A Survey On Finger Print Identification

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Abstract: **Authentication and validation of an individual is done with the help of various factors like signature, user-ids and passwords, palm, fingerprint, face, voice, heart-beat, iris, etc. The fingerprint technique is advantageous for such recognition as compared to other techniques. This paper is a brief review in the field of fingerprint identification. The aim of this paper is to review various latest minutiae based, correlation based and other global, local methods for fingerprint matching and status of success of concurrent methods.**

Keywords: **Fingerprint Identification, Fingerprint Biometrics, fingerprint Enhancement.**

1. INTRODUCTION

For security purposes, the identification and authentication of an individual is performed with signature, user-ids and passwords, cards. These are not successful in now days because signature can be copied, passwords can be guessed and cards can be lost or stolen. So, biometric features are used for the recognition of an individual. The recognition of an individual consists of identification (validation) and authentication (verification) process.

The biometric features are consists of anatomical (fingerprints, palm, face, iris, etc.) and behavioural characteristics (voice, heart-beat, etc.) [1]. Fingerprint identification is popular among them because of the inherent ease in acquisition. For a long time, researchers had come up with many approached identify and verify a fingerprint. Although the position, type of minutiae, ridges and many other parameters are used, the results are still not satisfied in recognizing fingerprint. However, all fingerprint recognition verification or identification, are eventually based on a well-defined representation of a fingerprint. The underlying principle of well-defined representation of a fingerprint and matching remains the same. The verification would be straightforward if the representation of fingerprints remains the uniqueness and kept simple [2].

Fingerprint is one of the important and most widely used biometric systems in the modern automated world where machines are replacing the human in almost every aspect of life. Automatic fingerprint authentication systems can be broadly classified into two categories [3].

1. Minutiae based systems
2. Patter (Image) based systems

Minutiae based fingerprint authentication systems are widely used by both human experts and machines. These systems usually rely on "local discontinuities in the ridge flow pattern" called minutiae. According to the empirical study, two individuals will not have more than seven common minutiae [4, 5]. The set of minutiae are restricted into two types Ridge endings and Ridge bifurcations. Ridge endings are the points where the ridge curve terminates, and ridge bifurcations are the points where a ridge splits from a single path to two paths at a Y-junction as shown in Figure 1. The positions and angular orientations of these points within a fingerprint uniquely characterize the fingerprint.

Fig. 1 Minutiae points (a) Ridge ending (b) Ridge bifurcation

2. IMAGE BASED FINGERPRINT AUTHENTICATION SYSTEM

In image based fingerprint authentication system the fingerprint image itself is used as a template or reference image and the intensity values at each and every point of this template are compared with the intensity values of the query image. Depending upon the correlation between the intensity values of the two images the authenticity of the person is determined.

Minutiae based algorithms which depend upon the local discontinuities in the ridge flow pattern and are used when template size is important as only a small part of finger image is required for verification in minutiae based systems. It would be ideal to use these algorithms where space restrictions impact the use and deployment of biometrics but this type of system requires high quality of fingerprint image.

The size of the image required for image based authentication must be larger as compared to minutiae based algorithm. This algorithm requires more of the image area to be present during verification. So, the memory requirement is more. But these algorithms are computationally more efficient because they can be directly applied to the gray scale fingerprint image without or very less pre-processing.

An identification system can be defined as the one which helps in identifying the individual from many people available. It generally involves matching

available biometrics feature like fingerprint with the fingerprints which are already enrolled in the database.

Fingerprint Recognition is the recognition of individual using fingerprint. It consists of verification and validation process for fingerprint recognition. There are various approaches for the fingerprint recognition are:

***A. Minutiae Based [6*]:** In this approach, minutiae are extracted from fingerprint image. Before extraction of minutiae, some operations are performed on it. Minutiae are used for recognising an individual.

B. Frequency Content and Ridge Orientation [6]: In this approach, Gabor filter is used for fingerprint enhancement in fingerprint recognition. Some operations are performed as the minutiae based approach.

C. Filter Bank based Algorithm [7]: The Filter Bank-based algorithm uses a bank of Gabor filters to capture both local and global information in a fingerprint as a compact fixed length Finger Code, which is suitable for matching and storage [7].

3. LITERATURE REVIEW

Fingerprint identification is based upon unique and invariant features of fingerprints. Fingerprints are graphical flow like ridges present in human fingers which are formed during embryonic development, caused by ridges underneath the skin. According to FBI, the odds of two people sharing the same fingerprints are one in 64,000,000,000. Fingerprints differ even for ten fingers of the same person [8].

Some of the advantages of fingerprint identification are: high distinctiveness, high permanence, low potential for fraud and high performance with medium collectively and acceptability. The method of identification is suitable for workstation access control, physical access control, Information system control etc.

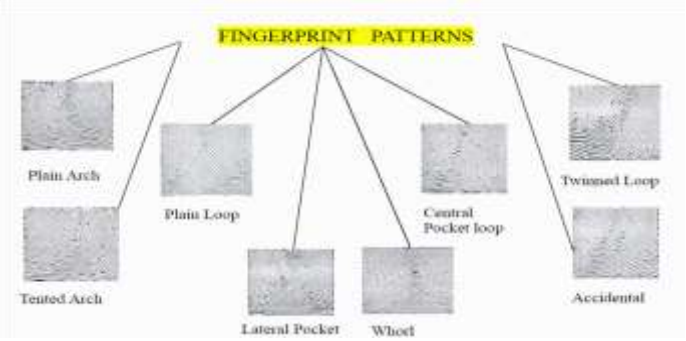

Fig 2. Types of Fingerprint Patterns

The uniqueness of fingerprint is determined by global features like valleys and ridges, and by local features like ridge endings and ridge bifurcations, which are called minutiae.

The earlier work in the field was done by Moayer [9, 10]. He considered fingerprint as a 1-D character string and another method considering fingerprint as 2-D tree and verifying two fingerprints by grammar matching. These methods worked for a rough classification but failed on low quality images and thus, were not suitable for an identification system.

Among the various current fingerprint matching algorithms such as minutiae based matching correlation filters based matching , transform feature based matching, graph based matching ,genetic algorithms based and hybrid feature based matching and other global and local methods, minutiae based fingerprint matching is dominant. A detailed reference for the various techniques can be found in [11].

The above mentioned local features are the ones considered by the FBI for the identification purposes [8]. The minutiae are obtained from the scanned image by fingerprint pre-processing

Usually the similarity of two fingerprints is determined by number of computing the total number of matching minutiae and the process is called minutiae matching [12]. However, general minutiae matching algorithms in automated Identity authentication systems use minutiae orientation and alignment [13].

Extraction of minutiae features before matching needs a series of processes, including orientation computation [12-13], image segmentation [14,15], image enhancement [15,16], ridge extraction and shinning [17], minutiae extraction and filtering [18], etc. before the matching can be done.

A. Montesanto [21] et al. proposed a method for fingerprint matching which use fuzzy operator. This method based on fuzzy logic and combines results of three different methods of minutiae extraction are sequential method, reactive agent and neural classification system for improving identification percentage of the fingerprint.

Mohamed Ahmed Wahby Shalaby [22] proposed three techniques for fingerprint classification are histogram analysis fuzzy c-means technique (HAFCM), enhanced HAFCM algorithm (EHA-FCM) and fuzzy multilevel structured scheme for fingerprint recognition (FMSFR). HAFCM performs the partitioning of fingerprints [22]. EHA-FCM algorithm improves smoothing of the fingerprint partitioning through fingerprint orientation field and complexity is reduced [22]. FMSFR based on EHA-FCM partitioning scheme which is more efficient and cost effective technique [22].

Carlos Henrique Moniwa Tada [23] et al. improves the quality of fingerprint image using fingerprint image quality estimation method using local features (contrast, curvature and ridge flow). A fuzzy inference system combines these features into single image quality score [23]. This improves performance of fingerprint matching.

Radu Miron [24] et al. implemented a fuzzy logic algorithm based on correlating a minutiae set and the regions between ridges for matching partial fingerprints. This combines the performances of minutiae based algorithm with the reliability of correlation algorithm.

4. CHALLENGES WITH FINGERPRINT IDENTIFICATION

Some of the common challenges related with fingerprint technology are low quality or degraded input images, noise reduction, data security related issues with fingerprint systems etc.

The low quality or distorted fingerprint images are perhaps the most common problem. The degradation can be of types like natural effects like cuts, bruises etc or it may be appearance of gaps on ridges or parallel ridge intercepts. The fingerprint enhancement techniques not only have to enhance the quality of image but at the same time, also have to reduce noise.

5. CONCLUSION

The fingerprint identification is one of the oldest and most common forms of biometric identification. As a result, it's a common misconception that fingerprint recognition is a completely solved problem. The truth is, the research on fingerprint recognition never stops due to its complexity and Intractability.

REFERENCES

[1] Sehasnainjot Singh et-al, "Finger Print Fusion Using Daubechies (Db1) Wavelet Transformation and Quality Measures", 2nd IEEE International Conference on Computing for Sustainable Global Development (INDIACom), Pp. 822-826, 2015.

[2] R. Priya et-al, "A Novel algorithm for Secure Internet Banking with finger print recognition", IEEE International Conference on Embedded Systems (ICES), Pp.104-109, Coimbatore, 2014.

[3] Sayak Bhowal et-al, "A Case Study of Illumination Robust Face and Finger Print Merging Identification Technique using Cross Correlation", IEEE International Conference on Emerging Trends in Communication, Control, Signal Processing & Computing Applications (C2SPCA), 2013.

[4] Dr. V. Vijayalakshmi et-al, "Finger and Palm print based Multibiometric Authentication System with GUI Interface", IEEE International conference on Communication and Signal Processing, Pp. 738-742, 2013.

[5] Smital D.Patil and Shailaja A.Patil, "Fingerprint Recognition Using Minutia Matching", in Proceedings of "Conference on Advances in Communication and Computing (NCACC'12)", 2012.

[6] M.N.Shah Zainudin, Radi et-al ., "Face Recognition using Principle Component Analysis (PCA) and Linear Discriminant Analysis (LDA)", International Journal of Electrical & Computer Sciences, Vol-12, No-05, 2012.

[7] Vikram Singh and Kalpna Kashyap, "A survey paper on "hybrid system for finger print identification", International Journal of Emerging Trends & Technology in Computer Science (IJETTCS), Volume 1, Issue 4, 2012.

[8] Vaidehi.V, Naresh Babu N T, Ponsamuel Mervin. A, Praveen Kumar. S, Velmurugan. S, Balamurali, Girish Chandra, "Fingerprint Identification Using Cross Correlation of Field Orientation," Second International Conference on Advanced Computing (ICoAC), Pp. 66- 69, 2010.

[9] Ashwini R. Patil, Mukesh A. Zaveri, "Novel Approach for Fingerprint Matching using Minutiae", in Fourth Asia IEEE International Conference on Mathematical/Analytical Modeling and Computer Simulation, 2010.

[10] J.A. Carrasco-Ochoa et al. (Eds.): "Fingerprint verification with Non-linear Composite Correlation Filters ," MCPR 2010, LNCS 6256, pp. 90–97, Springer-Verlag Berlin Heidelberg, 2010.

[11] S. L. de O. Gonzaga, "A Method for Fingerprint Image Identification Based on Gabor Filter and Power Spectrum", 2010.

[12] R. N. Rodrigues, L.L. Ling, and V.Govindarju, ": Robustness of Multimodal Biometric Fusion methods against Spoof Attacks," Journal of Visual Languages Communication,vol. 20, no. 3, pp. 169–179, 2009.

[13] Haiyun Xu, Raymond N.J.Veldhuis, Tom A.M. Kevenaar and Ton A.H.M. Akkermans, "A Fast Minutiae-Based Fingerprint Recognition System" in IEEE Systems Journal, Vol.3, No.4, Pp. 418-427, 2009.

[14] Ravi. J, K. B. Raja, Venugopal K. R, "Fingerprint Recognition Using Minutia Score Matching", International Journal of Engineering Science and Technology Vol.1 (2), Pp. 35-42, 2009.

[15] D. Maltoni, D. Maio, A.K. Jain, S. Prabhakar, "Handbook of Fingerprint Recognition (Second Edition)," Springer, London, 2009.

[16] H. Xu, R. Veldhuis, T. Kevenaar, A. Akkermans, and A.Bazen," Spectral Minutiae A Fixed Length Representation of a Minutiae Set Proceedings of Biometrics, Pp. 1-6, June 2008.

[17] K. Nallaperumall, A. L. Fred and S. Padmapriya, "A Novel for Fingerprint Feature Extraction Using Fixed Size Templates", IEEE 2005 Conference, Pp. 371-374, 2005.

[18] P. Komarinski, P. T. Higgins, and K. M. Higgins, K. Fox Lisa , "Automated Fingerprint Identification Systems (AFIS)", Elsevier Academic Press, pp. 1-118, 2005.

[19] S M Mohsen, S M Zamshed Farhan and M M A Hashem, "Automated Fingerprint Recognition: Using Minutiae Matching Technique for the Large Fingerprint Database", 3rd IEEE International Conference on Electrical & Computer Engineering (ICECE), Pp. 28-30, 2004.

[20] D. Maltoni, D. Maio, and A. Jain, S. Prabhakar, "4.3: Minutiae-based Methods" (extract) from Handbook of Fingerprint Recognition", Springer, New York, Pp. 141-144, 2003.

[21] Salil Prabhakar, Anil K Jain and Sharath Pankanti, "Learning fingerprint minutiae location and type", Pattern recognition, Pp. 1847-1857, 2003.

[22] Lin Hong, Student Member, IEEE, Yifei Wan, and Anil Jain, "Fingerprint Image Enhancement: Algorithm and Performance Evaluation" IEEE Transactions on Pattern Analysis And Machine Intelligence, Vol. 20, Pp. 777-787, 1998.

[23] D. Maio, and D. Maltoni, "Direct gray-scale minutiae detection in fingerprints", IEEE Transactions Pattern Analysis and Machine Intelligence, vol. 19(1), Pp. 27-40, 1997.

