A Study Latent Search and Feature Extraction Techniques used in Fingerprint Recognition

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ABSTRACT
Fingerprint improvement is a serious part in automatic fingerprint recognition system. It is an essential select the suitable improvement approaches for fingerprint, in order to reduce the processing part of the fingerprint recognition system. Various methods of improvement fingerprint images described based upon non-stationary directional Fourier domain filtering. Fingerprints are first curved using a directional filter whose orientation is everywhere matched to local orientation. A robust method for latent fingerprint verification improvement is studied. In contrast with most state-of-art-method, approaches do not rely on the information of local gradients, which are sensitive to structured and unstructured background noise. Thus the previous methods are robust against gradient deviations. It also provides forceful estimates to frequencies of fingerprints in a limited region to allow effective filtering for fingerprint ridges and valley pattern improvement.

Keywords
Fingerprint recognition, filtering Technique, directional filtering, structure and unstructured background noise.

1. INTRODUCTION
Biometric confirmation systems confirm a person's claimed identity from behavioural traits (signature, voice, keystrokes and gait) or physiological traits (face, iris, and ear, DNA, eye).Biometric is the science and technology used for measuring and analysing data. Biometric system is of two types Uni-modal and multi-modal biometric system. Biometric system trusts on the evidence of single source of information for authentication of a person. Human have used fingerprints for personal identification for many centuries and the similar correctness using fingerprints has been shown to be very high [1]. A fingerprint is the design of ridges and valleys on the surface of a sensitive, the formation of which is resolute during the first seven months of fatal advance. Fingerprints of identical doubles are dissimilar and so are the prints on each finger of the same person.

Automated Fingerprint Identification Systems have been positively used in forensics and law enforcement applications to reliably identify an individual. Fingerprint matching situations generally fall into one of the following two categories:

(i) Ten print search and

(ii) Latent search.

In ten print searches, rolled and plain impressions of a subject's fingers [2] are searched against the ten print fingerprint databases. Rolled fingerprint images are obtained by rolling a finger from one side to the other ("nail-to-nail") in order to detention the entire ridge details of a finger.

Fig 1: Rolled fingerprint

Plain fingerprints are developed by persistent a fingertip onto a flat surface of either a paper for inking methods or a flatbed of a live-scan device .While rolled prints contain a large number of minutiae plain fingerprints capture relatively small finger area with smaller number of minutiae and lower skin distortion than rolled prints.

Fig 2: Plain Fingerprint

Latent fingerprints which are raised from the surface of objects touched or handled by a person, are an extremely significant source of evidence in crime scene examination to [3] identify and convict the suspects. However, latent search is still a stimulating problem due to their poor quality. The latent fingerprints contain partial area of a finger, and often have smudged or blurred ridges and large nonlinear skin distortion due to pressure variations.

Fig 3: Latent fingerprint

The success of the AFIS in forensics and law enforcement agencies worldwide is based on the availability of a large record of rolled and plain prints of the ten fingers of all apprehended criminals.

2. OVERVIEW OF FINGERPRINT IMAGE RECOGNITION

Fingerprint image recognition is one of the most prominent and widely utilized biometric systems which have found its way in refined secured locations as [4] well as applications in our daily lives. It demands fewer assets than other biometric modalities such as the iris recognition system. In this work, we address the problem of latent FP processing.

For Example

Fingerprint recognition, which consists of a weak fingerprint image buried in the middle of structured and noisy background. This is an important problem, since a significant amount of FP imprints are acquired in this form in a crime scene, and they are not readily available for automatic processing. Pre-processing is required to effectively segment the FP region from the background and also enhance the quality of broken ridge/valley patterns.(shown in figure no: 4)

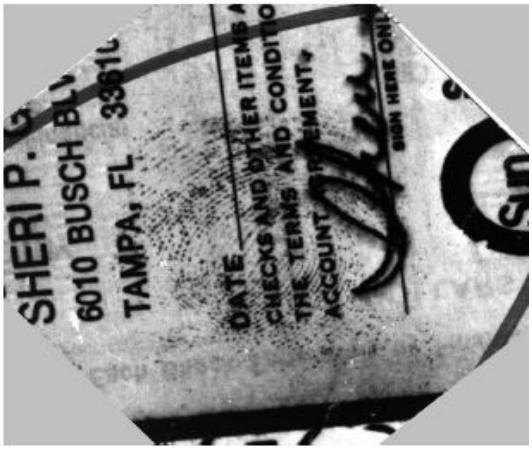

Fig 4: An example of latent fingerprint image

3. DOMINANT FEATURE FOR FINGERPRINT RECOGNITION

FP recognition is characterized by local orientations and frequencies of the local ridge/valley pattern. Significant efforts have been dedicated to estimation of these characteristics in the literature.

- A polynomial parametric function was used in to model the orientation flow in smooth regions along with point-charge models to accommodate singular points.
- This model performs reasonably well, as long as [5] gradients roughly align with true orientation directions. Gradient values were expected by a continuous function in to minimize the variation caused by noise, and a low-pass filtering is performed to enhance the results.
- In, dependencies on local orientations were modelled by a Markov Random Field model, and smoothing on estimated orientations can be achieved by applying the MRF to local raw gradient data.
- Methods based on geometric theory of differential equations were proposed in, which utilized the visual appearance of the phase portrait. They are where templates are dynamically defined by the phase portrait.
- For an extensive review on FP image processing. One underlying assumption in most algorithms is that averages of estimated local gradients are approximately collinear with true orientations. Then, model fitting is performed to smooth the data. If this vital condition is violated, the performance deteriorates accordingly.

4. RELATED PREVIOUS WORK

Raju Rajkuma et al., 2011 [7] studied on directional filter, which describes the splitting of the input image into eight parts and rebuilding in to image after image enhancement. **Anush Sankaran et al.,2013 [8]** defined as Clarity of a latent impression is defined as the discernibility of fingerprint features while quality was defined as the amount of features causal towards matching. Automated estimation of clarity and quality at local regions in a latent fingerprint is a study challenge and had received limited attention in the literature. [9] **Daniel Peralta et al., 2015** Fingerprint recognition had found a reliable application for verification or identification of 32 people in biometrics. Worldwide, fingerprints can be viewed as respected traits due to several 33 perceptions observed by the experts; such as the distinctiveness and the permanence on 34 humans and the performance in real applications. Among the main stages of fingerprint 35 recognition, the automatic matching phase has established much attention from the early 36 years up to nowadays. This paper was devoted to review and categorize the vast number 37 of fingerprint matching methods proposed in the specialized literature. In particular, they 38 focus on local minutiae-based matching algorithms, which provide good performance with 39 an excellent trade-off between efficacy and efficiency. **Emanuela Marasco et al., 2014 [10]** numerous issues related to the exposure of fingerprint recognition systems to attacks had been high- lighted in the biometrics nonfiction. One such susceptibility comprises the use of artificial fingers, where materials such as playdoh, silicone, and gel were decorated with fingerprint ridges. Researchers had demonstrated that some commercial fingerprint recognition systems can be misled when these artificial fingers are placed on the sensor, i.e., the system successfully processes the resulting fingerprint images thereby agreeing an adversary to spoof the fingerprints of another individual. Though, at the same time, several countermeasures

that separate between live fingerprints and spoof artefacts had been studied. While some of these anti-spoofing schemes were hardware-based, several software-based approaches had been proposed as well. In this paper, they review the works and present the state-of-the-art in fingerprint anti-spoofing. **Rijo Jackson Tom et al., 2013** [11] analyse their association with gender of an individual using frequency domain technique and a pattern appreciation technique. The combined dispensation has provided better results. This paper aims in using 2D- Discrete Wavelet and Principal Component Analysis combined to classify gender using an obtained fingerprint. **Shahyar Karimi et.al., 2008 [12]** existing as method for latent fingerprint image segmentation and enhancement was presented. In distinction with most state-of-the-art methods, our approach does not rely on the information of local gradients, which are sensitive to structured and formless background noise. Thus, the planned method was robust against gradient deviances. It also provides robust estimates to Orientations and frequencies of fingerprints in a local region to allow actual Gabor filtering for fingerprint ridge/valley pattern enhancement. **B.G. Sherlock et al., 1998 [13]** method of improving fingerprint images was described, based upon non-stationary turning Fourier domain filtering. Fingerprints were first curved using a directional filter whose orientation was everywhere matched to the local ridge orientation. Thresholding then yields the enhanced image. Various popularizations lead to efficient application on general-purpose digital computers.

Table 1: Technologies for Latent Fingerprint recognition

Method Name	Description
Ten print Search	Rolled and plain marks of the suspect's fingerprint are examined against the ten print databases. Rolled fingerprints are acquired by rolling a finger from one side to another so as to obtain the ridge details of a finger, which contains large number of minutiae whereas plain fingerprints are [6] obtained by pressing a fingerprint onto a flat platform of either on a paper with a inking method or on a live-scan device.
Latent search	These are the prints lifted from the surface touched or handled by the suspect and are a highly important source of information in investigation of the criminal involved in the crime scene. Various approaches which can be used under fingerprint [7] classification fall among one of these categories: syntactic methods, singularities based approaches, neural approaches, and others.

5. PRE-PROCESSING VARIOUS TECHNIQUES

The Pre-processing is a process improvement the Latent fingerprint image

value. The Pre-processing Techniques can be using includes 5 Categories:

Table 2: Pre-Processing Various Techniques

Techniques	Description
Histogram Equalization	The Histogram equalization to the Bad quality Latent fingerprint image into convert proper sequence in order to the clearing ridge structure.
Segmentation	The Segmentation is a parting of fingerprint is between foreground and background image.
Thinning	Thinning is a process finger [8] (print) image is Thinning to 1 pixel finger image. Which presentation to most usefully and useless Ridges clearing.
Smoothing	The impression Smoothing are those in which based on the ridge direction field are flow across flat surface of fingerprint images.
Binarization	Binarization is method to fingerprint gray-scale image converting into Binary images.

6. FEATURE EXTRACTION TECHNIQUES

6.1 Discrete Wavelet Transformation feature Vector Generation

The fingerprint image experiences discrete wavelet transformation for gaining the feature vector. Wavelets have been used frequently in image dispensation and used for feature extraction, denoising, density, face recognition, and image super resolution. Two dimensional DWT decays an image into sub-bands that are localized in frequency and orientation. The [10] decomposition of images into different frequency ranges documents the isolation of the frequency mechanisms introduced by "essential distortions" or "extrinsic factors" into certain sub-bands. These process consequences in isolating small changes in an image mainly in high occurrence sub-band images. Hence, discrete wavelet transform is a suitable tool to be used for designing a organization system. The obtained image is disintegrated using the investigation filter bank and the low frequency and the high frequency bands are detached as shown in the Figure no.5

Fig 5: Wavelet Decomposition

6.2 PCA Feature Vector generation

The pre-processed fingerprint also undergoes PCA algorithm for obtaining the feature vector in spatial domain. PCA algorithms are generally implemented for pattern recognition systems. Principal component analysis involves a measured procedure that transforms a number [11] of possibly correlated variables into a reduced number of uncorrelated variables called main components.

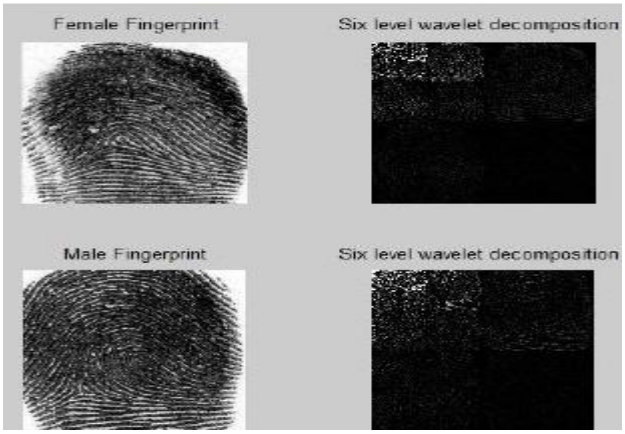

Fig 6: Six level decomposition of fingerprint

7. CONCLUSION

The latent fingerprints are found at law enforcement agencies crime sense. The literature survey on different existing latent fingerprint methods was includes done in this paper. We have described the contextual in the field, including some situations about feature extraction and pre-processing techniques. Then, we have calculated the main properties of the Latent methods, as well as the information. The effect of incorporating clarity in quality assessment is studied. It is diagrammatically shown that improvement assists in better estimation of quality thus resulting in improved performance.

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