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A Novel Approach for Palm Print Recognition Using Minutiae Points with BFOA

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Abstract: ***Biometric recognition is useful in user authentication as well as validation process. In the process of biometric recognition features from differ net biometric trait have been utilized so that maximum accuracy of system can be achieved. In this paper a novel approach of feature extraction from palm print has been implemented. Ridge and Bifurcation based approach has been implemented on the palm print samples for extraction of minutiae points. These minutiae points have been optimized using bacterial forging optimization approach that computes best point's on the basis of fitness from search space area. On the basis of best evaluated featured recognition has been done so that maximum accuracy can be achieved. We show that a purposed method outperforms the state of art methods in by a large margin in terms of accuracy. The purposed methods can be implemented in various applications of biometric authentication and recognition.***

Keywords: Ridge, Minutiae, FAR, FRR, Bacterial forging optimization and accuracy

1. Introduction

Multimodal biometric systems have recently attracted the attention of researchers and some work has already reported in literature. Most of the reported work has bimodal biometric system such as Finger prints, Face recognition, Iris, Hand and Palm print recognition [1]. Biometrics refers to the identification of humans by their characteristics or traits. It is the science and technology of measuring and analyzing biological data. It is also refers to technologies that measure and analyze human body characteristics, such as DNA, fingerprints, eye retinas and irises, behavioral traits such as voice patterns, facial patterns and hand measurements, and results for authentication purposes.

Authentication by biometric verification is becoming increasingly common in corporate and public security systems, consumer electronics and point of sale (POS) applications. In addition to security, the driving force behind biometric verification has been convenience.

The biometric use of palm prints uses ridge Patterns to identify an individual. Palms of hands epidermal ridges, thought to provide a friction surface to assist with gripping an object on surface[2].Palm print identification systems measure and compare ridges, lines and Minutiae found on the palm. Palm print recording and identification for law enforcement purposes has been in existence almost as long as palm prints systems are reported to comprise 30% of all crime scene marks [2]. As much as another 20% are made up of the edge of the hand, fingers between the palm and fingertips and other parts of the hand. A key driver for law enforcement agencies to adopt full-hand scan technologies is the high incidence of hand related crime scene marks. Joao de Barros, an early explorer and writer, wrote that the Chinese merchants distinguished young children from each other by recording palm prints on paper with ink. One of the earliest AFIS systems built to support palm prints is believed to have been developed in Hungary in the early 1990"s. In 1997, the technology was bought by a US company. In recent years, most AFIS vendors have added palm print records capabilities to their systems [4]. Palm print authentication is one of the relatively new physiological biometric technologies which exploit the unique features on the human palm print, namely principle lines, wrinkles, ridges, datum points, etc.[3]

The biometric palm print recognition system is the most permissible. The proposed system is applicable for both biometric enrollment and recognition of an individual. The new methodology can be adopted for biometric palm print recognition by using statistical properties of palm. The biometrics is playing an important role in order to recognize a person on the basis his or her physiological characteristic or behavioral characteristic. The Palm print is a physiological or is an external characteristic of human being which is found to be unique and distinct from among every individual. The palm print has maximum region of interest; which makes researcher to study and carry experiments over palm print image such as palm print features- ridge, minutia and principal lines etc.

1.1 Palm vein Authentication Technology

Palm vein authentication works by comparing the pattern of veins in the palm (which appear as blue lines) of a person being authenticated with a pattern stored in a database. Vascular patterns are unique to each individual, according to Fujitsu research — even identical twins have different patterns. And since the vascular patterns exist inside the body, they cannot be stolen by means of photography, voice recording or fingerprints, thereby making this method of biometric authentication more secure than others.

1.2 Principles of vascular pattern authentication

Hemoglobin in the blood is oxygenated in the lungs and carries oxygen to the tissues of the body through the arteries. After it releases its oxygen to the tissues, the deoxidized hemoglobin returns to the heart through the veins. These two types of hemoglobin have different rates of absorbency1.

Deoxidized hemoglobin absorbs light at a wavelength of about 760 nm in the near-infrared region. When the palm is illuminated with near infrared light, unlike the image seen by the human eye [Figure 1(a)], the deoxidized hemoglobin in the palm veins absorbs this light, thereby reducing the reflection rate and causing the veins to appear as a black pattern [Figure 1(b)]. In vein authentication based on this principle, the region used for authentication is photographed with near-infrared light, and the vein pattern is extracted by image processing [Figure 1(c)] and registered. The vein pattern of the person being authenticated is then verified against the preregistered pattern.

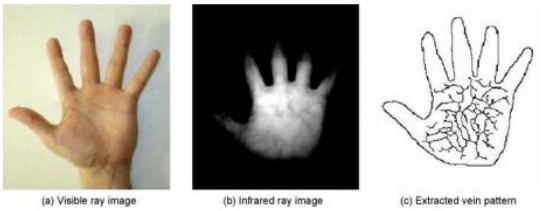

Figure 1: Extracting a palm vein pattern

1.3 Advantages of using the palm

In addition to the palm, vein authentication can be done using the vascular pattern on the back of the hand or a finger. However, the palm vein pattern is the most complex and covers the widest area. Because the palm has no hair, it is easier to photograph its vascular pattern. The palm also has no significant variations in skin color compared with fingers or the back of the hand, where the color can darken in certain areas.

2. Review of Literature

Frantic Ivan. Et al [2] "Techniques and Recent Directions in Palm print and Face Recognition". In this paper, face and palm print are two biometric attributes with the most astounding client acknowledgement. Frameworks in view of face speak to 19% of the biometric piece of the overall industry. There exist a mixed bag of systems, both element based and appearance-based, that can be utilized as a part of palm print and face biometric frameworks to concentrate important components and perform coordinating. Biometric combination can be utilized to consolidate various types of components, regularly got from the same biometric attribute, to enhance the execution of the framework

Junlin Hu, Yanxue XueYongwei. Et al [3] "Palm print Recognition Based on Multiple Feature Information Fusion" In this paper, they apply 2D Gabor channel, MFRAT and ODLPP to concentrate three various types of palm print elements including composition highlight, vital lines and appearance highlight. And after that perform numerous component combinations on the choice level to further enhance the palm print acknowledgment exactness. The strategy has been tried on Poly U palm print database and the trial results showed its viability, which likewise demonstrated that data combination based palm print acknowledgment can be moved forward.

Karthik Nandakumar. Et al [4] "Local correlation base fingerprinting" In this paper, a relationship based unique mark matcher that uses nearby connection of locales around the details to focus the level of match between two finger impression pictures. This strategy utilizes a no doubt understood calculation for details extraction and uses Procreates examination of relating edge bends to adjust the inquiry to the format. The two pictures are upgraded utilizing Gabor filter banks and the standardized cross-connection is utilized as the nature of the particulars match. The execution of our calculation is somewhat second rate compared to that of the 2D dynamic programming based details matcher, essentially because of the powerlessness to handle unique finger impression pictures of low quality. Nonetheless, incorporating the proposed calculation with the 2D dynamic programming based coordinating yields a superior coordinating.

Wua Xiangqian, Zhang David, Wanga Kuanquan,et al [5] "Palm printing classification using principal lines" In this paper, an arrangement of directional line locators is concocted for important line extraction. By utilizing these indicators, the potential line initials of the important lines are separated and after that, taking into account the extricated potential line initials, the essential lines are removed in their whole utilizing a recursive procedure. The neighborhood data about the extricated piece of the primary line is utilized to choose a return on initial capital investment and after that a suitable line indicator is decided to concentrate the following piece of the key line in this return for capital invested.

Zhang David, FeGuangming Lu, Wei Li,et al [6]"Palm print Recognition Using 3-D Information" In this paper, investigated another method for palm print based biometrics: 3-D palm printing recognition. A structured- light imaging-based 3-D palm print information securing framework was created. After the 3-D palm print picture is caught, the return for capital invested is separated to generally adjust the palm and uproot the pointless cloud focuses. This paper proposed the shape based component extraction calculations to concentrate the MCI, GCI, and ST highlights. A quick element coordinating system and score-level and highlight level combination methods were utilized to group the palm prints.

3. Methodology

The proposed system at block design Feature Vectors for all images in the database have been calculated in the feature extraction module, and stored in the form of a text file, called the system database. In the matching module feature vector has been calculated from the query image and compared with the system database. A decision for verification or recognition is taken as per the problem targeted.

- **Pre-processing**

In this proposed work, we used a sample of palm print image. We collect samples with the help of internet. All images are gray scaled and we converted all samples to same size (128×128). Figure 2 shows the original image sample & Figure 5.4 shows the binary image.

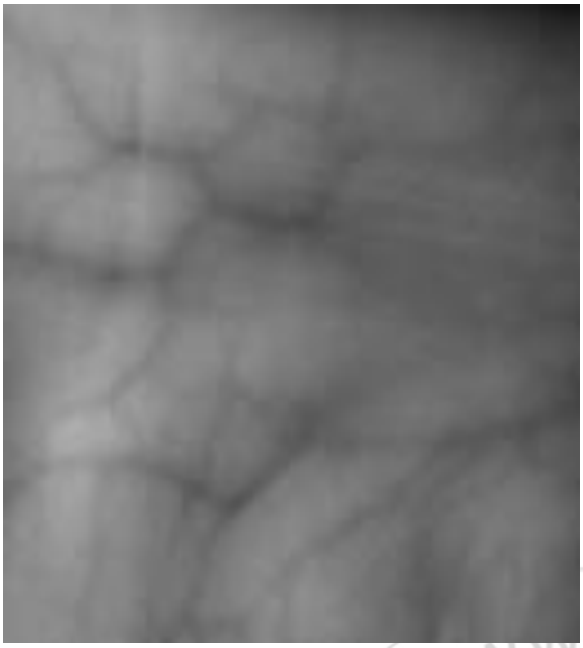

Figure 2: Original Sample

This figure represnets original palm sample image that has been used for palm recognition system. Image has been sensed by using capturing device that contain hand geomatry. This image has been preprocessed for extraction of palm prints from the image so that these can be used for recogntion process.

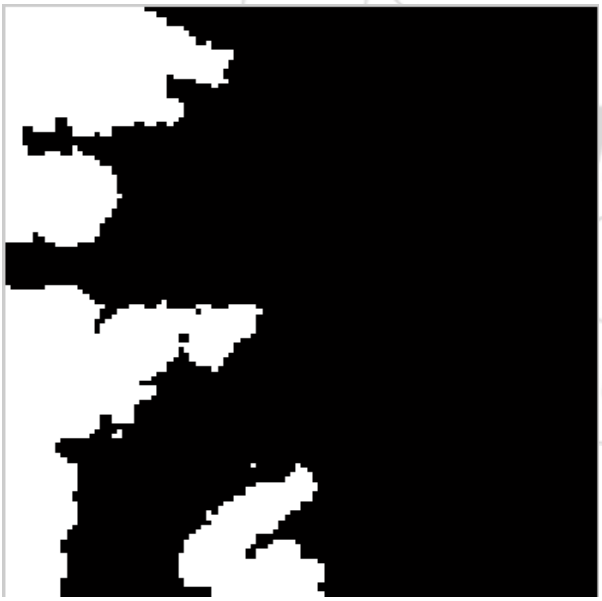

Figure 3: Binary Image

This figure represents image that has been converted to binary from the sample image using morphological operations. These images have been captured using binarization that removes original content and covert image into binary format of 0, 1. 0 represents black regions and 1 represents white regions.

3.1.1 Minutiae Extraction

Thinning operation is performed first and then minutiae feature are extracted as shown in Figure 4& Figure 5.

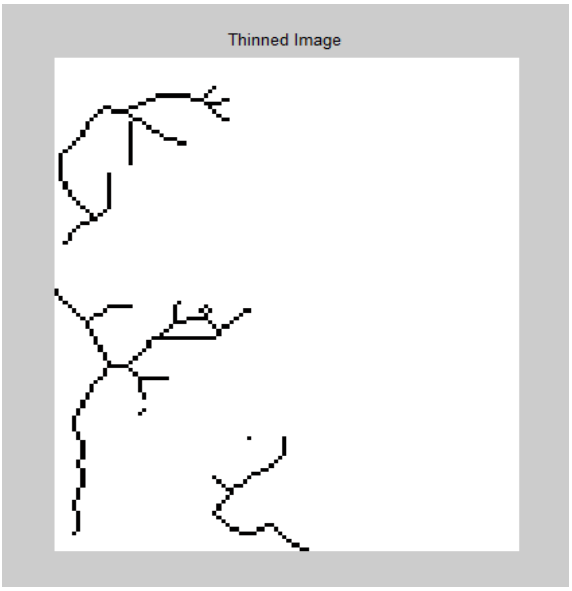

Figure 4: Thinned Images

This figure represents thinned image that has been used for fulfillment of the extraction palm print and used to connect and fill all the broken edges of the prints.

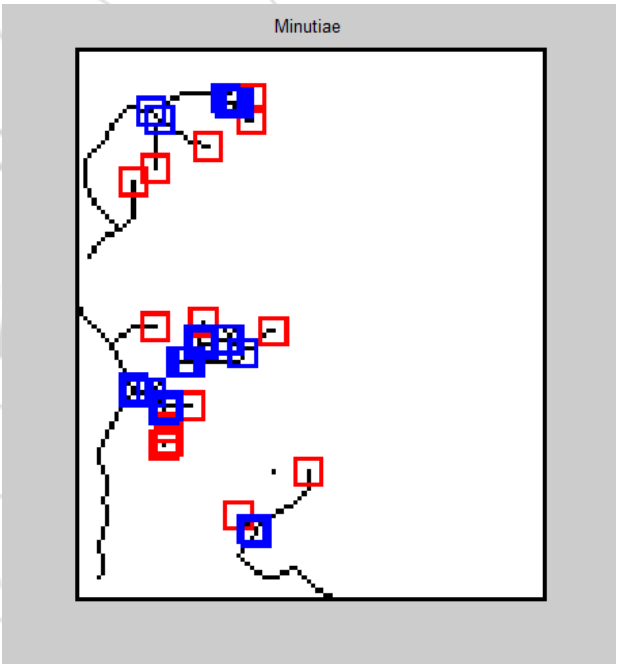

Figure 5: Minutiae Feature

This figure represents minutia features that have been used for recognition process. Minutiae are the points that have been localized on the images so that images can be used for extraction of various valuable features from hand geometry. These features are ridge edges and bifurcation.

4. Results

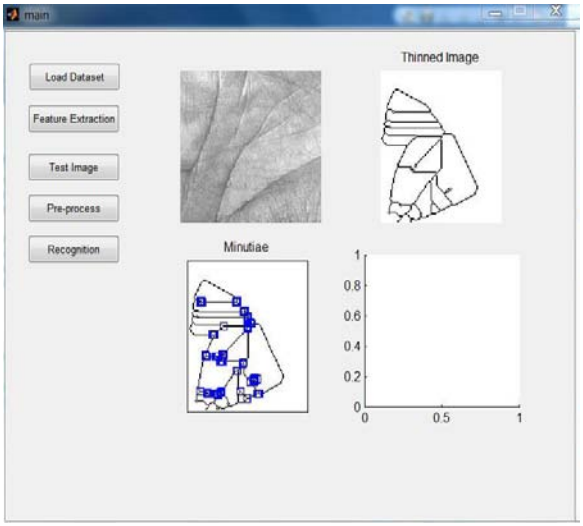

Figure 6: Minutia extraction

This figure repoints localize points that have been defined on the image that act as minutiae points. These points provide orientation of the images and these locations of these points have been act as feature values. These points are labels at the starting and end points of the edges, bifurcation points are those points that are pointed on different scales of the images so that best features where two lines joins and a single palm lines splits into other lines.

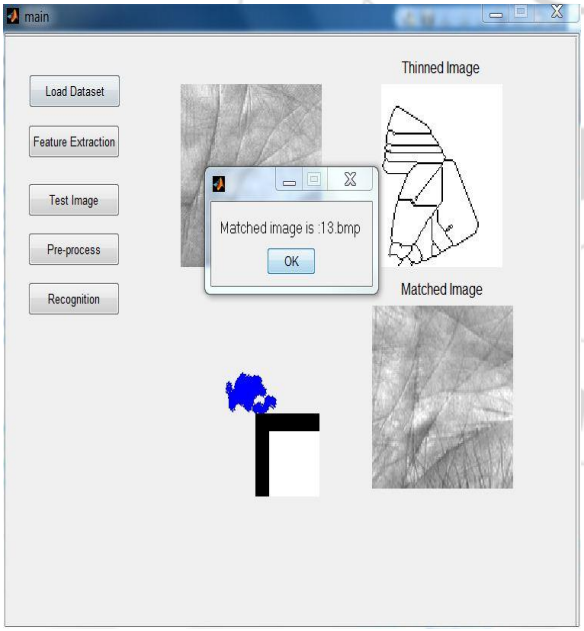

Figure 7: Feature optimization and recognition process

This figure represents bacterial optimization process and recognition process of the palm print images. In this process images have been matched with the other samples of the dataset and best results have been evaluated. The bacterial have been moved on the locations of the minutiae points to extract best solution based on health and fitness criteria. These bacteria have been generated new bacteria's and eliminate less valuable bacteria's so that best features can be evaluated and that can be used for recognition process. On the basis of these feature distance classifier has been implemented that has been used for recognition of the samples images with dataset images. Minimum distance has been measured that has been used or matching of the sample image with dataset images. On the basis of recognition FAR, FRR and Accuracy has been measured.

Table 4.1: Parameters Table

Parameters	Minutia Based	BFO based
FAR	20.6	2.6
FRR	0	0
ACCURACY	79.4	97.4

These results have been computed by analyzing various parameters for palm print recognition. On the basis of these parameters the comparison between purposed and previous work has been evaluated.

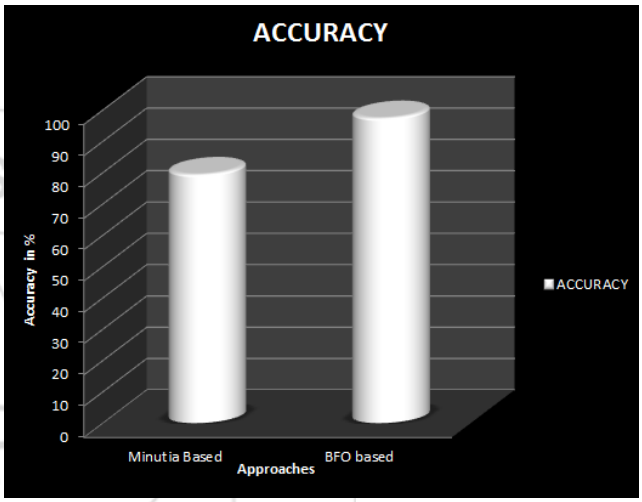

Figure 4.3: Graph for Accuracy

This graph represents the accuracy defined by the previous and purposed work. The graph represents that palm print with BFO optimization provides much accuracy as compare to the approach minutia extraction.

5. Conclusion

In the purposed work different operations have been done for preprocessing of the images. Ridge and bifurcation based approach has been used for extraction of location points on the palm print samples so that best features can be evaluated. These points find edges, line joining and discontinuing points that are important features of the palm samples. After selection of points of location on the samples these minutiae points has been used for optimization that removes unnecessary information from feature vector that has been used for recognition process. In the purposed work BFO has been used for best selection of the features.

Various parameters have been analyzed for performance evaluation of purposed work. These parameters are FAR, FRR and accuracy. On the basis of these parameters we can conclude that purposed approach provide better results than other approaches of palm print recognition process.

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