ISSN (Online) 2394-2320

International Journal of Engineering Research in Computer Science and Engineering (IJERCSE)
Vol 5, Issue 2, February 2018

Review on Iris Recognition

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Abstract: Iris Recognition has gained considerable attention in various fields such as industrial areas, vulnerable areas of defense, border areas and medical institutes, etc. Because of its high precision and uniqueness, it is used at border areas in various fields of access control and security. Thanks to their reliability, precision and uniqueness, the market for iris recognition is rising day by day. Among all other biometric features, it is the most effective recognition feature, as human iris remains unchanged throughout life. Scientists have to focus on various challenges such as images taken in unconstrained settings, noisy images, distorted images and many more for the successful functioning of the iris recognition system. The purpose of this review paper is to address steps involved in iris recognition method and different techniques used by different researchers for each stage of recognition. Iris recognition system is an accurate biometric system. Image acquisition, restoration, quality assessment, image compression, segmentation, noise reduction, normalization, feature extraction, iris code matching, large database search, applications, evaluation, performance under varying conditions, and multi-biometrics are developed in recent years.

Keywords: Acquisition, Feature Extraction and Matching,Iris Recognition, Localization

INTRODUCTION

The colored ring is called Iris[1], around the eye. The floral pattern is unique to every single individual. In recent years, Iris Recognition[2] has attracted a great deal of attention due to its unique characteristics such as ridges, freckles, rings, Furrows and complex pattern and therefore show a high degree of randomness. All the people have separate iris patterns. Even an individual's iris pattern has distinct iris patterns for both eyes. Though the individual ages, it is stable over time. Some desirable properties such as uniqueness, stability etc. makes recognition of iris suitable for highly reliable and accurate identification of humans. Iris also has a big advantage in mathematics as its pattern variability among different individuals is enormous. Iris is also well shielded from the environment, as it is an internal organ and is stable throughout life. For the first time in 1987, the idea of iris recognition was proposed as a reliable biometric. Several researchers such as John Daugman, K.W.Bowyer, and Wildes etc. have proposed several effective algorithms for iris recognition. Most of the algorithms need user co-operation and must ensure that user is properly positioned when image is being taken to get high quality image.

The degrees of freedom[3] assess the biometric suitability with more separate dimensions of variations that provide important biometric distinctiveness. Iris has been found to have 266 degrees of liberty which is the highest among all the facial organs. Improved, accurate, safe and genuine recognition methods are of great interest, and are more useful. Biometric[4] is the term used to identify an individual by using the physical and behavioral characteristics. It is therefore easier and more secure as one may lose an identity card or password but not physical properties. Human iris is a part of the human eye that is visible from outside.

Iris identification replaces the traditional system as PIN, password or tokens (identity cards, keys etc.) need to be identified. Identification of Iris is an evolving problem within civilized societies. An individual is an authorized user, performing transactions before entering the confidential area. In the biometric world, human identity is about its physiological and/or behavioral characteristics. Fingerprints, ears, retina scanning, ear shape, hand morphology are biometric dependent physiological characteristics and biometric deals with a person's attitude such as voice, gait, signature etc. Iris deals with human identification based on its physiological characteristics. In addition, the consistency, universality, longevity, collectability and specific information measured in a single iris is much higher than other biometric information. Figure 1 displays a front view of the iris.

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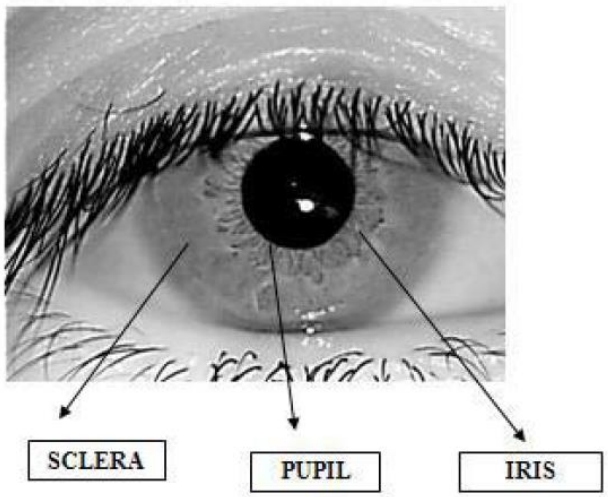

Figure 1: The Figure Portrays the Human Iris

Iris is the colored circular shaped internal organ which controls the size of the pupil which determines how much light can penetrate the eye. By the time a human is about eight months old, the structure which creates iris patterns is largely complete. The iris patterns formed are unique in the same way that no two Irises are alike even if they are in the same person from identical twins or from left to right eye.

Among all physical biometrics, biometric iris systems are highly secure biometric systems that operate at low false acceptance (FAR) rates. Iris biometrics technology applications include: identification cards and passports, border control and other government programs, jail security, access to databases and computer login, schools, aviation protection, hospital security, access control of restricted areas, entry to buildings and houses. The U.N. High Commissioner for Refugees (UNHCR) used Afghan refugees to recognize iris. Iris recognition is used for the recognition of prisoners in jails. Airports in U.K., United State, Canada, United Arab Emirates, and Singapore, Germany, and the Netherlands all use iris recognition at their boarders and immigration control.

Iris biometrics has a number of benefits which are briefly mentioned below:

1. Stability over time – It ensures that, over time, the iris pattern does not change relative to other biometrics. Glasses, contact lenses and even eye surgery don't distort the iris patterns ' appearance and characteristics. Voice may change as a result of aging or illness; fingerprints may not work for those individuals with no or few minute points (e.g. this may be the case for surgeons, as they often wash their hands with strong detergents, constructors and people with special skin conditions). Furthermore, cuts, dirt, or tears may affect finger ridge patterns. Finally, the face changes by age, injury, injuries or make up.

2. Ease of collection – Because of the small size of the iris file, an iris image archive of a large population can be saved and held on a personal computer or flash memory disk.

3. Uniqueness – There is a considerable inter-class variability, meaning large differences between individuals. The biometric iris is the most unique and robust biometric among all biometrics - even twin iris patterns are different.

4. Large number of features – The iris has over 200 points, including circles, furrows, freckles and the corona.

5. Contactless, hygienic – One of the benefits of recognizing the iris is being contactless. The iris recognition camera takes the image of the eye from a distance compared to the fingerprint recognition which is required to reach the fingerprint object. In a biometric fingerprint system that requires the individual to touch or contact the recognition device, the likelihood of contagion from diseases is high. Because iris recognition is contactless, the likelihood of contagion from diseases is low, and thus iris recognition is known as a biometric hygienic system.

IRIS RECOGNITION SYSTEM

1. Image Capturing/Acquisition:

The first stage is one of the major challenges of automatic iris recognition since we need to use specially designed cameras to get the iris images series from humans. Iris and the part of the pupil should be clearly visible in these photographs but sometimes it depends on images taken in which state of the world. There are also several free internet databases and image can be taken from them, the CASIA Iris Image database[5] is used for the research and a well-known database. There is also another site, such as the LEI and UPOL.

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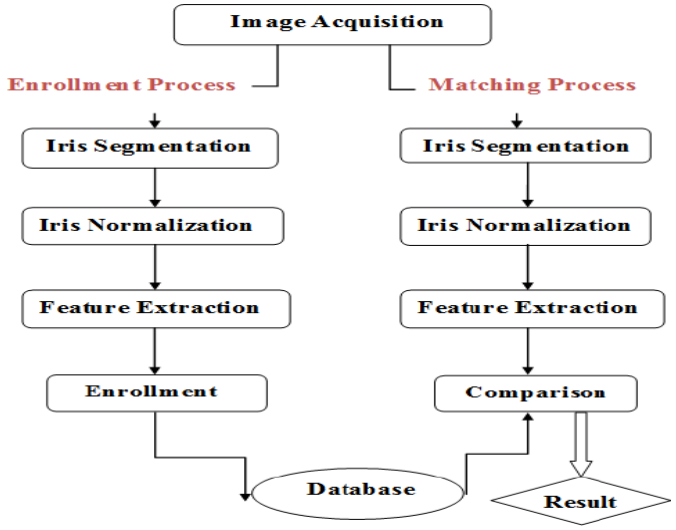

Figure 2: Steps in Iris Recognition Process

Acquisition is to acquire series of iris images from individuals using cameras specially designed. Image capture device will set a minimum 50 pixel radius to capture fine iris pattern information. The middle of the eye is inferior to iris, and nasal. Pupil radius ranges between 0.1 and 0.8 of iris radius. Photo processing mainly involves separation of the area from the photo of the eye. To control the amount of light it should use near infrared illumination. It also helps to unveil the complex pigmented iris structure. The main aim of image processing is to acquire a quality image that supports a biometric system that is efficient and reliable.

2. Iris Segmentation and Location:

Segmentation[6] of the iris is an important stage of identification of iris. There have been several suggested studies in this field. Daugman used active contours for boundary measurement of the iris. He computed the image gradient in a circular direction. He formed the occlusion of the eyelid with separate splines. He used a discrete approximation of the Fourier series[7], suited to the image gradient. Daugman also converted images of iris off-angle to frontal picture. He set the parametric equation for pupil's form. Through applying extensions of the proposed equations to the Fourier series he calculated the position of the look. Instead, the off-angle image was converted to the frontal image Iris identification is based on the fact that iris includes unique features that differentiate a person completely; the actual information that we are looking for is contained in the iris patterns. Therefore, it is important to separate the iris area from the other sections of the image, and also to distinguish external and internal contours of the iris boundary.

2.1 Algorithm Used:

- To convert the input image into binary edge map using feature detection operators.
- Applies the Hough Transform to find a circumference in image to describe the iris contour and pupil contour.
- Defined a three- dimensional Centre coordinates (cx, cy) and radius r of circle passing through each edge point.
- Hough Transform for circular boundary is definedas

$(x – xc) 2 + (y – yc) 2 = r2$

Three dimensional generalized Hough space given an edge point (x, y),

1. Loop over all values of (xc, yc),

2. Compute r

3. Increment H (xc, yc, r)

3. Normalization Stage:

This technique is based on the transformation of the iris into polar coordinates[8] to make it persistent and unchanging in nature against the effect of pupil size variation. Standardization process is performed by unwrapping iris region into rectangular strip. Thus the matching outcomes will be strongly affected. So these issues need to be addressed for exact matching. Daugman normalized the image of the iris by interpreting the image using a fixed parameter interval in a doubly dimensionless pseudo-polar coordinate system[9]. The ring iris is counter-clockwise unwrapped to a rectangular pattern of a fixed size. Standardization simplifies processing by reducing iris distortion due to pupil.

4. Feature Coding:

The most significant feature for categorization is described by function coding[10]. The dominant information present in an iris image must be extracted in a

precise manner for accurate recognition of personals. The area of the iris is encoded using wavelets for the iris code construction. Gabor wavelet, 1D Wavelet Log-Gabor filters used for process coding.

5. Matching Algorithm:

After creating iris code, during registration, you need to compare this iris template with stored template and see if any matches occur. Hamming distance is used between bits for comparison. It is measured as the difference between two templates in the number of bits. When comparison gives zero score, then both iris models are exactly the same as matches for irises and one score is exactly the opposite of irises. Weighted Euclidean distance is another matching technique which can be used.

CONCLUSION

The detection of iris is one of the most effective methods for human identification. This paper provides from time to time information on various existing methods proposed for iris recognition by different researchers. Most of the time, wavelets are effective solution for iris segmentation and localization, and Gabor filters are used for coding purposes. Compared with other edge detection techniques, canny edge detector with Hough Transform efficiency is far higher and finally the hamming distance approach works well for prototype matching.

Most of these methods follow the major steps of iris recognition-acquisition of images, pre-processing, and selection of features and matching of models. All these methods ' efficiency varies depending on the various algorithms they use. Based on the context in which photographs are taken, all of these approaches have their own value. Thanks to its effective functioning and precision, Iris identification has gained significant popularity in the last few years. The peculiar attribute of iris that keeps it durable throughout life is the main reason it is used in personal recognition at various locations such as airports, harbors, premises such as the home and laboratories.

REFERENCES

[1] A. R. Rees, “IRIS,” in *Handbook of Flowering: Volume I*, 2018.

[2] I. Hamouchene and S. Aouat, “A New Texture Analysis Approach for Iris Recognition,” *AASRI Procedia*, 2014, doi: 10.1016/j.aasri.2014.09.002.

[3] F. L. Pryor, “Capitalism and freedom?,” *Econ. Syst.*, 2010, doi: 10.1016/j.ecosys.2009.09.003.

[4] J. A. Unar, W. C. Seng, and A. Abbasi, “A review of biometric technology along with trends and prospects,” *Pattern Recognit.*, 2014, doi: 10.1016/j.patcog.2014.01.016.

[5] J. Deng, W. Dong, R. Socher, L.-J. Li, Kai Li, and Li Fei-Fei, “ImageNet: A large-scale hierarchical image database,” 2010, doi: 10.1109/cvpr.2009.5206848.

[6] N. H. Patel and P. Z. Liu, “Segmentation,” in *Encyclopedia of Insects*, 2009.

[7] G. Plonka, D. Potts, G. Steidl, and M. Tasche, “Fourier series,” in *Applied and Numerical Harmonic Analysis*, 2018.

[8] M. Ladd and M. Ladd, “Spherical polar coordinates,” in *Introduction to physical chemistry*, 2012.

[9] P. Schnizer, “Coordinate systems,” in *Springer Tracts in Modern Physics*, 2017.

[10] M. W. Spratling, “A review of predictive coding algorithms,” *Brain and Cognition*. 2017, doi: 10.1016/j.bandc.2015.11.003.

[11] S.Balamurugan , L.Jeevitha, A.Anupriya and Dr.R.GokulKruba Shanker, “Fog Computing: Synergizing Cloud, Big Data and IoT- Strengths, Weaknesses, Opportunities and Threats (SWOT) Analysis”, International Research Journal of Engineering and Technology (IRJET), Volume 3 issue 10, e-ISSN: 2395 -0056, p-ISSN: 2395-0072, 2016

[12] S.Balamurugan, S.Dharanikumar, D.Gokul Prasanth, Krithika, Madhumitha, V.M.Prabhakaran and Dr.R.GokulKruba Shanker, “Internet of Safety: Applying IoT in Developing Anti Rape Mechanism for Women Empowerment”, International Research Journal of Engineering and Technology (IRJET), Volume 3 issue 10, pp.713-719,e-ISSN: 2395 -0056, p-ISSN: 2395-0072, 2016

[13] Balamurugan S, Visalakshi P, “Hybrid Firefly Algorithm Harmony Search for Feature Selection with BCNF for Multiple Subtables and EM-GMM for Top Down Initial Partitioning”, Asian Journal of Research in Social Sciences and Humanities Year : 2016, Volume : 6, Issue : 8, 2016

[14] Usha Yadav, B K Murthy, Gagandeep Singh Narula,

Neelam Duhan and Vishal Jain, "EasyOnto: A Collaborative Semi Formal Ontology Development Platform", CSI-2015; 50th Golden Jubilee Annual Convention on "Digital Life", held on 02nd to 05th December, 2015 at New Delhi, published by the Springer under Nature Inspired Computing, Advances in Intelligent Systems and Computing having ISBN 978-981-10-6746-4 page no. 1 to 11.

[15] Usha Yadav, Gagandeep Singh Narula, Neelam Duhan and Vishal Jain, "A Novel Approach for Precise Search Results Retrieval based on Semantic Web Technologies", 10th INDIACom; INDIACom-2016, 3rd 2016 International Conference on "Computing for Sustainable Global Development", 16th – 18th March, 2016 having ISBN No. 978-9-3805-4421-2/, page no. 1357 to 1362.

[16] Usha Yadav, Gagandeep Singh Narula, Neelam Duhan, Vishal Jain, "Ontology Engineering and Development Aspects: A Survey", International Journal of Education and Management Engineering (IJEME), Hongkong, Vol. 6, No. 3, May 2016, page no. 9 – 19 having ISSN No. 2305-3623.