Investigation of Pattern Matcher Algorithm for Exact Fingerprint Matching System

R.Jayavadivel[1], B.Prabhushankar[2], S.Rajesh[3]
[1, 2] Assistant Professor, Dept of IT
[3]Assistant Professor, Dept of CSE
[1, 2, 3] Paavai Engineering College.

Abstract- *Nowadays there are many systems that have been used for human verification the fingerprint recognition ion and validation. Hence there is a need for security in the field of all aspects. However, there are many biometrics technologies that have been used to enhance the security, where the fingerprint recognition plays a major. However, discuss various fingerprint matcher algorithm such as Euclidean and spatial relationship, novel based segmentation to thinning, latent fingerprint matching, features extraction and matching, extracting GSLM features By studying these algorithm, we decide to implement CDRP pattern matcher to find the exact fingerprint matching.*

Keywords- Finger print, Pattern Matcher, Segmentation, Security, Thinning.

I. INTRODUCTION

Fingerprint recognition is one of the dominant one in Biometrics. It has been established by the continuous emergence of different forms of (AFIS) Automated Fingerprint Identification System. Fingerprint Identification involves matching query templates. These are used to determine the best matching score and therefore, the template that resembles it. It performs one to one matching where processing time required to perform identification is substantially more than the time required performing validation.

In order to reduce the number of matching operations, most fingerprint identification system uses some indexing mechanism, to narrow the number of templates against which the query image has to be matched.

A Variety of "fingerprint indexing mechanisms have been proposed in the literature. Where those literatures implied the fingerprint matching between same fingerprints (one to one matching). Using minutiae-Singular point's network uses Euclidean and spatial relationship algorithm in which it is used to reduce the FRR ratio and the computing time.

In segmentation and thinning it is used to convert the images into binary format. By using different mathematical models for fingerprint image segmentation. Latent fingerprint Matching used to extend features of fingerprint including singularity, ridge quality map, ridge flow map, ridge wavelength map, and skeleton. In feature extraction and matching include novel matching scheme using breath-first search to detect the matched minutiae pairs incrementally. In GSLM feature extraction uses Euclidean based matching that reduces the memory cost and processing time associated with verification.

The concept of combining minutiae descriptors for fingerprint matching uses a ridge based descriptors on minutiae matching that solves correspondence and similarity computation.

II. RELATED WORKS

1. Using Minutiae-Singular points Networks

The algorithm uses the Euclidean and spatial relationship between [1] the minutiae and singular points. It involves measurement of False Acceptance Rate(FAR), False Rejection Rate(FRR) and Average Matching Time(AMT). Receiver operating Rate(ROC). By analyzing those measurements it reveals the high adequacy level of distinguishing fingerprints obtained from different sources where the correct matching of images heavily [6] dependent on the quality of images. The study focused on the performance of different image qualities. During fingerprint image matching process, the core and delta points, priority was given to the core points and the FRR and FAR results obtained at a threshold value for the four datasets are shown in table.

Table.1

Statistics	DB1	DB2	DB3	DB4
FAR	0	0	0	0
FRR	10.23	7.85	5.51	7.47

Table.1 reveals that for each dataset,FAR of 10% was generated which indicates adequacy and ability of the new algorithm to identify fingerprint images from different fingers. Then obtained FRR values values are 10.23%, 7.85%,551% and 7.47% from the same finger in datasets DB1,DB2,DB3 and DB4 respectively. The variation in the failure rates are attributed to difference in pressure and contact area during fingerprint enrollment. The obtained results showed the effectiveness of the algorithm at distinguishing fingerprints from different sources with average FAR of 0%. The algorithm yielded different FRR values for the used datasets due to unequal corruption and noise levels.

The first dataset is mostly affected with FRR values of 10.23% the third dataset is least affected with FRR value of 5.51%. The new algorithm is more suitable for reducing the error rates and improving on the performances of the existing AFIS Future research direction aims at the optimization of the proposed algorithm for further reduction in the FRR values and the computation times.

2. Segmentation to Thinning

In this paper, mathematical algorithm for the fingerprint image enhancement were included to obtain new or improved versions that consist of different mathematical models for fingerprint image segmentation, normalization, ridge orientation, Gabor filtering, Binarization and thinning.

The results show that the modified sub-modified sub-models perform well with significant improvement over the original versions. Spurious features are those minutiae points that are created due to noise or artifacts where they are not actually a part of the fingerprints.

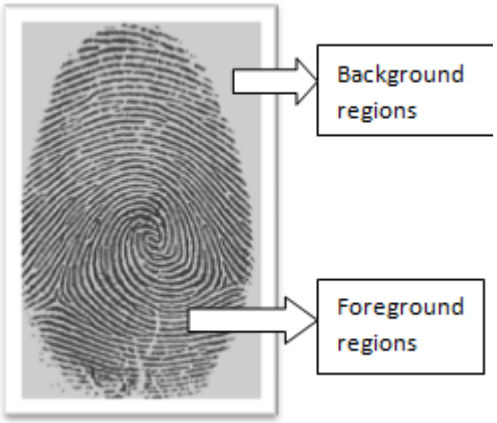

Figure1: Finger print

The background regions are mostly the outside regions where the noises introduced into the image during [3] enrolment is mostly found. The essence of segmentation is to reduce the burden associated with image enhancement by ensuring that focus is only on the foreground regions while the background regions are ignored. The purpose of the fingerprint enhancement experiments [2] is to analyze the performance of the modified algorithm under different conditions of images. The experimental result reveals that when the filter is applied to images with higher [12]noise level, the filter is unable to remove the noise effectively as it produced a significant amount of spurious features. The frequency at higher noise levels. When experiments were performed on real fingerprints images, the best results were obtained for image segmentation with variance threshold of 100.

The result obtained from the final stage of thinning show that the connectivity of the image ridge strictures has been preserved and improved at each stage.

3. Latent Fingerprint Matching

In Latent Fingerprint Matching, Tremendous progress has been made in plain and rolled fingerprints matching where latent fingerprints matching posse's difficult problems in poor quality of ridge impression, small finger area and large non linear distortion. The main difficulties in latent fingerprint matching compared [4] to the plain or rolled fingerprint matching.

The proposed system is based on finding the matching latent fingerprint at crime scenes to rolled fingerprints enrolled in law inforcement database and also in addition to minutiae they use extended features that include singularity, ridge quality map, ridge flow, ridge wavelength map, and skeleton. One way to reduce the manual processing is to define a latent fingerprint in which quality measures are continuously [4] updated when examiners are marking features. Once the quality measure reaches a predefined threshold, the latent examiners are notified that the image quality is already good enough to perform a latent search.

4. Features Extraction and Matching

In this, they proposed ridge features that are composed of four elements.

1) Ridge count
2) Ridge length
3) Ridge curve direction
4) Ridge type.

For extracting ridge features, ridge-based coordinate system in the skeletonized image has been defined. With the proposed ridge features and conventional minutiae that is based [5] on minutiae type, orientation, and position they include novel matching scheme to detect novel minutiae to detect[16] matched minutiae pairs incrementally using breath-first search. The proposed ridge features are invariant to any transform, thus they can be used in addition to conventional alignment-free features in the fingerprint [14] identification or cancellable fingerprint area.

5.Extracting GLSM Features.

GLSM based feature extraction with Euclidean based matching has been included to improve the efficiency of fingerprint matching. Co-occurrence metrics [15] can be used to extract features from the fingerprint image such that they are composed of regular texture patterns.

First image is preprocessed and unique reference point is determined to secure a Region-of-Interest (ROI). The Euclidean distance is used to find the [13] corresponding fingerprints, hence it is extremely fast. It produce a very good result of 97% of matching is achieved.

This method significantly reduces the memory cost and processing [time associated with verification, primarily because of the efficient use of GLSM features extraction. Gray-Level Co-Occurrence Matrix (GLSM) Distribution of pixel gray levels can be prescribed by second-order statistics like the probability of two pixels having particular gray levels at particular spatial relationship.

To evaluate the performance of the proposed matching methods, False Acceptance Ratio (FAR) and False Rejection Rate(FRR) are used. To compute False Acceptance Rate (FAR)

FAR = number of accepted Imposterclaims * 100

Total number of imposter accesses

And the False Rejection Rate (FRR)

FRR=Number of rejected Genuineclaims * 100

Total number of genuine accesses

To compute genuine match score for the entire database, one fingerprint sample of each person is matched against other Fingerprint samples of the same person. To compute imposter match, one fingerprint sample is matched against the remaining sample of the other persons. To improve the verification accuracy, further study is needed with larger database of fingerprint images, and on combining with soft biometric features.

6. Combining Minutiae Descriptors for Fingerprint Matching

A novel minutiae-based fingerprint matching algorithm is proposed that has been used to solve two problems, they are correspondence and similarity [7] computation. For the correspondence problem, they assign each minutia two descriptors

- Texture- based descriptors
- Minutiae-based descriptors

And uses an alignment-based greedy matching algorithm to [9] establish the correspondence between minutiae. For the similarity computation, they extract a 17-D feature vector from the matching result, and convert the feature vector into a matching score using support vector classifier. In our opinion, ridge-based descriptors are less discriminating than the other types, mainly because only one associated ridge is used in reference.

Comparison of Pattern Matcher algorithm table.1

S.no	Related works	Algorithm	Advantage	Disadvantage	CDRP Work
1	Using Minutiae-Singular Points Network	Euclidian and spatial relationships	Distinguishing fingerprints obtained from different sources.	Correct matching of images from same source is heavily dependent on the quality of the images.	Ease of Extracting minutiae point since converting into binary conversion
2	Segmentation to Thinning	different mathematical models for fingerprint image segmentation	modified sub-models perform well with significant improvement over the original versions	Necessity of each level of the enhancement.	Considering high level of minutiae points in the single pattern around 30-90.
3	Latent Fingerprint Matching	Use extended features, including singularity, ridge quality map, ridge flow map, ridge wavelength map, and skeleton.	tremendous progress has been made in plain and rolled fingerprint matching	Poor quality of ridge impressions, small finger area, and large nonlinear distortion are the main difficulties in latent fingerprint matching	Ease of Extracting minutiae point since converting into binary conversion
4	Features Extraction and matching	Novel matching scheme using a breadth-first search to detect the matched minutiae pairs incrementally.	Detect the matched minutiae pairs incrementally	Heavily dependent on the quality of images	Detect pore parameters as well and Ease of Extracting minutiae point since converting into binary conversion
5	Extracting GLCM Features	Euclidean based matching	reduces the memory cost and processing time associated with verification	Dependent on the quality of images	Ease of Extracting minutiae point since converting into binary conversion

6	Combining minutiae descriptors for fingerprint matching	A minutiae matching algorithm and uses ridge-based descriptors	Solves correspondence and similarity computation	ridge-based descriptors are less discriminating than the other types	It will reduce the FRR ratio than existing.

Table.2 Comparison of Pattern Matching Algorithm

In these bar chart gives the fingerprint recognition matching result of each algorithm Fig.1 such a minutiae based, novel based , GSLM, Euclidean base and CDRP pattern matcher algorithm. Based on the reduction ratio of false rejection rate efficiency of each algorithm has been examined, where CDRP pattern matcher algorithm gives more result than the other algorithm.

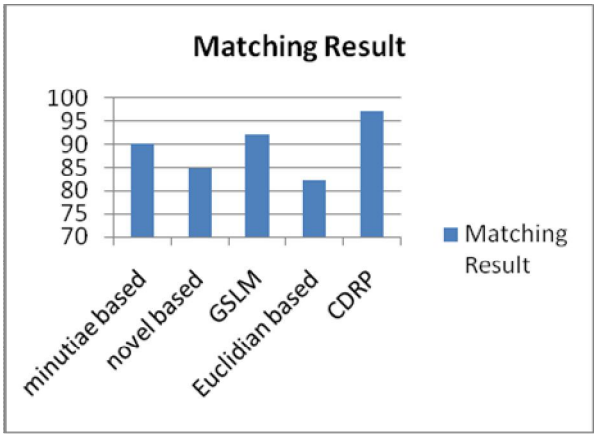

Figure.2 Matching result

7. CDRP Pattern Matcher

TheCDRP (Curriculum Design and Review Process)-Pattern matcher algorithm is usedto find the Exact Minutiae points. This algorithm is used for considering the core, delta and ridge bifurcation and ridge ending and pore parameters as well. The minutiae extractor able to identify the specific details known as minutia points in fingerprint image in which used to distinguish different users and also will be able to reduce the FRR ratio than the existing one.The obtained results showed the effectiveness of the algorithm at distinguishing fingerprints from different sources. Reducing the error rates and improving on the performances of the existing AFIS.

III. CONCLUSION

Fingerprint recognition is dominant one in Biometrics Technologies which can be used for security purpose in every field. There may be a chance for rejecting the same fingerprint in recognition process. By using binary conversion, clustering method, extracting minutiae points, edge detection technique is used to prevent the false rejection rate (FRR) and improve the efficiency of fingerprint recognition.

REFERENCES

[1] Iwasokum gabrial Babatundo,"Fingerprint matching using Minutiae-Singular points network"International journal of signal processing,image processing and pattern recognition.

[2] G. B. Iwasokun, O. C. Akinyokun, B. K. Alese and O. Olabode, "Fingerprint Image Enhancement: Segmentation to Thinning", International Journal of Advanced Computer Science and Applications (IJACSA), Indian, vol. 3, no. 1, (2012).

[3] G. B. Iwasokun, O. C. Akinyokun, B. K. Alese and O. Olabode, "Adaptive and Faster Approach to Fingerprint Minutiae Extraction and Validation", International Journal of Computer Science and Security, Malaysia, vol. 5, Issue 4, (2011), pp. 414-424.

[4] K. J. Anil and F. Jianjiang, "Latent Fingerprint Matching", IEEE Transactions on Pattern Analysis and Machine Intelligence, vol. 33, no. 1, (2011), pp. 88-100.

[5] A. J. Perez-Diaz and I. C. Arronte-Lopez, "Fingerprint Matching and Non-Matching Analysis for Different Tolerance Rotation Degrees in Commercial Matching Algorithms", Journal of Applied Research and Technology, vol. 8, no. 2, (2010), pp. 186-199.

[6] P. Peer, "Fingerprint-Based Verification System A Research Prototype", IWSSIP 2010 - 17th International Conference on Systems, Signals and Image Processing, (2010), pp. 150-153.

[7] F. Jianjiang, "Combining minutiae descriptors for fingerprint matching", Elsevier Pattern Recognition, vol. 41, (2008), pp. 342 – 352.

[8] "FIDIS, Future of Identity in the Information Society", Elsvier Inc., (2006).

[9] H. Yuliang, T. Jie, L. Liang, C. Hong and Y. Xin, "Fingerprint Matching Based on Global Comprehensive Similarity", (2005), Available online at http://www.fingerpass.net/downloads/papers/Fingerprint%20Matching%20Based%20on%20Global%20Comprehensive%20Similarity.pdf. Accessed 21/08/2011.

[10] T. Raymond, "Fingerprint Image Enhancement and Minutiae Extraction", PhD Thesis Submitted to School of Computer Science and Software Engineering, University of Western Australia, (2003), pp. 21-56, www.peterkovesi.com/studentprojects/ raymondthai/ RaymondThai.pdf. Accessed 16/05/2009.

[11] D. Maio, D. Maltoni, R. Cappelli, J. L. Wayman and A. K. Jain, "FVC2002: Second Fingerprint Verification Competition", in 16th International Conference on Pattern Recognition, (2002), pp. 811 – 814.

[12] A. K. Jain, S. Prabhakar, L. Hong and S. Pankanti, "Filter bank-Based Fingerprint Matching", IEEE Transactions on Image Processing, vol. 9, no. 5, (2000).

[13] A. K. Jain, L. Hong, S. Pankanti and R. Bolle, "An identity authentication system using fingerprints", Proceedings of IEEE, vol. 85, no. 9, (1997), pp. 1365–1388.

[14] Unhale A.A and V.G Asutkar, "Fingerprint Features Extraction and matching", Proceedings published by International Journal of Computer Applications, pp.28-32, (IJCA) ISSN: 0975 - 8887, 7-8 April, 2012.

[15] Benazir. K.K Vijayakumar, "Fingerprint Matching by Extracting GLCM Features", International Conference & Workshop on Recent Trends in Technology Proceedings published in International Journal of Computer Applications® (IJCA), (TCET) 2012.

[16] "An Efficient System for Fingerprint Finger Print Matching and Classification''Ashish Mishra* Priti Mahesh wary Volume 3, Issue 11, November 2013 ISSN: 2277 128X, International Journal of Advanced Research in Computer Science and Software Engineerin Research Paper. Available online at: www.ijarcsse.com