HYBRID FINGERPRINT MATCHING ALGORITHM FOR HIGH ACCURACY AND RELIABILITY

Atul Ganbawle[1], J. A. Shaikh[2]

[1]*Padmabhooshan Vasantraodada Patil Institute of Technology, Budhgaon (Sangli) Maharashtra, India*
[2]*Padmabhooshan Vasantraodada Patil Institute of Technology, Budhgaon (Sangli) Maharashtra, India*

Abstract

This paper introduces the hybrid fingerprint matching algorithm using texture algorithm and minutiae algorithm. These algorithm increases the high accuracy and reliability of the fingerprint images. The proposed texture features are arch texture, whorl texture and loop texture. The minutiae features are ridge ending, short ridge, and bifurcation etc. In this paper, we conclude that, the results are combined between the pattern and minutiae matching score. In minutiae algorithm, images are not well performed in the input images and database images. We present the hybrid algorithm by using texture and pattern algorithm.

Keywords: *Fingerprint image, texture and minutiae pattern.*

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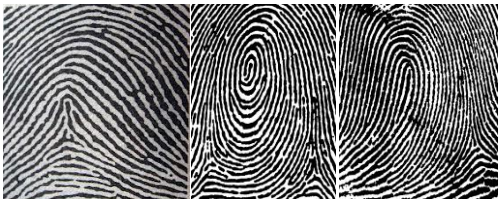
1. INTRODUCTION

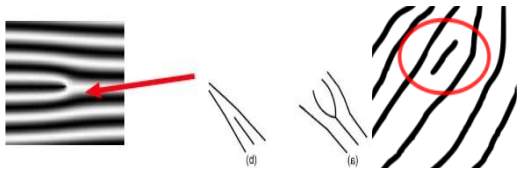
Biometric system is automatic identification by using fingerprint recognition system. Iris, retina, palm print recognition system is also biometric system. Fingerprint recognition system is most widely used method in the biometric systems. Fingerprint recognition is the reliable method and low cost compare to the iris recognition, face recognition, palm recognition, retina recognition, signature and gait fingerprint. Fingerprint matching is used in the criminal investigation and commercial application. In this paper, we proposed the hybrid fingerprint matching algorithm using textures based method and minutiae based method.

In the texture based method, texture recognition is the application of the system in fingerprint recognition system. Texture recognition method is compared to the template fingerprint textures. There are many types of texture recognition system such as Arch, whorl and loops. Left loop and right loops are the type of the loop textures. Left loop is one core point and delta point. These points are in the left side of the texture. Right loop is also one core and delta point. These points are in the right side of the texture. Arch texture is defined as one line is start from the left side and end from the right side of the finger. In arch, core and delta points are not present. In the whorl, one finger line is rotate around the point. Two core and delta points are present in whorl.



Arch Texture Whorl loop

In the minutiae based method, this method is another application of the fingerprint recognition system. Minutiae based systems determining the minutiae point present in the first fingerprint image and template fingerprint image. The minutiae systems perform with high quality fingerprint. Minutiae based matching algorithms present the minutiae points in the fingerprint image. Minutiae based method divided in to the three features such as Ridge ending, short ridge and bifurcation. In the short ridge, length of the ridges is less than the total length of fingerprint image. Bifurcation is divided in to the two ridges. Ridge ending is the ending point of ridges.



Ridge Ending Bifurcation Short ridge

1.1 Background

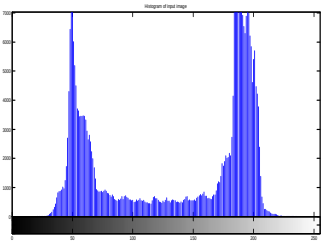
Fingerprint is a personal identification. The science of fingerprint identification stands out among all other forensic science for many regions Arun Ross et al [2] show that, hybrid matching algorithm that uses region and point information. It is also utilize the texture and minutiae information available in the fingerprint. Heeseung et al [4] show that, two methods are used to matching the novel fingerprint such as ridge feature and conventional minutiae feature. Unsang Park et al [8] show that, Scale Invariant Fourier Transformer method is used. The Scale Invariant Fourier Transformer (SIFT) operator can be used for fingerprint feature extraction and matching. It is possible to improve performance of SIFT. Mana Tarjoman et al. [9] present, graph theory. It is observed that Directional image of fingerprints to increase the number of subclasses. Jie Zhou et al, global structure and local curves methods are

used. It is observed that the fingerprint takes than 420 bytes to many fields.

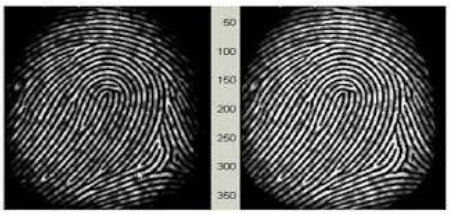
2. FINGERPRINT MATCHING

2.1 Histogram Equalization

Histogram defined as convert one grayscale fingerprint into another grayscale of image. Histogram equalization is spread the value of the pixels of fingerprint image so it is increase the information of image. The level of the gray scale of the fingerprint image is (0, L-1). Histogram equalization is used to increases the brightness of the images. Histogram equalization is also used to balance the brightness level of the fingerprint image



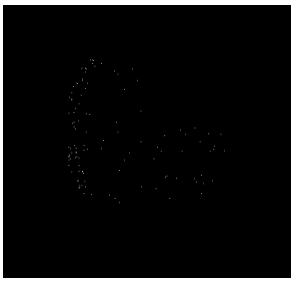
Histogram Input image



Original and equalization fingerprint image

2.2 Binarization

Image binarization is the process of gray scale fingerprint image is converted into the binary fingerprint image. The binarization step which is the accurate information of the equalized image is binary. Ridge extracting is most important process in the image binarization; the images are given as gray scale image. So image binarization converts the image images that give the accurate information of fingerprint image. The value of the pixel is 1 while value of the background pixel is 0. Finally, a binary image is created by coloring each pixel white or black, depending on value of pixels. Such as Black for 0 and white for 1.



Binarization

Binarization is the process in which the gray scale image is converted into a binary image by thresholding and if pixel value is larger than mean value of pixel then the binarized value is while binarized value is zero.

Fingerprint image after binarization

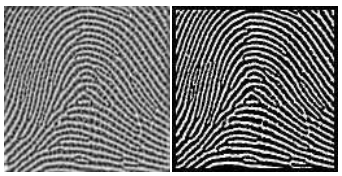
2.3 Thinning

Ridge thinning is to removing the redundant pixels of ridge. In ridge thinning, reduce the complexity in the binaries image then thinning is performed. It is the process of reducing the width of the ridges in the fingerprint image to skeleton image by thinning operation. Hilditch algorithm is used in the ridge thinning. We can generate a one pixel image. The thinning is then filtered by other thinning operation to remove some noise and points.

Ridge Thinning Image

2.4 Low Pass Filter

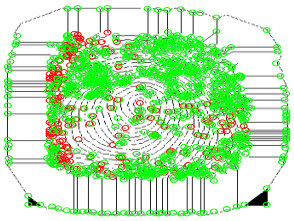
Low pass filter is used to noise reduction. Low pass filter is used to smooth the high frequency of the fingerprint images. These filter is based on the 3*3 each pixel's. In pixels wise image, the new value of each pixel only depends on each previous value. As shown in figure,



Original image Binary Image

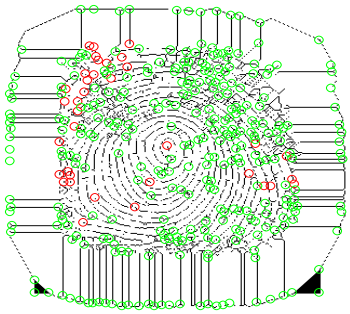
2.5 Extraction

The cross number (C.N) concept is widely used in the minutiae marking process. It is used for the extracting the minutiae point. Each 3*3 window if the central pixel is 1 and 3-value neighbors, then the central pixel is a ridge branch and stored in the separate database or template. If the central pixel is 1 and 1-value neighbors, then the central pixel is ridge ending and stored in a database.



Minutiae marking

There are four steps to removing the false minutiae points such as, the distance between one termination and bifurcation is less than distance and same ridges of minutiae, removing these two ridges. The distance between two bifurcations is less than distance and ridges are same then two bifurcations are deleted. Third is two terminations are within a distance then they are cut the ridge and they are removed. And fourth is two terminations are placed in the short ridge and less than distance then two terminations are removed as shown in figure,



Removal false minutiae point

Fingerprint Matching

Fingerprint matching is used to determine the two set of the fingerprint into the same fingerprint image. One fingerprint image is stored in the database and second fingerprint images are the current employee fingerprint image. The fingerprint image is to compare all ridges or information on the fingerprints. All the information on the fingerprint image is compare to the stored fingerprint image in the database. If the matching information is less than the pre-defined threshold then input image successfully matched with the output image while matching is failed..

In Minutiae method:

Fingerprint 2	**Fingerprint 1**
No. of terminations=36	No. of terminations=36
No. of Bifurcations=258	No. of Bifurcations=258

In Texture method:

Fingerprint 2			**Fingerprint 1**		
Name: Fingerprint 2			Name: Fingerprint 1		
X	Y	Ang	X	Y	Ang
244	38	7.80	244	38	7.80
2	1	0.29	2	1	0.29

Fingerprint1 fingerprint 2

Details of fingerprint comparison is show below. Here fingerprint 1 is compared with fingerprint 2 i.e. different fingerprint image. They are not matched. From following results, we can see that this method gives exact details of fingerprint.

In Minutiae:

Fingerprint 2	**Fingerprint 1**
No. of terminations=366	No. of terminations=36
No. of Bifurcations=701	No. of Bifurcations=258

In Texture method:

Fingerprint 2			**Fingerprint 1**		
Name: Fingerprint 2			Name: Fingerprint 1		
X	Y	Ang	X	Y	Ang
178	28	5.70	244	38	7.80
1	0	0.21	2	1	0.29

Fingerprint1 fingerprint2

3. CONCLUSIONS

In this work, easy method for feature extraction from fingerprint images is proposed. Fingerprint matching is done using hybrid fingerprint matching using minutiae and texture. The flow direction of the ridges is computed viewing the fingerprint image as a texture image. The input image quality did not affect the performance of hybrid method. Proposed work is divided into two parts, pre-processing and post processing. In pre-processing, the original fingerprint image is converted into gray scale image and after that it is converted into binary image. In post processing, make the thinned image as a perfect single pixel width image with continuity in the ridge flow connectivity is performed. In this process gives the better and accurate results than previous methods. The proposed method provides more accurate and high reliability results than existing methods.

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