© INTERNATIONAL JOURNAL FOR RESEARCH PUBLICATION & SEMINAR
ISSN: 2278-6848 | Volume: 08 Issue: 02 | January - March 2017
Paper is available at www.jrps.in | Email : info@jrps.in

A Novel Technique to Palm Vein Recognition

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ISSN : 2278-6848
© International Journal for Research Publication and Seminar

Abstract: The automated human identification has become essential part of many commercial and security agencies. Many approaches are given in this direction. The most secure and convenient way to achieve this goal is the use of biometric traits for identification. In this paper we have proposed an approach for human recognition using palm prints of a being. This approach is very secure for many reasons, firstly if is unique to every person, secondly it does not vary with age, roughness, dryness or any physical injury. As these vein patterns are internal to the body they are not possible to forge. In this paper we have used Gaussian filter for image pre-processing and gabor filter, accompanied by repeated line tracking, and artificial neural networks for the feature detection. The results depict that the given approach gives the promising results with good accuracy.

Keywords: *palm vein, pattern, recognition, palm print, biometrics*

Introduction:

The area of human identification using biometric traits has become more and more critical and challenging to meet the needs of stringent security. The biometrics- based identification methods are now highly popular in a range of civilian applications and has become an effective substitute to traditional identification systems such as passwords [1]. Human palms can be easily presented and they can reveal a lot of data about a being which can be used for identification purpose. Due to this reason, palmprint research has gained a lot of attention for civilian and forensic usage [2]. However, like other biometric features such as fingerprint, iris and, face the palmprint biometric is also prone to sensor level spoof attacks.

Palm vein recognition is better approach than the others as it does not get affected by the dryness or roughness of skin, neither it is affected by any physical injury on surface of the hand however, temperature and humidity can sometimes affect the quality of the captured image. Besides being more expensive than other methods it is highly adaptable because it is highly secure as the veins are hidden inside the body [4].

Like fingerprints and iris, the pattern of palm veins is also unique to every being, even twins have different blood vein patterns in their palm and apart from size, this pattern will not vary with the age. The palm is an ideal part of the body for human recognition; it normally does not have hair that can be an obstacle for photographing the pattern, and it is less susceptible to a change in skin color, unlike a finger or the back of a hand [5].

Previous work:

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Palm vein recognition approach was first proposed by Joseph Rice [3]. His identity gets stolen in 1984, which led to fraudulent use of his bank account. He decided to do something about it, which led to his first vein recognition prototype around1985.

Aravind Nalamothu [6] has given an algorithm for palmprint based human identification, and results are compared with FFT, DCT and DWT. The texture patterns are spread over the whole image of palm, which are then used for feature extraction. Feature extraction is achieved by simply calculating the standard deviation in order to attain high performance along with the minimum processing time. The more unique and efficient features obtained are used to achieve better recognition rate.

Jobin J [7] proposed a method to find out, how the shape of the palm can be used for feature extraction using very simple approaches. The work done by Jobin J. attempted to enhance the performance of hand geometry based identification systems features reduction, and by integrating new features.

Vijayta Chowdhary [8] has proposed two approaches with the goal to improve the performance of palm-vein-based verification systems with the use of Gabor filter. The algorithm tends to accommodate the potential deformations, rotational and translational changes more efficiently by encoding the orientation preserving features and using region-based matching approach. The approach is then compared with the previously proposed palmvein based verification approaches on two different databases that are acquired with the contactless and touch-based imaging setup. The performance improvement in both verification and recognition scenarios are evaluated, and the influence of enrolment size on the performance of the system is also analysed.

Eryun Liu [9] has proposed a coarse to fine matching strategy based on minutiae clustering and minutiae match propagation for palmprint matching. To deal with the large number of minutiae, a local feature-based minutiae clustering algorithm is designed to cluster minutiae into several groups. The coarse matching is then performed within each cluster to establish initial minutiae correspondences between two palmprint images. Starting with each initial correspondence, a minutiae match propagation algorithm searches for mated minutiae in the full palmprint. The given palmprint matching scheme has been evaluated on a latent-to-full palmprint database consisting of 446 latents and 12,489 background full prints. The matching results show a rank-1 identification accuracy of 79.4 percent, which is significantly higher than the 60.8 percent identification accuracy of a state-of-the-art latent palmprint matching algorithm on the same latent database. The average computation time of the given algorithm for a single latent-to-full match was approximately 141 ms for genuine match and 50 ms for impostor match.

Proposed approach:

In the proposed approach, first the image is inputted from the scanner, and then an algorithm runs for the enhancement of the gathered image. Then the vein detection procedure detects

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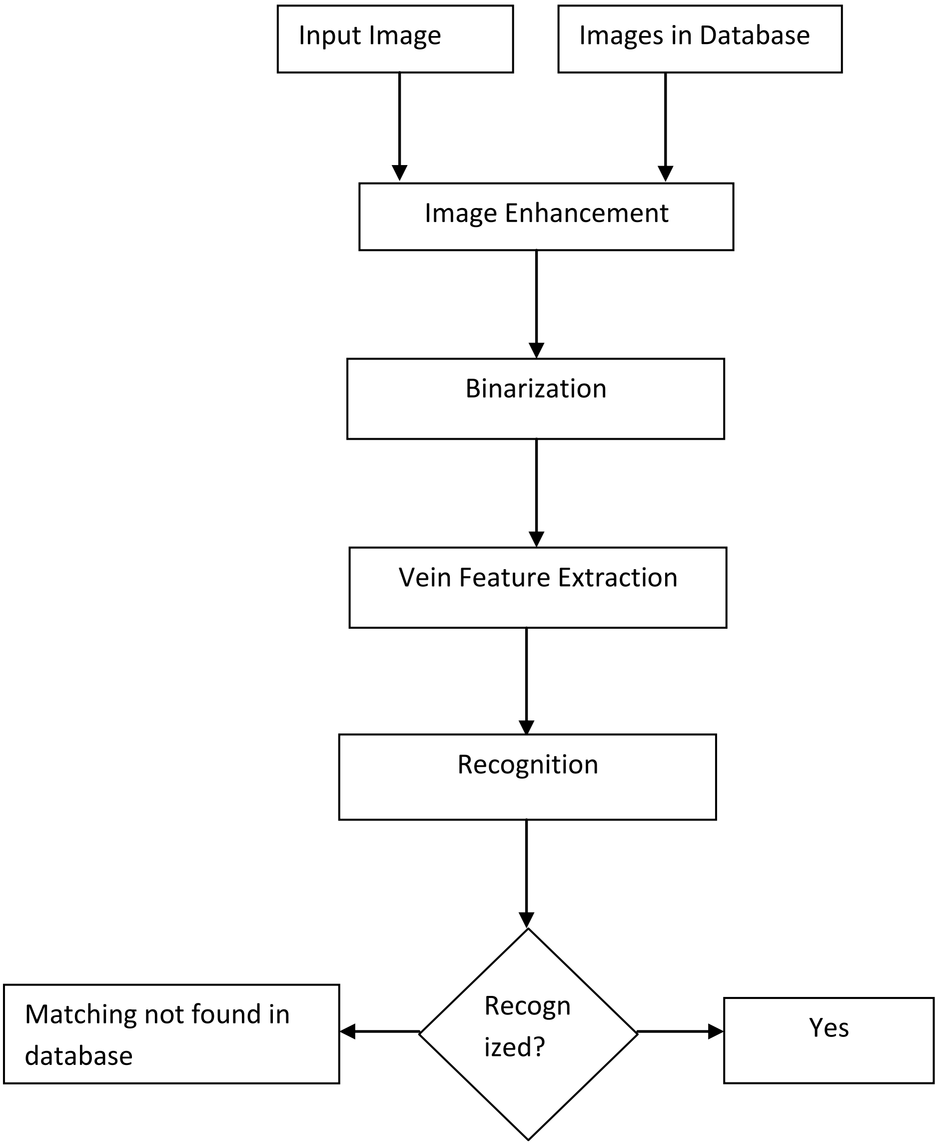
the veins from given image and then compares the received pattern with the stored one to recognise a person.

The image enhancement is done by using the gaussian filter. Then repeated line tracking, autotrimap detection, artificial neural network and gabor filter are used for feature detection. The vein pattern is recognised using feed forward and feed backward artificial neural networks and Euclidean distance.

The proposed approach works in the following manner.



Gaussian Filter: The impulse response to the Gaussian filter is the Gaussian Function. It minimizes the rise and fall time. So, the Gaussian filter has the minimum possible group delay. This is why, it is considered an ideal time domain filter. The transformation done by gaussian filter is called weierstrass transformation. Gaussian filtering involves convolution. The filter function is the kernel of an integral transform.

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Gabor Filter:

In image processing, is a linear filter used for edge detection purpose. Its frequency and orientation representations are same as those of the human vision mechanism, and are therefore suitable for texture representation and discrimination. In the spatial domain, a 2D Gabor filter is a Gaussian kernel function modulated by a sinusoidal plane wave. The analysis of an image by the Gabor functions is similar to perception in the human visual system. Its impulse response is defined by a sinusoidal wave (a plane wave for 2D Gabor filters) multiplied by a Gaussian function. Gabor filter has a real and an imaginary component which represents the orthogonal directions.

Artificial Neural Networks: Neural networks are a computational approach based on a number of neurons loosely bound together to work a similar way as the human brain does. These are self learning and self training networks and therefore work in excellent manner for the feature detection purpose. Neural networks are based on real numbers, with the value of the core and of the axon typically being a representation between 0.0 and 1.

Results and Conclusion:

As we discussed in earlier section that we have used repeated line tracking for vein extraction and for image enhancement we used Guassian Filter. Repeated line tracking helps us to detect the vein from the image of palm using Gabor filter that is shown in the below figure:

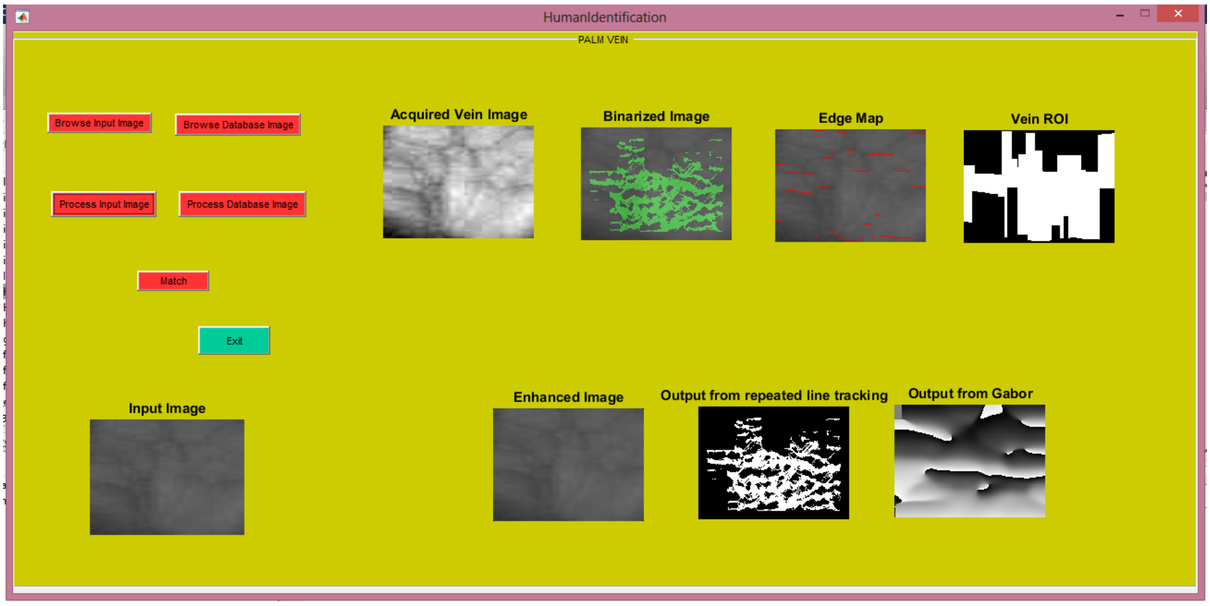

Figure 4.1 processing of palm image to extract vein.

We achieved 99.5 percent accuracy with a database of 6 images. Accuracy is shown below in the figure and comparison with other already existing matrices.

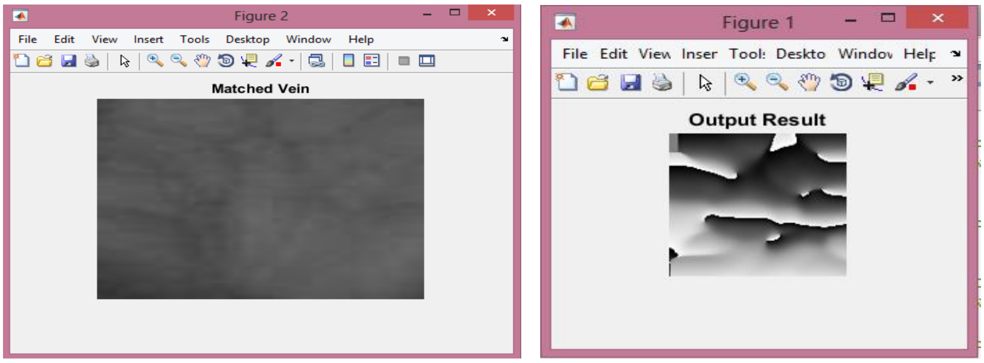

Figure 4.2 (a) Matched vein image of palm, (b) output result of of vein image

The table below comparise the our proposed technique with the existing techniques. Comparison is done based on many factors like average accuracy, mean square error, peak signal noise ratio and computation time.

Techniques name	MSE	PSNR	Average accuracy
Automatic trimap gen.	175.45	42.25	93.50
Repeated line tracking	171.95	16.77	64.99
Even Gabor	151.22	26.38	74.59
Even gabor with morphology	146.69	27.56	75.69
Proposed method	141.33	51.37	99.50

Table 4.1 Comparision with existing matrices

Peak signal noise ration should be near about 50 to give maximum accuracy and in this technique we have acieved nearabout 51 and mean square error is minimum which helps in adjusting PSNR and to achieve maximum accuracy.

Acknowledgement

I am very thankful to our HOD ....name, my guide who inspired me to work on an intersting topic and helped me a lot to complete my work. Without their help I will not be able to complete this huge work.

Not required in the research paper

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