Human Identification Using Finger Dorsal Pattern

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Abstract— In human forensics and biometrics identification of human using finger knuckle pattern is generating interest. Previously in biometrics, human identification is only done by using major finger knuckle images which is formed on finger dorsal surface by joining proximal phalanx and middle phalanx bones. This system also possible to use minor finger knuckle images which formed on finger dorsal surface joining distal phalanx and middle phalanx bones. The minor finger knuckle pattern is either used independently in biometrics or to improve performance of major finger knuckle pattern. A completely automated approach for the minor finger knuckle identification is developed by using key steps like region of interest segmentation, image normalization, enhancement, and robust matching to accommodate image variations. This system introduces a new or first publicly available database for minor and major finger knuckle images from 503 different subjects. Several open questions on the stability and uniqueness of finger knuckle patterns should be addressed before knuckle pattern/image evidence can be admissible as supportive evidence in a court of law. Stability of finger knuckle images is within 4-7 years.

Keywords- *finger dorsal surface, major finger knuckle pattern, minor finger knuckle pattern, forensics and biometrics.*

I. INTRODUCTION

Human identification using automated tool for their unique anatomical characteristics is generating interest among researchers. Automated tool have application in human surveillance and image forensics. Finger vein and finger knuckle images can be acquired while acquiring fingerprint images. Accurate identification of human using finger knuckle pattern is useful in forensic and covert identification of suspects. There are several cases in which finger knuckle pattern is only the evidence of information to scientifically identify individuals. This system we can use when no information regarding finger print or face is present in available photographs. Courtrooms also consider the result of finger knuckle patterns. Uniqueness and stability of knuckle pattern is over period of 6 years.
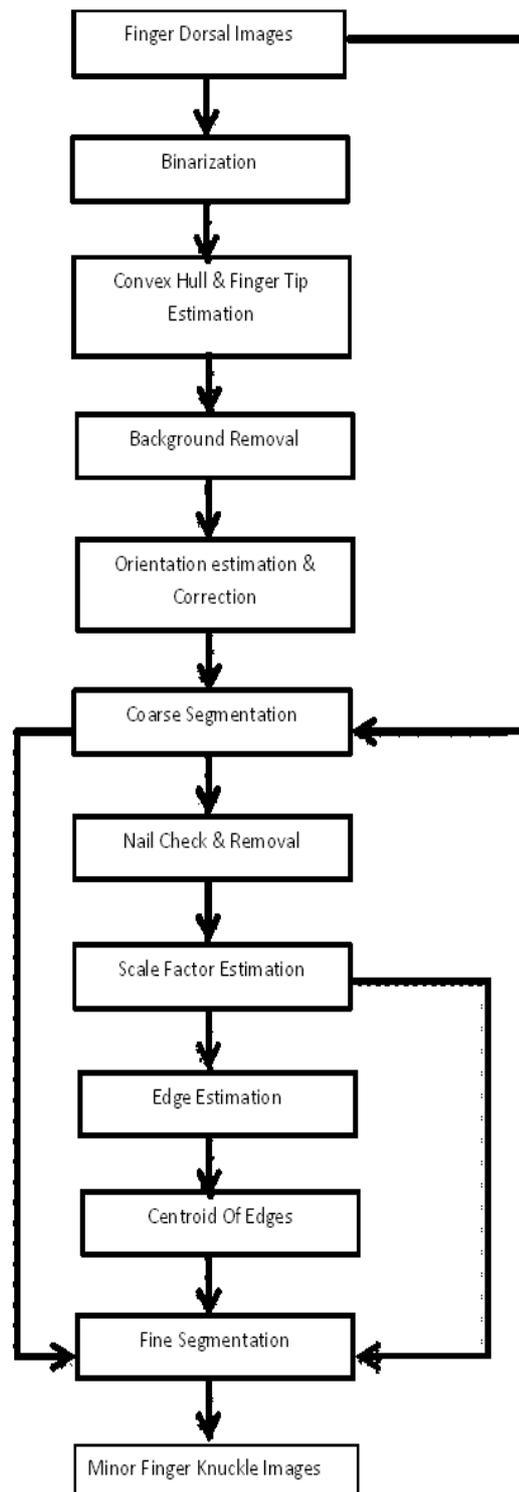
A normal human hand has four fingers each of which has 3 bone segments and 3 joints. Thumb has two bone segments and two joints. Segments are called as phalanges. In some human major finger knuckle pattern is surrounded by hairs, the minor finger knuckle do not have such a problem. There are several images in forensics where only the minor finger knuckle pattern image is the evidence for any suspect identification. User can easily access all information from this application by just login to system.

II. PROBLEM STATEMENT

In this section the formal problem definition of human identification using finger dorsal pattern is given.

To develop a system for identification of humans using major and minor finger knuckle pattern images with key steps like region of interest segmentation, image normalization, enhancement, and robust matching to accommodate image variations.

III.   PROPOSED SYSTEM

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│   Finger Dorsal Images   │───────────────┐
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┌─────────────────────────┐               │
│      Binarization        │               │
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│  Convex Hull & Finger Tip│               │
│        Estimation        │               │
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            │                              │
┌─────────────────────────┐               │
│    Background Removal    │               │
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┌─────────────────────────┐               │
│  Orientation estimation &│               │
│        Correction        │               │
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┌─────────────────────────┐               │
│    Coarse Segmentation   │◄──────────────┘
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│   Nail Check & Removal   │
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│  Scale Factor Estimation │─────┐
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│     Edge Estimation      │     │
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│    Centroid Of Edges     │     │
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┌─────────────────────────┐     │
│    Fine Segmentation     │◄────┘
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│ Minor Finger Knuckle Images│
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IV.   IMPLEMENTATION DETAILS

The structure mainly focuses on following areas namely region of interest segmentation, image normalization, enhancement, and robust matching to accommodate image variations.

1)   Dorsal Finger Image Segmentation and Normalization: For accurate identification of human using both finger knuckle patterns will require accurate segmentation of images. Though

there are varying age group segmentation should be able to generate normalized and fixed size region of interest images. For varying length of fingers, widths, nails, skin pigmentation poses several challenges for robust matching of finger knuckle images.

Each acquired image is firstly binarized then resulting image is clean so that longest object is remain which represent finger. The binarized finger shape is used to locate finger-tip from convex hull of images which is utilized to eliminate background image above finger-tip.

Segmentation which segments a small portion of acquired finger images that include minor and major knuckle portion separately and excluding nail part. Edge detection is used for locating center of minor finger knuckle image.

2)   Feature Extraction and Matching:

The finger knuckle images after enhancement typically represent some random texture pattern which appears to be quite unique in different fingers. Therefore a variety of spatial and spectral domain feature extraction strategies can be applied for matching accuracy from the finger knuckle images. These matchers are local binary patterns, improved local binary patterns, band limited phase only correlation and 1D log-Gabor filter. The LBP-based method has been receiving much attention since its effectiveness has been demonstrated in face recognition. LBP is obtained by thresholding neighborhoods of each pixel with the center pixel value, and then the histogram of LBPs is used as a texture descriptor.

The improved versions of LBP-based method have been proposed and been applied to various biometric recognition problems. LBP has the versatility for image matching since LBP does not need any optimization process. On the other hand, LBP cannot handle large deformation of images and also may not exhibit the comparable performance with the other methods specified to each biometric trait due to its versatility. A method is employed using phase information obtained by Discrete Fourier Transform of images. In particular, the phase-based image matching for biometric recognition called Band-Limited Phase-Only Correlation (BLPOC) has been used in various biometric recognition algorithms. These algorithms cannot handle the nonlinear deformation of images, since the phase information obtained from the entire image is employed. To deal with nonlinear deformation, the approach combined with phase-based correspondence matching and BLPOC has been proposed.

3)   Combining Major and Minor Finger Knuckles:

Multiple pieces of evidences from the same finger dorsal image, i.e., major and minor knuckle patterns, can be combined to improve matching accuracy for the human identification. Among several possibilities to integrate minor and major knuckle patterns, this work explored match score combination using linear and nonlinear strategies. In current application, it is important to select the score level combination strategy which is computationally simpler and yet effective to significantly improve the performance.

V.   RELATED WORK

Human identification using combination of minor and major finger knuckle pattern images can be used to achieve improvement of the performance. The accurate result cannot be obtained only by using major finger knuckle images.

Uniqueness and stability of knuckle pattern is over period of 6 years.

CONCLUSION

We are trying to build a system which will provide accurate result of human identification using finger dorsal pattern. In our system we are going to use major and minor finger knuckle images which will enhance the performance of the system as compared to the previous one.

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