ISSN: 0975-8585

Research Journal of Pharmaceutical, Biological and Chemical Sciences

Survey On Finger Vein Segmentation And Authentication For Security Purpose.

Chitra P[1]*, Chopperla Yaswanth[2], and Elluri Deepesh Reddy[2].

[1]Associate Professor, Dept. of Electronics and Communication Engineering, Sathyabama Institute of Science and Technology, Chennai, India.
[2]B. E. Student, Dept. Of Electronics and Communication Engineering, Sathyabama Institute of Science and Technology, Chennai, India.

ABSTRACT

Searching different fields for the authentication purpose, Finger vein authentication technique plays a vibrant role for personal identification and authentication for security purpose. Now a days this technique is gaining popularity, as unique for every person which is located beneath the skin which provides high security and convenience approach for personal authentication. Vein biometrics is emerging technology when compared to other systems because this authentication system has less forgery risk and has high stableness for long period of time and which is obtained only from living bodies. Literatures published based on different techniques used for finger vein authentication process are explained and described in this paper. This processes has gained promising performance in different applications or fields and gather attention among researches to improve performance, accuracy, efficiency and to reduce error rates. This paper in brief, describe various techniques and approaches for finger vein authentication process. The processes are based on various image processing techniques like image acquisition techniques, pre-processing, segmentation, feature extraction, classification and matching to get access.

Keywords: Finger, Vein, Bio-Metrics, Vein Extraction.

https://doi.org/10.33887/rjpbcs/2019.10.3.61

Corresponding author

ISSN: 0975-8585

Existing Bio-Metrics

Some of the implemented biometrics are finger print, face, iris, palm and vein. These are major biometric approaches in present life. Unlike finger print and iris in which finger print sensor is contact based and also it can be forged.

Fig 1: Finger print

On the other side iris scanner is a light emitting source. This light falls on the Iris and retina due to this it is inconvenience to some users.

Fig 2: Iris

In facial recognition the camera has dot projector which projects dots on face and forms patterns on face to extract features. The main backdrop of Facial recognition is it works for twins and 3D implemented faces.

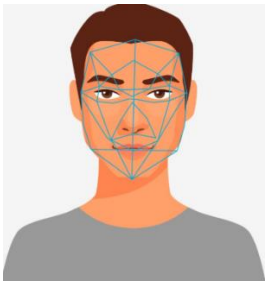

Fig 3: Face

When coming to Hand Biometric, it uses all dimensions like length, width, surface area of hand, distance and angle between the fingers due to all these it is complicated and not accurate as other methods.

ISSN: 0975-8585

Fig 4: Hand

When compared to all other biometrics vein Recognition has more advantage because the veins are present beneath the skin and unique for every person. So, they are not possible to forge and also they can't obtain from dead bodies.

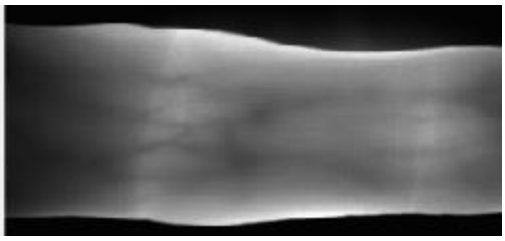

Fig 5: Finger vein

INTRODUCTION

Biometrics placed a major role in day to day life to provide security and privacy for every individual. Most of the organizations are depend on biometrics to identify their employees. Most of personal devices have biometrics for privacy. These biometrics will identify the people based on their biometric features. The one of the most important property of biometrics is uniqueness so it plays a major role in authentication process. These are unique because they are hard to forge and circulate them. Some of the biometrics are only possible for alive bodies. One of the most secured biometric is finger vein pattern which can retrieve from a live body because they veins are captured by sensor when haemoglobin absorbs the visible spectrum only. These patterns are unique from person to person including twins and mostly unchanged despite age unlike some other biometrics. This biometric doesn't affect health condition of a person. The finger vein biometric is user friendly because the device uses a contactless sensor which is convenience and hygienic for the user. Despite of huge advantages of finger vein over other biometrics, this has challenging processes to be done to implement this. Right off the bat, the finger-vein picture securing gadget has an incredible effect on the nature of the finger-vein pictures. Amid the catching procedure, the separation between the finger and camera is exceptionally near each other. This nearby position could cause optical obscuring on the caught. Furthermore, the lighting of the catching gadget is an extremely essential property for the framework. Poor lighting may cause the picture to show up incredibly dull or amazingly bright .The position direction of the finger is likewise critical. On the off chance that the finger isn't guided, the acknowledgment rate might be diminished as the finger-pictures could be misaligned. Other than that, the thickness of bones and skin shifted for each person. Along these lines, light dispersing may occurs as the human's skin layer isn't consistent. The noise on the caught pictures should be killed however much as could be expected. Therefore to overcome this issues different methods and complex image processing algorithms are implemented. Common steps for finger vein authentication process are

1. Image acquisition.
2. Pre-processing.
3. Segmentation.
4. Feature extraction and Classification.

Image Acquisition

In the process of image acquisition, vein images are produced by infrared scanner or through images stored in the database. When coming to the image acquisition through image sensor which depends upon the intensity of sensor, temperature of environment and also affect the image quality. The temperature should be ambient like it shouldn't be too cold or hot and nor around temperature of human body. The distance between sensor and finger also affects the image quality. Actually the sensor is prepared by using webcam and led lights which give low profile output images unlike a manufactured sensor[1]. These sensors can be made in two forms one is applying LED upon the finger and in other one the LED source is applied to sides of the finger[1]. On other hand images are taken from already created database. There are so many database like VERA AND UTFVP. However VERA database is challenging in terms of misalignment and variability of database images in realistic scenarios when compared to the UTFVP[2].

Image Pre-Processing

Due to the finger vein image condition, vein images always have a low quality and uneven illumination which causes error that degrades accuracy. A image can be enhanced by using different pre-processing techniques which helps to improve image quality by improving some parameters like contrast, brightness, edge detection, noise removal, image smoothing and sharpening etc. By doing this the quality of image will help to get better accuracy. The finger vein pre-processing involves finger region localization, ROI extraction, ROI enhancement[3]. If the acquired images are noisy the image enhancement took more process compared to the less noisy image. To remove that noise after ROI extraction some filters are used like median and Gabor and after that to remove background noise histogram equalization is used which smooth the image[4].

For uneven contrast images background pixels would influence the computation of the images. Lee Region detection gives that finger region is brighter than the background and determines the finger boundaries using simple 20 by 4, containing 2 rows of 1 followed by 2 rows of -1 for the upper boundary and a horizontally mirrored one for lower boundary. This makes the background pixels to back. The second pre-processing stage to improve and equalize contrast. CLACHE or some histogram equalisation techniques are used by most of the authors. For uneven contrasted images CLACHE is the best tool to avoid amplification noise. Further Gabor filter is used for enhancement to achieve great results[5].

Image Segmentation

Image segmentation is the process which involves of dividing an image into multiple parts. It is used to find the objects and other relevant information in digital images. There are many segmentation techniques to perform segmentation including threshold method like OTSU's method in which the pixel with greater brightness than mean brightness are set to background directly. Then the brightness which is lower than the mean brightness is considered as required region, than compute threshold by optimal Otsu method[6]. N. Miura proposed repeated line tracking method for pattern extraction which is based on the number of times that the point undergoes tracking line passes through it. It is based on line tracking in which the line starts at various points and executed by moving along the previous lines and pixel by pixel. If the line ends at one pixel it will start any new tracking operation from another position until all veins are tracked[7]. By using morphological dilation and erosion process one can find the segmentation results but to segment precisely ROI should be used. To do for total finger segmentation should be done with multiscale and multidirectional filters based on dyadic wavelet transform. After image is rotated Mumford shah model is used to generate the Hermitian matrix by using matrix one can get segmented image after doing morphological filtering[8]. K-means clustering algorithm is to find the partition of the data which reduces the squared error or sum of the squared distance between all points and their respective clustering centres. It uses iteration algorithm that reduces some of the distances between each object to clustered centroid, which is done for all centroids[9]. When compared to hierarchical clustering k-means clustering is much better because it is computationally faster.

Feature Extraction and Classification

Feature extraction means to find the parameters that are helpful for comparing the images and produce the results. There are various predefined feature extractions like GLCM which will give contrast, energy, homogeneity with which database can be created for comparison purpose. There are many predefined functions

like mean, median, skewness, Courtois, entropy with which numerical values will be generated according to digital image. There are some methods like wide line detector in which the circular neighbourhood vein regions are considered to extract all points from an image[10]. Features can extracted by using wavelet transform, HAAR transform is the simple wavelet transform like wavelet transform which is fast for implementation and able to produce local features. One of the most used classification method is Support Vector Machine (SVM) introduced in 1992. It is widely used in biometrics due to high accuracy and able to calculate and process dimensional data such as gene expression. It belongs to the kernel method, which algorithm depends only on data through dot products. SVM algorithm is done by firstly, defining optimal hyper plane and extending the definition for non-linear separable problems and finally map the data to high dimensional space[11]. In recent days there is greater development in deep learning and neural network by using the neural network there are so many algorithms for classification. Convolutional Neural Network (CNN) combines segmentation, feature extraction and classification in one module and it is trained with standard backpropagation algorithm. The CNN design for finger vein authentication process is developed in four layers. This design derived from LeNet-5 architecture which has smaller neural network size. The convolutional and subsampling layer fused together and two fully connected single nodes are used as classifier for classification[12]. Finger vein authentication can also be done by using DSP chip DM6437, which will produce pv1 as a registered template and it considered pv2 as vector to be matched[13]. In this the system manipulates pv2 by dividing n by n parts and then maps each part orthogonal matrix. In this each vector is compared with its 8 neighbour vectors. If it meets with both position and angular compatibilities then the matching flag will incremented by one. If the matching score is greater than threshold score then it will give matched output[13]. A feature extraction method called Local Line Binary Pattern (LLBP) which is modified and improved method to LBP in which horizontal and vertical components. The magnitude of LLBP parameter can be obtained by calculating the line binary codes for both components and by doing square root of squares of these components thereby one can obtain LLBP parameter. By using this parameter and code length hamming distance can be calculated for matching purpose[14].

REFERENCES

[1] Sarah B, Abdelkader B, Asmaa M. parallel extraction hand vein biometric parameters using low cost IR image system. WSCG conference of computer graphics, visualization and computer vision.2014, ISBN 978-80-86943-75-5

[2] Matthias Vanoni, Pedro Tome, Laurent El Shafey and Sebastien Marcel. Cross-Database Evaluation Using an Open Finger Vein Sensor, Idiap Research Institute. CH-1920

[3] JiaLiang Peng, Qiong Li, Ning Wang, Ahmed A. Abd El-Latif and Xiamu Niu. An Effective Preprocessing Method for Finger Vein Recognition. Proceedings of SPIE-The international society of optical engineering - 2013. Proc. of SPIE Vol. 8878 887808-1

[4] Poonam Dabas, Amandeep Kaur. Finger vein detection using Gabor filter, Segmentation and Matched filter. International Journal of computer applications technology and research, 2014 Volume 3-Issue 7,400-402

[5] Christoph Kauba, Jakob Reissig, and Andreas Uhl. Pre-processing cascades and fusion in finger vein recognition. 2014.

[6] Tong Liu, Jianbin Xie, Huanzhang Lu, wei Yan and Peiqin Li. A Threshold image method for finger vein segmentation. Applied Mechanics and materials. 2012. ISSN:1662-7482,vols-263-266, pp 2439-2442.

[7] Naoto Miura, Akio Nagasaka, Takafumi Miyatake. Feature extraction of finger vein pattern based on repeated line tracking and its application to personal identification, Machine Vision and application.2004, 15:194-203.

[8] Marios Vlachos and Evangelos Dermatas. Finger vein segmentation from infrared images based o modified separable Mumford Shah model and local entropy thresholding. Computational and mathematical in medicine, 2015. Article id: 868493.

[9] R.V.Patal, K.C.Jondhald.Edge based technique to estimate number of clusters in k-means colour image segmentation, IEEE conference on image processing, 2010, 171-221.

[10] Beining Huang, Yanggang Dai, Rongfeng Li, Darun Tang and Wenxin Li. Finger vein authentication based on wide line detector and pattern normalization, 2010, International conference on pattern recognization,IEEE,1269-1272.

[11] Kirandeep kaur, Shashi Bhushan. Finger enhancement using segmentation and SVM. International journal of computer science and informational technologies. 2015, 4549-4554.

[12] K.S. Itqan , A.R.Syafeeza, F. G.Gong, N. Mustafa, Y. C.Wong and M.M.Ibrahim.User identification system based on finger vein patterns using convolutional neural network,2016.Arpn journal of engineering and applied sciences,3316-3319.

[13] Xiao Sun, Chun-Yi Lin, Ming-Zhong Li, Hai-Wu Lin, Qing-Wu Chen. A DSP-Based finger vein authentication system, 2011, DOI 10.1109/ICICTA.2011.367, 333-336.

[14] Bakhtiar Affendi Rosdi , Chai Wuh Shing and Shahrel Azmin Suandi. Finger Vein Recognition Using Local Line Binary Pattern. doi: 10.3390/s111211357, 2011.