Biometric BFS based Fingerprint Identification System using MATLAB

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Abstract: Fingerprint identification is most important due to its singularity and flexibility .It can be used for identification purpose in a period of years. Fingerprints are accepted with a century, more recently become a automated due to advancement in computing capabilities. In this paper, we use the Novel based matching and Breadth first search technique for minutiae matching. This technique is used for finding the matched pairs. The experimental results shows that the proposed method is very accurate in matching the fingerprint .

Index Terms - **BFS technique, Ridge ending, Bifurcation point , Extraction and Matching.**

I. INTRODUCTION

Fingerprints are created by Dr. Henry fault in 1882[1].It analyse the pattern of fingertips .Fingerprint identification is very secure compared with other methods. They are used for recognition due to its uniqueness and durability. Fingertips consists of ridges and valleys in a finger.It is a process of identifying the match between the persons.It is also unique to each persons, fingerprint cannot be changed throughout their lifetime.Fingerprints can be done by enrollment and verification .Most popular algorithm used for fingerprint is minutiae matching because of efficiency and accuracy .The required work for fingerprint identification is skin distortions.It includes elasticity of skin, changeable load by apt. [2,4].

II.BIOMETRICS

The term bio means life and metrics means to measures .It provide the authentication and verification function . The term biometrics is related to security system.Biometrics are used to replace the id cards because it can be stolen away. It is a identification of a person customs or quality.Biometrics is based on physical or behavioural types.The types are face, fingerprint, hand ,geometry, iris, retinal, signature, and voice[3]. Secure identification is needed due to the security misuse and increase in fraud transactions. By utilising these techniques the recognition is accurate and it is very convenient.The applicationsare used invariety of sectors like criminal investigation, secure banking, financial transactions and criminal investigations[2].

Figure 1:Biometrics

III.TYPES OF BIOMETRICS

Two types of biometrics are used, that is physical and behavioural biometrics.

3.1.BEHAVIOURAL BIOMETRICS

It is a data and measurement derived from the action .

3.1.1. Keystroke Recognition

Keystroke recognition are also known as typing recognition that is just typing the word in a keyboard.It is used to find the typing pattern and word for time spacing.It decrease the deceptive proceedings of the internet users. Keystroke is a software that is installed on a computer.It gives the limited accuracy compared to other methods [2]

3.1.2. Speaker identification

Speaker identification is used to find the speaker based on voice dip and speech style. Behavioral patterns of a voice differ with every individual. In criminal investigations, a voice is compared to a database of voice model templates that were previously recorded. The success of the bio statistics voice data comparison varies since it is based on the availability of the voice recordings[2].

3.2PHYSICAL BIOMETRICS

It is a data and measurement derived from direct measurement of a human part.

3.2.1.Fingerprint identification

In this type it compares the two fingerprint that matches or not. Fingerprint patterns contains arch, loop, and whorl[4]. Few laptop computers put to use of fingerprint biometrics for authorizations for such as purposes as logging in and barge in website passwords[2].

3.2.2.Hand or geometry recognition

The camera takes a picture from the hand and calculate the width, distance,surface area and thickness.It uses the 3d analysis of the image.This can be stored for future use. The method uses 3D analysis of the finger for tracking and identification purposes[2].

3.2.3. Facial recognition

Facial recognition can be identified by digital image and it can be analysed and compared by patterns. Facial recognition uses algorithms to analyze features. 3D biometrics is the updated version for identification process. The image are captured by 3D camera or scanned 2D photo. The information can be made easy by using contour of the eye sockets, nose and cheekbones help make identification easier. The 3D method are overcome with the lighting issues. This can be used as the law enforcement and forensics investigations[2].

IV. FINGERPRINT MATCHING APPROACHES

4.1. Minutiae based matching

In this method we find the best sequence in the database. Generally this process consists of two steps : minutiae matching and minutiae extraction .In matching , the fingerprint is compared with database and matched minutiae is found.from the grayscale image the minutiae are extracted in extraction[1].

4.2. Correlation based matching

The images are overlapped and the relationship between pixels are add up for contrasting images.It is able to handle the low quality images[1]. Ridge feature based compare the fingerprint with the help of feature draw out from the ridge pattern.

V. LITERATURE SURVEY

5.1 Various methods are used to increase the performance of matching that is, Kovacs-vajna[5] suggested the concurrence of gray scale in between the every pair of minutiae by triangular matching .This is possible to check the affinity of global and local level. A co-ordination process may be executed to determine the local levels holds the global level.

T.Amorraksa ,S.Tachaphetpi[9] boon develop the FR based on DCT features and they are using a K-nearest neighbour classifier and it having more RR.ChihJen Lee et al[10] emphasizes with the local Gabor filter and it has the higher RR compare to global Gabor-based method.

Yun Yang ,Jia mi[11] uses the Gabor filter for enhancement and fortify the security for resolute and fidelity. Asker M.Bazen[12]uses the elastic matching algorithm to measure non linear transformation .Local and global matching are used to represent the elastic deformation by the thin plate spline.This model describes the original coordinates and to matching score.

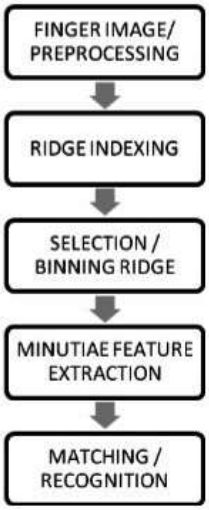
Heesseung Choi et al[13]use the gabor filter. A ridge based coordinate system are used to find the ridge features between two minutiae.BFS are used for matching the pairs of minutiae. Bayesian decision rule was used for matching score.

Weiwei Zhang and Yangsheng[14] used a core based fingerprint for matching. Low resolution and high resolution are used to find the core point. Then it uses the local and global matching for minutiae pair. The advantage of using this is ,it takes less time for matching.

VI. MODULE DESCRIPTION

There are five modules used which is listed beneath. Each module explains the working procedure of the project and the description is given below proceed from the agenta of modules.

Image Preprocessing,
Ridge Indexing,
Selection/Binning of ridge ,
Minutiae Feature Extraction and
Matching/ Recognition.



A. Flow of process

6.1. Fingerprint image preprocessing

The quality of the fingerprint can be improved by using some preprocessing methods that is ridge orientation and the ridge frequency is calculated[6].The image can be 8 - bit gray scale. After that the variances and mean values are calculated to divide the zone. The replica can be enhanced by using Gabor filter[10] and then obtain a skeletonized image. With the help of skeletonized image the minutiae can be detected. In poor quality zone, we use estimation of quality and circular variance to stop the generating features . This method reduce the finger image enhancement errors. The circular variance[7] is determined as

$$\mathbf{var}(\theta) = 1 - \tfrac{1}{n}[(\textstyle\sum_{i=1}^{n} cos\theta i)^2 + (\sum_{i=1}^{n} sin\theta i)^2]$$

n defines number of neighbouring elements, θiEstimate the orientation of ith element.

6.2. Ridge indexing

The method of Ridge indexing is finding the number of ridges that coincides with the straight line in the spatial domain is ciphered in between the two minutiae. When the ridge countingline is parallel to the ridge structures, the lineation they meet the same ridge at one point when ridge counting is parallel to ridge formation, at more than two points, or at no point, due to skin deformation. The ridge count may be positive or negative number therefore it follows the sign of the vertical axis[5,6].

6.2.1.Selection/Binning: The point at which the vertical and horizontal axis intersects is the distance from ridge length. The ridge length elements should not exceed 16 pixels. Consequently,the threshold of the ridge length trait is set to regulate the same fingerprint as 16 pixels. To define the curvature sampling points use the horizontal axis from the intersection of thevertical axis. Sampling point is calculated as, There must be more than two inflection points for a ridges. To increase the quality of ridge features, the ridge type (rt) is used rather than ridge features instead for a minutia type to avoid the error when they have more inflection point.

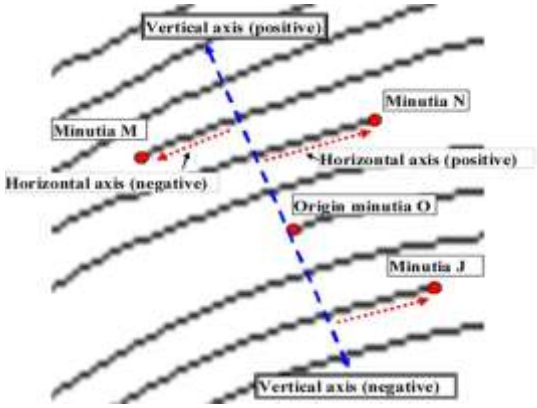


Figure 3:Ridge Coordinate System

6.3. Minutiae Feature Extraction

Extraction of minutiae feature is most important task in fingerprint identification . In between the two minutiae ,the ridge contracts and extraction of the ridge features is defined . In the ridge-based coordinates contains vertical and horizontal axes starting from the origin minutia. The origin, horizontal axes should be defined to represent the position of minutia. the origin and arbitrary minutiae describe the relationship between the ridge feature. Each minutia is classified to end point to determine the type of ridge features. Only one ridge belongs to minutia means then it is a endpoint, three ridges are connected to the minutiae means then it is a bifurcation. The conditions for termination is, the vertical region must reach the high circular variances and it reaches the background region. [2,3].

6.4.Matching/Recognition

In this method, we perform the breadth-first search (BFS) to dig up the matched the ridge-based coordinate pairs. First, match any pair of the ridges extracted from the enrolledimage and input fingerprint image using dynamic programming. Optimal solution can be found by matching the two string flows in the enrolled image and input ridge-based coordinates by using dynamic programming. The Ridge feature elements are ridge count, ridge length, and ridge curvature direction are used for calculating the matching scores and the ridge feature is used to check the validity of the aspirant pairs[8].The comparable score is positioned on bayesian decision rule and it can be determined as,

$$\text{Score} = p\left(\frac{w1}{x}\right), p\left(\frac{w1}{x}\right) > p\left(\frac{w2}{x}\right)$$
$$Score = 0, otherwise$$

where, x is the difference between two feature vectors,w1 is correctly matching pairs and w2 is incorrectly matching pairs.

VII. TECHNIQUES

Author	Techniques
Avinash kumar et al	Neural network scheme for FR
Chih-Jen et al	Local gabor based method
Jinwei Gu et al	Minutiae and orientation field
S.Malathi et al	Novel methodology
Chomtip Pornpanomchaiet	Euclidean distance
Zhu le-Qing	Knuckle point recognition
M.Gopikrishnan ,R.Indumathy,S.Jeevitha	Breadth first search

Table 1: Various Techniques used in Finger print Recognition.

VIII. EXPERIMENTAL RESULTS

Figure 4:Original image

The fingerprint can be identified by matching the ridge ending and bifurcation point.

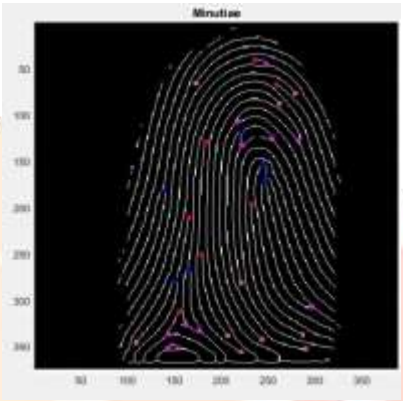


Figure 5:Output image

For minutiae matching we use Breadth first search techniques.Compared to other techniques, BFS experimental result gives the more matching score and it gives the extra information about the minutiae matching with small increment.

IX. CONCLUSION

In this paper, we use Breadth first search and novel based matching algorithm . Novel method used the minutiae and features that trace the link among the minutiae.Bfs is used for matching the fingerprints[8].Experimental method proves that it is highly accurate when compared to existing system that is image based approach. The future scope will be, Improve the quality of the images even with low quality image, Increase the matching performance in minutiae matching and to reduce the error in image enhancement.

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