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Method to Remove the Noisy Data from Captured Image of Iris and Identifying the Pupil by Detecting Its Centroid

Abhilash.KS.[1] and Dr.V.S.Dharun[2]

[1]*Research Scholar, Department of ECE, Noorul Islam University, Kanyakumari, Tamil Nadu, India.*

[2]*Principal, Immanuel Arasar J J College of Engineering, Marthandam, Kanyakumari, Tamil Nadu, India.*

[1]*Orcid: 0000-0003-4743-2030*

Abstract

Biometric refers to the identification of individuals based on physiological or behavioural characteristics. Human iris as biometric feature gives better advantages over other features like fingerprint, face, palm etc. This paper proposes a method to find the pupil and its centroid for proper iris identification. To find the edge of the image canny edge detection method is used and find all connected components. From these components pupil is detected .The centroid of the detected pupil is chosen as the reference point for extracting the features of the iris.

Keywords: canny edge detection; Thresholding; Connected pixels; Manhattan distance; Daugman's theory (key words)

INTRODUCTION

Individual identification based on biometric systems has been so far increasing for improving the focus on security throughout the world [18]. Biometrics system provides reliable identification by examining the physical or behavioural unique characters of human beings, [18] among all individuals. Examples are finger print, palm vein, face recognition, iris recognition, DNA, palm print [18]. Among these the use of the human iris as a biometric feature offers many advantages over other features and enough to be used as a biometric signature [18]. Iris is a ring like chromatic texture between the black white colour sclera and central pupil in the human eye [18]. Iris pattern has complex characteristics which exhibit the iris as an important, convenient and non-invasive natural identification means. Iris has epigenetic formation and it is formed part from the individual DNA [14], but a great deal of its final pattern is developed at random. [16] This means that the probability of finding people who have iris patterns which are identical so it is important to define a representation that is well adapted for extracting the iris information content from images of the human eye. In recent years, iris is more being utilized in identification systems. In historical viewpoint, identification of individuals using iris was proposed as a reliable biometrics in 1987 by L. Form [2]. After that, based on the 2d Gabor filter phase quantification and the code identification system Daugman given Daugman's theory [18][3]. Wildes continue his theory based on the multiscale Gaussian filter embedded iris identification system [4]. Boles recommended a method based on the wavelet transformation of the iris recognition algorithm [5].1-D dyadic[18] wavelet transform in multi resolution levels are used in iris image analysis, the feature vector of the iris image was extracted from the wavelet results in Boles and Boashash's system [18] [6]. After that based on probabilistic fuzzy logic method Chung-Chih Tsai [7] given iris segmentation to identify the local vectors. To identify the eye most of the algorithms use circular template [1]. But fact is they are not in a standard circle shape, so it difficult to have proper identification without iris legacy problems.

This paper proposes a method to identify the pupil and it centroid by removing the noisy data from the captured image of iris. The information extraction process starts by locating the pupil of the eye, which can be done using any edge detection technique. The edges defining it are connected to form a closed contour by knowing that it has a circular shape [16]. For extracting the features of iris the centroid of iris is chosen as reference point. For edge detection here uses canny edge detection method

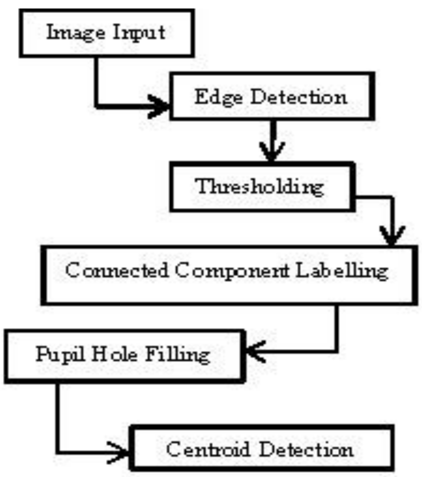

Figure 1: System for Noise Removal and Feature Extraction

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CANNY EDGE DETECTION

The canny edge detection method is to determine the iris and pupil boundaries from the captured image [18]. The effective edges of eye are thus obtained. Thus we can obtain the exact pupil edge to detect the image [8], [9]. The algorithm runs in 5steps: They are Smoothing, Finding gradients, Non-maximum suppression, Double thresholding, Edge tracking by hysteresis [10].

A. Smoothing

Almost all images acquired by a camera are supposed to have some amount of noise [18]. This noise must be reduced before further processing. Gaussian filter is used in the early stage of image smoothing. The removal of noise and blur from image is the main aim of smoothing.

B. Finding gradients

Basically canny algorithm is used to find the edges by changing the intensity of grey scale image .the areas are detected by obtaining the gradient of image [18]. Sobel operator is used to determine the gradient points from the smoothed images. Initial step is approximation of gradient in x and y direction by applying the kernels respectively. By applying law of Pythagorean Theorem the gradient magnitudes are determined as Euclidean distance

1. Manhattan distance measure can be used to reduce the computation complexity.
2. Euclidean distance measures where applied to the test image.

If Gx and Gy represent the x- and y-directions gradients respectively then.

$$|G| = \sqrt{G_X^2 + G_Y^2} \qquad (1)$$

$$|G| = |G_X| + |G_Y| \qquad (2)$$

C. Non-maximum suppression

This is used to remove blurred edges in images having gradient magnitude variation and sharp edges, all local maxima in gradient stage is preserved and removes everything else[18].

1. Corresponding to the use of an 8-connected neighbourhood the gradient direction θ is round to nearest coordinate.
2. Compare the edge strength of the current pixel with the edge strength of the pixel in the positive and negative gradient direction.
3. Suppress the value of the edge if strength of the current pixel is small; preserve the value of the edge strength if large [18].

D. Double thresholding

Edge pixels are marked in the order of strength pixel by pixel after the non-maximum suppression step. Due to rough surface there may be colour variation or noise in addition to true edges. Using thresholding they can be distinguished, and the preserved value will be of strongest edge. Edge pixels stronger than high threshold are usually identified as strong and those edge pixels that are weaker than lowest threshold are generally concealed and the edge pixels falling between the two limits are marked as weak [18].

E. Hysteresis based edge tracking

Some edges known as certain edges are included in final edge image .the certain edges are long edges of image [18]. If weak edges are connected to strong edges then they are also included. In strong edges noise and other small variations are never be included. The true edges in original image will result in strong edges. The second type is distributed probably and independent of edges on the entire image and in the adjacent location of strong edges a small amount will be located. Weak edges due to true edges are usually connected to strong edges. [18]

THRESHOLDING

Thresholding is used to create a binary image from grey scale image so that each pixel is replaced by black if it is less than the particular threshold or replace by white if it threshold After the edge detection the eye image undergo thresholding such that the central part of the eye is distinguishable

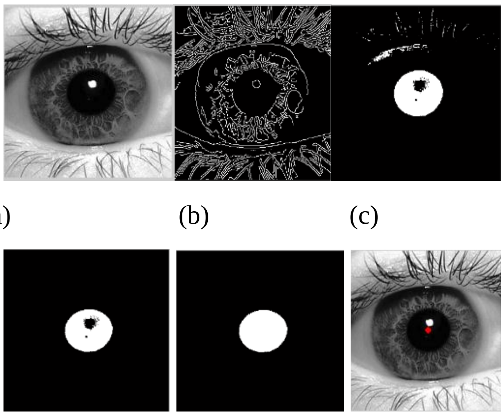
CONNECTED COMPONENT LABELLING

After detection of boundary region the region which is not separated by boundaries are extracted. Connected pixels are those set of pixels which are not separated by boundaries. Connected pixels have similar values of intensity for pixels but they are connected in one way or the other [15]. Using this, in the binary image of the eye it is possible to find such connected component (closed counters). The matlab function "`bwconncomp" can be used to find` the connected components in a binary image `which` can have any dimension. Once all components have been determined, the number of such components can be determined. Then each pixel is labelled with a graylevel or according to the component it was assigned to. Matlab function "*bwlabel*" can be used for this. Here an operation known as hole filling is also carried out. This hole filling helps in centroid detection that is it makes centroid detection easier by reducing the false detection rate of centroid detection. Usually holes in pupil are filled by gradients of adjacent pixels

CENTROID DETECTION

After labeling each component, our aim is to find the pupil from other components. For that the length of each component need to found. By knowing the approximate size of the pupil we can set the threshold. The component which is greater than the threshold is taken as the pupil. In binary image the holes are filled by filling.[13] A set of background pixels can't be reached that's known as holes after that the centroid can be found using the matlab function "*regionprops*". For extracting the features of iris the centroid of pupil is detected and that centroid is used as reference [11] point in feature extraction. Features thus extracted are used in authentication or identity purposes.

EXPERIMENTAL RESULTS



(a) (b) (c) (d) (e) (f)

Figure 2: (a) Input image (b) Edge detected image (c) Threshold image (d) Connected components (e) Pupil (f) Centroid of pupil

CONCLUSIONS

In eye authentication process, detection of the pupil is most crucial step to recognize the eye [18]. Traditional methods cause the problem of pupil legacy and loss of texture. The paper proposes a method to find the pupil and its centroid which can be taken as a reference point to extract features of an eye. The experimental result shows the effective pupil centroid detection for accurate authentication

REFERENCES

[1] Jain, A.K., Flynn, P., Ross, A. (Eds.), 2007. Handbook of Biometrics. Springer-Verlag

[2] L. Flom, A. Safir, Iris Recognition System, U.S. Patent 4 641 349, 1987.

[3] J G Dauglllan. High confidence visual recognition of Persons by a test of statistical independence[J]. IEEE Transactions on Pattern Analysis and Machine Intelligence, 1993,15(1):1148-116

[4] R P wildes, et al. A system for automated iris recognition[C]. In Proceedings of the Second IEEE Workshop on Applications of Computer Vision. Sarasota, Horida, 1994. 121-128.

[5] W W Boles. A wavelet transform based technique for the recognition of the human iris[C]. In Proeeedings of the 1996 International SylnPosium on Signal Proeessing and its Applications, Gold Cost, Australia, 1996.601-604

[6] W. W. Boles and B. Boashash, "A human identification technique using images of the iris and wavelet transform," IEEE Trans. Signal Process., vol. 46, no. 4, pp. 1185–1188, Apr. 1998.

[7] L. Ma, T. Tan, Y. Wang, and D. Zhang, "Personal identification based on iris texture analysis," IEEE Trans. Pattern Anal. Mach. Intell., vol. 25, no. 12, pp. 1519–1533, Dec. 2003.

[8] Thomas B. Moeslund. Image and Video Processing. August 2008.

[9] F. Mai, Y. Hung, H. Zhong, and W. Sze. A hierarchical approach for fast and robust ellipse extraction. Pattern Recognition, 41(8):2512–2524, August 2008.

[10] Chinni. Jayachandra, H.Venkateswara Reddy"Iris Recognition based on Pupil using Canny edge detection and K-Means Algorithm" International Journal Of Engineering And Computer Science ISSN:2319-7242 Volume 2 Issue 1 Jan 2013 Page No. 221-225

[11] R. Sanchez-Reillo. "Iris recognition for biometric identification using dyadic wavelet transform zerocrossing",Proceedings IEEE 35th Annual 2001 International Carnahan Conference on Security Technology (Cat No 01CH37186) , 2001

[12] Sree, V. Krishna, and P. Sudhakar Rao. "Diagnosis of ophthalmologic disordersin retinal fundus images", The Fifth International Conference on the Applications of Digital Information and Web Technologies (ICADIWT

2014),

[13] Wu, H.-S., and S. Dikman. "Segmentation and thickness measurement of glomerular basement membranes from electron microscopy images", Journal of Electron Microscopy, 2010.

[14] Vatsa, M. Singh, R. Noore, A.. "Reducing the false rejection rate of Iris recognition using textural and topological features.(ident", International Journal of Signal Processi, April 2005 Issue

[15] David Binns. "A Pilot Study of Automatic Lung Tumor Segmentation from Positron Emission Tomography Images using Standard Uptake Values", 2007 IEEE Symposium on Computational Intelligence in Image and Signal Processing, 04/2007

[16] W.W. Boles. "A human identification technique using images of the iris and wavelet transform", IEEE Transactions on Signal Processing, 4/1998

[17] Jersha Felix, V., Purohitam Adithya Udaykiran, and K. Ganesan. "Fuel Adulteration Detection System",Indian Journal of Science and Technology, 2015.

[18] Chinni. Jayachandra, H.Venkateswara Reddy "Iris Recognition based on Pupil using Canny edge detection and K-Means Algorithm" International Journal Of Engineering And Computer Science ISSN:2319-7242 Volume 2 Issue 1 Jan 2013 Page No. 221-225

[19] Bharadwaj S, Vatsa M, Bharadwaj R S, "Biometric quality: a review of fingerprint, iris and face", EURASIP journal on Image and Video Processing, 2014

[20] Jan F, "Segmentation and localization schemes for non-ideal iris biometric systems", 2017

[21] Kalra S, Lamba A, "Improving Performance by combining Fingerprint and Iris in Multimodal Biometric", International Journal of Computer Science and Information Technologies, Vol. 5 (3) , 2014, 4522-4525

[22] Mendu, Anusha, Krishna V, "Multimodal Biometric System Integrating Fingerprint Face and Iris", International Journal of Innovative Research in Computer and Communication Engineering, Vol. 4, Issue 10, October 2016

[23] Anil K. Jain, Arun Ross and Salil Prabhakar, "An introduction to Biometric Recognition", IEEE Transactions on circuits and systems for video technology vol. 14, no.1, January 2004.

[24] Igor B'ohm and Florian Testor, "Biometric Systems", ResearchGate

[25] Rajesh Bodade and Rajesh Bodade, "Dynamic Iris Localisation: A Novel Approach suitable for Fake Iris Detection", IEEE 2009.

[26] Sanjay Kumar Singh and Yogendra Narain Singh, "Vitality Detection from Biometrics: State-of-the-Art", IEEE 2011.

[27] Siddhesh Angle, Reema Bhagtani, Hemali Chheda, "Biometrics: A Further Echelon of security", 2005.

[28] Simon Liu and Mark Silverman, "A Practical Guide to Biometric Security Technology", 2001.

[29] Sung Joo Lee, Kang Ryoung Park, Jaihie Kim, "Robust fake iris detection based on variation of the reflectance ratio between the iris and the sclera", IEEE 2006.

[30] Xiaofu He, Yue Lu, Pengfei Shi, "A fake iris detection method based on FFT and quality assessment",IEEE 2008.

[31] Zhuoushi Wei, Xianchao Qiu, Zhenan Sun and Tieniu Tan, "Counterfeit Iris Detection Based on Texture Analysis", IEEE 2008.

[32] Sabarigiri B, Suganyadevi D, "An Efficient Multimodal Biometric Authentication based on IRIS and Electroencephalogram (EEG)", 2014