Palm Features Extraction for Biometric Authentication

Rajni Bala, Gaurav Bansal and Rakesh Kumar Bansal

Abstract: The Palmprint verification is a process of verifying the identity of the applicants. It performs one to one comparison between a newly input Palm print and the Palm print for the claimed identity that is stored in the database. In this paper, convolution filter and feature extraction using NI Vision Assistant 2009 has been used for detection. The feature extraction is templates of different size in the threshold response of Palm lines are formants, which is being detected and compared for verification. Data base of ten persons having five samples per person including male and female has been created for analysis of results.

Keywords: Biometrics, security, palm print, NI Vision Assistant 2009, image pre-processing, Pattern matching, identification.

I. Introduction

The term "Biometric" is derived from the Greek words "bio" (means life) and "metric" (means to measure).Biometric identification refers to the use of individual recognizing humans based upon physiological and behavioural characteristics, called biometric identifiers for automatically recognizing the individuals. Biometric identifiers can't be easily mislaid, fake, or mutual, therefore they are more consistent for personal recognition than traditional token or knowledge based methods [2] .The objectives of the biometric recognition system are better security, user convenience and higher efficiency. Biometrics is not only a pattern recognition technology but it also has the potential to make our society safe by reduce frauds and to provide user friendly man-machine interfaces or user convenience. In information technology, in particular, biometrics is used as a form of identity access administration and access control. It is also used to recognize individuals in groups that are under observation.

In modern approach, measurable Biometric description can be divided in two main classes:

- **Physiological characteristics:** The physiological characteristics are related to the shape of the body. It varies from person to person; Palmprints, fingerprints, face, iris recognition, hand geometry, DNA and palm print are some examples of this type of biometric.
- **Behavioural characteristics:** The behavioural characteristics are related to the behavior of a person. Some examples signature, keystroke dynamic, gait, and voice. Some time voice is also considered to be a physiological biometric as it varies from person to person.

Humans distinguish each other according to their various characteristics the biometric system must be able to recognize a person based on one or an arrangement of these biometric identifiers quickly, automatically, and with little or no human intervention in the decision. With biometric technology, a more robust level of security and protection can be achieved in the identification component of ID, access control, and verification programs. Three basic means or levels of identification are often referred in identity management function [4]:

- The lowest level is defined as ―something you have in your possession, such as an ID card with a photograph on it.
- The subsequent level is ―something you know, such as a PIN code to use at a bank ATM or password used with computer login.
- The uppermost level is ―who you are, which encompasses biometrics – the measurement of physical characteristics or traits.

More traditional means of access control include token-based identification systems, such as a driver's license or passport, and knowledge-based identification systems, such as a password or personal identification number Since biometric identifiers are unique to individuals, they are more reliable in verifying identity than token and knowledge-based methods, however, the collection of biometric identifiers raises privacy concerns about the ultimate use of this information. The basic block diagram of a biometric system is shown as in figure1.

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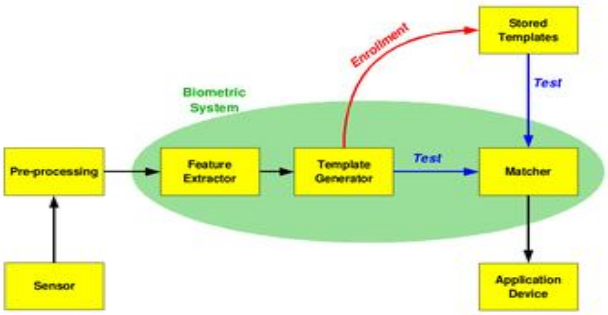


Figure: 1: The basic block diagram of a biometric system

Palm print, the inner surface of our palm normally contains three flexion creases, secondary creases and ridges. The flexion and secondary creases are also called principal lines. These non-genetically complex patterns have rich information for personal identification. Finger prints can be stolen easily because one touches the objects directly with their fingers, so this is not a reliable one. Palm Print is more difficult to be stolen, as large part of the palm print area would not be left behind even when people are holding glasses 46.

In this Paper, we also emphasized on the alignment method of the palm print image. Two different filters, convolution highlights and convolution custom, have been used for feature extraction purpose. A feature vector has been created and matched.

II. Module Requirements

The above mentioned image processing script as formed in NI Vision Assistant 2009 is included in NI Vision Builder 2009. To run Vision Assistant, system must meet the following minimum requirements:

- Personal computer using a 233 MHz Pentium-class processor. Using a Pentium III or Celeron 600 MHz or equivalent is recommended.
- Microsoft Windows 2000/NT/XP.
- 1024 × 768 resolution or higher video adapter; 65,536 colors, 16-bit or higher.
- Minimum of 128 MB RAM; 256 MB recommended.
- Minimum of 200 MB of free hard disk space.
- To acquire images, the system must have National Instruments image acquisition (IMAQ) hardware and NI-IMAQ 3.0 .

III. Algorithm Design

The present implementation of Palmprint verification algorithm assumes that the acquired Palm of all the individuals are vertically oriented. The main steps of the algorithm in Proposed Image Processing Algorithm are described step by step as follows:-

a) Firstly, the Palm print images are acquired into the system from the created database.

b) The acquired Palm print images are then pre-processed. Pre-processing is done in order to enhance their quality so that they can be used in the subsequent steps.

c) The pre-processing firstly equalize them using histogram equalization.

d) Onto the equalized images the filters are applied in order to highlight the edges of the fingerprint ridge patterns and to smooth them by removing the noise associated with them.

e) During the enrollment phase, the templates (features) are created from the enhanced images and are stored for further reference.

f) During the matching phase first a threshold limit is set.

g) After per-processing of the test images templates are created from them.

h) These templates are then matched with the corresponding Palm print templates stored in the database at the time of enrollment and scores are generated.

i) At the decision level, depending on the scores generated by the matching algorithm and the threshold limit set, decisions are made whether the user is verified or not.

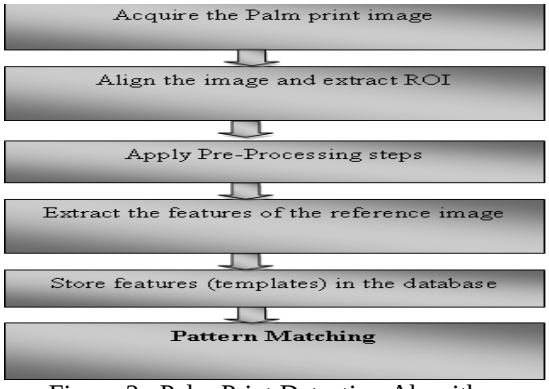


Figure 2 : Palm Print Detection Algorithm

IV. Developing the Script

The original images are acquired in NI vision assistant, and then they are ready for pre processing as per requirements. The different functions can be applied on images that available in processing function window. These processing steps get recorded in the script window. The script records the handing out operations and all parameters. If the same operations are to be performed on other images, the script can be saved and used again. The Palmprint script generated in the NI Vision Assistant [41] is shown in the figure 3.The different steps are as follow:

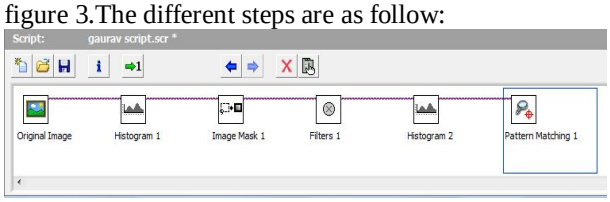
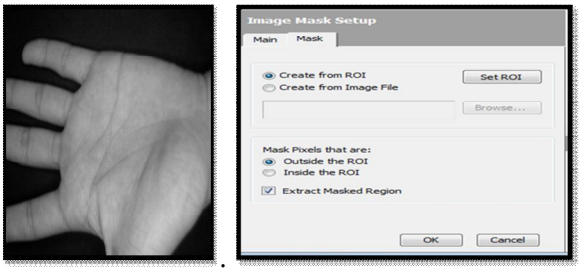
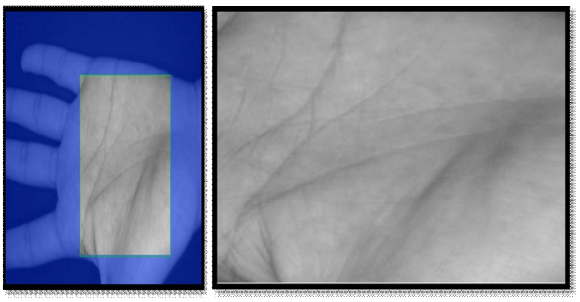


Figure 3: Script Palm print

Verify that the Reposition Region of Interest option is enabled for linking the region of interest specified in this step to a previously defined coordinate system. Link the region of interest to a coordinate system if the position of the object under inspection changes from image to image and you need to adjust the position of the region of interest to match the new location of the object. Now the iris image's can vary from one image to another so we use set coordinate 1 as reference coordinate system.



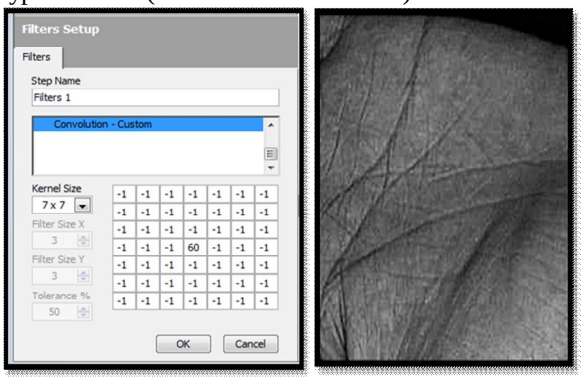
(a) Before masking (b) Masking parameters setup window



(c) Applied Mask (d) Extracted Region

Figure 4: Image Mask setup window Applying Filters

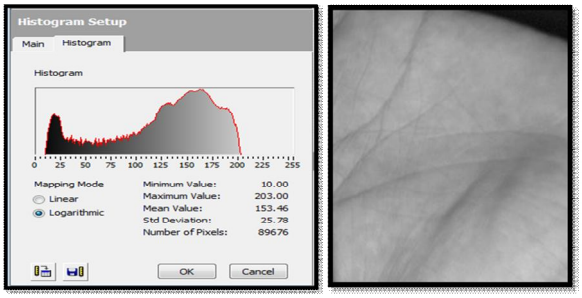
For better extraction of the features from any image it is required that the feature details should be highlighted properly as these features will be utilized in the further image enhancement steps. To reduce the processing the time of the system it is required to extract only the information needed from the image rather than processing the entire image. Filters can be used for preparing an image for this purpose. The filters apply a kernel across the image. A kernel represents a particular pixel and its relationship with the neighboring pixels. The coefficient of each neighborhood pixel specifies the weight of the relationship. The weight of the relationship is specified by the coefficients of each neighbor. Filters are divided into two types: linear (also called convolution) and nonlinear.



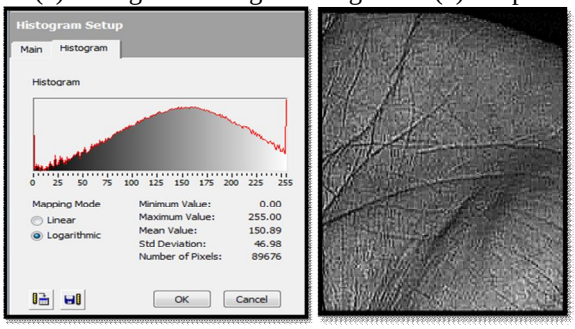
(a) convolution-custom setup window (b) After convolution-custom

Figure 5: Different Filters setup window

The histogram is an image analysis implement which describes the allotment of pixel intensities in an image. This function is used to count the total number of pixels in each grayscale value and graph the results. The histogram is used to establish if the overall intensity of the image is sufficient to carry out the examination task or if the image contains different regions of certain grayscale values. A histogram provides a general description of the appearance of an image and helps identify various components such as background, objects and noise. The Vertical axis of the histogram plot can be shown in a linear or logarithmic scale. In the logarithmic scale the gray level values used by small number of pixels that cannot be visualized using the linear plot can be visualized. In the logarithmic scale, the vertical axis of the histogram gives the logarithmic of the total number of pixels per gray-level value.



(a) Histogram of original image (b) Output image



(c) Histogram after pre- processing algorithm (d) Output image

Figurev6: Histogram set up window

Pattern matching quickly locates regions of a grayscale image that match a known reference pattern, also referred to as a model or a template. It finds template matches regardless of lighting variations, blur, noise and geometric transformations like shifting, rotation and scaling of the template. For pattern matching, first of all a template is created that represents the object we are searching for. Then the pattern matching tool searches for the instances of the template in each acquired image, and calculates the score for each match. This score relates how closely the template resembles the located matches. Most pattern-matching algorithms [1, 6, 7] are successful, regardless of surrounding conditions such as poor lighting and template shift. While traditional pattern-matching techniques have certain time constraints and other limitations, newer techniques relying on "image understanding" are faster and have applications in precision alignment, gauging, inspection, vision-guided motion, and icon verification. The traditional pattern matching techniques include normalized cross-correlation, pyramidal matching, and scale-invariant matching. New pattern matching methods rely on “Image Understanding” techniques to interpret template information. Image understanding refers to processing techniques that generate information about the features of a template. These methods include geometric modeling of images, efficient non-uniform sampling of images, and extraction of template

information that is independent of both rotation and scale. Image-understanding techniques reduce the amount of information needed to fully characterize an image or pattern, which greatly accelerates the search process. In addition, extracting useful information from a template and removing redundant and noisy information provides a more accurate search. A new pattern-matching technique takes advantage of non-uniform sampling. Most images contain information that is redundant, so using all the information in the image to match patterns is both time-intensive and inaccurate. By sampling an image and extracting a few points that represent its overall content, the accuracy and speed of pattern matching is greatly improved.

The problem here occurred was that for each test Image to check whether it is an authorized user or not, it is required to match it with the templates of each enrolled user. So there was a need to add numerous numbers of blocks of pattern matching in the Script.

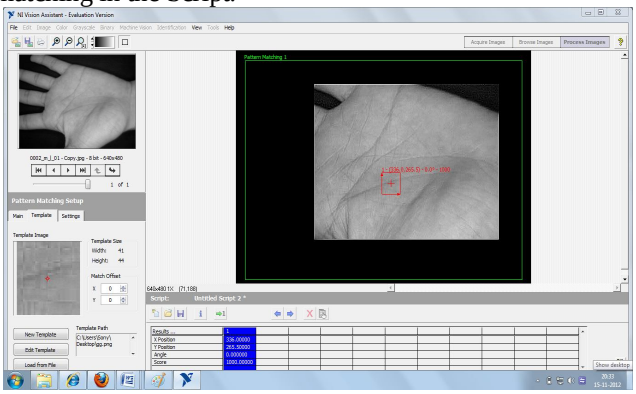


Figure 7: Pattern matching window

V. Response Time of the System

The response time is an important parameter which accounts for the processing speed of the system. In Vision Assistant there is a provision to measure the performance of the created Script by measuring its response time. In order to evaluate the performance of the script the following steps are used:

- Go to the **Tools** option in the menu.
- Then select the performance meter option.

The detailed report of the performance of the script can also be obtained. This is shown is fig.8. In the detailed report the time taken by each step or each function used for image processing is given.

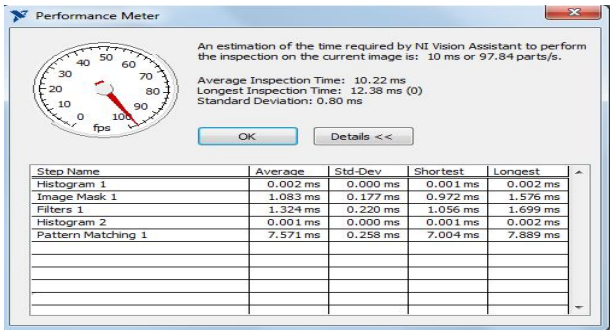


Figure 8: Performance time

VI. Conclusion

The work presented in this paper is the data base processing of the Palmprint Images. An image-based Palmprint verification system has been developed and checked for validity by employing images from a database of 50 Palm prints (5Palmprints from 10 different individuals). To ensure the performance of the automatic identification system to be robust with respect to the quality of Palmprint images, an enhancement algorithm has also been incorporated. The pre-processing of the Palmprint images in the database has been done using NI Vision Assistant. The pre-processing algorithm includes masking, histogram equalization, filtering for smoothing and Pattern matching. From the enhanced images the templates of different sizes are extracted. The input image first pass through the pre-processing steps so that the desired information can be extracted. A threshold limit is set for the system to accept the identity of the valid users. After pre-processing the Pattern matching function compares the two images i.e. the present test image and the corresponding stored template in the database. Pattern matching function generates a matching score. If the score lies within the threshold limit the system accepts the identity of the user otherwise it will reject it. The performance of the developed system is very fast. The success rate of the verification system is highly dependent on the threshold value and size of the template used for the learning stage. During the matching phase the time taken by the geometric matching function is 10 ms, which is very small.

VII. Scope for Future Scope

A Palmprint identification system using Vision Assistant 2009 has been developed. Although a lots of effort has been made for the developed of system, still following points are considered for the improvement of system in future.

This system has been tested with offline database, it is required that as system as identification system, the database should be online.

The present work has been implemented with Palmprint images only it can be extended to hand geometry enhance security as well to measurement.

The algorithm can be extended to identification colored images.

REFERENCES

[1]. Juan Jose Fuertes 1, Carlos M. Travieso2, Miguel A. Ferrer, Jesus B. Alonso ,"Intra-Modal Biometric System Using Hand-Geometry and Palm print Texture",IEEE, 978-1-4244-7402

[2]. J. Daugman, ''High confidence visual recognition of persons by a test of statistical independence,'' IEEE Trans. Pattern Analy. Machine Intel, vol. 15, pp. 1148--1161, Nov. 1993.

[3]. http://ethesis.nitrkl.ac.in/1542/1/m.tech_thesis_20606006.pdf

[4]. A.K. Jain, L. Hong, S. Pankanti, and R. Bole, "An identity–authentication system using fingerprints", Proceedings of the IEEE, 1997, 85, 1365-1388.

[5]. Rajni bala 1, Amar partap Singh 2, "Palm print identification pre- processing algorithm" PROCEEDING OF NCCN-12, 3-4 FEBRUARY, 12

[6]. Palm database-http://biometrics.idealtest.org

[7]. NI Vision Assistant tutorial manual 2009

[8]. LabVIEW Machine Vision and Image Processing Course Manual
[9]. L. Ma, T. Tan, Y. Wang, and D. Zhang, ‘‘Efficient finger recognition by characterizing key local variations,’’ IEEE Trans. Image Processing, vol. 13, no. 6, pp. 739--750, June 2004.
[10]. Rajat Garg, Vikrant Gupta, Vineet Agrawal,”A Biometric Security Based Electronic Gadget Control Using Hand Gestures”,IEEE9781-4244-
[11]. R. C. Gonzalez, R. E. Woods: Digital Image Processing. 2nd Edition, Pearson Education, India (2002).

[12]. Gaurav bansal, Rajni bala,”Palm print authenticate information technology in retail & internet banking”,2012, ISBN 978-93-82062-07-3
[13]. Adams Wai Kin KONG 2007 (Palm print Identification Based on Generalization of Finger Code) Final]. Available phd_thesis_adams_final Report.[Online] pdf.
[14]. Information Forensics and Security, 2006, 1, 125-142 3941
[15]. Gaurav bansal, Rajni bala,”Online retailing & management: technology on palm print biometric”,2012, ISBN 978-93-82062-07-3