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FINGERPRINT RECOGNITION USING EXTRACTION OF CONNECTED BOUNDARIES COMPONENTS EDGE DETECTION

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Abstract **- Fingerprint Recognition method based on Extraction of connected boundaries components edge detection is proposed In this paper,. It is difficult to notice similarity for fingerprints because the discontinues spots in fingerprint pattern, bifurcations, lakes, independent ridges, dots and islands and crossover. Thus image enhancement techniques are employed prior to minutiae extraction to obtain a more reliable to estimation of minutiae locations.**
The algorithm is proposed to create a connected boundaries components using the local features minutiae points in Fingerprint image as objects image ,one can draw a map connect this point so the work will be able to segment any part of the Fingerprint image by finding the map of the part by boundaries algorithm. The proposed scheme has been tested successfully on a large set of images. The proposed scheme can serve as a low cost preprocessing step for high level tasks such shape based recognition and image retrieval. The experimental results confirm the effectiveness of the proposed algorithm.
Keywords **- Fingerprint Recognition, Connected Components, Image Segmentation, Image processing, Object Detection, Extraction of connected boundaries .**

INTRODUCTION

Image segmentation is an important step in image analysis, pattern recognition, and computer vision. In radar images, for oil slicks detection, the segmentation is the main step for detecting the oil slick and defining its boundary.
Detection of edge is a critical element in image processing, since edges contain a major function of image information [1]. It is a fundamental tool, which is commonly used in many image processing applications to obtain information from images and frames. The separation of the image into object and background is a critical step in image interpretation. An edge may be regarded as boundary between two dissimilar regions in an image[11]. Edge detection is a terminology in image processing and computer vision, particularly in areas of feature detection and feature extraction [7].
Fingerprint Recognition is the method of recognition using the impressions made by the minute ridge formations or patterns found on the fingertips. No two persons have exactly the same arrangement of ridge patterns, and the patterns of any one individual remain unchanged throughout life. Fingerprints offer an infallible means of personal recognition. Other personal characteristics may change, but fingerprints do not. Fingerprints can be recorded on a standard fingerprint card or can be recorded digitally and transmitted electronically to the FBI for comparison. By comparing fingerprints at the scene of a crime with the fingerprint record of suspected persons, officials can establish absolute proof of the presence or identity of a person[8].
In mammography images, the segmentation is used to detect the region of the breast cancer . In fingerprint images, the segmentation can detect the cancer regions. In this study, we will work on the segmentation of fingerprint images in order to define the Object Detection of the fingerprint regions. Many techniques exist for image segmentation based on different methods[1]. One of the most useful applications of the color image segmentation is object detection and Object Detection[2] .
Edge detection of an image reduces significantly the amount of data and filters out information that may be regarded as less relevant, preserving the important structural properties of an image. Therefore, edges detected from its original image contain major information, which only needs a small amount of memory to store[3]. The purpose of detecting sharp

changes in image brightness is to capture important events and changes in properties of the world [4].
Once the pixels of interest are located, unsupervised segmentation is used to separate these pixels into smaller regions which are homogeneous in color. This is a very important step because the fingerprint detection will produce non-homogeneous regions . often containing more than one object[5]. Finally, a region merging step is introduced since the unsupervised segmentation can split the face regions into smaller homogeneous regions which has been greatly improved with respect to the work presented in [6].
There are three stages in fingerprint recognition. The first step i.e. image preprocessing is done to produce a noise free. second step involves application of the heuristic rules developed to extract true minutiae points and finally the proposed algorithm is applied for minutiae matching[9] .
The paper is organized as follows; Section 2 deals with the Extraction of connected boundaries components. Section 3 deals with the Fingerprint Recognition method perform the connected component analysis, section 4 deals with the design of template and its matching. Section 5 gives the Design approach and Experimental Results and last section 6 ends the paper with conclusion.

EXTRACTION OF CONNECTED BOUNDARIES COMPONENTS

Image editing tasks normally involve one or more extended contours, not single edge elements in isolation. For this reason, contour-based image editing depends upon an efficient method for specifying a group of edges to which an action is to be applied.
An efficient method for grouping edges into closed contours has recently been reported . The algorithm consists of three
main stages:
1. Line segment approximation.
2. Computation of posterior line grouping probabilities.
3. Shortest path computation of maximum-likelihood line segment cycles[10].

The next step is to remove small objects and connected the connected components for fingerprint image that have fewer than P pixels, producing another binary image .The default connectivity is 8 for two dimensions. We used the statement BW2 = bwareaopen(BW, P, conn) to specifies the desired connectivity . Where variable **conn** can have Value for Two-dimensional connectivity:

A) 4 if 4-connected neighborhood

B) 8 if 8-connected neighborhood

The 1-valued elements define neighborhood locations relative to the central element of **conn**. Note that conn must be symmetric about its central element.
The basic steps for the desired connectivity are:
1- Determine the connected components:

```
CC = bwconncomp(BW, conn);
```

2- Compute the area of each component:

```
S = regionprops(CC, 'Area');
```

3- Remove small objects:

```
L = labelmatrix(CC);
BW2 = ismember(L, find([S.Area] >= P));
```

The next step we find connected components in binary Fingerprint image .The basic steps in finding the connected components are:

1- Search for the next unlabeled pixel, p.

2- Use a flood-fill algorithm to label all the pixels in the connected component containing p.

3- Repeat steps 1 and 2 until all the pixels are labeled

The are four fields structure for components:

1-Connectivity: Connectivity of the connected components (objects)

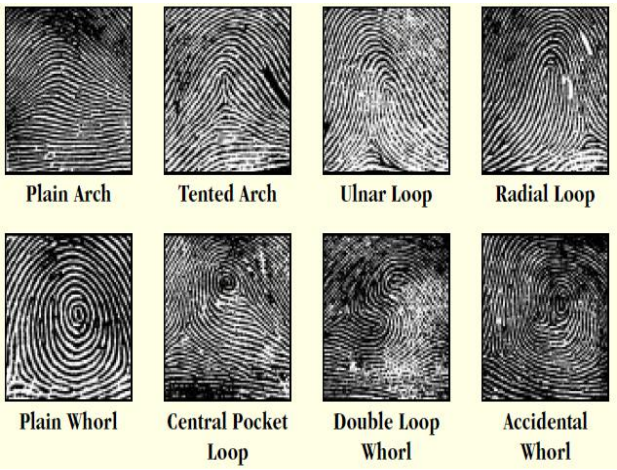
2-ImageSize: Size of image

3-NumObjects: Number of connected components (objects) in image

4-PixelIdxList: 1-by-NumObjects cell array where the kth element in the cell array is a vector containing the linear indices of the pixels in the kth object.

FINGERPRINT RECOGNITION

Most of fingerprint recognition system is based on minutiae i.e. ridge ending and ridge bifurcation. Reliable minutiae extraction plays imperative role in recognition system Performance. There are two main approaches used to minutiae extraction. The first approach
uses a thinned representation of the binary ridge structure, known as its skeleton. The second approach attempts to extract the minutiae locations from the grey-scale image itself. In view of that, there have been several approaches proposed for features not based on minutiae the cyclic structure of local fingerprint regions, shape signatures of fingerprint ridges and directional micro
pattern histograms have been proposed as alternative fingerprint features figure 1 shown Fingerprint pattern type .



Figure(1): Fingerprint pattern type

The reliable feature extraction stage is of great significance as it influences the performance of subsequent recognition algorithm therefore it is an essential step to obtain precise minutiae. Minutiae are local discontinuities in the fingerprint pattern. The Most important ones are ridge ending and ridge bifurcation illustrated in figure 2 [12].

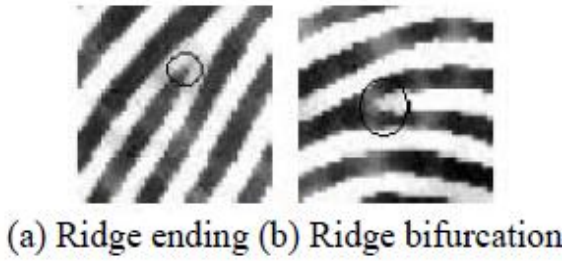


Figure (2): Example of minutiae

The minutiae are extracted by scanning the local neighborhoods of each ridge pixel in the image using a 3*3 window. The CN vale is then computed ,which is defined as half the sum of the differences between pairs of adjacent pixels in the eight neighborhoods.
Properties of the Crossing Number(CN) are CN=0 if Isolated point , CN=1 if Ridge End point, CN=2 if Continuing point, CN=3 if Bifurcation point and CN=4 if Crossing point.
Extracted features from thinned image(called minutiae)are used for matching between the original fingerprint image stored in the data base. The algorithm used here depend on Crossing Number(CN) concept. Step3 in algorithm above find number minutiae and minutiae Matrix contain (minutiae no., minutiae coordinates(x,y), minutiae type(end, bifurcation)and minutiae theta) used variables CN:crossing number ,x:raw coordinate ,y:column coordinate, minutiae counter :no. of minutiae found.

Algorithm for Minutiae Extraction
Step1: Start
Step2:Initialize minutiae counter to zero
Step3:For x=20 to (number of row)
For y=20 to (number of column)
Find CN for image(i,j)
If CN=1 or CN =3
Find Theta for image(x,y) with CN found
End if
Minutiae counter = minutiae counter +1
Store minutiae found and its information in minutiae Matrix
End for y
End for x
Step4:End

TEMPLATE MATCHING

The goal of edge detection is to produce something like a line drawing of an image. In practice we will look for places in the image where the intensity changes quickly. In general, the boundaries of objects tend to produce sudden changes in the image intensity. For creation of ear template, all types of the ear are considered to obtain a good representative template[colors or hues and this causes the image intensity to change as we move from one object to another [14]. The resulting image that we obtained after color segmentation would still contain some noise, which is made up of scattered fingerprint pixels and maybe some arbitrary pixels of other objects that share similar tones to that of the fingerprint . It is also possible that some pixels are missing within regions of a face because the segmentation was too strict, thus removing some pixels which are actually real fingerprint . We end up with a much cleaner image after performing these operations. The subsequent step will perform various feature checks and gradient matching to finally confirm whether or not a particular region is Fingerprint image [13].

DESIGN APPROACH AND EXPERIMENTAL RESULTS

In this section a detailed experimental comparison of the above stated propose minimum spanning tree algorithm is capable of Segment with Extraction of connected boundaries for Fingerprint Image Segmentation has been presented. We have used two types Fingerprint image databases:
(1) database prepared in our conditions ,images obtained from in Al-Sder Hospital.
(2) Fingerprint database [13] and some other images obtained from internet figure 3 shown sample data base .

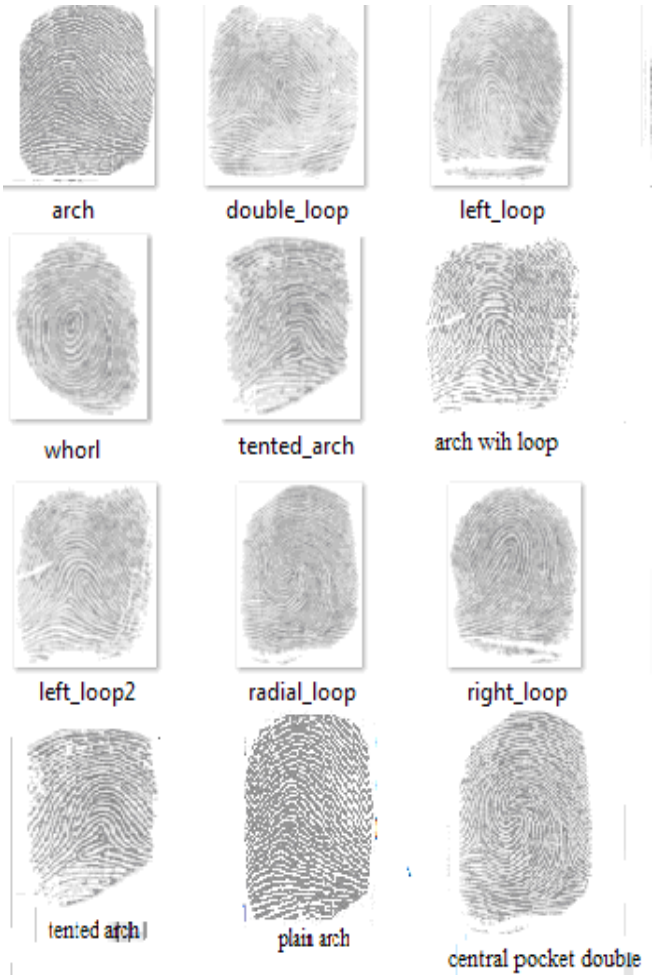


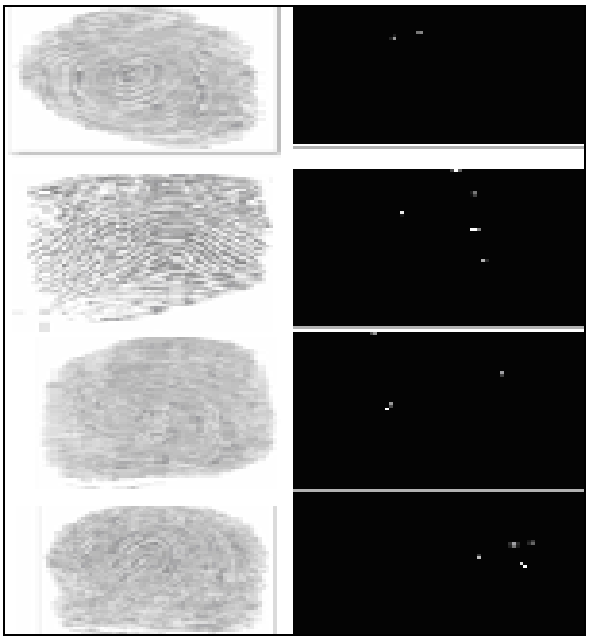
Figure (3) : sample data base

Image segmentation is the process of partitioning /subdividing a digital image into multiple meaningful regions or sets of pixels regions with respect to a particular application [1]. The segmentation is based on measurements taken from the image and might be grey level, colour, texture, depth or motion.

The result of image segmentation is a set of segments that collectively cover the entire image. All the pixels in region are similar with respect to some characteristic or computed property, such as colour, intensity, or texture. Adjacent regions differ with respect to same characteristics. Edge detection is one of the frequently used techniques in digital image processing[10] figure 4 shown Center points for some types of fingerprint

.

This last stage is processed for each region at a time. The objective in this stage is to reject regions which have no holes as mentioned in the above region.

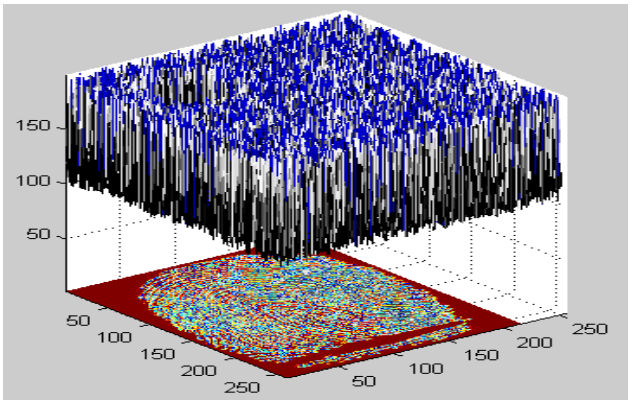


Figure(4):Center points for some types of fingerprint

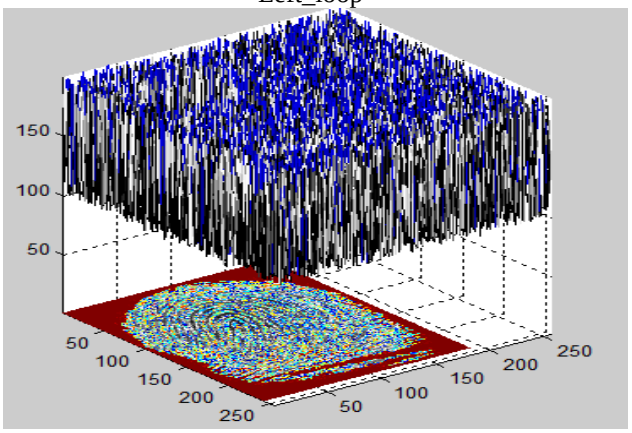
Figure 6 shown Connected Components for center points and intensity of gray levels for each pixel in image. To avoid the complexity and cost of the non-linear optimization process described above, we first resample each irregular polygonal patch into a regular grid of points (the spring mesh). We can then apply girded data fitting techniques to this spring mesh to obtain a spline approximation. The advantage of these techniques is that they avoid the parameter re-estimation step described earlier and are hence significantly faster. It is worth pointing out that in our application there is nothing sacrosanct about the original mesh vertices[13]. In particular, the vertices produced by our range image integration method are at a scale that approaches the noise-limited resolution of our sensor. As long as the grid is a reasonably careful sampling

of the polygon mesh, surface quality is not compromised[14]. Fingerprint application required to fit the original mesh vertices, this can be accomplished by first parameterize the mesh vertices using our regular spring grid and then running the standard non-linear optimization process described above figure 6 shown .

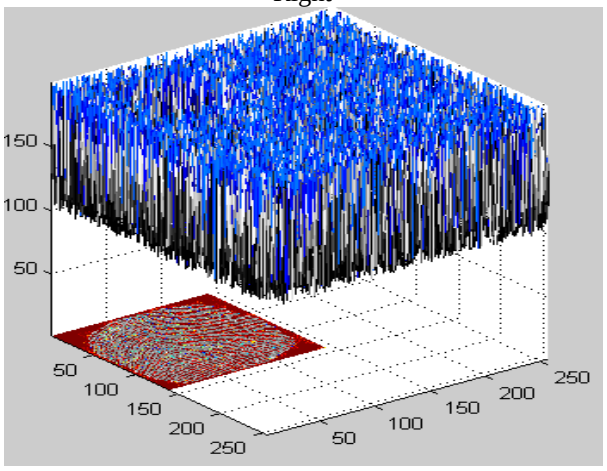
The only constraints are that it must be rectangularly parameterizable and must not have holes. These are reasonable assumptions since the models input to our system are seamless or can easily be made so by acquiring and integrating more scans and by recent hole-filling techniques [14]. Our goal is to generate a uniform grid of points over the polygonal surface that samples the surface well shown in figure 5.



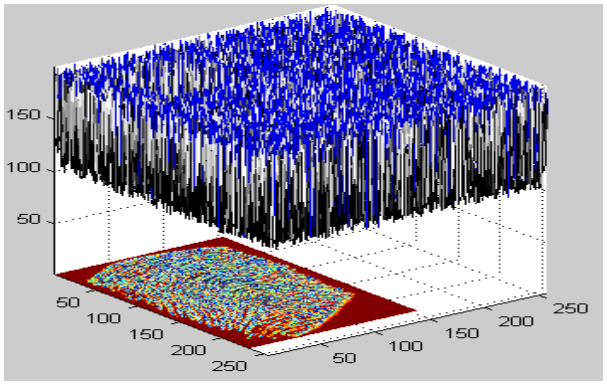
Left_loop



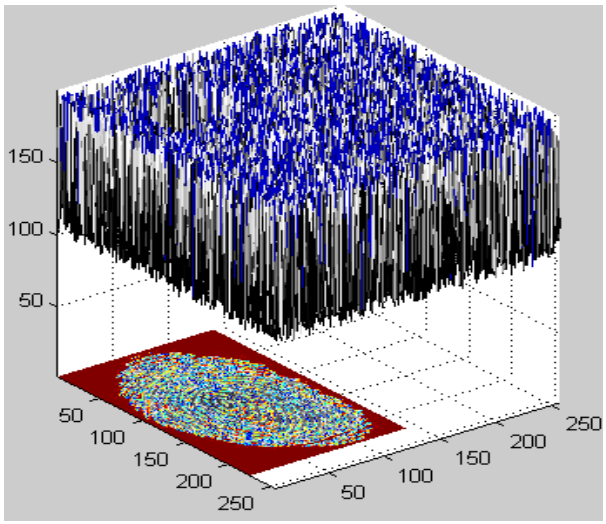
Right



Arch



tented_arch



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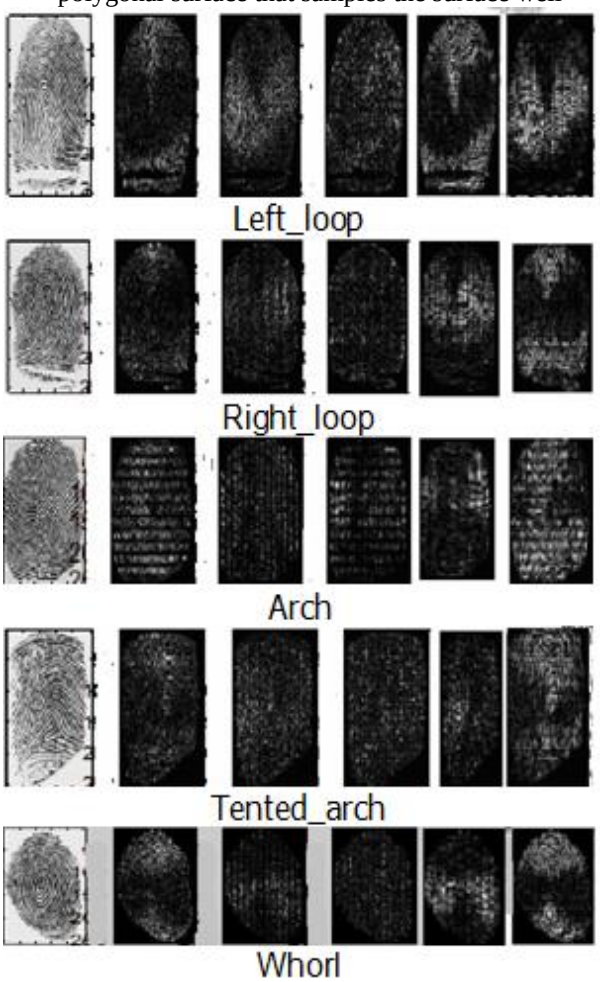
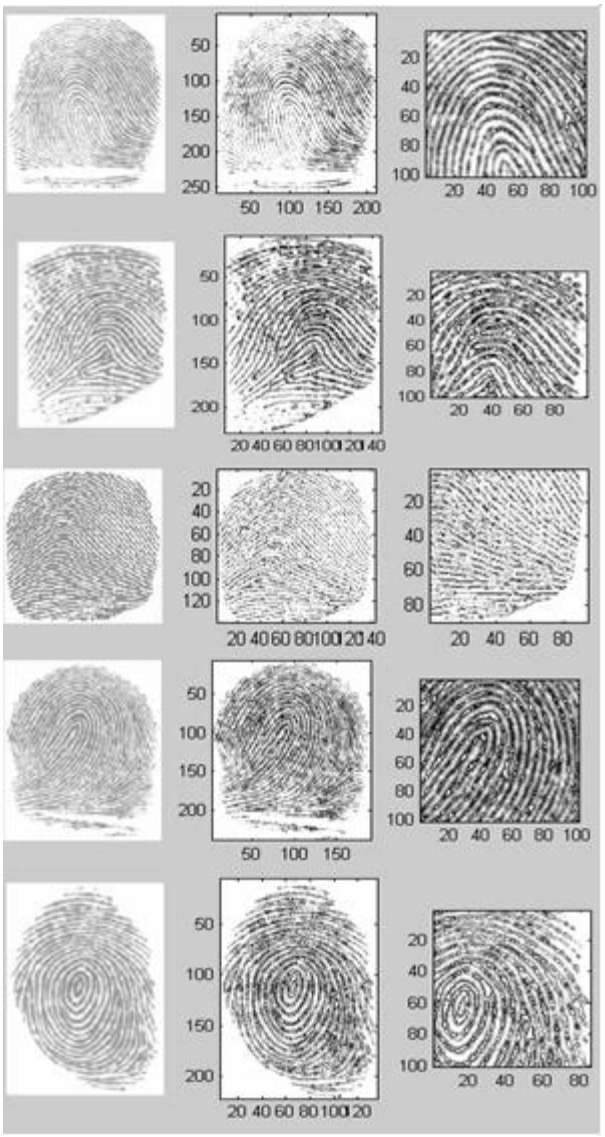
Figure(5):generate a uniform grid of points over the polygonal surface that samples the surface well



Figure(6):Connected Components for center points

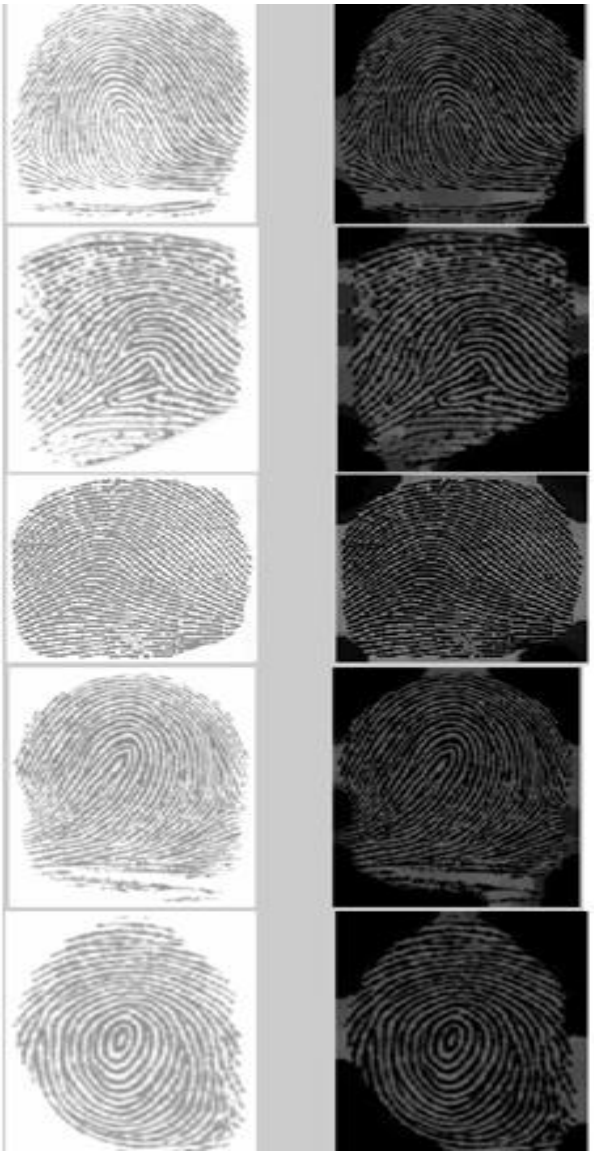
Figure 7 shown Connected Components for center region for each Fingerprint type.

After extracting boundary of images regions has to be identified for medical purposes. then to focus on particular area like tumors regions has to be filled to highlight that particular area the results, are minimally connected lines that form equidistant boundaries between the objects. Figure 8 shown Fingerprint boundaries components edge detection.
Figure 9 shown Fingerprint Recognition using Extraction of connected boundaries components edge detection.



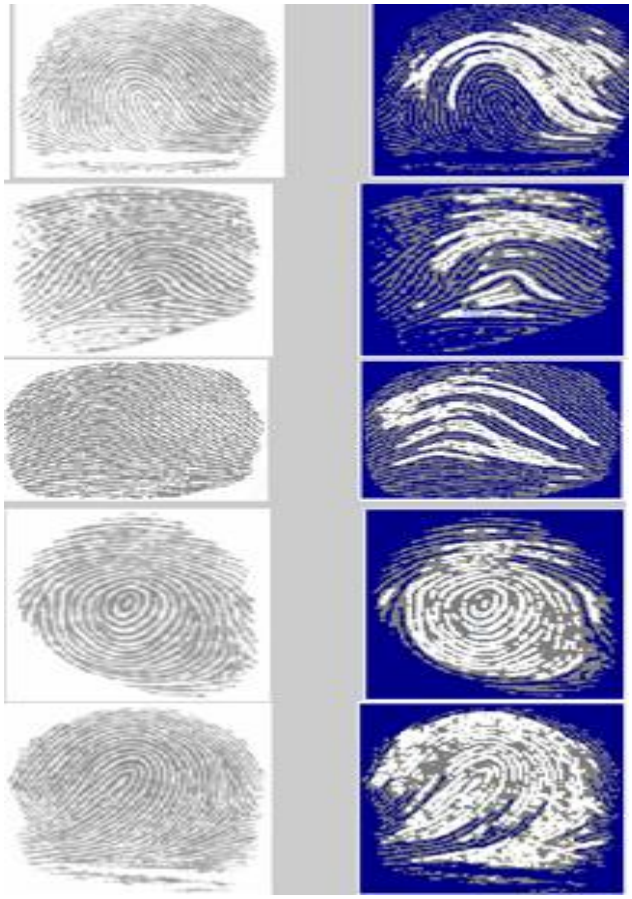
Figure(7):Connected Components for center region for each Fingerprint type

The elastic matching of minutia is achieved by placing a bounding box around each template minutia. If the minutia to be matched is within the rectangle box and the direction discrepancy between them is very small, then the two minutia are regarded as a matched minutia pair. Each minutia in the template image either has no matched minutia or has only one corresponding minutia.



Figure(8): Fingerprint boundaries components edge detection.

The final match ratio for two fingerprints is the number of total matched pair over the
number of minutia of the template fingerprint. The score is 100*ratio and ranges from 0 to 100.
If the score is larger than a pre-specified threshold, the two fingerprints are from the same finger.



Figure(9) : Fingerprint Recognition using Extraction of connected boundaries components edge detection.

CONCLUSION

Our approach is region based and applies most naturally to closed Extraction of connected boundaries components edge detection. We can extend it to open Extraction of connected boundaries components as long as the boundaries can be considered as organizing the image into distinct regions. We Connected Components for results by remove small objects and connected the connected components for fingerprint

Finally, the object tracking process performs as memory for collecting fingerprint objects obtained from previous frame to guide the next frame in order to remove fingerprint pixels that immediately appear from frame to frame. The experimental results show the satisfying subjective test results. It can be concluded that the present algorithm demonstrate the super performance with respect to speed, zero repeats, low false positive rate and high accuracy.

This method is necessary to provide a robust solution that is adaptable to the varying noise levels of these images to help distinguish valid image. Unauthorized reproduction of this article is Prohibited contents from visual artifacts introduced by noise. The experimental results show the satisfying subjective test results and The simulation results are very promising.

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