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SWIVEL AND WET FINGERPRINT RECOGNITION TECHNIQUE

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ABSTRACT

This paper assesses the effects of prolonged exposure of fingers to water on the performance of existing fingerprint recognition systems.Many fingers wrinkle or dwindle when immersed in water .When used for biometric identification; recognition rate for wrinkled fingers degrades. Apart from this the existing techniques used are not rotation invariant and fail when enrolled image of a person is matched with a rotated test image .The influence of wrinkling and rotated finger prints has so far not been well understood .In this paper we present a particularized report of how the finger skin inflation due to wrinkling and rotation of fingerprints influences the quality of scanned fingerprints and distinguish the qualitative changes that affect recognition.

KEYWORDS: Finger Print Recognization.

INTRODUCTION

Fingerprint Recognition or fingerprint authentication refers to the automated methods of validating a match between two human fingerprints. Fingerprint (FP) serves to distinguish that the person authenticating is who he/she pretends to be. Fingerprint authentication system is among the most commonly used biometric technologies [1]. The popular and widely used Biometric to authenticate a person is fingerprint which is unique and permanent throughout the person life. A biometric system contains mainly an image capturing unit, a feature extraction unit and a pattern matching unit. An image capturing unit acquires the raw biometric data of a person employing a sensor. Employing suitable algorithm/s feature extraction unit enhances the quality of the captured image. Database unit stores the biometric template knowledge of enrolled Persons. Pattern matching unit compares the educed features with the stored templates, which in-turn generates match score.

Although it has helped a lot in authentication of a person but still needs a lot of improvement. A major challenge in Fingerprint recognition lies in the preprocessing of the bad quality of fingerprint images which also appends to the low verification rate. An important question that has received inadequate attention has to do with how well a refined, commercially available fingerprint recognition system will perform in a marine environment. This paper explores the impacts of water-induced finger pruning on a typical fingerprint recognition system. Pruning is a short term skin condition caused by prolonged exposure to water. A wrinkled finger which is caused by pruning is often referred to as a pruney or water aged finger [3].when a wet fingerprint is imaged in air, the surface chorography has changed with wrinkling thus the fingerprints of the same person mismatch.

Figure 1: Example of a pruney finger after a warm bath [4].

FINGERPRINT PATTERN TYPES

Fingerprint patterns are characterized into three main groups which consists of Arches, Loops and Whorls. Almost 5% of all fingerprints are Arches, 30% are Whorls and 65% of these are Loops.

A. ***Loop Patterns****:*

In a Loop pattern, the ridges will roll in one side, re-curve, (loop around) touch or pass through an imaginary line drawn from the delta to the core, and leave the pattern on the same side from which it stepped in. The loop pattern comprises of one or more re-curving ridges and one delta.

There are two categories of loop patterns:

1. Ulnar loop
2. Radial loop.

Differences between ulnar and radial loop are, if the ridges roll in from the little finger side, this could be an ulnar loop and if the ridges roll in from the thumb side this could be a radial loop.

Fig.2: Loop Pattern of a Fingerprint

B. ***Whorl Patterns***:

Any fingerprint pattern which consists of two or more deltas would be a whorl pattern. A whorl pattern consists of regularly presented almost concentric circles.

Figure 4: Whorl Pattern of a fingerprint

C. Arch Pattern:

In this ridges roll in one side and roll out the opposite side. No deltas are there in an arch pattern

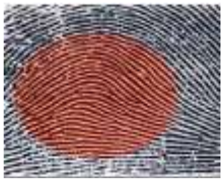


Figure3:Arch Pattern of a Fingerprint

FINGERPRINT RECOGNITION SYSTEM

Fingerprint recognition (also called as Dactyloscopy) is the process of distinguishing known fingerprints against another or template fingerprint to determine if the prints are from the same finger or not. It comprises of two sub-domains: one is fingerprint verification and the other one is fingerprint identification [5]. Verification defines an individual fingerprint by distinguishing only one fingerprint template stored or reserved in the database, while identification compares all the fingerprints stored in the database. Verification is one to one matching of fingerprints and identification is one to N matching. Verification is an efficient process as compared to identification.

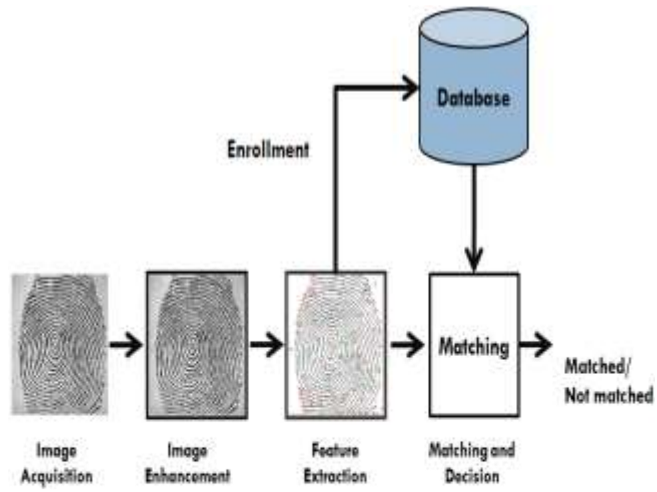


Figure 4: Flow chart of a typical fingerprint recognition system

There are three basic units used in this technique. Various units of the proposed technique are discussed below. Figure 4 shows the block diagram of the technique.

A. Image Acquisition

This unit is used to read fingerprint images. We collect the data using SecuGen Fingerprint scanner and images are collected at 500 dpi.

B. Image Enhancement

In this unit, image enhancement is carried out to remove the noise from fingerprint image. We make use of Gaussian smoothing filter for the removal of noise. We also use an average and a median filter for removing noise, however we found the best and efficient result in the case of Gaussian filter.

C. Feature Extraction

In the feature extraction unit, features from the enhanced fingerprint image are extracted. We have used SURF for the feature extraction process. The reason behind using SURF is that it is robust against rotation of fingerprints. Apart from this SURF represents image using local features.

D. ***Matching***

In matching unit, two fingerprint images are matched with the assistance of extracted local features. Depending upon the captured matching score, two fingerprints are announced as matched or not-matched.

ISSUES WITH EXISTING FINGERPRINT RECOGNITION TECHNIQUES

Most of the present fingerprint techniques in literature are based on minutiae points which are described using their co-ordinate positions in the image. When a test fingerprint image is rotated with respect to the enrolled image or partially available, these techniques face problem in matching due to the change in co-ordinate positions of these minutiae points and thus perform very poorly. Such a case is discussed below.

***A. Rotated Fingerprint Matching*:**

An example of a rotated fingerprint image is shown in Figure 5(b). We can see that it is a difficult and a time consuming task to match minutiae of the two images because due to rotation, coordinate positions of all the minutiae points in Figure 5(b) with respect to Figure 5(a) are changed.

Fig 5(a) Normal Fingerprint Image, (b) Rotated Fingerprint Image

PROPOSED TECHNIQUE FOR FINGERPRINT RECOGNITION

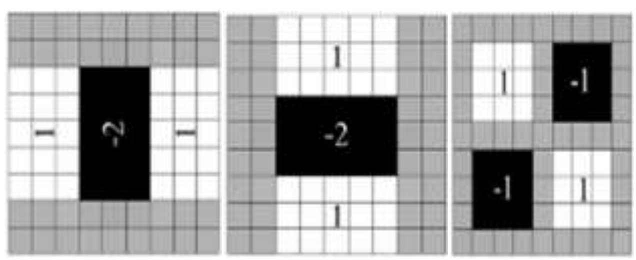
To runover the issues faced by minutiae based techniques; we propose the use of the local robust features for representing and matching fingerprints. Among various local features such as SIFT [6], SURF [7, 8], GLOH [9] etc. available, SURF (Speeded up Robust Features) have been described to be vigorous and distinctive in describing local image information [6]. SURF has been found to be a rotation-invariant interest point detector and descriptor.

Key-Point detection

SURF identifies essential feature points commonly called as key-points in the image. It makes use of hessian matrix for the detection of the key-points. For a given point in the image I, the hessian matrix H is defined as:

$$H= \begin{bmatrix} l_{xx} & l_{xy} \\ l_{yx} & l_{yy} \end{bmatrix}$$

Wherel_{xx},l_{xy},$l_{yx}$and l_{yy} are filter matrices defined as follows where the gray pixels represent 0



l_{xx} l_{yy} l_{xy}orl_{yx}

Key-points at different scales are determined by considering filters at the various scales. So as to localize interest points in an image and over scales, maximum filter in a $3 \times 3 \times 3$ Neighborhood is implemented.

B. Computation of Descriptor Vector

In order to generate a key point descriptor vector, a region around the key-point is taken into consideration and Hear wavelet filter responses in horizontal (dx) and in vertical (dy) directions are calculated. These responses are then used to obtain the dominant orientation in a circular region. Feature vectors are measured relative to the dominant orientation resulting in the generated vectors invariant to image rotation.

A square region around each key-point is taken into consideration and it is then aligned along the direction of the dominant orientation. The square region is further divided into 4×4 sub-regions and Hear wavelet responses are calculated for each sub-region. The sum of the wavelet responses ($d_x$and d_y) in horizontal and in the vertical directions and of their absolute values ($|d_x|$and$|d_y|$) for sub-region are used as the feature values. Thus, the feature vector (v_i) for i^{th}sub-region is computed as:

$$V_i = \left\{\sum d_x, \sum d_y, \sum |d_x|, \sum |d_y|\right\}$$

SURF feature vector of a key-point is acquired by concatenating feature vectors (v_i) from all the sixteen sub-regions around the key-point resulting a vector which consists of 64 elements.

EXPERIMENTAL RESULTS

We first designed the histogram diagram among the dry genuine and the dry impostor match scores. To highlight the changes in the collective performance of the designated fingerprint recognition system, we then distinguished this against the histogram diagram acquired from the match scores between dry and wet fingerprints. As predicted, the distributions of scores are very akin; however, there is more overlapping among genuine and impostor scores of data collected under marine environment. This overlapping is an indication of slight decrease in the performance of the system due to the effects of marine environment. After the comparative analysis among two histogram diagrams we then plotted the ROC curves of both the situations. To summarize the quality of the ROC curve, we made the use of the equal error rate (EER) which corresponds to a point where the line FPR = 1 – TPR intersects the ROC curve [10].

a.

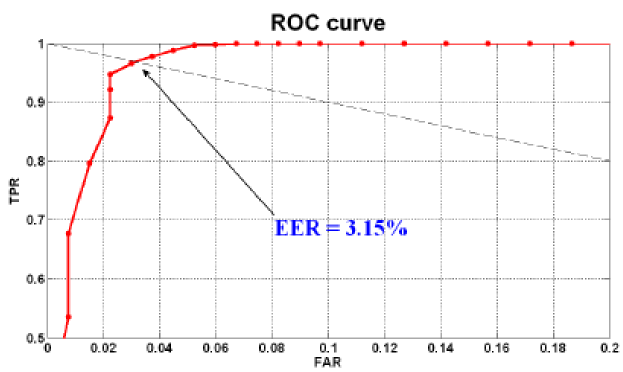


Figure 6. The ROC curve is describing the relative tradeoffs between true positive and false acceptance rate of dry+wet genuine scores and the dry+wet impostor scores. The dashed, diagonal is the reference line. FAR and TPR denote x and y axes respectively. Red line sweeps over the different cut-off points. EER value as ROC curve intersects with diagonal line(reference line) is 3.15%.

CONCLUSION AND FUTURE SCOPE

The purpose of this study was to quantitatively analyze the effect of water-aged finger pruning on the performance of a common and mostly used, minutiae-based fingerprint recognition system. From the analysis we were able to show the decrease in performance of the system by a comparative analysis among the ROC curves of dry and the wrinkled fingerprint match scores. This paper has used Speeded-up Robust Features (SURF) as local robust features for the fingerprint recognition as it is found to be superior as compared to other local features in terms of accuracy as well as speed. The technique has also performed well in presence of rotation

As future work, we would prefer to:

- Explore the other commercially available sensors
- Examine variability of inter finger pruning
- Make use of different fingerprint matching algorithms

REFERENCES:-

[1] IBG, Biometrics Market and Industry Report. 2007, IBG: NY. p. 224.

[2] Y. J. Wang and K. N. Plataniotis, ―An analysis of random projectionfor changeable andprivacy-preserving biometric verification,‖ *IEEETransactions on Systems, MAN and Cybernetics — PART B:CYBERNETICS*, vol. 40, no. 5, Oct. 2010

[3] C. H. Hsieh, K. F. Huang, P. C. Liang, S. F. Jeng, and H.H. Tsai. "Paradoxical response to water immersion inreplanted fingers". Journal of Clinical Autonomic

[4] Research. pp. 223-227, Apr. 2006.Adapted from sthe Wikimedia Commons file"Image:Wrinkly fingers.jpg"http://commons.wikimedia.org/wiki/File:Wrinkly_fingers.jpg

[5] Davide Maltoni, Dario Maio, A. K. Jain and Salil Prabhakar, *Handbook of Fingerprint Recognition,* Second Edition, Springer, 2009

[6] David G. Lowe, *Object recognition from local scale-invariant features*, Proceedings of the International Conference on Computer Vision. 2. pp. 1150–1157, 1999.

[7] Herbert Bay, Andreas Ess, Tinne Tuytelaars and Luc Van Gool, *Speeded-Up Robust Features (SURF). Computer Vision and Image Understanding*, 110(3), pp. 346-359, 2008.

[8] Herbert Bay, Tinne Tuytelaars and Luc Van Gool, *SURF: Speeded up robust features*, In Proceedings of 9th European Conference on Computer Vision (ECCV' 06), pp. 404-417, 2006

[9] Krystian Mikolajczyk and Cordelia Schmid, A performance evaluation of local descriptors, IEEE Transactions on Pattern Analysis and Machine Intelligence, 27(10), pp. 1615--1630,2005

[10] Kevin P. Murphy. Performance evaluation of binaryclassifiers. Technical Report, University of British Columbia, 2007