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HUMAN FINGER VEIN SEGMENTATION IN INFRARED IMAGES BY COMPOUND ENHANCING AND CRISP CLUSTERING FOR SECURITY SYSTEM

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ABSTRACT

Extracting finger vein patterns from infrared images is the most difficult part in finger vein authentication. Uneven illumination, varying tissues and bones, and changes in the physical conditions and the blood flow make the thickness and brightness of the same vein different in each acquisition. Accordingly, extracting finger veins at their accurate positions regardless of their thickness and brightness is necessary for accurate personal identification.

A new finger vein extraction method which is composed of gradient normalization, principal curvature calculation, and binarization. As local brightness variation has little effect on the curvature and as gradient normalization makes the curvature fairly uniform at vein pixels, our method effectively extracts finger vein patterns regardless of the vein thickness or brightness. In our experiment, the proposed method showed notable improvement as compared with the existing methods.

Keywords: Finger vein authentication, finger vein extraction, principal curvature, gradient normalization, biometrics.

1. INTRODUCTION

In recent years biometrics is widely functional to personal recognition and verification such as face fingerprints and iris recognition and verification system. But these features are located at the surface of the body and easy to change. Finger vein is an inner build-in pattern that has many advantages: uniqueness, stability and hard to manufacture. Although some researchers have done on finger vein but there are also some troubles:

Many finger vein network feature extraction are developed but the further work on the corresponding verification algorithms has not been done enough. The pattern of a vein is generated by the vein projected from three-dimensional to two-dimensional, so a small angle of rotation will cause the two dimensional pattern of image change, affecting the verification performance. The characteristic lines of the finger vein are not enough, even some girl's vein features are few. So it is difficult to determine the same ROI area, and use a small number of crossing points, or terminal points for matching is not perfect. So only using single finger vein pattern to authenticate is not enough.

2. RELATED WORK

Finger vein segmentation based on multi-channel even symmetric Gabor filters, Author says: Jinfeng Yang, Jinli Yang, Yihua Shi.,(2009) [1] In this paper a new approach to personal identification, finger-vein recognition is becoming an active topic in biometrics. And exploiting the fundamental features related to finger-vein networks has been measured as a reliable way for finger-vein recognition. However, finger-vein network segmentation always is a difficult task due to the low contrast of finger-vein images. This paper focuses on finger-vein enhancement and segmentation based on Gabor filters in the spatial domain. Considering the high random city of the finger-vein networks, a bank of even-symmetric Gabor filters with eight orientations is to begin with used to exploit vein information in images. Then, image renovation is implemented to generate an image containing an integrated finger-vein network. Finally, the finger-vein network is segmented using a proposed doorstep image method. Experimental results show that the proposed method is capable of enhancing and segmenting finger-vein networks reliably and effectively.

A method for capturing the finger-vein image using non uniform intensity infrared light: Author says: Dai, Yanggang; Huang, Beining; Li, Wenxin; Xu, Zhuoqun,(2010) [2] In this paper, In the finger vein authentication, one problem is that the variable finger brightness makes the veins unclear. For the same reason, it is difficult to get the intact finger-vein pattern which contains more features. developed an experimental rule to adjust the intensity of the light, which can solve the problem mentioned. Propose three criterions, the standard difference of the gray level, total time taken of the vein and the number of bifurcations, to judge the quality of the image. In our experiment, our method makes the brightness of the finger more uniform, thus the standard deviation of the gray level decrease by 48.4% on average. The numbers of two features, the veins and its bifurcations, increase by 44.1% and 31.4% respectively. Using our method, our have built a finger vein image database which has 600 images. Palmprint recognition using fisher-gabor feature extraction: Said Boussakta, (2012) [3] this paper presents a new approach for palm print recognition using a combined Fisher linear discriminate (FLD) and Gabor Wavelet responses. Gabor wavelets have properties of organism more robust to image illuminations, small translations limited rotations and have a superior feature representation in both spatial and frequency domains. On the other hand FLD seeks those projections that are efficient for data discrimination and produce well separated classes in low-dimensional subspaces. The new combined method involves convolving a palm print image with a series of Gabor wavelets at different scales and rotation before extracting features from the resulting Gabor filtered images. Linear discriminate analysis is then applied to the feature vectors for dimension reduction as well as class reparability. Experiments show that the proposed method yields a high classification rate even when using a simple classifier when compared with other popular approaches reported in the literature.

3. EXISTING CURVATURE-BASED FINGER VEIN EXTRACTION METHODS

One of the most popular methods for finger vein extraction is the method by Miura et al. which uses local maximum curvatures in cross-sectional profiles of a vein image. This method is known to show better performance than others including the matched filter method or the line-tracking method.

Among other methods, Song's recent work which uses the mean curvature of the vein image concentration showed remarkable performance improvement in comparison with the line-tracking method. Although Song did not directly compare his method with Miura et al.'s method, we deduce from their comparison results comparative to the line-tracking method that the performance of the Song's method is quite comparable to or slightly better than Miura et al.'s by comparing their performances.

As we think that abovementioned curvature-based methods, Miura et al.'s and Song's, are two of the better finger vein extraction methods existing, we introduce them here and take them as the methods for performance comparison.

4. PROPOSED FIGER VEIN EXTRACTION METHOD

4.1 Overview of the proposed method

- A new finger vein extraction method comprising three steps, namely, gradient normalization, principal curvature calculation, and binarization.
- The curvature of the intensity profile is little influenced by the local brightness variation and made quite uniform among vein pixels by gradient normalization. Owing to these facts.
- Our method effectively extracts finger vein patterns regardless of the vein thickness or brightness.

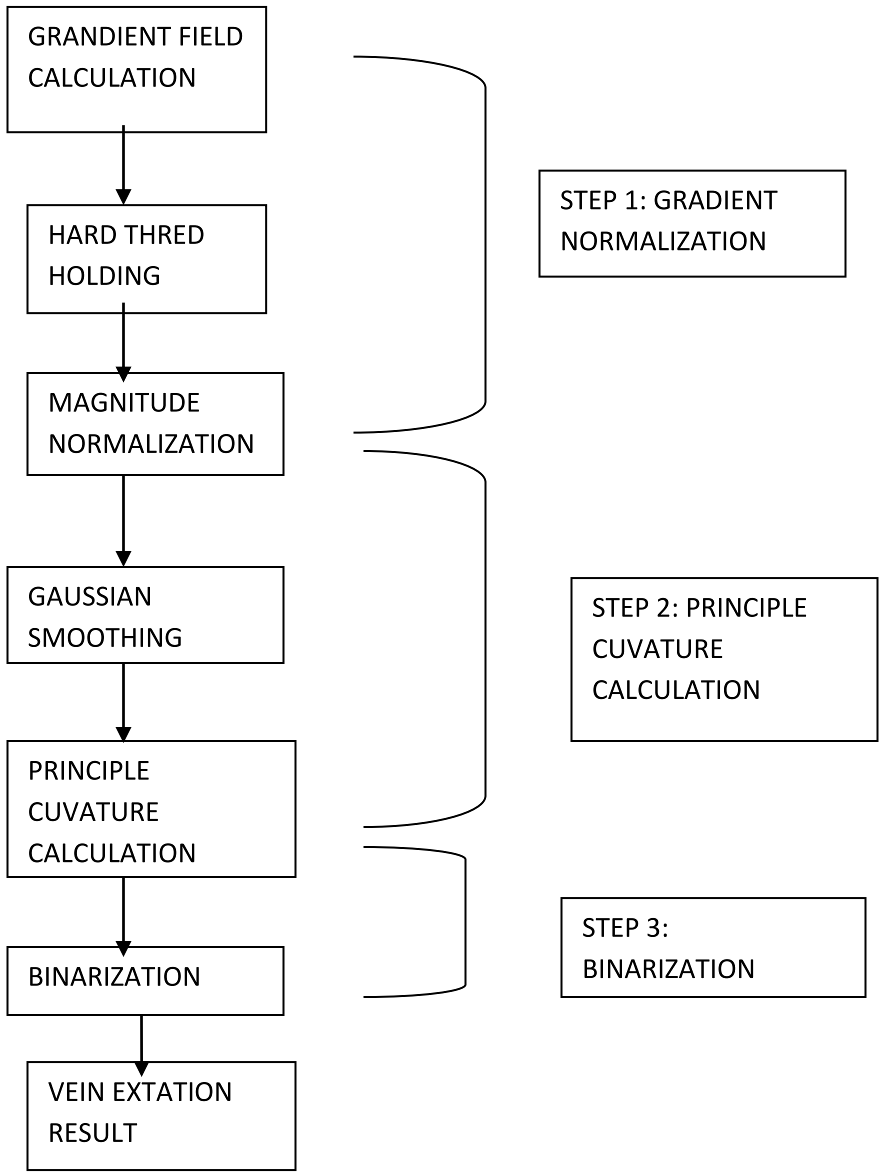

Fig. 2. Flow Diagram of the proposed vein extraction method

Step 1: Gradient normalization

An infrared image of a finger has local brightness variation caused by uneven illumination or varying tissues and bones. Furthermore, changes in the physical conditions and the blood flow make the thickness and brightness of the same vein appear different on each acquisition.

Step 2: Principal curvature calculation

Extracting the maximum curvature points in image profiles is similar to what is described above. However, the proposed method yields more precise results than Miura et al.'s because the proposed calculates the "real" maximum curvature regardless of the vein directions, while Miura et al.'s calculates the maximum curvatures among only four directions. Song's method using the divergence of gradient is also similar to the proposed method in that both are based on the curvature of the intensity surface. However, Song's method uses not the principal curvature but the mean curvature, which is defined as the mean of the two eigen values of the Hessian. As veins have tubular shapes, the minimum curvature $^{2}\lambda$ at each point in the vein region is very low.

Step 3: Binarization

Existing finger vein extraction methods apply binarization for efficient matching. We also binarize the maximum curvature values using the Otsu's method

ADVANTAGE

Over other biometrics is the low risk of forgery or theft, due to the fact that finger veins are not normally visible to others. Finger vein patterns are quite unique to the owners

5. EXPERIMENTAL RESULTS

5.1.1 Finger-vein ROI localization

The middle phalanx of a finger makes the finger activities possible. And a functional inter phalange joint organ is constituted by several components. Obviously the density of synovial liquid filling in the clearance between two cartilages is much lower than that of bones. This make possible that more lights penetrate the clearance region when a near infrared LED array is placed over a finger. Thus a brighter district may exist in the CCD image plane. Actually, the clearance of a finger inter-phalange joint only is with 1.5-2 mm width. Hence, the brighter region can be substituted by a line with a pixel width. Finger-vein information in multi-scale and multi-orientation. Finally to improve the reliability of identification, finger-vein features are extracted in Gabor transform domain and a fusion method in conclusion level is adopted. Experimental results show that the proposed method performs well in individual identification.

5.1.2 Finger-vein imaging system

In anatomy, finger veins lie beneath epidermis, and forma network spreading along a finger in a high random manner. Since they are internal, visible lights usually are incapable of imaging them. Thus, illuminating the subcutaneous region of a finger properly is an important task of vein visualization.

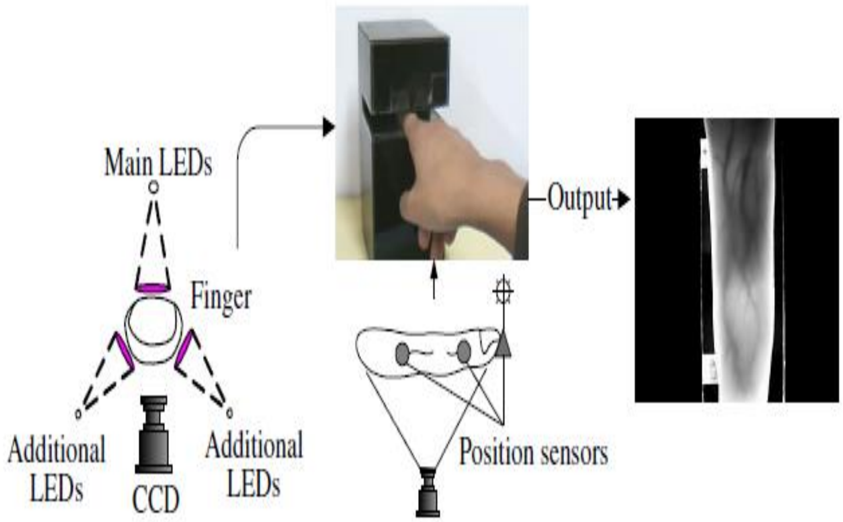

Fig. 3 The proposed principle of a homemade finger-vein imaging system

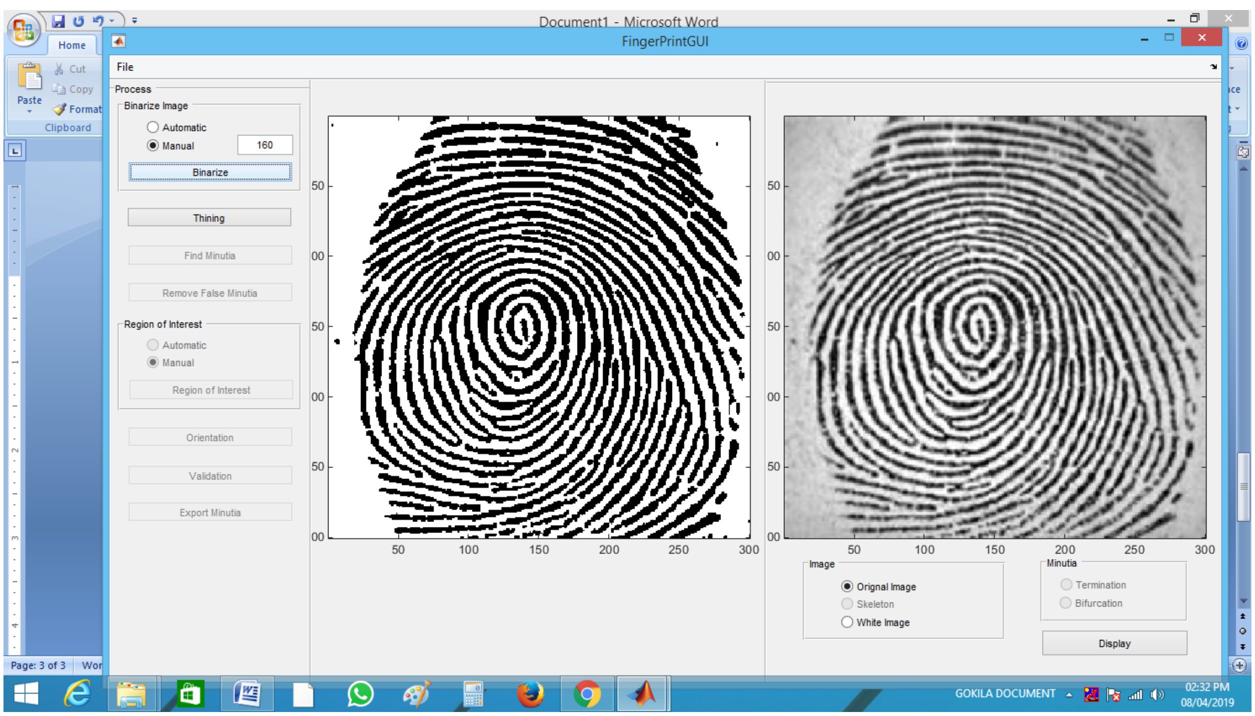

Fig. 5.1 Binarization

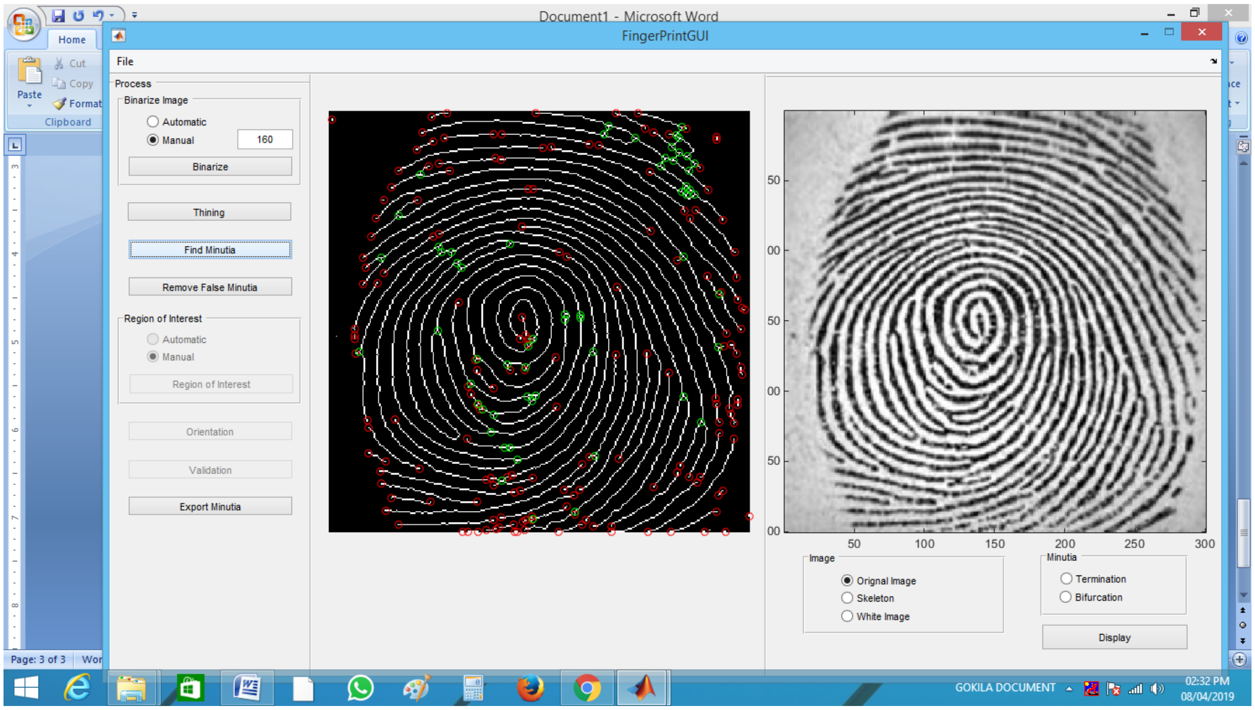

Fig. 5.2 Neighborhood image

6. CONCLUSION

- A new finger vein extraction method with the three main functional blocks: gradient normalization, principal curvature calculation, and binarization.
- As the influence of local brightness variation on the curvature is insignificant and as fairly uniform curvatures can be obtained at vein pixels through gradient normalization
- Their method yielded rather high EER in our experiment. The difference in experimental result is caused by the lower quality of infrared finger images in our database.
- Our finger vein sensor is a fully contactless type, while the sensor used in has the parts that guide the finger into a correct position in each acquisition.

7. REFERENCES

[1] Choi, J.H.; Song, W.; Kim, T.; Lee, S. & Kim, H.C. (2009). Finger veinextraction using gradient normalization and principal curvature. *Proceedings of the SPIE*, Vol.7251, pp.1-9,ISBN 978-0-8194-7501-5, San Jose, USA, January 21, 2009

[2] Delac K. and Grgic M. , "A survey of biometric recognition methods," Proc. ELMAR, 184-193 (2004).

[3] Gray, A. , [Modern Differential Geometry of Curves and Surfaces with Mathematica], CRC Press, Boca Raton, 363- 367 (1997).

[4] Hoover, A., Kouznetsova, V. and Goldbaum, M. , "Locating blood vessels in retinal image by piecewise threshold probing of a matched filter response, " IEEE Trans. Med. Imaging, 19(3), 203-210 (2000).

[5] Mariño, C., Penedo, M. G., Penas, M. and Carreira, M. J. , "Personal authentication using digital retinal images," Pattern Anal. Applic., 9(1), 21-33 (2006).

[6] Miura, N., Nagasaka, A. and Miyatake, T. , "Extraction of finger-vein patterns using maximum curvature points in image profiles, " IEICE Trans. Inf. & Syst., 90-D(8), 1185-1194 (2007).

[7] Miura, N., Nagasaka, A. and Miyatake, T. , "Extraction of finger-vein patterns based on repeated line tracking and its application to personal identification," Mach. Vis. Appl. 15(4), 194-203 (2004).

[8] Mulyono D. and Horng S. J. , "A study of finger vein biometric for personal identification," IEEE Int. Sym. On Biometrics and Security Technologies, 23-24, 1-8 (2008)

[9] Otsu, N. , "A theshold selection method from gray-level histograms," IEEE Trans. Sys., Man., Cyber.,9 ,62–66 (1979).

[10] Song, W. , "Finger-vein identification system using level set curvature," M. S. Thesis, Seoul National University (2008).

[11] Yanagawa, T., Aoki S. and Ohyama T, "Human finger vein images are diverse and its patterns are useful for personal identification," MHF Preprint Series, Faculty of Mathematics, Kyushu University, Fukuoka (2007).

[12] Yang, J.F.; Shi, Y.H. & Yang, J.L. (2009). Finger-vein Recognition Based on a Bank of Gabor Filters. *Proceedings of Acian Conference on Computer Vision*, pp.374-383, ISBN 978-3-642-12306-1, Xi'an, China, September 23-27, 2009