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FINGERPRINT RECOGNITION BY USING EXTRACT LEVEL3 FEATURE

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Abstract

Fingerprint identification and recognition are considered popular technique in many security and law enforcement applications. Many systems rely on the matching of fingerprints using various methods and algorithms based on find position pores. In this paper, Level 1 features are defined by fingerprint ridge flow and general morphological information, e.g. ridge orientation field, ridge pattern types, and singular points. These features are not very unique to each finger and are thus mostly used for fingerprint type classification and indexing. Level 2 features refer to individual fingerprint ridges and fingerprint ridge events, including minutiae, dots, incipient ridges, etc. There are two prominent types of minutiae, i.e. ridge endings and ridge bifurcations. Level 2 features are generally believed to be discriminative, stable, and robust. As a result, commercial fingerprint systems are primarily based on the minutiae features. Level 3 features are defined as fingerprint ridge dimensional features. Pores and ridge edge shapes are typical level 3 features, their position and their type (open and closed) are detected. All they are considered as an important in matching phase by calculating number of pores found in the specified position.

Key words---Fingerprint recognition, Pores, Closet point algorithm.

1. Introduction

Recently, forensic science has had many challenges in many different types of crimes and crime scenes vary from physical crimes to cyber or computer crimes. Accurate and efficient human identification or recognition have become crucial for forensic applications due to the large diversity of crime scenes, and because of the increasing need to accurately identify criminals from the available crime evidences. Biometrics is an emerging technology that provides accurate and highly secure personal identification and verification systems for civilian and forensic applications. The positive impact of biometric modalities on forensic science began with the rapid developments in computer science, computational intelligence, and computing approaches. These advancements have been reflected in the biometric modality capturing process, feature extraction, feature robustness, and features matching. A complete and automatic biometric identification or recognition systems have been built accordingly [1].

2. Pores concept

Pores, also known as sweat pores, are located on finger ridges. They are formed in the sixth month of gestation due to the sweat-gland ducts reaching the surface of the epidermis. Once the pores are formed, they are fixed on the ridges; typically, there are between 9 and 18 pores along a centimeter of a ridge. A pore can be visualized as open on one print, but as closed on another print of the same finger depending on the finger pressure and whether it is exuding perspiration. a closed pore appears as an isolated dot on the ridge, while an open pore is connected to one or both of the two valleys surrounding it. As a result, the shape and size of pores can vary from one impression to another, and therefore only the pore, position is used in matching. The basic idea of the proposed pore extraction method is to model the spatial appearance of pores in fingerprint images and detect them via filtering the images with suitable matched filters. Along the ridge tangential orientation, the intensity profile across the pore has a Gaussian shape irrespective of whether it is open or closed as shown in figure (1(a) and 1.(b)). Based on this observation, an anisotropic pore model was established and an adaptive pore extraction algorithm was proposed [2].

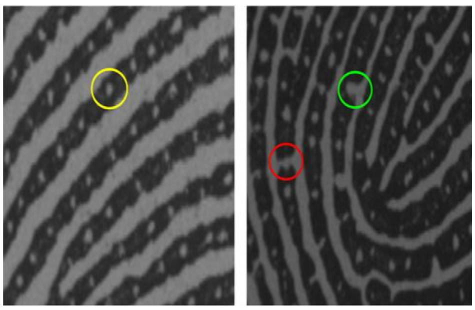

Figure (1) Type of pores

(a) close pores (b) open pores

in fingerprint images. These ridges and furrows present good similarities in each small local window, like parallel is mind average width **[**Kum10]. Fingerprints are not distinguished by their ridges and furrows, but by minutia, which are some abnormal

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points on the ridges (figure 1). A typical young male has, on an average, 20.7 ridges per centimeter while a female has 23.4 ridges per centimeter [Lee01].

3. Fingerprint Representation

A representation of fingerprint is classified into three parts:

i. Global Level Representation: - This type of representation is known as pattern, which is an aggregate characteristic of ridges, and minutiae points [Pat13]. The global level structures consist of many ridges that form arches, loops, whirls [3] as shown in figure(2).

Figure (2) Global level representation

ii. Local Level Representation: - Local representation consists of several components within a restricted region in the fingerprint which are unique features found within the pattern that is used for unique identification. In the local level, the ridges and valleys pattern can exhibit a particular shape called minutia. There are several types of minutiae, two types of minutiae are considered: ridge ending and ridge bifurcation as shown in figure (3) [4].

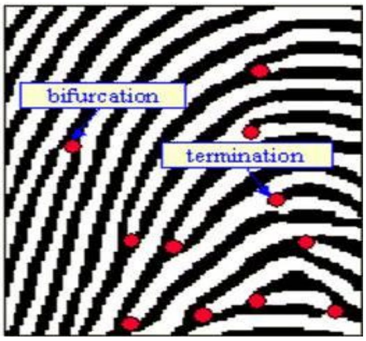

Figure (3) Local representation

iii. Very Fine Level Representation: - A small point which is called pore is sometimes opening and closing in the skin as shown in figure (4) [4].

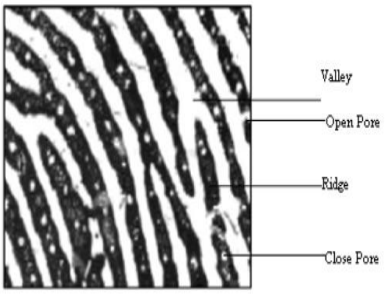

Figure (4) Very Fine Level Representation

4. Pore Detection

Based on their positions on the ridges, pores can be divided into two categories: open and closed. A closed pore is entirely enclosed by a ridge, while an open pore intersects with the valley lying between the two ridges. However, it is not useful to distinguish between the two states for matching since a pore may be open in one image and closed in the other image, depending on the perspiration activity. One common property of pores in a fingerprint image is that they are all naturally distributed along the friction ridge. As long as the ridges are identified, the locations of pores are also determined, regardless of their being open or closed as show in figure(5)

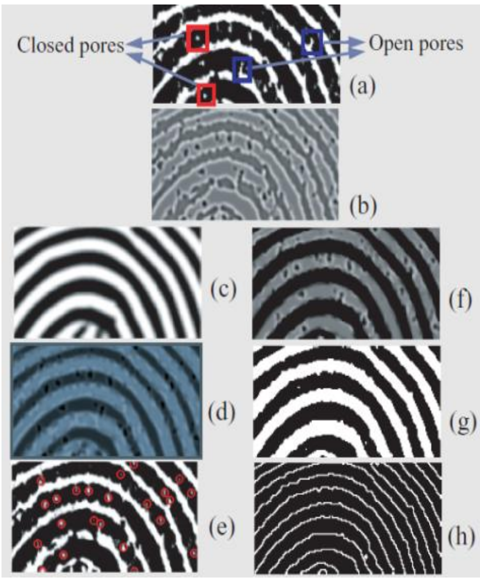

Figure (5)

6. The proposed System

The preprocessing stage is considered as a necessary step in the reliable model since extraction and matching stages depends greatly upon the quality of the input fingerprint image. Therefore a preprocessing should cover three main steps .The model used The dilation process for removing the weak pores. A

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global binarization is applied on the gray level image; that is based on the minimum and maximum contrast
.

6.1 Preprocessing

The phase which has been analyzed using various image preprocessing stages is shown in figure (6). Each step of this phase has described in details.

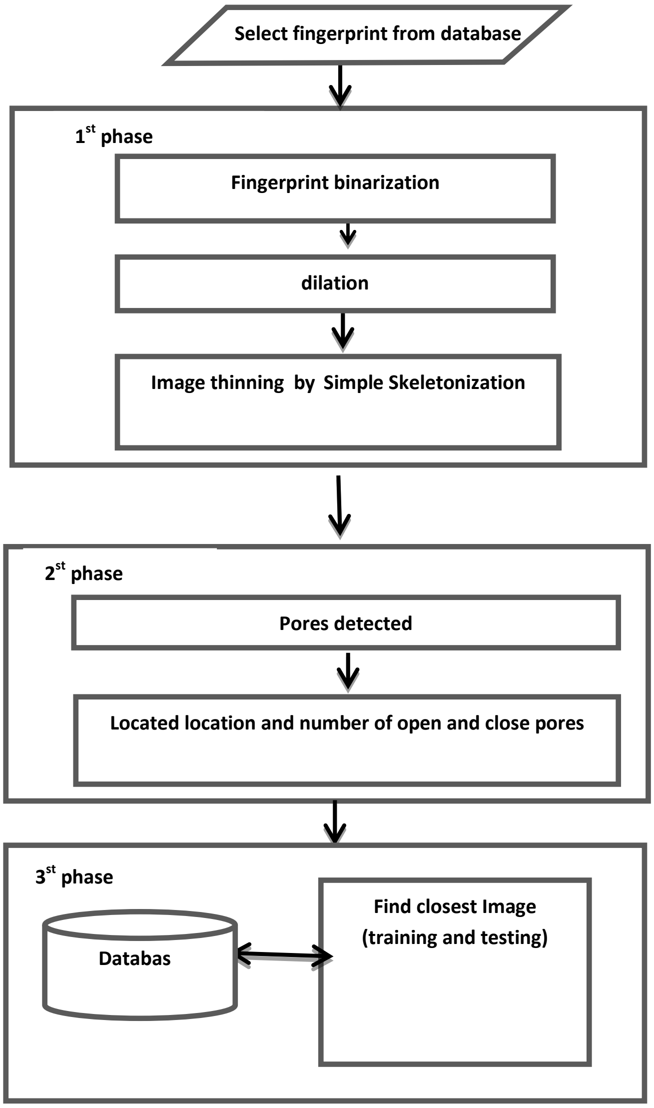

figure (6) Phase describe details

6.2 Select Fingerprint Image

The fingerprint image is served to the model as a (JPEG) image file. The image data is loaded form database and then used to compute the gray image.

6.3 Image Binarization

The selected threshold used to convert gray image to black and white is chosen manually, and it is choose gray image represents the red, green and the blue color components of the pixels in an image take the same value between 0-255. Hence the model fixed value by trailed and error threshold values 128 will be chose using the gray value component, threshold. A simple output is a jpeg image which consists of only two gray levels (black and white), then the output is a binary image in which black generally represents the foreground pixels or the pixels of interest and white represents the background pixels.

Figure (7) Image Binarization

6.4 Morphological operation

Such as dilation and erosion are approach the preprocessed image.

I. Image Dilation Process

The dilation process is performed by laying the window on the image and sliding it across the image, is used to thicken the edges in order to eliminate weak pores as shown in figure(8)

Figure (8) Dilation Process

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II. Image Erosion Process

The erosion process is similar to dilation, but turns pixels to 'white', not 'black as shown in figure (9)

figure (9)Erosion Process

III. Simple Skeletonization:

Skeletonization is a process for reducing foreground regions in a binary image to a skeletal remnant that largely preserves the extent and connectivity of the original region while throwing away most of the original foreground pixels. The skeleton can be produced in two main ways. The first is to use some kind of morphological thinning that successively erodes away pixels from the boundary (while preserving the end points of line segments) until no more thinning is possible, at which point what is left approximates the skeleton. The alternative method is to first calculate the distance transform of the image. The skeleton then lies along the singularities (i.e. creases or curvature discontinuities) in the distance transform. the same as the distance transform but with all points off the skeleton suppressed to zero as shown in figure (10).

Figure (10) Simple Skeletonization process

7. Feature extraction

In this stage, a set of features is extracted. So, an array of values for each feature over the whole image is obtained. Generally, this process includes extracting features from level2

A. Pores extraction

Level 3 feature's type is based on pores found on ridges of fingerprint image, the number of both types of pores (closed and opened) is calculates. Figure (11) shows a sample of result after extracting these pores. Two types of extracted pores appears, they are closed and open pores. In this thesis, red color is used to represent closed pores, while blue colored represent open pores. In order to extract the pores, two different ways are used:

1- **Dilation then thinning (simple skeleton): The number of open pores that is extracted by this method is (77) and the closed pores is (286) which is shown in Figure (11. a).**

2- Dilation, Erosion then Thinning: The number of open por es that is extracted from this method is (104) and closed pores is (730) which are shown in figure (11.b).

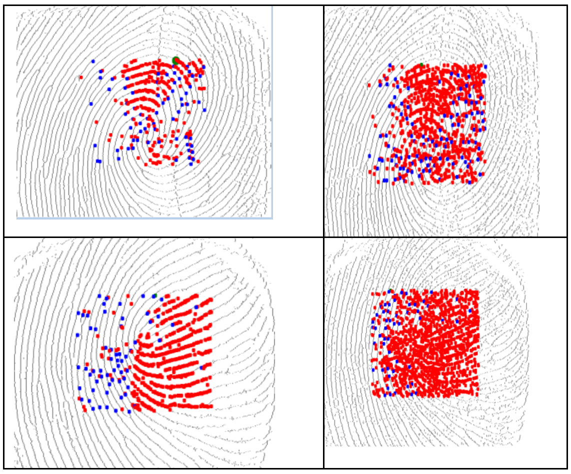

Figure (11) pores detect

dilation process After dilation process then erosion

While the result of extracted pores when applying median filter followed by zhang –Sue algorithm as shown in figure (12)

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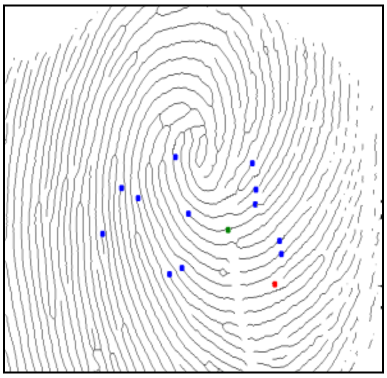


Figure (12) Pores detect

When applying the filter on the same person with different contrasts is shown in figure (13).

- Number of open pores for dark image (77), and of closed pores (268).
- And number pores for light image are open pores (73), close pores (347

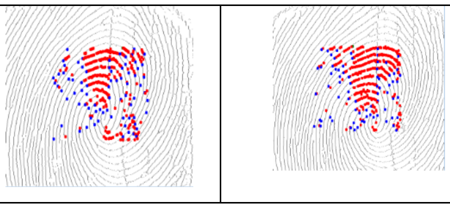


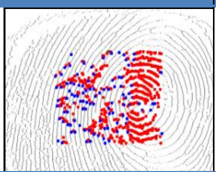
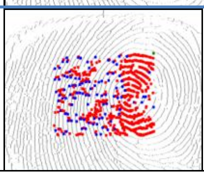
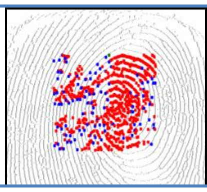
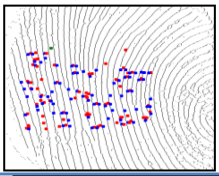
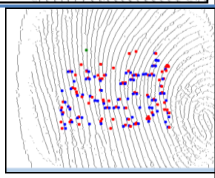
Figure (13).

(a)Dark image (b)Light image

A. Closest Algorithm

The closest algorithm has been used in matching phase to find the best matched pores points depend on the locations of these points (x and y) and the number of pores as described in table (1).

Table (1) Shown recognition rate

id	imaged		Closed	open
1	1_1_2		103	**505**
2	1_1_3		103	**555**
3	1_2_4		102	**658**
4	2_1_1		82	**77**
5	2_1_2		**82**	**88**

7. Conclusions

the establishment of recognition and identification system based on pores found on ridges of fingerprint image, the number of both types of pores (closed and opened) is calculates, and the effect of system parameters on its performance have, been illustrated. Several conclusions have been deduced from the obtained test results. Some of these conclusions are summarized in the following points:

1- The experimental results which use part of an image (160X120) are better than using an image (320x240) as a whole in time, where the time of matching for pores (level 3).

2- The proposed PFR use dilation process to get the stronger pores instead dilation followed by erosion which gives strong and poor pores.

3- In level 3 using dilation only followed by thinning gives (100 %) recognition rate.

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