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A SURVEY ON FINGERPRINT FEATURE EXTRACTION TECHNIQUES FOR LOCAL AND GLOBAL FEATURES

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Abstract: A literature survey of some techniques used for extracting features of a fingerprint is specified in this paper. In some research paper traditional procedures such as identification techniques and verification techniques are used, whereas the other articles have used novel methods. Fingerprints are widely used for identity in recent years. To design and develop a fingerprint feature extraction method, First It is necessary to acquire a good quality of fingerprint image. Good quality images are acquired using a high resolution scanner or using Image enhancement algorithms. Finally features are extracted from fingerprint and can be used for verification or identification.
Keywords: Fingerprint Image; Identification; Feature extraction; Binarization; Thinning, Local Features; Global Features.

I. INTRODUCTION

Humans have different biometric characteristics which includes physical and behavioural characteristics. These characteristics are widely used in identification and verification system because of many reasons such as ease of capture, highly distinctiveness, persistence over time, also the fingerprint sensors are smaller and cheaper compare with other biometric sensors. Biometric characteristics can be categorized into behavioural and physical characteristics. The behavioural characteristics include voice, keystroke-scan, and signature-scan. While physical characteristics include face, fingerprint, iris, retina and speech [1] The fingerprint identification system is an automated system to identity a person, based on comparison with template fingerprint image. The fingerprints are the patterns present in fingers of human. In recent years, the fingerprint identification technique has attracted the interest of so many researchers, due to its several benefits. One of the best benefit is that it is very well acknowledged by the legal community. This identification technique is very fast, reliable, least cost and easiest way to recognize an individual. Fingerprint never changes until any physical disorder like accidents occurs or those who works in mechanical or metal industries with burning or hot materials which can harm finger prints. Fingerprints are very beneficial.

II. LITERATURE REVIEW

This section presents the work done by other research people related to fingerprint identification, feature extraction, minutiae and core point extraction and matching. In this literature different authors proposed the different solution to the problems of fingerprint feature extraction system. Coetzee and Botha [2] proposed a binarization technique based on the edges extracted using Marr-Hilderith operator. The resulting edge image is used in combination with the original grayscale image to obtain the binarized image. This is based on the recursive method of line following and line thinning. Two adaptive windows, the gray-scale window and the edge window are used in all steps of the recursive process. To begin with, the pixel with the lowermost gray-scale value is selected and a window is placed on it. The boundary of the window is then observed to determine the next position of the window. The window continuously positions to trace the ridge boundary and the recursive process terminates when all the ridge pixels have been monitored to their respective ends. Ratha et al. [3] proposed an adaptive flow orientation based segmentation algorithm. In this approach the orientation field is calculated to get the ridge directions at each point of the image. To segment the ridges, a 16x16 window oriented along the ridge direction is measured around each pixel. The projection sum along the ridge direction is calculated. The centres of the ridges appear as peak points in the projection. The ridge skeleton thus obtained is smoothened by morphological process. Finally minutiae are detected by tracing end points and bifurcations in the thinned binary image. P. Peer et al. [4], proposed a fingerprint verification system based on minutiae matching. They first performed image enhancement using Gabor filters, then extracted minutiae points on the binary enhanced image using the Crossing Number method. Obtained minutiae points are then matched using thresholding. Although they presented a full framework for fingerprint verification, the authors did not take into account the texture characteristics of the fingerprint images. Same finger may be regarded as different if the scaling variance among images is big enough, likewise translation and rotation difference can also increase their disparity. Thus dealing with these differences can help improve the verification accuracy. Farina et.al. [5], proposed an approach to clean bridges and validate minutiae for skeletonized fingerprint images. Instead of thinned image, an improved principal curves is used for minutiae extraction. Qijun Zhao et al. [6] proposed an adaptive pore model for fingerprint pore extraction. Sweat pores have been recently used for fingerprint identification, in which the pores are normally extracted by using a computational thinning method or a unitary scale isotropic pore model. In this paper, author shows that actual pores are not always isotropic. To extract pores, they proposed an adaptive anisotropic pore prototypical, whose parameters could be adjusted according to the fingerprint ridge path and period. The fingerprint image is partitioned into blocks and a local pore model is analysed for each block. To use this local pore model, a matched filter is used to extract the pores for each block. Experiments on a high resolution fingerprint samples are performed and the results show that the proposed pore model and pore extraction method can identify pores more accurately in comparison with other modern pore extractors. Hoi Le et al. [7] proposed online fingerprint recognition with a fast and distortion compliant hashing method. ID cards, e-commerce and access to computer systems are some scenarios where trustworthy identification is a must. Existing verification systems depend on knowledge-based methods like passwords or token-based PIN such as magnetic cards. Biometrics such as fingerprint, eye retina, iris, face, voice and gait offer a more reliable means of authentication. However, due to huge biometric data and multipart biometric measures, it is challenging to design and develop an accurate as well as a fast biometric matching system. Fast fingerprint indexing is one of the most inspiring issues encountered in fingerprint identification system. In this paper, they presented a specific contribution by introducing a novel robust indexing scheme that is able to fasten the fingerprint matching process as well as improve the accuracy of the system. Manvjeet Kaur et al. [8] proposed a fingerprint verification system using minutiae extraction techniques. Most fingerprint verification techniques are constructed on minutiae matching methods and have been well considered. However, this technique still undergoes from issues associated with the treatment of low quality images. One problem troubling fingerprint matching is distortion. Distortion changes geometric location and alignment, and also leads to many difficulties in matching among multiple impressions picked up from the same finger. Identifying all the minutiae correctly as well as rejecting false minutiae is another concern which is still under research. This work has pooled many methods to construct a minutia extractor and a minutia matcher. Some changes like splitting up using morphological processes, thinning, false minutiae removal methods, minutia locating, minutia unification by transforming a branch into three terminations, and matching the combined x-y coordinate system. Anil Jain et al. [9] proposed a Pores and Ridges: Fingerprint Matching Using Level 3 Features. Fingerprint friction ridge details are generally defined in a tiered order at three levels, namely pattern, minutiae points and pores and ridge shapes. Although high resolution sensors (1000 dpi) have become commercially obtainable and have made it possible to unfailingly extract Level 3 features, most Fingerprint Matching Systems employ only Level 1 and Level 2 features. As a result, increasing the image resolution does not offer any matching performance improvement. They develop a matcher that utilizes Level 3 features, including pores and ridge shapes, for 1000 dpi fingerprint matching. Level 3 features are extracted using wavelet transform and Gabor filters and are matched using the ICP algorithm. Their experiments on a medium-sized database show that Level 3 features carry significant discriminatory information. EER values are reduced when Level 3 features are employed in combination with Level 1 and 2 features. Shunshan li et al. [10] proposed the Image Enhancement Method for Fingerprint Identification System. In this paper a new fingerprint image enhancement method, a refined Gabor filter, was suggested. This method can connect the ridge by filling the blanks, also ensures the maximal gray values traced at the ridge centre and has the ability to compensate for the nonlinear deformations. It also includes ridge orientation approximation, a Gabor filter processing and a refined Gabor filter processing. The first Gabor filter reduces the noise, provides more accurate distance between the two ridges for the next filter and gets a rough ridge orientation map while the refined Gabor filter with the adjustment parameters significantly enhances the ridge, connects the ridge breaks and ensures the maximal gray values of the image being located at the ridge centre. In addition, the algorithm has the ability to compensate for the nonlinear distortions. This method does not give result in any spurious ridge structure, which avoids undesired side effects for the subsequent processing and provides a reliable fingerprint image processing for Fingerprint Recognition System. In a word, a refined Gabor filter is applied in fingerprint image processing, then a good quality fingerprint image is achieved, and the performance of Fingerprint Recognition System has been improved. Mayank Vatsa et al. [11] proposed an algorithm combining pores and ridges with minutiae to improve fingerprint authentication. This paper presents a fast fingerprint verification algorithm using level-2 minutiae and level-3 pores and ridges features. The proposed algorithm uses a two-stage procedure to enrol fingerprint images. In the first phase, Taylor series based image transformation is used to perform rough enrolment, while in the second phase; thin plate spline transformation is used for fine enrolment. A fast, feature extraction algorithm is proposed using the Mumford–Shah functional curve evolution to segment efficiently contours and extracts the complex level-3 pore and ridge features. Delaunay triangulation based fusion algorithm is proposed to combine level-2 and level-3 information that provides structural constancy and robustness to minor changes caused due to redundant noise or non-linear distortion during image capture. They define eight quantifiable measures using level-2 and level-3 topological characteristics to form a feature super vector. A 2n-support vector machine implements the final classification of genuine or impostor cases using the feature super vectors. Experimental results and statistical assessment show that the feature super vector produces discriminatory information and higher accuracy compared to existing identification and fusion algorithms.

III. CONCLUSION

This section presents the work done by the researcher related to fingerprint matching systems, minutiae and core point extraction and matching system. This paper presents a survey of feature extraction techniques of fingerprint and matching novel approaches. It also explains an overview of different types of features like global and local features in the literature. The proposed work in these papers are an attempt to overcome some weakness regarding security and accuracy concern of the system. In all biometric based systems, fingerprint based systems are more efficient than other multimodal system.

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