Instrumentation And Measurement, Vol. 59, No. 02, pp.480-490, 2010.

[4] D. M. Mancini, L. Bolinger, H. Li, K. Kendrick, B. Chance and J. R. Wilson, “Validation of Near-infrared Spectroscopy in Humans”, Journal of Applied Physiology, Vol. 77, no. 06, pp. 2740-2747, 1994.

[5] N Miura, A. Nagasaka, and T. Miyatake. “Extraction of Finger-Vein Patterns Using Maximum Curvature Points in Image Profiles”, Journal of Machine Vision Application, pp. 347-350, Volume E90-D, Issue 8, 2007.

[6] M.Deepamalar, M.Madheswaran, “An Enhanced Palm Vein Recognition System Using Multi-level Fusion of Multimodal Features and Adaptive Resonance Theory”, International Journal of Computer Applications, Vol. 1-No. 20, pp.95-10, 2010.

[7] Li Xueyan, Guo Shuxu, “A Fourth Biometric-Vein Recognition”, Pattern recognition techniques, technology and applications, ISBN - 953-7619-24-4, 2008.

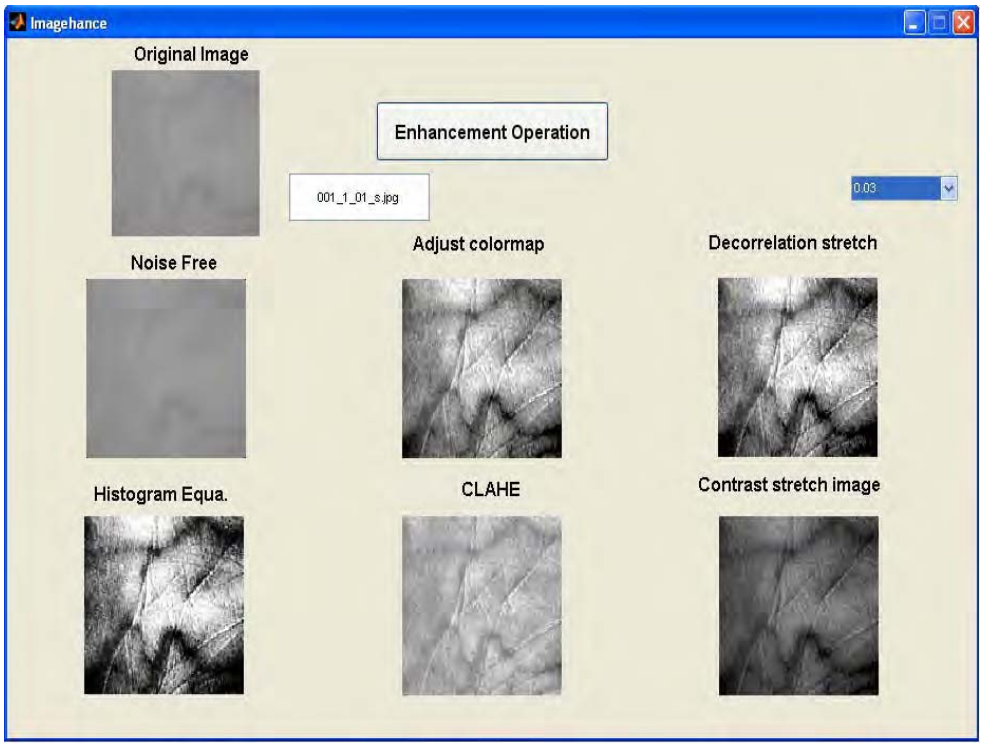


Fig 8.Graphical User interface model build using MATLAB to demonstrate implemented image enhancement operations.