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DETECTION AND MATCHING OF IRIS REGION IN IMAGES TAKEN IN UNFAVORABLE CONDITIONS LIKE LIGHT, CAMERA DISTANCE ETC. FOR MAKING IRIS RECOGNITION SYSTEMS MORE EFFECTIVE

Mandeep Kumar[1], Mrs. Ranju[2], Ms. Malika[3]

[1] *Department of Electronics & communication, mandeepkumar7@yhaoo.com*
[2] *Department of Electronics & communication, Kanwarranju97@gmail.com*
[3] *Department of Electronics & communication, kandamalika@yahoo.com*
[1,2,3] *Punjab College of Engineering & Technology, LALRU (MOHALI)*

Abstract: *Iris recognition has become a hot research topic driven by its wide applications in national ID card, border control, banking, etc. Iris is a ring-shaped region of human eye with rich texture information under near infrared illumination. Iris texture is regarded as a genotypic biometric pattern and stable during life so that iris recognition provides an extremely reliable method for individual authentication. Iris recognition aims to assign unique identity label to each iris image based on automatic preprocessing, feature analysis and feature matching. State-of-the-art iris recognition methods include Gabor phase demodulation, ordinal measures, etc. Iris recognition systems have made tremendous inroads over the past decade, but work remains to improve their accuracy in environments characterized by unfavorable lighting, large stand-off distances, and moving subjects. We have proposed a method for iris extraction and matching in these unfavorable conditions. The results show that it gives better performance in valid iris detection by removing upper and lower eyelids accurately.*

I. INTRODUCTION TO BIOMETRICS

Biometrics is the science of establishing human identity by using physical or behavioral traits such as face, fingerprints, palm prints, iris, hand geometry, and voice. Iris recognition systems, in particular, are gaining interest because the iris's rich texture offers a strong biometric cue for recognizing individuals [1]

The human iris is defined as a thin circular diaphragm lying between the cornea and the lens in the eye [4]. Iris is one of the organs present internally in human body but also visible externally when the eye-lids are open. The iris is known to develop in the third month of gestation and prominent structures resulting in the patterns are mostly complete by eighth month [5]. It contains rich amount of texture and unique structures like furrows, freckles, crypts, and coronas [4]. Color of the iris is known to vary individually for each person. The color is related to density of melanin pigment in the anterior layer and stoma [6] in iris. The presence of lower amount of melanin pigment in iris results in light colored iris and the higher amount of melanin pigment results in darker iris. Light colored iris allows the penetration of long wavelength light and usually scatters shorter wavelength light [2]. One important aspect to consider is the epigenetic nature of iris patterns. This results in unique, completely independent and uncorrelated iris patterns for an individual and even for identical twins. Biometric features such as face or fingerprint are always at the risk of being changed due to various factors. The performance of the recognition system depends largely on the change in facial expressions based on the social factors and also throws in challenges in recognition with varied illumination, age and poses [3]. Another well known biometric modality is fingerprint. Any intentional or unintentional scars or cuts on the fingerprint may introduce false recognition or rejection of authentic subjects. Fake fingerprint attack has to be considered for a secure biometric recognition. These factors influence the intra-class variability to larger extent and thereby make the inter-class variability lower. Lower inter-class variability leads to challenges in accurate recognition. Thus, iris provides two unique biometric identities for any single person with a high level of identification confidence. Human iris is also one of the most distinctive features for each individual and is thus used for robust biometric recognition. Owing to the robust level of identity protection it provides, iris recognition is unparalleled by any other biometric feature. Iris biometric feature is not prone to the vast changes or morphing over the period of lifetime.

II. IRIS ANATOMY

The iris dilates and constricts the pupil to regulate the amount of light that enters the eye and impinges on the retina. It consists of the anterior stoma and the posterior epithelial layers, the former being the focus of all automated iris recognition systems. As Figure 1 shows, the anterior surface is separated into the *papillary zone* and the *celery zone*, which are divided by the *collarets*, an irregular jagged line where the sphincter and dilator muscles overlap. The two zones typically have different textural details. As the pupil dilates and contracts, *crypts*—pit-like oval structures in the zone around the collarets—

permit fluids to quickly enter and exit the iris. A series of radial streaks, caused by bands of connective tissue enclosing the crypts, straighten when the pupil contracts and become wavy when the pupil dilates. Concentric lines near the outer celery zone become deeper as the pupil dilate, causing the iris to fold. These *contraction furrows* are easily discernible in dark irises. The *limb s*and *papillary boundaries* define the iris's spatial extent and, in 2D images of the eye, help delineate it from other ocular structures, such as the eyelashes, eyelids, sclera, and pupil. The rich textural details embedded on the iris's anterior surface provide a strong biometric cue for human recognition. The iris anatomy has been explained in the figure below:

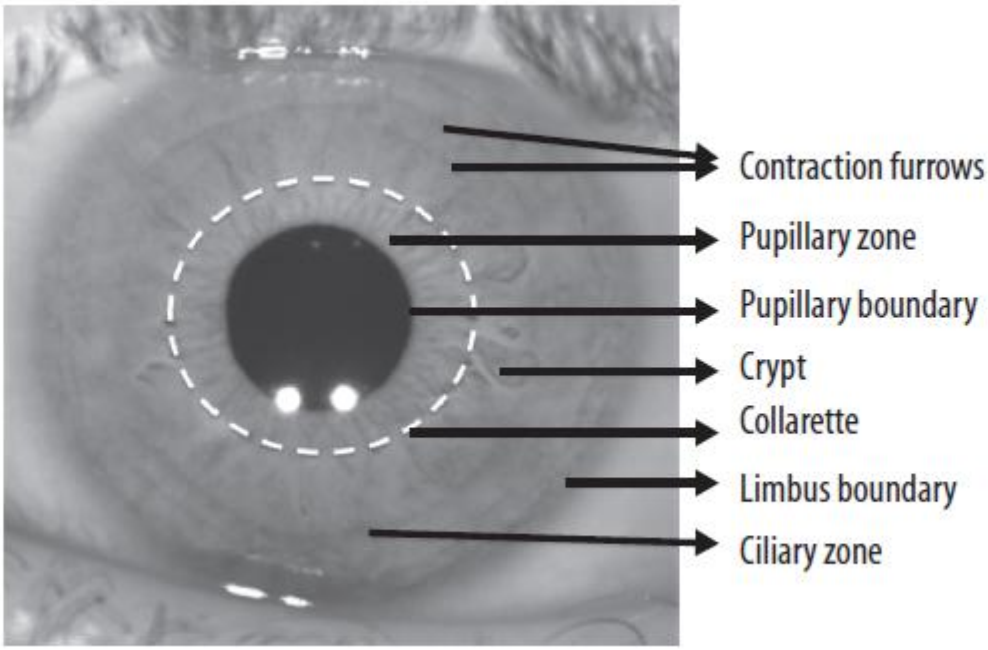

Figure 1: Different elements of an iris

III. ELEMENTS OF A RECOGNITION SYSTEM

Most iris recognition systems consist of five basic modules leading to a decision:

- The *acquisition* module obtains a 2D image of the eye using a monochromatic CCD camera sensitive to the NIR light spectrum.
- The *segmentation* module localizes the iris's spatial extent in the eye image by isolating it from other structures in its vicinity, such as the sclera, pupil, eyelids, and eyelashes.
- The *normalization* module invokes a geometric normalization scheme to transform the segmented iris image from Cartesian coordinates to polar coordinates.
- The *template* module uses a feature-extraction routine to produce a binary code.
- The *matching* module determines how closely the produced code matches the encoded features stored in the database.
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IV. PROPOSED METHOD

Proposed method has number of steps. All these steps play an important role .A brief of these steps has been explained in this section. At first we uses smooth out filters to enhance the image. After this, iris segmentation is a critical component of any iris detection system because inaccuracies in localizing the iris can severely degrade the system's matching accuracy and undermine the system's usefulness. A usual iris segmentation process includes the following steps: demarcating the iris inner and outer boundaries at the pupil and sclera; demarcating its upper and/or lower eyelids if they occlude; and detecting and excluding any superimposed occlusions such as eyelashes, eyelids, shadows, or reflections [18].

The segmentation module detects the papillary and limbos boundaries and identifies the regions where the eyelids and eyelashes interrupt the limbos boundary's contour. We use Hough transform for detecting iris and pupil contours. Finally template has been created in a binary form in order to carry out matching process. Below are the steps which has been used in our technique

- A database has been created in the first. It can be created by using a normal CCD camera, but we use the images from the internet which has been used in previous works.
- As the image taken can have more area other than eye, a preprocessing step is needed to extract eye. Filters and contrast adjustment functions are used in this step to better highlight eye region.
- Segmentation has been done for the extracted portion using intensity based clustering technique. Our technique uses Euclidian distance and intensity values for clustering the eye image and iris region has been find out in a single cluster of same intensity.
- After applying edge detection on segmented image. Circular Hough transform has been applied in order to extract the iris and pupil circles.
- In this step, Upper and lower eyelids have been traced and marked by RGB lines using brightest intensity sclera region and lower intensities of eyelids.
- Valid iris portion has been extracted using the marked upper and lower eyelids and a binary template has been stored in the database folder for matching process.
-

V. EXPERIMENTAL RESULTS

We have tried our algorithm on a database of 50 images of different persons. The outputs at various levels of the algorithm have been explained below.

Figure 2: Image taken to describe the algorithm

As we seen above the image taken after acquisition process can contain regions other than. In previous systems only eye portion has been acquired by acquisition process and therefore very little preprocessing was needed. In the unfavorable environment the image acquisition system can take the image of whole human face. So preprocessing is needed for extraction of eye region from whole image.

Figure 3: Extraction of eye portion

As seen above, in preprocessing step we remove the eye region from whole image. After this iris circle has been figured out and extracted. A segmentation process is needed for doing this. The results after segmentation have been shown below.

Figure 4: Clustering of eye region using Euclidian distance and intensity based fuzzy technique.

It has been figured out that iris region pixels comes in single cluster and hence can be extracted from whole image. Circular Hough transform has been applied at this step and iris has been extracted. After that pupil area has been find out using a range evaluated from iris circle radius. The results at this step have been shown below.

Figure 5: Marking of Iris and pupil circles in the image.

After these upper and lower eyelids has been figured out and located using RGB color line. The marked upper and lower eyelids has been shown in figure below.

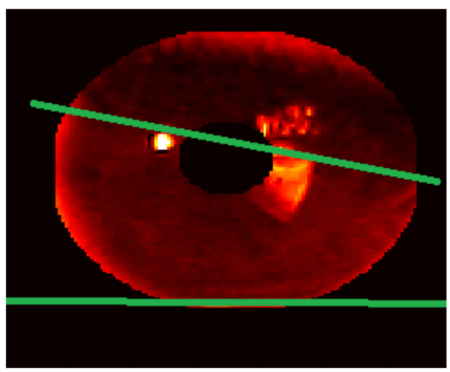

Figure 6: Upper and lower eyelid separators marked in green color.

After this a template has been extracted for valid iris portion. A valid iris portion found in used image is shown below.

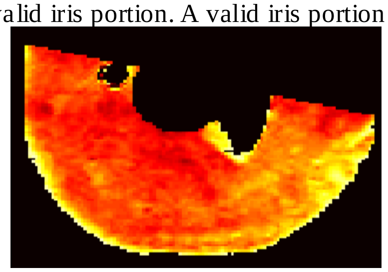

Figure 7: Valid iris region

These are the steps in presented method in which a binary template has been made and stored for matching process.
Below is the table showing false and true positives for a database of four iris types in matching process. Six iris templates has been generated and from each database of unique person.

True positive has been marked as ☑ if the template is matched with correct person and correspondingly false-positive has been marked as ☑ if the template is matched with incorrect person Table 1: Results for the test images as true and false positives.

Iris type 1	True positive	False positive
Data1	☑	☒
Data2	☑	☒
Data3	☑	☒
Data4	☑	☒
Data5	☒	☑
Data6	☑	☒
Iris type 2	True positive	False positive
Data1	☑	☒
Data2	☒	☑
Data3	☑	☒
Data4	☑	☒
Data5	☑	☒
Data6	☒	☑
Iris type 3	True-positive	False positive
Data1	☑	☒
Data2	☑	☒
Data3	☑	☒
Data4	☒	☑
Data5	☑	☒
Data6	☑	☒
Iris type 4	True-positive	False positive
Data1	☒	☑
Data2	☑	☒
Data3	☑	☒
Data4	☑	☒
Data5	☑	☒
Data6	☑	☒

Below is the bar graphs of above table in which bars draw as positive are true positives and bars drawn as negative are false positives.

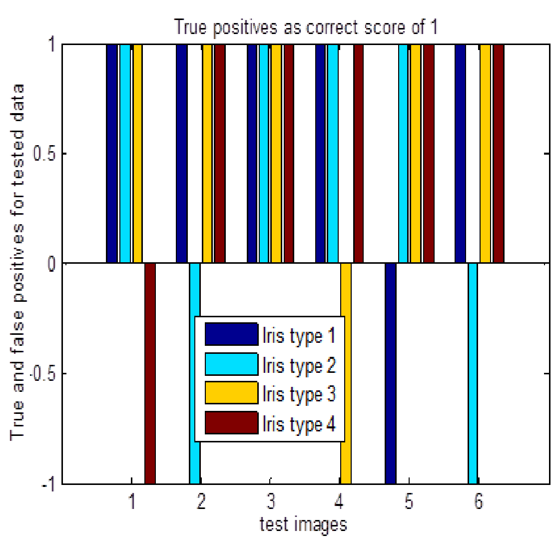

Figure 8: Bar graphs of tested data as true and false positives.

It has been found that iris circles are easily located by this technique and it has shown 80 percent of templates that has been correctly matched with the correct person

VI. CONCLUSIONS

This paper has presented an efficient technique of iris extraction in unfavorable environments. There are so many algorithms that have created to help human identification through Iris recognition but that are based on databases for high quality input images, The new Iris recognition method is based on the natural-open eyes. This method can find the iris characteristic point in a short time, the recognition rate is high, high recognition speed is guaranteed. In particular, a comparative study of existing methods for iris recognition has been conducted. Such performance evaluation and comparison not only verify the validity of our observation and understanding for the characteristics of the iris but also will provide help for further research.

REFERENCES

[1] K.W. Bowyer, K. Hollingsworth, and P.J. Flynn, "Image Understanding for Iris Biometrics: A Survey," Computer Vision and Image Understanding, vol. 110, no. 2, 2008, pp. 281-307.

[2] MR Chedekel, "Photophysics and photochemistry of melanin," Melanin: Its Role in Human Photoprotection, pp. 11–23, 1995.

[3] Yael Adini, Yael Moses, and Shimon Ullman, "Face recognition: The problem of compensating for changes in illumination direction," Pattern Analysis and MachineIntelligence, IEEE Transactions on, vol. 19, no. 7, pp. 721–732, 1997.

[4] FH Adler, "Physiology of the eye, mosby, st," Louis, Mo, 1965.

[5] Thierry Lefevre, Bernadette Dorizzi, Sonia Garcia-Salicetti, NadegeLemperiere, and StephaneBelardi, "Effective elliptic fitting for iris normalization," ComputerVision and Image Understanding, 2013.

[6] John Daugman, "How iris recognition works," in Image Processing. 2002. Proceedings. 2002 International Conference on.IEEE, 2002, vol. 1, pp.I–33.

[7] J. Daugman, "New methods in iris recognition," *IEEE Trans. Syst.,Man, Cybern., Part B: Cybern.*, vol. 37, no. 5, pp. 1167–1175, 2007.

[8] D. Monro, S. Rakshit, and D. Zhang, "DCT-based iris recognition," *IEEE Trans. Pattern Anal. Mach. Intell.*, vol. 29, no. 4, pp. 586–595, 2007.

[9] A. Kumar and A. Passi, "Comparison and combination of iris matchers for reliable personal authentication," *Pattern Recognit.*, vol. 43, no. 3,pp. 1016–1026, 2010.

[10] H. Proença, "Iris recognition: Analysis of the error rates regarding the accuracy of the segmentation stage," *Image and Vision Comput.*, vol. 28, no. 1, pp. 202–206, 2010.

[11] B. Kang and K. Park, "A robust eyelash detection based on iris focus assessment," *Pattern Recognit.Lett.*, vol. 28, no. 13, pp. 1630–1639, 2007.

[12] L. Ma, T. Tan, Y. Wang, and D. Zhang, "Efficient iris recognition by characterizing key local variations," *IEEE Trans. Image Process.*, vol. 13, no. 6, pp. 739–750, 2004.

[13] J. Daugman, "High confidence visual recognition of persons by a test of statistical independence," *IEEE Trans. Pattern Anal. Mach. Intell.*, vol. 15, no. 11, pp. 1148–1161, 1993.

[14] R.Wildes, "Iris recognition: An emerging biometric technology," *Proc. IEEE*, vol. 85, no. 9, pp. 1348–1363, 1997.

[15] Z. He, T. Tan, Z. Sun, and X. Qiu, "Toward accurate and fast iris segmentation for iris biometrics," *IEEE Trans. Pattern Anal. Mach. Intell.*, pp. 1670–1684, 2008.

[16] R. Mukherjee and A. Ross, "Indexing iris images," in *Proc. 19th Int. Conf. Pattern Recognit.*, 2008, pp. 1–4.

[17] H. Mehrotra, B. Majhi, and P. Gupta, "Robust iris indexing scheme using geometric hashing of SIFT keypoints," *J. Network Comput. Appl.*, vol. 33, no. 3, pp. 300–313, 2010.

[18] T.M. Khan, M.A. Khan, S.A. Malik, S.A. Khan, T. Bashir, A.H. Dar, Automatic localization of pupil using eccentricity and iris using gradient based method, Opt. Lasers Eng. 49 (2011) 177–187.

