

**REVIEW ARTICLE**

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## A SURVEY ON BIOMETRIC AUTHENTICATION TECHNIQUES USING PALM VEIN FEATURE

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**Abstract:** Palmprint recognition has been investigated over 10 years. After palmprint, fingerprints or iris digital, biometric identification of an individual can be done through the veins of the hand. This paper provides an overview of current biometric systems technology based on hand vein. We first review the component modules including the algorithms they employ. Finally, a summary of the accuracy results reported in the survey is also provided and some suggestion is offered

**Keyword:** Hand vein, palm, dorsal, finger, and biometric system.

### INTRODUCTION

Biometrics is the science and technology of measuring analyzing biological data. In information technology, Biometrics refers to the technology that measure and analyzes human body characteristics for authentication purpose [21]. Human recognize each other by their various characteristics for ages. Biometrics offer automated method of identity verification or identification on the principle of measurable physiological or behavioral characteristic such as fingerprint or voice etc.

Palm vein patterns shown in figure 1.1 and 1.2 are unique to every individuals and is not affected by aging, cuts, scars, tattoos, nor skin color affect the scans outcome. Palm vein patterns are unique even among identical twins, the vascular patterns of an individuals palm is taken as the feature for palm vein authentication. Blood loaded with oxygen comes into the hands through the arteries, and then again towards the heart through the veins. The oxygen depleted blood is not the same as the absorption filter arterial it absorbs light at wavelengths near infrared. When the hand is illuminated with infrared light, the vein appears black. It is recorded as an "identity card" in a database and can then be used for comparison during authentication. There is no way to cheat, because they cannot "shoot" the veins of the hand. The vascular network is unique to each individual: even identical twins are different. According to Fujitsu, which compared 140000 palms, TFA -False Acceptance Rate (people authenticated as some one else) is less than 0.00008%. There is no Contact during authentication as with fingerprints, so no hygiene problem. However, the method is still too recent to be properly assessed. The scanner is relatively bulky compared to fingerprint sensors.

### OPERATION OF A HAND VEINS-BASED BIOMETRIC SYSTEM

The biometric system has two purposes: authentication and identification. shown in figure 2.

#### **Verification:**

It allows to certify (ensure) a claimed identity of the user.

#### **Identification:**

It allows users to determine which best fits the person to recognize. It adds the ability to check whether the user actually belongs to the database. Based on the comparison result, the claimed identity is accepted or denied.

### SURVEY REPORT

#### **Thresholding (Removing Noise):**

In [12], they used the low pass Gaussian filter (3 \* 3) and high pass (11 \* 11) to obtain a good image vein patterns. Others have preferred to use the Median filter (5 \* 5) instead of Gaussian [13],[14],[15] in the case of the Gaussian filter remove some needed edges, as an alternative the Median filter that conserves the edges.[19]

On the other hand,[4],[2],[17] used the two filters: low pass Gaussian components to reduce the image having a high frequency (dark pixels) and Median (5 \* 5) to remove speckles (the small jobs that appear in the image texture). Another technique has been adapted in<sup>8</sup>; the ridgelet transform in order to eliminate noise and highlight the veins. In [8], they used Match filter, Wiener filter, smoothing filter to eliminate noise and get clear veins.

#### **Binarization:**

Several techniques exist for the binarization. Indeed [2-5],[7],[8],[16], used a local thresholding based on the neighboring pixels, as it gives better results compared to the global threshold<sup>8,11</sup> have used another type of automatic thresholding is OTSU, for it requires short processing time<sup>9</sup>. One more method of binarization, is the K-means which was applied with k = 2 (the bottom and hand).

#### **Feature Extraction:**

Some researchers divide this module in two steps extraction veins then extracting minutiae; sometimes we can found only feature vein's extraction.

#### **Extraction Veins:**

The local thresholding gives good results; for that it is very used in particular in [1-5],[10],[12],[13],[16] Applied the wavelet transformation to locate veins. Others used a

quadratic function<sup>6</sup>, for the reason that it has as main advantage reducing the size of the matrix; which has a direct impact on the processing time classification<sup>6-7</sup>. Used OTSU method which has been widely used for the document's binarization; it often gives the best results and the fast. Used Cholesky decomposition and Lanczos algorithm to reduce the processing time. When, based on an histogram equalization; this makes dark pixels appear darker and bright pixels appear brighter. To get the right threshold from the histogram.

**Extraction Of Minutiae:**

Crossing number used to extract more properties on the veins[5],[9],[10],[20] used Hough transform to isolate the end points that will be used afterwards for classification[14]. shown in figure 1.3.

**Classification:**

To compare the shape of the extracted veins (s) size (s) of reference[4],[16],[3],[10] used the Hausdorff distance, the test results showed that all the vein pattern images in the database have been correctly recognized[4],[6],[7],[10]. Used Euclidean distance, the error rate of FAR and FRR was still reduced. Others<sup>11</sup> have used the method of minutiae triangulation, which can form triangles from minutiae (bifurcation points and end points). Then a score is generated by computing the number of triplets bifurcation and end points of the input image, and compared with the number of the triplets and end points that are stored in the database. Another technique was used, the rigid registration, which showed that the right hand and the left hand of the same person are not identical. Table1. Survey : palm vein biometrics, In the followed table, we quote some works that have been studied around the palm veins. The boxes marked with / want to say that the technique was not mentioned in references

In[17], the filter-GSZ shock was used to eliminate noise and improve contour[18-19]. Used the Gaussian filter to correct the contrast of the image used the Gaussian filter for high pass intensity improvement. In[17], they based on the Gabor filter to extract the characteristics of the hand in the form of texture. Others have preferred to use a local thresholding "SIFT". In [18] extract the hand and palm vein doing like[15], and showed the effectiveness of this method for binarization. Another technique, which is the multi-level thresholding was applied in[20]. In[17], they used the Gabor filter to extract the veins, then they made a skeletonization to better visualize the veins and they used K-NN to classify individuals where used another technique which is the correlation coefficient; it is widely used in image processing. By cons adopted the method of TOH et al in[16]

**Enhancement:**

Used a filter oriented to improve the image<sup>6</sup>. In<sup>17</sup>, the median filter (5 \* 5) was used to improve the image quality. Median filter and another Special (3 \* 3) was applied after the detection of finger vein to eliminate all single points (unwanted noise in the background) from the image<sup>17</sup>. In<sup>18</sup>, they used the Gaussian filter to eliminate noise such as dust, the median filter for image binarization, and an iterative labeling connected components because the picture still contains points not belonging to the finger vein.



Figure1.1 palm vein

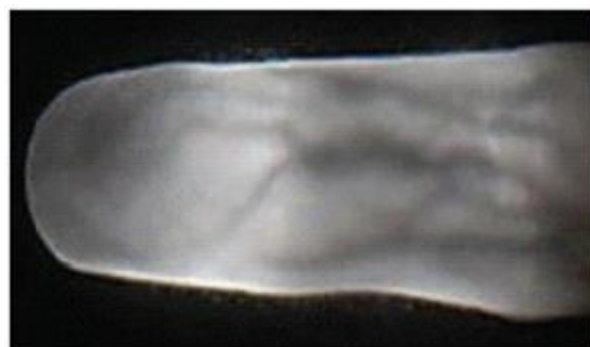


Figure1.2 finger vein

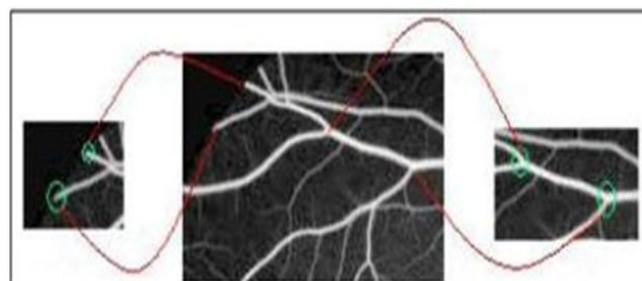


Figure.1. 3 End Points, veins branching point

Table1.Survey report on various techniques and results used in palm vein biometrics

Ref.	Thresholding	Binarization	Extraction of Veines patterns	Minutie's extraction	Classification	Result and Performance
[2]	Gaussian low pass & high pass	Local thresholding	Local Thresholding	No	/	FAR 0.01%
[3]	Median	Local thresholding	Wavelettrans Form	No	/	FRR 1.5% FAR 3.5%
[4]	Median,	Local thresholding	Local thresholding	No Distance	Hausdorff	FAR 0.4%
[5]	Median	Iterative thresholding	Local thresholding	No registration	Rigid	FAR 0.02%
[6]	Match filter, ,smoothing filter	Seuillage automatique	Quadratic infrence function	No	Euclidean distance	FAR 0.02% FRR 0.03%
[7]	Laplacian	Local thresholding	OTSU	Crossing number distance	Euclidean distance	FAR 1.14%
[8]	Match filter, Wiener Threshold, smoothing filter	Automatic thresholding	Cholesky Decomposition &lanczos algo	No	Euclidean distance	FAR 0.5% FRR 0.1%
[9]	Median	Local thresholding	Local thresholding	Crossing number	Hausdorff distance	EER 3.68%
[10]	Gaussien	Local thresholding	Local	No distance	Euclidean distance	FRR 0.03%
[11]	Median	Histogram equalization and local thresholding	OTSU	Crossing number	/	/

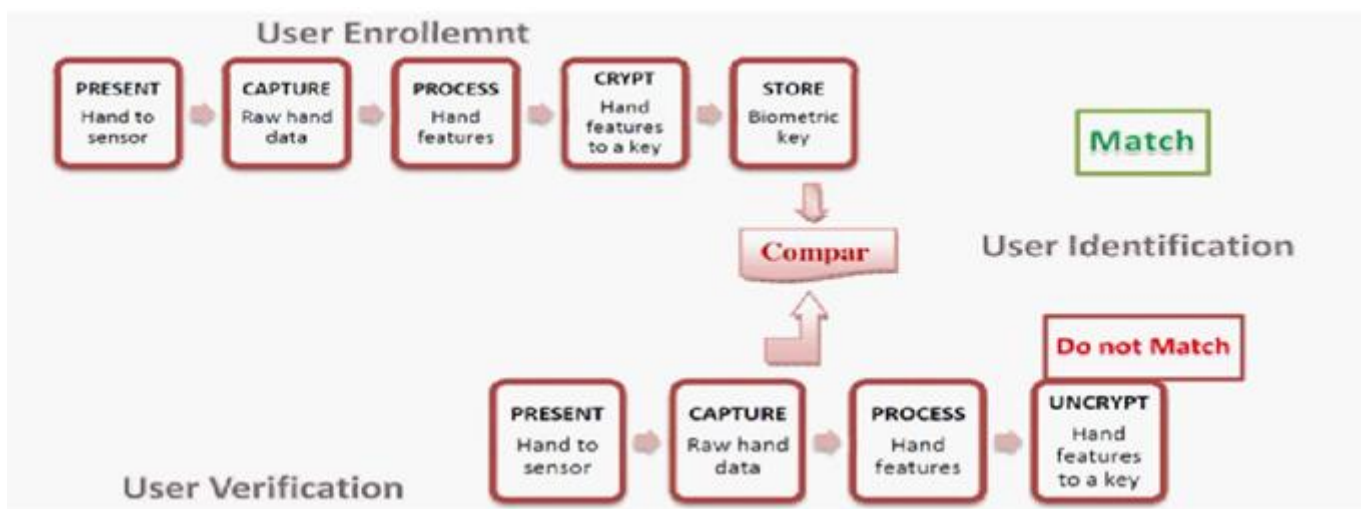


Figure2. Processing steps in an identity verification system using hand vein

**CONCLUSION**

In a biometric system, two important criteria to consider: the accuracy of results and processing time. It is for this reason that this paper has presented a state of the art biometrics veins of the hand, to discover and study different algorithms. Further it has been also concluded then by fusing palm vein with another feature will increase accuracy.

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