

# Different Techniques of Age and Gender Prediction from Iris Recognition

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*Abstract*— Literature survey on the recent developments in age and gender prediction from iris recognition techniques and the survey highlight on two major approaches for human identification, namely biometric identification. Physical ageing is an important factor for practical bio-metrics. Different Age prediction techniques are relatively represented in the literature. Experimentally an approach to age prediction from iris images by using a combination of a small number of very simple geometric features, and a more versatile and intelligent classifier structure which can achieve accuracy to more than 75% .Iris recognition system can be enhanced by identifying age group of the persons from their iris images. Prediction of gender characteristics from iris images has been investigated and some successful results have been reported in the literature, but without considering performance for different iris features and classifiers. This paper also investigates an approach to gender prediction from iris images using different types of features and a more versatile and intelligent classifier structure. Proposed approaches can achieve gender prediction accuracy of up to 90% in the Bio-Secure Databas.

**Keywords:** Iris Recognition, Accuracy (ACC)

## I. INTRODUCTION

Iris recognition emerges as one of the most useful modality for bio-metrics recognition in the last few decades. The goal of iris recognition is to recognize human identity through the textural characteristics of one's iris muscular patterns. The procedures for iris recognition usually consist of four stages: image acquisition, iris segmentation, feature extraction, and pattern matching. The iris recognition has been acknowledged as one of the most accurate biometric modality because of its high recognition rate. It has been applied in the field of border control and national security. More and more countries and private companies have shown interests to use the technique of iris recognition. Large-scale application of iris recognition in daily life is just a matter of time. Iris bio-metrics derives an iris code from the texture pattern of the iris and uses this code to verify an identity claim with high accuracy, or to recognize a person as one from among a potentially large set of enrolled persons. Iris bio-metrics is an active and expanding research area. The technology has been used in border control in the United Arab Emirates for over a decade, and is currently used in large scale applications such as India's Unique ID, project to develop an identity system for 1.2 billion people.

Biometric-based age estimation[1] is perhaps the most common and valuable manifestation of this process. The literature shows that face, speech, and signature bio-metrics, have received most attention in the research area of age prediction. However, even though it is thus possible to find some interesting work dealing with age estimation based on various different biometric modality there is only one reported study concerning age estimation based on iris bio-

metrics. Substantial efforts spanning over a long period have been made by the research community towards guessing approximate age of a human face. Presently, an interesting topic in iris biometric is to resolve or determine age from the iris image. Sufficient research has not been reported that can help decide age bracket of a person from the available iris image. Age estimation based on snapshot of the eye is relatively more difficult because the tempo at which structure/characteristics of human eye are changed is not very well known. In the establishment of iris biometric research, the research community has somewhat compromised with the earlier findings that iris remains stable throughout the life of a person. "Template aging" and "Iris aging" are two dissimilar terms, as template aging takes place when enrolled image and verified image match score degrades after lapse of certain time, but with iris aging it means that considerable changes can occur in iris texture pattern as humans grow older . It is generally emphasized that significant features of an iris do not change and remain stable for many years, but there are some other factors that occur in the eye structure in old age.

Identify a person's gender[5] from an iris image when such identification is related to security surveillance systems and forensics applications. The ability to predict soft biometric attributes such as gender based on iris texture is potentially useful in a variety of ways. In a 1-to-N recognition application, where a probe iris code is matched against a large number of enrolled identities for recognition, prediction of demographic factors could be used to order the search and thereby reduce the average search time. Also, a recognition system can naturally only recognize people who have previously been enrolled in the system. For persons who are not yet enrolled and so cannot be recognized, it may still be useful if the system could provide some basic demographic information for the person. In addition, at the time that a person is enrolled in the biometric system, prediction of demographic attributes could serve as an independent check on the accuracy of elements of information presented for enrollment. Also, there may be situations in which automated demographic classification and counting of persons without identity recognition is useful.

## II. LITERATURE REVIEW

M .Erbilek,M.Fairhurst and M. C. D. C.Abreu develop Age Prediction from Iris Bio-metrics[1] .This paper develops the basic processing of biometric data in our iris-based age prediction approach, as illustrated in five steps .The steps are acquisition, segmentation, geometric feature extraction, prediction. the prediction steps uses common individual classifiers mainly SVM, MLP, KNN, NEGOTATION METHOD. The proposed intelligent agent-based configuration increases the prediction accuracy substantially, returning an accuracy greater than 75% using the negotiation configuration. Obtaining high level of performance with only

five geometric features can be explained by the fact that geometric features of the iris are apparently highly correlated with age.

Asima Abbasi and Muhammad Khan Shaheed Zulfikar proposed Iris-Pupil Thickness Based Method for Determining Age Group of a Person. Three publicly available CASIA version 4.0 datasets namely CASIA -Iris-Twins, CASIA -Iris-Interval and CASIA -Iris-Thousands. Overall 180 images were selected from three data sets four images (two for left and two for right eyes) for each subject were selected, thus making a total of 60 images from each data set. Divide the age groups into three categories: Children, youth and senior citizen. The proposed algorithm consists of three main components i.e., iris segmentation, iris pupil ratio and Analysis of Variance (ANOVA) statistical analysis. Iris segmentation was performed by using circular ROI crop algorithm. After the iris segmentation Matlab 'imtool' function was used to calculate radius of iris and pupil size against each image. children age group shows that Iris-Pupil thickness ratios of all the images lie between 2.0 to 3.0. Iris-Pupil thickness ratios for iris images of youth group and senior citizen group lie between 2.0 to 3.5 and 2.5 to 4.5. Statistical Analysis on Iris Data using Boxplots. ANOVA computes ratio of the variation between sample means and the variation within the samples. The Turkey's pair wise method is based on applying the well-known t-test on each pair of group. Iris-Pupil ratio contributes in template aging and experimental results proved the concept.

Amanda Sgroi, Kevin W. Bowyer, and Patrick J. Flynn develop The Prediction of Old and Young Subjects from Iris Texture[2]. In this experiment, 50 subjects between the ages of 22 and 25 were selected as the "younger" group, and 50 subject older than the age of 35 were selected as the "older" group. The old and young data sets are also balanced with respect to gender, race, and eye color. Comparison within the old and young sets was performed using the Iris-BEE matcher. To extract our feature values, the filtered unrolled iris image is broken up into four row regions each containing 10 rows of size 240-by-10, and 10 column regions each containing 24 columns of size 24-by-40. nine Iris Texture Feature Filters used in feature extraction step Two validation sets were also created in order to test this result. The first validation set was created using new images from five random subjects from the younger group and five random subjects from the older group. The second validation set was generated using ten new subjects. All the subjects in this new data set are in the younger age range. Feature was individually used to train and test each fold of a Random Forest classifier,

Baohua Yang, Jingfang Wang proposed Iris Image Quality Evaluation Method Research Based On Gradation Features[3]. The iris image quality evaluation is proposed based on gradation feature focus and motion blur are improved in the process of acquiring iris images. The eye image is captured, the iris is detected first in the image or the iris image is too biased towards the edges. Iris visibility mainly refers to the proportion of the effective iris region. Since the iris image acquisition process is dynamic, it is susceptible to eyelid cover and pupil scaling value, its results is that real available iris region is not much. Iris visibility indicators must simultaneously reflect the impact of the two

factors of the eyelid and pupil, iris visibility indicators are represented with  $Q = Q1 + Q2$ ,  $Q1$  is the evaluation scaling factor of the covered eyelid, and  $Q2$  is the evaluation scaling factor of the covered pupil. Iris Clarity Measurement steepness of the pupil edges are often different in iris image clarity evaluation, the roundness of the pupil edge is different, so the maximum gradient average value of the pupil edge or the calculated value of the rounded contours operator are used to evaluate the iris image clarity, it is less accurate. The Iris Comprehensive Quality Evaluation The three quality metrics are taken and the quality indicators are comprehensive. The iris image quality evaluation method is proposed based on gray feature, and the image quality is reflected by evaluating the "iris position detection," "Iris visibility," "Iris clarity". First, according to the gray characteristics block of the image, the gray value sum is calculated to determine whether the iris is in the appropriate area of the image; Then the eyelid covers and the pupil scaling two factors are evaluated to determine the visibility of the iris. The average height of the pupil edge is calculated by the gray differential accumulation sum, iris clarity is evaluated. These three quality evaluation are taken, the "weight points system" is applied, and a "Comprehensive Quality Evaluation" is obtained.

Virginia Ruiz- Albacete Pedro Tome-Gonzalez, Fernando Alonso -Fernandez, Javier Galbally, Julian Fierrez, and Javier Ortega-Garcia invented Direct attacks using fake images in iris verification. A new iris database has been created using iris images from 27 users of the Bio-Sec baseline database. The process is divided into three steps: first the original images are preprocessed for a better afterwards quality, then second they are printed on a piece of paper using a commercial printer and lastly and, third the printed images are presented at the iris sensor, The experimental setup consisting of four steps these are segmentation, normalization, encoding and matching For iris segmentation, the system uses a circular Hough transform in order to detect the iris and pupil boundaries. Iris boundaries are modeled as two circles. The system also performs an eyelids removal step. Normalization of iris regions is performed using a technique based on Daugman's rubber sheet model. The center of the pupil is considered as the reference point, based on which a 2D array is generated consisting of an angular-radial mapping of the segmented iris region. Feature encoding is implemented by convolving the normalized iris pattern with 1D Log-Gabor wavelets. The rows of the 2D normalized pattern are taken as the 1D signal, each row corresponding to a circular ring on the iris region. It uses the angular direction since maximum independence occurs in this direction. The filtered output is then phase quantized to four levels using the Daugman's method with each filtering producing two bits of data. Matching, the Hamming distance is chosen as a metric for recognition. The Hamming distance employed incorporates the noise mask, so that only significant bits are used in calculating the Hamming distance between two iris templates. Two different attack scenarios are considered in the experiments and compared to the system normal operation mode: normal mode, attack1 and attack2. detection procedures are possible countermeasures against direct attacks. For the case of iris recognition systems, light reflections or behavioral features like eye movement, pupil response to a sudden lighting event.

Stephen Lagree and Kevin W. Bowyer proposed Predicting Ethnicity and Gender from Iris Texture[3]. Contributions of this work include greater accuracy than previous work Iris-BEE software from the Iris Challenge Evaluation, They segmented the iris region, created a normalized iris image, and created a log-Gabor filtered version of the normalized iris image to compute texture features separately for eight five-pixel horizontal bands, running from the pupil-iris boundary out to the iris-sclera boundary, and ten twenty-four-pixel vertical bands of the 40x240 image. The six statistics are: (1) average value of filter response over the region, (2) standard deviation of filter response, (3) 90th percentile value of filter response, (4) 10th percentile value of filter response, (5) range between 90th and 10th percentile value, and (6) a "local window difference". Several detectors used for gender prediction. Seven algorithms used for Ethnicity prediction. Accuracy of predicting ethnicity using person-disjoint 10-fold cross-validation on a 120-person, 1,200-image dataset exceeds 90%. Accuracy on predicting gender using person-disjoint 10-fold cross-validation on a 60-person, 600-image dataset is close to 62%.

Chun-Wei Tan, Ajay Kumar proposed integrating ocular and iris descriptors for fake iris image detection[4]. The developed spoof iris detection approach analyzes the image features such as intensity distribution, randomness of the iris texture, edge strength which is computed from the localized iris and periocular/ocular regions. The feature computed from the entire image is essential part of our strategy, especially when either of the following two common scenarios are encountered: (i) when the iris segmentation algorithm fails to localize the pupillary and limbic boundaries, (ii) pupillary and limbic boundaries have been successfully localized. Eye image divide into ocular, iris, pupil. The effectiveness of proposed spoof detection strategy is ascertained using experimental results on publicly available spoof or fake iris database. Average Classification Error (ACE) as defined as the performance metric to evaluate the classification performance of the developed approach. The False Living Rate represents the percentage of the falsely classified fake iris images as real, while the False Fake Rate represents the percentage of falsely classified real iris images as fake category.

Nour Eldeen M. Khalifa<sup>1</sup>, Mohamed Hamed N. Taha<sup>1</sup>, Aboul Ella Hassanien<sup>1,2</sup>, Hamed Nasr Eldin T. Mohamed<sup>3</sup> proposed Deep Iris: Deep Learning for Gender Classification Through Iris Patterns. A robust iris gender-identification method based on a deep convolutional neural network is introduced. The proposed architecture segments the iris from a background image using the graph-cut segmentation technique. The proposed model contains 16 subsequent layers; three are convolutional layers for feature extraction with different convolution window sizes, followed by three fully connected layers for classification. Graph cut based segmentation method was proposed, it has obtained a lot of attention because this method utilizes both boundary and regional information. Classify graph cut method into three categories. They are speed up-based graph cut, interactive-based graph cut and shape prior based graph cut. The proposed deep architecture consists of 16 layers, layer ten is a fully connected layer with 1,024 neurons, with a ReLU activation function followed by a dropout layer to

reduce over fitting in neural networks by preventing complex co-adaptations on training data. A fully connected layer with 512 neurons and a ReLU activation function layer is then presented. The last fully connected layer has 2 neurons that classify the result into 2 classes for iris gender recognition. Visualizing the feature extraction and classification layers in the proposed deep neural architecture provides a better understanding.

Vince Thomas, Nitesh V. Chawla, Kevin W. Bowyer, and Patrick J. Flynn invented Learning to predict gender from iris image[5]. Machine learning techniques is used to develop models that predict gender based on the iris texture features. While there is a large body of research that explores bio-metrics as a means of verifying identity, there has been very little work done to determine if biometric measures can be used to determine specific human attributes. If it is possible to discover such attributes, they would be useful in situations where a biometric system fails to identify an individual that has not been enrolled, yet still needs to be identified. The iris was selected as the biometric to analyze for two major reasons: first on is quality methods have already been developed to segment and encode an iris image, and second one current iris encoding methods are conducive to selecting and extracting attributes from an iris texture and creating a meaningful feature vector. The derivation of a feature vector from iris images to predict gender. The most critical component of a learning task is providing a cogent representation of data. The data and feature creation can be done by Data Acquisition, Segmentation and Encoding, Feature extraction, Geometric Features. Then Machine learning framework is used in prediction step. The machine learning framework consisted of feature selection, decision tree learning and ensemble methods. Classifier learning and feature selection are mainly two step in machine learning framework.

Michael Fairhurst<sup>1</sup>, Meryem Erbilek<sup>2</sup>, Marjory DaCosta-Abreu<sup>3</sup> proposed Exploring gender prediction from iris bio-metrics [6]. The basic processing of biometric data in our iris-based gender prediction approach is illustrated in acquisition, segmentation, feature extraction and prediction. An eye image is captured in the Acquisition step. The Segmentation step localise the iris region from the acquired eye image. This step involves detection of the sclera/iris and pupil/iris boundaries. Segmentation step is done by mainly using three approaches the first one is Geometric feature extraction and correlation it is important to note that the extraction of these features is computationally simple and fast, since none of them requires the extraction of texture information relating to the iris. Patterning extraction of the 12 geometric features defined in in this approach. Second one is Normalisation and texture feature extraction and normalisation, 1D Log-Gabor wavelets are used to encode features. Each row of the 2D normalised iris pattern corresponds to a circular ring on the iris region. These rows are divided into a number of 1D signals and convolved with 1D Log-Gabor wavelets which outputs a template of size 20\*480 with both real and imaginary components. Only use the real components to extract texture features, and the third one is Combining geometric and texture features this approach simply adopts the combination of approach1 and approach 2. Hence, geometric and texture features obtained

from approach 1 and approach 2 respectively, are combined simply by concatenating them. The Feature extraction step extracts geometric, texture or both geometric and texture features of the iris according to the configuration required. Prediction The gender prediction task involves the specification to form the training and testing sets as well as the classification method to be applied, which may be described two step. first one is Forming testing and training sets In order reliably to evaluate the performance of the gender classification task, divide the available samples into person-disjoint testing and training sets. Thus, samples from approximately 72% of the male and the female subjects are used as a training set and there main subjects' samples are used as a testing set. then the second one is Classification techniques One of the more difficult aspects of designing any classification task is making the best choice of classifier or, in the case of a multi-classifier approach, choosing the set of base classifiers for the fusion method. the proposed iris based gender prediction approach 1 uses only five simple geometric features of iris images and can reach accuracy close to 73% within approximately 2 seconds for classification. Approach 3, which adopts both geometric and texture features able to reach accuracy close to 90% within approximately 3 seconds using also the multi-agent system

### III. COMPARISON

This paper discuss different methods of age and gender prediction from iris recognition & iris image quality evaluation. while comparing all the papers age prediction from iris bio-metrics gives better technique by using simple classifiers to predict the age. Empirical study then evaluates the accuracy of the proposed age prediction approach by using the defined feature vectors and classifiers presented in with respect to the defined dataset. The results are shown in Table 3.1. This approach uses different classifiers the negotiation method gives better accuracy comparing with other classifiers.

Classifier		Accuracy (%)
SVM		62.06
MLP		61.80
Jrip		62.50
KNN		52.41
Decision Tree (J48)		51.09
Fusion	Sum	64.11
	Vote	62.94
Negotiation	Game theory	72.65
	Sensitivity	75.09

Table.1: Accuracy of proposed age prediction from different classifiers

Gender prediction & classification discussed in this paper Deep iris: deep learning for gender classification through iris patterns gives classification techniques using convolutional neural network. neurons and ReLU activation function functions are used for the classification.

More accurate method for Gender prediction are discussed in exploring gender prediction from iris biometrics. Different types of simple classifiers are used for the prediction purpose. table 3.2 and table 3.3 shows the Accuracy (ACC) and execution time (ET) of individual classifiers and Accuracy (ACC) and execution time (ET) of combined based classifiers. Both geometric and texture features as able to reach accuracy close to 90% within approximately 3 seconds using also the multi agent system.

Approach	Results	SVM	MLP	Jrip	KNN	DT
1	ACC (%)	55.68	57.86	56.64	49.61	56.81
	ET (sec)	0.39	0.98	0.29	0.37	0.51
2	ACC (%)	65.68	67.86	56.03	59.61	66.81
	ET (sec)	1.47	0.49	0.41	0.74	1.47
3	ACC (%)	81.43	76.64	64.51	73.72	81.43
	ET (sec)	1.97	0.89	1.27	1.31	1.97

Table 2: Accuracy (ACC) and execution time (ET) of individual classifiers

Approach	Results	GT	Sens	Sum	Vote	Bagging
1	ACC (%)	70.89	72.46	69.23	59.18	59.72
	ET (sec)	1.83	1.96	0.86	1.31	0.54
2	ACC (%)	72.46	75.96	70.86	70.30	68.00
	ET (sec)	2.05	2.37	1.42	1.47	1.09
3	ACC (%)	87.31	89.74	85.39	85.03	71.24
	ET (sec)	2.84	2.59	1.99	1.84	1.58

Table 3: Accuracy (ACC) and execution time (ET) of combined based classifier

### IV. CONCLUSION

This paper discusses various techniques used age and gender detection from iris biometrics. The main aim of this work is to provide a timeline view of various iris recognition technique for the detection. have investigated experimentally three approaches to gender prediction from iris images which use a combination of a small number of very simple geometric features or which uses texture features alone, Based on this view it is concluded that most of the works carried on iris recognition is more or less similar but the focus was mainly made into 4 major areas namely iris segmentation, normalization which includes noise removal, feature extraction and classification of iris templates. Accuracy on predicting gender using person disjoint 10-fold cross-validation on a 60-person, 600-image dataset is close to 62%

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