

Palm Recognition Using K-Mean Clustering With Geometrical and Texture Features

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ABSTRACT: This paper proposes two algorithms (k-mean clustering and back propagation) for palm recognition of an individual using geometrical and texture features. Palmprint recognition being one of the important aspects of biometric technology is one of the most reliable and successful identification methods. Thus palmprint recognition is a very interesting research area. In this study algorithm is proposed to extract geometrical features and principal lines as texture feature and result is compared in both cases. The database is taken from www.coep.org.in and http://www4.comp.polyu.edu.hk/~csajaykr/IITD/Database_Palm.htm for processing. MATLAB with version 7.10.0.499 (R2010a) 32 bits will be used to implement the proposed work. In the case of k-mean clustering result is 95.65% and recognition time is 0.10. On the other hand in BP-ANN result is 93.47% and recognition time is 0.8.

KEYWORDS: Palmprint Recognition, Texture features, Geometrical features, Pre-processing.

I. INTRODUCTION

Automatic authentication of individual is a significant component of security systems facing many challenges. The old and traditional methods of identification includes passwords or tokens are not much secured, but to identify individual on the basis of his or her unique biometric characteristics is much reliable technique. Palm print based identification is a new modality getting great acceptance in this identification system. It aims to recognize or we can say differentiate a person with the help of some unique features. A palm print is essentially the large inner surface of the hand. It possesses certain unique characteristics, which can be easily extracted using Palm print Capture Devices. These unique features include geometric, texture, wrinkles, single points; etc. Palm print is the acquired image of the palm. It can be captured by scanner or digital camera in case of online image and offline image where the image is taken with ink and paper. The region of the palm consists of principal lines, wrinkles, and geometric features. This technique of Palm identification can be used for criminal, forensic, or commercial applications. In forensic applications such as criminal detection high resolution images are most suitable but in case of commercial applications such as access control low resolution images can be used as well. From high resolution images points and minutia features can be extracted but in low resolution images principal lines, wrinkles and texture features can be extracted.

Biometrics guarantees the identification of individuals based on measuring the personal unique features with a high degree of assurance. Biometric characteristic satisfies the requirements of universality and distinctiveness, permanence, collectability, performance, acceptability. Few biometric traits that are used to authenticate or identify individuals are Fingerprints, Palm print, Iris, ECG, Retina, Gait, Footprint, Speech, Face, DNA, etc. Palmprint is also one of the physiological characteristic that can be used to distinguish between individuals. Palmprint is a biometric modality which can be used for authentication of a person's identity because of its property richness. It has not only the information available on fingers of human palm but it has more details in terms of principal lines, wrinkles and creases. Moreover these features can be combined with shape of palm in order to make an accurate and more reliable biometric system based personal identification. This identification has become an increasingly active research topic over the

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years. In proposed palmprint identification system we utilize the geometric features of the palm like area, centroid, solidity, Euler number, length of major and minor axis, perimeter, etc. In case of texture features principal lines have been utilized for identification.

II. RELATED WORK

Early researches on fast palmprint identification can be roughly classified as a hierarchical matching. Hierarchical matching approach typically involves first extracting multiple kinds of features and then searching in a layered fashion. The palm line patterns have popularly been believed to be able to predict a person's future. But its uniqueness and capacity for distinguishing individuals is being used as an authentication proof as well.

[1] Amit Taneja and Sonika, "Pattern recognition using neural network of hand biometrics" Journal of Global Research in Computer Science, Volume 2, No. 7, July 2011, a peg-free hand-geometry verification system has been developed in this thesis work which is independent of orientation and placement of the hand.

[2] Aravind Nalamothu, Hemantha Kumar Kalluri, "Texture based Palm print Recognition using Simple Methods", International Journal of Computer Applications, Volume 50 – No.4, July 2012, proposed a texture based palmprint recognition system. It is suitable to large organizations for maintaining employee entry record.

[3] Jobin J., Jiji Joseph, et.al, "Palm Biometrics Recognition and Verification System", International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering Vol. 1, Issue 2, August 2012, presents biometric user recognition system based on hand geometry. The goal of a biometric verification system consists in deciding whether two characteristics belong to the same person or not.

[4] Eryun Liu, Anil K. Jain, et.al, "A Coarse to Fine Minutiae-Based Latent Palmprint Matching" IEEE transactions on pattern analysis and machine intelligence vol.35, No.10, October 2013 proposed an efficient and robust latent-to-full palmprint matching algorithm, which can also be applied to full-to-full palmprint matching. To deal with the large number of minutiae in palmprint images, a minutiae clustering algorithm is proposed to group minutiae into several clusters based on the local features (i.e., ridge orientation and ridge period) in minutiae neighbourhood.

[5] Mansi Manocha, Parminder Kaur, "Palm Vein Recognition for Human Identification Using NN", International Journal of Innovative Technology and Exploring Engineering (IJITEE) ISSN: 2278-3075, Volume-3, Issue-7, December 2013 proposed algorithm is an alternative to currently employed palm-vein identification approaches that do not take advantage from the cross-level image measurements.

[6] Rashmi Shrivastava, Nilmani Verma, Vikas Singh, "Palm print Biometrics using Feed Forward Back Propagation Neural Network", International Journal of Computer Applications (0975 – 8887) Volume 74– No.3, July 2013 proposed a new method for human identification using palm print based biometrics.

[7] Jaspreet Kour, Shreyash Vashishtha, et.al, et.al, et.al, "Palmprint Recognition System", International Journal of Innovative Research in Science, Engineering and Technology Vol. 2, Issue 4, April 2013, several existing palmprint recognition algorithms have been studied and analyzed.

[8] Poonam Rathi and Dr. Sipi Dubey, "Hand Geometry Recognition System Using Feature Extraction" International Journal of Advanced Research in Computer Engineering and Technology Volume 2, Issue 6, June 2013, paper proposes a technique for hand biometric feature extraction using hand contour matching. Hand shape feature is obtained by using Euclidian distance from starting reference point and then calculate the tip and valley point of finger.

[9] Sumalatha K.A, Harsha, "Palmprint Recognition System: A Review", International Journal of Advanced Research in Computer Science and Software Engineering, Volume 4, Issue 1, January 2014, Palm print acquisition using CCD based scanner is recommended.

[10] Priyanka A. Mane A. S. Gaikwad, "3D Palm Print Classification using Global Features" International Journal of Advance Research in Computer Science and Management Studies, Volume 2, Issue 7, July 2014 overcome the shortcomings of 2D images and three dimensional (3D) palm print identification system has been developed.

[11] Mr. Lokhande S.K., Prof. Mrs. Dhongde V.S. ME, "Fingerprint Identification System Based on Neural Network" International Journal of Innovative Research in Science, Engineering and Technology, Volume 3, Special Issue 4, April 2014 proposed global features for 3-D palm print images.

[12] Rohit Khokher, Ram Chandra Singh, et.al, "Palmprint Recognition Using Geometrical and Texture Features" 2nd International Conference on Research in Science, Engineering and Technology (ICRSET'2014), March 21-22, 2014

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Dubai (UAE), proposes an algorithm for biometric palm recognition of an individual using geometrical and texture properties.

[13] Gitanjali Sikka and Er.Vikas Wasson, “Palm Vein Authentication: A Review” International Journal of Science and Research (IJSR), Volume 3 Issue 9, September 2014, aim of the proposed model is to improve the accuracy and response time of palm vein authentication.

III. PROPOSED SYSTEM

The proposed system has following objectives which will be discussed in further sections of paper.

- To calculate various geometrical shapes and texture features of palm image.
- To implement K-mean clustering algorithm for classification purpose.
- To implement BP algorithm on same data set.
- Comparison evaluation of both algorithms based on performance measures.

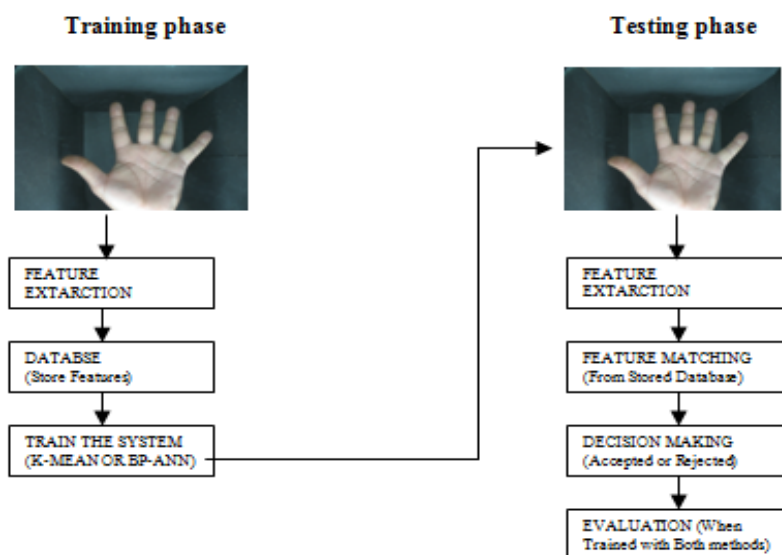


Fig: 1 Flow diagram of proposed system

Architecture of proposed system:

There are many different stages involved in this system:

ACQUIRING IMAGE

The image can be captured through various ways. Digital scanners, CCD-based scanners, video camera, etc. can be used to collect image of human palm. CCD based scanners capture high resolution image. Digital scanners produce low resolution images. The device to capture image can selected on the basis of type of task to be performed.

PREPROCESSING

The acquired image might contain some noise or any other errors, so pre-processing is used to correct distortions. So in this section various processes like noise removal, binarization, segmentation, etc can be used depending upon the quality of image.

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FEATURE EXTRACTION

In this stage the features are extracted. Converting the input data to the set of features is called as feature extraction. This is the most important step in case of palm recognition because the features are the only way through which different persons can be identified. If the features are extracted in a perfect way, only then relevant task can be performed accurately. In proposed work we will focus upon following features:

(A) Geometrical Features

- **Area:** It specifies the actual number of pixels in the region. It is calculated by: bw_{area} (This value might differ slightly from the value returned by bw_{area} , which weights different patterns of pixels differently.)
- **Minor axis:** This gives the length of minor axis of ellipse which has same normalized central moments of region of palm. The length is specified in pixels.
- **Major axis:** This gives the length of major axis of ellipse which has same normalized central moments of region of palm. The length is specified in pixels.
- **Centroid:** This feature is defined as arithmetic mean ("average") of a two- dimensional region is the position of all the points in the shape.
- **EquivDiameter:** This calculates the diameter of circle with same area as of the region. It is calculated as: $\sqrt{4 * Area / \pi}$.
- **Extent:** The feature is calculated as a ratio of number of pixels in bounded region to the number pixels in the region. It is calculated as: $(\text{No. of pixels in bounded region}) \div (\text{No. of pixels in bounded region})$.
- **Mean:** The feature gives the mean of all the orientations in region.
- **Object area:** This feature estimates the area of the objects in binary image. It is a scalar whose value corresponds roughly to the total number of on pixels in the image, but might not be exactly the same because different patterns of pixels are weighted differently.
- **Perimeter:** Returns a scalar that specifies the distance around the boundary of the region. Regionprops computes the perimeter by calculating the distance between each adjoining pair of pixels around the border of the region. If the image contains discontinuous regions, regionprops returns unexpected results. It uses the distance formula as: $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$.
- **Solidity:** This feature is calculated as: $(Area / \text{Convex Area})$. It is used to specify the ratio of pixels in region to the convex hull.
- **Euler number:** This feature gives the count of number of objects minus number of holes present in the region (O-H).

(B) Texture features

Texture features includes principal lines, creases, wrinkles but in this system we have considered principal lines as feature along with other geometrical features for reliable security. Fig: 2 represent the basic view of the implemented system how features are extracted and system is trained.

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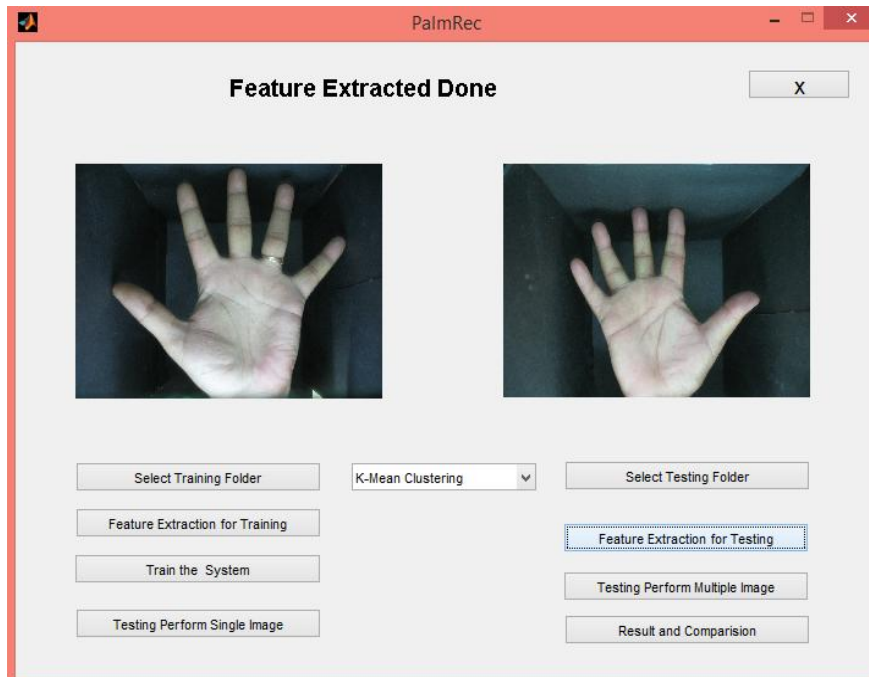


Figure 2: Basic view of implemented system

MATCHING

The last phase of the system is matching. This phase calculates the degree of similarity between the stored data set and claimed features. Here the features extracted in previous stage are matched with features of particular person. This is done to achieve the satisfaction level in case of authentication.

DECISION

After the matching process has been done, the person is authenticated if the features matched with the data set stored otherwise it is rejected.

IV. STRUCTURE USED FOR CLASSIFICATION

K-Mean Clustering

Clustering is the process of partitioning a group of data points into a small number of clusters. For instance, the items in a supermarket are clustered in categories (butter, cheese and milk are grouped in dairy products). Of course this is a qualitative kind of partitioning. A quantitative approach would be to measure certain features of the products, say percentage of milk and others, and products with high percentage of milk would be grouped together. In general, we have n data points $x_i, i=1...n$ that have to be partitioned in k clusters. The goal is to assign a cluster to each data point.

Back Propagation

Back propagation, an abbreviation for "backward propagation of errors", is a common method of training artificial neural networks used in conjunction with an optimization method such as gradient descent. The method calculates the gradient of a loss function with respect to all the weights in the network. The gradient is fed to the optimization method which in turn uses it to update the weights, in an attempt to minimize the loss function. Back propagation requires that the activation function used by the artificial neurons (or "nodes") be differentiable.

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V. RESULTS AND DISCUSSIONS

From the proposed system we have considered that the K-Mean is the more appropriate method for matching in this case as it gives better results than the BP-ANN. We have used 50 images for this purpose and during testing 46 same images and 4 different images are used in order to obtain the results. Fig: 3 show the comparative analysis of K-mean and BP-ANN in terms of accuracy and recognition time. Fig: 4 show the performance plot in neural network. Hence the accuracy can be calculated in case of K-mean as:

$$\text{Accuracy} = \frac{\text{No. of images matched}}{\text{No. of correct images}} \times 100$$

$$(44/46) \times 100 = 95.65\%$$

And accuracy can be calculated in case of BP-ANN is:

$$\text{Accuracy} = \frac{\text{No. of images matched}}{\text{No. of correct images}} \times 100$$

$$(43/46) \times 100 = 93.47\%$$

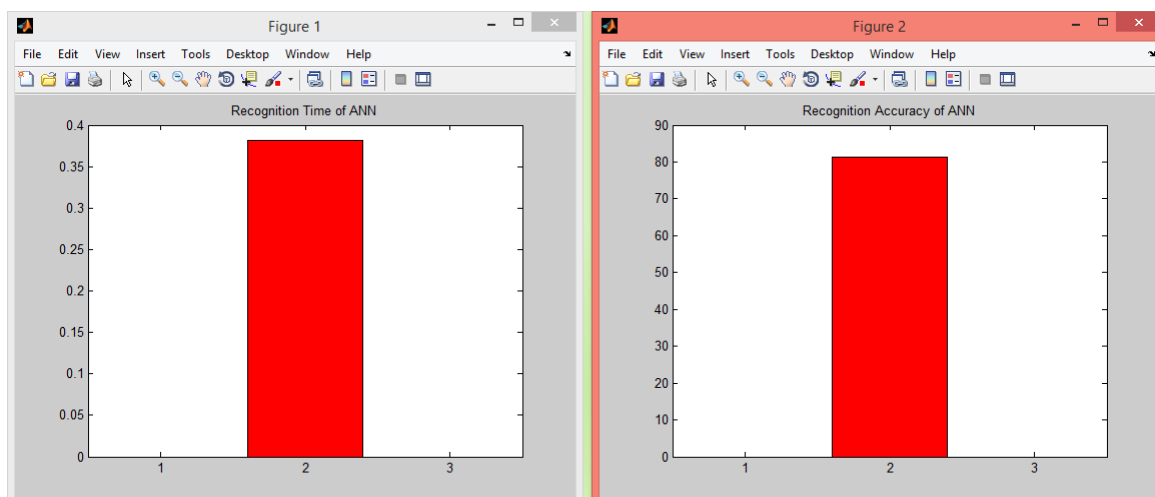


Fig: 3 Comparison evaluation (graphic) in terms of accuracy and time in K-Mean and BP-ANN

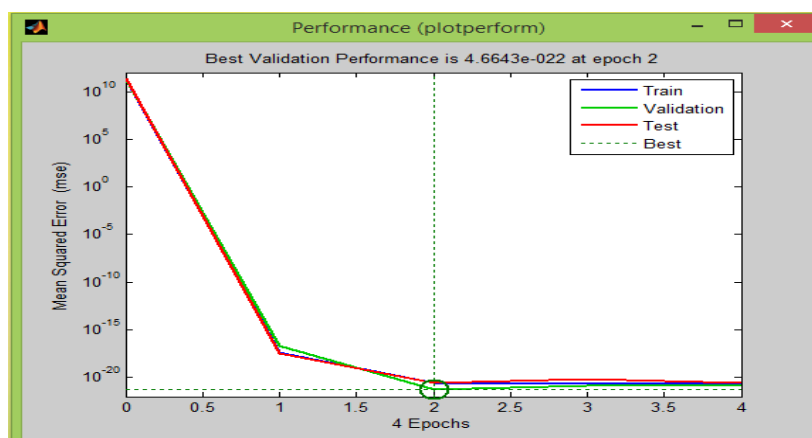


Fig: 4 Performance plot (for Neural Network Training)

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Table 1: Results

No. of images in training	Method used for Recognition	No. of images used in testing	No. of images matched	Accuracy (in %)	Recognition Time(in sec)
50	K-Mean Clustering	50(46 correct)	44	95.65	0.10
50	BP-ANN	50(46 correct)	43	93.47	0.8

VI. CONCLUSION AND FUTURE WORK

In this paper we have used various geometrical and texture features of palm. Two different algorithms are used classification and there performance is compared in both cases to analyse which method provides better results. So form the whole results and discussion we conclude that the K-mean clustering gives better results and more accuracy in less time. In future this work can be extended to combination of more and different features of palm using more efficient features in order to get more accurate recognition rate.

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