Analysis of Fingerprint Matching by using Similarity Score

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Abstract— This paper present the analysis of fingerprint matching on the basis of similarity score. The fingerprints of human is having rich details which is called minutiae. By getting information from minutia we can perform fingerprint verification and identification.in this project. We are fetching the minutiae from the fingerprint by using a number of steps and then generate the similarity score between two minutiae. The methodology in this project is how to extract minutia form the fingerprint image and after that between two fingerprint matching on the basis of the similarity score. The stages are Image enhancement, image segmentation, minutiae extraction and minutiae matching.FVC2002 is used as database for fingerprints data. The matching process is further divided into two parts one part is one minutiae is match with one another minutiae and second part is one to many matching. MATLAB software is used for performing the project programming and result verification. MATLAB software is used to verify the results.

Key words: Minutiae, Image Segmentation

I. INTRODUCTION

Human fingerprint consist of valley and rides and the mixing of both is created distinct patterns. The development of these patterns is done at time of the pregnancy. During pregnancy time these patterns are created and the every pattern is different to others and also it is present till whole life. On the research basis we can observed that fingerprint of two person cannot be same because of this fingerprint is used for person identification, security system etc. The biometric is also design on the concept of fingerprint. The matching of fingerprint is very complex just because of its complex patterns. Manual fingerprint matching [6] and [8] taking more time and addition time is also required for education and training by experts.

Presently fingerprint is used in Android smart mobile phones which having fingerprint sensor for fingerprint based protection and security. The password, id-cards are not more secure and reliable than fingerprint based protection and security system. In the fingerprint some abnormal point present on ridges. On the basis of these abnormal point we can distinguished the fingerprint and it is also called Minutia. The minutia having two major parts one is ridges ending or termination and second one is bifurcation.

The recognition of fingerprint system [11] and [13] is divided into two major parts

1) Verification of fingerprint
2) Identification of fingerprint

The rule of Thumb suggested by Lords et2012 he described that We can match 12 pair minutia point between, He also said that in this matching[24] any disturbance is not occurred and no doubt beyond establishment of ID. The national association of identification said that "no valid basis exist for requiring that a predetermined minimum number of friction rigid characteristics must be present in two impression in order to establish identity"[18].

The sensor is made up of semiconductor and optical material. The accuracy of theses material sensors are very high and also efficiency is very high but if the user's finger is too dirty and dry then efficiency and accuracy of sensor is decreases.

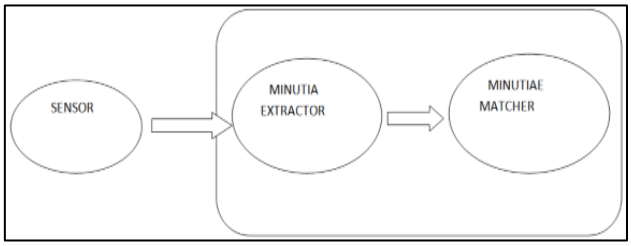


Fig. 1: Recognition Process

II. MINUTIAE EXTRACTION PROCESS

The minutia extractor extracts the ridge ending and bifurcation from the fingerprint [11]. The minutia extraction process consist of three major stage which are as follows—

1) Pre-Processing
2) Minutia Extraction
3) Post-Processing

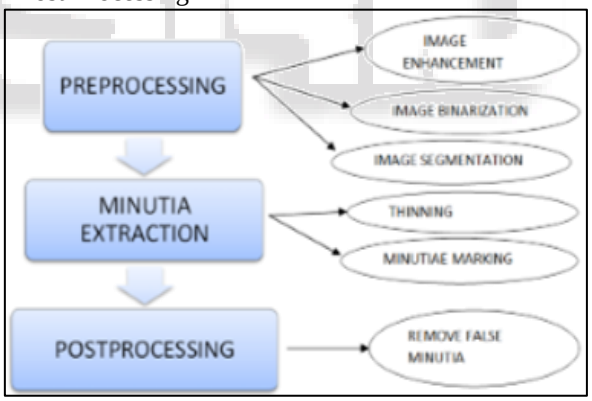


Fig. 2: Minutiae Extractor

A. Pre-Processing

The pre-processing is used improve the image quality and get ready image to for minutia extraction. This process is further divided into three stages

1) Enhancement
2) Image Binarization
3) Image segmentation

Fourier transform and histogram equalization method are used for enhancement of image and the adaptive threshold method is used for Binarization process of image.

The image segmentation used for analysis of image segment by segment.

The image segmentation is done in three step

1) Block direction Estimation
2) By direction intensity

3) ROI (Region of Interest) extraction by Morphological operations.

B. Minutia Extraction

In this process we find out the ridges ending and bifurcations which are playing main role in verification and identification of fingerprints. For the minutia extraction we used iterative parallel thinning algorithm. Minutia extraction process id done is following steps.

1) Ridge Thinning
2) Minutia Making

For eliminating the redundant pixels of ridges image thinning process is used. The eliminating process of redundant pixels is going on till the size of image ridges to one pixel wide. The second process minutia making is used crossing number algorithm which quite simple and reliable.

C. Post-Processing

This post-processing is used for removing the false minutia form the image of fingerprint which is converted into minutia form by using minutia extraction process. A novel representation of ridges and bifurcations is proposed to unify ridge ending and bifurcation. The minutia matcher is used to find out that whether the two minutia sets are form same finger or not. If the two minutia sets ridges are match well then these two images aligned. After this all remaining minutia are matched.

Fig. 3: Step by Step Fingerprint Recognition System

D. Fingerprint Image Enhancement

In the enhancing process [15] we make image clear for better handling and for achieved accurate result from further process. Our fingers are comes in contact with manual task which is perform by us because of this fingertips[16] becomes dry, wet, dirty, worn, creased etc. This creates more noise in the fingerprint image which create troubles in minutia extraction. So to enhance the image of fingerprint, basically two methods are used.

1) Histogram Equalizer

The histogram equalizer [5] is used for increasing the pixel value of an image and by doing this we increase perceptional information. It represents the relative frequency of various type of gray scale level in image. This technique have an addition quality. By using this method we can easily improve the contrast of an image.

III. MINUTIA EXTRACTION

In the minutia matching process after completing the false minutia, image enhancement and segmentation process by using two Morphological method we extract the minutia form fingerprint image.To extract the minutia [7],[10]and [15] from fingerprint image two stages are required and we can also say that to extract the minutia we divide the extraction process in the two sub process. Which are as follows.

1) Ridge Thinning
2) Minutiae Marking

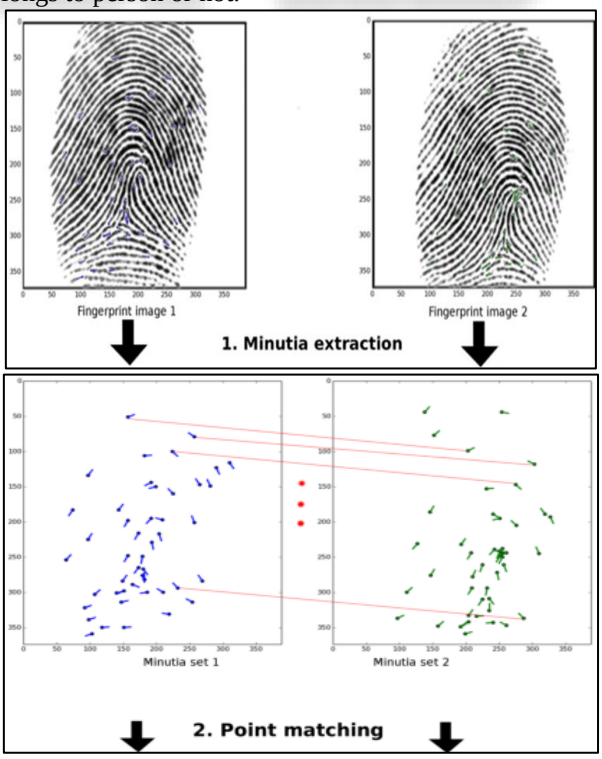
IV. MINUTIA MATCHING & SIMILARITY SCORE

A. Minutia Matching

Fingerprint is a tool which is used for reliably identification of human beings. The fingerprint recognition system is used for one of the most famous biometric system. This system is also used for various other applications—border control, system security etc. we used feature based fingerprint matching in this thesis. In this chapter we describe about few things which are as follows

1) Fingerprint Accessing from Database
2) Fingerprint Enhancement
3) Fingerprint Filtering
4) Fingerprint Matching

Firstly we take a set of minutiae for testing purpose. To perform the matching process we select the two fingerprint image and find the minutiae then according to the alignment and matching ridges and bifurcation we can find the result. The result having the information the fingerprint is belongs to person or not.



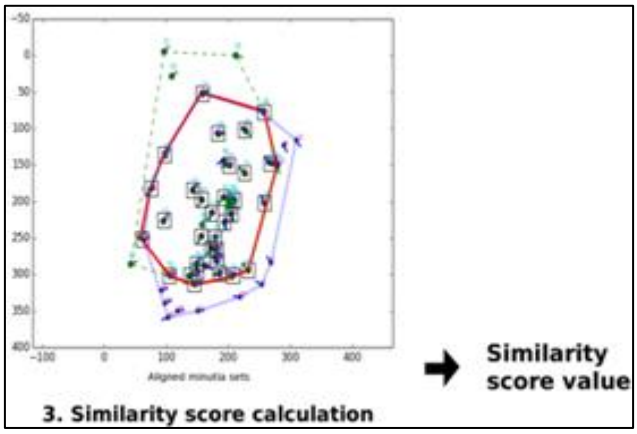


Fig. 4: The Three Step for Matching Of Minutia (1) Minutia Extraction (2) Minutia Point Matching (3) Similarity Score Value Generation

V. RESULT

A. One to One Matching Results

Firstly we take few finger-print to match one to one 102_1.tif to 101_2.tif

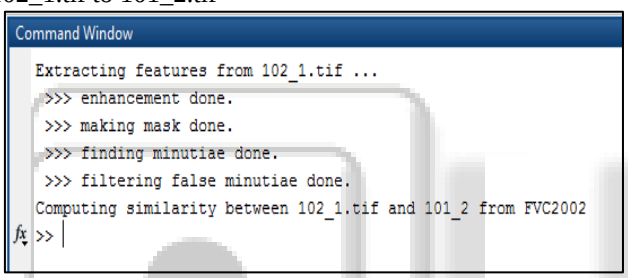


Fig. 5: Matching of Image 102_1.tif with 101_2.tif

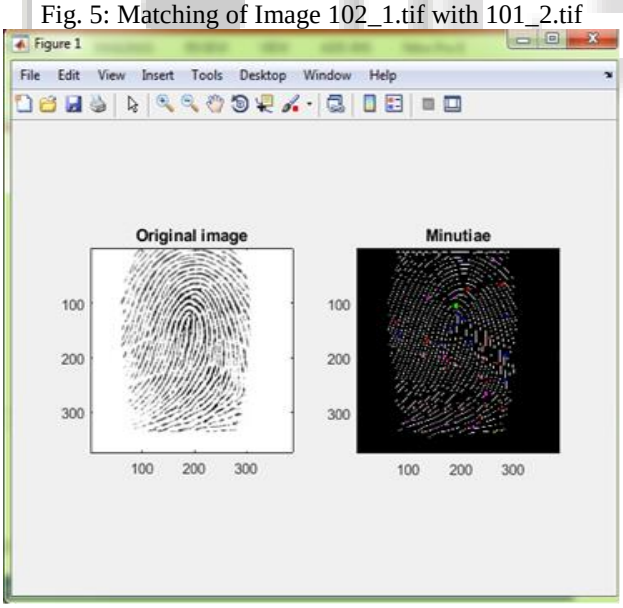


Fig. 6: Original Image & Minutia

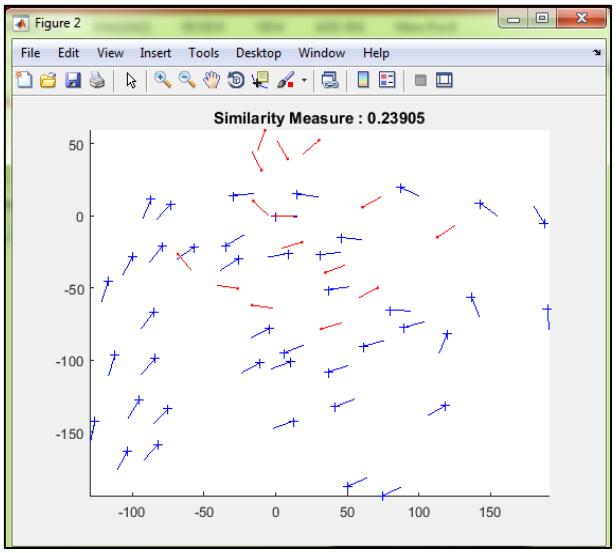


Figure 7. Similarity Score between 102_1.tif & 101_1.Tif

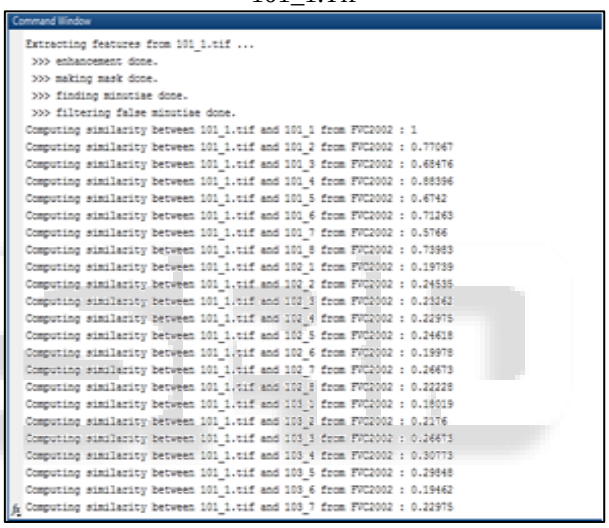


Fig. 8: 101_1.tif to All

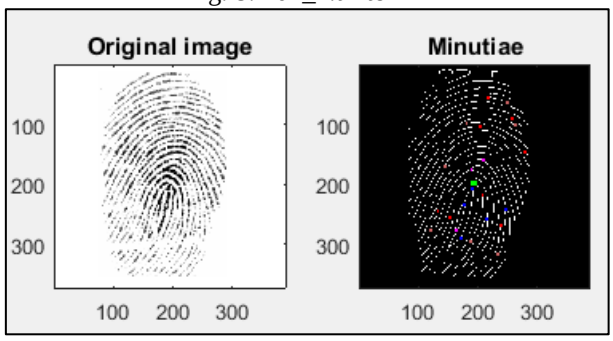


Fig. 9: Figure 8.101_1.tif to All

We used A fingerprint database from the FVC2002 (Fingerprint Verification Competition 2002) for testing our experiment performance.

THRESHOLD VALUE	FALSE ACCEPTANCE RATE (In percentage)	FALSE REJECT RATE (In percentage)
7	0.075	7.25
8	0.028	9.54
9	0.009	12.36
10	0.02	14.52

Table 1:

VI. CONCLUSION

The proposed system is in manner understand the Fingerprint Recognition system. The application of fingerprint is in various area like biometric measurement, to solving crime investigation and in security system.to generate the matching score the minutiae extraction and minutiae matching all stage are used and the various standard techniques are used preprocessing stage.

We have taken the fingerprint of persons and for matching process we do a numbers of algorithms to achieve the less error result. The minutiae extracting process and preprocessing and matching score generation are steps to find the match score between two fingerprints.

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