International Journal of Advanced Trends in Computer Applications
www.ijatca.com

Finger Vein using Repeated Line Tracking, Gabor Filter and K-Means

[1]Navpreet Kaur
Ramgarhia Institute of Engineering and Management, Phagwara
[2]Er. Varinderjit Kaur
Head of Department (CSE)
Ramgarhia Institute of Engineering and Management, Phagwara
[3]Dr. Naveen Dhillon
Principal
Ramgarhia Institute of Engineering and Management, Phagwara
[1]preet16.aulakh@gmail.com, [2]vari006rupi@gmail.com

Abstract: *Finger vein is a unique physiological biometric for identifying individuals based on the physical characteristics and attributes of the vein patterns. This technology is at present in use or development for a wide range of applications; this contain credit card authentication; security in automobile; employee time and tracking attendance; computer and network authentication and security[1]. The proposed work simultaneously acquires the finger-vein and low-resolution finger image images and combines these two techniques using a better score-level combination strategy of finger vein. Analyse the previously proposed finger-vein identification approaches and develop a new approach that describes it superiority over prior efforts. In this thesis developed and analyzed three new score-level combinations i.e., Repeated Line Tracking, Gabor Filter and K-means comparatively evaluate them with more popular score-level fusion approaches to ascertain their effectiveness in the proposed system.*

Keywords: *Finger vein; Gabor Filter; Repeated Line Tracking and K-Means.*

I. INTRODUCTION

The Finger vein is a unique physiological biometric for identifying individuals based on the physical characteristics and attributes of the vein patterns in the human finger. It is a fairly recent advance in the field of biometrics that is being applied to different fields such as financial, law enforcement facilities and other applications where high levels of security or privacy is very crucial. This technology is very impressive because it requires small, relatively cheap single-chip design, and has a fast identification process that is contact-less and of higher accuracy when compared with other identification biometrics like fingerprint, iris, facial and others. This higher accuracy rate of finger vein is not unconnected with the fact that finger vein patterns are virtually impossible to forge thus it has become one of the fastest growing new biometric technology that is quickly finding its way from research labs to commercial development.

For authentication purposes, the finger is scanned as before and the data is sent to the database of registered images. The authentication process takes less than two seconds. Overall, its advantages include: uniqueness, living body identification, internal characteristics, small sample file, a higher level of security and so on. In the finger vein image acquisition process, the light intensity has a great impact on the quality of finger vein image. The Stronger light can cause the overall image bright and make the vein disappear in the serious. The lower light can cause the overall image dim and make a very few difference between the blood vessels and the background. In order to finish sufficient extraction of the finger vein feature, the image needs pre-processing. The pre-processing is mainly divided into image denoising and image Enhancement. The methods of feature extraction mainly include: threshold segmentation methods, the maximum principal curvature methods. Finger Vein proved that each finger has unique vein patterns so that it can be used in personal verification. To obtain the pattern, an individual inserts a finger into an attester terminal containing a near-infrared LED light and a monochrome CCD camera. The haemoglobin absorbs near-infrared LED light, which makes the vein system. The camera records the digitized raw data and the image and sent to a database of registered images. The finger is scanned as before and the data is sent to the database of

registered images for authentication purposes which takes less than two seconds.

Finger vein based biometric system has several benefits when compared with other biometric methods. The finger vein pattern is hard to replicate to it's an internal feature. The quality of the captured vein pattern is not easily influenced by skin conditions. The palm vein based verification system; the size of the device can be made much smaller. At last, the finger vein recognition does not require contact between the finger and sensor. When the networks are not segmented, the recognition accuracy may be degraded recognition technology however offers a promising solution to these challenges due the following characteristics.

1. Its universality and uniqueness such as individuals have unique fingerprints, so also they do have unique finger vein images.
2. Hand and finger vein detection methods do not have any known negative effects on body health.
3. The condition of the epidermis has no effect on the result of vein detection.
4. Vein features are difficult to be forged and changed even by surgery.
5. Vein is free from the impact of external contamination and minor injuries
6. Information characteristic is insensitive to the changes in humidity and temperature.

These desirable properties make vein recognition a highly reliable authentication method. What is more, it is easy to collect, readable and so on. Because of the above unique advantages, the vein recognition is widely used in biometric identification.

II. WHY WE USE FINGER VEIN?

Traditional Biometric authentication system will be provided by using passwords or Personal Identification Numbers (PINs) which are easy to implement but is vulnerable to the risk of exposure and being forgotten. Biometrics which uses human physic-logical or behavioural features for personal identification, has attracted more attention and is becoming one of the most popular and promising alternatives to the traditional password or PIN based authentication techniques. As we step ahead into the new millennium, identity thefts and Internet scams are becoming increasingly common. More and more governments and institutions are now using this technology to safeguard their airports, hospitals, prisons and other sensitive areas. In this era, it is imperative that we continuously upgrade our security systems and the use of biometrics is a step towards the security upgrade that we continuously require.

The following advantages are:

1. The vein is hidden inside the body and is mostly invisible to human eyes. The non-invasive and contactless capture of finger-veins ensures the convenience for the user.
2. The finger-vein pattern can only be taken from a live body. It is a natural and convincing proof that the subject whose finger-vein is successfully captured is alive.
3. As vein is hidden inside the body and is mostly invisible to the human eye. The non-invasive and contactless capture ensures both convenience and cleanliness for the user.
4. With ten fingers of person, if something unexpected happens in one finger. Then other fingers can also be authenticated. Finger vein pattern is forecast one of mainstream identification technology in the future.

III. METHODOLOGY

The block diagram of the proposed system is shown in Figure1. The fingers presented for the identification of subjects are simultaneously exposed to a webcam and an infrared camera as illustrated from the device of our imaging device.

Image Acquisition: Image acquisition means acquiring an image from the source stored in some hardware or from direct source. In image acquisition the browse image is loaded for further processing.

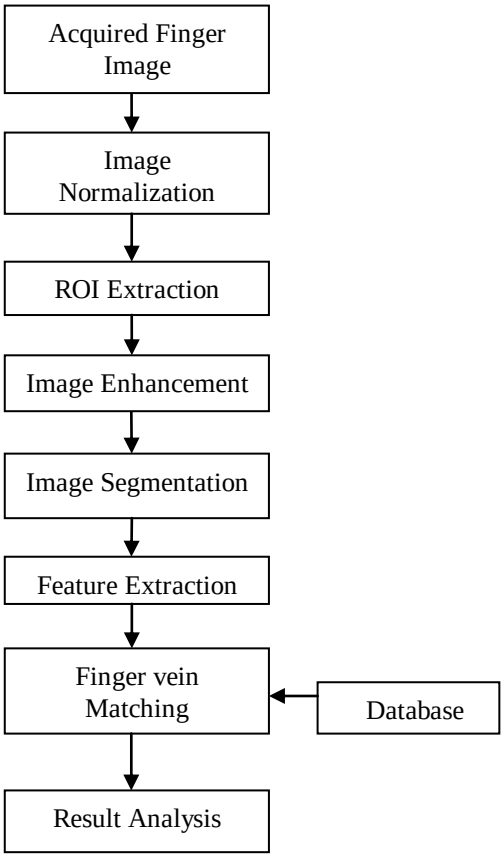


Figure 1: Methodology of proposed work

Image Normalization: **-** Each of the acquired finger-vein images is first subjected to normalization, in which Binarization is done. A binary image is a digital image that has only two possible values for each pixel. There are two colours used for a binary image are black and white though any two colours can be used for the objects in the image is the foreground colour i.e. green while the rest of the image is the background colour i.e. black. In present work we use a fixed threshold value as 250 to coarsely localize the finger shape in the images, i.e., the eliminating number of connected white pixels being less than a threshold.

ROI Extraction: **-** The Edge detection is performed to highlight the ROI. Sobel which is a popular edge detection method is considered in this work. The Sobel method uses the derivative to find edges. Then it returns edges at those points where the gradient of the considered image is maximum. Standard Sobel operators, for a 3×3 neighbourhood, in which each simple central gradient estimate is vector sum of a pair of orthogonal vectors.

Image Enhancement: **-** The finger vein details in the acquired images, particularly the thin ones, are not very clear and the image got damaged or its quality decrease during the process of clicking the image or transferring the image then the image enhancement is use to improve the image. It is the process of improving the quality of a digitally stored image by manipulating the image with software. It is quite easy. An advanced enhancement software also supports many filters for altering images in various ways.

Image Segmentation: **-** Image segmentation is an important step for finger-vein identification technique. It is difficult to extract precise details of the image because of the irregular noise and shades around the finger-vein. The Automatic Trimap Generation is used to achieve good segmentation performance for low quality images of finger-vein.

Feature Extraction: **-** Transforming the input data into the set of features is called feature extraction. The feature extraction is done to extract the thickness, length and shape of the vein pattern. The three methods are used to extract the features are Repeated Line Tracking, Gabor filter and K-means and these methods are explained below:

a) Repeated Line Tracking

The repeated line tracking method is the idea to trace the veins in the image by chosen directions according to predefined probability in the horizontal and vertical orientations, and the starting seed is randomly selected; the whole process is repeatedly done for a certain number of times.

b) Gabor Filter

A Gabor filter is a linear filter whose impulse response is defined by a harmonic function multiplied by a Gaussian function. It is because of the multiplication-convolution property, the Fourier transform of a Gabor filter's impulse response is the convolution of the Fourier transform of the harmonic function and the Fourier transform of the Gaussian function. The Gabor Filters have received considerable attention because the characteristics of certain cells in the visual cortex of some mammals can be approximated by these filters.

c) K-Means

Miura proposed a method that is based on calculating curvatures in cross-sectional profiles of a vein image. In each profile, the location of the k-means is found and those maxima and their width are taken as the center and the width of the veins respectively. A new method has been developed to robustly extract the precise details of the veins by calculating local k-means in the cross-sectional profiles of a vein image. This method rectifies the problems found in previous methods by checking the curvature of the image and focusing only the centrelines of veins. This method of finding the k-means positions is against the variation in vein's brightness and width. The positions are interconnected with each other and finally the vein pattern is detected.
The details are described below in points.
Step 1: Calculation of the curvatures of profiles
Step 2: Detection of the centers of veins
Step 3: Assignment of scores to the center positions
Step 4: Calculation of all the profiles
Step 5: Connection of vein centers

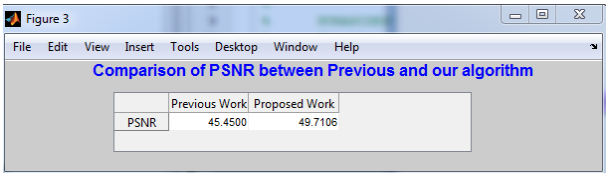
Finger Vein Matching: **-** The output come from all the pervious steps will be matched with the data stored in the database, which shows whether the acquired vein is matched with the database or it will be unmatched. Here SURF feature is used for matching vein pattern. The SURF is used for object recognition, for it is of better speed and accuracy compared with other features. The database contains the features of all vein images.

Database: **-** To test the performance of the proposed method, the finger vein images are stored in database. The captured images containing finger veins are 8-bit gray images with a resolution of 320 9 240. The recorded finger-vein images are not high in quality. We choose six images to make up training samples and the remaining as testing data. Acquired images and their processed vein patterns are stored in the database.

IV. RESULTS AND DISCUSSION

A starting GUI was created to perform all the five operations that is browse input image, process input image, create database, process database and match.

Table 1: Comparison of PSNR values between Previous Work and Proposed Work



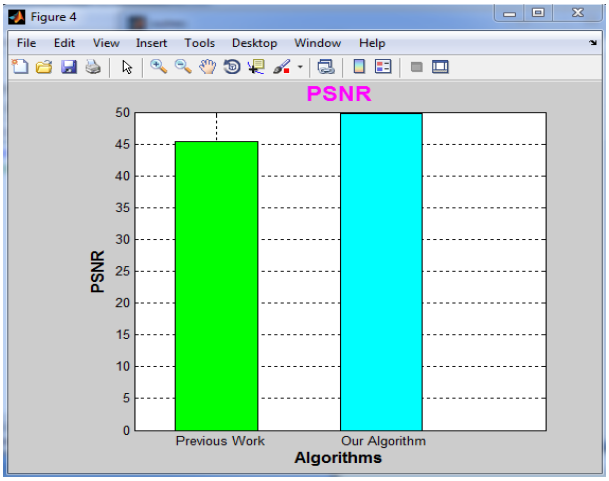
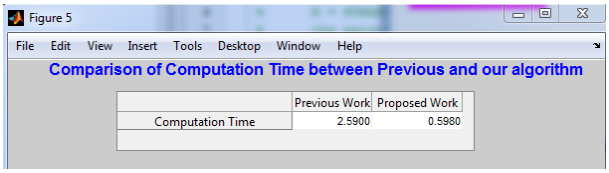


Figure 2: Graph showing comparison of PSNR values between Previous Work and Our Algorithm

Table 2: Comparison of computation time between Previous Work and Proposed Work



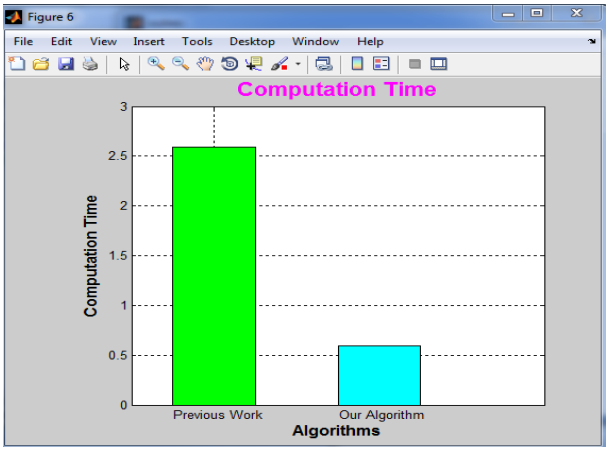


Figure 3: Graph showing comparison of Computation Time between Previous Work and Our Algorithm

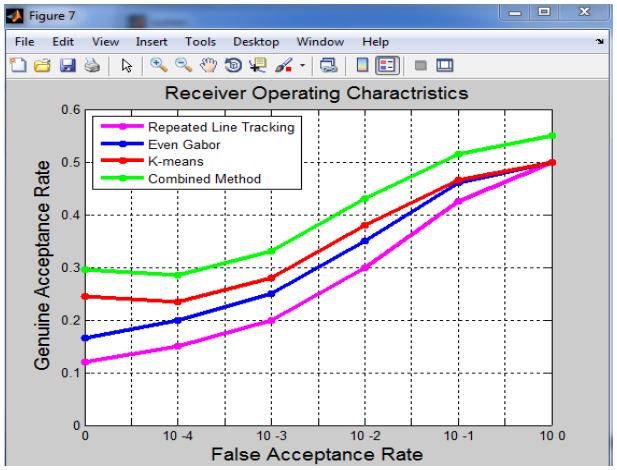


Figure 4: Graph of GAR and FAR

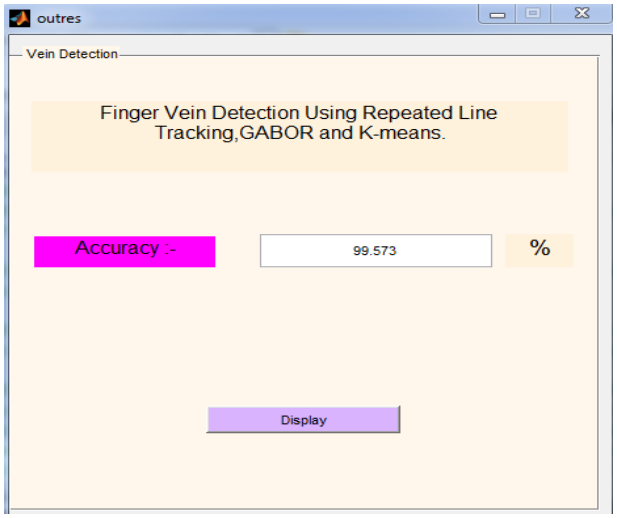


Figure 5: Image with accuracy result.

The above figure shows the result of identity authentication using finger vein and image recognition by using repeated line tracking; Gabor Filter and K-Means. This technique gives better result as compare to previous technique. By use this technique the value accuracy up to 99.573%.

V. CONCLUSION

In this paper the numbers of finger vein image techniques have been proposed earlier but they were not secure enough and can be temporarily tampered with so the task was not fulfilled. Finger vein and image detection using repeated line tracking or gabor filter alone could not provide better results. Identity authentication using repeated line tracking has been proposed previously but there have been always need for better finger vein recognition technique and the existing identification using finger vein image recognition algorithm is costlier. An enhanced identification algorithm using finger vein image which is based on repeated line tracking, gabor filter and k-means is proposed. The identification using finger vein image

algorithm by proposed method will be low cost and more accurate with respect to human identifications using finger vein with other technique.

ACKNOWLEDGMENT

Thanks to my Guide and family member who always support, help and guide me during my dissertation. Special thanks to my father who always support my innovative ideas.

REFERENCES

[1] Ajay Kumar & Yingbo Zhou "Human Identification Using Finger Images" Published by IEEE in 2012.
[2] Jinfeng Yang & Yihua Shi "Finger Vein Based Enhancement and Segmentation" Published by Springer in 2013.
[3] Vanathi G, Nigarihaa R,Uma Maheswari G &Sjuthi R "Real Time Recognition System Using Finger Vein" Published by IJAEEE in 2013.
[4] Wenming Yang, Qing Rao, Qingmin Liao "Personal Identification For Single Sample Using Finger Vein Location and Direction Coding" Published by IEEE in 2011.
[5] Jinfeng Yang and Xu Li "Efficient finger Vein Localization and recognition" Published by ISSN in 2010.
[6] Qin Bin Pan Jian-fei Cao Guang-zhong & Du Ge-guo "The Anti Spoofing Study of Vein Identification System" Published by IEEE 2009.
[7] Yang JF, Yang JL, Shi YH "Finger-vein segmentation based on multi-channel even-symmetric Gabor filters" Published by IEEE international conference on intelligent computing and intelligent systems in 2009.
[8]. David Mulyono & Horng Shi Jinn "A Study of Finger Vein Biometric for Personal Identification" Published by IEEE in 2008.
[9] Kejun Wang, Hui Ma, Oluwatoyin P. Popoola and Jingyu Li "Finger Vein Recognition" Published by ISSN in 2008.
[10] Naoto Miura, Akio Nagasaka, Takafumi Miyatake "Extraction of Finger-Vein Patterns Using Maximum Curvature Points in Image Profiles Published by IEEE in 2005.
[11] Naoto Miura, Akio Nagasaka, Takafumi Miyatake "Feature Extraction of Finger-Vein Patterns Based on Repeated Line Tracking and its Application to Personal Identification" Published by Springer in 2004.
[12] C. Yam, M. Nixon, and J. Carter, "Gait Recognition by Walking and Running: A Model-Based Approach," Proc. Asia Conf. Computer Vision, pp. 1-6, 2002.
[13] 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.
[14] Z. Zhang, S. Ma, and X. Han, "Multiscale feature extraction of finger vein patterns based on curve lets and local interconnection structure neural network," in *Proc. ICPR*, Hong Kong, 2006, pp. 145–148.
[15] N. Miura,A. Nagasaka, and T. Miyatake, "Feature extraction of finger vein patterns based on repeated line tracking and its application to personal identification, *"Mach. Vis. Appl.*, vol. 15, no. 4, pp. 194–203, Oct. 2004.
[16] Kefeng Li; "Biometric Person Identification Using Near-infrared Hand-dorsa Vein Images". University of Central Lancashire in collaboration with North China University of Technology, 2013.
[17] Jinfeng Yang and Xu Li; "Efficient Finger Vein Localization and Recognition". IEEE International Conference on Pattern Recognition, 2010.