Detection of Iris Image using EMD approach

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Abstract— IRIS recognition is one of the most reliable techniques in biometrics for human identification. Iris recognition techniques have been used widely by governments, such as the Aadhaar project in India. This paper presents a biometric recognition system based on the iris of a human eye using wavelet transform. The proposed system includes three modules: image preprocessing, feature extraction, and recognition modules. The feature extraction module adopts the gradient directions (i.e., angles) on wavelet transform as the discriminating texture features. We present a new approach for detecting and matching iris crypts for the human-in-the-loop iris biometric system. Our proposed approach produces promising results on all the three tested datasets, in-house dataset. The identification result obtained using the EMD approach illustrates the success of its efficient use in iris recognition. A fast iris localization method like rectangular area method is used. Using this method, iris segmentation is performed in short time.

Key words: Image Processing, IRIS, Matching and Detection

I. INTRODUCTION

Iris recognition is one of important biometric recognition approach in a human identification is becoming very active topic in research and practical application. Iris region is the part between the pupil and the white sclera. This field is sometimes called iris texture. The iris texture provides many minute characteristics such as freckles, coronas, stripes, furrows, crypts, etc. These visible characteristics are unique for each subject. Such unique feature in the anatomical structure of the iris facilitates the differentiation among individuals [1]. The human iris is not changeable and is stable. From one year of age until death, the patterns of the iris are relatively constant over a person's lifetime. Because of this uniqueness and stability, iris recognition is a reliable human identification technique. Iris recognition consists of the iris capturing, pre-processing and recognition of the iris region in a digital eye image. Iris image preprocessing includes iris localization, normalization, and enhancement. Each of these steps uses different algorithms. In iris localization step, the determination of the inner and outer circles of the iris and the determination of the upper and lower bound of the eyelids are performed. A variety of techniques have been developed for iris localization.

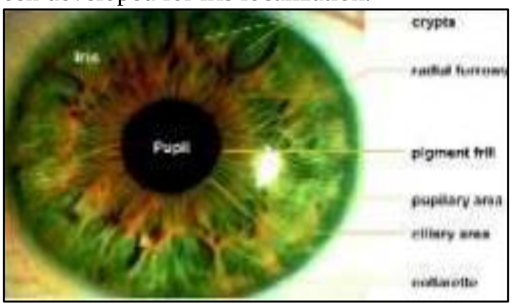


Fig. 1: Structure IRIS

In this paper we have used rectangular area technique for iris localization. Iris recognition is a biometric technology for identifying humans by capturing and analyzing the unique patterns of the iris in the human eye [2]. Iris recognition can be used in a wide range of applications in which a person‘s identity must be established or confirmed. passport control, border control, frequent flyer service, premises entry, access to privileged information, computer login and r transaction in which personal identification and authentication are the key elements. Most dangerous security threats in today‘s world are impersonation, in which somebody claims to be someone else. Through impersonation, a high-risk security area can be vulnerable. An unauthorized person may get access to confidential data or important documents can be stolen. Normally, impersonation is tackled by identification and secure authentication [3]. Traditional knowledge based (password) or possession-based (ID, Smart card) methods are not sufficient since they can be easily hacked or compromised. Hence, there is an essential need for personal characteristics-based (biometric) identification due to the fact that it can provide the highest protection against impersonation. Among other biometric approaches, the new Iris recognition technology promises higher prospects of security. Due to eye diseases Iris recognition sometimes failed. In this proposed method diseases affected parts of the iris are identified and remedial actions are taken. So this method used for medical diagnosis and person identification [4]. Commonly occurring diseases are Burning Eye, Bloody Eye (Subconjunctival Hemorrhage), Contact Lens Problem, Cataract, Discharge eye drainage, Eyelid twitching, Glaucoma. Eye burning is mainly induced due to eye strain, eye allergies and strain. Blood eye is caused when the blood vessels get broken in the sclera part. A very small blood vessel gets rupture from the eye surface. Contact lens problem is created when wearing the poor contact lens, in taking bad hygiene. There are many types in contact lens problem which consists of burning sensation, dry eyes, blurred vision, photophobia and redness. It will be easily cured when wearing fresh contact lens, washing hands before wearing the contact lens [5]. Cataract problem was mostly found at the age of 80 in the United States or they had a cataract surgery over that period. Double vision, glare, faded colours and double vision are symptoms for cataract problem. Eye drainage is the moisture that leaks out from the eye. Discharge eye drainage is mainly caused by bacteria or virus, parasites and other organisms. Eyelid twitching is the nerve problem and it persists for a weeks or months. It usually caused because of eye stress or fatigue.

II. LITERATURE REVIEW

Wen-Shiung Chen [6] presents a biometric recognition system based on the iris of a human eye using wavelet transform. The proposed system includes three modules: image preprocessing, feature extraction, and recognition modules. The feature extraction module adopts the gradient directions (i.e., angles) on wavelet transform as the discriminating texture features. The identification system encodes the features to generate the iris codes using two simple and efficient coding techniques: binary Gray encoding and delta modulation. The experimental results show that the recognition rates up to 95.27%, 95.62%, 96.21%, and 99.05%, respectively, using different coding methods can be achieved.

Jianxu Chen,[7] The iris is a stable biometric trait that has been widely used for human recognition in various applications. However, deployment of iris recognition in forensic applications has not been reported. A primary reason is the lack of human friendly techniques for iris comparison. To further promote the use of iris recognition in forensics, the similarity between irises should be made visualizable and interpretable. Recently, a human-in-the-loop iris recognition system was developed, based on detecting and matching iris crypts. Building on this framework, we propose a new approach for detecting and matching iris crypts automatically. Our detection method is able to capture iris crypts of various sizes. Our matching scheme is designed to handle potential topological changes in the detection of the same crypt in different images. Our approach outperforms the known visible-feature based iris recognition method on three different datasets. Specifically, our approach achieves over 22% higher rank one hit rate in identification, and over 51% lower equal error rate in verification. In addition, the benefit of our approach on multi-enrollment is experimentally demonstrated.

Ujval Chaudhary [8] The Human Iris is one of the best biometrics features in the human body for pattern recognition. This paper provides a walkthrough for image acquisition, image segmentation, feature extraction and pattern forming based on the Human Iris imaging. It also shows recognition using Back propagation Neural Network on classifying the patterns formed in the first part of the paper and properly verifies one’s identity. Neural networks using back propagation is presented in this paper for personal iris recognition The recognition rate of BPNN system was found to be 99.25%.The identification result obtained using the neural network approach illustrates the success of its efficient use in iris recognition.. A fast iris localization method like rectangular area method is used. Using this method, iris segmentation is performed in short time. The vector as an input signal the back propagating neural network is used to recognize the iris patterns. The BPNN algorithm is preferred over other neural network algorithms because of its unique ability to minimize errors. BPNN is found to be very accurate where recognition is required over other neural networks.

Prof. N.Deepa [9] Iris is a biometric trait used for human recognition in various applications. There is a lack of human friendly techniques for iris comparison. Therefore it has not been reported in forensics applications. We need to capture iris of human and similarities between the irises is captured. Recently Human-in-the-loop system has been developed based on matching and detection of iris crypts. Our detection is able to capture crypts of various sizes and able to identify any kind of topological changes. Presently iris recognition exists in Aadhar card projects. The proposed system of this model is to provide more accuracy in detecting. Our proposed approach produces promising results on all the three tested datasets, in-house dataset, CASIA-iris-interval. our approach improves the iris recognition performance by at least 22% on the rank one hit rate in the context of human identification and by at least 51% on the equal error rate in terms of subject verification.

III. PROPOSED SYSTEM

This would allow evaluating whether the quality of each acquired image is good enough for visual feature matching. This approach under the human in-the-loop iris recognition framework exhibits a promising application of the iris as a biometric trait in forensics. In this, by using the gabor filter we are detecting the disease in the eye. After that by providing the authentication the disease will be identified by using support vector machine (SVM) and the patient details will be displayed. Based on our observations and trial studies, our approach is robust with respect to certain common factors, such as interlacing or moderate blurring. In our matching algorithm, we adopt a matching model based on the Earth Mover‘s Distance (EMD). This matching model is quite general. Specifically, to handle possible differences in crypt topology, our matching algorithm is able to establish correspondences between the detected crypts in two images, which can be one-to-one, one-to-multiple, multiple-to-one, or even multiple-to-multiple matching. Additionally, due to different lighting conditions, there may be some false alarms or missing detections.

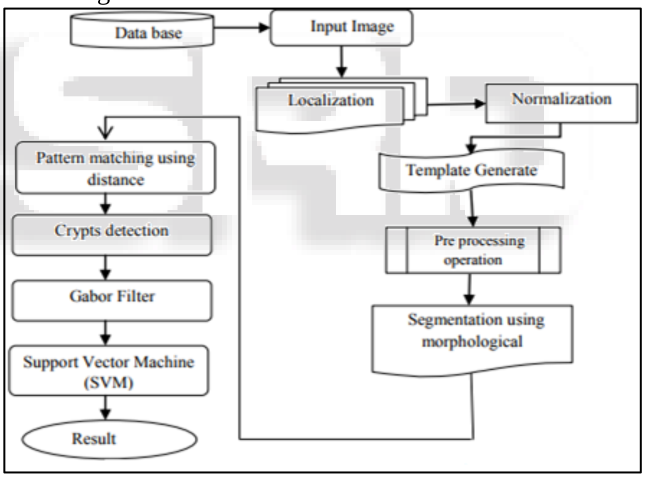


Fig. 2: Proposed Architecture

A. Image Acquisition

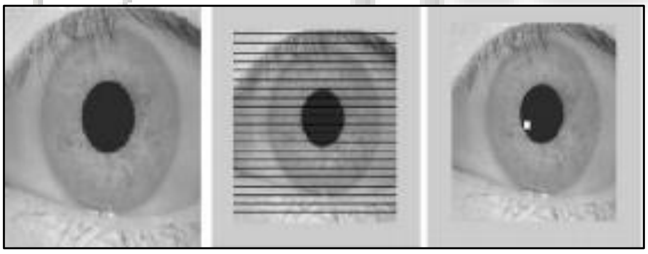
The image acquired from a unknown human subject is often called a probe image, and the images enrolled in the system dataset are often called gallery images. A collection of probe images or gallery images are termed as probe set or a gallery set from any capturing video or image formate. Most commercial iris recognition systems use near-infrared (NIR) illumination instead of visible light in image acquisition. NIR illumination, in the 700 to 900 nm range of wavelengths, is worn for unobtrusive imaging at distances of up to 1 m. Daugman perceived that NIR illumination is superior in iris image acquisition because its intensity can be controlled, but it is not perceived by humans and is protected for the eyes [10]. In NIR wavelengths, deeper and somewhat more slowly modulated stoma features dominate the iris texture pattern, and even darkly pigmented irises disclose rich and complex features.

B. Feature Extraction

The network will gain the 960 real values as a 960-pixel input. It will then be required to identify the eye by responding with a output vector. The output vectors represent a eye or non-eye. To operate correctly the network should respond with a one if eye is presented to the network or output vector should be zero. In addition, the network should be able to handle non-eye [11]. The network will not receive a perfect image of eye which represented by vector as input.

C. Feature Matching

The CRC code is calculated using the generator polynomial. The selection of the generator polynomial is the crucial part of implementing the algorithm. CRC32 is a type of function that takes as input a data word of any length, and produces as output a value of a certain space, commonly a 32 bit integer. The CRC considers a collection of data as the coefficients to a polynomial, and then divides it by a fixed, predetermined generator polynomial. The coefficients of the result of the division are recorded as the redundant data bits. This modular arithmetic accepts an efficient implementation of a form of division that is speed and sufficient for the purposes of calculating the distance between the iris codes. The CRC-32 is used as the polynomial generator as it is used for the matching process. The CRC-32 process reads each iris image from the beginning to the end, and determines a unique number from the file's contents. This number is used to compare this iris image with the database image to determine if they are identical. This method calculates a long integer from the file and is generally considered to be very accurate [12]. This procedure must be implemented for both the database and acquired image if the difference between two irises is less than or equal to 0.5 then, a match is found otherwise, both images are not equal. Usually the difference must be zero if the two irises are same.



(a) (b) (c)

Fig. 3: (a) Iris image, (b) The lines that were drawn to detect rectangular areas, (c) The result of detecting of rectangular area

D. Earth Mover's Distance algorithm to detect the iris

In our matching algorithm, we adopt a matching model based on the Earth Mover's Distance (EMD). This matching model is quite general. Specifically, to handle possible differences in crypt topology, our matching algorithm is able to establish correspondences between the detected crypts in two images, which can be one-to-one, one-to-multiple, multiple-to-one, or even multiple-to-multiple matching. Additionally, due to different lighting conditions, there may be some false alarms or missing detections. Not all crypts can be captured in every image, subject to different physical conditions. Our matching algorithm is carefully designed so that it performs robustly to segmentation errors and potential appearance/disappearance of small crypts. The segmentation algorithm may detect some blob-like regions not physically corresponding to iris crypts [13]. As long as such regions are stable, they will be accepted as human interpretable features, and can contribute to discriminating different irises. Our matching algorithm is designed to be robust to such false positive errors.

IV. EXPERIMENTAL RESULT

In the experiments of human identification, each probe image was compared against all gallery images to determine the identity of the probe image. The top m (say 10) candidates with the smallest dissimilarity scores were presented to human examiners for further inspection. This was a closed set comparison. Namely, it was known that at least one image from the same subject had been enrolled in the gallery set. Before selecting the candidates, a pre-check was imposed. The performance of our method on the dataset mixing all the three datasets (i.e., with 7775 probe images and 1340 gallery images/subjects) will also be reported. All original NIR images were pre-processed and unwrapped into images of 64 × 512 pixels by the iris BEE software. Our proposed automated approach was implemented and tested in Matlab, with the unwrapped images as input.

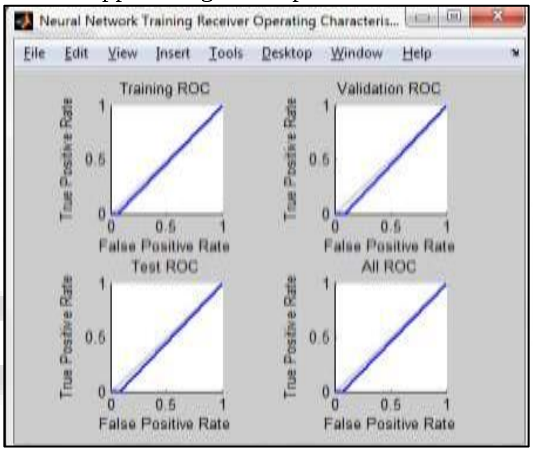


Fig. 4: Result of false positive rate

In the results of our approach, on all datasets if we select the top 10 candidates for further inspection, the probability that the true image is returned was higher than 95%. The errors incurred by our approach were mainly due to blurry images, high occlusion by eyelids or eyelashes, and large deformation caused by off-angle iris. Thus, additional pre-check at image acquisition to remove low quality images or advanced algorithms to enhance image quality will be helpful for further improvement

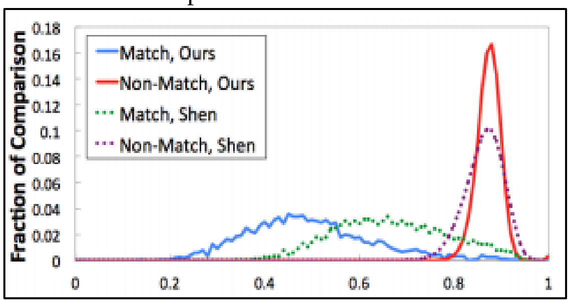


Fig. 5: The match (authentic) and non-match (imposter) distributions of our proposed approach

In fig 5 which is defined as the common value when the false acceptance rate is the same as the false rejection rate. The errors incurred by our approach were mainly due to blurry images, high occlusion by eyelids or eyelashes, and large deformation caused by off-angle iris. . Furthermore, the 95% confidence intervals of the results on the dataset mixing all the three datasets and on each individual dataset are shown in Figure 5.

V. CONCLUSION

This paper presents a biometric recognition system based on the iris of a human eye using wavelet transform. The proposed system includes three modules: image preprocessing, feature extraction, and recognition modules. The feature extraction module adopts the gradient directions (i.e., angles) on wavelet transform as the discriminating texture features. We present a new approach for detecting and matching iris crypts for the human-in-the-loop iris biometric system. Our proposed approach produces promising results on all the three tested datasets, in-house dataset. The identification result obtained using the EMD approach illustrates the success of its efficient use in iris recognition. A fast iris localization method like rectangular area method is used. Using this method, iris segmentation is performed in short time.

REFERENCES

[1] J. Daugman, "How iris recognition works," IEEE Trans. Circuits and Systems for Video Technology, vol. 14, no. 1, pp. 21–30, 2004.
[2] "Probing the uniqueness and randomness of IrisCodes: Results from 200 billion iris pair comparisons," Proc. IEEE, vol. 94, no. 11, pp. 1927–1935, 2006.
[3] K. McGinn, S. Tarin, and K. W. Bowyer, "Identity verification using iris images: Performance of human examiners," in IEEE Conf. on Biometrics: Theory, Applications and Systems (BTAS), 2013, pp. 1–6.
[4] H. Proenca, "Iris recognition: On the segmentation of degraded images acquired in the visible wavelength," IEEE Trans on Pattern Analysis and Machine Intelligence, vol. 32, no. 8, pp. 1502–1516, 2010.
[5] K. R. Nobel, "The state of the art in algorithms, fast identification solutions and forensic applications," MorphTrush USA, Tech. Rep., January 2013.
[6] Wen-Shiung Chen, "Personal Identification with Human Iris Recognition based on Wavelet Transform"
[7] Jianxu Chen, "Iris Recognition Based on Human-Interpretable Features"
[8] Ujval Chaudhary IRIS RECOGNITION USING BPNN ALGORITHM
[9] Prof. N.Deepa IRIS RECOGNITION BASED ON IRIS CRYPTS
[10] Z. Sun, L. Wang, and T. Tan, "Ordinal feature selection for iris and palmprint recognition," IEEE Trans. Image Processing,
[11] M. Sunder and A. Ross, "Iris image retrieval based on macro-features," in Proc. International Conf. Pattern Recognition
[12] J. D. Mira and J. Mayer, "Image feature extraction for application of biometric identification of iris — a morphological approach," in Proc. Brazilian Symp.
[13] F. Shen, "A visually interpretable iris recognition system with crypt features,"

