

# Review Paper on Enhancing Palm Print Recognition System

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**Abstract**— A palm print refers to an image acquired of the palm region of the hand. Palm print image enhancement is required for better feature extraction. To extract fine features enhancement is required. Fine features increase the accuracy of palm print recognition system. The main purpose of this review paper is to study and compare various palm print recognition techniques in terms of performance, accuracy, overheads and Peak Signal to Noise Ratio (PSNR).

**Key words:** Biometric, Authentication, Palm print identification, verification

## I. INTRODUCTION

Biometric [1] is a field of science and technology whose aim is the verification of a person's identity based on his or her behavioral or physiological characteristics. Unlike commonly used identification techniques based on keys or passwords, which can be forgotten or lost, biometric requires the person to be physically present at the point of authentication.

Biometrics is used as a form of access control. Biometric technologies are now becoming the foundation of highly secure identification and personal verification solutions. The major advantage of biometric system over traditional methods is that they are typically unique for each person and cannot be forged.

### A. Characteristics in Biometric:

#### 1) Physiological Characteristics:

Commonly used physiological characteristics in biometrics are fingerprint, palm print, hand geometry, face, iris, ear and retina.

#### 2) Behavioral Characteristics:

These include voice, signature, lip movement, gestures etc. A number of biometric traits have been developed and are used to authenticate the person's identity. The scheme is to use the special properties of a person to identify him. By using special properties we mean the using the features such as face, signature, fingerprint, iris etc. The method of identification based on biometric characteristics is chosen over traditional passwords for various reasons such as: The person to be identified is required to be physically present at the time-of identification. Recognition which is based on biometric techniques removes the need to remember a password.

#### 3) Steps of Biometric System:

The biometric system commonly consists of two steps i.e. enrollment and verification.

- 1) In enrolment a sample of the biometric attribute is captured which is processed by a computer and store for later comparison.
- 2) In verification mode biometric system authenticates a person's claimed identity from their previously enrolled sample pattern.

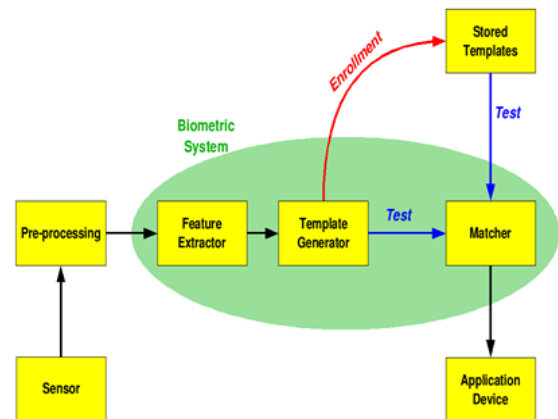


Fig. 1: Biometric System

### B. Biometric Template:

A biometric template is a digital reference of distinct characteristics that have been extracted from a biometric sample. Templates are used during the authentication of biometric process. This could be an image ranging from the nature of our hand to our finger, to our eye, and even the way we talk. This image then becomes a master profile-and it is from this, that the unique features of our finger, our eye, our hand, or our voice are obtained, and then converted into a mathematical file. These mathematical files are known as the Biometric Templates-not the images which were extracted and created.

## II. APPROACHES IN BIOMETRIC SYSTEM

### A. Fingerprint Recognition:

#### 1) Advantages:

- The Cost of fingerprint sensor is comparatively low.
- There are large numbers of solutions available.

#### 2) Disadvantages:

- Ease of forgery.
- Fingerprints require high resolution image acquiring devices which make them costly [2].

### B. Facial Recognition:

Many computers today ship with software that uses a laptop or other camera to capture an image of the user's face. Then this image is converted into a reference template during enrollment. [3]

#### 1) Advantages:

- The cost is often much lower than solutions requiring a separate sensor for collection of physical characteristics because many computers and laptops today come with cameras.
- It is very difficult to forge a face[4]

#### 2) Disadvantages:

- It is difficult to forge a face, but not impossible.

- Another issue is lighting. If lighting is not sufficient, verification failure rates increase.[5]

### C. Iris Recognition:

An iris scanning solution provides accuracy with very low probability of forgery. In addition, the technological characteristics of iris scans provide scanning from a distance with little or no user interaction.

### D. Voice Recognition:

Voice recognition is easy for users, but it is subject to easy forgery. This approach works well for telephone-based [6] authentication, but it is very weak authentication and voice tends to change with age and physical conditions of the person.

It is not as accurate as other forms of biometrics, and voice tracks are subject to theft through soundtrack devices. [7]

### E. Palm Printing:

A palm print refers to an image acquired of the palm region of the hand. It can be either an online image or offline image where the image is taken with ink and paper.

The palm consists of principal lines, wrinkles, and epidermal ridges. Palm prints can be used for forensic, criminal or commercial applications.

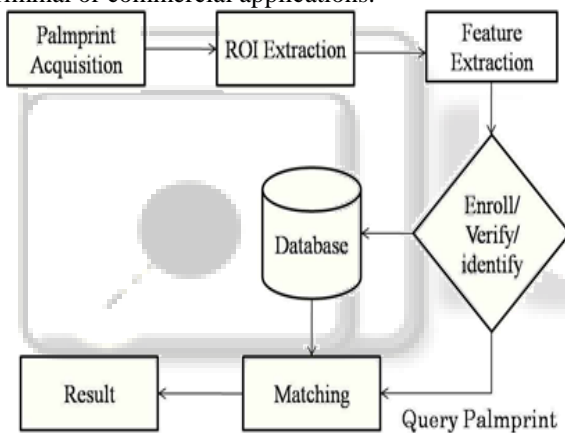


Fig. 2: Palm print identification System

### F. Categories of Palm Print Identification Techniques:

#### 1) Low Resolution Feature:

This approach makes use of low-resolution images, where just principal lines, wrinkles, and texture are extracted. These images are suitable for forensic applications.[8]

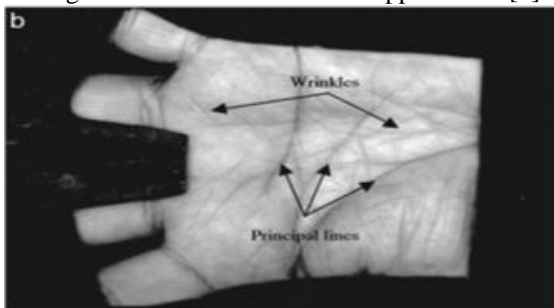


Fig. 3: Low resolution image

#### 2) High Resolution Feature:

In this approach in addition to principal lines and wrinkles, more distinguish features similar to ridges, singular points, and minutiae can be extracted. These images are suitable for civil and commercial applications.[9]

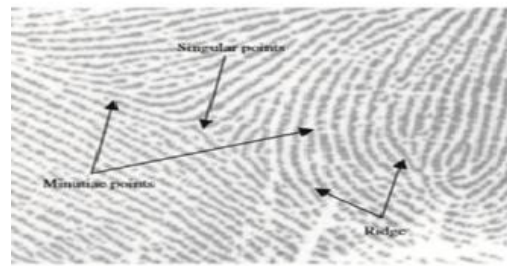


Fig. 4: High resolution image

### III. PERFORMANCE METRICS

The recognition results of a palm print recognition system should be reported with commonly used performance evaluation tools to simplify system comparisons. The most widely used standard metrics [10] for analyzing performance and accuracy of a biometric system are:-

#### A. False Acceptance Rate (FAR):

FAR is the ratio of the number of unauthorized users accepted by the biometric system to the total of identification attempts made.

$$FAR = FA / GA + FR$$

- FR: False acceptance occurs when the system incorrectly accepts the person that should be rejected.
- GA: Genuine Acceptance.

#### B. False Rejection Rate (FRR):

FRR is the ratio of the number of number of authorized users rejected by the biometric system to the total number of attempts made.

$$FRR = FR / GA + FR$$

- FR: False rejection occurs when the system rejects a person who is enrolled in the database.
- GA: Genuine Rejection.

#### C. Equal-Error-Rate (EER):

It is defined as the rate at which the FAR is equal to the FRR

### IV. WHY PALM PRINT RECOGNITION?

- 1) Surface area of Palm print is larger than fingerprints so it contains additional features.
- 2) Palm prints are more robust to dirt.
- 3) The images of palm print are cheaper to collect.
- 4) The palm print images are more acceptable than iris.
- 5) The distinction between individuals can be analysed more accurately by palm prints than face.
- 6) It is difficult to acquire fingerprint features i.e. minutiae, for some class of persons like elderly people.
- 7) Palm prints can be easily integrated with existing authentication system.
- 8) Palm prints provide enhanced level of confidence in personal authentication.
- 9) Palm prints are cost effective.
- 10) Palm print images are simply captured by low resolution policy.
- 11) Palm prints are less affected by age.

## V. TECHNIQUES IN PALM PRINTING

### A. Gabor Convolve Method:

S. Sali and C. Bhyri et. al. [11] presents Gabor convolve method and also shows the comparison of this method with ICA based techniques for neural network and Palm print recognition. This method overcomes the bandwidth limitation of traditional Gabor filters [12]. They have taken ten palms of a person from Singapore polytechnic database, eight palms for training and two palms for testing. They have achieved 92.50% efficiency by Gabor convolve technique and 83.33% by ICA and 40% by neural network. The performance evaluation and comparisons with other methods indicate that the proposed method is a very efficient method for palm recognition and results give better performance for Log Gabor technique.

### B. Palm Line Extraction and Matching:

X.Wu et. al. [13] presents a novel approach to palm line extraction and matching for use in personal authentication. Directional line detectors are used to extract palm lines in different directions. These irregular lines are represented by their chain code. Chain code is a pixel by pixel direction code of a line. A matching score is defined between two palm prints according to the points of their palm lines to match palm lines. The proposed approach is more powerful for palm print verification than the 2-D Gabor algorithm [12]. The experimental results shows that when the palm prints are dirty this proposed approach can effectively discriminate between palm prints. This method satisfies the requirements of a real-time biometric system. The speed of the proposed approach is faster.

### C. 3D Palm Print Identification System:

Priyanka A. Mane et. al [14] provides an overview of current palm print scrutiny, describing in particular reproduce devices, preprocessing, authentication algorithms, palm print-related fusion, algorithms mostly designed for real-time palm print identification in large databases. Most of the earlier studies are based on 2D image of the palm print. 2D images are easily pretentious by noise. The preceding work of 3-D palm print detection done using local features such as line, texture, wrinkles, point but, in this they are using the global features such as length, width and area of the palm. To overcome these shortcomings, they develop a three dimensional (3D) palm print identification system.

### D. Enhanced Eigen Palm Feature:

A. James Terna and Dr.V.E Ejiofor et. al. [15] recommends a Palm print Recognition method based on an enhanced Eigen Palm [16] Feature using Gaussian Pyramid decomposition. It achieves better feature extraction by filtering and down sampling the images into reduced resolutions. Experiment is carried out by matching the decomposed images with their stored templates on each of the three reduced image resolution levels. An analysis of the results illustrates the effectiveness of our method in terms of a higher recognition rate at a resolution of 64 x 64 pixels.

### E. Band Pass Filtering:

S. Karar et. al [17] proposed an automated system for recognizing palm prints for biometric identification of individuals. Palm print images were converted to the

frequency domain using 2D DFT and thereafter band pass filtered using a log-Gabor filter to extract the phase symmetry information. Classification was done on basis of correlation between training and testing set images. The approach was tested over a data set of 200 images divided into 10 classes and seen to provide 100% recognition accuracy. A modern technique was also implemented on the current dataset for judgment of accuracy results [18].

### F. Discrete Curvelet Transform Method:

S.Palanikumar, M.Sasikumar and J.Rajeesh et. al. [19] presents a novel approach for magnifying palm print image. Enhancement is used to modify the contrast of the image and remove the noise. Palm print consists of fine features. Enhancement has to be done in order to extract fine features from the palm print image. This paper provides enhancement based on curvelet which preserves the fine features without introducing noise. Discrete curvelet method gives better result in the presence of noise. The experiment result shows high PSNR value for the Curvelet method.

### G. Structured Light Imaging:

D. Zhang et. al [20] developed 3-D palm print recognition system by using the method of Structured Light Imaging. In this method structured light scanning is used to obtain palm depth information. After capturing the 3-D palm print image, the ROI is extracted to roughly align the palm and remove the unnecessary cloud points. In this process special types of obtained features are

- Mean curvature image,
- Gaussian curvature image
- Surface type,

A fast feature matching and score-level fusion strategy is proposed for palm print matching and classification. By fusing the 2-D and 3-D information the recognition rate can be improved. This technique is used for 3-D palm print because 3-D palm print is more user friendly and convenient than other techniques.

### H. Coarse Level Matching and Ranking Support:

B.Zhang et. al [21] proposed extracting the global features from 3-D palm print image. The following global features are extracted:

- 1) Maximum depth (MD) at the center of the palm,
- 2) Horizontal cross-sectional area (HCA) at different levels of the palm; and
- 3) Radial line length (RLL)

#### 1) They Then Adopt Two Schemes:

- 1) Coarse-level matching: The purpose of this scheme is to speed up the identification.
- 2) Ranking support vector machine (RSVM): This method is used to rank the candidate samples in database.

These methods improve the efficiency of palm-print recognition.

### I. Segment Based Matching:

J. Dai et. al. [22] developed a novel palm print recognition system. In this system palm print matching is based on ridges. The following methods are used:

- 1) In order to identify good features for registration and matching the palm print features are statistically studied.

- 2) Segment-based matching and fusion algorithm is proposed.
- 3) An orientation field-based registration algorithm is designed to reduce the computational complexity.
- 4) A cascade filter is built to reject the nonmated gallery palm prints in early stage.

Ridge features in palm prints are proven persistent and unique.

In this method cascade filter is used which is faster than the existing matchers but its efficiency still requires improvement.

## VI. COMPARISON OF VARIOUS TECHNIQUES FOR PALM PRINT ENHANCEMENT

This table shows different techniques of palm print enhancement and its comparison with other techniques. In this table various advantages and disadvantages of these techniques are also discussed.

Sr. No.	Technique	Comparison with	Advantages	Disadvantages
1.	Log Gabor Filter	ICA and neural network	Better response by Log Gabor method. Desirable high pass characteristics. Better performance.	Stability of principal lines and wrinkles has not been systemically investigated.
2.	3D palm printing based on Global features	2D palm printing	Not affected by noise, such as dirty in the palm.	
3.	Enhanced Eigen palms Features	Hierarchical identification.	Robust algorithm in terms of performance. maximum Performance rate is 99.9%	This research work does not use high-resolution approach.
4.	Phase Symmetry	Symbolic Aggregate approximation(SAX)	100% recognition accuracy. Minimum CPU overhead. Quick, simple and efficient.	
5.	Discrete Curvelet Transform	Histogram equalization techniques curvelet	Better result in presence of noise. High PSNR (Peak Signal-to-Noise Ratio). More accuracy	
6.	structured-light imaging-based 3-D palm print data acquisition system	2-D palm print recognition	High recognition rate High anti counterfeit capability High robustness to illumination variations	Palm surface is relatively plane so that the depth information of palm is more difficult to capture than that of face or ear.
7.	1)Coarse-level matching 2) Ranking support vector machine	1)No classification 2) RSVM	Reduce the penetration rate during retrieval. Reduces search times	Global features cannot be extracted from 2-D palm prints and are not correlated with local features.
8.	Segment based matching and fusion algorithm.	Latent Palm print Matching	Reduce the computational complexity. Improves accuracy and speed.	Its efficiency still requires large improvement.

9.	Palm Line Extraction and Matching	2-D Gabor algorithm and Sobel method.	More robust to dirty palms. Fast enough for real time biometric system.	This approach is not suitable for high security system.
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Table 1: Comparison Of various Techniques for palm print enhancement

## VII. CONCLUSION

Several existing methods have been studied for palm print enhancement. Log Gabor filter gives better response but suffers from one drawback that stability of principal lines and wrinkles has not been systemically investigated. 3D palm printing based on global features is not affected by noise such as dirty palm. Segment based matching and fusion algorithm reduces computational complexity and improves accuracy and speed.

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