International Journal of Applied Engineering Research
ISSN 0973-4562 Volume 10, Number 3 (2015) pp. 8307-8312

http://www.ripublication.com

A Literature Review on Fingerprint Image Enhancement Based on Non-Linear Dynamic Range Adjustment

S Chandana and Mrs. Mary Sajin Sanju I

M.Tech., VLSI Design, Dept:ECE,
Sathyabama university Chennai-600119
Chandana.sudunagunta@gmail.com
Dept:ECE, Assistant Professor
Sathyabama University, Chennai-600119

ABSTRACT

Recently there are several improvements in fingerprint image enhancement techniques based on different filtering methods and algorithms. To acquire reliable feature matching from the poor quality fingerprint images is the main problem in automatic fingerprint identification. This paper describes a few image enhancement techniques based on the extraction of the minutiae features of the fingerprints. A total of 150 ridge characteristics have been identified. The term adaptive implies that the parameters are automatically adjust according to the given input fingerprint image. Five processing blocks include the adaptive fingerprint image enhancement method, out of which four blocks are updated in the proposed method. The four modified processing blocks are: 1) preprocessing, 2) local analysis, 3) global analysis, 4) matched filtering. In preprocessing and local analysis blocks a non-linear dynamic range adjustment method is used. The ridge characteristics include ridge ending, ridge bifurcation, core, delta, etc. This paper gives the information about the ridge direction and ridge orientation.

INDEX TERMS - Biometrics, minutiae, enhancement, feature matching.

INTRODUCTION

Biometrics refers the performance related to human characteristics. Biometrics is used in computer science as a form of identification and to access control. In general biometrics is used to identify an individual in groups. Biometrics are categorized into two characteristics, 1) Physiological 2) Behavioral. Physiological characteristics are related to shape of the body which include fingerprint ,palm veins, face recognition,

DNA, palm print, hand geometry ,retina, iris recognition, odour. Behavioral characteristics are related to pattern of behavior of a person, including typing, voice.

Until the 1960's, fingerprint matching was used only for forensic purposes and human experts performed the fingerprint analysis manually. To develop automatic fingerprint identification system (AFIS) the research has been conducted for last fifty years. However, fingerprint matching, especially when the fingerprint images have low quality or when the matching is performed cross sensors, is still an open research question. For user convenience and better security biometrics provides higher efficiency.

Recently many biometric technologies are deployed. Fingerprints are the widely used biometrics characteristics because of its distinctiveness and cost. As everyone knows that each and every individual has their own unique pattern. The ridges and valley are the most significant structural characteristics of the fingerprint. To acquire matching reliable features from fingerprint images with poor quality is the main problem in automatic fingerprint identification. The ridges are dark and valleys are bright

Minutiae mean major features of the fingerprints, which is used for the comparison of the characteristics of one fingerprint from another. Minutiae include:
Ridge Ending: The abrupt end of the ridge.
Ridge Bifurcation (or) Fork: A single ridge that divide into two ridges.
Short Ridge (or) Independent Ridge: A ridge that travels short distance and then ends.
Ridge Enclosure: A ridge that bifurcates and again enclose after a short period.
Island: A single ridge inside a short ridge.
Spur: A bifurcation of a short ridge branching off a longer ridge.
Crossover (or) Bridge: A short ridge that cross over between two parallel ridges.
Core: U turn in ride pattern.
Delta: Y shaped ridge meeting.

The minutiae characteristics of the fingerprint images are shown in the figure 1 which includes all the above mentioned characteristics. There are many other characteristics of which the ridge ending and the ridge bifurcation are the major ones to be considered.

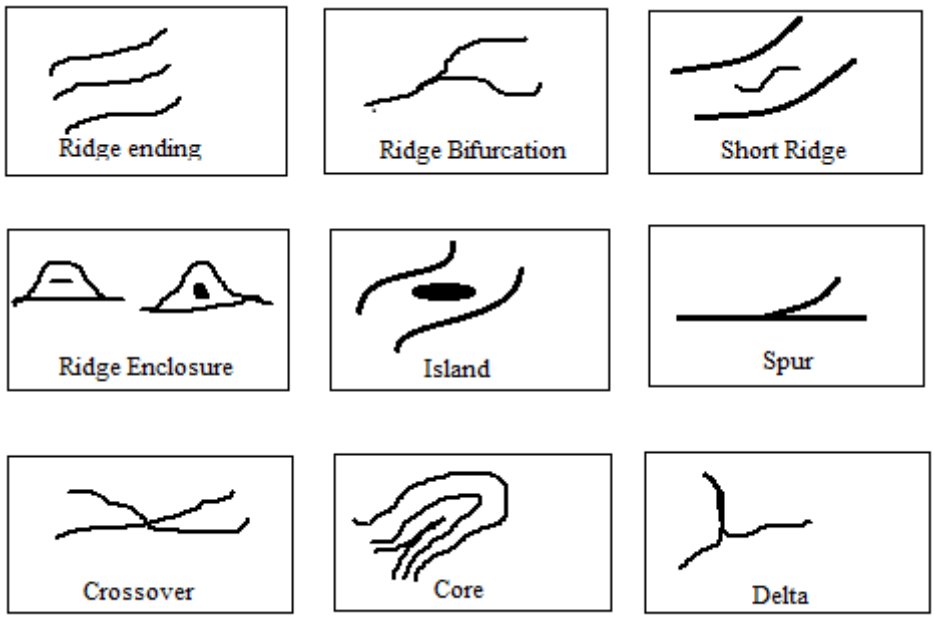

Fig 1: Fingerprint image characteristics

This article gives a brief explanation of the different fingerprint image enhancement techniques. The different techniques include contextual filtering, Gabor filter, Butterworth Bandpass filter, Second order statistical filtering, Classic directional filter, etc.

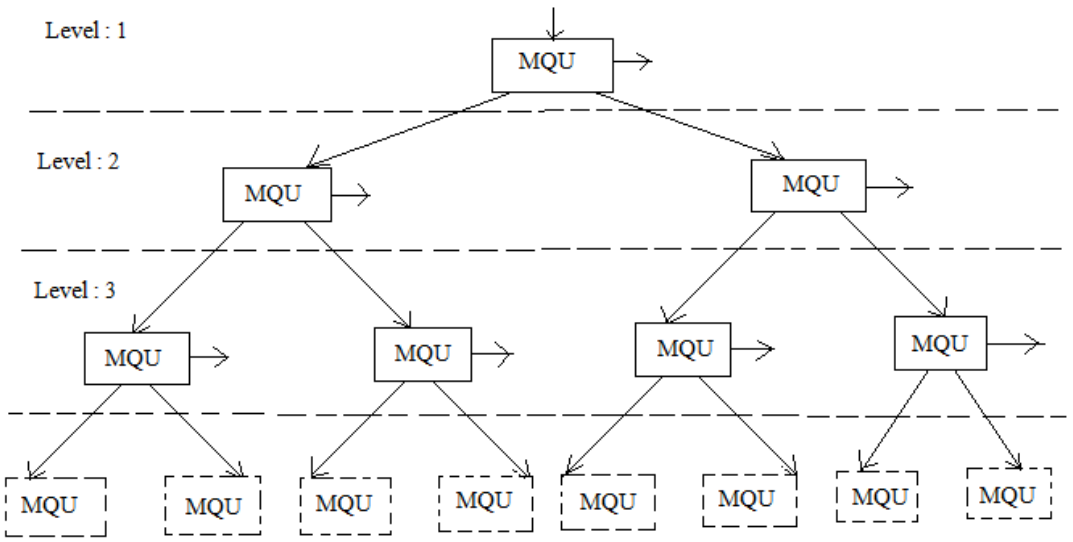

Fig 2: SMQT binary tree made of MQU

Josef strom bartunek et al(2013) proposed the adaptive fingerprint image enhancement can be done based on dynamic range adjustment. Adaptive implies the parameters of the fingerprint will automatically adjust based on the given input fingerprint. Five blocks include pre-processing, local analysis, global analysis, matched filtering, image segmentation. The preprocessing and local analysis block used a dynamic range adjustment algorithm [1] and the global analysis and the matched filtering uses the order statistical filtering methods. The algorithm used here is SMQT (successive mean quantization transform) [10]. The order-statistical filter include median filter, which may not work properly for high Gaussian noise.

B.Sateesh kumar (2013) proposed an idea in the field of machine learning, boosting is one of the most used method which combine weak classifiers to form a strong classifier. In biometrics the boundary between the genuine and imposter is to found classifiers by the use of boosting based score level fusion. There are different types of boosting include AdaBoost, boosting based score fusion scheme, bipartite RankBoost [5]. To minimize misranking error and in multimodal biometrics the rank boost using bipartite version is used. Based on the result comparison the AdaBoost achieves same results as bipartite RankBoost and when compared to transformation based score fusion classifier approach perform well.

C.Gottschlich (2011) proposed a curved gabor filter approach. For the enhancement of various types of images and extraction of Gabor features the Gabor filter is mainly used. Here he introduced a curved filter which will locally adapt their shape according to the curved noisy structure. To estimate more features from noisy images first combine two orientation field estimation methods, then through local orientation the local regions are constructed. With the estimated local orientation the local ridge frequency [2] is estimated and then the curved Gabor filters are defined and applied for the previous estimated ridge frequencies. The curved Gabor filter will enhance the image without creating artifacts.

Hartwig fronthaler et al (2009) described the local features for enhancement and minutiae extraction for fingerprint. First to decompose the given input fingerprint image into subbands a laplacian like image pyramid on spatial scales. In the next step on the pyramid for level contextual smoothing is performed for linear symmetry feature. A parabolic symmetry is applied to local fingerprint model for minutiae extraction which gives accurate direction and position of minutiae. It consists of an alternative to conventional minutiae extraction that does not require morphological operations or explicit thinning. By using this procedure the matching error is reduced.

Andreas Uhl and peter wild (2009) explains the effect of children as biometric users for accuracy recognition. In this they reviewed an access control in public and private places [4]. Now a days system has to process many diverse range of people, so for processing those many people systems has the challenging environment. First we have to know if there exists a difference in the performance of age groups i.e., in between kids and adults. The systems include preprocessing and feature extraction and matching. They analyze the child aging effects reasons at instant a future level.

Mauricio Villegas and Roberto Paredes (2009) proposed a score fusion algorithm based on maximizing the area under the ROC curve [9]. For the biometric system performance improvement the information fusion is widely used. Based on

maximizing the area under ROC curve the parameters of score fusion are optimized. The computational cost of algorithm is high and for large datasets it is unpractical. The AUC (Area under ROC curve) is improved iteratively and for new data the results are generalized.

Josef Strom Bartunek et al (2008) introduced an adaptive fingerprint binarization. In the enhancement the redundant artifacts are removed in the fingerprint mask. The previous algorithm uses determining the size of local area, fingerprint analysis matched filter design and binarization process. The proposed algorithm includes filter mask generation and post preprocessing of the mask [6]. The proposed method adjusts adaptively to every fingerprint without user supervision. So the algorithm is insensitive of the sensor and to the various appearances of the fingerprint. The contrast is improved in the given algorithm.

Hye-Wuk and Jee-Hyong Lee (2009) proposed stochastic approach based fingerprint classification. Fingerprint are divided into classes such as arch(a), left loop(l), whorl(w), right loop(l) [7]. for fingerprint image with paper and ink the classification is based on singular point information. But this is not suited for recent approaches because it is not confirmed the singular points are extracted well. The global feature i.e., fingerprint ridge direction is used in this algorithm and for each class the probabilistic approach is applied. The preprocessing steps like smoothing, binarization, thinning algorithms are used to reduce noise before classifying. The efficiency of the algorithm is observed.

Ajay Kumar and Cyril Kwong (2013) proposed a novel accurate and a low cost 3D fingerprint identification system. One of the important limitations of replacing 2D fingerprint with 3D fingerprint system is cost and their bulk, results in the use of multiple imaging cameras and structured lighting employed in the system. In this paper with the use of single camera they developed a 3D fingerprint identification system [3]. Using finger surface codes they developed the representation of the 3D finger surface features. The performance of 3D fingerprint minutiae matching is a bit low when compared to the 2D minutiae.

Sheng Li and Alex C Kot (2013) introduced a privacy protection based on combination of fingerprint. At first two different fingerprints from the two different fingers are enrolled. Then the reference points are collected from both fingerprints and minutiae is extracted from one and the orientation from the other. Based on the collected information they obtained a combined minutiae template [8] and stored in database. While authentication the fingerprint require same fingerprint captured from same fingers. The matching process is performed in two stages against the combined minutiae template. It is difficult to separate combined minutiae template from the original minutiae template for the stole's, so the system is secure and efficient. The error rate is also low for the system.

CONCLUSION

This paper gives a literature summery on different types fingerprint image enhancement algorithms and techniques to decrease the error rate and increase the efficiency. In general for minutiae extraction the fingerprint image has to be

enhanced. The enhancement can be done by using different ways like contextual filtering, Gabor filter, classical directional filter etc., but the finger print is of curved structure by the use of non linear dynamic range adjustment methods we can easily enhance the image without any loss of information. The error rate is also reduced by using this non-linear technique.

REFERENCES

[1] Josef strom bartunek, mikael nilsson, benny salberg and ingvar claesson, " Adaptive fingerprint image enhancement with emphasis on preprocessing of data, " IEEE transactions on image processing, vol. 22 no. 2 pp. 644-656, 2013.

[2] C. Gottschlich, " Curved regions based ridge frequency estimation and curved gabor filters for fingerprint image enhancement," IEEE transactions on image processing, vol. pp, no. 99, pp. 1-1, 2011.

[3] Ajay Kumar, Cyril Kwong , " Towards contactless, low-costand accurate 3D fingerprint identification system, " IEEE conference on computer vision and pattern recognition, 2013.

[4] A.Uhl and P. Wild, " Comparing verification performance of kids and adults for fingerprint, palmprint, hand geomentry and dugutprint biometrics," in IEEE 3rd international conference on biometrcis : Theory, Applications, and Systems, (BTAS), 2009, pp. 1-6.

[5] B.sateesh kumar and dr. A. govardhan, "Bipartite rankboost approach for score level fusion of face and palmprint biometrics," International journal of adavanced research in computer science and software engineering, ISSN: 2277 128x volume 3,Issue 12, December 2013.

[6] Josef strom Bart unek, Mikael Nilsson, Jorgen Nordberg, and Ingvar Claesson, "Improved adaptive fingerprint binarization," in IEEE Congress on image processing, 2008.

[7] Hye-Wuk Jung, Jee- Hyong Lee, "Fingerprint classification using the stochastic approach of ridge direction information," Fuzz IEEE, korea, August 20-24,2009.

[8] Sheng Li, Alex C. Kot, "Fingerprint combination for privacy protection," IEEE transactions on information forensics and security, vol. 8, No.2, February 2013.

[9] Mauricio Villegas and Roberto Paredes, "Score fusion by maximizing the area under the ROC curve," ibPRIA. Pp. 473-480, 2009.

[10] M.Nilsson, M.Dahl, and I. Claesson, "The successive mean quantization transform," in IEEE international conference on acoustic speech, and signal processing (ICASSP), vol. 4, March 2005, PP. 429-432.