ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Website: www.ijareeie.com

Vol. 8, Issue 4, April 2019

A Smart and Efficient Knuckle Pattern Identification for Security Purpose

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ABSTRACT: The texture pattern produced by the finger knuckle bending is highly unique and makes the surface a distinctive biometric identifier. The finger geometry features can be simultaneously acquired from the same image at the same time and integrated to further improve the user-identification accuracy of such a system. The finger back surface images from each user are normalized to minimize the scale, translation, and rotational variations in the knuckle images. This work investigates the possibility of using lowest finger knuckle patterns formed on joints between the metacarpal and proximal phalanx bones for the automated personal identification. We automatically segment such region of interest from the palm dorsal images and normalize them to accommodate illumination, scale and pose variations resulting from the contactless imaging. The normalized knuckle images are investigated for the matching performance using several spatial and spectral domain approaches. We use database of different subjects acquired from the contactless hand imaging to ascertain the performance. This paper evaluates the minor and major knuckle patterns for the performance evaluation. The experimental results presented in this paper provide very encouraging security based values and demonstrates the potential of such unexplored minor finger knuckle patterns for the biometrics applications.
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KEYWORDS: Knuckle pattern, Spatial domain, Spectral Domain, Biometrics, Finger Knuckle Pattern

I. INTRODUCTION

Majority of physiological patterns employed for the biometrics identification are closely related to the anatomy of individuals which is relatively unique and believed to be correlated with DNA patterns. The choice of these biometric patterns largely depends on the nature of biometric applications, achievable, accuracy, convenience, or restricted to the rarity of patterns available for the forensic analysis. The fingerprint, finger-vein and finger knuckle patterns can be simultaneously acquired and employed for more reliable biometrics identification. Speech is also one of the biometric method used now a days [11]. But if the speech is with different emotions then it is tough to identify the attack. Since recognition of emotion [13,17-18] itself is a tough from the speech.In this context, the constrained imaging requirement associated with the acquisition of finger-vein images can add to the total cost and user inconvenience while integrating them with fingerprint based systems. However, the simultaneous acquisition of fingerprint and finger knuckle images can be achieved without any additional inconvenience to users, also at lower cost, with simple addition of an external imaging camera to the existing (slap) fingerprint devices which can simultaneously acquire finger dorsal images and synchronizes the acquisition with external software. Therefore it is important to investigate the uniqueness and stability in the pieces of information which can be recovered from the finger dorsal images. In [20], the high performance analysis of the half pel and quarter pel interpolation for a single frame is done . The multimedia communication is efficient and standard video coding compression. The first frame can improve the resolution process and second frame can use the location of quarter pixel. In [21], presents the block matching algorithm based on the optimization and differential evolution, Two optimization technique can be using the method, partial swarm optimization (PSO) and differential evolution(DE) .The proposed method the high PSNR and compared with PSO algorithm. In addition, there

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are varieties of recorded forensic images in which only the finger dorsal patterns are available to establish the identity of a suspect. Automated or forensic identification of knuckle.

Forensic identification is the task of determining whether or not observed evidence arose from a known source. It is useful to associate probabilities with identification/exclusion opinions, either for presentation in court or to evaluate the discriminative power of a given set of attributes. At present, in most forensic domains outside of DNA evidence, it is not possible to make such a statement since the necessary probability distributions cannot be computed with reasonable accuracy, although the probabilistic approach itself is well-understood. In principle, it involves determining a likelihood ratio (LR)[16] – the ratio of the joint probability of the evidence and source under the identification hypothesis (that the evidence came from the source) and under the exclusion hypothesis (that the evidence did not arise from the source). Evaluating the joint probability is computationally intractable when the number of variables is even moderately large. It is also statistically infeasible since the number of parameters to be determined from the data is exponential with the number of variables. We generalize this approach to more complex data such as vectors and graphs, which makes LR estimation computationally tractable [9,12]. In paper [22] A modified UMHexagonS algorithm is employed in which search size of diamond is increased and a search pattern is skipped off and the experimental results of the algorithm employs improved PSNR with just a minimum bit rate increase with the maintenance of the image quality .[23] A real-time uncompressed video diffusion system, where Unequal bit Allocation (UBA) approach are adopted end-to-end.

II. METHODOLOGY

The key objective of our work is to investigate the possibility of using finger knuckle patterns, formed between proximal and the metacarpal phalanx bones (metacar-pophalangeal joints) of the fingers, for automated human identification. It may be noted that prior work available in the literature has investigated the finger knuckle patterns formed on finger dorsal surface joining middle phalanx and proximal phalanx bones (PIP joints), However in the best of our knowledge there has not been any study to ascertain the possibility of exploiting knuckle patterns formed between metacarpal and the proximal phalanx bones of fingers for the automated biometric identification. In this work , we refer such knuckle patterns as the second minor finger knuckle patterns to distinguish with the first minor knuckle patterns formed on DIP joints.

III. KEY FEATURES OF THE SYSTEM

DATABASE CREATION

In order to assess the proposed FKP recognition, an FKP database is to be recognized by collecting finger back images of various persons. The FKP images are collected from 5 persons. Four images, left index finger, the left middle finger, the right index finger and the right middle finger are taken for each person. Therefore 20 images are collected. The features of composed FKP images are extracted by using feature extraction method described in above section. These features are trained in neural network. The trained data for each person are saved by specific name. Image processing is the name for operation on image, which aims to look up the image by suppressing the undesired distortion or by enhancing some image feature for further processing. By the process of edge detection the greyscaled images are changed into edges. Many techniques are available for detecting the changes in horizontal direction. Then the changes in vertical direction can be found by testing mix up.

IV. SYSTEM SETUP

The key objective of our work is to investigate the possibility of using finger knuckle patterns, formed between proximal and the metacarpal phalanx bones (metacar-pophalangeal joints) of the fingers, for automated human identification. It may be noted that prior work available in the literature has investigated the finger knuckle patterns formed on finger dorsal surface joining middle phalanx and proximal phalanx bones (PIP joints), However in the best of our knowledge there has not been any study to ascertain the possibility of exploiting knuckle patterns formed between metacarpal and the proximal phalanx bones of fingers for the automated biometric identification. In this

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proposed system, we refer such knuckle patterns as the second minor finger knuckle patterns to distinguish with the first minor knuckle pat-terns formed on DIP joints. A neural network is a computing model whose layered structure resembles the networked structure of neurons in the brain, with layers of connected nodes. A neural network can learn from data—so it can be trained to recognize patterns, classify data, and forecast future events. A neural network breaks down your input into layers of abstraction. It can be trained over many examples to recognize patterns in speech or images, for example, just as the human brain does. Its behaviour is defined by the way its individual elements are connected and by the strength, or weights, of those connections. These weights are automatically adjusted during training according to a specified learning rule until the neural network performs the desired task correctly.

A. BLOCK DIAGRAM

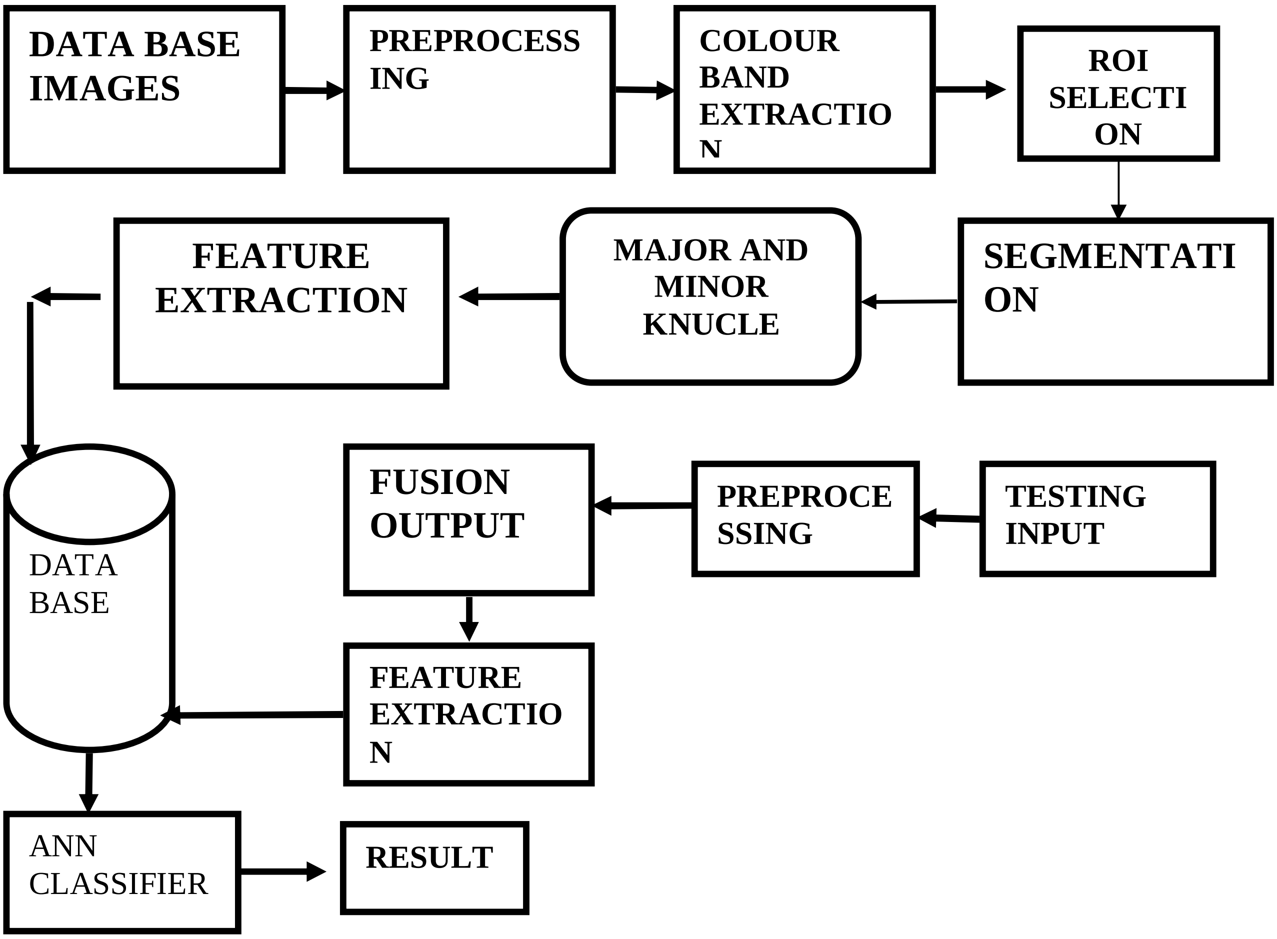

Fig 1 Block Diagram

Fig.1 shows the overall block diagram of the proposed system. Usually the images that are obtained during image acquisition may not be suitable straight for identification and classification purposes because of certain factors, such as noise, lighting variations, climatic conditions, poor resolutions of an images, unwanted background etc. 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 user-friendly imaging system is constructed. 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. Each of these images requires localization of region of interest for the feature extraction. The region of interest is the region having maximum knuckle creases. An ROI can be cropped from the original image for reliable feature. This section proposes an efficient finger-knuckle print ROI extraction technique. The prime objective of any ROI extraction technique is to segment same region of interest consistently from all images. The central knuckle point as can be used to segment any finger-knuckle-print consistently. Since finger-knuckle-print is aligned horizontally, one can now easily extract the central region of interest from any finger-knuckle-print that contains rich and discriminative texture using this point. The proposed ROI extraction algorithm performs in three steps; detection of knuckle area, central knuckle-line and central knuckle-point defined as follows. The central knuckle line is defined as that column of the image with respect to which the knuckle can be considered as symmetric as observed from This line is used to extract the finger-knuckle print ROI. A very specific and symmetric texture is observed around the central knuckle line which is used for its detection. To perceive such a specific texture, a knuckle filter is created by modifying the conventional gabor filter which is defined.

The K means algorithm is a clustering algorithm developed by Dunn, and later on improved by Bezdek. It is useful when the required numbers of clusters are pre-determined; thus, the algorithm tries to put each of the data points to one of the clusters. What makes FCM different is that it does not decide the absolute membership of a data point to a given cluster; instead, it calculates the likelihood (the degree of membership) that a data point will belong to that cluster. Hence, depending on the accuracy of the clustering that is required in practice, appropriate tolerance measures can be put in place. Since the absolute membership is not calculated, it can be extremely fast because the number of iterations required to achieve a specific clustering exercise corresponds to the required accuracy. Color space represents the color in the form of intensity value. We can specify, visualize and create the color by using color space method. There are different color feature extraction methods. Color feature extraction methods: a. Histogram Intersection Method: Histogram Intersection (HI) considers global color Features. The color histograms X and Y with k bins for each, HI is defined as, In Histogram Intersection method, the number of bins makes impact on performance. The large no of bins represent the image in very complex manner it increases the computational complexity.

V. MODULES OF IMAGES

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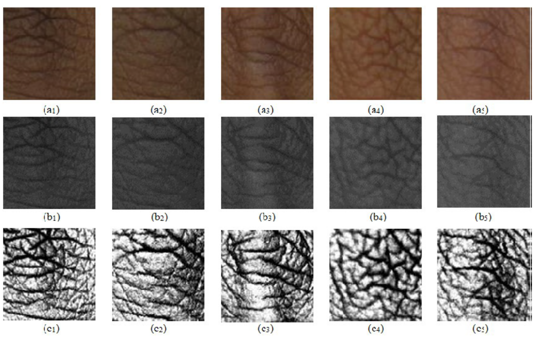

Fig.2 Various Input Knuckle Images

Fig.2 shows the various input images of knuckles used for processing. Here , in the proposed work we have executed the analysis with the saved knuckle databases.

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Vol. 8, Issue 4, April 2019

VI. RESULT AND CONCLUSION

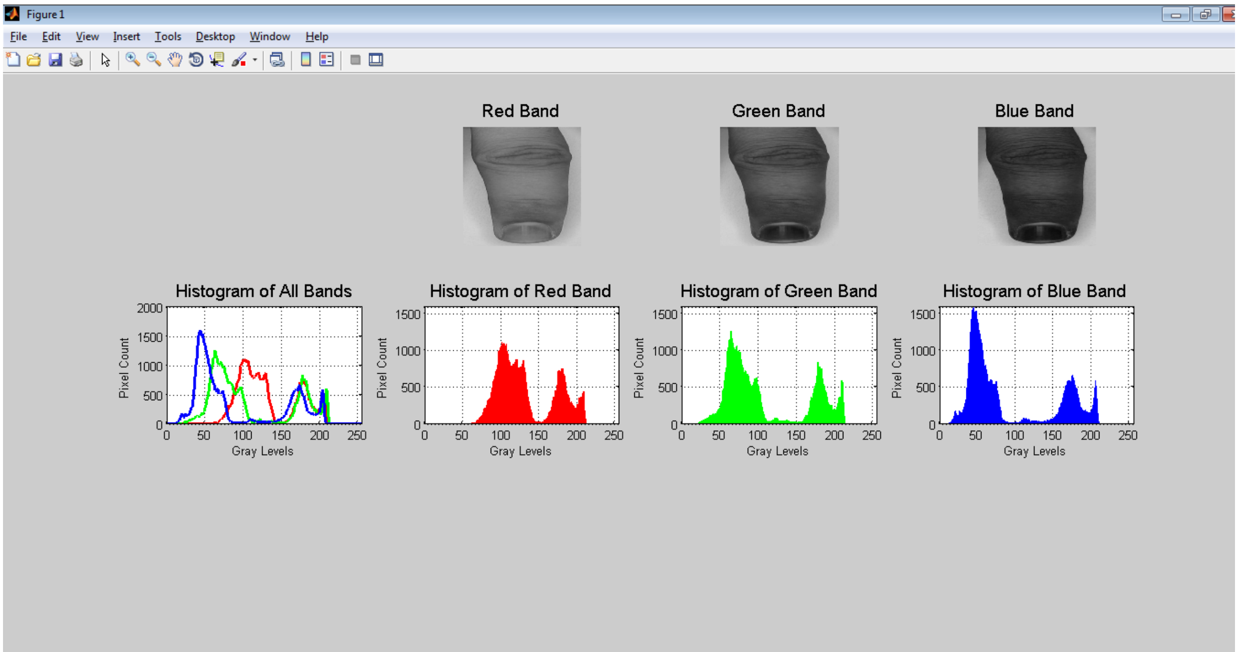

Fig 3 Implemented module histogram result

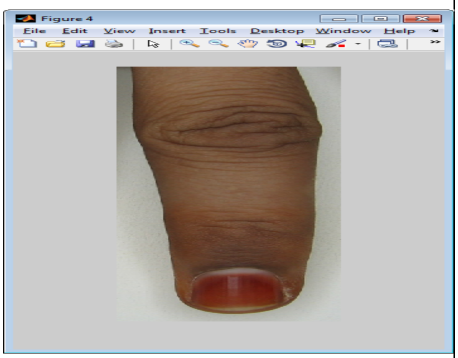	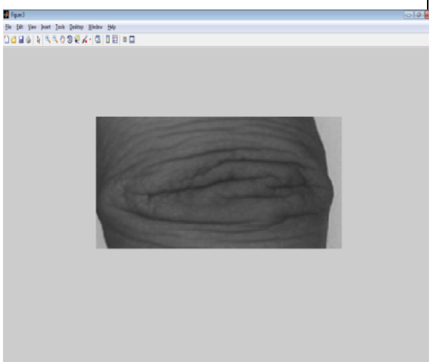	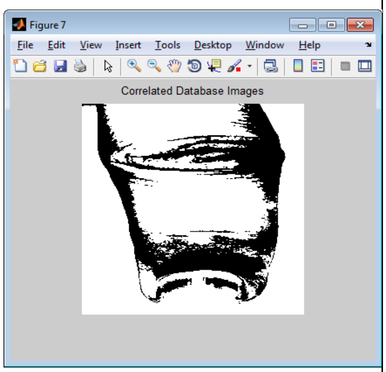
Fig.4 Input Knuckle Image	Fig.5 Segmented knuckle Image	Fig.6 Binary Knuckle Image

Fig.3 and Fig.4. shows the combination of various knuckle images processed with their histogram specifications. Because of some random noise and imperfect placement in image capture, it is necessary to remove the noise and correct the skewed image before ROI extraction. Image pre-processing can reduce the complexity of subsequent image processing. De-noising is necessary for processing and based on the above consideration , we choose a suitable filter, which can de-noise effectively and meanwhile respect the sharpness of the original images. Gaussian filter not only effectively denoise the salt-and-pepper noise, but also preserves the edge details in image deblurring. In 2-D, an isotropic (i.e. circularly symmetric) Gaussian has the form in to remove the noise as a linear filter. The correction process is expected to enhance the precision of center point of FKP and hence to improve the

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accuracy of ROI extraction.Fig.5 shows the segmented knuckle image pattern and Fig.6. shows the binary form of knuckle image.

After the pre-processing, we have eliminated random noise and corrected the skewed image in the horizontal direction which is followed by the detection of the center point. From the FKP images, we could find that the brightest area is related to the center point. The ROI extraction method is based on the assertion that the center of the brightest area is the center point of FKP. However, this assertion is not accurate in some conditions, especially when the image skews in the vertical direction, Thus, we propose two-stage center point detection method, which could deal with the skewed images in the vertical direction. The method has two stages to detect the center point Stage I, we will detect the brightest area in FKP images and roughly regard the center of the area as the initial center point; in Stage II, we will relocate the center point according to the angle of the finger skewed in order to pinpoint the precise position. ROI extracted is the extracted output stored colour map stored in output.

Our results demonstrated that the combination of finger knuckle patterns provides better efficient and accurate matching performance results. The results presented from these set of experiments can be considered preliminary, indicating great potential for this region to serve as biometric, and require further work to achieve more accurate performance. This work has investigated the possibility of using second minor finger knuckle image for the personal identification. The approach described in this proposed system is completely automated and uses contactless imaging which is expected to produce/accommodate large variations in images. We also investigated a computationally simpler method of matching such knuckle patterns using local features and achieved out performing results

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ISSN (Print) : 2320 – 3765
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International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

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Vol. 8, Issue 4, April 2019

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