www.ijecs.in
International Journal Of Engineering And Computer Science ISSN:2319-7242
Volume 4 Issue 7 July 2015, Page No. 13121-13127

Comparative analysis of Statistical Parameters of Finger Knuckle in Digital Image Processing

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ABSTRACT

Accurate automatic personal identification is becoming more and more important to the operation of our increasingly electronically interconnected information society. Among the several types of biometrics used for security purpose, finger-knuckle print biometric has a low data collection error rate and high user acceptability. So, the finger-knuckle print identification has been the important topic of research for many years. Another approaches that uses the estimated orientation field in a finger-knuckle print image to classify finger- knuckle print, on the other hand suffer from lower accuracy. The work explored the use of image processing in finger knuckle-print gives the different parameters of finger-knuckle print, and also explains in what amount two finger-knuckle print are similar. This system is used for the verification of a person, and we also analysis PSNR as well as SNR.

Keywords: *Biometrics, wavelet, security, finger-knuckle print recognition, image processing.*

1. INTRODUCTION

1.1 Overview of Biometric Recognition System

In an increasingly digitized world the reliable personal authentication has become an important human computer interface activity. National security, e-commerce and access to computer networks are now very common where establishing a person's identity has become vital. Existing security measures rely on knowledge-based approaches like passwords or token-based approaches such as swipe cards and passports to control access to physical and virtual spaces, but these methods are not very secure. Tokens such as badges and access cards may be duplicated or stolen. Passwords and personal identification number (PIN) numbers may be stolen electronically. Furthermore, they differentiate between authorized user and a person having access to the tokens or knowledge. Biometrics such as finger-knuckle print, face and voice print offers means of

reliable personal authentication that can address these problems and is gaining citizen and government acceptance.

1.1.1Biometrics

Biometrics is the science of verifying the identity of an individual through physiological measurements or behavioural traits [1]. Since biometric identifiers are associated permanently with the user. They are more reliable than token or knowledge based authentication methods. It can be used to achieve a "positive identification" with a very high level of confidence, such as an error rate of 0.001% Biometrics offers several advantages over traditional security measures. These includes

a) Non-repudiation

With token and password based approaches, the perpetrator can always deny committing the crime pleading that his/her password or ID was stolen or compromised even when confronted with an electronic audit trail. There is no way in which his claim can be verified effectively. This is known as the problem of deniability or of 'repudiation'. However, biometrics is indefinitely associated with a user and hence it cannot be lent or stolen making such repudiation infeasible.

b) Accuracy and Security

Password based systems are prone to dictionary and brute force attacks. Furthermore, such systems are as vulnerable as their weakest password. On the other hand, biometric authentication requires the physical presence of the user and therefore cannot be circumvented through a dictionary or brute force style attack. Biometrics has also been shown to possess a higher bit strength compared to password based systems and is therefore inherently secure.

c) Screening

In screening applications, we are interested in preventing the users from assuming multiple identities e.g. a terrorist using multiple passports to enter a foreign country. This requires that we ensure a person has not already enrolled under another assumed identity before adding his new record into the database. Such screening is not possible using traditional authentication mechanisms and biometrics provides the only available solution.

The various biometric modalities can be broadly categorized as

Physical biometrics: These involve some form of physical measurement and include modalities such as face, fingerprints, iris-scans, hand, finger-knuckle print geometry etc.

Behavioural biometrics: These are usually temporal in nature and involve measuring the way in which a user performs certain tasks. This includes modalities such as speech, signature, gait, keystroke dynamics etc

2. FINGER-KNUCKLE PRINTS AS A BIOMETRIC:

Finger knuckle-print biometric system has widely used in modern e-world. The region of interest is needed as the key for the feature extraction in a

good biometric system. The symmetric discrete orthonormal stock well transform provides the computational efficiency and multi-scale information of wavelet transforms, while providing texture features in terms of Fourier frequencies. It outperforms leading wavelet-based texture analysis methods. This motivates us to propose a new local and global feature extractor. For the finger knuckle-print, the local and global features are critical for an image observation and recognition. For the finger knuckle-print, the local and global information are critical for an image observation and recognition.

The finger-back surface, also known as dorsum of hand, can be highly useful in user identification and has not yet attracted the attention of researchers. The contact free imaging of the finger back surface is highly convenient to users. The skin pattern on the finger-knuckle is highly rich in texture due to skin folds and creases, and hence, can be considered as a biometric identifier. Further, advantages of using Finger Knuckle Print (FKP) include rich in texture features, easily accessible, contact-less image acquisition, invariant to emotions and other behavioural aspects such as tiredness, stable features and acceptability in the society [1].

2.1 METHODOLOGY USED FOR FINGER KNUCKLE

Finger-knuckle print matching system consists in modelling the perceptual quality metric between an original (ideal) finger-knuckle print and a distorted version of it. The goal is to evaluate and compare the performance of digital image processing algorithms. Traditionally, Mean Squared Error is used for this task, due to its simplicity and its many nice mathematical properties. For Quality Analysis of finger-knuckle Images, step by step operations performed are:[2]

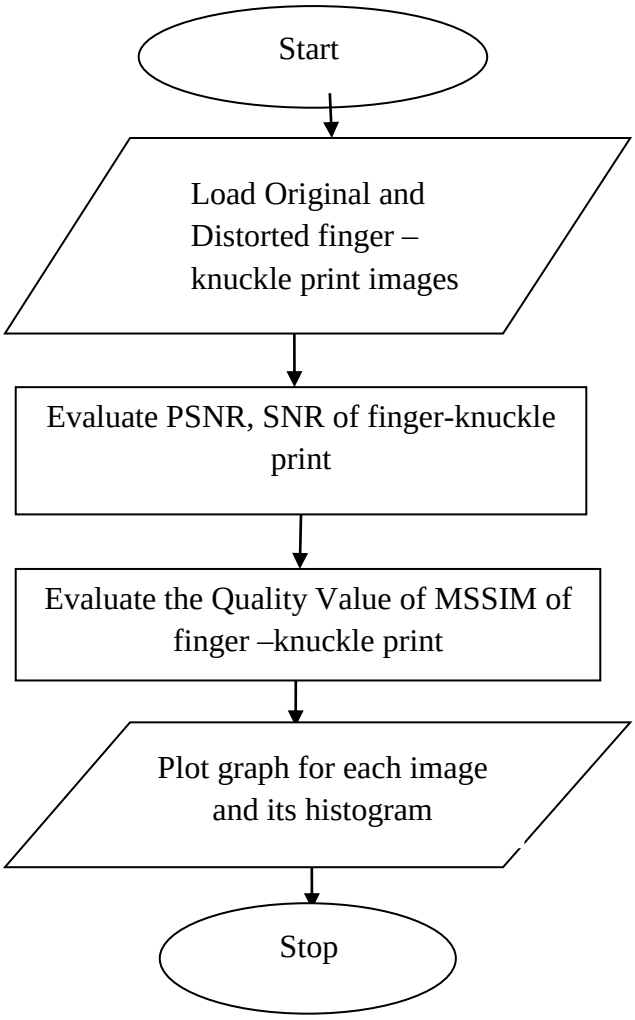


Fig. 1.1: Flowchart of the Methodology Adopted

2.2 Load the Original and Distorted Finger-knuckle print Images

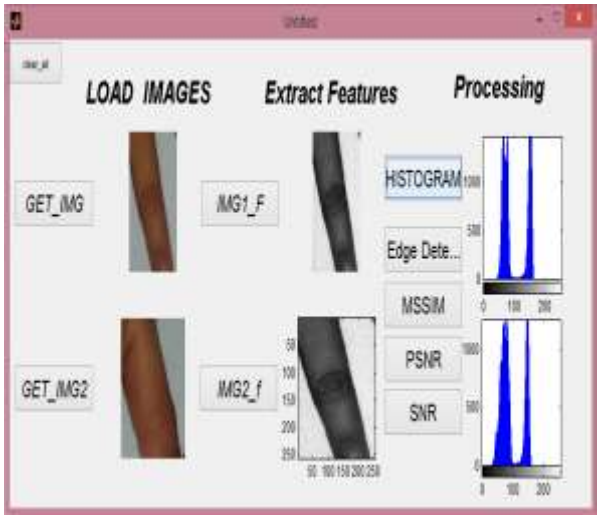
Firstly we load the original and distorted Finger-knuckle print images to analyse the quality of distorted images by taking original images as reference. This method is known as full reference modals. The Finger-knuckle print images used are as follows:[3]

Fig. 1.2:Finger-knuckle print images used for analysis a) Front Side, b)Left Side

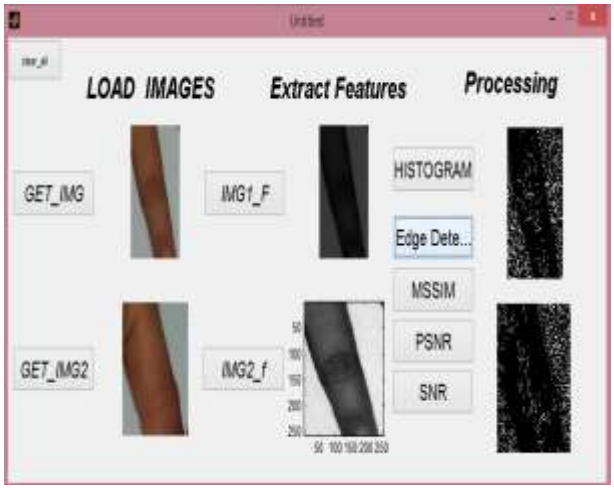
2.3 Experimental Results and Discussion

In this section, we compare the performance of MSSIM with the statistical methods that are PSNR, SNR. The specific contents of the type of noise we have used are salt & pepper noise.

2.4 Simulation Results for Histogram: In this we load the two finger- knuckle print and draw its corresponding histogram, which gives the graphical representation of the finger- knuckle print images and features are also extracted of two finger-knuckle print.

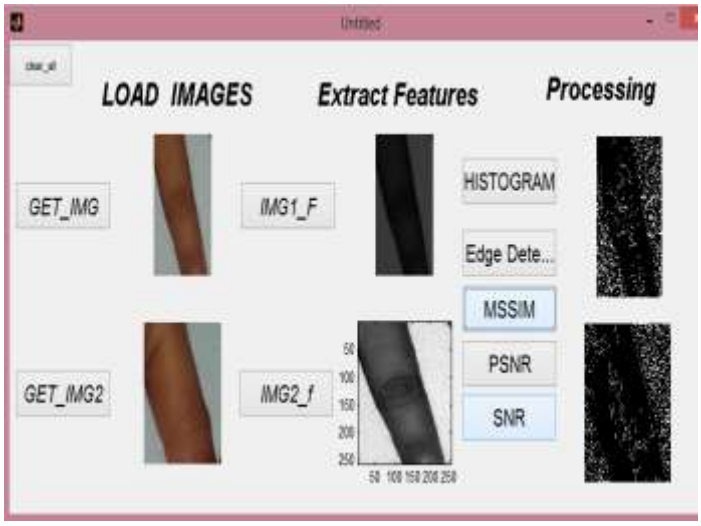


2.5 Simulation Results for edge detection: In this we load the two finger- knuckle print and edges of the two finger- knuckle print are to be detected. Canny and sobal operator is to be used for their edge detection.



2.6 Simulation Results for MSSIM: In this we load the two finger- knuckle print and calculate the mean structural similarity index and peak signal to noise ratio and also calculate the signal to noise ratio of the finger knuckle print. Mean structural similarity index defines the amount of similarity between the two finger-knuckle print. PSNR and SNR define the distortion of finger-

knuckle print. The amount of similarity and PSNR and SNR is to be calculated.[4] [5]



2.7 Load the Original and Distorted Finger-knuckle print Images

fig.1.3:Finger-knuckle print images used for analysis a) Front Side, b)Left Side

Table 1.1Calculation of different parameter of finger –knuckle print

Sr No.	Parameter	Values
1	Mean structural similarity index	0.839392
2	Elapsed Time	0.271893 Seconds
3	Peak signal to noise ratio	18.682665
4	Signal to noise ratio	11.6355

3. CONCLUSION

The work explored the use of wavelet transform to reduce the size of fingerprint images with less pre-processing and post-processing operations which made the system simple and less space and time consuming. It has also explored the use of new feature vector wavelet co-occurrence signatures to match the database fingerprint images with the input fingerprint images using Euclidian distance. [6][7]

After this proposed work, it can be concluded that it is more efficient, than previous techniques of fingerprint recognition due to the following reasons –

- The use of wavelets directional resolving power in horizontal, vertical and diagonal direction of the fingerprint image increases the recognition rate.
- The use of multi resolution, compactness and den-noising property

of wavelets makes it useful in fingerprint recognition system.

- Wavelet transform reduced the size of fingerprint.
- The system cropped out only the core location (small portion of image) of the fingerprint image to make it translation invariant.

Besides being the efficient algorithm, it has not degraded the accuracy which is still 95%. So, the fingerprint identification system developed during the work has proved to be a cost effective algorithm in both time and space, with a good level of accuracy. And the work explored the use of image processing in finger knuckle-print gives the give the different parameter of finger-knuckle print, and also explain in what amount two finger-knuckle print are similar. This system is used for the verification of a person, and we also analysis PSNR as well as SNR.

4. FUTURE WORK

The work would be improved in the future; by the use of other directional resolving algorithm of images. The system could have better accuracy when the database images are trained using neural network, which has not been implemented here. The developed system has the satisfactory performance for the small test sample. The performance degrades when the sample size is increased, this can be addressed in future.

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