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손정맥 패턴 추출에 관한 연구

김종석 *, 백한욱, 정진현
광운대학교 제어계측공학과

A Study of the extraction of a Hand Vein Pattern

Jong Seok Kim, Han Wook Baek, Chin Hyun Chung
Dept. of Control & instrumentation Engineering. Kwangwoon Univ.

Abstract - Biometrics is the electronic recognition of individuals achieved through a process of extracting, and then verifying, features which are unique to that individual. This field is rapidly evolving technology that has to be widely adopted in a broad range of applications. Many methods have been studied such as extraction of the facial features, the voice, the vein and even a person's signature. Among biometrics, a hand veins provide large, robust, stable, hidden biometric features. Hand vein patterns have been proven to be absolutely unique by Cambridge Consultants Ltd. Because of this advantage, hand vein recognition are recently developing field in the field of a security.

1. Introduction

Biometrics refers to the automatic identification of a person based on his/her physiological or behavioral characteristics. This method of identification is preferred over current methods involving passwords and PIN numbers for various reasons: the person to be identified is required to be physically present at the point-of-identification; identification based on biometric techniques obviates the need to remember a password or carry a token. With the increased use of computers as vehicles of information technology, it is necessary to restrict access to sensitive/personal data. By replacing PINs, biometric techniques can potentially prevent unauthorized access to or fraudulent use of ATMs, cellular phones, smart cards, desktop PCs, workstations, and computer networks. PINs and passwords may be forgotten, and token based methods of identification like passports and driver's licenses may be forged, stolen, or lost. Thus biometric systems of identification are enjoying a renewed interest. Various types of biometric systems are being used for real-time identification. Fingerprint, a voice, a vein, and a facial recognition belong to biometrics. Biometric technologies should be used to provide individuals with enhanced privacy, security, and convenience. Vein biometric systems produce unique and private identification templates for users and present large, robust, stable and largely hidden patterns. Subcutaneous features can be conveniently imaged within palm of the hand. And vein patterns are within you, people don't leave them around nor can they be easily observed like Iris patterns or faces. Vein structures are not easily covertly captured or reproduced like other biometric traits. Because of this merits, the study of vein recognition are active progress. In this paper, extraction of hidden vein pattern treat mainly. And directional morphology are used template matching for a personal identification.

2. Extraction and Enhancement of a Hand Vein Image

In order to extract avaliable data, variable appropriate processing processes are applicates in a original image. In this section, optimum extraction algorithm is presented to verify through an actual experiment data.

2.1. Input Image

Obtaining input image by CCD is represent in Fig 1. Due to variable factor - change of illumination and position, spot noise and etc, this image always obtains differently. Because of the noise and information losses, there is a wide difference between input image and actual image. This losses yields a unsuitable result. To reduce losses, it is necessary to enhance a image.

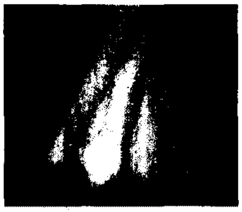


Fig 1. Input vein image

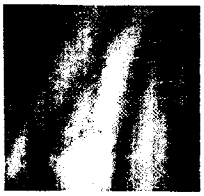
2.2. Image Enhancement

A difference of gray-level between the vein image and the background of the hand images is used in a avaliable data region extraction method. This processing reduces computation volume. It's represent in Fig.2 (a). And Hands have a lot of hair and mole. Gaussian lowpass and high-boost filter is used to reduce the noise component. The oriented Gaussians are given by

$$G(x,y) = \exp\left(-\frac{(x\cos\theta + y\sin\theta)^2}{2\sigma x^2} - \frac{(-x\sin\theta + y\cos\theta)^2}{2\sigma y^2}\right)$$

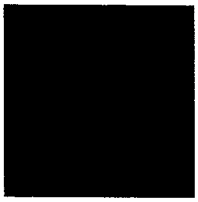
where σ_x and σ_y control the width of the Gaussian filter in the x and y directions respectively and θ

determines the orientation. Gaussian lowpass filter eliminates a hand hair and 'mole in a hand vein image. High-boost filter enhances edge component of veins.



(a)avaliable data region

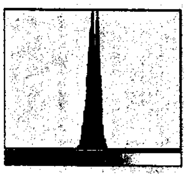
(c)Gaussian lowpass filtered image



(c)High-boost filtered imges

Fig 2. De-noised hand vein image

Since the image denoised is low-contrast, the equalization processing is needed. In order to extract the valid vein pattern from input-image, in this paper, the difference of gray-level between the vein pattern and hand-skin. The contrast of image can be higher by the equalization, with thresholding adaptively, the image can be simplified to binary image. Fig 3. shows that histogram equalization and thresholding are applied.



(a)Histogram of high-boost filtered image

(b)Histogram of equalization image

(a)Equalized image

(b)Thresholding image

Fig 3. Histogram Processing

3. The Skeletonizing Algorithm

Region points are assumed to have value 1 and background points to have 0. The method consists of successive passes of two basic steps applied to the contour points of the given region, where a contour points is any pixel with value 1 and having at least one 8 neighbor valued 0. With reference to the 8 neighborhood definition shown in Fig 4. Step 1 flags a contour points p for deletion if the following conditions are satisfied.

(a) $2 \leq N(p1) \leq 6$;
(b) $S(p1)=1$;
(c) $p2 \cdot p4 \cdot p6=0$
(d) $p4 \cdot p6 \cdot p8=0$;

where N(p1) is the number of nonzero neighbors of p1; that is,

$$N(p1)=p2+p3+p4+ \cdots +p8+p9$$

p9	p2	p3
p9	p1	p4
p7	p6	p5

Fig 4. Neighborhood arrangement used by the thinning algorithm

and S(p1) is the number of 0-1 transitions in the ordered sequence of p2, p3 , $\cdots$, p8, p9, p2.
In step 2, conditions (a) and (b) remain the same, but conditions (c) and (d) are changed to

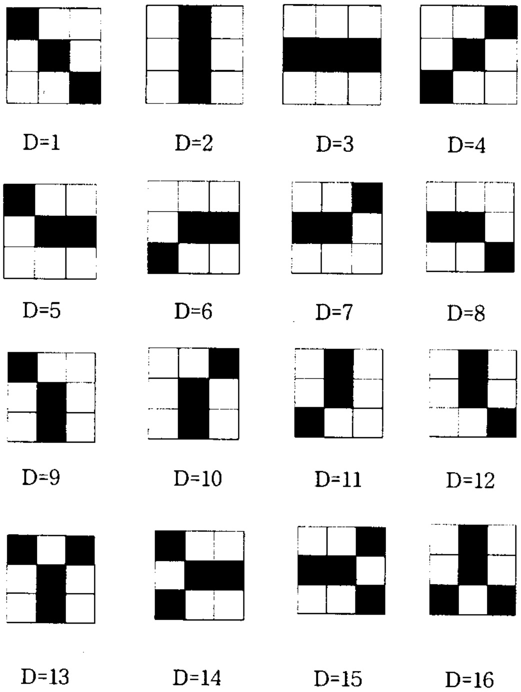
(c') $p2 \cdot p4 \cdot p8=0$;
(d') $p2 \cdot p6 \cdot p8=0$.

Thus one iteration of the thinning algorithm consists of (1) applying step 1 to flag border points for deletion; (2) deleting the flagged points;(3) applying step 2 to flag the remaining border points for deletion; and (4) deleting the flagged points. This basic procedure is applied iteratively until no further points are deleted, at which time the algorithm terminates, yielding the skeleton of the region. Applying this algorithm in a thresholding image, a hand vein image for template matching are acquired. Fig.5 shows the hand vein pattern.

Fig 5. Hand vein pattern image

4. Directional Morphology

Directional morphology gives a direction to morphological structure element. The hand vein patterns are mainly composed of the basic morphology. D indicate structural element labels. 16-directional morphologies is proposed. Each pattern mask is scanned over the entire input image and mask is compared with the input image. This processing extracts only pattern region and obtains pattern information.



5. Conclusion

The hand vein patterns are not revealed in the surface. And, Improving recognition rates in a hand vein recognition depends on how-well extracting vein patterns - how clean and exact patterns. Namely, Because of hidden pattern, preprocessing are more important than other biometric recognition.

This paper uses infrared LED in illumination and various preprocessing methods are implement. Through implementation, a suitable processing method and result can be obtained. Based on Acquired data through this implementation, realization of the hand vein recognition system is an object from now on.

[Reference]

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