

# Exploring the Finger Dorsal Pattern for human Identification using LBP-Haar Decomposition and 1-D Log Gabor Filter

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**Abstract**— In biometric Identification method dorsal pattern of finger also unique including major finger pattern and minor finger pattern (knuckle pattern) so there is need to develop an approach which is contactless and efficient than conventional fingerprint identification. This method is used to explore possibilities of finger dorsal pattern in biometric identification with stability and uniqueness. To investigate the possibility of employing major finger knuckle images and minor finger knuckle images for biometric identification. To reduce Equal Error Rate(EER) and to improve on Decidability Index(DI) by technique first Local Binary pattern( LBP)- Haar decomposition and Principal Component Analysis ( PCA) second 1-D Log Gabor Filter and Artificial Neural Network(ANN) .

**Index Terms**— Biometric Identification, Knuckle Pattern,

## I. INTRODUCTION

Finger Dorsal pattern is new biometric tool for identification and prominent option for fingerprint recognition. Knuckle pattern (major and minor) is taken into consideration as into of this system. In this paper, standard database of knuckle pattern is use which is available on internet. Total 503 subjects image is available.

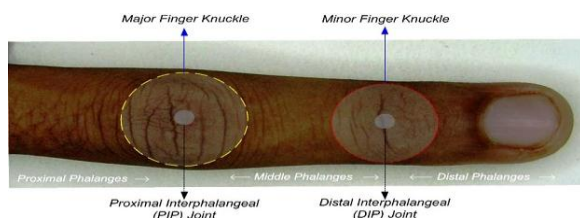


Fig.1. Image sample from a typical finger dorsal surface

Knuckle image with different environmental condition and time is captured then preprocessing on database image

*Manuscript received Feb, 2016.*

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important to select Region of interest mention in fig:1. Region of interest mention in fig 2, fig.3. Preprocessing consist of segmentation, Fingertip detection, background removal, edge detection on acquired image.



Fig:2 Input Image Minor Finger Knuckle pattern



Fig: 3 Input Image Minor Finger Knuckle pattern

## II. METHODOLOGY

### A. Histogram

Implementation consists of Histogram of acquired image is taken which consists of grayscale image for input to the feature extraction technique. Histogram having different gray level intensity.

Histogram of digital image with grayscale in range 0 to (L-1) is discrete function

$$h[r_k]=n_k$$

$k$  -kth grayscale level,

$n_k$  – number of pixels,

B. Haar- Discrete wavelet Transform

One level Decomposition of Image is take place and image in transform into sub-image. With Left top image called Approximation A1 and other (component) called detail.

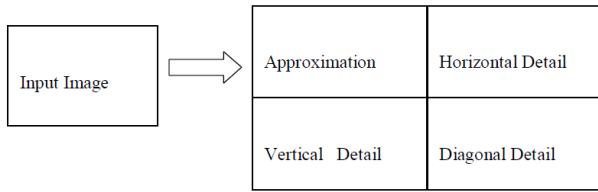


Fig4: Wavelet Decomposition of a 2D Image

C. Feature Extraction

In feature extraction method many techniques is useful this paper illustrate the local binary pattern and 1D Log Gabor Filter

1. local binary pattern

grayscale image is input to the local binary pattern for feature extraction with the help of center pixels and neighbor pixels[1] Center pixel  $Z_c$  is computed with neighbored pixels  $Z_p$  in equ.(1)

$$h(Z_p - Z_c) = \begin{cases} 1, & Z_p - Z_c \geq 0 \\ 0, & \text{otherwise} \end{cases} \dots\dots(1)$$

2. 1D Log Gabor Filter

Segmented image is filtered by using this feature extraction approach i.e  $H(\omega, \phi)$

$$H(\omega, \phi) = e^{-\frac{(\ln(\omega/\omega_0))^2}{2(\ln(2\pi\sigma_f/\omega_0))^2}} \cdot e^{-\frac{(\phi - \phi_0)^2}{2\sigma_\phi^2}} \dots\dots(2)$$

D. Recognition Algorithm

1. Principal Component Analysis

Principal Component Analysis is linear transform with statistical approach used to reduction in data dimension or data correlation. PCA is pattern recognition algorithm for matching between test image of knuckle pattern and database image.

2. Artificial Neural Networks

Artificial Neural Network is feed forward network easily implement in hardware. This is non-linear Analytical technique. 2 D color image array with RGB array is computed into 1 D array with all red component, all green component, all blue component.

III. MATH

$$\text{False Negative} = \frac{\text{Numer of missed false}}{\text{total number of actual Knuckle}}$$

$$\text{False Positive} = \frac{\text{Numer of Incorrect knuckles}}{\text{total number of actual Knuckle}}$$

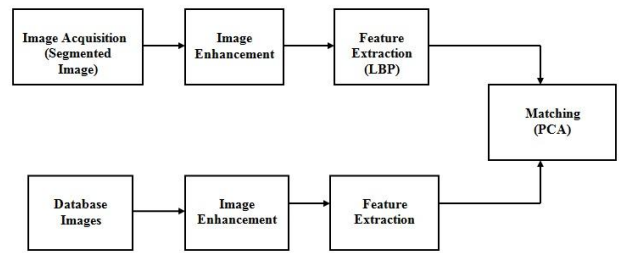


Fig5 : Finger Dorsal pattern Identification using Local Binary Pattern (LBP) and Principal Component Analysis (PCA)

Fig 5 describes recognition flow with segmented image as input use for image Enhancement with grayscale form then computed histogram and images is computed into sub-image. Approximation A1 with low frequency component taken as having higher information. Feature is extracted by LBP Scheme and pass to Principal Component Analysis (PCA). There is comparison between input image and database image then minimum difference is consider as matching.

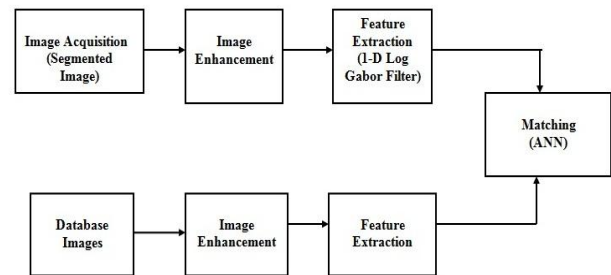
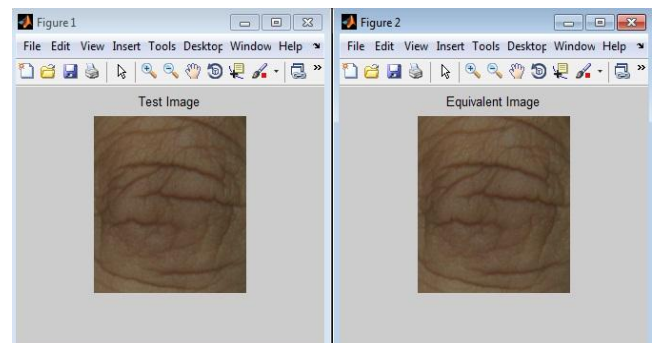


Fig6: Finger Dorsal pattern identification using 1-D Log Gabor Filter and Artificial Neural Network (ANN)

Segmented images is taken as input from standard database corresponding grayscale image is obtained for Histogram transformation and combined Histogram is computed. Feature is extracted by 1-D Log Gabor Filter technique with hamming distance then pass to Artificial Neural Network For recognition. There is comparison between input image and database image then minimum difference is consider as matching.

IV. RESULT



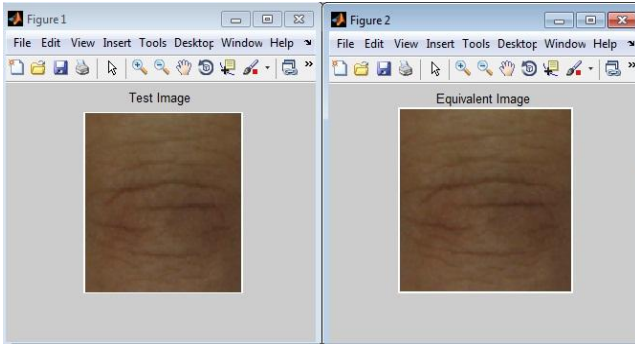


Fig 7: Test Image and Equivalent Image for LBP-Haar Decomposition

Local Binary pattern (LPB)-Haar Decomposition scheme gives the extracted features of both major finger knuckle image and minor finger knuckle image form training database image which extracted features is passed to Principal Component Analysis Classifier for recognition from test database by using minimum distance is found. When input image (test image) tested then it is check matching score with the training database image it will calculated the difference of all training database image and then selected as equivalent image. Fig 7: Test Image and Equivalent Image for LBP-Haar Decomposition

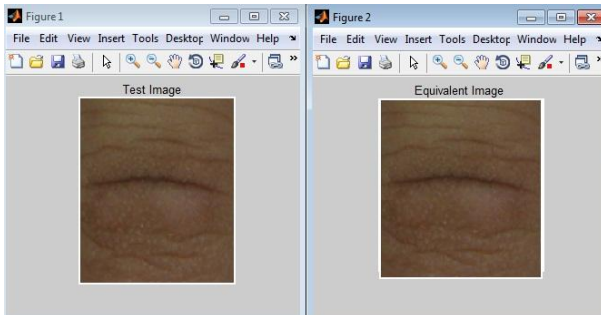
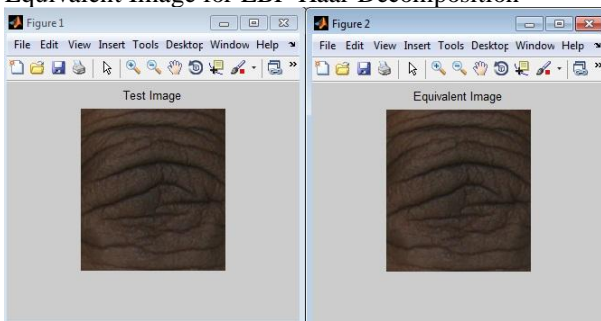


Fig:8 Test Image and Equivalent Image of Artificial neural network

1-D Log Gabor Filter technique is used for feature extraction with edge extraction. Hamming distance is calculated by using this filter. Signal is independent of mean value. Artificial neural network is feed- forward network useful for pattern recognition. ANN is non-linear orthogonal technique. Extracted features is passed to ANN. 2-D image array with RGB Component is transform into 1-D array for recognition. Fig 8: Test Image and Equivalent Image of 1-D Log Gabor Filter

A. Comparison between 1 Log Gabor Filter scheme and LBP-Haar scheme

Parameter	Protocol A	Protocol B
Equal Error Rate (major finger) %	11.14	9.73
Equal Error Rate (minor finger)%	16.34	13.84
Decidability Index (major finger)	0.8758	0.9321
Decidability Index (minor finger)	0.8617	0.8339

V. CONCLUSION

This paper describes the use of knuckle pattern in biometric identification is strong option for fingerprint approach. Equal Error rate for Protocol A 11.14% and 16.34% and Protocol B is 9.73% and 13.84% Decidability Index is increased to 0.8758 and 0.8617 for Protocol A and 0.9321, 0.8339 for Protocol B. Finger Knuckle pattern can be used in biometric identification , evidence in court law, security system, UID Number.

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