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Innovative Haar-LBP scheme based Human Identification using Finger knuckle pattern

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Abstract—**Like human fingerprints finger dorsal pattern is also unique so I am using that dorsal patterns for Human Identification. The human forensics and biometrics are application of this new biometric method. The surface between proximal phalanx joining middle phalanx are useful to form knuckle pattern which is helpful for human identification. An automated approach contains key steps for region of interest segmentation, image normalization, and enhancement. This paper also use available database of 50 different subjects, to explore automated major finger knuckle pattern matching scheme over the conventional finger knuckle identification and contact based finger print identification. Many questions associated with stability and uniqueness of knuckle patterns should be addressed before knuckle pattern/image evidence can be admissible as supportive evidence in a court. Index Terms—Finger knuckle biometrics, major finger knuckle, finger knuckle, finger dorsal biometrics, knuckle segmentation, biometrics fusion.**

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INTRODUCTION

This paper explains a new way to develop secure human identification methods that are reliable and convenient. Hand-based biometrics analyze many features that are unique and they are becoming more convenient and user friendly with the introduction of peg-free and touch less imaging. The anatomy of the human hand is quite complicated. In particular, the image-pattern formation from process of finger-knuckle bending is more unique and it makes different biometric identifier. The Structure of our fingers allows them to bend forward and resist backward motion. Therefore, finger-knuckle patterns are promising platform further developments in touch less personal identification. The advantages of employing finger-knuckle imaging are numerous.

First, user acceptance of outer-palm surface imaging is very high since, unlike for fingerprints, there is no stigma of potential criminal investigation associated with this approach. Second, the finger geometry can be acquired simultaneously from the same image and employed to improve the system's performance. Normalized images of knuckle patterns are highly useful for identification purposes. Phase information can be extracted from knuckle creases and lines using comparative responses from the even and odd components of the Gabor filters and used to form a 'Knuckle Code,' Alternatively, Knuckle Code yields promising results that are comparable to or better than several other current biometric approaches.

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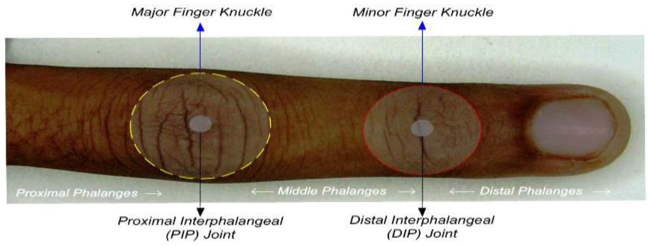

Fig 1. Image sample from a typical finger dorsal surface image identifying the *major* and *knuckle* pattern regions with respect to the PIP/DIP joints.

A comparative performance study using individual knuckle images from the five fingers of one hand suggests that middle and ring fingers yield highly discriminate information and achieve the best performance compared to the thumb, index, or little finger.

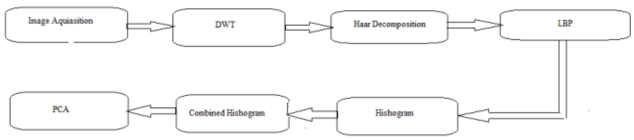

Fig 2: Simplified Block Diagram illustrating key steps in matching of major finger knuckle test images with equivalent images

To develop automated knuckle patterns achieve promising results with improved performance for conventional finger knuckle identification. I. Methodology Image Acquisition Images of 50 subjects acquire with the size 160*180 with same environmental condition and brightness[4].

I. Methodology:

A. Image Acquisition

Images of 50 subjects are taken from the database and it was captured with same environmental condition and brightness using particular setup for further process. Here standard database is used so preprocessing is avoided.

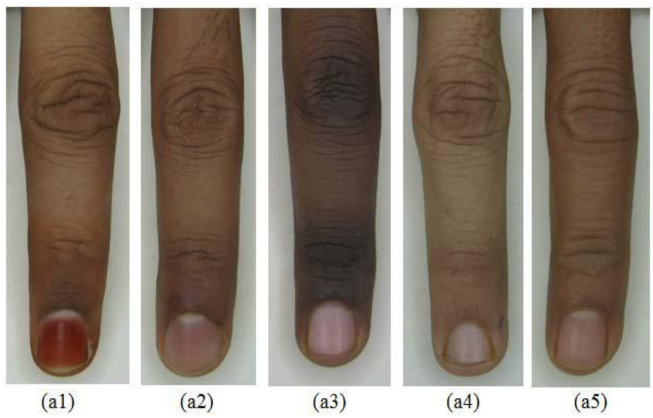

Fig 3: Images taken by 5 different subjects

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B. Haar- DWT

The frequency domain transform we applied in this research is Haar-DWT, the simplest DWT. A 2-D Haar-DWT has two operations: First horizontal operation and second the vertical one. Procedures for a 2-D Haar-DWT are containing for steps:

Step 1: At first, left to right scanning of pixels then addition and subtraction operations on neighboring pixels. Left side store sum and right side store difference in Figure 4. The pixel sums represent the low frequency part (denoted as symbol L) while the pixel differences represent the high frequency part of the original image (denoted as symbol H).

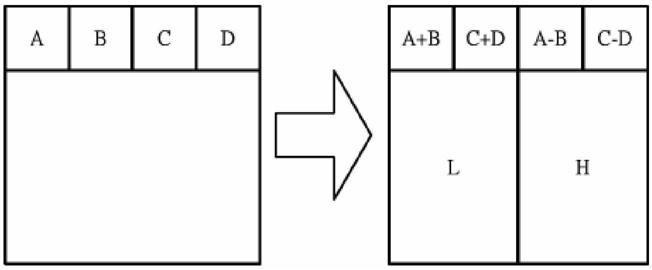


Fig 4: Horizontal operation on first row

Step 2: Secondly, scan the pixels from top to bottom in vertical direction. Perform the addition and subtraction operations with neighboring pixels and then store the sum on the top and the difference on the bottom as illustrated in Figure 5. Repeat the operation .We will obtain LL, HL, LH, and HH 4 sub-bands respectively. The LL sub-band contains low frequency part so appears like original image.

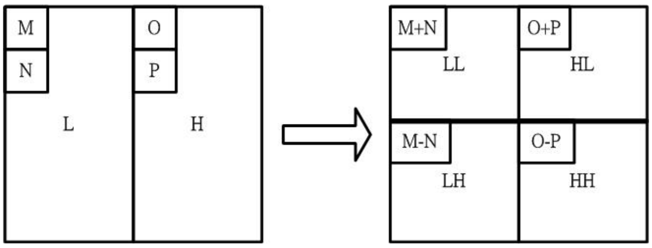


Fig 5: Vertical Operation

C. Local Binary Patterns(LBP)

The LBP encoding can represent multi-scale appearances. The binary patterns for every pixel centered at zc, with neighboring/surrounding pixels z p, is obtained as follows:

$$h\,(z_p - z_c) = \begin{cases} 1, z_p - z_c \geq 0 \\ 0, Otherwise \end{cases}$$

The LBP code for the having pixel zc is generated by assign binomial weight 2p to the above equation.

$$LBP\,(z_r) = \sum_{p=0}^{P-1} h\,(z_p - z_c)2^p$$

Where in a local region containing total pixels p and p = 0, 1, 2 . . . P - 1. LBP descriptors can be generated by PBP encoded images of knuckle pattern. The histogram information from each of the local regions is concatenated to extract the LBP descriptors. The similarity between two LBP descriptors is computed by comparing histogram intersection similarity measure as follows:

$$S_G^{1,2} = \sum_{i=1}^{W} min\left(g_i^1, g_i^2\right)$$

Where w is the number of histogram bins while g1 and g2 represent LBP descriptors from the enhanced knuckle images. There are several variants of LBP that may be explored for the matching of knuckle image patterns. Instead of center pixel, mean value of neighbor pixels are used for binarization in Improved LBP . Image Enhancement take place by Histogram and Combined Histogram equalization.

Uniform histogram of output image can obtained by gray scale transformation. A common approach is Histogram Matching (HM). For color mapping there is two algorithms having outcoms as mentioned below:

First, it is limited to only two histograms and cannot deal with multiple histograms simultaneously.

Second, HM approximates the optimal solution with respect to the L1 norm over the cumulative histogram pair , but is unable to provide an optimal solution for other metrics.

Finally, the HM solution is designed for continuous PDFs and may produce non optimal solutions in the discrete histogram case. E. Knuckle Matching Using Principal Component Analysis(PCA). PCA is sophisticated technique for matching has been called, 'one of the most important results from applied linear algebra' and perhaps its most common use is as the first step in trying to analyze large data sets. Some of the other common applications include; de-noising signals, blind source separation, and data compression. In general terms.PCA is used to reduce Sets of large data is used in

C. Figures

FIG 6: INPUT IMAGE

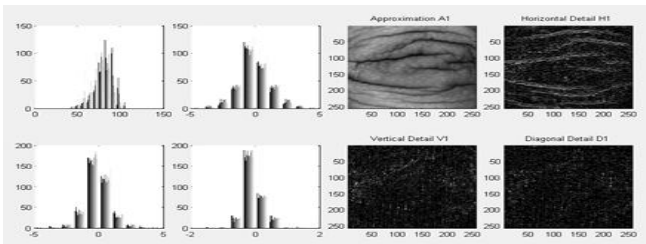
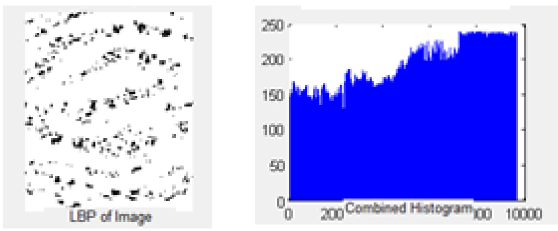


FIG 7: HISTOGRAM OF IMAGE INCLUDING APROXIMATION A1, HORIZONTAL DETAIL H1, VERTICAL DETAIL V1, DIAGONAL DETAIL D1



8 (a) 8(b)

Fig: 8 (a) LBP of Input Image, Fig 8 (b) Combined Histogram of Image

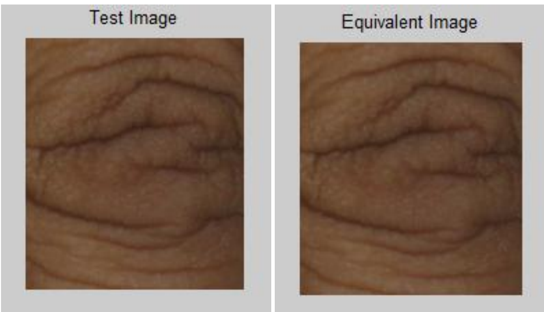


Fig 9: test Image and Equivalent Matched Image

II. Math:

In this paper we take the 40 image training set and after apply 5 different images, that is combination of known and unknown testing images. After apply our methodology we get 3 match and 2 mis match images. So we know that

$FAR= \{Mismatch/ (Match + Mismatch)\}$

$FRR= \{Match/ (Match + Mismatch)\}$

$FAR= \{3/ (7+3)\} =0.30$

$FRR= \{7/ (7+3)\} =0.70$

III.Conclusion:

This project has investigate the possibility of employing finger knuckle (major) images for the biometric identification. In this paper LBP-Haar and PCA scheme has been quite successful and higher matching accuracy is acheived. on the database of 50 subjects, can achieve promising performance from only using contactless finger knuckle images. The experimental results reported in this project also suggest that the use of major finger knuckle images can help to significantly improve the performance that may not be possible by using major finger knuckle images alone. Two finger joints, i.e., PIP and DIP joint as shown in figure 1. Availability of such images in public domain will serve as useful evidence to favorably argue on suspects/ offenders for forensic and law-enforcement applications[2]. Accurate segmentation of stable major finger knuckle regions is significantly important as it can control the achievable identification accuracy from the finger dorsal images. This can be attributed to the use of database from a number of subjects (50), under varying imaging conditions (indoor and also outdoor environment) and more importantly to the use of contactless imaging which generally produces large intra-class variations. Although much more work remains to be done, the results presented in this paper indicate that the human identification using ‘’ finger knuckle images can constitute a promising addition to the biometrics security, especially for image forensics and surveillance applications

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