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A Security-Enhancing Technology For Using Texture Based Biometric Palm-Print Recognition System

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Abstract— The Biometric recognition refers to the automatic recognition of individuals based on a feature vector(s) derived from their physiological and/or behavioral characteristic. Palmprint recognition is one of the most popular method which has been investigated over last twenty years due to its several advantages such as stable line features, low-resolution imaging, easy acceptance, and high computation. This paper is an attempt which provides an overview of current palmprint research, explaining in particular capture devices, preprocessing, verification algorithms, and palmprint related fusion. This system makes palmprint recognition simpler and more accurate. Unsharp masking is for sharpening the edges while histogram equalization is used to improve the contrast of images. Proposed System using Adaptive Thresholding and 2-D Gabor filter is used to obtain the texture information and two palmprint images are compared in term of their hamming distance based Template matching palmprint recognition. The experimental results show that our method is effective. Various palmprint recognition using Software Simulation MATLAB**.**

Keywords—Biometrics,Palmprint recognition, Unsharp masking, Histogram equalization, Adaptive thresholding, Template matching.

I. INTRODUCTION

Traditionally, passwords or ID cards have been used for applications, ranging from customer/employee verification, computer log –in, time and attendance control, keyless ignition in automobiles. These types of identity recognition methods present serious disadvantages, as they escalating(e.g. identify theft, terrorism). The increasing need for improved and higher security system has been accompanied by a continuous research and commercial growth of biometric related technologies being expected that the global biometric market is to grow at an annual rate of more than 20% through 2012 according to a new market research report.

The palm print recognition system has many advantages over other biometric systems in respect of reliability, low cost and user friendly [1]. Palm print is one of the most reliable means in personal identification because of its stability user acceptance and unique feature to improve the antispoof capacity and to make it tamper proof. Even though Gabor filter can be used to high security zones it involves higher computational cost. In the recent years, a few multispectral palm print systems have been developed for accurate means of authentication..

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Biometrics refers to methods for uniquely recognizing humans based upon physiological or behavioral characteristics. Physiological characteristics are defined as the identification of people. Examples include fingerprints, scars, hand and palm geometry, height, eye which has largely replaced retina and odor/scent. [2]Behavioral characteristics are related to the behavior of a person. Example include gait, and voice. Some researchers have coined the term behaviometrics for this class of biometrics. In other words biometrics is used as a form of access control.

II. TEXTURE BASED BIOMETRIC PALMPRINT RECOGNITION SYSTEM

Fig: 2.1.1: Input image

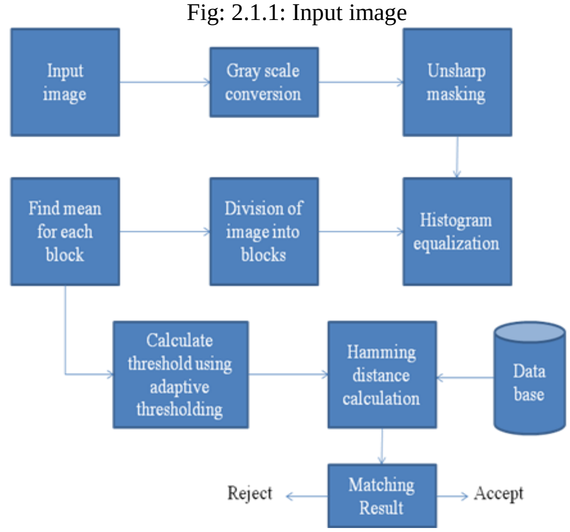

Fig 2.1.2. Block Diagram

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A. Palm Image Acquisition

A Hand biometric authentication system based on the technology which is used as in the multispectral finger print as discussed above, extending the system to the whole hand. [3]

The resulting multispectral data is rich in biometric information providing multiple characteristics of the hand, including: all four fingerprints as well as a partial thumb print, major characteristics of the palm ridges and minutiae, hand shape and skin texture. Each time a hand is placed on the sensor plate

The preprocessing step is being done. The preprocessing is used to segment the centre into blocks for feature extraction.

Pre-processing consists of steps,

- Input Image
- Gray Scale Conversion
- Unsharp masking
- Histogram Equalization
- Division of image into blocks
- Find mean for Each Black
- Calculate Adaptive Thresholding

The algorithms used for boundary extraction and binarizing are similar but detecting key points have tangent based bisector based approaches. The proposed the palmprint image processing Post-processing consists of steps

- adaptive threshold algorithm,
- boundary tracking and automatic positioning palm ROI ,
- Find The Texture Algorithm
- Convert the Template Matching
- feature value Calculation

Feature -processing consists of steps,

- Classification of Palmprint Recognition which guarantee the accuracy and efficiency of the identification systems.

B. Palmprint Pre-processing

A complete block diagram of the proposed system is given in figure.The input palm print color images of various palmprints are captured by an image capturing device. The captured image is in the form of array or matrix of pixels arranged in columns and rows. This image is principally converted into gray scale image by using the following equation:

Fig2.2.1: Pre processed image

G=0.299 x Red +0.587 x Green + 0.114 x Blue ------(1)

To obtain a binary image from Gray level image Otsu's auto-thresholding method is used. From the binary image, the midpoint between fore finger and ring finger is found using 8-neighbourhood to obtain the sub-image from the middle of the palm.

For that consider the number of pixels of an image in row wise (‘X’) and find the midpoint by dividing the number of pixels by two (X/2). From the middle point scan towards right to get the point ‘I’ [B(x, y+1) =1].Move the pointer up from ‘I’ to get the corner point ‘k1’ and move the pointer down from ’I’ to get another corner point ‘k2’. Move the pointer from the point ‘mid’ with the fixed number of pixels towards middle of the palm and position the fixed sized square to crop the image. As the centre of the palm contains more information the region of interest (ROI) or sub-image of size 300 ×300 is cropped from the centre of the palm.

Fig.2.2.2: Region of Interest (ROI) of palmprint

C. Sharpening - Unsharp Mask

The standard tool for sharpening in order to make edges clear and distinct is known as UnSharp Mask filter (called USM). An USM filter cannot create additional detail, but it helps to emphasize texture and enhance the appearance of detail. It performs sharpening using a procedure that subtracts an unsharp version of an image from the original image.

The unsharp filtering technique is also used in other areas such as photographic and printing industries. Unsharp asking filter produces an edge image e(x,y) from an input image i(x,y) via

e(x,y) = i(x,y) – fsmooth(x,y) -------(2)

where fsmooth (x,y) is a smoothed version of i(x,y). The complete unsharp sharpening operator for the unmask Fig.

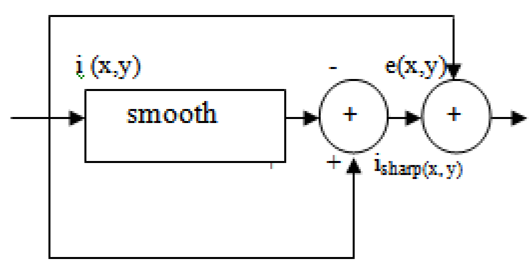

Fig:2.3.1: The complete unsharp filtering operator

The combined equation is,

fsharp(x,y) = f(x,y) + k * g(x,y) ----------(3)

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Where k is a scaling constant. Reasonable values for k fluctuate between 0.2 and 0.7, with the larger values on condition that higher rate of sharpening. In order to extract a sharpened view of the edges, original image is added with the edge image as in equ.3 the edge image is obtained by subtracting the original image with smoothened version of the original image as in equ.2.

D.Histogram Equalization

If Y is the input image, then the histogram for that image is H(Y). Based on the histogram H(Y), the Probability Density Function (PDF) is defined as

p(k) =nk/N = nk / (n0+n1+…+nL-1) for k = 0,1,….L-1 -----(4)

where L is the number of possible intensity values, nk represents the number of pixels that have the gray level k appears on the input image Y, N is the total number of pixels in the input image and, p(k) is associated with input image's histogram and it represents the number of pixels that have a specific intensity Yk. The pictorial appearance of PDF is known as the histogram.

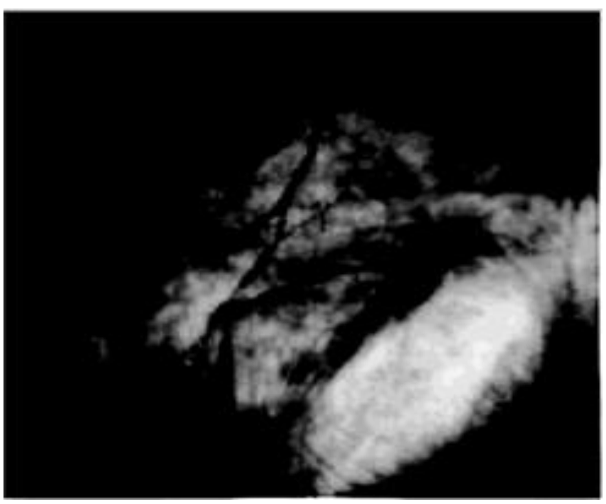

Fig.2.4: Histogram equalized image

f(k)= Y0 + (YL-1 - Y0) . c(k) ---(5)

Where Y0 is the minimum gray level and YL is the maximum gray level. Thus, histogram equalization remaps the input image into the entire dynamic range [Y0, YL-1].

III. THRESHOLDING

Definition- Thresholding is a process of converting a grayscale input image to a bi-level image by using an optimal threshold.

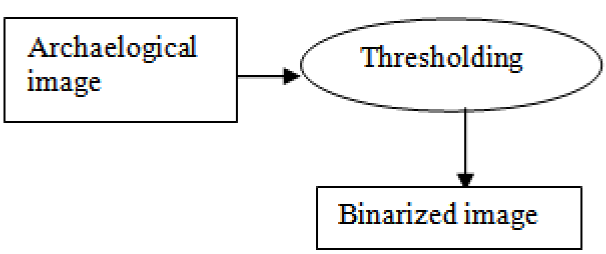

Fig. 3.1: The process of thresholding along with its inputs and outputs.

The purpose of thresholding is to extract those pixels from some image which represent an *object* (either text or other line image data such as graphs, maps).Though the information is binary [4] the pixels represent a range of intensity. Thus the objective of binarization is to mark pixels that belong to true foreground regions with a single intensity and background regions with different intensities.

A. Thresholding algorithms

For a thresholding algorithm to be effective, it is necessary to have logical and semantic content. Thresholding algorithms can be classified into two types.

1. Global thresholding algorithms
2. Local or Adaptive thresholding algorithms

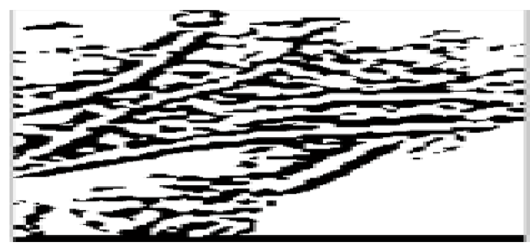

Fig3.2: Adaptive thresholding contrast enhanced image

In global thresholding, a single threshold for all the image pixels is used. Global thresholding could be used when the pixel values of the components and that of background are fairly steady in their respective values in the entire image.

IV. PALMPRINT FEATURE EXTRACTION WITH TEXTURE ANALYSIS

In generally, a palmprint contains geometries like principal lines, wrinkles and ridges where the principle lines can be extracted by using stack filter algorithm. However this principal line does not provide high accuracy [5] because many people may have similar principle lines. Wrinkles in the palmprint play an significant role in palmprint identification but accurately extracting them is a difficult task. This prompts us to apply texture analysis to palmprint recognition. The Gabor filter [6] is an effective tool that can be used for texture analysis, and the general form of which is represented using the following formula,

$$G(x,y,\theta,u,\sigma)= \frac{1}{2\pi\sigma^2} \exp\left\{\frac{x^2+y^2}{2\sigma^2}\right\} \exp\{2\pi i(ux\cos\theta + uy\sin\theta)\}$$

---------(6)

where$i$= -1 ; *u* is the frequency of the sinusoidal wave;*q* controls the orientation of the function and *s* is the standard deviation of the Gaussian envelope.

Gabor filters are generally used in texture analysis and biometrics .In order to provide more robust to brightness, the Gabor filter be turned to zero DC by using the following formula

$$G(x,y,\theta,u,\sigma)=G[x,y,\theta,u,\sigma]-\frac{\sum_{i=-n}^{n}\sum_{j=-n}^{n} G[i,j,\theta,u,\sigma]}{(2n+1)^2}$$
-------(7)

Where $(2n+1)^2$ represents the size of the filter. In fact, the imaginary part of the Gabor filter automatically has zero DC because of odd symmetry. This adjusted Gabor filter will convolute with the central part of a palmprint.

V. TEMPLATE GENERATION

The principal lines extracted images are divided into 9×9 blocks of size 20×20. These blocks are then traced to create feature vector. While generating a template [7] the feature vector bit is set to binary value such as '1'if the concerned block contain the line else the feature vector bit is set to '0' which represents there exist no lines in the block concerned.

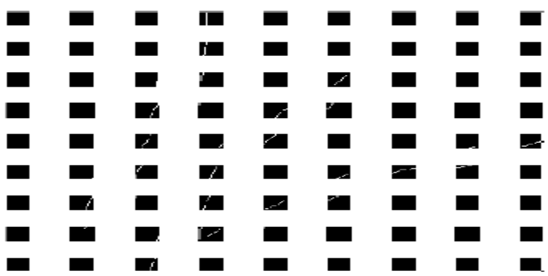

Fig.5.1: The resultant image is divided into Blocks

A. Matching

For matching, test sample feature vector is compared with feature vector of the enrolled templates and checked with that template from which maximum similarity is obtained by taking the average similarity of all samples of particular user. Next matching is successful if the average similarity is greater than the threshold value otherwise unsuccessful match.

For identification, let us assume, TP and EP is the matrix of test palmprint sample and enrolled palmprint database. The images are partitioned into m sub-blocks respectively as.

TP = tp1,1 tp1,2 tp1,3,…….tp1,m
e1,1 e1,2 ……. e1,m
e2,1 e2,2 ……..e2,m
EP = en,1 en,2 ……. en, m

In the above equation 'm' represents the number of enrolled templates in database. The test sample palmprint TP is assumed to be matched with enrolled template 'e' if the maximum similarity is obtained by taking average similarity of all samples of particular user. If the average similarity is greater than the threshold value the matching is successful otherwise unsuccessful.

VI. CONCLUSION

Biometrics is being used all over the globe and is undergoing constant development. A palmprint is considered as a texture based image, and the texture information is captured by using an adjusted Gabor filter. Human palmprint and hand geometry has proved to be a reliable biometric. Thus by using adaptive thresholding and template matching technique high efficiency is produced. The accuracy rate reached is 98%.

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