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GENDER PREDICTION BASED ON IRIS RECOGNITION

Ms.M.R.Rajput[1]
P.E.S. College of Engineering
Aurangabad (MH), India
meenakshiutsav@gmail.com

Dr. G.S.Sable[2]
Maharashtra Institute of Technology
Aurangabad (MH), India
Sable.eesa@gmail.com

ABSTRACT
As Iris is the most safe and reliable biometric pattern, Iris biometrics provides high recognition rate and high accuracy for person identification as compared with the other biometric techniques As Iris biometric only identify the identity a person , more research is needed to identify the gender , age and ethnicity based on iris textural and geometric features. Gender identification is equally important in critical security environment like Passenger control in airports ,access control in prohibited areas ,border control, database access, banking services. Major project undertaken by government of India that is Aadhar Project identify millions of citizens is also implemented with iris recognition. In literature most of the research is on gender identification based on facial images. Very few researchers reported gender identification based on human iris patterns.

General Terms
Person identification, Gender identification.
Keywords
Iris biometric technology, Recognition rate, feature extraction, iris segmentation

1. INTRODUCTION
Though , Iris Biometric technology is considered as a safe, highly reliable, robust and having high recognition accuracy, there are various issues and challenges in iris recognition. It includes factors such as as off angle, pupil dilation, limbus occlusion etc. Also the Presence of contact lenses, intensity variations, poor illumination, motion blur, large stand off distances ,specular reflections and improper focus which results in degradation in quality of acquired iris images which further affects iris recognition rate.
Various challenges include proper iris area localization, segmentation, proper features extraction of the iris pattern, feature code size reduction, and fast computation. Also it is necessary that, no process should consume much time and resources. And the iris recognition should work in a real time.
Different steps involved in iris biometrics includes iris image acquisition, Iris preprocessing, Iris localization/segmentation, normalization, and feature extraction, gender prediction using classification and matching.
Iris recognition systems acquire images of an iris illuminated by light in the near infrared wavelength band (NIR: 700–900 nm). This step is very complicated because the size and color of iris of every person is different. It is very difficult to capture clear images using the standard CCD camera in different environmental conditions. Sometimes the acquisition process produces different results for the same person due to the different lighting effect, positioning and different standoff distance, eye glasses or contact lenses , poor illumination occlusion by eyelashes etc. Some of the cameras used in literature for acquiring iris images includes 3M Cogent CIS 202 High Speed Dual IRIS Scanner, I SCAN 2 Dual Iris Capture Scanner, iriMagic 1000BK Iris Capture Scanner, TM-4000C PulniX, LG Icam4000 etc.
Preprocessing is the process to convert the acquired eye image into a form which is suitable for feature extraction. Iris image impossibly contains iris only. It also contains some other influencing factors such as eyelids, eyelashes and pupil. Preprocessing includes noise elimination, histogram equalization and removal

of irrelevant parts. Various preprocessing methods includes image enhancement by Median filtering, spatial low pass filtering, Gamma Intensity Correction, histogram fit . Iris image is preprocessed to detect the region of interest that is iris. Iris Localization/Segmentation is the process to detect region of interest in acquired image. In this case iris is the interested region. It is necessary to compute the iris inner (iris/pupil boundary) and outer (iris/sclera boundary) boundary. The problem arising in detecting two circles is a occlusion of eyelids and eyelashes also iris and pupil both are nonconcentric.

Feature Extraction is special form of dimensionality reduction. Extracted information from iris may contain local , global , or both local and global information . Only the significant features of the iris must be encoded so that comparisons between templates can be made easy. Different wavelet transforms and their energy compaction properties can be well used for feature extraction. High energy coefficients can be used to generate a feature vector.

Classification is done by template matching against the stored template for verification by one-to-one matching or by identification one to many matching. In identification an attempt is made to identify identity of unknown individual. The person will be genuine individual if the comparison of the biometric sample to a stored template in the database falls within a previously set threshold. Matching algorithms estimates the distance between stored template and obtained template. The feature vectors are classified through different algorithms like Hamming Distance, Euclidean distance, weight vector, dissimilarity function, or Neural network. For gender identification SVM classifier is more robust as input vectors are non-linearly mapped to a very high-dimensional feature space. It maximize the margin. Its kernel implicitly contains a non-linear transformation.

SVMs can be robust, even when the training sample has some bias. The effectiveness of SVM depends upon the selection of the kernel and the kernel parameters. The organization of paper is as follows.

Section 2 gives detailed literature review regarding the iris biometrics, experimental results on different databases. Finally, section 3 describes security and privacy aspects of iris biometrics. We also discussed future scope and existing difficulties

2. DETAILED LITERATURE SURVEY

Table 1 gives brief review of challenges and algorithms developed by different researchers for last few years.

Table 1: Detailed Literature Survey

Ref No.	**Database & No . of Images**	**Issues and Challenges**	**Proposed Methodology**	**Reported Experimental Results**	**Gap Identified**
[3]	CASIA	Parallel Computing	Cyclone-II FPGA development Kit	Time to localize iris is zero., Accuracy of iris Localization=94%	Improvements is needed in Iris localization Accuracy
[4]	WVU-IBIDC (584 from 73 subjects)	Off angle Non idealistic iris localization	Combination of Least Square Ellipse Fitting (LSEF) Geometric Calibration	Success rate of iris localization=99.6%, Recognition Rate=99.83%,FRR=0.15% ,FAR=0.02%	Segmentation rate degraded for larger degrees off angle .
[7]	WVU-IBIDC (584 from 73 subjects)	Off angle Non idealistic iris localization	Combination of Least Square Ellipse Fitting (LSEF) Geometric Calibration	Success rate of iris localization=99.6%, Recognition Rate=99.83%,FRR=0.15% ,FAR=0.02%	Segmentation rate degraded for larger degrees off angle .
[8]	NDB CASIA-v3	security of iris recognition	Negative iris recognition based on p-hidden	GAR=98.94% at FAR=0.01%,EER=0.6%	fails to match iris data having euclidean and hamming

			negative database		distance
[10]	Own dataset (1372)	To improve matching accuracy	fusion of fragile bit distance and hamming distance for matching	FAR=0.001,FRR=0.013,EER=0.008	more complex algorithm
[11]	NDB(676) ICE2005 (132)	Low quality acquired iris image recognition & security ,privacy of user data	Sparse represen-tation for selection of iris , cancellable biometrcs to revoke and reissue stolen patterns, security by random projections and random permutations	Accuracy = 99.15% for NDB 98.13% for ICE2005	Poorly acquired iris images are rejected . More memory and computation requirement.
[12]	IITK	To reduce dimensionality of feature vector , to reduce system complexity	feature vector by sobel opeartor, 1D discrete wavelet as a filter	accuracy= 92.82% for 3 segments image	not suitable for Off angle ,less controlled environment-al images
[13]	Palacky university database (384)	To reduce feature vector size	concept of energy compaction of transforms in higher coefficients	accuracy is 85% with walsh wavelet transform	accuracy is less
[15]	CASIA (108)	To study distortion of polar coordinate transform to Recognition Rate.	contourlet transform for feature extraction, SVM as a classifier	RR is 96.30%	Only normalized energy as a feature Optimized feature vector is not taken into consideration
[16]	phoenix MMU IITD	Illumination variations in images	Radon based preprocessing,T-DCT based feature extraction	Accuracy is 88.89% (phoenix) 78.04%(MMU) 94% (IITD)	Not suitable for unconstrained environment images
[17]	UBIRIS (1205)	Images suffered from illumination change, bad focus, noise	GLCM based haralick feature extraction, matching by PNN	FAR=2.74%, FRR=3.15% CRR=97%	not suitable for off angle iris images
[18]	own dataset (70)	To improve classification accuracy	2D walsh hadamard transform based feature extraction,MLP neural network for classification	ACA=90%	Dimensionality of input feature vector is large.
Ref No.	**Database & No . of Images**	**Issues and Challenges**	**Proposed Methodology**	**Reported Experimental Results**	**Gap Identified**
[19]	UBIRIS (1205)	Nonuniform illumination,rotational inconsistencie,and noisy iris image recognition	DWT and ICA for feature extraction ,fuzzy logic for classification	Accuracy =97%	Not suitable for distant and off angle iris images.

[21]	JLUBR-IRIS(200)	To extract local and spatial directional features	Decomposition of iris images by GHM multiwavelet transform	FAR=1.59%, FRR=2.76%	Local characteristic and textural can be combined to form a vector code, Accuracy is less
[22]	UBIRIS.V1	To improve accuracy	GLCM based feature extraction	Accuracy=96%	It is not suitable for image degraded with noise ,images with glasses
[23]	Phoenix(192), IITD (1120), CASIA (240)	Recognition under varying contrast and live tissues	Radon transform thresholding based feature extraction, gradient based isolation as a preprocessing	Accuracy =87.96% forPhoenix,86.14% for IITD & 60.01% for CASIA ,testing time per image =700msec	Testing time per image is more
[24]	CASIA	Noisy images	Morlet transform for feature extraction	Accuracy=99.95% EER =0.055% & Recognition time is 9.5sec	Not suitable for distant images.
[27]	Palacky university database (384)	Copyright protection, security of multimedia data	Canny edge detection to extract features,grid based watermarking algorithm using singular value decomposition ,DWT	EER=0.8%, FAR=3%, FRR=0.54%	time consuming process
[29]	UBIRIS (500)	To reduce FAR,FRR	DWT and DCT for feature extraction	Accuracy is 98% for DWT ,and 96% for DCT, recognition time is 0.2718sec for DCT 0.9512 sec for DWT respectively	Not suitable for off angle images
[30]	CASIA	to remove localized high frequency information from segmented iris region	Log Gabor wavelet for feature extraction, maximum suppression of eyelids and eyelashes	EER=0.54% FAR=0.001%, FRR=37.88%	Not suitable for off angle iris
[31]	ICE2005 (122)	detecting and matching iris crypts automatically	matching model based on the Earth Mover's Distance (EMD) key morphological operation for segmentation	EER is improved by 85% on ICE2005 dataset	Less suitable for occluded images
[36]	BioSecure Database (1600)	Choice between geometric and textural features and to choose best classifier	Combined geometric and textural features, support vector machine(SVM) for classification	Prediction accuracy 90% by SVM	Less Accuracy
[37]	A dataset of 400 iris images of 200 subjects.	Computation of feature vector from statistical features	SVM binary classifier	Gender prediction Accuracy= 85.68%	Less accuracy
[38]	Iridian LG EOU200 system to acquire dataset	To improve gender identification accuracy	C4.5 decision tree classifier	Accuracy=75%	large quantity of features, Less accuracy.

3. IRIS BIOMETRICS - SECURITY AND PRIVACY

The use of iris biometric systems in large-scale government military and civilian based applications has raised the question of iris template's security. Security and privacy of centralized databases, which can store millions of iris templates is of important concern. Privacy-enhancing technology along with cancelable biometrics is likely to raise the privacy and security levels of such information. In [12], idea of canceling biometrics is used reissued in case stored templates are stolen. Different templates are assigned to different applications so as to avoid cross matching. Sparse representation and recognition of iris image is used which protects original iris patterns as well reissue new patterns when old ones are lost or stolen. Cancel ability is through random permutations of dictionary columns. They propose score level fusion approach, where they combine the recognition results of different sectors based on recognition confidence using corresponding Sparsity Concentration Index (SCI) values. They achieved recognition performance on ICE 2005 database as 98.13%. However, more research is required to include security schemes in an operational environment. The grid based watermarking algorithm uses a hybrid singular value decomposition (SVD). This method was strong and undetectable and resolves various watermarking attacks in robust manner [27].

4. CONCLUSIONS

This paper provides a brief review of challenges and algorithms developed by different researchers for last few years. From this study it is observed that, existing methods for iris recognition still faces problems with images acquired in noisy environment or images acquired under non-ideal conditions as localization and segmentation becomes a challenging task. It also affects accuracy of the system. Many researchers implemented the feature extraction algorithms with different wavelet transforms. It is also observed that existing biometrics method reveals only the identity of person, they does not specify the other attributes of a person such as age, gender and ethnicity which is also important in security applications. Thus there is a scope for new researchers to work on identification of other attributes using iris images. Security and privacy of centralized databases, which can store millions of iris templates is of important concern. The biometric system should reissue a new template in case it is stolen. Iris biometric security is also emerging research area in this field.

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