An Efficient Approach for Neural Network Based Fingerprint Recognition by Using Core, Delta, Ridge Bifurcation and Minutia

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Abstract. Fingerprint recognition refers to the automated method of verifying a match between two human fingerprints. Fingerprints are one of many forms of biometrics used to identify individuals and verify their identity. In this paper we create a neural network algorithm for fingerprint recognition that is using the three basic patterns of fingerprint ridges are the arch, loop, and whorl. We know that an arch is a pattern where the ridges enter from one side of the finger, rise in the center forming an arc, and then exit the other side of the finger. The loop is a pattern where the ridges enter from one side of a finger to exit from the same side they enter. In the whorl pattern, ridges form circularly around a central point on the finger. First we design a supervised neural network for any fingerprint images by using three basic pattern then algorithm outputs show the recognition result. By this method, we improve the recognition result and comparison with other fingerprint image and also it is very useful to overcome the problem of finding number of criminals in the crime.

Keywords: Image processing, Minutia analysis, Ridge analysis, Pixel orientation.

1 Introduction

A fingerprint is the feature pattern of one finger. It is believed with strong evidences that each fingerprint is unique. Each person has his own fingerprints with the permanent uniqueness. So fingerprints have being used for identification and forensic investigation for a long time. A fingerprint is composed of many ridges and furrows. These ridges and furrows present good similarities in each small local window, like parallelism and average width. However, shown by intensive research on fingerprint recognition, fingerprints are not distinguished by their ridges and furrows, but by Minutia, which are some abnormal points on the ridges. Among the variety of minutia types reported in literatures, two are mostly significant and in heavy usage: one is called termination, which is the immediate ending of a ridge; the other is called

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bifurcation, which is the point on the ridge from which two branches derive. The fingerprint recognition problem can be grouped into two sub-domains: one is fingerprint verification and the other is fingerprint identification. Fingerprint verification is to verify the authenticity of one person by his fingerprint. The user provides his fingerprint together with his identity information like his ID number. The fingerprint verification system retrieves the fingerprint template according to the ID number and matches the template with the real-time acquired fingerprint from the user. Usually it is the underlying design principle of AFAS (Automatic Fingerprint Authentication System). Fingerprint identification is to specify one person's identity by his fingerprint. Without knowledge of the person's identity, the fingerprint identification system tries to match his fingerprint with those in the whole fingerprint database. It is especially useful for criminal investigation cases. And it is the design principle of AFIS (Automatic Fingerprint Identification System).

2 Neural Network Architectures

An Artificial Neural Network [3] is defined as a data processing system consisting of a large number of simple highly interconnected processing elements in an architecture inspired by the structure of the cerebral cortex of the brain. Generally, an ANN structure can be represented using a directed graph. A graph G is an ordered 2 tuple (V, E) consisting of a set V of vertices and a set E of edges. When each edge is assigned an orientation. The ANN are [4, 5] following

a. Single Layer Feed forward network
b. Multi Layer Feed forward network
c. Recurrent Networks

3 Finger Print Recognition

Minutiae Based Matching: - Feature [6]. Minutia-based algorithms extract information such as ridge ending, bifurcation, and short ridge from a fingerprint image.

Short Ridge Ridge ending Bifurcation

These features are then stored as mathematical templates. The identification or verification process compares the template of the image with a database of enrolled templates and showed the matching result.

4 Proposed Work

4.1 Method Description

My work is based on supervised neural network of fingerprint recognition techniques. It is very effective method because it have the three most recognition technique.

4.2 Flowchart of the Methodology

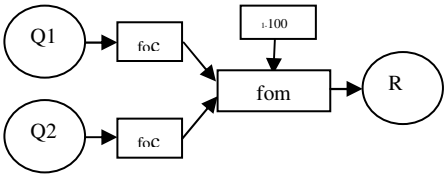


Fig. 1. Supervised Neural Network for Recognition of the One-to-One Fingerprints

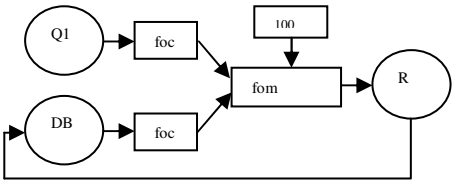


Fig. 2. Supervised Recurrent Neural Network for Recognition of the One-to-Many Finger-print

Above figure (1) show the supervised neural network that have input layer, output layer and hidden layer. The input layer neurons receive the fingerprint images and the output layer shows the percentage of recognition.

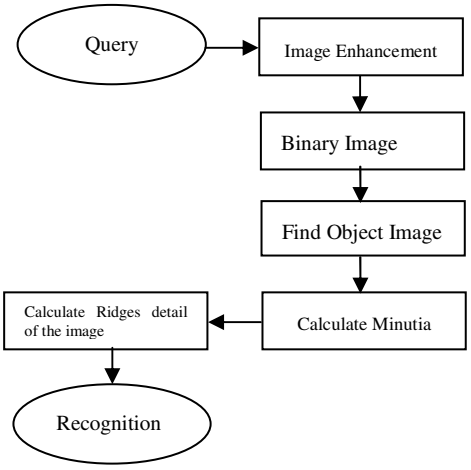


Fig. 3. Recognition procedure of the image

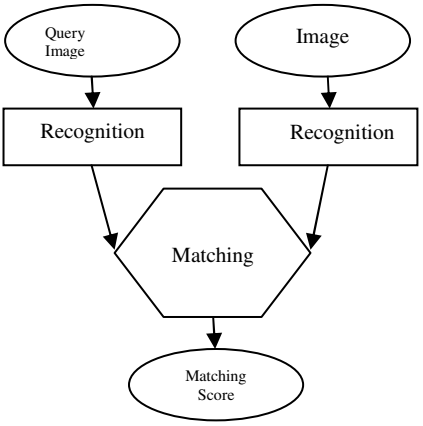


Fig. 4. Displaying the matching scores of two finger print images

5 Experimental Results

We determine the recognition of the image and after recognition we will performed the matching task. Fig (1, 2) show the neural network model of the proposed work. Fig(3) show the recognition procedure of the image and fig (4) displaying the matching score of two finger print images.

Accuracy and efficiency of our proposed work in most clear in below graph image, this graph is represent the matching result by the following consideration of Minutia Points, Ridge bifurcation, Island, Delta and Core fetched by the inputted finger print images. And Table 1 is showing exact result after evolution of finger print images. Below table and graph is showing the proposed simulation result of our work.

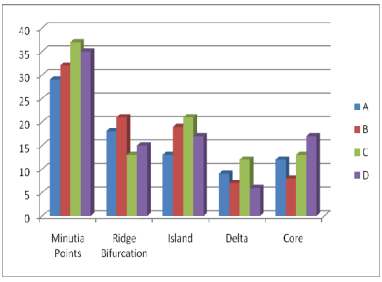
Here, show the some fingerprint images like A, B, C and D.

Table 1. Shows the fingerprint image details

Images	Minutia Points	Ridge Bifurcation	Island	Delta	Core
A	29	18	13	9	12
B	32	21	19	7	8
C	37	13	21	12	13
D	35	15	17	6	17

Table 2. Show the matching score between two fingerprint images pair by proposed work

Images	Proposed Work
(a, b)	50%
(a, c)	40%
(a, d)	54%
(a,,a)	100%
(c,c)	100%
(e,e)	100%



Graph: Compare and give exact & accurate match Result(proposed simulation result)

In the above Table 2, Shows the final percentage ratio of matched finger prints grey scale image. First Morphological operations of removing noise and small objects from fingerprint images. Second improve the image intensity for better analysis.

Now we apply a threshold value by graythresh function for binary image. After this we will get information about fingerprint image & by the Determining the pixels value of the image with position, we get data as shown in Table -1 then correlation between two corresponding images pixel can evaluate the matched ratio.

6 Conclusion and Future Work

In this paper, we have developed a neural network based recognition method that is very effective and efficient. It reduces the deficiency of existing methods like minutia, ridge and correlation. This proposed method gives better result than all the other individual method. In future we will add some other concept like 2D cross correlation, shape descriptor and moment invariants to get more accuracy in result.

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