Efficient Ridge Based Fingerprint Authentication Using Minutia Extraction

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***Abstract*- Fingerprints are incomparable in the sense of location and direction of minutiae points present. Fingerprint verification is one of the most consistent personal identification methods. Conversely, manual fingerprint verification is feeble of meeting today's increasing performance requirements. An automatic fingerprint identification system (AFIS) is needed to rectify the Manual verification method. This paper describes the design and implementation of an online fingerprint authentication system which functioning in two stages: minutia extraction and minutia matching. An enhanced version of the minutia extraction method projected which is much faster and more trustworthy; it is implemented for obtaining features from an input fingerprint image captured with an online inkless scanner.**

Index Terms: Fingerprint recognition, Identification, Graph matching, Encoding

1. INTRODUCTION

A fingerprint is signifies in the type of a graph whose nodes communicate to ridges in the issue. Edges of the graph connect to the node that signifies to neighbouring or intersecting ridges. Therefore the graph structure encapsulates the topological interaction within the fingerprint. The algorithm has been implemented and tested using a library of real-life fingerprint images. Fingerprint is a broadly used form of biometric credentials. It is a most powerful tool by means of person identification. Fingerprint recognition has forensic product like Criminal investigation, missing children etc., government applications like social security, border control, passport control, driving license etc., and commercial applications like e-commerce, internet access, ATM, credit card etc. Because of their individuality and stability over the time, fingerprints have been used for identification and verification over a century. The process of fingerprint detection is becoming programmed and results in many AFIS (Automatic Fingerprint Identification System). Fingerprint typically materializes as a series of dark lines that symbolize the ridges while the valleys between these ridges appear as white space.

The process of fingerprint recognition system classified into three key important measurements: fingerprint image pre-processing, feature extraction, and matching. An efficient noise cleaning is essential to get superior quality images in case the input is not clear. Minutiae are limited discontinuities in the fingerprint pattern and fingerprint identification generally depends on the location and direction of these minutiae points for example ridge ending and junction (merging and splitting) along the ridge path. These minutiae points are then matched for detection or authentication process. Fingerprint pre-processing is an important component of Fingerprint Recognition System (FRS) as the quality of image acting a major task in the performance of the system.

PROBLEM DEFINITION

This framework proposes to recognize the identity of a person based on their fingerprint minutiae features and describing the fingerprint pattern with respect to each minutia detail.

2. PROPOSED METHODOLOGY

The proposed System methodology utilizes 3 stages of features (pores and ridge contours) along with matching fingerprints at 500 ppi, in a sequential manner. The ridge features and conventional minutiae features (minutiae type, orientation, and position) is used. The Ridge features are collected of four elements: (ridge count, ridge length, ridge curvature direction, and ridge type). Breadth-first search (BFS) is performed to detect the matched ridge-based coordinate pairs**.**

Fingerprints are classified into five categories:

- Arch/Fingerprint Pre-processing
- Tented arch/Ridge Indexing
- Left loop/Binning Ridge
- Right loop /Minutiae Feature Extraction
- Whorl/Matching Recognition

2.1 ARCH/FINGERPRINT PROCESSING

This arch divides the image into 8x8 pixel blocks. Then, the mean and variance values of each block are calculated to segment of the fingerprint regions in the image**.** Finally the method described to estimate the ridge orientation and the ridge frequency is calculated. The Finger Ridge Features is projected the ridge features which are composed of four elements: ridge count, ridge length, ridge curvature direction, and ridge type. We propose a new and simple matching scheme by incorporating conventional minutiae features and additional ridge features associated with corresponding minutiae sets.

To extract the ridge features, a ridge-based coordinate system has two methods

1) Ridge Indexing and 2) Selection/Binning Ridge.

ALGORITHM

- Get the input Fingerprint Image
- Now Pre-process the Image
- Preprocessing is done to reduce the noise of image using Gabor/Gaussian filter
  - G(x,y)=(1/2πσ)*e-
- After pre-processing the image will change it to skeletonized ridge image

2.2 TENDED ARCH /RIDGE INDEXING

Ridge indexing is known as ridge count, that the ridge count methods find the number of ridges that intersect the straight line between two minutiae in the spatial domain. When the ridge-counting line is parallel to the ridge structures, the line may meet the same ridge at one point, at more than two points, or at no point, due to skin deformation, We also consider the direction of the ridge count line. The ridge count (rc) is not always a positive number and the sign of the ridge count follows the sign of the vertical axis.

ALGORITHM

- Get the Skeletonized Image as input.
- Index the image using Ride Indexing called as Ridge count.
- Find the number of ridges that intersect the straight line b/w two minutiae in spatial domain.
- And also find the minutiae points where the ridge meets. It may be at one point or more than two points.
- Now find the direction of the ridge count line which follows the sign of the vertical axis.
- Finally map this as Ridge Oriented Image.

2.3 LEFT LOOP/BINNING RIDGE

The Ridge length (RL) is the distance on the horizontal axis from the intersection of the vertical and horizontal axis. The absolute differences of ridge length elements are mostly less than 16 pixels. Therefore, we can set the threshold of the ridge length feature to determine the same fingerprint as 16 pixels.

To define the Ridge curvature we are using the sampling points along the horizontal axis from the intersection of the vertical axis. Ridge curvature based sampling point is calculated as, 1) Ridges may have more than two inflection points. 2) Some ridges are too straight to define a curved direction

ALGORITHM

- The Ridge Oriented image is given as input.
- The ridge Length (rl) is found to the distance on the Horizontal axis from the intersection of the vertical and horizontal axis. But the absolute differences of ridge length elements are mostly less than 16 pixels. Therefore, we set the threshold of the ridge length feature to determine the same 16 pixels.
- Using the sampling points along the horizontal axis from the intersection of the vertical axis we find the Ridge Curvature.
- Then Ridge type is found due to skin deformation and errors. it may be of a bifurcation or an end point.
- The Binned Image is sent as Input to Feature Extraction.

2.4 RIGHT LOOP/MINUTIATE EXTRACTION

In the ridge-based coordinate system is defined by a minutia (called origin) and vertical and horizontal axes starting from the origin minutia. To represent the relative position of the minutiae according to the origin, horizontal axes should be defined. The ridge-based coordinate system and the ridge features describe the relationship between the origin and an arbitrary minutia. To determine the ridge type (rt), each minutia is first classified as an end point or a bifurcation. If a minutia is an end point, there is only one ridge belonging to the minutia. If a minutia is a bifurcation, there are three ridges connected to the minutiae.

ALGORITHM

- Get Binned image as input.
- We define the ridge coordinates and extract ridge features between two minutiae.
- The ridge-based coordinate system is defined by a minutia (called origin) where vertical and horizontal axis is starting from the origin minutia.
- To represent the relative position of the minutiae according to the origin, horizontal axis should be defined.
- To determine the ridge type (rt), each minutia is first classified as an end point or a bifurcation. If a minutia is an endpoint, there is only one ridge belonging to the minutia. If a minutia is a bifurcation, there are three ridges connected to the minutiae IGHT LOOP

2.5 WHORL/ MATCHING RECOGNITION

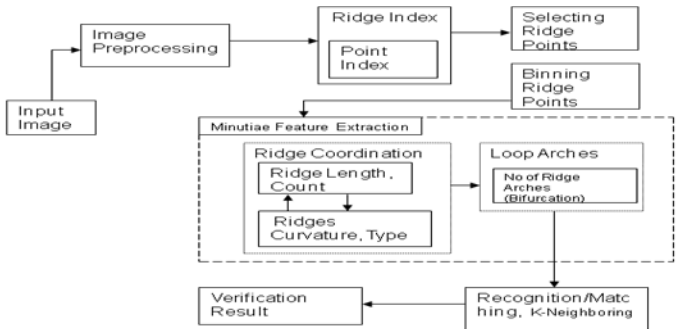
A breadth-first search (BFS) is performed to detect the matched ridge-based coordinate pairs. The ridge- based coordinate system is very similar to the K-plet structure. Initially match any pair of ridge-based coordinate systems extracted from the enrolled fingerprint image and applied to find the optimal solution in matching two string sequences in the enrolled and input ridge- based coordinates. The Ridge feature vector the three feature elements (ridge count, ridge length, and ridge curvature direction) are used to calculate the matching scores.

ALGORITHM

- Get Extracted image to be matched as input.
- For every initially matched pair, a breadth-first search (BFS) is performed to detect the matched ridge-based coordinate pairs.
- Initially matching any pair of ridge-based coordinate systems is extracted from the enrolled fingerprint image and the input fingerprint image is matched using dynamic programming.
- Dynamic programming is applied to find the optimal solution in matching two string sequences in the enrolled and input ridge-based coordinates**.**

The Ridge feature vector the three feature elements (ridge count, ridge length, and ridge curvature direction) are used to calculate the matching scores and the ridge type feature is used to check the validity of the candidate pairs and are displayed

Block Diagram for overall processing



CONCLUSION

The Proposed Fingerprint classification provides an important for This framework proposes to recognize the identity of a person based on their fingerprint minutiae features and describing the fingerprint pattern with respect to each minutia detail Iindexing mechanism in a fingerprint database. An accurate and consistent classification can greatly reduce fingerprint matching time for a large database. We present a fingerprint classification algorithm which is able to achieve accuracy. The originality smear in the matching technique used for matching Level 2 features (minutiae) and Level 3 features (ridge contours). Finally, we have tried to overcome the fingerprint matching distortion, small overlap between query and template images, error and noise introduced by feature extraction algorithms, due to unfavourable skin conditions. The use of Level 3 features is beneficial in deciding match/ non match, with increased accuracy, in case of fingerprints with small overlap.

REFERENCES

1. Bazen A.M, Verwaaijen G.T.B, Gerez S.H., Veelenturf L.P.J., and vander Zwaag B.J, “A Correlation-Based Fingerprint Verification System”. In Proc. of 11th Annual Workshop on Circuits Systems and Signal Processing (ProRISC), pages 205-213-(2000).

2. Faulds H, “On the skin-furrows of the hand. Nature”, 22:605-(1880).

1. Hong .L, Y. Wan, and A. Jain, “Fingerprint image enhancement: algorithm and performance evaluation”- IEEE Transactions on Pattern Analysis and Machine Intelligence, 20(8):777-789-,(1998).

4. Jain. A and S. Pankanti, “Fingerprint classification and

matching".Michigan State University-(1999).

5. Jain A.K, S. Prabhakar, Lin Hong, and S. Pankanti, "Finger Code: A filter bank for fingerprint representation and matching". In Proc. of IEEE Computer Society Conference on Computer Vision and Pattern Recognition, volume 2, pages -193- (1999).

6 Jain A . K ., Y . Chen a n d M . Demirkus, "Pores a n d R i d g e s : High-Resolution Fingerprint Matching Using Level 3 Features". PAMI, 29(1):15-27-(2007).

8. Kryszczuk K, A. Drygajlo, and P. Morier, Extraction of Level 2 and Level 3 Features for Fragmentary Fingerprints". In Proc. Second COST Action 275 Workshop, pages 83-88-(2004).

9. Louis C o e t z e e a n d E l i z a b e t h C . Botha, " Fingerprint r e c o g n i t i o n in low quality images, In Pattern Recognition", volume 26, pages 1441-1460-(1993).

10. Mayank Vatsa, Richa Singh, Afzel Noore, and Max M. Houck. "Quality augmented fusion of level-2 and level-3 fingerprint information using DSm theory".Int. J. Approx. Reasoning, 50(1):51-61-(2009).

11. Nalini K. Ratha, Kalle Karu, Shaoyun Chen, and Anil K. Jain. "A Real-Time Matching System for Large Fingerprint Databases". IEEE Transactions on Pattern Analysis and Machine Intelligence, 18(8):799-813-(1996).

12. N.K. Ratha, S. Chen, and A.K. Jain. "Adaptive ow orientation-based feature extraction in fingerprint images". Pattern Recognition, 28(11):1657-1672-(1995).

13. Sharat Chikkerur, Alexander N. Cartwright, and Venu Govindaraju. "Kplet and Coupled BFS: A Graph Based Fingerprint Representation and Matching Algorithm". In ICB, volume 3832 of Lecture Notes in Computer Science, pages309-315- (2006).

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