Feature Extraction for Human Identification Using Finger Images

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Abstract— **Nowadays, Human identification plays a major role in many fields .Finger images are used for positively identifying a person. Finger image recognition has a lot of advantages; a finger image is compact, unique for every person and stable over the lifetime. Whenever an image is converted one form to another by digitizing, scanning, transmitting, storing, etc., degradation occurs at the output. Hence image enhancement is done to improve the visual appearance of an image. This project is based on fuzzy interference system tool in MATLAB 7.12. The finger Vein using Fuzzy interference system, the Binary values of the unknown obtained images are compared with the binary values of the already stored reference image. Mapping of the binary values of obtained image with binary values of stored image was done using fuzzy logic .if the unknown image is matched with stored original image then the person will be identified. if the unknown image is not matched with stored image then the person will not be identified. The fuzzy interference system includes the steps Logical operations Membership Functions, and If-Then Rules..**

Keywords— **Finger vein recognition, Fuzzy logic, Fuzzy interference system, matching algorithm, pre-processing**

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I. INTRODUCTION

Human identification is confirming the truth of an attribute an item of data or existence. This involved confirming the authenticate of a person, indicate the origins of an another time, confirming that a product is what it's packaging and labeling claims to be, or indemnity that a computer program is a trusted one. If the Authentication request is approved, then the person becomes authorized to get access

Veins of Human Being In human circulatory system, veins are the large network of blood vessels. Main function of veins is to carry deoxygenated blood to the heart. Veins are always close to the skin and are invisible to the naked eye. Veins are also called "capacitance vessels" because most of the blood volume (60%) is contained within veins. Vein colour is determined in large part by the colour of venous blood, Which is usually dark red (and not blue as is commonly believed) as a result of its low oxygen content. The Veins appear in blue because the inner layer fat absorbs the minimum frequency light, offering only the most energetic blue wavelengths to penetrate through to the dark vein and reflect off. A recent study found the colour of veins is determined by the following factors: the scattering and absorption characteristics of skin at several wavelengths, the oxygenation of blood, which affects its absorption ratio, the diameter of the vessels, and the visual perception process. This absorption characteristic of human vein plays an important role in our research.

Biometric System A biometric system is essentially a pattern-recognition system that recognizes a person based on a feature vector derived from a specific physiological or behavioral characteristic that the person possesses. That feature vector is usually stored in a system (or recorded on a smart card given to the individual) after being extracted. A Biometric system consists of two main procedures: identification and verification. While identification involves comparing the acquired biometric information against templates corresponding to all users in the system, verifying involves matching with only those templates corresponding to the required identity. This indicates the identification and verification are two problems that should be dealt with separately.

The finger print identification technique was used as pattern based algorithm, data compression algorithm it gives better results for human identification. but the drawback as privacy as poor, finger print are easy to developed now a days. another method finger vein identification technique use line tracking algorithm, block wise matching it exhibit good result. but it takes more time, then occupied more storage space in the system. Fuzzy interference algorithm is used for identification of human using finger images. The performance of the algorithm depends on identification. this algorithm more times better than other matching algorithm

My work

The proposed method (feature extraction) transforming the input data into set of features. This task is reduced representation instead of full size input this extraction using fuzzy means to improve their performance to authenticate a human. Fuzzy interference techniques are powerful tool for knowledge representation and preprocessing. fuzzy algorithm used in the finger vein extraction means to improve their performance ,no need more time to take extract the image then also occupy less space only. Fuzzy also implement in MATLAB 7.12 using language as C and VB. It just overview of this project about feature extraction for human identification using finger images.

Fuzzy logic

Fuzzy systems are more favorable in that their behavior can be explained based on fuzzy rules and thus their performance can be adjusted by the rules. But the knowledge acquisition is difficult and also the universe of discourse of each input variable needs to be divided into different interva applications of fuzzy systems are blocked to the fields where expert knowledge is available and the number of input variables is small. nowadays, the number and variety of applications of fuzzy logic have increased significantly. In Fuzzy Logic Toolbox should be termed as FL, that is, fuzzy logic in its wide sense The basic concept in Fuzzy logic, which plays a major function in most of its applications, is if-then rule or, simply, fuzzy rule. The rule-based systems use in Artificial Intelligence (AI),The calculus of fuzzy rules serves as a basis for what might be called the Fuzzy Dependency and Command Language (FDCL). The FDCL is not used explicitly in the toolbox,. In most of the applications of fuzzy logic solution is, in originally, a translation of a human solution into FDCL.

Finger vein biometrics and its importance

Finger vein identification is the method of biometric system that uses pattern recognition method based on images of finger vein patterns beneath the skin's surface. Finger Vein identification is a biometric identification system that matches the vein pattern in an individual's finger to previously obtained data. To obtain the pattern for the database, an individual inserts a finger into an attester terminal containing a finger vein sensor. The haemoglobin in the blood absorbs light, which makes the vein system appear as a dark pattern of lines. The image is recorded and the raw data is digitized and certified, sent to a database of stored images for identification purposes, the finger is scanned as before and the data is sent to the database for comparison. Unlike other biometric systems, vein patterns are almost impossible to counterfeit because they are located beneath the skin's region. This system based on finger image can be fooled with a dummy finger fitted with a copied finger image; facial characteristic-based systems can be fooled by recordings and higher-resolution images. The finger vein ID system is harder to fool because it authenticates the finger of a living person only. Finger vein authentication technology has several important features that set it apart from other forms of biometrics as a highly secure and convenient means of personal authentication.

1. Resistant to criminal tampering:
Because veins are hidden inside the body and unrepeatable, there is little risk of forgery or theft.
2. High accuracy:
The authentication accuracy is high with minimum FRR (False Rejection Rate) and FAR (False Acceptance Rate), and FTE (Failure to Enroll) will be very less comparatively.
3. Unique and constant:
Finger vein images are several even among identical twins and remain constant lifelong.
4. Contactless:
The infrared light allows for non-invasive, contactless imaging that ensuring both convenience and cleanliness for the user experience.
5. Base of feature extraction:
Pattern of vein images are relatively stable and clearly captured, enabling the use of low-resolution cameras to take vein images for small-size, simple data image processing.
6. Fast authentication speed:
One-to-one authentication takes very less time in the order of seconds. Moreover, the authentication device can be compact due to the small size of the fingers.

Finger vein biometric technology

There are a lot of decision factors for selecting this biometric technology for a specific application.

1. Economic Feasibility or Cost
The cost of biometric system implementation has decreased recently; it is still a major barrier for many organizations. Modern authentication systems, such as passwords and PIN number, it require relatively minimal training, but not in this case most commonly used biometric systems. Soft operation of those systems required a training for both systems administrators and users.
2. Risk Analysis
Error rates and the types of errors vary with the biometrics deploy and the circumstance of deployment. Certain types of faults, such as false matches, lead fundamental risks to business
3. Perception of Users
Users generally view behavior-depend biometrics such as voice recognition and signature verification as less intrude and less privacy-threatening than physiology-based biometrics.
4. Techno Socio Feasibility
Organizations should focus on the user-technology interface and the conditions in the industrial environment that may influence the technology outcome. The organization should create awareness among the users how to use the techniques and should overcome the psychological factors as user scare about the technology. Industrial has to also consider the privacy rights of users while implementing the biometric techniques
5. Security
Veins are very complicated and found beneath the skin, therefore contain lots of different features that help to identify a person. Biometric techniques should have high security standards if they will be implemented in high protected environment. The biometric techniques should be verified on the basis of their features, high risk and area of application, and subjected to a risk analysis.
6. User friendly and social acceptability
Biometric techniques should be robust and user friendly to use and they should function reliably for a long time. The techniques should not split the society into two parts i.e. digital and non digital society.
7. Legal Feasibility
Government has to form a regulatory statutory framework for the use of biometric techniques in various commercial applications. It should form a stable regulatory framework for use of these techniques in commercial applications or transactions. If needed the framework has to be regulated and changed time to time.
8. Privacy
As biometric techniques rely on personal physical characteristics, an act has to be protect the individual's privacy data not to be used by anyone. A data security law has to be

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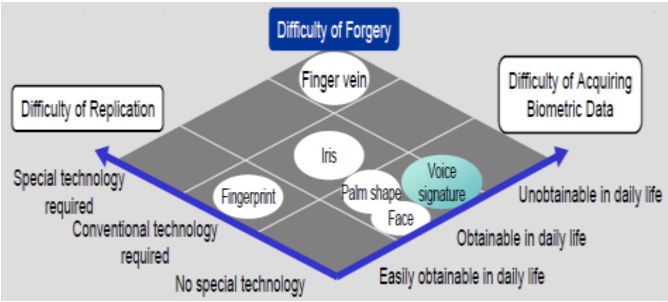
created in order to protect the person's privacy data which should not be disclosed to others.

Comparative Analysis

The existing biometric techniques can be compared in order to justify that finger vein biometrics is superior to them in all possible aspects. A comparison chart showing all the biometric techniques in terms of various parameters. Comparison of Fingerprint and Finger Vein Biometrics Hence finger vein authentication system can fast replace all the existing biometric recognition system .



Comparative Analysis

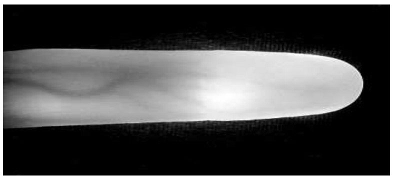
II. FINGER VEIN IMAGE PRE-PROCESSING METHODS

PRE-PROCESSING METHOD COMPRISES OF SIX SUB-BLOCKS:

1. colour to Grayscale conversation
2. Gray scale median filter
3 .Image segmentation
4. Image resize
5. Binarization
6. Thinning process..

Color to Grayscale Conversion

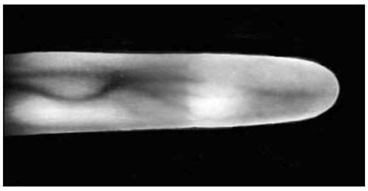
The raw finger vein image which is in colored RGB format with 3 bytes per pixel will be first converted to grayscale image to reduce the size from 3. The size should be low because while storing the template, the image should occupy less memory space in the board. The output image is shown in below



Gray scale output image

Histogram Equalization

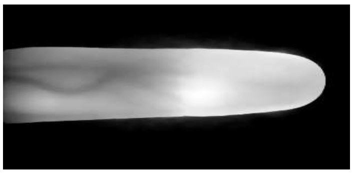
Histogram Equalization enhance the contrast of images by transforming the values in intensity image and values in the color map of an indexed image, then the histogram of the output image approximately matches a specified histogram. It transforms the intensity image so that the histogram of the output intensity image, returning intensity image with discrete gray levels. A roughly equal number of pixels are mapped to each of the levels in output image, so that the histogram of output image is approximately flat. The output image is shown in below.



Histogram equalized image

Grayscale Median Filter

A grayscale median filter is applied to the grayscale image to smooth the noisy background. By applying median filter to the noisy edge background, this will reduce the significant effect of the noisy background surrounding the finger image, for a better finger region detection in the next process. The output image is shown in below



Output of gray scale median filter

Finger Region Extraction

To separate the finger region from the background, an image segmentation process is performed. This step involves three processes, namely: finger edge detection, edge smoothing, and finger region filling. Firstly, a canny edge detection technique is used to detect the finger edge. The edge is then smoothed by using morphological dilation to join the broken edge. After smoothing, the region inside the finger region is then filled with white pixels (data value 255). The resultant image is shown in below

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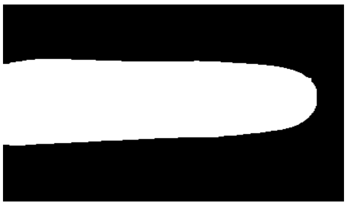


Output of figure region extraction

Finger image resize

After the finger region is extracted, the finger is resized to a fixed size to minimize the discrepancy in matching process cause by the non – uniform size obtained during image capturing. Finger resize process is done by taking a reference scalar value to which size should be adjusted. The resized output image is shown in below.

Resized output image

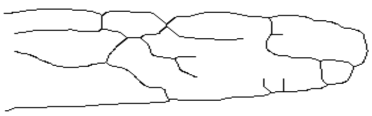
Binarization

Binarization is a technique to convert the grayscale image into a bi-level representation which are black pixel with value □0□ and white pixel value „255□. Binarization extracts the vein pattern form the vein image. The output of binarization is given in fig. it shows an approximate vein pattern present in the captured finger image.

Binarization output image

Thinning

To extract the skeleton image of the vein texture which consist only a single pixel wide line. Thinning gives the final vein pattern of the captured image which is shown in fig 7.8. This image is provided as input to the next block to extract its hidden features. The continuity of the veins from the finger image is not lost during thinning process. The pattern produced almost matches with the original vein pattern.



Output after thinning process

Matching module

In the next stage, the processed image should be given for matching with the stored templates. This process is carried out internally using the hardware codes. The processed image is received as 32 bit data from the finger vein sensor device, which is compared with the already stored template available in the matching module.

III.FINGERVEIN FEATURE EXTRACTION

The extraction of finger vein features using adaptive neuro fuzzy interference system suggest with promising result. Systematically develop a new approach for the finger vein feature extraction using gabor filters

FEATURES

Contrast

Calculate of the intensity contrast between a pixel and its neighbour over the whole image.

Range = [0 (size (GLCM,1)-1)^2]

Contrast is 0 for a constant image

$$\sum_{i,j} |i-j|^2 p(i,j)$$

Correlation calculate of how correlated a pixel is to its neighbour over the whole image.

Range = [-1 1]

Correlation is 1 or -1 for a perfectly positively or negatively correlated image. Correlation is NaN for a constant image.

$$\sum_{i,j} \frac{(i-\mu i)(j-\mu j)p(i,j)}{\sigma_i \sigma_j}$$

Energy

sum of squared elements in the GLCM.

Range = [0 1]

Energy is 1 for a constant image

$$\sum_{i,j} p(i,j)^2$$

Homogeneity

Value that calculate the closeness of the distribution of elements in the GLCM to the GLCM diagonal. s

Range = [0 1]

Homogeneity is 1 for a diagonal GLCM.

$$\sum_{i,j} \frac{p(i,j)}{1+|i-j|}$$

glcm is an *m*-by-*n*-by-*p* array of valid gray-level co-occurrence matrices. If glcm is an array of GLCMs, stats is an array of statistics for each Glcm. It normalizes the gray-level co-occurrence matrix (GLCM) so that the sum of its elements is equal to 1. Each element (r, c) in the normalized GLCM is the joint probability occurrence of pixel pairs with a defined spatial relationship having gray level values r and c in the image.

Performance and result from the finger vein

The experimental results for the feature extraction performance using from individual finger vein. The experiment in this section organized to form several features are Contrast ,homogeneity ,entropy ,energy, correlation and mean .The best one identification performance was achieved by using Adaptive fuzzy interference method .The above features are suggest the significant improvement of finger vein identification. Mapping of the binary values of obtained image with binary values of stored image was done using fuzzy logic .if the unknown image is matched with stored original image then the person will be identified. if the unknown image is not matched with stored image then the person will not be identified.

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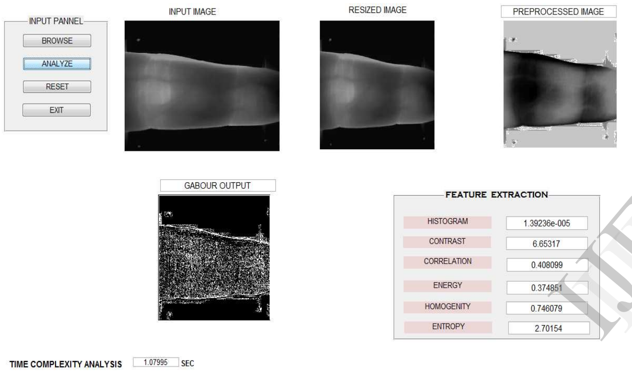
IV.ALGORITHM

```
function varargout = Main(varargin)
% Main MATLAB code for Main.fig
%      Main, by itself, creates a new Main or raises the existing
%      singleton*.
%      H = Main returns the handle to a new Main or the handle
to
%      the existing singleton*.
%      Main('CALLBACK',hObject,eventData,handles,...) calls
the local
%      function named CALLBACK in Main.M with the given
input arguments.
%      Main('Property', 'Value',...) creates a new Main or raises
the
%      existing singleton*.  Starting from the left, property
value pairs are
%      applied to the GUI before Main_OpeningFcn gets called.
An
%      unrecognized property name or invalid value makes
property application
%      stop.  All inputs are passed to Main_OpeningFcn via
varargin.
%      *See GUI Options on GUIDE's Tools menu.  Choose
"GUI allows only one
%      instance to run (singleton)".
% See also: GUIDE, GUIDATA, GUIHANDLES
```

```
 % Edit the above text to modify the response to help Main
 % Last Modified by GUIDE v2.5 29-Jan-2013 11:36:15
 % Begin initialization code - DO NOT EDIT
gui_Singleton = 1;
gui_State = struct('gui_Name',       mfilename, ...
                   'gui_Singleton',  gui_Singleton, ...
                   'gui_OpeningFcn', @Main_OpeningFcn, ...
                   'gui_OutputFcn',  @Main_OutputFcn, ...
                   'gui_LayoutFcn',  [] , ...
                   'gui_Callback',   []);
if nargin && ischar(varargin{1})
    gui_State.gui_Callback = str2func(varargin{1});
end
 if nargout
    [varargout{1:nargout}] = gui_mainfcn(gui_State, varargin{:});
else
    gui_mainfcn(gui_State, varargin{:});
end
```

V.RESULT



VI.CONCLUSION AND FUTURE WORKS

In this paper I have presented finger image matching by utilizing the finger surface features, i.e. from finger vein images. I presented experimental result in the preprocessing steps. Then features are done in similar. which can more reliable and accuracy then previous proposed finger vein approaches .My finger vein matching scheme is more effectively and reduce the time complexity .In future this approach using for feature discretization.In future, system can be improved normally in fuzzy the framing of rules must be the proper one for building the fuzzy interference system. Normally in neural network, while increasing the hidden nodes the time complexity will be very high. By implementing with neurofuzzy, the system will do more than high accuracy, low time complexity , high specificity, high sensitivity.

VII.REFERENCES

[1] AjayKumar, Senior Member, IEEE and Yingbo Zhou" Human Identification Using Finger Images" IEEE Transactions on image processing, vol 21.no.4 April 2012.

[2] S. Chaudhuri, S. Chatterjee, N. Katz, M. Nelson, and M. Goldbaum,"Detection of blood vessels in retinal images using two-dimensional matched filters," *IEEE Trans. Med. Imag.*, vol. 8, no. 3, pp. 263–269,Sep. 1989

[3] Federal Bureau of Investigation (FBI), The Science of Fingerprints: Classification and Uses, US Government Printing Office, Washington, DC, 1984.

[4]J. Feng, "Combining minutiae descriptors for fingerprint matching", Pattern Recognition, vol. 41, pp. 342-352, 2008.

[5] Finger print matching system using Level 3 features. Prince et. al./International Journal of Engineering Science and Technology Vol. 2(6), 2010, 2258-2262

[6] J. Hashimoto, "Finger vein authentication technology and its future,"in *VLSI Symp. Tech. Dig.*, Honolulu, HI, 2006, pp. 5–8.

[7] A. Jain, A. Ross, S. Prabhakar, Fingerprint matching using minutiae and texture features, in: International Conference on Image Processing (ICIP), Thessaloniki, Greece, 2001, pp. 282–285

[8]M. Kono, H. Ueki, and S. Umemura, "Near-infrared finger vein patterns for personal identification," *Appl. Opt.*, vol. 41, no. 35, pp. 7429–7436, Dec. 2002

.

[9] A. Kumar and Y. Zhou, "Human identification using knucklecodes,"
in *Proc. 3rd Int. Conf. BTAS*, Washington, DC, Sep. 2009, pp. 1–6.

[10] E. C. Lee and K. R. Park, "Restoration method of skin scattering blurred vein image for finger vein recognition," Electron. Lett. vol.45, no. 21 , pp. 1074–1076, Oct. 2009

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