신경회로망을 이용한 지문인식방법에 관한 연구

A Study on the Fingerprint Recognition Method using Neural Networks

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ABSTRACT

In this paper we have presented approach to automatic the direction feature vectors detection, which detects the ridge line directly in gray scale images. In spite of a greater conceptual complexity, we have shown that our technique has less computational complexity than the complexity of the techniques which require binarization and thinning. Afterwards a various direction feature vectors is changed four direction feature vectors. In this paper used matching method is four direction feature vectors based matching. This four direction feature vectors consist feature patterns in fingerprint images. This feature patterns were used for identification of individuals inputed multilayer Neural Networks(NN) which has capability of excellent pattern identification.

Ⅰ. INTRODUCTION

In this paper, a fingerprint identification method using neural networks and the direction feature vectors based on the directional image extracted from gray-scale fingerprint image is proposed. In this paper proposed, where the direction feature vectors are extracted directly from the gray-scale image without binarization and thinning

The basic idea of the above mentioned method is to track the ridge lines on the gray-scale image, by "sailing" according to the local orientation of the ridge pattern. A set of starting points is determined by superimposing a grid on the gray-scale

image ; for each starting point, the algorithm keeps following the ridge lines until they terminate or intersect other ridge lines (direction detection). A labeling strategy is adopted to examine each ridge line only once and locate the intersections between ridge lines. After the direction feature vectors is consisted of vectors by four direction labeling. Matching method used in this paper is four direction feature vectors based matching. In this paper is proposed the use of Neural Networks(NN) in fingerprint matching.

In section 2, which discusses the direction feature vectors detection algorithm. In section 3, discusses Four Direction Labeling and Pattern Detection. In section 4, discusses the result of fingerprint matching. Finally, in Section 5 some conclusions are drawn.

II. Direction Feature Vector Detection

Let I be an a×b gray-scale image with gl gray levels, and gray(i,j) be the gray level of pixel (i,j) of I, i = 1,....a, j = 1,...b. Let z = S(i,j) be the discrete surface corresponding to the image I: S(i,j) = gray(i,j), i = 1,...a, j = 1,...b. By associating bright pixels with gray levels near to 0 and dark pixels with gray levels near to gl-1, the fingerprint ridge lines (appearing dark in I) correspond to surface ridges, and the spaces between the ridge lines (appearing bright in I) correspond to surface ravines(Fig.1)

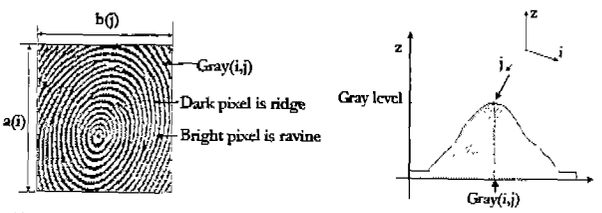
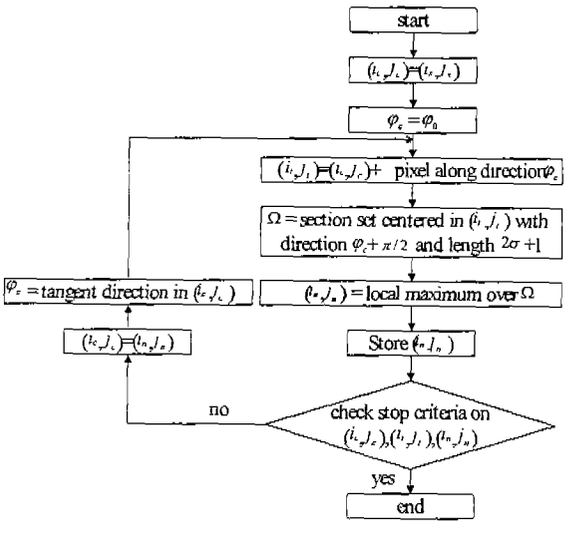


Fig. 1 a×b gray-scale fingerprint image

From a mathematical point of view, a ridge line is defined as a set of points which are local maxima along one direction. The ridge-line extraction algorithm attempts to locate, at each step, a local maximum relative to a section orthogonal to the ridge direction. By connecting the consecutive maxima, a polygonal approximation of the ridge line can be obtained

Let (i_s, j_s) be a local maximum of a ridge line of I, and φ_0 be the direction of the tangent to the ridge-line in (i_s, j_s); a pseudo-code version of the ridge-line following algorithm is :



III. Four Direction Labeling and Pattern Detection

I shall begin with four direction labeling. This algorithm steps, a various direction feature vectors of 360° is changed four direction labeling. In principle, each vector is computed simply by determining conditional : using an angle value of the direction feature vector. Fig. 2 show the coordinates which are four direction labeling. Labeling of coordinates, 0° = direct1, 45° = direct2, 90° = direct3, 135° = direct4. The direct1 is the direction feature vectors of 0° ~ 22.4° or 157.5° ~180° . The direct2 is the direction feature vectors of 22.5° ~67. 4° . The direct3 is the direction feature vectors of 67.5° ~112.4° . The direct4 is the direction feature vectors of 112.5° ~ 157.4° .

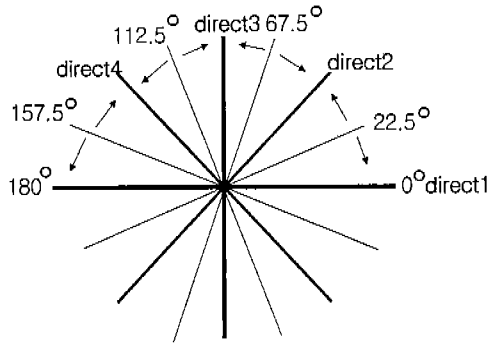


Fig. 2 Four direction labeling coordinates

In this explained, making fingerprint feature pattern of four direction labeling. A fingerprint image is divided on blocks the size of 15×15 pixels. At each block is labeling. Let 128×128 fingerprint image is consisted of 49 blocks. At each blocks, the direction vector is expressed label value(Fig. 3). All the blocks is consisted of label values. Therefore, a fingerprint image is built up of feature vector pattern using 49 direction label value.

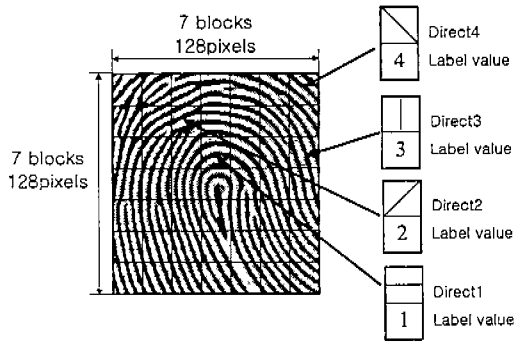
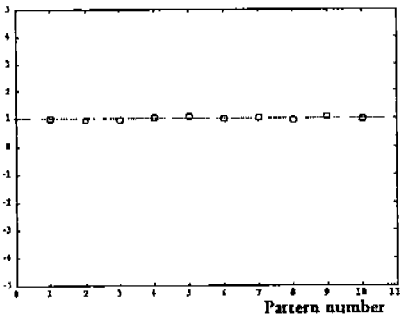


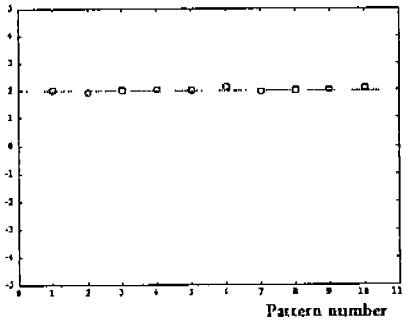
Fig. 3 A fingerprint image is divided on blocks the size of 15×15 pixels.(128×128 Image, At each blocks, show label value)

Ⅳ. Experimental Results

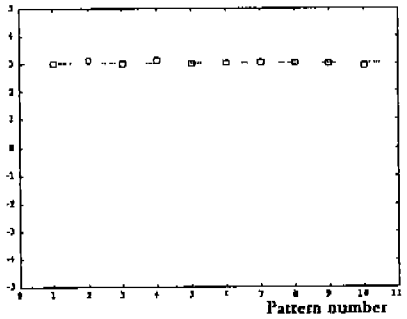
In experimental, preference step1, four fingerprint images are detected as various direction feature vectors, and step2, a various direction feature vectors are changed Four direction feature vectors, and step3, the direction feature vectors are labeling, and step4, registered for matching system(neural networks) labeling each fingerprint images for number: in experimental, whorl registered to number1, arch registered to number2, right loop registered to number3, left loop registered to number4. Step5, Matching experimental using label feature patterns of each fingerprints. Fig. 4 shows matching results. As shows experimental results is presented very good capability.



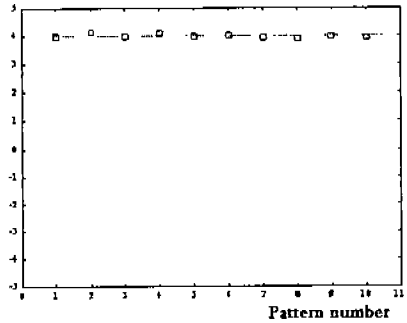
(a) Whorl is number 1



(b) Arch is number 2



(c) Right loop is number 3



(d) Left loop is number 4

Fig. 4 Results for feature pattern matching

V. Conclusion

In this paper, a fingerprint identification method using neural networks and the direction feature vectors based on the directional image extracted from gray-scale fingerprint image is explained. In spite of a greater conceptual complexity, we have shown that our technique has less computational complexity than the complexity of the techniques which require binarization and thinning. We experinented identification using multilayer Neural Networks (NN) which has capability of excellent pattern identification. The experiment results, error rate was not which mistaken identification a fingerprint not resigistered of a fingerprint registered, and error rate presented 1.8% which mistaken identification a fingerprint resigistered of a fingerprint not registered.

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