International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056
Volume: 04 Issue: 06 | June -2017 www.irjet.net p-ISSN: 2395-0072

Human Identification Based on Sclera Veins Extraction

O. G.Hastak

Assistant Professor, Dept. of E&TC, Priyadarshini College of Engineering, Nagpur, Maharashtra, India

---

Abstract - *In this paper, we propose Human Identification Based on sclera Veins extraction. Here sclera segmentation is performed by Fuzzy clustering Means (FCM). Since the sclera veins are not clearly visible, image enhancement is required. A Fuzzy logic-based Brightness Preserving Dynamic Fuzzy Histogram Equalization (BPDHE) is used to enhance the sclera vessel patterns. Dense Local Binary Pattern (D-LBP) is used for feature extraction. The UBIRIS.v1 database is used here for experimentation.*

Key Words: **Biometrics; Sclera veins Patterns; FCM; BPDHE; D-LBP.**

1. INTRODUCTION

Security is in danger if the authentication of individuals fails. Automatic identification without human involvement will considerably increase the security and the speed. So biometrics are the key that can be a solution in such scenarios. Biometrics is the science of identifying or verifying every individual from a set of people by using physiological or behavioral characteristics possessed by them. As opposed to knowledge-based and token-based security systems, cutting-edge biometrics-based identification systems it offer higher security and less probability of tampering. The need for biometric systems is increasing in day-to-day life due to their ease of use by common people, e.g. Aadhaar card, gate access control system and in attendance systems of organizations etc. The financial sector, government, and reservation systems are now adopting biometric technologies for ensuring security in their own areas. The earliest biometrics, for example cataloging of fingerprints, dates back to 1891 when Juan Vucetich started a collection of fingerprints of criminals in Argentina. The first automatic biometric system was proposed in the late 19th century.

Many biometric systems are in used. Though biometric identification based on digital fingerprints, retinal scans, facial characteristics, gesture, and voice patterns are distinctive to each and every individual and are considerably more reliable than the traditional token-based or knowledge-based systems in differentiating between an authorized and a non-authorize person. Though, till now no biometric system claims the properties of a perfect authentication system.

Among various biometrics, biometrics including iris and retina are known as the most accurate biometrics. But a few disadvantages such as the capture of iris images requires the cooperation of the user since an off-axis iris image can deteriorate system performance, and retina scanning requires contact with an eye-piece which is far from being user-friendly. Apart from iris and retinas, the human eye has an ocular surface known as the sclera. To date, this biometric has not been thoroughly studied and little is known about its utility.

To our knowledge, the first recognized work on sclera biometrics is recorded in [1]. Automatic segmentation processes of sclera is proposed in [4], [6] and many features such as LBP [9], GMCL [8] are used for recognition. Work on multi-angled sclera recognition [2, 7] as well as multimodal eye recognition techniques [3, 5, 10] are also proposed using sclera and the iris.

This present work proposes a whole biometric system for personal identification based on sclera vessels. Here sclera segmentation was performed by Fuzzy C-means clustering. A new preprocessing approach for vein highlighting is proposed here by the Brightness Preserving Dynamic Histogram Equalization (BPDHE). Dense Local Binary Pattern (D -LBP) is used for sclera feature extraction also new in the literature.

The paper is organized in a pattern as follows. Section II explains the proposed segmentation approach, preprocessing of the sclera images i.e. sclera vessel enhancement process and feature extraction. In Section III, describes some results the experimental results and in Concluding remarks are given in Section IV

2. PROPOSED APPROACH

In this section, the proposed system sclera recognition process involves: segmentation of sclera (FCM), a sclera vein pattern enhancement technique (BPDHE) and sclera feature extraction((D-LBP) is explained. The proposed system block diagram in shown in figure 1.

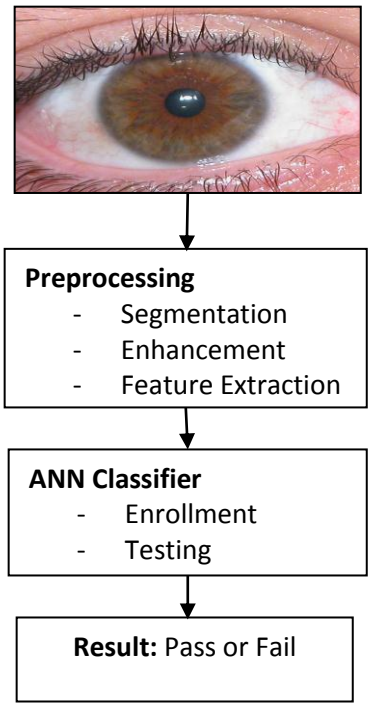


Fig -1: Proposed System Block Diagram

A. *Sclera Segmentation*

The sclera is a white portion of connective tissue and blood vessels surrounding the iris. This portion of blood vessels inside the sclera portion is randomly oriented which creates a pattern which is used for biometric identification. Segmentation is the first step for most biometric related research. Similarly in sclera biometrics, accurate segmentation
is very important, otherwise, an incorrect segmentation can reduce the pattern available, but also it can introduce other patterns such as eyelashes and eyelids. Here sclera segmentation is performed by a Fuzzy C-means clustering-based segmentation proposed in [20]. Fuzzy C-means is a method of clustering which allows one piece of data to belong to two or more clusters [18, 19].
The performance of the segmentation is depends on to appropriate initialization and optimal configuration of controlling parameters, which require some manual intervention. A Fuzzy Clustering Means (FCM) algorithm is used for sclera segmentation. It is possible to directly evolve from the segmentation by fuzzy clustering Means. The controlling parameters of level set are estimated from the results of fuzzy clustering Means. However the fuzzy C-Means algorithm is enhanced with locally regularized estimation. Such improvements facilitate level set manipulation and lead to more accurate segmentation.

The parameters that affect the level set segmentation are:

i. Controlling the spread of the Gaussian smoothing function
ii. Controlling the gradient strength of the initial level set function
iii. Regulator or direct function
iv. Weighted coefficient of penalty term
v. Coefficient of counter length for smoothing
vi. Artificial balloon force
vii. Time set for level set initialization
viii. Maximum iteration for level set evolution.

A experimentation of the proposed algorithm is carried out on sclera images from different modalities. The results confirm its effectiveness for sclera image segmentation. The number of clusters considered here was three and index three. The segmentation was performed on grey images. Figure 2(c) shows the Fuzzy C means-based sclera segmentation of 1(a) index 1. Figure 2(d) shows the Fuzzy C means-based sclera segmentation of 2(a) index 2 and Figure 2(f) shows the Fuzzy C means-based sclera segmentation of 2(a) index 3 and 2(b) grey image of 2(a).

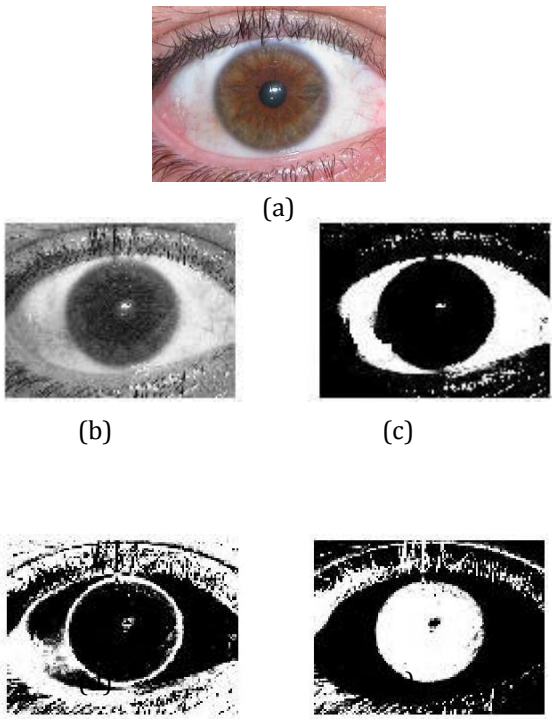


Fig - 2: (a)original image, (b) grey image of (a). Figure (c) shows the Fuzzy C means-based sclera segmentation of 1(a) index 1.Figure (d) shows the Fuzzy C means-based sclera segmentation of (a) index 2 and Figure (e) shows the Fuzzy C means-based sclera segmentation of (a) index 3.

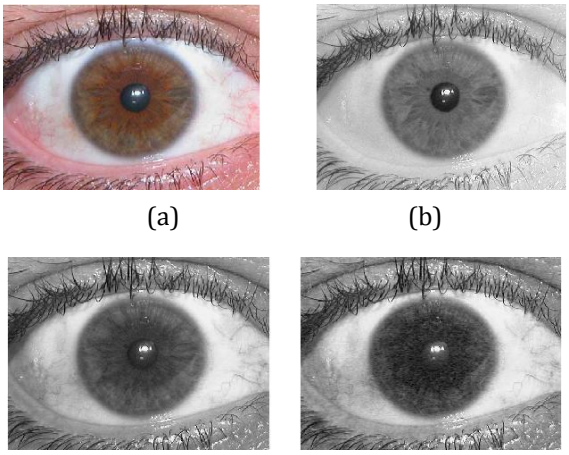
Here the Fuzzy C means-based sclera segmentation of index 1 is used as mask for further experimentation.

B. Sclera vessel structure enhancement

The vessels in the sclera are not clearly visible, so in order to make them clearly visible, image enhancement is required. Brightness Preserving Dynamic Fuzzy Histogram

Equalization is on the green channel of the sclera image as the sclera vessel patterns are most prominent in the green channel as shown in Figure 3(c)) to make the vessel structure more clear as shown in Figure 4.

Brightness preserving dynamic histogram equalization technique improves its brightness preserving and contrast enhancement ability while reducing its computational complexity.



(a) (b)

(c) (d)

Fig – 3: (a) The original RGB image, (b) The red channel component of (a),
(c) The green channel component of (a), and (d) blue channel component of (a),

C. Feature Extraction Method

In past years, a certain level of good performance has been achieved by several researchers. Although there exists security weakness in their extracted templates. Inherently, the extracted biometric template cannot be used as a passwords and personal identification number(PIN) if compromised. This can be significant issue particularly when many application share a biometric and the biometric template. Since Dense Local binary pattern(D-LBP) algorithm is used for feature extraction figure 1 shows extracted sclera vessel structure . D-LBP based approach is expected to be easily extended to multimodal sclera recognition. and also for Artificial Intelligence Based Human Identification.

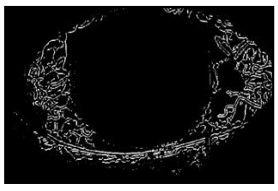


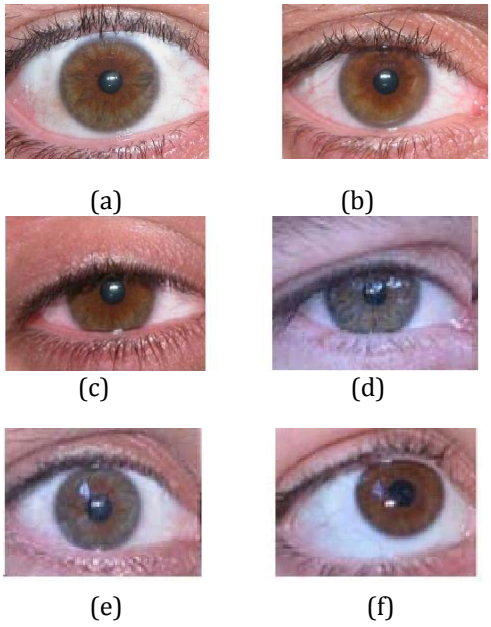
Fig - 4: Extracted Sclera Vessel structure

3. EXPERIMENTAL RESULTS

The experimental setup and the results of our proposed work are explained in this section.

A. Data Set

In order to experiment the performance of the proposed method, the UBIRIS.v1 database [13] was utilized for our experiments. This database consists of 1877 RGB images taken in two distinct sessions (1205 images in session 1 and 672 images in session 2) from 241 identities where each channel of RGB color space is represented in grey-scale. The database contains blurred images and images with blinking eyes. Both high resolution images (800 × 600) and low resolution images (200 × 150) are provided in the database. All the images are in JPEG format. We have used different quality images and some of the sample images are shown below in Figure 5.



(a) (b)

(c) (d)

(e) (f)

Fig- 5: Different quality of eye images used.in the experiments (a) is the type of best quality image of Session 1, (b) is the type of medium quality image of Session 1 (c) is the type of Poor quality image of Session 1, (d) is the type of below average quality image of Session 2, (e) is the type of average quality image of Session 2 (f) is the type of best quality image of Session 2

Some of them are not occluded having good quality of sclera regions visible, some of them are of medium quality and the third type was of poor quality with respect to sclera region visibility. The first session images were taken in a dark room so that the noise factors such as reflection, luminosity, and contrast were minimized. In the second session, the images were taken under natural illumination conditions with spontaneous user participation in order to introduce natural luminosity and add more noise factors than the first session. In the experiments, some sample images of sessions 1 and 2 are used.

B. Results of Segmentation

The results of segmentation are discussed here.

a. Segmentation Results

In these experiments, different quality images were used. Some of them were not occluded having good quality of sclera regions visible, some of them are of medium quality and the third type was of poor quality with respect to sclera region visibility, some closed eye images were also used. In the experiments, some sample images is used for segmentation. Examples of manual segmentation are given below in Figure 6.

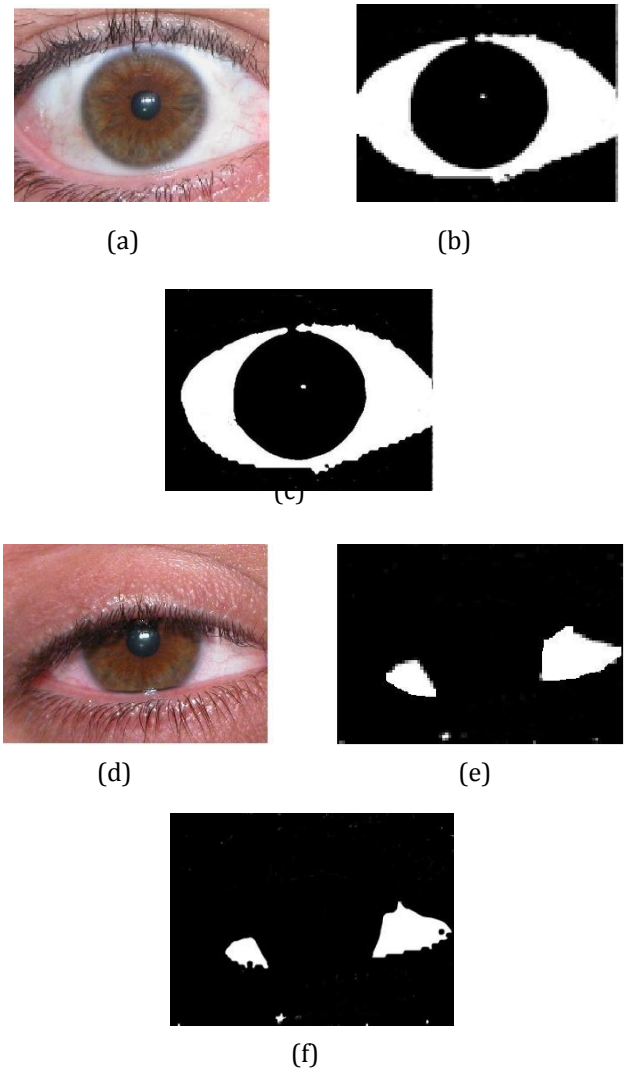


Fig -6: Examples of the few manually segmented images. (a) & (d) are the original images, (b) & (e) are the manually segmented images and (c) & (f) are automatically segmented images.

C. Results for Sclera Vessel Enhancement

Experimental results of the enhancement techniques used for sclera vessel enhancement is discussed here.

a. Image Channel Selection

In the experiments, it has been found that in the green channel of the images, the sclera vessel patterns are most prominent as indicated in Figure 3.

b. Fuzzy logic-based Brightness Preserving Dynamic Fuzzy Histogram Equalization

Here Fuzzy logic-based Brightness Preserving Dynamic Fuzzy Histogram Equalization was used to make the pattern clearer. Fuzzy statistics is able to handle the inexactness of gray values as compared to classical crisp histogram thus it producing a smooth histogram. Thus the use of fuzzy histogram is suitable for this particular application.

c. Partition of the Histogram

The local maxima based partitioning of the histogram is required to obtain multiple sub histograms. This is performed in this step.

d. Dynamic Histogram Equalization of the Sub -histograms

The sub -histograms obtained are individually equalized by Dynamic Histogram Equalization(DHE) technique. The equalization method uses a spanning function based of total number of pixels in the partition to perform equalizaion. It involve two stages of operation, namely, mapping partition to a dynamic range and histogram equalization

e. Normalization of Image Brightness

The image obtained after the dynamic histogram equalization(DHE) of each sub histogram is the mean brightness that is slightly different than input image. To remove this difference the normalization process is applied on the output image.

D. Sclera Veins Pattern Selection

For sclera veins pattern extraction, few local features extraction techniques such as Dense SIFT (Scale Invariant Feature Transform), Dense LBP (Local Binary Pattern) and dense color can be used. The previous results of researchers show that dense LBP produces the best results. Hence, dense LBP was used for feature extraction.

4. CONCLUSION

In this paper we proposed a method of Human Identification based on sclera veins extraction. For segmentation, a Fuzzy C–means-based segmentation approach is proposed. Fuzzy logic-based Brightness Preserving Dynamic Fuzzy Histogram Equalization(BPDFHE) is used for sclera enhancement. Dense Local Binary Pattern(D-LBP) is used for feature extraction. The proposed approach is experimented on the UBIRIS.v1 database. Experimented images gives substantially good sclera veins pattern which can be used for human identification.

REFERENCES

[1] R. Derakhshani, A. Ross, and S. Crihalmeanu.," A new biometric modality based on conjunctival vasculature.," Proceedings of Artificial Neural Networks in Engineering, 2006 pp.1-8.

[2] Z. Zhou, Y. Du, N. L. Thomas, and E. J. Delp.," Multi angled sclera recognition," IEEE Workshop on Computational Intelligence in Biometrics and Identity Management:,2011, pp.103–108.

[3] Z. Zhou, Y. Du, N. L. Thomas, and E. J. Delp," Multimodal eye recognition," Proceedings of the International Society for Optical Engineering, 7708(770806), 2010, pp.1-10.

[4] Z. Zhou, Y. Du, N. L. Thomas, and E. J. Delp," A new biometric sclera recognition," IEEE transaction on System, Man And Cybernatics –PART A: System And Human, 42(3), 2012 pp.571-583.

[5] Z. Zhou, Y. Du, N. L. Thomas, and E. J. Delp," Quality Fusion Based Multimodal Eye Recognition," IEEE International
Conference on Systems, Man, and Cybernetics, 2012, pp.1297-1302.

[6] M. H. Khosravi and R. Safabakhsh," Human eye sclera detection and tracking using a modified time-adaptive self-organizing map," Pattern Recognition, 41, 2008, pp.2571 – 2593.

[7] S. Crihalmeanu and A. Ross, "Multispectral sclera patterns for ocular biometric recognition," Pattern Recognition Letters, 2012, pp.1860–1869.

[8] S. P. Tankasala, P. Doynov, R. R. Derakhshani, A. Ross and S. Crihalmeanu, "Biometric Recognition of Conjunctival Vasculature using GLCM Features," International Conference on Image Information Processing, 2011, pp.1-6.

[9] K. Oh and K. Toh, "Extracting Sclera Features for Cancelable Identity Verification," 5th IAPR International Conference on Biometric, 2012, pp.245-250.

[10] V. Gottemukkula, S. K. Saripalle, S. P. Tankasala, R. Derakhshani, R. Pasula and A. Ross, "Fusing Iris and Conjunctival Vasculature: Ocular Biometrics in the Visible Spectrum," IEEE Conference on Technologies for Homeland Security, 2012, pp.150-155.

[11] T. Mäenpää, M. Pietikäinen, Texture Analysis with local binary Patterns\, in C.H. Chen, P.S.P. Wang (eds.): Handbook of Pattern Recognition and Computer Vision, 3rd edn. World Scientific, 2005, pp. 197-216.

[12] S. Lazebnik, C. Schmid, and J. Ponce, "Beyond bags of features: Spatial pyramid matching for recognizing natural scene categories," In *Proc.* Computer Vision and Pattern Recognition CVPR, 2, 2006, pp. 2169–2178.

[13] Hugo Proença and , Luís A.Alexandre, UBIRIS: A noisy iris image database, Proceed. of ICIAP 2005 - Intern. Confer. on Image Analysis and Processing, 1, 2005, pp.970-977.

[14] A. Das, U. Pal, M. F. A. Ballester and, M. Blumenstein, "A New Method for Sclera Vessel Recognition using OLBP," In Proc. Chinese Conference on Biometric Recognition ,LNCS 8232, 2013, pp. 370–377.

[15] M. A. F. Ballester, A. Morales, A. Das, M. Blumenstein and U. Pal, "Model based Sclera vessels segmentation with SIFT Recognition and its combination with Iris", appeared in Spanish biometric consodium, VII Jornadas de Reconocimiento Biometrico de Personas, 2013, pp. 68-76.

[16] A. Das, U. Pal, M. F. A. Ballester and, M. Blumenstein, "Sclera
Recognition Using D-SIFT," In Proc. 13th International Conference on Intelligent Systems Design and Applications, 2013, pp. 74-79.

[17] A. Das, U. Pal, M. Blumenstein and M. F. A. Ballester, "Sclera Recognition - A Survey," In Proc. Recent Advancement in Computer Vision and Pattern Recognition,2013, pp. 917-921.

[18] J. C. Dunn, "A Fuzzy Relative of the ISODATA Process and Its Use in Detecting Compact Well-Separated Clusters," Journal of Cybernetics 3,1973, pp. 32-57.

[19] J. C. Bezdek , Pattern Recognition with Fuzzy Objective Function Algoritms, Plenum Press, New York, 1981.

[20] Abhijit Das, Umpada Pal, Miguel Angel Ferrer Ballester and Michael Blumenstein ." Fuzzy Logic Based Sclera Recognition," IEEE International Conference on Fuzzy System, 2014,pp. 561-568, Jul. 6-11.

[21] D. Sheet, H. Garud, A. Suveer, J. Chatterjee and M. Mahadevappa, "Brightness Preserving Dynamic Fuzzy Histogram Equalisation," IEEE Trans., Consumaer Electronics, 6(4), Nov. 2010, pp. 2475-2480.

Nternational