IJISET - International Journal of Innovative Science, Engineering & Technology, Vol. 1 Issue 9, November 2014.
www.ijiset.com
ISSN 2348 – 7968

Identification of Palmprint and Fingerprint Using Improved Hierarchical Minutiae Matching

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Abstract
For person identification and forensic security, the fingerprint and the palmprint are the common authentic biometrics methods. Biometric system which is essentially a pattern recognition system makes use of biometric traits to recognize the person. This project proposes to exploit the minutiae based fingerprint and palmprint identification using Hierarchical Minutiae Matching Method. This method decomposes the matching step into several stages and rejects many false fingerprints or palmprints on different stages, thus it can save much time while preserving a high identification rate.

Keywords— *Biometrics, fingerprint and palmprint verification, minutiae, hierarchical structure.*

I. INTRODUCTION

Palm print recognition inherently implements many of the same matching characteristics that have allowed fingerprint recognition to be one of the most well known and best publicized biometrics. Both palm and finger biometrics are represented by the information presented in a friction ridge impression. This information combines ridge flow, ridge characteristics, and ridge structure of the raised portion of the epidermis. The data represented by these friction ridge impressions allows a determination that corresponding areas of friction ridge impressions either originated from the same source or could not have been made by the same source. Because fingerprints and palms have both uniqueness and permanence, they have been used for over a century as a trusted form of identification. However, palm recognition has been slower in becoming automated due to some restraints in computing capabilities and live-scan technologies. In this paper, the hierarchical minutiae matching method decomposes the matching step into several stages and rejects many false fingerprints or palmprints on different stages, thus it can save much time while preserving a high identification rate. Experimental results show that the proposed algorithm can save almost 50% searching time compared with traditional methods and illustrate its effectiveness.

II.THEORY

A. *Preprocessing*

(i) Convert input image into Binary Image based on threshold

Convert the input image to grayscale format (if it is not already an intensity image), and then converts this grayscale image to binary by thresholding. The output binary image has values of 0 (black) for all pixels in the input image with luminance less than level and 1 (white) for all other pixels.

(ii) Thinning Process

Thinning is a morphological operation that is used to remove selected foreground pixels from binary images, somewhat like erosion or opening. It can be used for several applications, but is particularly useful for skeletonization. In this mode it is commonly used to tidy up the output of edge detectors by reducing all lines to single pixel thickness. Thinning is normally only applied to binary images, and produces another binary image as output.

Ridge Thinning is to eliminate the redundant pixels of ridges till the ridges are just one pixel wide. An iterative, parallel thinning algorithm is used. In each scan of the full fingerprint image, the algorithm marks down redundant pixels in each small image window (3x3) and finally removes all those marked pixels after several scans. The thinned ridge map is then filtered by other Morphological operations to remove some H breaks, isolated points and spikes. In this step, any single points, whether they are single-point ridges or single-point breaks in a ridge are eliminated and considered processing noise.

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B. Feature Extraction

In pattern recognition and in image processing, **feature extraction** is a special form of dimensionality reduction. When the input data to an algorithm is too large to be processed and it is suspected to be very redundant (e.g. the same measurement in both feet and meters, or the repetitiveness of images presented as pixels), then the input data will be transformed into a reduced representation set of features (also named features vector). Transforming the input data into the set of features is called *feature extraction*. If the features extracted are carefully chosen it is expected that the features set will extract the relevant information from the input data in order to perform the desired task using this reduced representation instead of the full size input.

(i) Ridge Ending - the abrupt end of a ridge

(ii) Ridge Bifurcation - a single ridge that divides into two ridges

C. Minutiae Matching

Minutiae matching is still a challenging problem for reliable person authentication because of the complex distortions involved in two impressions of the same finger or palm. Since the vast majority of fingerprint matching algorithms rely on minutiae matching, minutiae information are regarded as highly significant features for Automatic Fingerprint Recognition System. The accuracy of the AFRS system depends on the image quality, image enhancement methods, feature set extraction algorithms, and feature set pre-processing/post-processing algorithms

III.PROPOSED SYSTEM

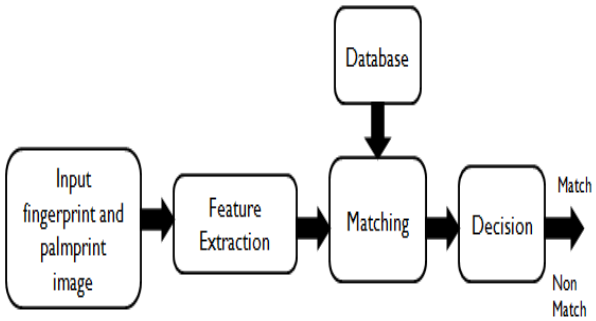

Fig.1.Block diagram of palmprint and fingerprint identification system.

A. *Improved Heirarchical Minutiae Matching*

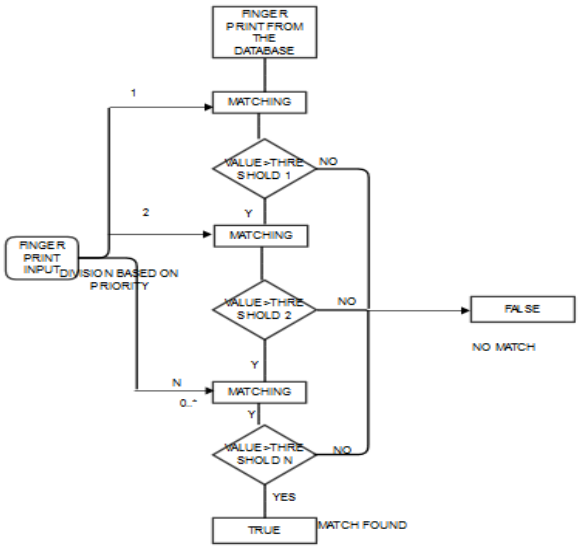

Fig.2.Proposed system

The hierarchical algorithm for palmprint and fingerprint minutiae matching is to speed up the identification. The proposed algorithm tries to reduce the time of one-to-one verification, then the total searching time can be cut down. The alignment time *tA* is very high in Exsisting system. Denote the average minutiae number of a fingerprint as *n*, then the time complexity of the alignment algorithm is about $\circ(n2)$. Since the spurious minutiae detected in the minutiae extraction step, *n* is generally 40 or even bigger, which makes the alignment time-consuming.

With the advantage of the hierarchical strategy, the proposed identification searching algorithm can reject many palmprints that do not belong to the same finger as the input palmprint at the frontal steps, and can save a lot of searching time. Fig. 2. illustrates the flowchart of this method.

IV.SIMULATION ANALYSIS

A.Image Preprocessing

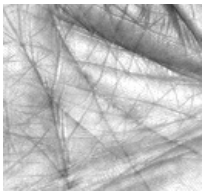

Fig.3.(a)Input (Palmprint)

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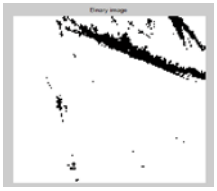

Fig.3.(b)Binarised Image

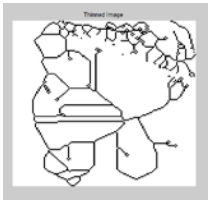

Fig.3.(c)Thinned Image

B.Feature Extraction

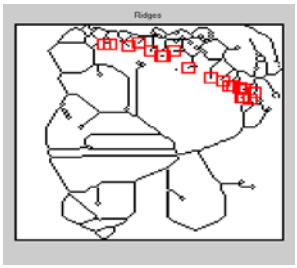

Fig.4.(a)Ridge endings

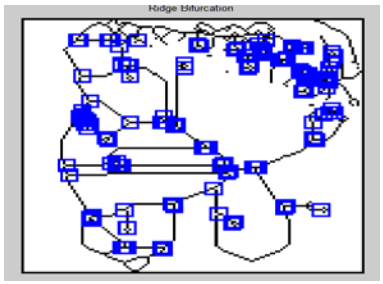

Fig.4.(b)Ridge Bifurcation

IV.CONCLUSION

In this paper, an improved hierarchical minutiae matching algorithm for fingerprint and palmprint identification is proposed to save time. A hierarchical strategy is proposed and utilized in the matching stage. The hierarchical strategy can reject many fingerprints (in the database of the AFIS) which do not belong to the same finger as the input fingerprint quickly, thus it can save much time. Experimental results show that the proposed algorithm can reduce the searching time compared to the traditional method. Not as the conventional methods based on classification and indexing, the proposed method does not use more features or information than minutiae, and it can be integrated to the conventional identification systems in future.

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