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HUMAN IDENTIFICATION USING PALM VEIN IMAGES

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***Abstract*— Human identification using palm vein authentication is the modern biometric technique, which employs the vein pattern in the human palm to verify the person. The merits of palm vein authentication are a low risk of falsification, difficulty of duplicated and stability. The technology is currently in use or development for a wide variety of applications, including credit card authentication, automobile security, employee time and attendance tracking, computer and network authentication, end point security and automated teller machines. The previously proposed palm-vein identification approaches are compared with our proposed ones on different databases that are acquired with the contactless and touch-based imaging setup. In this context, the proposed approaches are also compared for its superiority using single image enrollment on two different databases.**

***Index Terms*— Palm vein, gabor filter, biometrics , human identification , image enhancement, feature extraction .**

1 INTRODUCTION

Biometric technology depends on physical or behavioral features for the person identification. There are many biometric systems which exist today using fingerprint, iris, face etc. and palm vein is a new member of biometric family. It is defined as vascular patterns under the skin of the palm [3]. The vein pattern is different in each part in the same body. Since the pattern of veins are hidden underneath the skin and invisible directly by the eye, thus vein pattern is difficult to copy when compared with other biometric types [18]. The human identification using palm vein authentication is impossible to fake. In [16] the researchers take the shape and texture of the hand vein for person authentication. The Hausdorff distance is used and like edge mapping for shape authentication and Gabor filter for vein feature extraction. The vascular patterns of an individual's palm as personal identification data is used for palm vein authentication. Compared with a finger or the back of a hand, a palm has a broader and more complicated vascular pattern and thus contains a wealth of differentiating features for personal identification.

The human hand is the oldest among various biometric characterstics used , and the most successful form of biometric technology [6]. The palm is an ideal part of the body for this technology because it does not have hairs normally which can pose obstacles for photographing the blood vessel pattern, and it is also less susceptible to a change in skin color of hand. Light having a wavelength of about 7.6 x 10-4 mm is absorbed by the deoxidized haemoglobin within the near-infrared area. The blood vessel pattern containing the deoxidized hemoglobin is only visible as a series of dark lines when infrared ray image is captured . Based on this information or feature, the vein authentication device translates the black lines of the infrared ray image as the blood vessel pattern of the palm, and then it is matched with the previously registered blood vessel pattern of the person. The physiological and behavioral characteristics of humans, has been extensively employed in the identification of criminals.

The biometrics based automated human identification is now highly popular in a wide range of civilian applications and has become powerful alternative to traditional identification systems. Human palms are easier to for imaging and variety of information can be revealed. Therefore, palm print research has invited a lot of attention for civilian and forensic usage [15]. However, like some of the popular biometrics (e.g., fingerprint [8], [5], iris [1], face [12], [2], the palm print biometric is also prone to sensor level spoof attacks. On the other hand, intrinsic biometrics characteristics require more challenging efforts to acquire without the knowledge of an individual and, therefore, more difficult to forge. Different skin layers have different responses to the wavelength of the incident illumination [9]. The optical penetration depth 1 for near-infrared imaging at 850 nm is estimated to be 3.57 mm and such illumination has shown to offer higher contrast for the subcutaneous veins while imaging [13]. However, in civilian applications it is also crucial for a biometrics trait to ensure high collectability while the user interacts with the biometrics device. In this context, palm-vein recognition has emerged as a promising alternative for personal identification. In [1], the researchers consider the palm vein as a piece of texture and apply texture based feature extraction techniques to a palm vein authentication. The approach employed in [14] may be similar to that in this work. The proposed approach is based on the information of anatomical structure of the healthy parts and compares it with the infected parts.

II. GABOR FILTER

Gabor filter is named after Dennis Gabor, it is a linear filter used for edge detection. The orientation and frequency representation of Gabor filter is very much similar to that of human visual system and they are particularly appropriate for discrimination and texture representation. Image analysis done by the Gabor functions are similar to perception in the human visual system [10], [11], and its impulse response is defined by a sinusoidal wave multiplied by a Gaussian function. Due to multiplication-convolution property, the Fourier transform of a Gabor filter's impulse response is the convolution of the Fourier transform of the Gaussian function and Fourier transform of the harmonic function. The Gabor filter has a real and an imaginary component which represents orthogonal directions. These components are:

Complex

$$g(x,y,\lambda,\theta,\psi,\sigma,\gamma) = exp\left(-\frac{x'^2+\gamma^2 y'^2}{2\sigma^2}\right) exp\left(i\left(2\pi\frac{x'}{\lambda}+\psi\right)\right)$$

Real

$$g(x,y,\lambda,\theta,\psi,\sigma,\gamma) = exp\left(-\frac{x'^2+\gamma^2 y'^2}{2\sigma^2}\right) \cos\left(i\left(2\pi\frac{x'}{\lambda}+\psi\right)\right)$$

Imaginary

$$g(x,y,\lambda,\theta,\psi,\sigma,\gamma) = exp\left(-\frac{x'^2+\gamma^2 y'^2}{2\sigma^2}\right) \sin\left(i\left(2\pi\frac{x'}{\lambda}+\psi\right)\right)$$

Where

$$x' = xcos\theta + ysin\theta$$

And

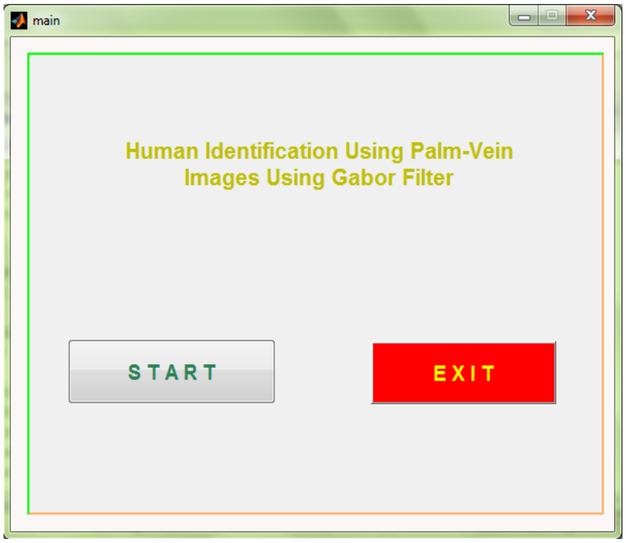
$$y' = -xsin\theta + ycos\theta$$

.

In above equations, σ is the sigma/standard deviation of the Gaussian envelope θ represents the orientation of the normal to the parallel stripes of a Gabor function, λ represents the wavelength of the sinusoidal factor and γ is the spatial aspect ratio, and ψ is the phase offset. The ridge in the image [4, 17, 7] is detected by using real part of the Gabor filter. They are directly related to Gabor wavelets. Filter bank consisting of Gabor filters with various rotations and scales is being created. The filters are convolved with the signal and the result is called Gabor space. The Gabor space is very useful in different image processing applications such as iris recognition and fingerprint recognition.

III. EVALUATION AND RESULT

Main.m file is run in MATLAB then the below fig is open.



Human Identification Using Palm-Vein Images Using Gabor Filter

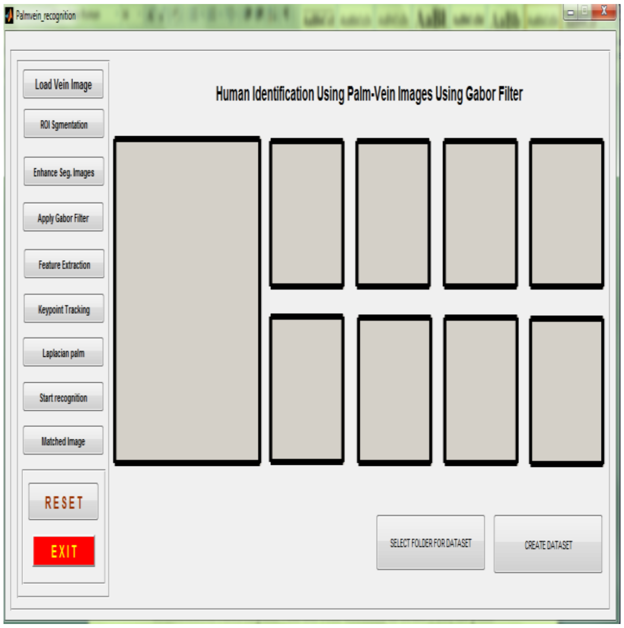


Fig1. Main Figure window

Dataset is created then image is loaded after then ROI segmentation by this process we select region of interest on palm vein image and segmented from original image.

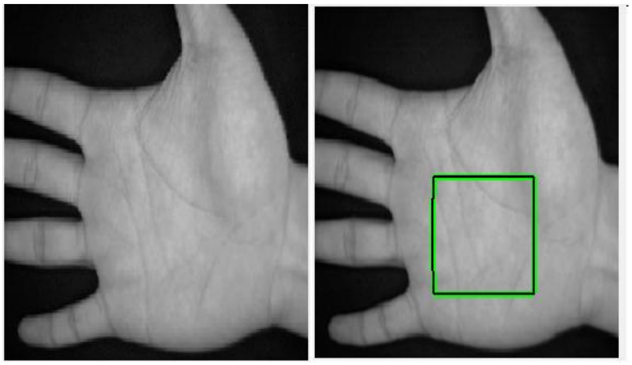


Fig2. (a) Original Image **(b) Region of palm**

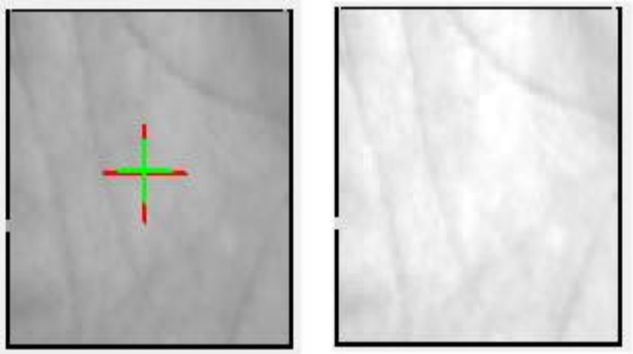


Fig3. (a) Selected Palm Region **(b) Cropped Image**

In below figure shown the result of enhance image.

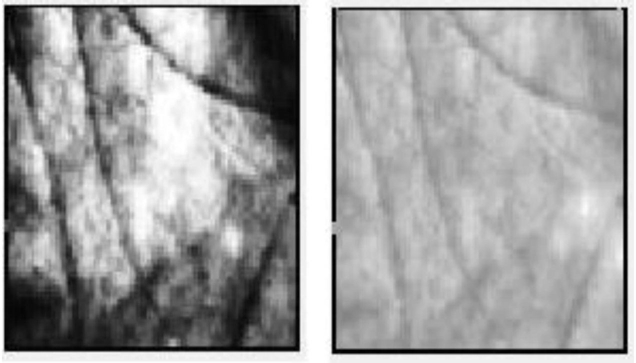


Fig4. (a) Enhanced Image 1 **(b) Enhanced Image 2**

In the below figure shown the result of gabbor filter and edge detection of filtered image.

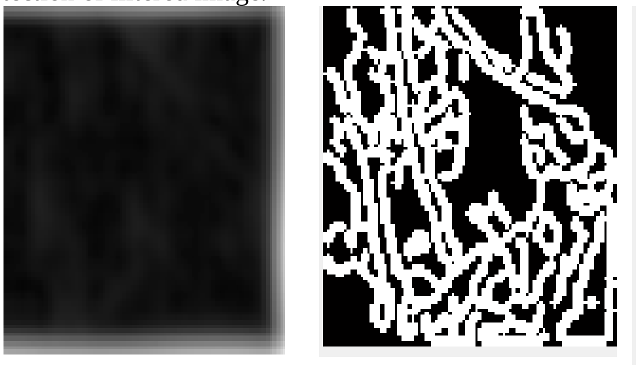


Fig6. (a) Filtered Image **(b) Edge Image**

Tracking and laplacian Image of palm vein image.

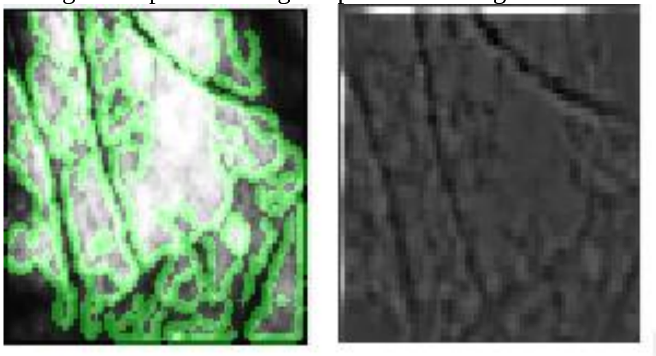
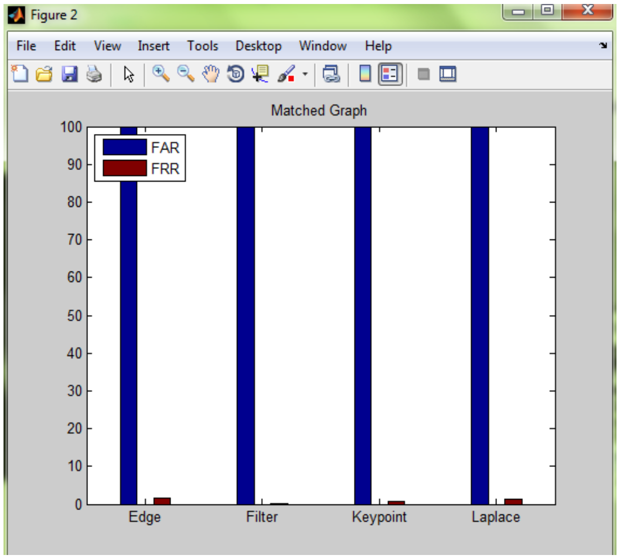
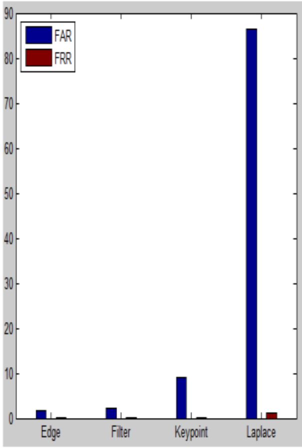


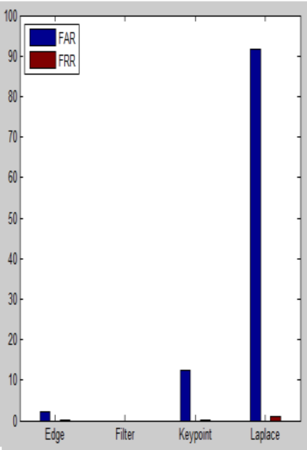
Fig5. (a) Key point of Image **(b) Laplacian Palm Image**

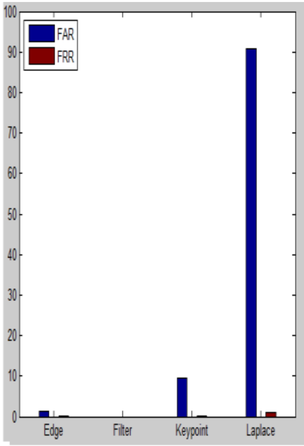
IV. RECOGNITION

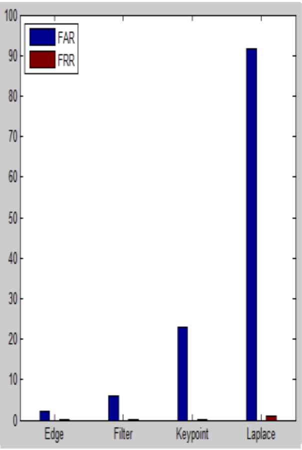
In this process we recognized the matched image from dataset. Plot the graph for all images in the dataset with value of FAR and FRR. Below is the result of that graph.











V. TABLE

TABLE I. FAR and FRR of Image 1

Parameters	FAR	FRR
Edge	100	1.5916
Filter	100	0.0400
Key point	100	0.7489
Laplace	100	1.2499

TABLE II. FAR and FRR of Image 2

Parameters	FAR	FRR
Edge	2.8417	0.0659
Filter	11.2457	0.0727
Key point	16.0099	0.2196
Laplace	83.2584	0.8316

TABLE III. FAR and FRR of Image 3

Parameters	FAR	FRR
Edge	7.0774	0.0957
Filter	32.6667	0.2192
Key point	20.7983	0.2224
Laplace	71.7372	0.8966

TABLE IV. FAR and FRR of Image 4

Parameters	FAR	FRR
Edge	5.2244	0.0881
Filter	43.1667	0.2897
Key point	22.7612	0.2052
Laplace	67.0567	0.8381

TABLE V. FAR and FRR of Image 5

Parameters	FAR	FRR
Edge	6.7910	0.1026
Filter	20.6667	0.1387
Key point	25.2732	0.2072
Laplace	67.1467	0.8392

TABLE VI. FAR and FRR of Image 6

Parameters	FAR	FRR
Edge	4.0959	0.1557
Filter	26.0000	0.1745
Key point	13.1507	0.1620
Laplace	67.7789	0.7300

TABLE VII. FAR and FRR of Image 7

Parameters	FAR	FRR
Edge	2.1577	0.0327
Filter	0	0
Key point	21.2443	0.1567
Laplace	73.6274	0.9202

TABLE VIII. FAR and FRR of Image 8

Parameters	FAR	FRR
Edge	6.4147	0.1466
Filter	11.4130	0.0469
Key point	13.3378	0.2271
Laplace	82.4427	0.9713

TABLE IX. FAR and FRR of Image 9

Parameters	FAR	FRR
Edge	5.0859	0.1237
Filter	23.0000	0.1355
Key point	11.1307	0.1320
Laplace	63.8789	0.2300

TABLE X. FAR and FRR of Image 10

Parameters	FAR	FRR
Edge	5.7910	0.1356
Filter	28.6667	0.2787
Key point	22.2732	0.2372
Laplace	65.1467	0.4592

VI. CONCLUTION

In this paper, 'Efficient Human Identification Using Palm-Vein Images' is proposed. A new method for human authentication based on palm vein images has been discussed in detail. First, the palm vein images ROI segmentation is performed and then enhancement of the image. Then a bank of Gabor filter is being created and convolution on the enhanced images and convolution images are used as a feature vectors. To get best features for verification the dimentional reduction is implemented. Finally, using nearest neighbor classifier the palm vein verification has been implemented. Our proposed method shows its robustness and superiority in both cases. We find average of match ratio of feature, edge, tracking and Laplacian of palm vein images. This approach performs very well even with the minimum number of enrollment images the performance was rigorously evaluated and compared to the existing method on different databases with a different imaging setup, and evaluated with all possible numbers of training samples. For future scope we can use palm and iris together to improve this proposed work.

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