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A Palm Vein Pattern Recognition using Modified Partition Local Binary Pattern Extraction Method

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Abstract: Biometric is the mechanism to measure the physical and behavioral traits of every individual human being that is used to authenticate the person is genuine or imposter. Palm Vein Recognition is one of the efficient technique which is used to authenticate the person. Instead of using ID cards, Passwords, palm vein patterns can be used which is very unique for all the individual person that provide authentication to access the resources. In this proposed framework, Modified Partition Local Binary Patterns (MPLBP) method is used to extract the features of palm vein image which is used to improve the accuracy and also it uses ROI Extracted feature mechanism to enhance the quality of image in better way. Our Proposed framework tested using a CASIA Multi-Spectral Palm Print Image Dataset which is having 100 people sample of 7200 palm vein images. The system was measured using EER.

Keywords: PVR, Biometric authentication, MPLBP, ROI, Binarization, Thinning

1. INTRODUCTION

In the present modernized world, everyone is try to access their resource from anywhere and anytime. But it contains more risk factors like others can access their resource at anywhere and anytime. Due to that, there are many authentication techniques were used to validate the person like ID card, password, pin. But all this techniques are having more risk factor like ID cards can be stolen and password and pin no are easily guessed by other person. To solve the above problem only, biometric authentication techniques were used to identify the person is genuine or imposter.

In Biometric authentication system, physical (finger print, palm vein, iris, face) or behavioral of individual person are registered with the database. Whenever the user want to access the data, it will be validated with the database and check the person is genuine or imposter. Every biometric authentication system consists of two phases.1. Enrollment phase 2. Recognition phase. In the Enrollment phase, the individual person's traits are acquired and set of operations like feature extraction, template matching are estimated and the results are stored in the database. In the recognition phase, the person's identity is confirmed.

Palm Vein Pattern based recognition(PVR) uses the palm vein images as the personal identification. Compared to the remaining physical traits, palm has a larger and more complicated vascular pattern that contains more features than other traits. It is also one of the most secured mechanism since which was part of the outside body.

a)Raw Image b)IR Image c)Feature Extracted from palm

II. LITERATURE REVIEW

[1].Pooja et al proposed framework for palm vein recognition which provides the higher security .They were used the fusion mechanism of Local Binary Pattern and Scale Invariant Feature Transform to extract the features of palm vein.

They were used dimensionality reduction technique to image enhancement before storing the templates of the image. They were employed their framework with PolyU database which contains the palm images of 500 users. From every user 12 sample images collected. For the recognition rate, they were done 3 experiments on palm images like only left palm images, only right palm images and both. The accuracy of the system is 100 due to False Acceptance Rate, False Rejection Rate is 0%.

[2]Yutthana Pititheeraphab et al proposed a framework for vein pattern verification which uses the hybrid features of dorsal hand vein and dorsal geometry once the images are captured from Infrared, the images were preprocessed using median filter, closing morphological process, thinning morphological process, pruning morphological process and minutia detection. Geometric invariants are used to find the minutia points for the two pattern vein images. To verify the patterns of palm vein, a new rule which combines the geometric distance map error with the barcoded features. The accuracy of the system is 99.84% with EER of 0.243%.

[3]Abikoye et al proposed an improved palm vein based recognition. It consist of 4 stages. *Image Enhancement* – a raw image is enhanced through Histogram Equalization method. *Segmentation* – By using K means algorithm, the images were binarized. *Image Thinning*–Zhang Suens algorithm is used to thinning the image after binarization process. *Pattern matching – To identify the similar pattern of palm veins* Euclidean Distance formula is used.

[4]. Ali Mohsin Al-juboori et al proposed paper for palm vein segmentation and verification. To extract the features of palm vein, matching filter mechanism is used. Gabor filter is used to extract the features in 8x8(Scale,Directions).Both local and global features are measured with LBPV_LPP and WLPP. For verification of palm vein pattern, Euclidian distance classifier is used for classification and distance matrices of palm veins are used weighted sum fusion rule. In which feature vectors are computed based on the combination of local and global features, matching score of this work reaches lowest EER.

III.PROPOSED SYSTEM

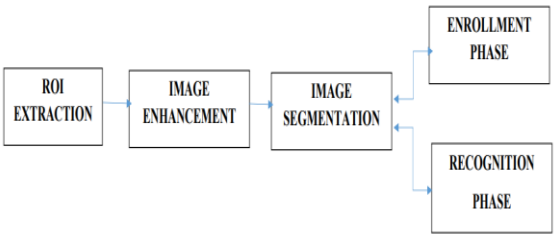

Fig 3.1 – Proposed System

Preprocessing is very important to separate palm vein pattern from the background. When the images is captured from any input device which may lead to capture the images with noise. A set of processes need to be followed to extract the feature of palm vein to enhance the quality of the image. All these enhancement tasks are used to identify the ROI of Palm Vein's.

3.1 ROI Extraction

There are 4 stages in ROI Extraction. **1) *Noise Removal*:** Unnecessary parts of image is removed from the input image before going to the next stage. Median filter is used to remove the noise which gives better results.***2) Binarization*:** Based on the global threshold value, the input image is converted to binary image.***3) ExtractingBoundaries*:**To identify the reference points from the ROI, some part of images are cropped.***4) IdentifyingJoints***: To identify the key points of joints.

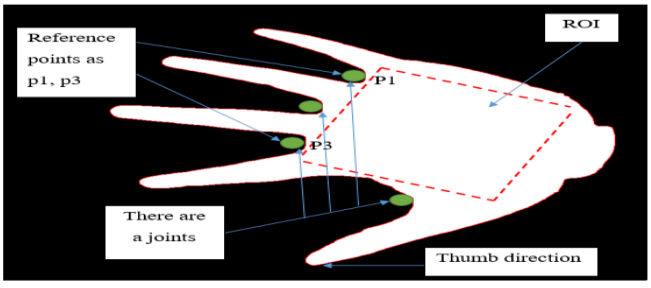

Fig 3.1 – Palm Vein Reference Points

3.2 IMAGE ENHANCEMENT

There are 3 steps involved in image enhancement.1) To make vein to be clear, Convert the given grey image into inverse.2) To convert the image pixels of the image into range of [0,255], the linear stretching method.3) Again median filter is applied to image to remove the noise in the image.

3.3 SEGMENTATION

It is one the hardest part of our proposed system. When the palm vein patterns are separated from background, it will increase the lowest percentage of recognition rate.

Algorithm:

1. To set the threshold value of image to separate the palm vein from background based on the background, illumination gradient.
2. Binarization: Convert the gray scale image black and white image.
3. Dilation: To fill the small gaps dilation process is applied. It is the process of no of white pixels in the images of particular region is greater than threshold value then the region is converted to white color.
4.Two Stage Thinning: In the first stage, to convert the vein image into thinnest by applying Zhang-Suen's algorithm. Few parts of image, that is not belongs to vein pattern. It will be remove in Second Stage.

3.4 MODIFIED PARTITION LOCAL BINARY PATTERN FOR FEATURE EXTRACTION(MPLBP)

$$s(x) = \begin{cases} 1, & x \geq 0, \\ 0, & x < 0. \end{cases}$$

MPLBP algorithm is used for feature extraction.MPLBP is better than LDP, LBP which is used to extract the binary codes from the enhanced image. There are two components that exist in MPLBP method.1) Horizontal Component 2)Vertical Component.

First n-1bits of each pixel of horizontal component are extracted using equ (1),(2). Similarly by using (1),(3) the vertical component are extracted. By concatenating this two , binary code of every pixel is calculated.

$$LLBP_{hN,c}(x,y) = \sum_{n=1}^{c-1} s(h_n - h_c) \cdot 2^{c-n-1} + \sum_{n=c+1}^{N} s(h_n - h_c) \cdot 2^{n-c-1} \quad (2)$$

$$LLBP_{vN,c}(x,y) = \sum_{n=1}^{c-1} s(v_n - v_c) \cdot 2^{c-n-1} + \sum_{n=c+1}^{N} s(v_n - v_c) \cdot 2^{n-c-1} \quad (3)$$

$$MPLBP_m = \sqrt{LLBP_h^2 + LLBP_v^2} \quad (4)$$

3.5 RECOGNITION

Hamming Distnace(HD_R) formula is used to check the similarity value of extracted binary code and enrollment binary code.

$HD_R = \frac{C_A \oplus C_B}{C_L}$

where as C_A,C_B – Extracted Binary codes of Enrollment, C_L- Total Length of Enrollment Code

IV.EXPERIMENTAL RESULTS

To evaluate the performance of our proposed system used CASIA Multi-Spectral Palm print Image Dataset which is having 100 people sample of 7200 palm vein images. In this database along with original image, extracted ROI images also available. Final results of our framework measured using EER.EER is the point in which FAR, FRR Equal.

The below table represents the comparison of previous related works with our proposed system.

References	Methodology	Performance (EER)
Ahmad et al. [10]	Wave atom transform	1.49%
Cho et al. [11]	Cross-spectral matching	0.472%
Wu, Elliott, Lin, & Yuan [12]	Partial Least Square Algorithm	0.4058%
Zhou &	Neighborhood	0.51%

Kumar [13]	Matching Random Transform	
Zhou & Kumar [14]	Hessian Phase Local Radon Transform Ordinal Code The Laplacian palm Score Combined of above four methods	2.24% 1.03% 2.00% 5.00% 0.38%
Gupta & Gupta [15]	Serial Methodology	0.72%
Kumar et al. [16]	Triangulation of hand vein images and simultaneous extraction of knuckle shape information	EER is 1.14%, EER of fusion is 0.38% for left hand and 0.28% for right hand
Kang & Wu [31]	Improved LBP Method on mutual foreground	0.267%
Proposed Method	Modified PLBP	0.13%

Table 4.1 Comparison of Proposed System with Existing Works

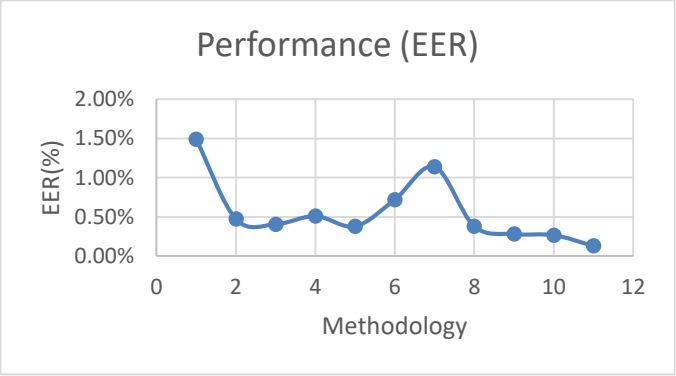

Fig 4.1 EER Comparison Chart

V.CONCLUSION

To enhance the security aspect of day to day life, biometric systems are essentials to access our personal information using our physical or behavioral traits. The proposed system was developed using Palm Vein Pattern as input trait to authenticate the person is genuine or imposter. In this work,to extract the features of palm vein pattern Modified Local Binary Pattern methodology used which gives better results compared to LDB,LBP method. ROI Mechanism is used to improve the quality enhancement of the image which helps to improve the recognition rate. The experimentation of proposed work used publicly available database from CASIA Multi-Spectral Palm print Image Dataset which is having 100 people sample of 7200 palm vein image.

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