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A Survey on Palm Vein Recognition

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ABSTRACT: For a wide range of systems that requires reliable personal recognition schemes to either determine or confirm the identity of a person requesting the services, personal recognition using palm–vein patterns has emerged as a promising alternative for human recognition because of its uniqueness, stability, live body identification, flexibility, and difficulty to cheat. Palm vein imaging requires near infrared (NIR) light for the complex vascular structures residing inside the palm to become visible. The blood vessels which absorb the NIR illumination appear darker than other tissues. In this paper analysis of various palm vein recognition techniques that are widely applied in today's palm vein recognition technology is represented. The process of the palm vein recognition starts right just from the process of image acquisition. In section III the pre-processing of the images is discussed which is followed by the feature extraction of the pre-processed image and the pattern recognition. After this a final result is obtained.

KEYWORDS: Palm vein recognition, local binary pattern, local Gabor binary pattern histogram, feature extraction.

I.INTRODUCTION

A biometric system is particularly a pattern recognition system that operates by acquiring biometric data from an individual, extracting a feature set from the acquired data, and comparing this feature set against the template set in the database. Depending on the application context, a biometric system may operate either in verification mode or identification mode.

In the verification mode, the system validates a person's identity by comparing the captured biometric data with its own biometric template stored in the system database.
In the identification mode, the system recognizes an individual by searching the templates of all the users in the database for a match.

Intrinsic psychological patterns are hard to observe and therefore offers a high degree of security. Vein structures are subcutaneous and hidden and hence cannot be seen by naked eye. It has higher security and reliability compared to the traditional authentication systems that are used in today's technology such as password or code as biometric features are difficult to forge and comparatively easy to use. Compared to more authorized biometric patterns such as face, iris, fingerprint, vein patterns have higher security. Finger print and palm print recognition are also widely used in authentication but the acquisition mode requires contact with the sensor which may be regarded as unsanitary. In addition under some conditions such as in factory or construction sites foreign matter such as oil on the fingers, moisture and dirt will have a negative impact on the recognition performance.

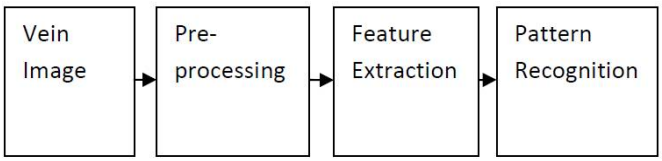

Fig.1 A vein pattern recognition system

II. VEIN IMAGES

Vein images are taken as reference from the palm image database of IIT Delhi which is acquired through digital CMOS Camera.

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III. PRE-PROCESSING

The pre- processing step includes

1. ROI segmentation
2. ROI normalization
3. Image enhancement

A. Contactless Palm Vein Recognition Using Mutual Foreground-Based Local Binary Pattern: presented the ROI extraction technique which uses OTSU method and a radial distance function (RDF) [1].
Here Gaussian blur is first adopted for smoothing the images. The OTSU algorithm is subsequently applied to obtain the initial threshold Th, which can be used to segment hand shape after multiplied by an adjustment coefficient C to obtain new threshold $Th*$. Finally, the theory of maximal connected domain is introduced for further improving the performance of the binary image. An effective strategy is proposed to eliminate the noisy region at the wrist section of the image.

First the coordinates of the centroid of the binary image are calculated and next the right sided region is padded out with zeros until the horizontal distance of the base from the centroid is L. For extraction of peak and valley points the midpoint of the right vertical line is taken as the reference point p_{ref} and the Euclidean distance is calculated between p_{ref} and all points on the hand contour to obtain RDF. Larger ROI is extracted from palm vein image by defining the midpoint p_1 of the valley points on both sides of the index finger and the midpoint p_2 valley points on both sides of the little finger as two reference points for the ROI extraction.

B. Human Identification Using Palm-Vein Images: In this paper a coordinate system is constructed for image normalization and for image enhancement background intensity profiles is estimated by dividing the image into slightly overlapped $\begin{pmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{pmatrix}$ blocks and the average value of each block is calculated [4].

Two webs are utilized as the reference points to build up the coordinate system i.e the web between the index finger and the middle finger together with the web between the finger and the little finger. The palm images are first binarized to separate the palm region from the background region. This is followed by the estimation of the distance from centre position of the binarized palm to the boundary of the palm. The webs are located by finding the corresponding local minima from the calculated distance. In this approach the two parameters location and size of ROI are selected based on the distance between the two webs. For image enhancement first the background intensity profiles are estimated by dividing the image into slightly overlapping 32×32 blocks and average gray level pixels in each block are computed. Subsequently, the estimated background intensity profile is resized to the same size as the original image using bicubic interpolation and the resulting image is subtracted from the original ROI image. Finally, the histogram equalization is employed to obtain the normalized and enhanced palm vein images.

IV. FEATURE EXTRACTION

A. Online Biometric Authentication Using Hand Vein Pattern: A 2 dimensional Gabor filter is used as a tool for convolving with ROI's to make the underlying texture more pronounced. The 2 Dimensional Gabor filter when convolved with a ROI separates it into real and imaginary parts. Further processing like feature extraction is carried out only on the real part using Gabor wavelets [9].

Gabor wavelets are created at orientations $\theta \in \{1,2,3,4\}$ but the scale is fixed at $s = 4$. Since different scales from 0 to 3 have no effect on the results except increasing complexity of the algorithm value of σ is chosen to be 2π . The real part of the Gabor filter convolved ROI is then partitioned into no overlapping windows of 8×8. Each of the designed Gabor wavelets is then convolved with successive windows covering the entire ROI and the mean of each such convolution is taken as a feature.

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B. Biometric Authentication Based On Infrared Thermal Hand Vein Patterns: Here Branch point and Box approach is utilized for representing the vein pattern. In Branch point approach a point of vein pattern is said to be a branch point if there are more than two paths of the vein pattern originating from that point. To find all branch points, thinned image of vein pattern is considered [10].

A test is applied to each point of the skeleton of the vein pattern to decide whether it is a branch point or not. If by travelling on the border of 5×5 window around the point if a transition from 0 to 1 or 1 to 0 occurs more than four times then the given point is a branch point. Then the branch points are stored in a vector called feature vector in the same order as they are found by scanning the image row wise. This vector then is used to match the two thinned images of vein patterns. The Genuine Acceptance Ratio (GAR) for each approach is found to be 99% with False Acceptance Rate (FAR) value of 0.1% .

In Box approach thinned images are divided into equal number of boxes and in each box both the orientation and distance from the left corner of the box can be taken as feature and the extracted features are then used to compare any two input images. Since size of the vein pattern varies, all vein patterns are resized to a fixed size. Resized vein pattern is divided into equal sized square regions. From each square region the average distance of the vein pattern pixel lying in that region is found from the left corner of that square. Then these average distances for each square as a feature vector are stored. The Euclidean distance between the two feature vectors are used as a measure of similarity. The Euclidean distance is used as a classifier to generate genuine and imposter classes.

V.CONCLUSION

After the survey of different research papers, we analysed different palm vein validation and its corresponding methods that can be used for palm vein recognition. Beside different number of palm vein techniques are already been developed there is still a further scope of improvement. The future work should include a feature extraction method for important feature extraction of the palm vein image. Also can introduce a new technology with higher accuracy and robustness of the system.

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