Identification of Suspects using Finger Knuckle Patterns in Biometric Fusions

P Diviya[1] | K Logapriya[2] | G Nancy Febiyana[3] | M Sivashankari[4] | R Dinesh Kumar[5]

[1,2,3,4] UG Scholars, [5]Professor,Dept of CSE, KTVR Knowledge Park for Engineering and Technology, Coimbatore, India)
(vp.diviya@gmail.com[1], logupriyak@gmail.com[2], nancyfebiyana@gmail.com[3], sivashankarimoorthy@gmail.com[4], me.dineshkumar@gmail.com[5])

Abstract— *Verifying Human Identities using major finger knuckle and minor finger knuckle has increased interesting with the human forensics. Major finger knuckle patterns consist of proximal phalanx and middle phalanx and minor finger knuckle patterns consists of middle phalanx and distal phalanx. In investigation both major and minor finger knuckle patterns are used along with thumb finger. The finger knuckle can be used in self-sufficient biometric system in which the result is more accurate and typical. It involves the steps in interest segmentation, image normalization, enhancement, vigorous matching for image difference. Here, the databases are used for both finger knuckle images which is visible. The minor finger knuckle is use to extensively improve the performance of the predictable finger knuckle identification and major finger knuckle image used for high accuracy. This paper presents the correct of reliability of finger knuckle patterns. Knuckle pattern can be acceptable as evidence in a court of law. The experimental result provides new insight on the finger knuckle pattern and to utilize finger knuckle patterns in forensics and biometric applications.*

Keywords— Knuckle patterns; Image Segmentation; Normalization; Enhancement

I.Introduction

A programmed identification of humans using their distinctive anatomical characteristics has been increased for investigation in human observation and figure forensics. Arising general programs that necessitate accurate, online and large scale identification is motivated project which identify the persons among a billion population using their fingerprints, facial expression and iris images. A collection of biometrics in large scale identification problems is not only restricted by the personality of the experience something but also acquired by the user-convenience. The finger knuckles images can be concurrently acquire the fingerprint images and no additional difficulty to the users. The finger-vein images can have some unconventional in existing fingerprint images by using the infrared based intrusive imaging requirement for finger-vein imaging. Finger knuckle images can obtain an adding up of external imaging cameras which finger dorsal images and coordinate the pattern with external software. The nature of information focuses on this paper used for investigates the possibility of using both major and minor finger knuckle pattern for biometric fusion identification

Fig 1: Sample images with knuckle patterns (a) gesture (b) emotions (c) converting video and surveillance (d) roburing in mall

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Exact identification can be used for numerous applications includes forensics and identification of suspects using both major and minor finger knuckle.

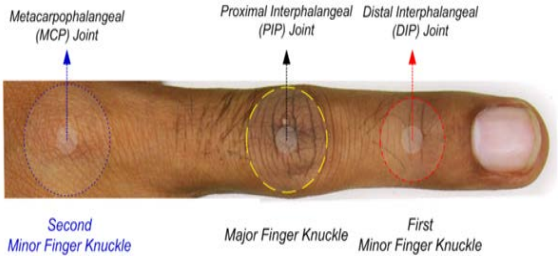


Fig 2: Images for dorsal finger patterns

The lawful issues relating to the consistency of finger knuckle image patterns will largely be judged in the courtrooms. In addition to their uniqueness and their stability over a time stage must also be recognized.

A normal human being has 3 bones and 3 joints except thumb and it has 2 bone segments and 2 joints. These segments are known as phalanges. The proximal phalanges (hand) are the bones that are found at the bottom

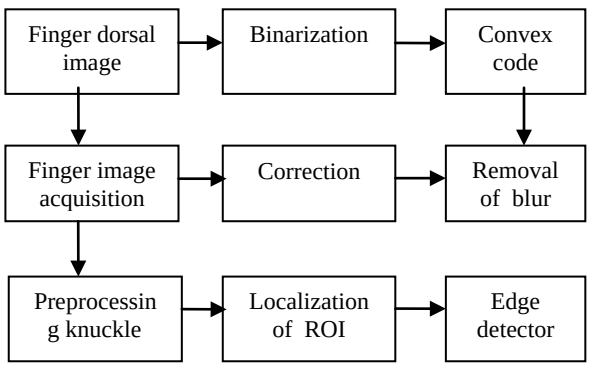
of the finger, also known as knuckles. The middle phalanges are unique and act as an intermediate to the bones located in the finger. The distals phalanges are the fingertips. The thumb is a single digit in the hand. In this paper the major finger knuckle can contain block of hair but does not suffer from such problem the matching result from both knuckle pattern engaged to improve the reliability and accuracy based biometric identification.

A. Related works

The personal identification system using knuckle prints operate in two modes namely enrolment stage and identification phase. During the enrolment stage, some knuckle pattern of the persons are obtained then the FKP(Finger Knuckle Pattern) are passed to the system. The piece of image from the system are taken by knuckle pattern are passed through pre-processing and feature extraction to produce the templates which are then stored in the database. In the recognition mode, the query knuckle print image is approved to the system. These subject knuckle prints are passed through pre-processing and feature extraction block. The extract features from the query knuckle print are then comparing with template stored in the database in order to find the accurate match. A distance calculate is used to find the close match between the query knuckle feature and the template path stored in the database. Key hand-outs are explained as:

a. This paper includes the concept of major and minor finger knuckle pattern for human identification are used to combine the improvement of performance and accuracy of the image. In addition this thumb finger also wears for similar accuracy.
b. The finger knuckle patterns in image forensics for law enforcement and national applications. Hence the knuckle pattern can also be acceptable as a piece of evidence in courts.
c. It also provides widely available databases on both finger knuckle pattern from 503 different subjects.

This idea which also explain about the segmentation and image enhancement and also includes the feature extraction work of image with a variety of accomplish combination major and minor finger knuckle pattern. It also converse about the strength of an image.



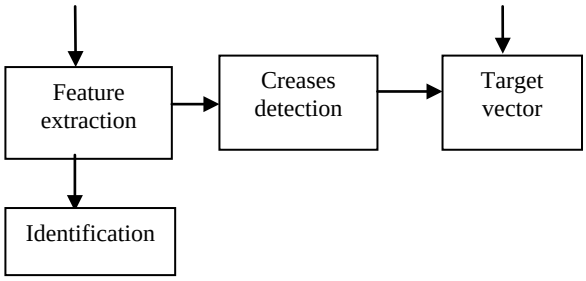


Fig 2: A block diagram for dorsal pattern

II . Finger Image Acquisition

In the Finger Image Acquisition the backside of finger is to be acquired using web cam or smart phone or digital camera. An acquisition system has been developed for the collection of finger-back images. A very available imaging system is created. This imaging system uses a web camera focused against a white background under uniform illumination. The camera has been set and fixed at a suitable distance from the imaging Surface

III. Pre-processing for Feature Extraction

Each of these images requires localization of region of interest for the feature removal. The region of interest is having highest knuckle crease. An ROI (Region of Interest) can be crop from the image for reliable feature removal and matching. This gives segmented finger knuckle image.

The image is captured it is pre-processed to obtain only the area information of the FKP. The full steps for pre-processing process are as follows first; apply a Gaussian smoothing operation to the original image. Second, determine the X-axis of the coordinate system fitted from the bottom boundary of the finger; the bottom boundary of the finger can be easily extracted by a edge detector. Third, determine the Y-axis of the coordinate system by applying an edge detector on the cropped sub-image extracted from the image original based on X- axis, and then discover the convex way code system.

A. Advanced Local binary patterns

The local binary pattern which encodes represents multi-scale texture appearances. Each pixel is centered ac X_C and the neighboring pixel as X_P. It can be written as

$$h(Xp - Xc) = \begin{Bmatrix} 1, Xp - Xc \geq 0 \\ 0, otherwise \end{Bmatrix}$$

X_c - centered pixel
X_p - Neighboring pixel

Superior LBP(Local Binary Patterns) is one variant that uses mean value for neighborhood pixel of binarization, instead of center value used in LBP.

LBP enables RGB to gray level center pixels. Its more robust to removal of noise.

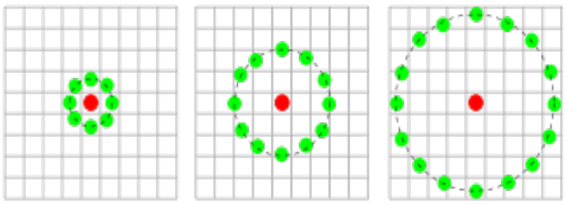


Fig 3: Texture of Local Binary pattern

B. 1-D Log-Gabor filter

This approach is used to extract the local phase information from the enhanced finger images.

$$Srs = \frac{\sum_{a=1}^{x}\sum_{b=1}^{y}\{r_i(d,e) \oplus s_i(d,e) + r_m(d,e) \oplus s_m(d,e)\}}{2 \times d \times e}$$

The knuckle image generated by normalized Hamming distance where S_{rs} represents complex binary, r and s represents bit wise knuckle template.⊕ represents Hamming distance operator.

C. Band limited phase only correlation

This approach is determined to establish the similarity of the spectral domain and to minimize the influence from the matching of components in two images. Hence in this approach the image can be extracted by using 2D fast fourier transform is used. It also includes the concept of correlation which is used for joining the extracted images into a single and accurate image.

IV. Knuckle Feature Extraction

The knuckle image mainly consists of curled line. Knuckle curled lines and crumple are to be detect. In feature extraction, first the aim vector is created. Aim vector is n x m matrix with corner to corner values are one and all others are zeros. The purpose of feature removal is to dig out the significant features of images.

V. Identification

Identification is the final application portion of the system it is used to identify the name of the user. The input feature vector is extracted from the user input image file. The binarized templates generated from every finger knuckle image is subjected to template matching to ascertain the similarity between claimed user identity and the input template(s) stored in the enrollment database. The degree of the similarity or the dissimilarity between two templates is determined using the Hamming distance.

VI. Experimental results

The experiments were done in two phases to provide the usefulness of major and minor finger knuckle patterns for the biometric authentication. The database of 250 middle finger dorsal images acquired from 503 subjects was utilized to provide the superiority of four matchers considered in this work. The finger imaging is setup in the outdoor and the indoor environment for the human beings. This approach can be more realistic experiments. Therefore comparative performance for the verification problem using minor and major finger knuckle was further investigated on the full finger knuckle database from 503 subjects using two best matches. Every dorsal image were engaged to automatically segment major and minor finger image of 196 X 824 pixels size are used for comparison and performance progress

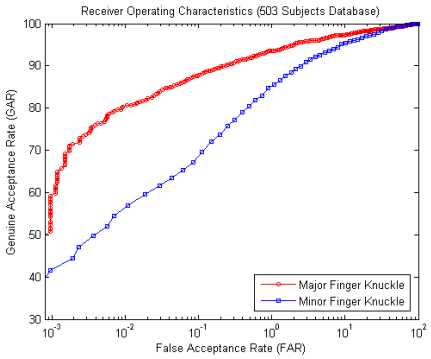


Fig 4: ROC diagram for knuckle pattern

This graph represents the ROC from the protocol for matching. The mixture of similar score using biometric fusion can considerably improve the performance. The verification accuracy between two assembly images is relatively capable. In biometrics, the picture of a security system imperfectly verifying or identifying an unauthorized person to avoid this band limited on phase only correlation are used.

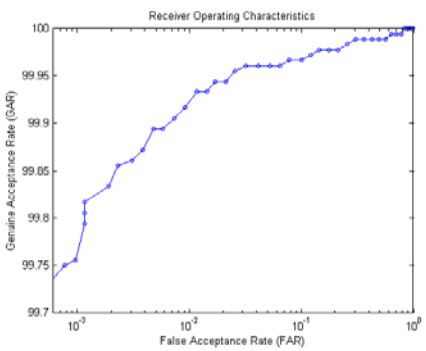
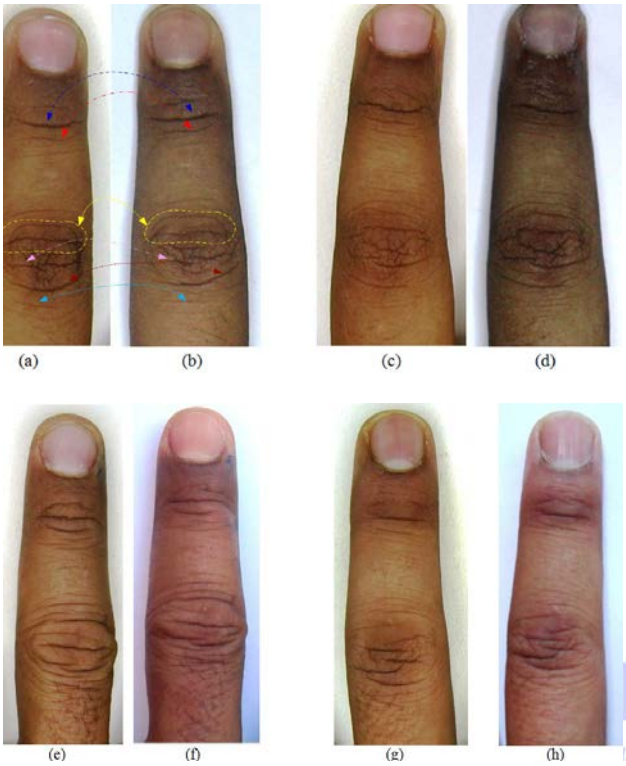


Fig 5: Diagram for False Acceptance Rate

The above graph which represents the presentation of various matching combination of an image. The experimental results obtain advantage and remuneration for using minor finger knuckle rather than major finger.



In the above finger images the fig (a),(c),(e),(g)which represents the imaging in the indoor environment and (b),(d),(f),(h) which represents the imaging in the outdoor environment. The changes in image of second session is caused due to the imaging distance and the environment.

V. Stability of finger knuckle pattern

The both finger knuckle pattern which gives an essential properties of uniqueness and constancy to serve a new physiological pattern in biometric. Stability of knuckle pattern characteristics to serve as loyal biometric, particularly for forensic applications where the time period for matching the suspects could be short interval of time. The knuckle patterns can be collect from the individuals using the two occasions. To get a reliability of finger knuckle from the dorsal image of dissimilar subject in the interval and these images can be imitate. Thus the above mentioned shapes of the creases and line curve of major knuckle and the minor knuckle are stable of at different age group and also it improves the performance of the knuckle pattern. In the case of any accident occurs to the fingers the behavior of thumb is used in additional matching process.

VI. Conclusion and future work

This paper successfully investigated the possibility use minor and major finger knuckle pattern for the high matching accuracy. To identify high matching accuracy segmentation, normalization and enhancement process are suggested. The two joints namely PIP and DIP are used to prevent from dislocation and sub luxation. This process which includes knot, thumb extensor tendinous attachments and biometric action of muscles. Accurate segmentation is simultaneously important for high matching precision for identification from the finger dorsal images. The results achieved for the experiment by using finger knuckle is higher which compared to the result of fingerprint. The large number of databases is used for different imaging situation. The human identification using finger knuckle pattern can be used as an addition biometric security and also used for the image forensics and surveillance applications. Therefore conclusion on future attempt is required less controlled finger image like reduced difference, smear and in excess of diffusion can be achieved. Though much more work to be complete the results available in this paper indicate that the human recognition using both finger knuckle images can comprise a promising addition to the high amount of safety, mainly for image forensics and inspection applications.

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