Adaptive Fingerprint Image Enhancement Techniques and Performance Evaluations

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ABSTRACT:

Image Processing is basically the use of digital computer to perform image processing on digital images. Simply to use and with other approach benefit its contribute growing of digital image processing popularity. But still some drawbacks are there. The proposed algorithm adaptive parameter to enhance image effects and removing the noise from the image. To do that use various mask filter and spatial as well as frequency domain. Thus Adaptive Fingerprint Image Enhancement method reduce the complexity and try to improve the speed. In this paper study of various adaptive finger print image enhancement algorithm is present and compare with each other.

KEY WORDS:
Adaptive Algorithm, Fingerprint Enhancement, Filter, OF Estimation, RF Estimation

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

A. Aim and Scope

This reviewed method provides a recent advances in fingerprint image enhancement techniques to improve the robustness of fingerprint image enhancement to change in

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finger position, finger condition and finger pressure. Contrary to popular belief, despite decades of research in fingerprints, reliable finger fingerprint recognition is still an open this this technique describe as follow. Spatial Domain filtering technique problem.

a robust algorithm behavior.

B. Outline

The paper is outlined as follows. Background & Related work given in section II & III respectively. Study of various adaptive algorithm introduced in IV respectively. A discussion is provided in V, and a conclusion with future work is given in VI.

II. 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. 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.

III. 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[1]. According to the classification of the filters, the existing enhancement processing is roughly classified into either spatial-domain filtering or frequency-domain filtering.

1. Spatial Domain Filtering

The first proposed the use of contextual filters for smoothing fingerprint image enhancement. It is used an anisotropic smoothing kernel or different size of mask whose major axis was oriented parallel to the ridges in the fingerprint. The spatial-domain techniques involve spatial convolution of the image with different size of filter masks, which is simple for operation. For computational reasons, such masks must be small in the spatial extent, computation perform on variety size of mask.

Contextual filtering is to design various directional filters particular horizontal and vertical with their shape aligned to the ridge orientation in fingerprint image. The filter increased the ridge contrast in a direction perpendicular to the ridges, while it performed smoothing in the direction of the ridges.

2. Frequency Domain Filtering

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 completely in the 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.

IV. STUDY OF VARIOUS ADAPTIVE ALGORITHM

Here proposed study of the various adaptive fingerprint enhancement algorithm.

A. Adaptive Fingerprint Image Enhancement With Emphasis on Preprocessing

In this approach, We make contact with the field of for ground and back ground statistics and present a development and generalization of method. Figure:1 shows block diagram of this method. 1) Local fingerprint image patches are spatially and spectrally similar to a sinusoidal signal, where the dominant peaks in the magnitude spectrums of the two signals are co-located.

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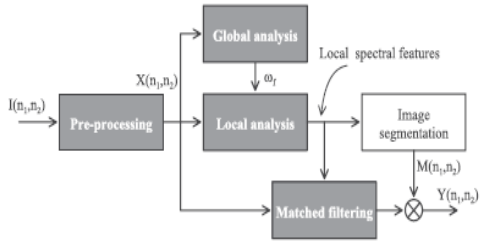

Fig:1 Processing blocks of the proposed method

1) Pre processing : Let I(n1, n2) represent a fingerprint image of size N1×N2,where n1 ∈ [0, N1 − 1] and n2 ∈ [0, N2 − 1] denote horizontal and vertical coordinates. Successive Mean Quantization Transform use for the that transformation purpose.2) Global Analysis : Suppresses data outliers by a median filter. Figure:2 shows structure of the ridge and valleys. 3) Local Analysis : Local dynamic range adjustment, Transformation is conducted in order to improve local spectral features estimation. 4) Matched Filtering : This block perform smoothing of these estimated frequencies to reduce the impact of this noise. 5) Image Segmentation: To suppress parts of a fingerprint image where there is no fingerprint data, a segmentation of the image is performed by binary mask and spectral features from the local analysis are used to construct the binary mask.

The advantage of this method[1] is a block based processing with a fixed size of the local area and do not employ the adaptive window size that is used in work, so reduce unsatisfactory feature estimates. Also the method does not employ any nonlinear contrast enhancement on a global- or a local level.

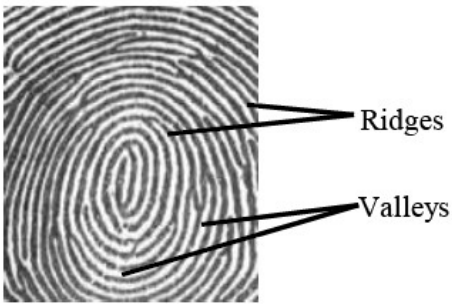

Figure:2 Ridges and valleys on a fingerprint image

B. Two-Stage Enhancement Scheme for Low-Quality Fingerprint Images 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.

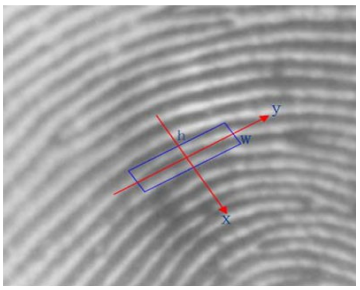

Fig: 3 Demonstration of an enhanced window along the local ridge orientation.

The first stage performs ridge compensation along the ridges in the spatial field[2]. Figure:3 shows enhanced window along the local ridge orientation. Each pixel in the fingerprint is replaced with its weighted neighbor sampling pixels in a small window .

A second stage enhancement with a tuned bandpass filter is proposed to enhance the fingerprint image serially. Figure:4 shows orientation of ridge pixel in a fingerprint for the locating purpose of bandpass filter. As an important feature, the parameters of the bandpass filter are learnt from both the original image and the enhance image.

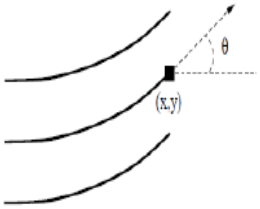

Figure: 4 The orientation of a ridge pixel in a fingerprint

The advantages of this method is used spatial as well as frequency domains paper, This leads to more effective noise reduction in the filtered image. Ridge structures that are affected by unusual spatial convolution of the image with filter masks so the experimental results show that the proposed scheme is able to handle various input contexts and achieves the best performance in combination with two nominated verification algorithms.

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The future works related to this paper are as follows. We could use block processing instead of pixel processing to reduce the computation complexity, and try to improve the speed of the proposed method.

C. Curved-Region-Based Ridge Frequency Estimation and Curved Gabor Filters for Fingerprint Image Enhancement

In this approach, Gabor filters (GFs) play an important role, curved GFs that locally adapt their shape to the direction of flow. These curved GFs[3] enable the choice of filter parameters that increase the smoothing power without creating artifacts in the enhanced image. In Figure:5 shows left part of image with curved . Curved GFs are applied to the curved ridge and valley structures of low-quality fingerprint images.

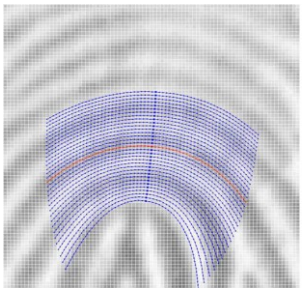

Fig:5 Left curved region

The main advantage of curved GFs is that they enable the choice of larger curved regions and high values for and without creating spurious features .

Future work includes an exploration of a locally adaptive choice of these parameters, depending on the local image quality and, for example, the local reliability of the OF estimation. In addition, it will be of interest to apply the curved-region-based RF estimation and curved GFs to latent fingerprints.

D. Fingerprint image enhancement techniques and performance evolution of the SDG and FFT

This is a study of various [5]techniques of fingerprint enhancement and the performance evaluation of fingerprint enhancement by using SDG and FFT.

This method shows its increase performance on second derivative. which reduce the computation cost. Very simple in structure and required less time for computation.

E. Fingerprint Image Enhancement segmentation and Thinning

In method[4] existing mathematical algorithm for the fingerprint image enhancement were modified to obtain new and improved versions. The new versions consist of different mathematical models as shown in Figure:6 for fingerprint image.

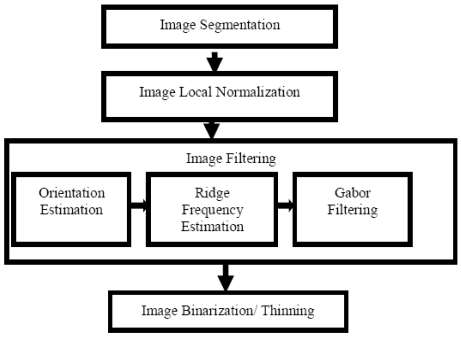

Figure:6 The conceptual diagram of the fingerprint enhancement algorithm

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.

F. Adaptive Fingerprint Binarization by Frequency Domain Analysis

A straightforward method for automatically tuning the size of local area is obtained by analyzing entire fingerprint image in the frequency domain. Hence, the algorithm will adjust adaptively to the local area of the fingerprint image, independent on the characteristics of the fingerprint sensor or the physical appearance of the fingerprints[6].

The advantage of the adaptive fingerprint binarization algorithm shows a good ability to tune itself to each fingerprint image. This results in an algorithm which is insensitive to varieties in sensors, skin etcetera. Other than the initial setup, the algorithm is fully automatic.

The main limitation of this paper is high compression speed is required for the process of each segment of model.

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TABLE I
COMPARISION OF ADAPTIVE METHOD

Method	Advantage	Limitation
Adaptive Fingerprint Image Enhancement on Preprocessing	global and a local level enhancement	Pixel processing
Curved-Region-Based Ridge Frequency	increase speed	better OF estimation
Two-Stage Enhancement by Learning From the Images	able to handle various input contexts and achieves the best performance	pixel processing it increase Computation Complexity.
Fingerprint Image Enhancement Algorithm and Performance	unrecoverable corrupted regions also recovered	Waves of ridges miss
Binarization by Frequency Domain	No need of extra model	Error propagate to each stage of d model
Fingerprint image enhancement with SDG and FFT	Self tuning parameter	High computation speed

V. 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 1,i represent comparison of various adaptive algorithm with it a advantage and limitation.

VI. CONCLUSION AND FUTURE WORK

In this paper i am described the operation of the various adaptive algorithm and different filter that effect the performance of the adaptive algorithm. So i can conclude from that lower quality of image required more filtering and enhancement with respect to good quality image. 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 This adaptive algorithm are complex in nature and so speed of the processing is very low.so various approach define now days which improve the speed and reduce the complexity.

The future work includes that the development of the new solution of the enhancement algorithm to reduce the noise from the image and increase the computation speed using combined method and efficient filter.

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