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Palmprint recognition system using an Association extraction methodology of Principal lines

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ABSTRACT
Biometric system uses technology of pattern recognition which makes identification by determining the authenticity of specific behavioral or physiological characteristics possessed by an individual. Human palm is used as biometric measure to identify an individual because of its unique, stable, discrete and multiple features such as principal lines, wrinkles, ridges, minutiae. The principal lines which are one of the static and important features in palmprint images can provide effective information for application of palmprint technology. In this paper we had an overview of our proposed work of recognition techniques on principal lines based extraction methods. Niblack's method is used for segmentation, while SUSAN's operator is used as complementary operator for more accurate results. These two methods are complementary algorithm and can yield a better extraction of principal lines.

I. INTRODUCTION

A palm is the inner surface of the hand from the wrist to the base of the fingers. The inner surface of the palm normally contains three flexion creases, secondary creases and ridges. The flexion creases are also called principal lines and the secondary creases are called wrinkles. The flexion and the major secondary creases are formed between the third and fifth months of pregnancy [1]. It has distinct and multiple features, each feature can be used to identify an individual as it is unique for every person. Detection of palm lines is basically an edge identification issue. Edges are projected due to the gradient change in intensity.

II. EXTRACTION OF REGION OF INTEREST

1. Binary Thresholding method

Binarization is an essential step in image preprocessing. In this the image is converted from a gray scale image to a binary form. This method is used to extract the required region from background. By using mode method [2] a threshold is determined by determining a local minimum between two local maxima in the histogram of a grayscale image. When a grayscale value is lower than this threshold, we set the pixel. value as '0'; otherwise, the pixel value is set '255' to segment the palm shape.

2. Inner Border Tracing Algorithm

The inner border tracing algorithm [2] is adopted to trace the shape of a palm. In the beginning, the starting point Wm is set at the middle point of the intersection line segment formed by the wrist and the bottom margin of the palm shape. Then, all contour pixels of the palm shape are traced in the anti-clockwise direction. The eight neighboring directions are applied to describe the relative position of those traced points more precisely. The coordinates of contour pixels would be recorded sequentially as p1, p2, p3. . . . pn.

3. Finger-webs locating

As we determined Wm and p (i), now we can calculate the Euclidean distance between the middle wrist point and each contour point to draw a distribution diagram. The pattern of the diagram is similar to the geometric shape of a palm. To meet the speed and reliability requirements, a contour and curvature based method [3] is adopted to find the location of the four finger-webs. The locations of the second and the fourth finger-webs are selected as the reference points to determine the ROI from the palm region

III. EXTRACTION METHODOLOGY

After the region of interest extraction we now concentrate on acquiring the features of palmprint. Principal lines extraction is capable of providing valuable information for low resolution palmprint

images. The individual difference of principal lines with respect to width, shape and depth is more complex for the distribution of combination three main lines. All of these factors bring major difficulty to extraction work.

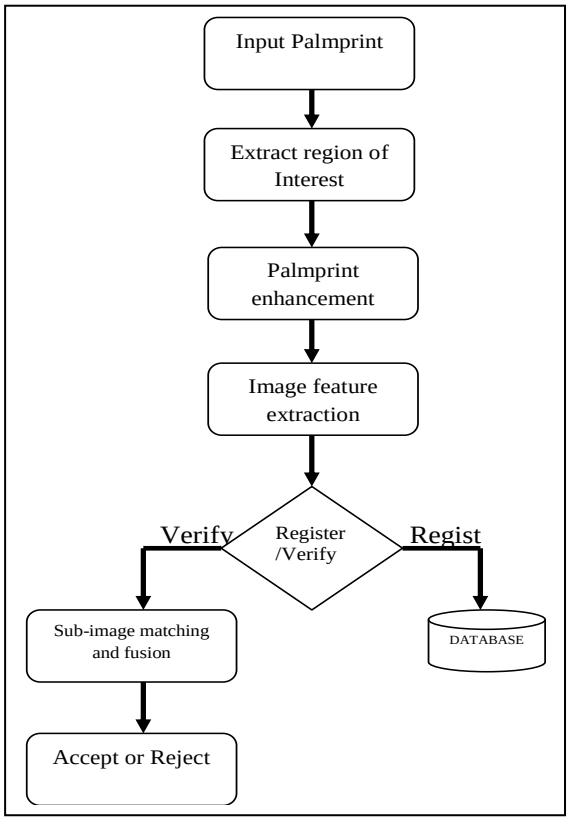

Fig. proposed methodology

Along with all these disadvantage principal lines have some advantage which make them useful for extraction. Firstly features of principal lines are so evident that it hardly affected by lighting and other acquisition conditions Secondly, it can effectively keep detail characteristics both in the high and low resolution palm images. In addition, the principal lines are relatively stable and less likely to be transmuted by skin attritions and scars. For medical palmprint images, Cheng produced a palmprint and principal lines extraction method [6] based on wavelet modulus maxima and multi-resolution wavelet analysis

In this paper we used idea that principal lines are separated from coarse extraction [4]. For this design, Niblack's and SUSAN operator were made use of complementary advantage between each other to extract principal lines which result in accurate shape, width and positioning. Figure 1 shows the proposed flow of used methodology. Figure 2 shows the extraction methodology flow.

In 2010 the dynamic threshold algorithm of Niblack's method has been applied in palm vein images [7]. Basically niblack's method use the local threshold values of each pixel[1]. It firstly designs a moving rectangular window, then the threshold T is depend on the local mean m and the standard deviation s of all pixels under the mask as shown

$$T(x,y) = m(x,y) + k \times s(x,y)$$

where (x, y) is pixel coordinates, k is correction factor, the $m(x, y)$ and $s(x, y)$ are expressed as follows:

$$m(x,y) = \frac{1}{l} \sum_{i=x-l/2}^{x+l/2} \sum_{j=y-l/2}^{y+l/2} I(i,j)$$

$$s(x,y) = \sqrt{\frac{1}{l} \sum_{i=x-l/2}^{x+l/2} \sum_{j=y-l/2}^{y+l/2} (I(i,j) - m(x,y))^2}$$

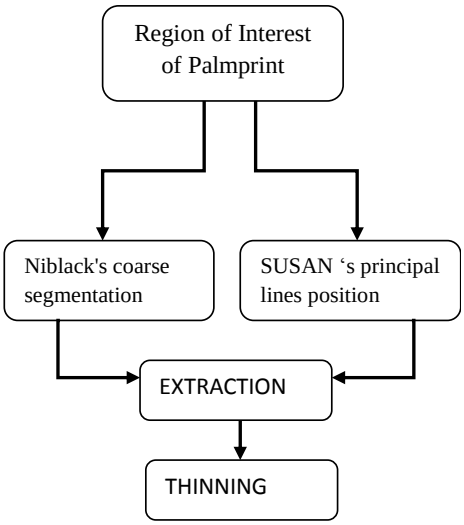

Fig. Extraction methodology

Where I is palmprint image and l is the length of rectangular window. The number of l should be suited for extraction based on the size of the principal lines. Because palmprint is located in low gray pixels, so the pixel is set to 1 if it lower than the threshold value T, and the other pixels are 0 [4].

Using this method palmprint structural information is extracted correctly from original image. But there are some fake palmprint lines in it, because the Niblack's method is tend to produce noise in non-texture regions. So SUSAN operator is used to locate principal lines so that the fake lines noise could be moved out from coarse extraction [4].before applying SUSANS operator closing residue transform is applied which can detect gray valleys that will increase extraction constancy of SUSAN algorithm.

The SUSAN edge detector isotropic responses and wide line detect function is suitable for palmprint images. The SUSAN edge detector requires designing one mask for calculation of each pixel, which approximates to circle Firstly, the center of mask which called nucleus slides to each point corresponding with pixel of image then the comparison function between nucleus and its neighborhood within mask is given as the following.

$$c(r, r_0) = \exp\left[\left(\frac{I(r) - I(r_0)}{t}\right)^6\right]$$

I (r0) is the gray value of center mask, I (r) is the grey value of other pixels within mask, c is the comparison results, and t is gray difference parameter by artificial setting[5].

$$t = a\left(\left|\frac{1}{n}\right|\sum_{i=1}^{N} I_{min} - T_{Ostu}\right)$$

This equation computes t by the subtraction of average grey of palmprint and background. The Imin is the minimum grey value, a is adjustment parameter TOstu is on behalf of average grey value of background[1]. After computing the comparison results by nuclear and other points within the mask, an equation is given to count SUSAN's area n of this nuclear as

$$n(r_0) = \sum_r c(r, r_0)$$

$$R(r_0) = \begin{cases} n(r_0) - g & n(r_0 > g) \\ 0 & \text{Otherwise} \end{cases}$$

Where R(r0) is the initial edge response results, and g also set as nmax. nmax is the maximum value of n. The pixels whose value is zero would be reserved as the regions of the principal lines. The small connections between areas are considered that it is more likely to be noise rather than principal lines. So it would be removed after image binarization[1]. In this way we get the processed features of principal lines using Niblack's and Susans Method. For better and accurate result thinning procedure is applied.

IV. CONCLUSION

In this paper we adopted coarse segmentation method which is obtained by Niblacks method, SUSAN operator was applied to limit principal lines range as position result. The thinning algorithm can also be adopted for better result. To achieve the stability and fine principal lines the work can be extended by use of different filters. This is helpful for noise removal and accuracy enhancement.

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