Indian Journal of Science and Technology, *Vol 9(35), DOI: 10.17485/ijst/2016/v9i35/95759, September 2016*
ISSN (Print) : 0974-6846
ISSN (Online) : 0974-5645

Dual Authentication of a Human Being from Simultaneous Study of Palm Pattern and IRIS Recognition

Parthasarathi De*, Dibyendu Ghoshal and Tapajyoti Deb

Department of CSE, National Institute of Technology Agartala, Agartala, Tripura, India;
parthasarathide76@gmail.com

Abstract

Objective: The present study deals with a dual authentication of a human being from simultaneous analysis of iris pattern and single side of the palm of same person which is expected to form some basis in the dual biometric based authentication to avoid fraudulent activities. **Methods/Statistical Analysis:** For iris pattern matching, a thorough denoising by LOG Gabor filter of 7X7 dimension is used. Subsequently edge linking and iris boundary detection is carried out by local processing. For palm detection, in the current study the features of front portion of the palm are considered. The tool that will be used for the development purpose is MATLABR2016a, and emphasis will only be on the software for performing recognition. **Findings:** In the front side, the various mounts, creases, some deep uneven spaces and wrinkles in the human wrist are evaluated. The recognition rate for the human iris pattern has been observed to be around 95.5% while that of palm has yielded 91.99%. **Application/Improvement:** The aim of the study is to provide better social security and proper identification i.e. authentication of a particular person especially when one biometric is lost due to some severe accident.

Keywords: Authentication, Human, IRIS, Palm, Pattern, Recognition

1. Introduction

Security has never been so crucial, but ironically, thanks to the computing power at everyone's fingertips - never been so effortless to breach. In most of the cases, security has an essential imperfection because with the right key even the wrong individual can gain authorization. Biometric authentication strikes at these root problems because it is distinct for each individual. Biometric alludes to advances that quantify and breakdown human body traits, for e.g. DNA, fingerprints, retinas and irises, voice signatures, facial structures etc. for justifying authentication[1].

The palmprint and iris pattern matching are amongst the most important biometrics[2] when authentication is done based on physiological attributes of human. The palm area of a human hand generally contains some creases and ridges which are formed during pregnancy and other lines after birth. Indeed, even the indistinguishable twins have distinctive palmprints[3]. So the highly randomized appearance of the palm creases and lines makes its use as a biometric notable.

Similarly, iris scans are also a very reliable way of identifying someone, simply by taking quick photo of their eyes. The iris is a shaded ring of muscle that opens and closes the pupil of the eye like a camera shutter. The colored pattern of our irises is determined genetically when a baby is the womb but not fully matured until two years of age. It originates from a pigment called melanin. More melanin results in brownish eyes whereas less melanin results in blue colored eyes. In reality, the shades and pattern of peoples' eyes are extremely complex and unique. Even mono-zygotic twins have different iris patterns[3]. Iris pattern matching has a big advantage over other biometrics because of its accuracy and reliability. It is evaluated to be 10 times more precise than fingerprinting (claimed to produce around 1 in 1-2 million false matches).

Author for correspondence

On our present paper, we are implementing a system in which a person is identified for biometric authentication by dual recognition of a person's physiological characteristics or biometric both by palm and iris recognition so as to make an efficient and effective way of biometric signature for authentication.

Although lot of works has been done on irises and palm recognition, no such works on both irises and palm together identified for a person for biometric authentication has been found on any published journal or literature so far.

Previous study on palm recognition was based on feature extraction of the Region Of Interest (ROI). They used low pass filter and matching was done based on the basis of line based approach and statistical approach[3,4]. Some of them used a similar approach for palmprint recognition by extracting feature vectors comparing to palm images and performing match taking into account some distance metrics. Some of the previous works on palm pattern recognition composed of two veils to figure out the vertical first and 2nd order derivative of palmprints. They utilized zero-intersections of the main request subordinates to recognize the edge focuses and compare headings. The size of relating 2nd order derivative is considered as the extent of lines. The weighted total of the local directional size is viewed as a component in the element vector[4,5]. Some of them provided a survey of palmprint recognition depicting specifically the capturing devices, preprocessing, palmprint related combinations and algorithms particularly intended for real time palmprint authentication in large databases. Furthermore, they proposed measures to ensure palmprint frameworks and clients' privacy [5]. Previous works of some scientists was based on utilization of complex wavelets for measuring the local comparability of two pictures. They decomposed palmprints pictures and proposed adjusted complex wavelet structure comparability for assessing image quality. They estimated the general similitude of two palmprints as the mean of all local adjusted complex wavelets [5].

Previous study on iris acknowledgement framework was contingent on a custom division system that depended on Hough change. It could restrict the circular iris and reflections by blocking eyelids and eyelashes. The removed iris area was then standardized into a rectangular segment with unfaltering estimations to exhibit imaging asymmetries.

The apparent arrangement of a human iris in a progressing video picture was encoded into little progression of multi scale quadrature 2-D Gabor wavelet coefficients, whose most extreme bits incorporate a 256 byte iris code. Statistical decision speculation makes recognizing verification decisions of complete iris codes and point out decision assurance level. Their work rested upon a pyramid Laplace to perform 2-D band pass decay taking into account the final objective to address iris snapshots. A mapping limit gave the right correspondence amongst them and Fischer's discriminant surveyed their comparable qualities. One of the teams worked on iris recognition fixating on an effective approach for iris acknowledgement, not withstanding when the pictures have hindrances, visual clamor and distinctive levels of radiance. They utilized CASIA iris database and gained proficiency when execution assessment was exact.

2. Proposed Methodology

The present paper is based on dual authentication of human biometrics by recognizing both iris as well as palm of any particular human being which makes efficient and effective signature for authentication which is more reliable than any single biometric recognition. The flow diagram of the recognition process by dual authentication of a human being from simultaneous study of iris pattern and both side palm recognition is shown in the Figure 1_De.

3. Stages of Palm Feature Selection Process

3.1 Image Acquisition

Clear image of the palm has been captured by a high-definition DSLR camera so as to get a better quality picture which is very much helpful for analysis of the palm image for better feature selection process and recognition rate.

3.2 Preprocessing

Preprocessing of the palm image is done as to get a noiseless image so that all the palm features of any human being are distinct and clear by aligning the palmprints and cropping the ROI. So, overall preprocessing decreases overhead. The cropped ROI is then utilized for feature extraction. It is done in following stages:

a. The image of the palm is binarized in MATLAB using the function '*im2bw*'.

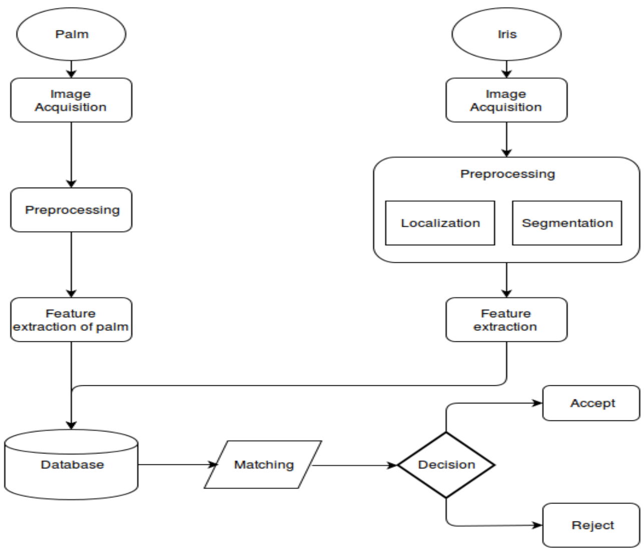

Figure 1_De. Flow diagram for dual authentication by iris and palm recognition

b. Then the boundary of the image is traced by the function '*bwtraceboundary*'. The '*bwtraceboundary*' function returns the column & row coordinates of all the pixels on the border of an object in an image.
c. Next the detection of key points is done. From each point between two fingers, the distance upto the central position is measured which can be determined using Euclidean distance. The distance of all the five reference points is measured from the central point.
d. A coordination system is established by orienting an ellipse to the image of the palm and applying tangent approach.
e. The central portion of the palm is segmented after establishing a coordinate system and different features are taken. The principal lines of the central part of the palm are shown in the diagram along with ridges and wrinkles marked in the diagram shown in Figure 2_De.

3.3. Methods of Feature Selections

3.3.1 Line Based Approach Using Histogram Analysis

Line based approach develops detection of edge or boundary[5] and is used to analyze the extent of the palm lines. Then histograms equalization[6] of the size of palm lines are framed by anticipating the x & y coordinates so as to figure out the first and second order derivatives of the palm pictures. Histogram equalization is done to boost the contrast of the picture. The primary order derivate is utilized to recognize the edge focuses and compare orientations whereas second order derivate is utilized to distinguish the extent of lines. For coordinating and matching, Euclidean distance is used.

The formula for histogram is:

$$S_k = T(r_k) = \sum_{j=1}^{k} P_r(r_j) = \sum_{j=1}^{k} \left(\frac{n_j}{n}\right) \qquad (1)$$

where - r_k: input intensity, S_k: processed intensity, k: intensity range, n_j: frequency of intensity j, n: sum of all frequencies.

3.3.2 Extraction of Local Phase Information Using 2D LOG Gabor Filter

For extracting local phase information, 2D LOG Gabor filter[6,7] is employed to allocate line content scores to various palmprint segments. This segregated phase data is utilized by the palmprint recognition frameworks to decrease the enrolled information size and manage varying deformations between palmprint pictures. Due to low memory prerequisite and quick coordinating pace, this approach is quite convenient.

The Gabor transform of a signal p(t) with a Gaussian function g(t) is defined by this formula:

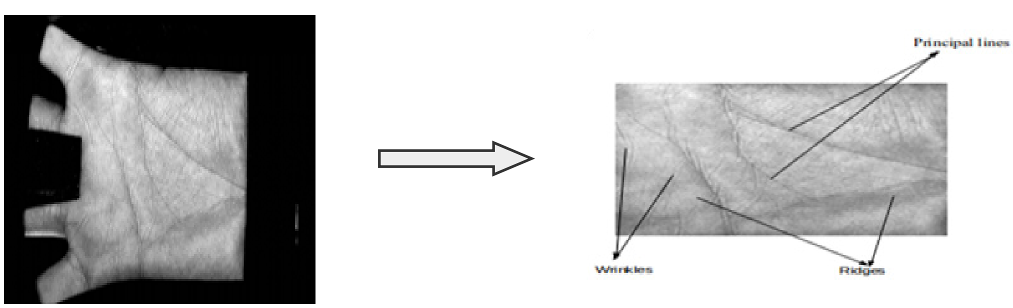

Figure 2_De. Binarized palm image and central portion of the palm

$$G_p(\omega,\tau) = \int_{\infty}^{\infty} p(t)\, g(t-\tau)\, e^{-j\omega t}\, dt \tag{2}$$

The 2D-Gabor filter basis function has the following general form:

$$\psi_{pq}(xy) = a_0^{-p} exp\left\{\frac{a_0^{(-2p)}}{8}\left[4\left(xcos\frac{(q\pi)}{k} + ysin\frac{(q\pi)}{k}\right)^2 (I\omega) + \left(-xsin\frac{(q\pi)}{k} + ysin\frac{(q\pi)}{k}\right)^2\right]\right\}$$
$$exp\left[I\omega\omega_0^{-p}\left(xcos\frac{(q\pi)}{k} + ysin\frac{(q\pi)}{k}\right)\right] \tag{3}$$

4. Stages of IRIS Feature Selection Process

4.1 Image Acquisition of IRIS

A person's eye image has been captured with a high-definition DSLR camera by a close eye camera distance to obtain a better quality image for recognition analysis.

4.2 Preprocessing of IRIS Image

In preprocessing, there are two subordinates- localization and segmentation[8]. First of all the eye image captured is passed through canny edge detector[9,10] as to sharpen the image by reducing various noises like reflection, occlusions etc. After then, localization is followed by segmentation.

Localization – In localization process, only the inner and outer circle boundary are taken into account. This is done by circular half transform to identify the boundary between pupil/iris[9,10] and iris/sclera. This is shown in Figure 3a_De.

Segmentation – The segmentation process is done to get the iris portion as a ROI by removing the eyelashes and eyebrows[10] and also to remove certain reflections of lights as shown in Figure 3b_De.

4.3 Feature Extraction of IRIS

For simple correlations of iris, simply the key points of the iris need to be encoded. The component representation ought to have enough data to arrange different irises and it should be less delicate to noises. Figure 4_De indicates how the correlate area[11] of the iris has been extricated.

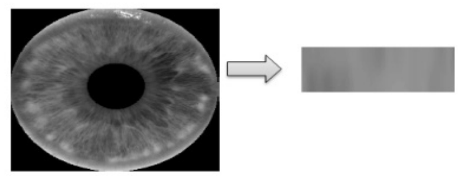

Figure 4_De. Correlate region of iris extracted from the segmented portion of the iris

A relatively easier and efficient way of utilizing the Gabor filter is by fragmenting the 2D normalized pattern into a number of 1D wavelets, and then these signals are combined with 1D Gabor wavelets. Gabor filters are actually used to extract localized frequency information and Logarithm Of Gausian (LOG) is used to reduce DC component to zero.

The frequency response of a Log-Gabor filter[11,12] is given as:

$$G(f) = exp\left\{\frac{\left(-log\left(f/f_0\right)\right)^2}{2\left(log\left(\sigma/f_0\right)\right)^2}\right\} \tag{4}$$

where 'f_0' represents the frequency of center and 'f ' gives the filter bandwidth.

5. Matching of Palm and IRISES

The matching of two irises once stored in database and the other for verification as to have a clean match for

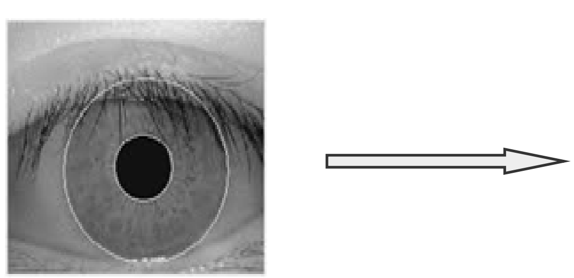

Figure 3a_De. Localization of iris

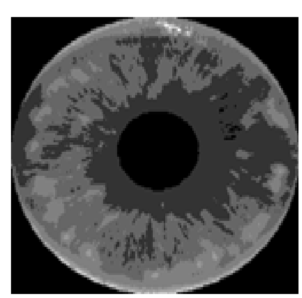

Figure 3b_De. Segmented iris

authentication is done by the method of Euclidean distance[13-15]. A distance of zero signifies a perfect matching output whereas the level of distance directly measures the amount of dissimilarity of two irises. With dimension of feature vectors[16-19], this Euclidean distance performs best giving almost accurate results.

If x values are x_1, x_2 till x_n and values of y are y_1, y_2 till y_n are the two points in Euclidean space, then the distance from x to y is given by:

$$D(x,y)=\sqrt{\left((y_1-x_1)^2+(y_2-x_2)^2+....(y_n-x_n)^2\right)} \quad (5)$$

$$D=\sqrt{\left(\sum_{k=1}^{n} y_k - x_k\right)} \quad (6)$$

Similarly, the palm is also matched with the samples stored in the database by the method of Euclidean distance.

Now if there is a match between the stored iris and palmprint data and the present person's data who wants to gain access[20] with his iris and palmprint, then the person's authentication is accepted otherwise authentication is rejected.

6. Conclusion

This study is an effective and efficient biometric recognition for dual recognition system of both irises and palm together for an individual. Previous works are based on single biometric recognition but no studies have been found so far in any journals and literatures based on dual biometric authentication system. This work will measure a better output for recognition rate as two biometric matching are working simultaneously making the system more reliable and robust.

7. References

1. Phadke S. The Importance of a Biometric Authentication System. The SIJ Transactions on Computer Science Engineering and its Applications (CSEA), 2013Sept-Oct; 1(4):1-5.
2. Zajkowska A, Zimnoch W, Saeed K. A Study on the Importance of Biometric Technique Selection in the Protection of Company Resources. Computer Information Systems and Industrial Management Applications. 2007, p. 369-74.
3. Kour J, Vashishtha S, Mishra N, Dwivedi G, Arora P. Palmprint Recognition System. International Journal of Innovative Research in Science, Engineering and Technology (IJIRSET). 2013; 2(4):501-15.
4. Lipane GS, Gundre SB. Palm Print Recognition Review Paper. International Journals SRG. 2010; 4(2):183-85.
5. Kong A, Zhang D, Kamel M. A Survey of Palmprint Recognition. Pattern Recognition. 2009; 42(7):1408-18.
6. Zhang WK, Kong J, You M, Wong W. On-line palmprint identification. IEEE Transactions on Pattern Analysis and Machine Intelligence. 2003; 25(9):1041–51.
7. Guo Z, Zhang L, Zhang D, Mou X. Hierarchical multi scale LBP for face and palmprint recognition. Proceedings of IEEE 17th International Conference on Image Processing. Hong Kong, 2010, p. 4521-24.
8. Gayathri R, Ramamoorthy P. A Fingerprint and Palmprint Recognition Approach Based on Multiple Feature Extraction, European Journal of Scientific Research. 2012; 76(4):514-26.
9. Daugman J. How Iris Recognition Works, IEEE Trans. Circuits and Systems for Video Technology. 2004; 14(1):21-30.
10. Masek R. Recognition of Human Iris Patterns for Biometric Identification, School of Computer Science and Soft Engineering, the University of Western Australia. 2003, 4669, p. 553-63.
11. Wildes R, Asmuth J, Green G, Hsu S, Kolczynski R, Matey J, McBride S. A system for automated iris recognition. Proceedings IEEE Workshop on Applications of Computer Vision, Sarasota, FL. 1994, p. 121-28.
12. Gonzalez RC, Woods RE. Digital Image Processing, 2nd ed., Prentice Hall.2008, p. 594.
13. De P, Ghoshal D. Human Iris Recognition for clean Electoral process in India by creating a fraud free voter registration list. Eleventh International Multi- Conference on Information Processing, 2015, p. 134-47.
14. Roselin V, Chirchi E, Waghmare LM, Chirchi ER. Iris Biometric Recognition for Person Identification in Security Systems. International Journal of Computer Applications. 2011; 24(9):1-6.
15. Zhu Y, Tan T, Wang Y. Biometric personal identification based on iris patterns, In: Proc. IEEE Int. Conf. Pattern Recognition, Barcelona.2000, 2, p. 801–04.
16. Sujitha R, Lalithamani N. Counter Measures for Indirect Attack for Iris based Biometric Authentication. Indian Journal of Science and Technology. 2016 May; 9(19):1-7.
17. Manju R, Nargunam AS. Estimation of Performance in Multimodal Biometric based Authentication System using Various Clustering. Indian Journal of Science and Technology. 2016 Apr; 9(13):1-7.

18. Saminathan K, Chakravarthy T, Devi MC. Comparative Study on Biometric Iris Recognition based on Hamming Distance and Multi Block Local Binary Pattern. Indian Journal of Science and Technology. 2015 June; 8(11):1-8.
19. Le TH. On Approaching Heuristic Weight Mask to Enhance Lbp-Based Profile Face Recognition System. Indian Journal of Science and Technology. 2016 May; 9(17):1-7.
20. Kim S, Jang B. Development of Bellows Design Software using MATLAB. Indian Journal of Science and Technology. 2015 Apr; 8(S8):1-6.