Analysis of Iris Detection Techniques

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Abstract- The image processing is the technology which can access digital information stored in the form of pixels. The iris detection is the major challenge of image processing due to complexity. The iris detection can be performed with the technique of edge detection. In this paper, various techniques of iris detection has reviewed and analyzed in terms of various parameters

Keywords- Iris, Edge detection, Localization

I. INTRODUCTION

Image processing is a technique to perform a few operations on an image, with a specific end goal to get an enhanced image or to extract some helpful information from it. It is a kind of signal processing in which input is an image and output might be image or characteristics/features associated with that image. These days, image processing is among quickly growing technologies. It forms core research area within engineering and computer science disciplines as well. It is a kind of signal dispensation in which input is image, similar to video frame or photograph and output might be image or characteristics associated with that image. Typically Image Processing system includes treating images as two dimensional signals while applying effectively set signal processing methods to them [1]. It is among quickly growing technologies today, with its applications in different parts of a business. Image Processing forms core research area within engineering and computer science disciplines as well. Image enhancement techniques enhance the quality of an image as perceived by a human. These techniques are most valuable on the grounds that numerous satellite images when examined on a color display give inadequate information for image interpretation. There is no conscious push to enhance the fidelity of the image with regard to some ideal form of the image. There exists a wide assortment of techniques for improving image quality. The contrast stretch, density slicing, edge enhancement, and spatial filtering are the all the more normally utilized techniques. Image enhancement is endeavored after the image is rectified for geometric and radiometric distortions. Image enhancement methods are connected independently to every band of a multispectral image. Digital techniques have been observed to be most acceptable than the photographic technique for image enhancement, as a result of the precision and wide assortment of digital processes [2]. The extraction of image content description is called feature detection. Feature extraction also involves their associated matching of the content detected from the image. The main step of which is required is memory consuming and redundant raw images. Today's e-security are in critical need of finding accurate, secure and cost-effective alternatives to passwords and personal identification numbers (PIN) as financial losses increase dramatically year over year from computer-based fraud such as computer hacking and identity theft. Biometric solutions address these fundamental problems, because an individual's biometric data is unique and cannot be transferred [3]. Biometrics which refers to identifying an individual by his or her physiological or behavioral characteristics has capability to distinguish between authorized user and an imposter. An advantage of using biometric authentication is that it cannot be lost or forgotten, as the person has to be physically present during at the point of identification process. Biometrics is inherently more reliable and capable than traditional knowledge based and token based techniques. The commonly used biometric features include speech, fingerprint, face, Iris, voice, hand geometry, retinal identification, and body odor identification. The critical attributes for any biometrics are: the number of degree-of-freedom of variation in the chosen index across the human population, since this determines uniqueness; its immutability over time and its immunity to intervention; and the computational prospects for efficiently encoding and reliably recognizing the identifying pattern.

Iris recognition is a method of biometric authentication, based on extraction features of the iris of an individual's eyes [4]. Each individual has a unique iris; the variation even exists between identical twins and between the left and right eye of the same person. Biometric recognition refers to an automatic recognition of individuals based on a attribute vector(s) derived from their physiological and/or behavioral feature. Biometric iris recognition systems should provide a reliable personal recognition schemes to either confirm or determine the identity of a person. Different algorithms are implemented to perform iris recognition system. In this work, iris recognition system is implemented via hybrid technique. Iris is a biometric feature, found to be reliable and accurate for authentication process comparative to other biometric feature available today. As a result, the iris patterns in the left and right eyes are different, and so scan be used quickly for both identification and verification applications because of its large number of degrees of freedom. Iris as in Figure 2 is like a diaphragm between the pupil and the sclera and its function is to control the amount of light entering through the pupil. Iris is composed of elastic connective tissue such as trabecular

meshwork. The agglomeration of pigment is formed during the first year of life, and pigmentation of the stroma occurs in the first few years. The highly randomized appearance of the iris makes its use as a biometric well recognized [5].

In general, the iris recognition system is composed of the following five steps as presented in Figure 1.

a. Image Acquisition: Several points are of particular concern. First, it is desirable to acquire images of the iris with sufficient resolution and sharpness to support recognition. Second, it is important to have good contrast in the interior iris pattern without resorting to a level of illumination that annoys the operator, i.e., adequate intensity of source constrained by operator comfort with brightness [6]. Third, these images must be well framed (i.e., centered) without unduly constraining the operator (i.e., preferably without requiring the operator to employ an eye piece, chin rest, or other contact positioning that would be invasive). Further, as an integral part of this process, artifacts in the acquired images (e.g., due to specular reflections, optical aberrations, etc.) should be eliminated as much as possible.

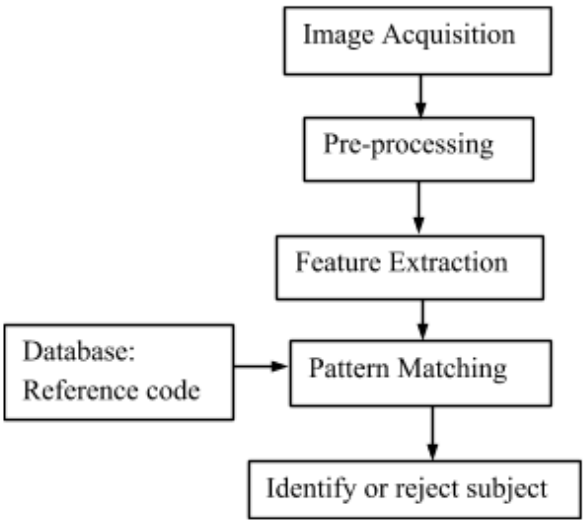

Fig.1: General steps of Iris Recognition

b. Pre-Processing: Algorithm for detection and segmentation

• Iris detection: Irises are detected even when the images have obstructions, visual noise and different levels of illumination. Lighting reflections, eyelids and eyelashes obstructions are eliminated. Images with narrowed eyelids or eyes that are gazing away are also accepted using wavelet algorithm [7].

• Correct iris segmentation: It is achieved under these conditions:

- Perfect circles fail. VeriEye uses active shape models that more precisely model the contours of the eye, as perfect circles do not model iris boundaries.
- The centers of the iris inner and outer boundaries are different. The iris inner boundary and its center are marked in red; the iris outer boundary and its center are marked in green.
- Iris boundaries are definitely not circles and even not ellipses and especially in gazing-away iris images [8].
- Iris boundaries seem to be perfect circles. The recognition quality can still be improved if boundaries are found more precisely.

• Locating Iris: The first processing step consists in locating the inner and outer boundaries of the iris and second step to normalize iris and third step to enhance the original image.

c. Pattern Matching: Binary Coding Scheme: It is very important to represent the obtained vector in a binary code because it is easier to find the difference between two binary code-words than between two number vectors. In fact Boolean vectors are always easier to compare and to manipulate. In order to code the feature vector first observed some of its characteristics. Now found that all the vectors that we obtained have a maximum value that is greater than 0 and a minimum value that is less than 0 [9].

d. Identification and Verification: Identification and verification modes are two main goals of every security system based on the needs of the environment [10]. In the verification stage, the system checks if the user data that was entered is correct or not (e.g., username and password) but in the identification stage, the system tries to discover who the subject is without any input information. Hence, verification is a one-to one search but identification is a one-to-many comparison.

II. LITERATURE REVIEW

Dewi Nurdiyah et.al (2018) proposed a novel technique which changed the intensity of image to new intensity for recognizing the pupil using normalization [11]. Stretching the image contrast was the major objective here. The image illumination was maximized such that the contrast between dark and bright regions of image can be clearer through normalization. Contrast stretching and gamma are the two methods used for performing normalization. The highest limit of contrast stretching is responsible for providing the values. An accuracy of around 99% was achieved when the proposed technique was applied on the dataset of 150 images collected from random biometric Ideal Test 4.0 Version. Thus, it was seen that this technique outperformed other techniques when detecting iris.

Fei Wang, et.al (2017) proposed the face and eyes detection system by applying OpenCV (Open Source Computer Vision) [12]. The frequency of closed eyes was compared by applying this approach. This technique also established a fatigue detection mechanism through which the examinee's fatigue state could be determined accurately. The traditional face

detection approach was enhanced initially and the efficiency of face detection was improved. Further, the eye was tracked in real time by updating the iris template constantly such that the accuracy of matching was improved by applying the template matching technique in the second step. Using the Android platform, the description of implementation's system was done at the last. It was seen that high detection rate was achieved when the proposed technique was applied in such real time scenarios.

Yang Hu, et.al, (2016) presented the iris code calculation from the point of view of optimization. It is demonstrated that the traditional iris code is the solution of an optimization problem which minimizes the distance between the feature values and iris codes [13]. Two additional objective terms are investigated. The main objective term exploits the spatial relationships of the bits in different positions of an iris code. The second objective term mitigates the influence of less reliable bits in iris codes. The two objective terms can be applied to the optimization problem individually, or in a combined scheme. Experiments are led on four benchmark datasets with fluctuating image quality. The experimental results demonstrate that the iris code produced by solving the optimization problem with the two additional objective terms achieves a generally improved performance in comparison to the traditional iris code calculated by binarizing feature values based on their signs.

N. Pattabhi Ramaiah, et.al, (2016) proposed a domain adaptation framework to address this problem and introduces another algorithm utilizing Markov random fields (MRF) model to significantly improve cross-domain iris recognition [14]. The proposed domain adaptation framework based on the credulous Bayes nearest neighbor order utilizes a real-valued feature representation which is fit for learning domain knowledge. In this paper, another class of bi-spectral iris recognition system that can at the same time acquire visible and near infra-red images with pixel-to-pixel correspondences is proposed and evaluated. It was displayed by reproducible experimental results from three publicly available databases; PolyU crossspectral iris image database, IIITD CLI and UND database, and achieve outperforming results for the cross-sensor and crossspectral iris matching.

Juan E. Tapia, et.al, (2015) predicted the gender specifically from similar binary iris code that could be utilized for recognition. It is likewise observed that utilizing selected features representing a subset of the iris region achieves better accuracy than utilizing features representing the whole iris region. The measures of mutual information were utilized to guide the selection of bits from the iris code to use as features in gender prediction [15]. Utilizing this approach, with a person-disjoint training and testing evaluation, we could achieve 89% correct gender prediction utilizing the fusion of the best features of iris code from the left and the right eyes. The underlying experiments recommend that information relevant to gender-from-iris is distributed throughout the whole iris region.

Ryan Rakvic, et.al, (2015) studied that in the previous couple of years there has been a shift to multicore computing, specifically with general reason graphic processing units (GPGPUs or GPUs). Conventional CPUs have between 2-8 centers, however GPUs can have hundreds, even thousands of centers [16]. While past research has focused on the effect GPUs have on performance, there are many less studies on the effect of GPUs on energy consumption and efficiency. A few researchers have hypothesized that if the performance of an algorithm was adequately increased on a GPU that the accelerated time would really bring about the GPU to consume less energy. Interestingly to our knowledge, we study the energy efficiency of a GPU with an application to iris recognition. It is demonstrated that portions of these algorithms implemented on the GPU reduce energy consumption by as much as 272 times.

Vibhav Prakash Singh, et.al, (2015) proposed an efficient content based image retrieval system for normal and abnormal classes of mammograms [17]. In this work, content based image retrieval (CBIR) system for two classes of mammograms from the MIAS database has been implemented. Here, first the process automatically removed the labels, artifacts and pectoral muscles. Facilitate, proposed modified segmentation approach confirmed the effectiveness of the work for image retrieval. This work, performances are significantly better than, Otsu, Fuzzy c means, and Region growing based segmentation approaches. In future, for enhancing the retrieval performance, one can utilize adaptive filters and dominating features (through feature selection methods).

Zhen Lei, et.al, (2015) improved original "shallow" face descriptors to "deep" discriminant face features by introducing a stacked image descriptor (SID). With deep structure, more complex facial information can be extracted and the discriminant and compactness of feature representation can be improved [18]. The SID is learned in a forward optimization way, which is computational efficient compared to deep learning. By applying SID to face recognition, this emphatically supervised optimization method was identified at every layer can extract discriminant and compact face representation, which achieves good face recognition accuracy in the wild furthermore has good generalization performance on traditional frontal face recognition. Compared to deep learning, the time complexity of SID is lower when applied to large scale training data. The SID is a good decision to learn discriminative representation from large scale data, particularly when GPU device is not available.

Table 1: Table of Comparison

Authors' Names	Year	Description	Outcome
Dewi Nurdiyah and Indra Abdam Muwakhid	2018	A novel technique was proposed which changed the intensity of image to new intensity for recognizing the pupil using normalization.	It was seen that this technique outperformed other techniques when detecting iris.
Fei Wang, Xiaofeng Chen, Daoxiong Wang, Bo Yang	2017	The face and eyes detection system was proposed by applying OpenCV (Open Source Computer Vision).	It was seen that high detection rate was achieved when the proposed technique was applied in such real time scenarios.
Yang Hu, Konstantinos Sirlantzis, and Gareth Howells	2016	The iris code calculation was performed from the point of view of optimization. It is demonstrated that the traditional iris code is the solution of an optimization problem which minimizes the distance between the feature values and iris codes	The experimental results demonstrate that the iris code produced by solving the optimization problem with the two additional objective terms achieves a generally improved performance in comparison to the traditional iris code calculated by binarizing feature values based on their signs.
N. Pattabhi Ramaiah, Ajay Kumar	2016	A domain adaptation framework was proposed to address this problem and introduces another algorithm utilizing Markov random fields (MRF) model to significantly improve cross-domain iris recognition	It was displayed by reproducible experimental results from three publicly available databases; PolyU crossspectral iris image database, IIITD CLI and UND database, and achieves outperforming results for the cross-sensor and crossspectral iris matching.
Juan E. Tapia, Claudio A. Perez, Kevin W. Bowyer	2015	The gender was predicted specifically from similar binary iris code that could be utilized for recognition.	The underlying experiments recommend that information relevant to gender-from-iris is distributed throughout the whole iris region.
Ryan Rakvic, Randy Broussard, and Hau Ngo	2015	In the previous couple of years there has been a shift to multicore computing, specifically with general reason graphic processing units (GPGPUs or GPUs).	It is demonstrated that portions of these algorithms implemented on the GPU reduce energy consumption by as much as 272 times.
Vibhav Prakash Singh, Ashim Gupta, Shubham Singh, Rajeev Srivastav	2015	An efficient content based image retrieval system was proposed for normal and abnormal classes of mammograms	This work, performances are significantly better than, Otsu, Fuzzy c means, and Region growing based segmentation approaches.
Zhen Lei, Dong Yi and Stan Z. Li	2015	With deep structure, more complex facial information can be extracted and the discriminant and compactness of feature representation can be improved.	The SID is a good decision to learn discriminative representation from large scale data, particularly when GPU device is not available.

III. CONCLUSION

It is concluded that iris detection is the major challenge of image processing to high pixel complexity. The localization and edge detection techniques are reviewed in this paper for the iris detection. The hybrid techniques are designed based on the edge detection and localization. In future novel approach will designed for the iris detection which has high accuracy.

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