Feature Extraction from hand Dorsal Vein and Palmprint

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Abstract— **Dorsalvein, palmprint patterns are among the biometric traits being investigated today for identification purposes, attracting interest from both the research community and industry.In this paper, we present a competent approach for both dorsal hand vein features extraction from near infrared images and palmprint feature extraction.The physiological features characterize the dorsal venous network of the hand and the principle line of the palm. These networks and principle line are single to each individual and can be used as a biometric system for person identification /authentication.Statistical features are extracted in this work such as mean,standard deviation, entropy, energy, and Harris corner detection. In this paper only features are extracted from two different types of biometric image after we prepare the same processes are used on them.**

Index Terms—**:hand dorsal vein,palmprint,feature extraction, pattern extraction, Harris, principleline, statistical feature.**

Ⅰ. Introduction

Computer-based personal identification is also known as biometric computing, which attempts to recognize a person by his/her body or behavioral characteristics has more than 30 years of history. The first commercial system, called Ident mat, which measured the shape of the hand and the length of fingers, was developed in the 1970s. At the same time fingerprint-based automatic checking systems were widely used in law enforcement. Because of the rapid development of hardware, including computation speed and capture devices, iris, retina, face, voice, signature, finger vein and DNA have joinedthe biometric family [1, 2, 3, 4].

Palmprint and hand dorsal vein play vital role in biometric identification and recognition system [1][7].The biometric system has two categorize traits: physical and behavioral. The physical like fingerprint , palm vein, palm print,iris ,tongue, hand geometry, hand dorsal, etc.,while the behavioral traits is voice ,signature ,keystroke ,etc. This paper proposed how can remove noise , extract the pattern and then extract the feature from the image for , for palmprintimage used Gaussian sharpen filter as sharpening filter, and mean filter for the dorsal vein as a smoothing filter also apply histogram equalization and then local threshold for dorsal vein , global threshold for palm print to extract the pattern from the two image . The remainder of the paper is organized as follows , the related work and dataset described in section 2, and in section 3. image preprocessing ,ROI , pattern extraction described in section4.the experimental result and conclusion described in section 5.in section6.

Ⅱ.Related Work

Researchers have deployed different stages, viz, capture, preprocessing and feature extraction. Pooja Ramsoful.[5]have used three feature extraction and representation techniques namely Hough lines transform, Pixel by Pixel Method and Directional Coding Method have been explored and implemented . Soni et al. [6] have used an uncomplicated digital SLR camera with an infrared filter to capture the images along with a low cost night vision lamp. For the setup,a wooden box with a hollow rod found in the middle to house the infrared lamp was used. In another work, Badawi[7] used a non-harmful infrared lightning accompanied with a CCD (charge-coupled device) video camera.Sathish et al. [17] have applied normalization first to the image acquired to extract the most discriminating features of the hand vein. The technique is called contrast stretching which fix the upper and lower limits to discriminate between features. Next, the image is segmented by using local adaptive threshold procedure. To remove noises relative to their size,the area sizes of the black and white backgrounds are calculated. A block considered as noise if the area size of the background was smaller than the known size.Generally recognition system accuracy rely on feature extraction , since this work talk about palmprint as biometric feature that employed for recognition system , so the feature that can be extracted , wrinkles , principle line , and texture ,and so on , many algorithms used to for evaluation of recognition system , for example edge detection is one of must popular methods that used in image processing for feature extraction , the most frequently edge detection method that used in image processing canny , Sobel , in this work the general sequence of work is used , but initially ROI have been obtained by apply proposed .method ,the result analyzed and compared with canny and .Sobel [10][11][12][13]. Many paper take minutia and delta point as feature instead of principle line , but these feature can be gained only from good resolution and high quality image , some work divide the image into multi sub image and extract high probability local information ,like Funada et al. [14] and then restored

image is constructed , other work extract the ridgesdirection characteristics , by applied directional projection algorithm to classify palmprint image like ,Shu et al. [9] and Zhang et al. [10].

Deshpandeet al [18].Presents a multimodal biometric identification system based on the fusion of Palm vein and Palm print modalities of the human hand. The former is, Palm vein features are extracted using matched filter technique. The later is the hand image initially preprocessed after that palmprint feature extraction is applied , wavelet decomposition technique is used as feature extraction for this work .

Ⅲ.Datasets

Hand Dorsal vein dataset sample 100 hands (500 images), each has 5 images per person per each hand, it is associated to 50 distinct person for left and right hands, the first 50 are for the right hands, the last 50 are for the left hand of the same persons hand (mirrored to have the same coordinate basis of patterns localization).This dataset is for both females and males in the range of 16-65 years age. Subjects are of healthy conditions (no arthritis) and are from all folks for life (students, professor'smech/elec engineers and workers, house wives, etc. from all folks of workers).

Palmprint data set is IIT Delhi , this dataset consist of 235 volunteer , the age of these people are range between 12 – 57 years , and acquire in July 2006 – July 2007 , each one give about 7 sample for per hand , the format of these image is bitmap (bmp) , all sample is associated with integer identification number , the quality (resolution) of the image is 800'600 pixel . the volunteer are the IIT Delhi staff , and student , it is touchless palmprint dataset .

Ⅳ.The Proposed System of Feature Extraction

Extract the features from both dorsal vein and palmprint, including statistic feature (mean , standard deviation, entropy and energy) (Eq 1,2,3,and 4) describe how can get statistical features and the algorithms. 1,2,3,and 4 illustrate how can apply statistical equation in programing languages , Harris corner detection(Harris point)for both palmprint and dorsal vein image in order to use in recognition system severallyor after fuse the two image to make more effective and efficient (identification /authentication)Fig.1 is describe the proposed our system.

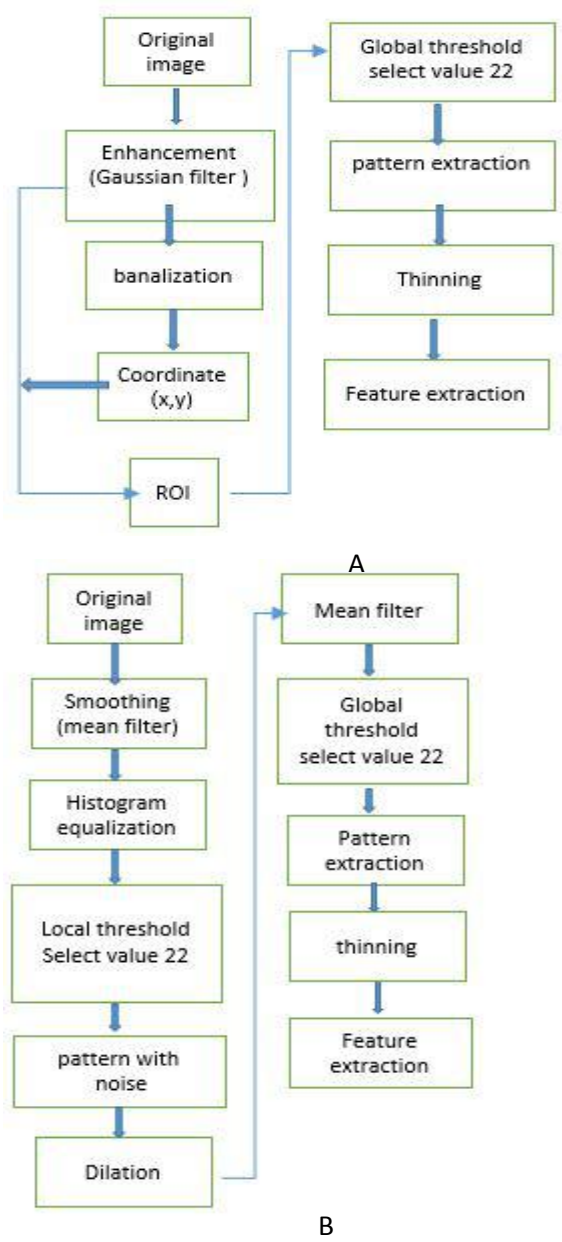


Fig.1: step of feature extraction system

(a) Palmprint feature extraction system
(b) Hand dorsal vein feature extraction system

A. Image Preprocessing

Preprocessing operation aim to variation (noise) elimination i.e. reduce un willing information caused by rotation and translation

1. Usingenhancement filters, Gaussian sharpen for palmprintand mean filter for hand dorsal vein.
2. Convert the original image into gray scale image , by getting image color information (R,G,and B) , make summation to the value of that color and divide by 3for each pixel ,after that converted

from gray image ,Algorithm 1 illustrate the work. to binary image by determining a threshold value for each pixel value greater than threshold value is set to 255 or 1,if less than threshold it is set to zero, then set the image color to the result of last operation see Fig.1(b)

Algorithm 1:global threshold

Algorithm name	global threshold
Input	Gr_image\\ Gray scale image
Output	T_image \\ threshold image
Goal	Extract pattern

```
Begin:
Step1: for x = 0 to  no_row
            for y = 0 to  no_Colum
              Get Gr_image pixel value (x,y (R,G,B))
                        Average (R+G+B)
                    If average>=T_value
                  Set T_image pixel value(x,y(0))
      Else  Set T_image pixel value(x,y(255 or 1))
            End for
        End for
Step2 : return T_image
end
```

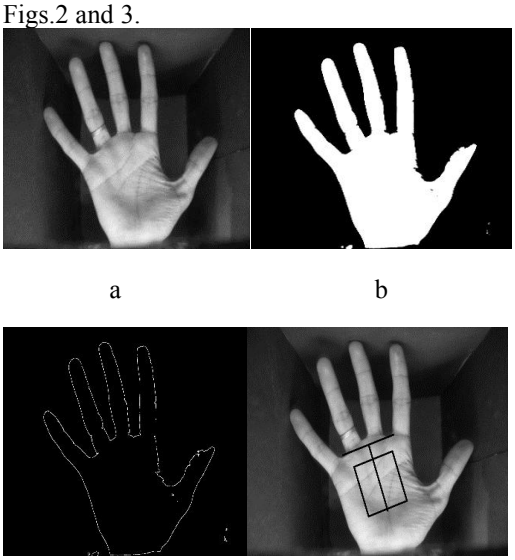
B. Region of Interest (ROI)

ROI , , it is the most informative region of palm , i.e. the part of the palm that paly vital role in biometric identification system , because it contain very important trait that use to recognize between sample of each individual. to extract ROI , original image have to separate into two part , background , and foreground(object), and applied boundary detection in order to focus on the whole hand only[8]. The simplest and reliable algorithm used for this work is proposed by Zhang [9] . the following steps illustrate how it's work .

1. Apply Gaussian smoothing is use as noise reduction filter
2. Convert gray scale image into binary image
3. Find the boundaries of the hand , by apply edge detection algorithm
4. Marking gaps between index and middle fingers, and between little and ring fingers
5. Connect the two gaps by line ,
6. Perpendicular line is taken from the middle of connection line and return the coordinate point
7. ROI is capture base on system coordinate point

An original image and the ROI extracted from it are shown in

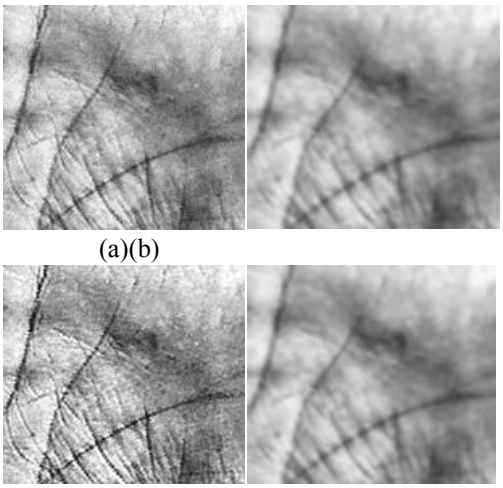
Figs.2 and 3.



a b

C d

Fig.2: (a) The original image (b) the binary image (c) boundary tracing (d) determine ROI



(a)(b)

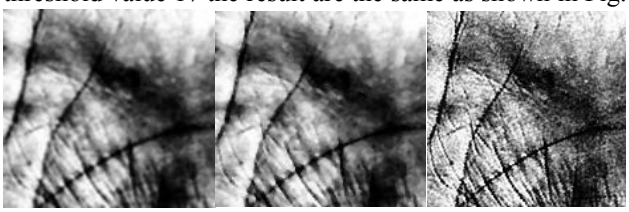
(c) (d)

(e)

Fig.3: ROI: (a) Original ROI, (b) Gaussian blur, (c) Gaussian sharpen,(d) median filter, and(e) Mean filter

c.*Pattern Extraction*

The best result image result from Gaussian sharpen it make the image very clear and so can be easily get the pattern of the print as shown in Fig.4.Next step either apply threshold directly without histogram and select threshold value 92or apply Histogram Equalizationin order to increase the intensity of dark region as shown inFig.5, and then select threshold value 17 the result are the same as shown in Fig.6.

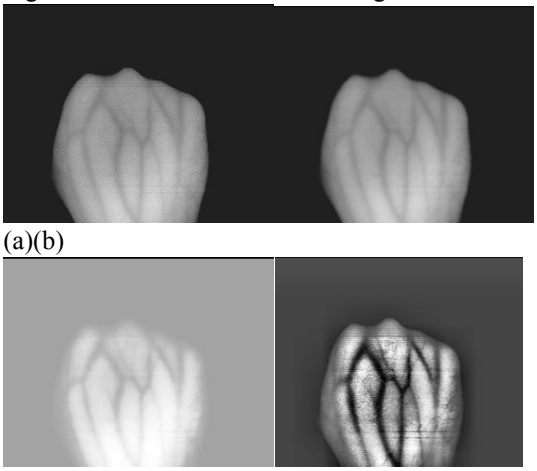


a b c

Fig.4: histogram equalization

(a) with mean filter, (b) with median filter ,(c) with Gaussian sharpen filter .

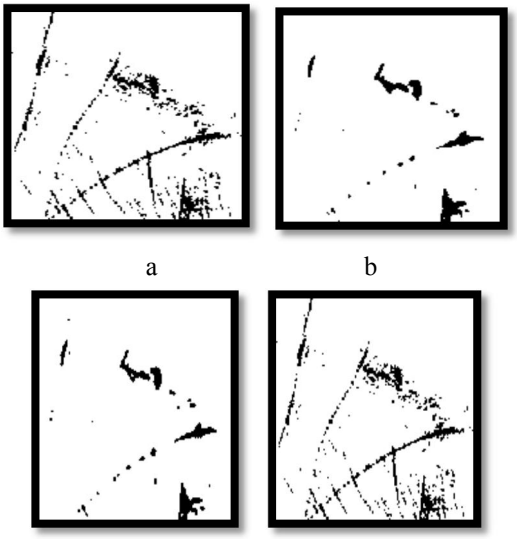
In Hand dorsal vein,first of all use mean filter to eliminate noise from image and left itsmooth. To facilitate the extraction of pattern histogram equalization is used, Fig.5 is illustrated the resulted image.



(a)(b) (c) (d)

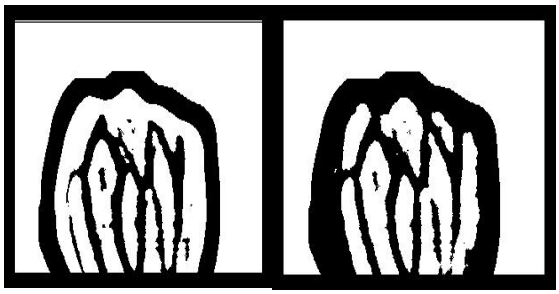
Fig.5: hand dorsal vein :(a) Original image, (b) mean filter, (c) Histogram Equalization, and (d) CLAHE

Histogram equalization give with better result it make the vein clear and facilitate the tracking of pattern, the aim of this paper is to extract the pattern of the two images (palmprint and dorsal vein)and determine the important feature of it . Fig7 (a) show the dorsal vein pattern extraction after applying preprocessing operation (mean filter)and local threshold with selected value 15. And (b) is show hand dorsal vein pattern but with histogram and selected value 22. Fig.7presents the final vein pattern after dilation and thinning.



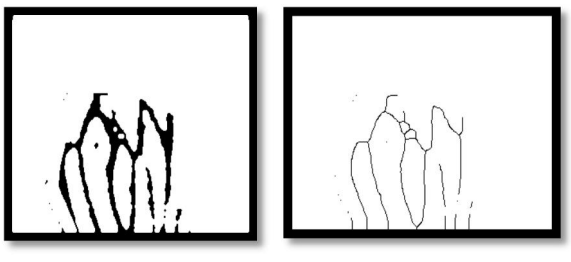
a b C d

*Fig 6:*palmprint pattern: a) apply Gaussian sharpenas smooth filter before threshold, b) apply mean as smooth filter before threshold, c)apply median as smooth filter before threshold, d)palmprint pattern when used histogram equalization and select threshold value 17



(a) (b)

Fig.7: dorsal vein pattern ,
(a) Without histogram(t=22),(b) with histogram(and T=15).



a b

Fig 8 : vein pattern after (a) dilation , (b) thinning

Algorithm 2 **: statistical feature extraction**

Algorithm name	Statistical features
Input	Fuse_im\\ Gray scale image
Output	Mean , std , energy , entropy \\ threshold image
Goal	Feature extraction

Begin:
Step1: for x = 0 to no_row
for y = 0 to no_Colum
Get Gr_image pixel value (x,y (R,G,B))
Point_val(x,y)= (R+G+B)/3
sum=∑ point_val (x,y)
End for
End for
Mean = sum / no. of element in fuse_im // x*y
// previous block to calculate mean value
for x = 0 to no_row
for y = 0 to no_Colum
temp= (Point_val(x,y) - Mean)^2
temp2=+temp
energy = ∑ (Point_val(x,y)) ^{2}
End for
End for
Std= square_root(temp2 / (x*y))
// x*y is image element
// previous block to standard deviation and energy value
for x = 0 to no_row
for y = 0 to no_Colum
entropy= - ΣPoint_val(x,y) , $\log_2$Point_val(x,y)
End for
End for
// previous block to calculate entropy value
Step2 : return Mean , Std , energy , entropy
End

Ⅴ .equations

mean equation

$\mu 2= 1/M*N\Sigma^{m}_{i=1} \Sigma^{m}_{j=1} p(i,j)$ [19] (1)

standard deviation equation

$\sigma=SQRT\{ 1/M*N\Sigma^{M}_{i=1} \Sigma^{N}_{j=1} p(i,j)-\mu 2$ [19] (2)

entropy equation

$\hbar=-\Sigma_{k=0}^{i-1} p_k(\log_2 p_k)$ [19](3)

energy equation

$E=\Sigma_{i,j}P|i-j|2$[19] (4)

Ⅵ .Experimental Result

As we mention earlier this paper tend to extract statistical feature , corner point ,from dorsal vein and palmprintfor two dorsal vein and palmprintimage, Table1 show the statistic featurefor each image when apply the algorithms 2 ,and Fig. 9 show Harris point for each pattern.

*Table 1:*the feature extracted from vein palmprint pattern.

id.	Mean	Std (standard deviation)	energy	Entropy
V1	166.74609375	121.994836854337	3265555500	102376489.547705
V2	163.4158203125	123.002925459513	3200335425	100331813.740931
P1	230.191333333333	77.0774376296771	1320722775	41405194.7272915
P2	232.469333333333	73.9605191496622	1333792800	41814945.3126982

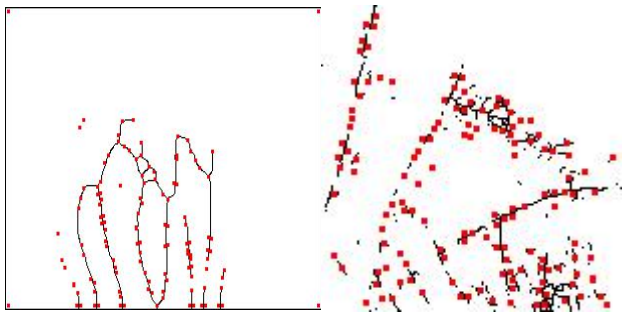


Fig 9: Harris point:(a) vein pattern (b) palmprint pattern

Ⅶ. Conclusion

Is this study we propose hand dorsalvein palm print feature extraction based on most accurate and efficient trait , the statistical feature (mean ,standard deviation, energy , entropy) , and Harris corner detection these feature are important for future step of unimodal or fusion of multimodal (identification/recognition) system by matching the feature of template and the image that need to identify .

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