Finger Vein Authentication using Deep Learning

Dr. Pallavi R[1], Amala Renita[2], Jasmine Karam[3], Umama Amin[4], Yuthika MB[5]
[1] *Professor, Department of Computer Science & Engineering, Sir M Visvesvaraya Institute of technology*
[2,3,4,5]*Student, Department of Computer Science & Engineering, Sir M Visvesvaraya Institute of technology*

***Abstract* - The main aim of the project is to use finger vein for authentication. Finger vein recognition technology is one of the new biometric technologies, which has been gaining a significant amount of attention. It uses the vein pattern underneath the skin for authentication. This technique captures the finger vein pattern by shining an infrared light on the fingers. If the finger vein matches with the person's vein pattern which is stored in the database a success message is displayed. If it does not match a buzzer sound will be played.**

I.INTRODUCTION

Finger vein is the vascular pattern underneath our skin which is unique to a person. Finger vein authentication system helps us to uniquely identify a person by using their finger vein pattern. Some current identity verification systems such as password, smart cards, etc carry the risk of theft, forgery and unauthorized use. This has lead to a lot of financial loss. Finger vein authentication has been lately gaining a lot of attention due to its many advantages. Some advantages of using finger vein for authentication are-It has a high accuracy of identifying a person. It cannot be easily forged, unlike the fingerprint and iris of a person, as it is present under the skin. The fingerprint of a person changes as he ages i., it starts to wear off and a person's iris pattern can also change if he/she gets some surgery done. This is not the case with the finger vein patter which remains exactly the same throughout a person's life. The finger vein is obtained by using a near-infrared reader.

II. LITERATURE SURVEY

In paper [1] a method is proposed which extracts the vertical cross-sectional profiles to determine the approx. positions of the vein regions in a given finger-vein image. The proposed method correctly detects the positions of the vein regions of the finger by checking the depth of the vein profile using various depth thresholds. Based on the detected positions, the proposed method measures the quality of the finger-vein. Image using the number of detected vein points (NDVP) relative to the depth thresholds, which allows one's variations in the vein density to be considered for quality assessments. In this study, the vein points are all the image pixel points on the detected vein lines. Finally, this proposed method assesses the quality of input finger-vein images and images of inferior quality are not used for recognition, thereby enhancing the accuracy of finger-vein recognition. Capturing a clear vein pattern in the finger-vein image is very important in finger-vein recognition.

In paper[2], they have presented a finger-vein based biometric security system that can be used for security based electronic devices. The method can extract the finger-vein feature for recognition from the NIR images. This method uses single sample and is convenient to the application. This work can be extended with increasing the database for further verification

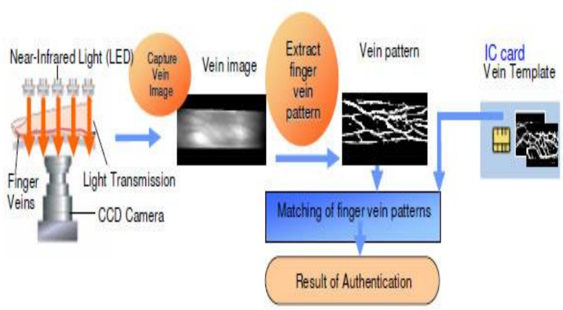
In paper [3] they have discussed recent approaches to solving the problem of varying finger lengths and proposed using a set of images of same size interval in a selected sub-block approach. For each image sub-block, wavelet moment was performed and PCA features extracted. LDA transform is performed, and the two features were combined for recognition. For

Finger Vein Recognition 53 matching and identification, we proposed a method of fuzzy matching scores. Experimental results show that wavelet moment PCA fusion method achieved good recognition performance; error rate FAR was 0.7%, rejection rate FRR of 1.05%.

In paper [4] they propose precise extraction of finger vein pattern is a elementary step in developing finger vein based biometric authentication systems. Finger veins have textured patterns, and the directional map of a finger vein image represents an intrinsic nature of the image. The finger vein pattern extraction method uses oriented filtering technology. Venkateshan Baskar's and Sugantharaja Radhakrishnan's method extends traditional image segmentation methods, by extracting vein object from the oriented filter enhanced image. Experimental results show that their method has higher efficiency than NiBlack segmentation method. To take full account of the original image quality factor, they selected two typical images from their database with one from high quality images and the other from poor quality images to show the results of comparative test. Apart from smoothness and continuity or removal of noise and pseudo-vein characteristics, the method proposed in this paper extracts vein features effectively not only from the high-quality images but also from the low-quality vein images.

DSP-based design method of finger vein
recognition was proposed in paper [5] and a finger vein authentication system FV-1 was developed. In this system, finger vein images were captured with infrared, and normalized through rotation correction, then they were segmented and thinned to wipe off useless segments. Finally, features on vein points were obtained and two finger vein images were matched in view of a feature distance.

II. METHODOLOGY



Step one: As shown in the device of our imaging device, the fingers provided for subject identification are exposed to a charge coupled device, also known as CCD, camera and an infrared camera, and we acquire input image. However, instead of using a CCD camera or a near-infrared camera, we use the information gathered from the database.

Step two: Since the acquired picture is noisy, this step is critical. A series of operations are performed on the acquired input finger vein image during pre-processing. These procedures are outlined below.

We do pre-process of an input image after acquiring a finger vein image, which includes:

Binarization: converts a greyscale picture to black and white, or 1 and 0 in binarized form. Binarization is applied to each of the acquired finger-vein images. A binary image is a digital image in which each pixel can only have one of two values: 1 or 0. To coarsely localize the finger shape in the images, use a fixed threshold value.

Edge detection: Using a soble edge detector, we perform detection of the edges that are present in the picture of the finger vein so that the finger vein region can be extracted properly. Once binarization is done, the remaining loosely linked and isolated regions which are present in the binarized images, are then removed in two steps: The first step being, The SOBEL edge detector, is used to detect the edges. This edge detector is implemented on the complete image of the finger vein, and then from the binarized image, the edge map is subtracted. The remaining blobs which are isolated, if any, in the resulting images are then removed from the region by using the process of thresholding. In this process, a certain amount of white pixel, which are connected, are removed if it is less than a threshold.

Vein ROI: ROI (REGION OF INTEREST) is a technique for acquiring essential regions of interest in a finger vein image in order to save time and eliminate unnecessary areas. By removing unnecessary background information from a finger vein image, ROI, which stands for REGION OF INTEREST, is used to extrapolate only the appropriate regions, resulting in less processing time. The region of interest from the original image of the finger-vein is segmented using the binary mask generated in the previous stage.

Enhancement of Image: This is used to enhance the quality of the picture of the finger vein by increasing color contrast, brightness, and lowering noise levels. To enhance images in any way, several different, mostly simple and heuristic methods are used.In addition to geometrical transformations, tentative grey level changes may be necessary to account for acquisition device imperfections. This can be achieved pixel by pixel, with the output of a constant brightness image as a guide. For contrast stretching, range compression, and other purposes, space-invariant grey value transformations are frequently used. The grey value histogram is the vital distribution, which is the relative frequency of each grey value.

Step three: In this process, the foreground, background, and blended regions of the finger vein image are segmented. For this we are using Automatic Trimap Generation, which is used to separate the background part, foreground part and the blended regions present in the image. For low-quality finger-vein images, good segmentation efficiency is obtained by the use of Automatic Trimap Generation. If A (x, y) and Z (x, y) represent a foreground and background image, respectively, an image of the restored finger vein O(x, y) can be modelled as:

$O^\wedge (x, y) = A(x, y)\ \alpha (x, y) + Z (x, y)\ (1 - \alpha (x, y))$ ------ (1.1)

Where x and y is the opacity of foreground of the pixel. O (x, y), A (x, y), Z (x, y), and a (x, y) are represented in the following by O, A, Z, and a, respectively. Since the A and Z are all unknown, the problem mentioned in the equation is ill-conceived. However, provided the Trimap, Equation may be used to estimate it correctly.

Step four: In this stage includes the extraction of a finger vein image using the haar wavelet transform, repeated line tracking or even Gabor filter for multidimensional pixel diagnosis and improved performance.

Haar wavelet transform: This transformation is computed using a matrix product for an list, whose length is even and contains numbers. The (vector) has a length of eight. Using the first half of the output, we obtain the averages and using the second half, we obtain the differences.

Repeated line tracking: This technique of repeated line tracking yields excellent outputs: The main goal is to map out the veins that are present in the image in predetermined horizontal and vertical directions, with the starting pixel chosen at random. As implied by the name, the entire procedure is repeated a certain number of times. In the case of finger vein recognition, the repeated line tracking approach yields promising results: The concept is to map out the veins in the picture in predetermined directions, with the starting point chosen at random. This is repeated a number of times.

Even Gabor Filter: A linear filter with a harmonic function multiplied by a Gaussian function is known as a Gabor filter. The Gabor Filters have gotten a lot of attention because they can be used to estimate the attributes of some cells in the visual cortex of certain individuals. Gabor filters have also been used in a vast range of applications, such as texture segmentation, edge detection, and retina recognition.

Step five: We use two techniques to align the input image with the database images in the final stage.

->Speed up robust features, which is also abbreviated as SURF. Speeded Up Robust Features (SURF) is an acronym for "Speeded Up Robust Features." It's a reliable algorithm for detecting local features. The SIFT (Scale Invariant Feature Transform) descriptor stimulates it in part. The basic version of SURF is three times quicker than SIFT, and the authors claim that it is much powerful than SIFT. SURF is based on the amounts of responses obtained from the HAAR wavelet and uses integral images extensively. It approximates the determinant retrieved from the Hessian blob detector with an integer approximation. This is calculated with an image integral. This scheme employs SURF for the extraction of relevant features as well as the extraction of descriptors from photographs. In SURF, a 64-bit descriptor vector is generated by using a histogram of gradient orientations in the immediate vicinity of each interest point. Due to its short descriptor duration of 64 floating point values, this scheme is preferred over the others. This is why the SURF algorithm is favored to other matching algorithms.

-> GSA (Gravitational search algorithm)

GSA(Gravitational search algorithm) is an algorithm which has been inspired by nature. It mathematically modeled the Newton's law of gravity and motion. GSA has a number of benefits, including a learning rate which is adaptive, a memory-free algorithm, and strong and a rapid convergence

-> Cross validation and matching using graph.

The computer will activate if a picture match; otherwise, it will not. They are an effective technique for data classification. A Cross Validation scheme separates or categorizes data by determining the most efficient hyper-plane which can separate distinct data points of different classes

III. CONCLUSION

The current study proposed a feature extraction method for finger vein recognition using the LBP algorithm and the Haar wavelet transform. The finger vein authentication security system has very distinct characteristics, and its potential growth, have been addressed in this paper. The impact of authentication and security technology in a vast number of sectors will continue to expand. Since the precision and ease of use of finger vein authentication is very dependent of devices such as image sensor, microcomputers and semiconductors, there is a lot of scope for semiconductor technology advancement.

REFERENCE

[1] New Finger-vein Recognition Method Based on Image Quality Assessment by Dat Tien Nguyen, Young Ho Park, Kwang Yong Shin, Kang Ryoung Park, Vol. 7, No. 2, February 25, 2013.

[2] Finger vein based biometric security system Jose Anand, T. G. Arul Flora, Anu Susan Philip

[3] Finger vein recognition by Kejun Wang, Hui Ma, Oluwatoyin Popoola, Jingyu Liu.

[4] Finger vien Authentication by Sugantharaja Radhakrishnan and Venkatesh Baskar, PSG College of technology, Coimbatore

[5] A DSP-Based Finger Vein Authentication System by Chun-Yi Lin,Mingzhong Li,Hai-Wu Lin