ijournals International Journal of Software & Hardware Research in Engineering
ISSN No: 2347-4890 Volume 2 Issue 5, May 2014

Adaptive Fingerprint Image Enhancement for Low-Quality of Images by Learning From the Images and Features Extraction

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ABSTRACT

Image Processing is basically the use of digital computer to perform image processing on digital images. But still some drawbacks are there. The proposed algorithm adaptive parameter to enhance image effects and removing the noise from the image. Thus Adaptive Fingerprint Image Enhancement method improve accuracy and feature extraction. In this paper study of two adaptive finger print image enhancement algorithm is present and compare with each other. To do that I enhanced the Adaptive Fingerprint Image Enhancement method by median filter and include more ridge information for features extraction from the fingerprint image so it improve the accuracy and matching score between two fingerprint image improve as well as number of minute extraction increase from the fingerprint image. The performance of the processing is presented in the evaluation part of this paper. The algorithm is evaluated toward the NIST developed fingerprint recognition on FVC 2002 database. Experimental results show that our proposed algorithm is able to handle various input image contexts and achieves better results compared with some existing algorithms over public databases, and to improve the performances of fingerprint-authentication systems.

KEY WORDS
Adaptive Algorithm, Fingerprint Enhancement, Filter, Minutiae, OF Estimation

1. INTRODUCTION

Image enhancement is the simplest and most widely used areas of digital image processing. The enhancement performed due to extract or highlight the feature. Enhancement is the process of manipulation of image . Different types of noise in the fingerprint images create difficulty for recognizers like environmental and technical, good quality images is very important, but due to some environmental factors like user's body condition, a significant percentage of acquired images is of poor quality in practice . From the poor quality images many unwanted minutiae may be created and many genuine minutiae may be ignored. Most Automatic Fingerprint Identification Systems (AFIS) use some form of image enhancement based on the recent filter technology. Here different various methods have been described in the following literature study, there is need some further processing for improvement. Real-time image quality can greatly improve the accuracy of an AFIS.

Here propose a methodology of automatic parameter selection for fingerprint enhancement procedures. The enhanced performances are not satisfactory because of the complicated ridge and valley structures that are affected by unusual input contexts that need adaptive tuning of parameter. The methods for constructing enhancement image for fingerprint images:

1. Normalization:
The first step in this process involves the normalization of the fingerprint image so that it has a pre-specified mean and variance.

2. Orientation Estimation:
An orientation image is then calculated, which is a matrix o vectors representing the ridge orientation at each location in the image.

3. Ridge Frequency Estimation :
The Ridge frequency image defines the local frequency of the ridges contained in the fingerprint.

4. Filtering:
The filtering increases the contrast between the foreground ridges and the background, whilst effectively reducing noise. law quality image reduce

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ISSN No: 2347-4890 Volume 2 Issue 5, May 2014

the performance of the AFIS and matching algorithm depends critically upon the quality of the input fingerprint .

1.1 Aim and Scope

In frequency domain techniques, filter can be used to calculate convolutions effectively from the entire image rather than from a small area of the filtered point that used in the spatial domain. This deals with variety of filters that are defined explicitly in the frequency domain. The contextual filtering operating a robust algorithm behavior.

1.2 Outline

The paper is outlined as follows. Background & Related work given in section 2 & 3 respectively. Proposed algorithm introduced in 4. A discussion and Experimental result is provided in section 5 and 6 respectively , and a conclusion with future work is given in 7.

2. BACKGROUND

In recent year the idea is to classify fingerprint images based on their quality and select image enhancement parameters for different quality of images[1]. The quality of a fingerprint image cannot be measured, its clarity of the ridge structure in the fingerprint image. There are several reasons that may degrade the quality of a fingerprint image. As per the to recent report by the U.S. National Institute of Standards and Technology 18% of poor quality to cause a significant deterioration of the overall system performance. Experts use the context information of fingerprint images, such as ridge continuity and regularity to help in identifying them.

3. RELATED WORK

The efficiency of an novel automated enhancement algorithms depends on the extent to which they utilize the contextual information. Variety of filters for these enhancement tasks are classified either in the spatial or in the frequency domain[2]. According to the classification of the filters, the existing enhancement processing is roughly classified into either spatial-domain filtering or frequency-domain filtering.

Reliable finger fingerprint recognition is still an open problem. This problem technically describe as Spatial Domain and Frequency Domain.

The spatial domain techniques involve spatial convolution of the image with different size of filter masks, and frequency domain include whole image for filter mask. convolution. which is simple for operation. For computational reasons, such masks must be small in the spatial extent, computation perform on variety size of mask. The filter increased Frequency domain with variety of filter use in various size and direction. Each full image is convolved with eight location-independent filters. It is take large time and space for real applications that is not suite for the real time application. This reviewed method provides a recent advances in fingerprint image enhancement techniques to improve the robustness of fingerprint image enhancement to change in finger position, finger condition and finger pressure. Contrary to popular belief, despite decades of research in fingerprints, this

the ridge contrast direction to the perpendicular of the ridge.

4. PROPOSED ALGORITHM

Here study of proposed adaptive fingerprint enhancement algorithm. Figure 1 shows diagram of whole work flow.

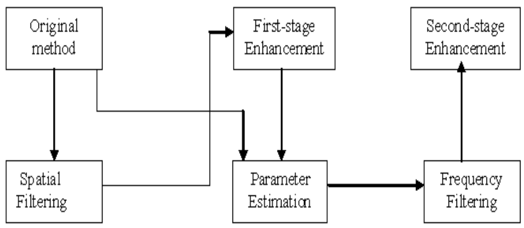

Fig 1 : Diagram of the whole work flow

4.1 First-Stage Image Enhancement

The first stage performs ridge compensation along the ridges in the spatial field. This step enhances the fingerprint's local ridges using the neighbor pixels in a small window with a weighted mask along the orientation of the local ridges. Each pixel in the fingerprint is replaced with its weighted neighbor sampling pixels in a small window and with the controlled contrast parameters along the orientation of the local ridges[3].

1) Local Normalization: This step is used to reduce the local variations and standardize the intensity distributions in order to consistently estimate the local orientation. The pixel wise operation does not change the clarity of the ridge and furrow structures but reduces the variations in gray-level values along ridges and furrows, which facilitates the subsequent processing steps. The global normalization method is also used for the fingerprint enhancement employing a Gabor filter that was proposed in. It can normalize all the values into a defined mean and variance.

2) Local Orientation Estimation: This step determines the dominant direction of the ridges in different parts of the fingerprint image. This is a critical processing, and errors occurring at this stage are propagated to the frequency filter. We used the gradient method for orientation estimation and an orientation smoothing

ijournals International Journal of Software & Hardware Research in Engineering
ISSN No: 2347-4890 Volume 2 Issue 5, May 2014

method with a Gaussian window to correct the estimation.

3) Local Ridge-Compensation Filter: With the estimated orientation values in place, the final step compensates the ridge artifacts using a local ridge-compensation filter with a rotated rectangular window to match the local orientation. For each pixel (i, j) in the normalized image, the computing formula for the ridge-compensation filter. Figure 2 shows ridges and valleys on a fingerprint image.

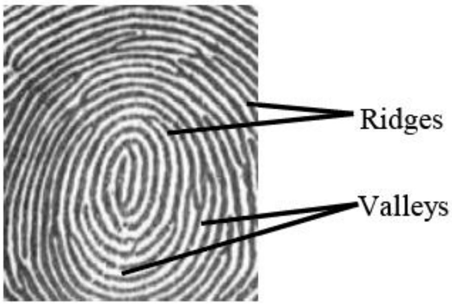

Fig 2 : Ridges and valleys on a fingerprint image

4.2 Second-Stage Enhancement Scheme by Learning From the Images

In this approach ,filters in the frequency domain can be used to calculate convolutions effectively from the entire image rather than from a small area of the filtered point in the spatial domain.

Although the result of the first spatial filter increases the ridge contrast in the direction perpendicular to the ridges[4][5], this processing may blur the image as well. Thus, a second-stage enhancement with a tuned bandpass filter is proposed to enhance the fingerprint image serially. The frequency bandpass filters used are separable in the radial and angular domains, respectively. The processing is able to enhance the fingerprint image both in the radial and the angular domains and enhance the ridges completely. As an important feature, the parameters of the bandpass filter are learnt from both the original image and the enhanced image. The enhancement of fingerprint images with bandpass filters may take advantage of the regularity of the spatial structure by filtering the image with a position-dependent bandpass frequency filter whose passband is matched everywhere with the local ridge orientation and local ridge frequency. Instead of using the entire image, we apply the frequency filters to the blocks to utilize all of the local frequency and local orientation information.

1) Local orientation estimation by learning: This step determines the dominant direction of the ridges in different parts of the fingerprint image by learning from the images. The orientation estimation is similar with Step 2 in the first-stage filtering, which used the gradient method for orientation estimation. However, the new orientation θ(x, y) is corrected in the enhanced image after the first stage enhancement. The formula for the computation of the new orientation.

2) Local frequency estimation by learning: This step is used to estimate the inter ridge separation in different regions of the fingerprint image. The local frequency is estimated by applying FFT to the blocks by F = FFT (img) and the local frequency is pixel processing.

The formula for the computation of the new frequency is similar to using the frequencies both from the enhanced image and the original image[6], the new frequency equals the average value of its neighbor if their difference is larger than a threshold value, or else it equals the frequency that is acquired from the enhanced image.

3) Coherence image: The coherence indicates the relationship between the orientation of the central block and those of its neighbors in the orientation map. The coherence is related to the dispersion measure of circular data.

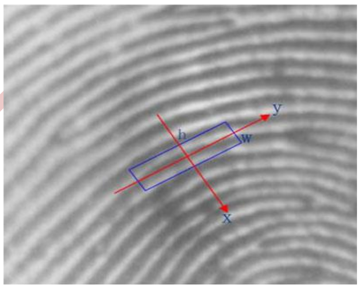

Fig 3 : Demonstration of an enhanced window along the local ridge orientation.

The advantage of this method is that there is no need for any extra model need for process. This approach can be inefficient if the one of the model propagate the wrong estimation then error up to the end model. Figure 3 shows demonstration of an enhanced window along the local ridge orientation.

5. DISCUSSION

The quality of fingerprint images and fingerprint sensor characteristics have a great influence on the performance of a fingerprint matching system. It is therefore common to employ fingerprint enhancement to increase the image quality and to improve the matching performance. In this paper, the proposed enhancement method is compared with three similar methods based on contextual filtering. In Table , represent comparison of various adaptive algorithm with its results.

6. EXPERIMENTAL RESULT

The public fingerprint image databases of the Fingerprint Verification Competition (FVC2000) were established with the aim of providing techniques in fingerprint recognition applications. The proposed fingerprint enhancement algorithm is acting as a pre processing stage to the fingerprint recognition system consisting of a minutiae extractor.

The fingerprint images are well suited for testing a fingerprint system with prints that are acquired using modern capacitive and optical scanners.

Table 6.1 shows database set that is used in this experiment is the FVC2000 database, which contains four distinct sub databases with four different scanners.

TABLE 6.1 : COMPARISION TABLE OF DIFFERENT DATASET

	Sensor type	Image Size	Resolution
DB1	Optical Sensor	338x374	500 dpi
DB2	Optical Sensor	296x560	500 dpi
DB3	Capacitive Sensor	300x300	500 dpi
DB4	SFineGe v2.51	288x384	500 dpi

TABLE 6.2 : TABLE OF EXISTING FINGERPRINT MATCHING SYSTEM RESULTS

FVC 2000 Database		
Sub Database	Existing Method Result	
	TMR (%)	MINUTIAE
DB_1	19.65	19
	10.82	10
DB_2	66.21	27
	13.10	19
DB_3	16.66	10
	9.92	9
DB_4	42.85	18
	5.31	10

TABLE 6.3 : TABLE OF PROPOSED FINGERPRINT MATCHING SYSTEM RESULT

FVC 2000 Database		
Sub Database	Proposed Method Result	
	TMR (%)	MINUTIAE
DB_1	56.05	24
	39.62	12
DB_2	84.27	29
	47.63	25
DB_3	65.31	16
	59.21	12
DB_4	76.37	22
	50.37	21

After comparing result of above table 6.2 and 6.3 one can say that result of proposed method improve due to using the median filter in place of Gaussian filter and calculating window parameter using whole image rather then calculating locally.

This shows that proposed method improve matching of finger print on every dataset of FVC 2000 as compare to Based two stage fingerprint matching system.

For an image database, each sample is matched against the remaining 8 samples of the same finger to compute the True Match Rate where minutiae shows number of minutiae that recognise in fingerprint.

7. CONCLUSION AND FUTURE WORK

In this thesis work present two methods for assessing the sufficiency in terms of quality and quantity of information present in a fingerprint image. Both methods rely on the same framework: minutiae and filter. By adding extended ridge information to our minutiae features: works described the operation of the adaptive algorithms and filter that effect the performance of the adaptive algorithm. Here first conclude that matching rate and number of minutiae extracted from the image increase after the enhancement using filter. Second, after performing on different database set say that lower quality of image required more filtering and enhancement with respect to good quality image. Third after performing various filter on the finger print image, quality of the image improve and noise reduce from the image, which shows true minute ridge, valley, core and delta into the finger print image .

Lastly, a task to undertake for future work would be to use of pixel processing approach instead of block processing to improve further accuracy and reduce the computational complexity and try to improve speed of proposed algorithm.

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