

Analysis of Iris Spoofing - A Review

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ABSTRACT

An important drawback in the biometric system that is used for the authentication is to secure the presence of real approved feature in dissimilarity to a forged physical specimen. This procedure requires a new way of approach in order to improve the protection measures. So, many communities like biometry and other standard units have proposed a method called spoofing, which is used for the fake detection of images. This was used in case of images that include face or iris. The methods of spoofing were combined with the other techniques for the automatic recognition of iris in different levels. The above mentioned other techniques involve Segmentation, Normalization and Feature encoding. In each of the process, the iris image is converted to the required format and the noise is reduced by other filtering and transformation techniques. In Segmentation, large number of resources are selected that provide relevant information which is to be classified that delimits the iris image.

INTRODUCTION

need to show our acceptance in different locations, secure access to houses, airline and railway transportation, cast a ballot, etc. In different areas of life, protection and the encryption of the individual are important. We used photo-based identification cards to show our legitimacy, and we were very familiar with it. In several cases, these recognize cards have been increased / superseded by passwords. Late though, these modern proofs of identity are being replaced by authentication determination to solve many of these approaches' limitations. The imitation, in which public figure appears to be someone else, is among the most harmful security alerts. There is a step towards authentication in the field of identification and encryption. Fingerprints, face recognition, Iris recognition, and identification of DNA patterns replace written identity cards. Biometric authentication provides a valid alternative, such as 1 D cards and credentials, to traditional security. Biometric identification defines an individual based on "who they really are (Biometrics)" instead of "what they possess (passport)" or "what they know (password)." IRIS recognition method is a very important tool that uses trend-recognition approaches on irise images to specifically recognize a person. Recognition / r / s is a specific type of fingerprint method which can be used by analyzing patterns contained in the iris to accurately recognize an individual. This is a very reliable form of iris because of the uniqueness of the eye

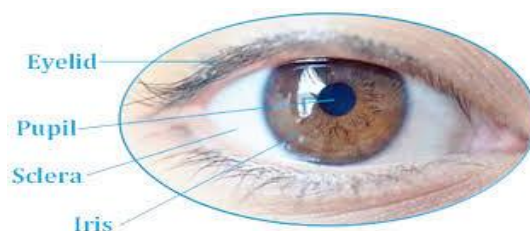


Figure1: The outer look of a human iris

IRIS RECOGNITION

Iris recognition is a highly effective and efficient identification technology which is regarded as a reliable and tremendously accurate biometric system. Iris is the annular portion between the dark pupil and the white sclera which provides many interlacing minute characteristics. Iris has a rich uniqueness of differences in anatomical texture information which is essentially stable over a person's life. The personal identification systems are noninvasive to their users based on iris recognition system. Iris recognition system consists of four stages such as iris acquisition, segmentation, normalization, feature extraction and matching which leading to a decision.

Iris recognition is an automated identification method that uses mathematical Pattern Recognition techniques on the unique features of an individual’s eyes to provide an unmatched identification technology. In iris recognition system, accuracy is most considerable one. Because accuracy of iris recognition system depends on reduce the false acceptance rate and increase the false rejection rate. The following five main reasons to answer why iris recognition is more important.

- In these the error rate is very less.
- Iris is a permanent and best biometric.
- User acceptability is logical.
- It is a Real time biometric authentication.
- Less susceptible.
- Spoofing system.

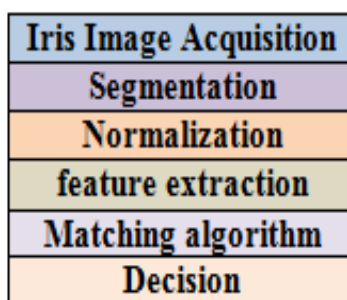


Figure : Iris Recognition System

IRIS IMAGE ACQUISITION:

The acquisition stage obtains the images of an eye. Iris images are normally acquired in near infra red lighting. The variation of distance between the camera and eye system from 4-50 cm. For extracting good texture with the intensity level Iris diameter normally should be between 100 pixels. The Chinese Academy of Sciences (CASIA) iris image database collected 756 iris images from 108 eyes over two sessions with noise free and perfect imaging conditions. UBIRIS database collected 1877 images data from 241 peoples over two sessions. LEI database is a small database of 120 grayscale images with noise. UPOL database having the localization work which includes images from the internal part of the eye.

Acquisition Cameras	Remarks
NIR camera.[11]	The maximum operational distance is 60 cm with near infrared illuminator. The typical resolution 640×480 used for iris identification with commercial availability.
High Resolution camera[8]	The visual light illuminator operated in maximum distance 5 cm with typical resolution 6144×4096. It is used for iris pattern analysis and it has challenges against intrusive capture and short operational distance
Telescope type camera[2]	The maximum operational distance of telescope type camera is 3 m with near infra red illuminator. It is used in iris surveillance and more challenges against eye safety.

Table 1: An overview of Iris image acquisition cameras

SEGMENTATION/LOCALIZATION

The Iris is located in between the student and sclera. The darker part of the eye is student. Iris localization technique is located and isolates the iris region. isolating it from other structures such as the sclera, pupil, eyelid and eyelashes which are isolating ny the spatial extent in eye image segments the iris. The Canny operator used to obtain the accurate parameters of the pupil and limbus and the Hough transform obtain the center of the pupil.

Methods	Remarks
Coarse to fine strategy and integro-differential operator[9].	In the coarse stage technique, from the rescaled image finds outer iris boundary as circles using integro-differential operator in order to improve localization time.
detector of canny edge with Hough transform and Homocentric circle algorithm[16].	Normal line algorithm is created for finding center and inner edge by means of canny edges. To find outer edge by Homocentric circle algorithm which improve localization speed.
Graph cuts	images of non-ideal has been developed using graphical segments for a robust segmentation approach with pixel label error rate 5.9%.
Bisection method and Histogram equalization[3]	The Bisection method used to find inner boundary and eyelid position is employed to determine the outer boundary. To find out the correlate boundary by Histogram equalization and satisfied information. When iris image is blurred.

Table 2: over view of image segmentation

NORMALIZATION

After locating the iris, the locating iris image cannot carry on the code immediately and firstly should carry on the calibration. To unwrap the segmented region using Daugman’s rubber-sheet model, mapping points from the Cartesian coordinate system of the original image into a normalized polar region. The normalization process have the same constant dimensions will produce iris regions. At the same spatial location two photograph of the similar iris under dissimilar state will have quality item. The angular resolution, which determines how many sample points selected around the iris circumference. Along any given rays the radial resolution, which specifies how many points sampled between the pupil and limbic boundaries. Band averaging is another technique to initially create a larger normalized image. When generating the iris code, then average neighboring rows to create a smaller image is used.

FEATURE ENCODING

From the preprocessing step, with the normalized iris image proper iris features can be extracted. In the feature encoding process, the template is generated which also need a corresponding match metric gives a measure of similarity between two iris templates. During the feature extraction step the uniqueness of the characteristics extracted that will determine the reliability of the recognition. characteristics of set of items will be assigned to each iris pattern created which allows the computation of a similarity measure between two iris patterns. When the patterns are given by the same eye the similarity value must be within predefined range to make a reliable decision about the identity of an iris pattern known as interclass comparisons. Different eye creates the different patterns are compared within different range known as interclass comparisons. The meta-heuristic is a nature-inspired approach which is applied for finding solutions of difficult combinatorial optimization problems. The Evolutionary methods such as Tab Search, Harmony Search, Genetic Algorithm, Particle Swarm Optimization, K-Nearest Neighbor, Bee Colony Optimization and Ant Colony Optimization can be used to perform the feature selection which optimizes the measure of probability in image processing.

MATCHING ALGORITHM

All other design extraction methods presented before provide a sequence of numbers or a sequence as a product and do not provide any details regarding their relationship with the models contained in the server. Another template fitting technique is conducted once the characteristics have been extracted, which can be separated into, 1. Assessment of the correlation for the knowledge stored, resulting in a similarity score. 2. Decision of recognition: app acceptance/rejection. In fact, the decision-making stage for recognition is focused on a threshold which governs the decision to accept / reject. The level of safety provided by the specification will render its validity almost rigorous, thus increasing the number of false dismissals or incorrect acceptations.

2. LITERATURE SURVEY

S.NO	AUTHOR NAME	METHODOLOGY	REMARK	DATA SET
1	Huang et al. [4] 2013	Pupil contraction after a lighting event	ERROR 0.2%	Proprietary, 12 identities, 322 samples
2	Chen et al. [5] 2012	Conjunctival vessels detection using multispectral imaging	Error 0.2%	Proprietary, 100 identities, 2000 samples
3	Raghav. and Busch [6]2014	Depthvariation Light Field Camera	Error 1.1%	Public, GUC-LF-VIAr DB [6] 104 identities, 4847 samples
4	Lee et al. [7] 2008	Four Purkinje reflections using NIR illumination	0.3%	Acquisition, 30 roles, 500 specimens
5	Czajka [8] 2015	Fundamentals of the pupils	Error 0.9%	Acquisition, 52 roles, 525 specimens
6	He et al. [9] 2008	using the FFTIris texture spectrum analysis	Error 1%	Acquisition, 30 roles, 1500 specimens
7	Zhang et al. [10] 2014	using Weighted LBIris texture analysis	Error 0.5%	Acquisition, 72 roles, 1400 specimens
8	Galbally et al. [11] 2014	using image quality measuresIris texture analysis	Error 0.3%	ublic, ATVS-FIris DB [12], 50 identities, 1,600 samples
9	Menotti et al. [13]2015	using deep learningIris texture analysis	Error 0.9%	Public, ATVS-FIris DB [12]
10	Raghav. and Busch [16]2015	Study of the texture of Iris utilize multi-scale graphical object	Error 0.5%	Public, VSIA DB
1. 11	Mohit Kumar et al.[9]2015	<ul style="list-style-type: none"> • Mean, standard deviation • median, • kurtosis and skewness . • Pupil Center Corneal Reflection (PCCR) 	an accuracy of 87.5%.	A set of 600 fake iris images from the UPOL iris database. The database consists of 3×128 iris images
3. 12	AbhilashaMalhotra et al.[2]2016	<ul style="list-style-type: none"> • spoof pattern generated by Gabor filter , • PCA, • hamming distance, • anatimical model. Self Quotient Image (SQI) 	Accuracy- 88.99%	Iris images were taken from 800 objects and 20 subjectsimages of each of the left and the right eye.
13	Kiran B. Raja, et al [11] 2011	<ul style="list-style-type: none"> • near-infrared (NIR) illumination. • Eulerian Video Magnification 	Average Classification Error Rate(ACER)	Server consists of 62 exclusive mobile iris videos – iPhone 5S and Nokia

		(EVM)	= 0%	Lumia 1020.
14	Jonathan Connell, et al.[3] 2012	<ul style="list-style-type: none"> • Hamming distance, Gabor transform, segmentation, normalization, • feature extraction and matching techniques. IBM	Accuracy of 93.99%	We took 6 pictures of the bare eyes of the object (both left and right).
15	R Raghavendra Babu, et al.[3] 2015	Detection of spoofing using Structural and Textural feature (DESIST) framework for detecting spoofed iris images.	The highest classification accuracy of 82.20% is observed by the proposed framework for detecting normal and spoofed iris images on a combined iris spoofing database.	Inventory consisting of 3,300 standard iris and artifact specimens obtained by simulating five separate iris recognition device attempts.
16	Pedro Silva, Eduardo Luz, et al.[4] 2015	<ul style="list-style-type: none"> • Presentation Attack Detection (PAD), • Multi-scale Binarized Statistical Image Features (M-BSIF) and • linear Support Vector Machines (SVM). • near infrared (NIR) 	92.22% of the artefact samples can successfully intrude the system.	3300 iris ordinary and aberration samples that are seized by simulating five different moves on iris recognition structure. The MobLive 2014 collection contains of 1,600 specimens collected in regular (or actual or live) & artifact (or fake) iris.
20	Javier Galbally, et al.[1]2014	Assist sensor control in the Clinical Cyber-Physical Applications	96% and 98.7% respectively, which is higher than that of the three CD-free modalities.	database consists of 1600 samples
21	Nishat I Mowla et al.[2] 2016	<ul style="list-style-type: none"> ▪ Mobile Iris Liveness Detection Competition (MobLive), ▪ Iris liveness detection (ILD) 	Accuracy- 93.76%	The benchmark data set was the MobBIO fake data base which is composed by a set of 800 iris images, the iris images, with a 250x 200pixels,
22	Ana F. Sequeira et al.[3] 2014	IRS, Competition for Mobile Iris Liveness Detection	Accuracy- 94.77 percent	The false MobBIO database consists of 16 i

		tion (MobILive). (ILD)		images (8 real and 8 fake) of a total of 1,600 iris images from 100 individuals.
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Table 4: Comparison of various authors methods

By Paper Javier (GalballyZ.Wei, 2014), a novel multi-biometric and multi-attack security approach based on software was implemented that aims to overcome some of the limitations by using IQA. It is not only capable of operating under different conditions with very good performance Biometric systems and for different spoofing purposes, but it also offers a very strong level of protection against certain non-spoofing (multi-attack) attacks.

Biometric accuracy is accurate biometric. Therefore, the accurate I d segmentation of the iris pattern is impoKant challenging to process non-ideal data. The paper (JinyuZuoZ.Wei, 2010) s suggested a comprehensive segmentation technique for non-ideal iris images that are influenced by s factors such as specular reflection, distortion, variance of illumination, occlusion and offangle images.And also demonstrates how to illustrate the technique of robustness segmentation by comparing images of ideal it non-deal iris.

An assessment of image quality is very critical for biometric system performance that includes iris images. The paper (U. M. ChaskarZ.Wei, 2012), focused on the factors of consistency that influence the images of iris. The iris images are influenced by many quality factors such as dilation, specular reflection, iris clarity, motion blur, etc.This paper also discussed the calculation method for ideal iris resolution, real iris resolution, iris resolution measurement, signal to noise ratio, etc.

Iris is an evolving and well-known biometric software gy based on human body's physiological features. The paper (KshamarajGulmireZ.Wei) has suggested four iris recognition steps such as: segmentation, standardization, extraction and matching features. In order to slice,On the basis of the Principle Component Analysis (PCA) and Independent Component Analysis (ICA), Daughman's method using integro-differential operator is used to extract features for iris. Such techniques have been used to produce effective efficiency. And the Hamming distance approach is used for the study of the main component and separate component analysis for matching purposes.

The paper (Minakshi R. Rajput Z.Wei, 13), reviewed iris recognition literature and explained the iris images ' need and significance. The suggested subject explored the contour's capacity for transforming and matching for iris xture representation.The paper presented quantitative methods for assessing image quality (PoonamDabasZ.Wei, 2013). The proposed method also centered on the different quality metrics and an algorithm for modeling HVS (Human Visual System) with these objective methods.HVS has perceived luminance and frequency response characteristics. HVS is used for image processing.

Theirisimagequalitydeterminestheperformanceofirisrecognition.Thepaper (XingguangLiZ.Wei, 2011), has proposedthe comprehensiveassessmentofirisimagequalitytoassesstheoverallquality scoreofaniris image. The paperhascontributedforthreerespectsaccordingly:I Three methods for calculating quality metrics; (ii) Proposed a fusion method for combining six iris image quality factors into a single quality score; (iii) Proposed a statistical quantization method for classifying iris images and databases into a number of quality factors. The paper proposed shows the robust quality score to predict the iris recognition efficiency.

Nowadays, biometric is the most important and trusted identification technique for an individual. Among biometrics, the iris recognition is more accurate and important identification technique. The paper (Sudipta Roy Z.Wei, 2011), proposed and implemented the iris recognition technique with Daughman. It is more reliable than traditional technique. This paper used novel technique to detect outer iris boundary. This new strategy worked successfully and helps security issues.

As the iris of a human eye is unique and reliable source for identification purpose. The paper (Karthik Raja PitchaiZ.Wei), proposed a system in which there is no co-operation of subject for iris recognition and if there

is forged attempt, then error is flashed. This paper described the six parts of iris segmentation and normalized each segmented region followed by feature extraction and compared with database. It identifies the fake image and never demands for the co-operation from the subject.

For iris recognition, the paper (J. DaugmanZ.Wei, 2014) has proposed Daughman’s algorithm method. First image has acquired with near infra-red camera then iris region has isolated. Then feature encoding has implemented by winding normalized iris pattern with 1D Log-gabor wavelet. The feature has extracted in codes of 0 and 1. Hamming distance matrix has chosen for template matching. Daughman’s algorithm has used for segmentation. Two preprocess operations has used i.e. histogram equalization and binarization then optimized the algorithm. Sobel edge detection has applied to search the region and then normalization has done for feature extraction.

The paper (Z.WeiZ.Wei, 2005), first preprocessed the iris/pupil image. Then eyelids has isolated by linear hough transform, eyelashes by 1D Gabor filter and multiple eyelashes by variance of intensity. The iris image has normalized by using rubber sheet model. Then feature has extracted by contour let transform using multi-scale and directional filter banks. Feature selection has selected with several methods as gray level co-occurrence matrix (GLCM), combination of local and global properties in an iris and vector of iris feature has created with the use of PCA and ICA and in the co-efficient domain. To classify iris images, SVM has used.

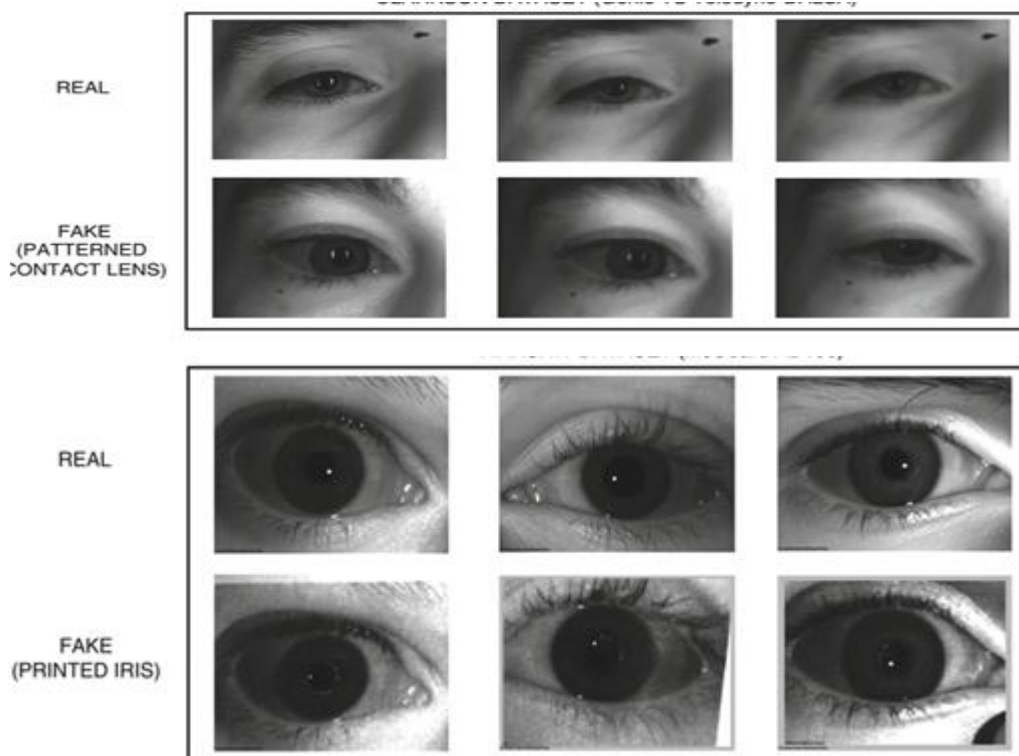


Fig 2: iris images of real and fake(patterned contact lens) and (printed iris)

CONCLUSION

From above literature reviews made, we can conclude that Daughman’s algorithm is effective for segmentation. Image quality is improved with Quality parameterization set. For feature extraction, PCA and ICA methods are effective giving 85.3% and 89.5% recognition rate respectively. Laplacian of Gaussian (LoG) operator is effective for the evaluation of qualities of iris images than wavelet decomposition method. Contourlet transform will be more effective method for feature extraction which works for low quality iris images for the recognition system. To detect Outer boundary, Circular Hough Transform is preferred. Finally, Iris Recognition is more secured and reliable methodology for authentication preventing direct attacks. we can say that, as the article has shown, big advance shave been achieved in the development of counter measures against attacks to the sensor. However, everyday new attacking methodologies are also

being devised in order to gain fraudulent access to the information protected by these systems. Accordingly, there is still the need to devote further efforts to the design of new and more efficient anti-spoofing approaches that may increase the reliability of the biometric technology.

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