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BIOMETRIC RECOGNITION OF HUMAN BEINGS USING RETINAL IMAGES

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Abstract: Biometrics finds a lot of application in the modern day security aspects whether it may be in industrial sector, defense sector or in domestic sectors. In this world, without biometrics, it is very difficult to incorporate the security measures in any organization. Hence, personal identification can be very important problem in any bio-metric recognition scenarios. In this proposed technique, this biometric recognition using retinal images is done. The retinal images are preprocessed and features are extracted using image processing and KNN classifier is trained with 66 recognized images and 35 unrecognized images The proposed algorithm is tested with 20 images and the output represents if the input image is a recognized one or not.ROC curve is plotted. This accuracy of the algorithm can be extended with more number of training images. This method of biometric recognition using retinal images finds more use in this Covid pandemic situation compared to the fingerprint biometric recognition system.

Keywords:Bio-metric recognition, Retinal images, KNN classifier

I. INTRODUCTION

Biometrics are body measurements and calculations related to human characteristics. Biometrics authentication (or realistic authentication) is used in computer science as a form of identification and access control. It is also used to identify individuals in groups that are under surveillance.

Biometric identifiers are the distinctive, measurable characteristics used to label and describe individuals. Biometric identifiers are often categorized as physiological versus behavioral characteristics. Physiological characteristics are related to the shape of the body. Examples include, but are not limited to fingerprint, palm veins, face recognition, DNA, palm print, hand geometry, iris recognition, retina and odour/scent. Behavioral characteristics are related to the pattern of behavior of a person, including but not limited to typing rhythm, gait, keystroke, signature, behavioral profiling, and voice. Some researchers have coined the term behaviometrics to describe the latter class of biometrics.

Iris scanning biometrics measure the unique patterns in the colored circle of your eye to verify and authenticate your identity. Contactless, fast and renowned for its accuracy, biometric iris recognition can operate at long distances, with some solutions that leverage the modality requiring only a glance from a user.

Biometric Recognition, authenticates a person based on his biological and behavioral (biometric) traits.Biometric recognition forms a strong *link* between a person and his identity because biometric traits cannot be easily shared, lost, or duplicated. Hence, biometric recognition is intrinsically superior and more resistant to social engineering attacks (e.g., phishing) than the two conventional methods of recognition, namely, passwords and tokens. Since biometric recognition requires the user to be present at the time of authentication, it can also deter users from making false repudiation claims.

II RELATED WORK

[1] Iris recognition stands as a vital topic in biometrics, holding marvelous potential intended for a vast array of real-life applications. This paper as well presents a literature survey on the various segmentation techniques associated in iris recognition, the Iris recognition's importance is also introduced and as well the various sorts of IRIS recognition process besides their limitations are discussed briefly. This literature work enlightens the various existing methods of iris segmentation proposed by various diverse researchers occasionally which assists the researchers in forthcoming effort in this particular area. For the upcoming work, we suggested working on addressing the current research problem that was discussed above along with it we would like to explore Machine Learning and segmentation approaches that have the potential to cause the iris recognition easier. It will be motivating in the forthcoming years to compare the performance and computational demand with that of more customary algorithms

[2] New fusion of various iris recognition approaches has been suggested utilizing nonperfect visiblewavelength images caught in an unimpeded environment.

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[3] implemented an iris recognition technique intended for identifying corresponding. The proposed matching plan was intended to manage potential topological alterations in the spotting of a similar crypt in various images. Their approach beats the eminent visible-feature centered iris recognition strategy predicated on three distinctive datasets. In particular, their approach accomplished in excess of 22% higher rank one hit rate in the identification, and more than 51% lower EER in verification. Likewise, the benefits of their approach on multi-enlistment was tentatively illustrated. Still substantial occlusion along with terrible illumination have a more extreme effect on their approach than the customary iris code. Poor illumination may bring about low contrast so fewer features can be spotted than under normal illumination.

[4] Flexible Iris Recognition was proposed which used Random Transform and Top hat filtering. DWT+DCT were utilized for extracting the iris features. Computational time is high aimed at real time applications.

[5] A NN structure was proposed to upgrade the iris recognition performance in noisy condition and furthermore to build the recognition rate Exact Computation time isn't assessed.

[6] suggested a code-level plan in heterogeneous iris recognition. The non-linear connection betwixt binary elements codes of heterogeneous iris images was demonstrated via an adapted Markov network. Additionally, a weight map on the dependability of binary codes in the iris template can be gotten from the model. Broad exploratory results of matching cross sensor, high-resolution versus low-resolution and, clear versus obscured iris images exhibited that the code-level approach can accomplish the most noteworthy accuracy in contrasted with the current pixel-level, feature level besides score-level solutions.

[7] recommended a new hardwaresoftware hybrid strategy to build the stand-off distance in an iris recognition framework. When designing the framework hardware, they utilized an improved wavefront coding procedure to expand the field depth. To recompense for the image obscuring caused by wavefront coding, on the software side, the presented framework utilized a local patch centered super-resolution strategy to re-establish the obscured image to its clear variant. The presented framework can expand the catch volume of a regular iris recognition framework by three times and keep up the framework's high recognition rate. But still, attributable to the hardware implementation, the planned model has the downside of high-cost.

[8] HOG-SVM and Grow Cut. Reduces false segmentation. Proposed algorithm doesn’t need parameter modification for the different database. The Complex algorithm owing to some ante and post processing techniques.

[9] introduced a vigorous key points-centered feature extraction framework aimed at iris recognition beneath changeable image quality conditions. Their proposition relied upon the productive fusion of SIFT features’ three data sources at matching score level. Three detectors employed to distinguish particular key points: Harris-Laplace, Hessian-Laplace, accompanied by Fast Hessian. Once the three sources were acquired, they were portrayed as far as SIFT features. The proposed fusion rule figures weights, which represent the reliability degree to which every individual source must contribute keeping in mind the end goal to decide the more discriminative matching scores. The disadvantage of this model is the planned feature extraction stage, which is tedious.

[10] has given an enhanced Daugman iris recognition algorithm that incorporates in two aspects: Improvement intended for iris confinement as well as The improvement intended for iris encoding along with matching algorithms. In Step 1, the localization and shape of the pupil were generally decided in iris image. In Step 2, the conceivable noise from residual eyelashes was additionally separated by choosing a “pure” iris part as a reference and making an approval judgment pixel-wise. The suggested algorithm has an undeniable improvement in boosting the speed accompanied by lessening the dismissal rate.

LIMITATIONS OF EXISTING SYSTEM

- Few works require excessive computation to achieve high accuracies (computationally quite expensive).
- In some methods, longer execution time and large amount of storage is required to achieve secure authentication.
- The number of computations involved in the recognition process was very high

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III.PROPOSED SYSTEM

Block diagram of the proposed method is as shown in fig.

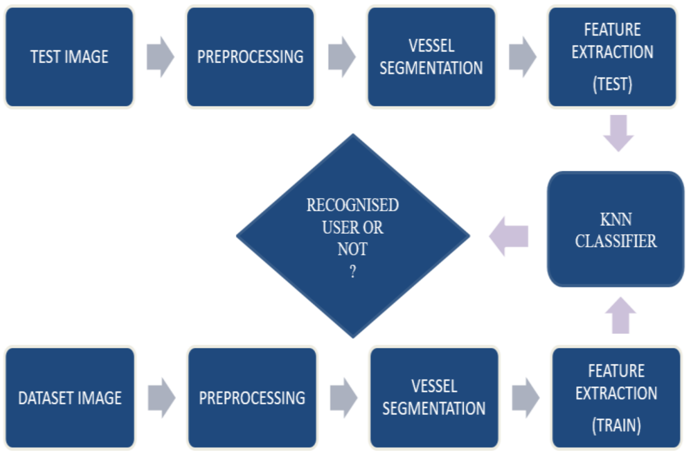

Fig: Block diagram of the proposed method.

The retinal images are pre processed that includes contrast conversion to grey scale image conversion ,contrast enhancement and noise removal. The vessels in retinal images are segmented using morphological operations. The features such as energy, homogeneity, mean, variance ,entropy ,smoothness and skewness are extracted and trained using KNN classifier. The test input image are given to the classifier to say if it is a recognised image or not.

IV.DIGITAL IMAGE

A digital remotely sensed image is typically composed of picture elements (pixels) located at the intersection of each row i and column j in each K bands of imagery. Associated with each pixel is a number known as Digital Number (DN) or Brightness Value (BV) that depicts the average radiance of a relatively small area within a scene (Fig).

A smaller number indicates low average radiance from the area and the high number is an indicator of high radiant properties of the area The size of this area effects the reproduction of details within the scene. As pixel size is reduced more scene detail is presented in digital representation.

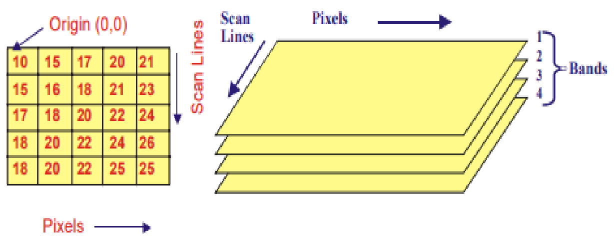

Figure 1 : Structure of a Digital Image and Multispectral Image

COLOR COMPOSITES

While displaying the different bands of a multispectral data set, images obtained in different bands are displayed in image planes (other than their own) the color composite is regarded as False Color Composite (FCC). High spectral resolution is important when producing color components. For a true color composite an image data used in red, green and blue spectral region must be assigned bits of red, green and blue image processor frame buffer memory. A color infrared composite 'standard false color composite' is displayed by placing the infrared, red, green in the red, green and blue frame buffer memory (Fig. 2). In this healthy vegetation shows up in shades of red because vegetation absorbs most of green and red energy but reflects approximately half of incident Infrared energy. Urban areas reflect equal portions of NIR, R & G, and therefore they appear as steel grey.

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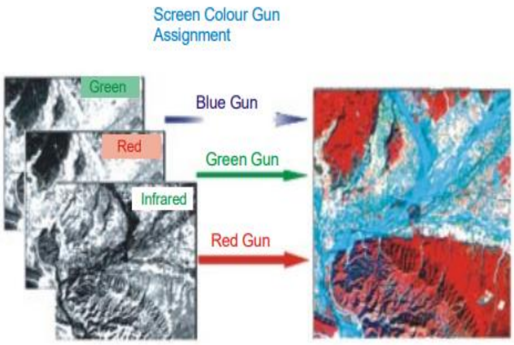

Figure : False Color Composite (FCC) of IRS : LISS II Poanta area

V.IMAGE ENHANCEMENT

Image enhancement techniques improve the quality of an image as perceived by a human. These techniques are most useful because many satellite images when examined on a colour display give inadequate information for image interpretation. There is no conscious effort to improve the fidelity of the image with regard to some ideal form of the image.There is a variety of techniques for improving image quality.

The contrast stretch, density slicing, edge enhancement, and spatial filtering are the more commonly used techniques. Image enhancement is attempted after the image is corrected for geometric and radiometric distortions. Image enhancement methods are applied separately to each band of a multispectral image. Digital techniques have been found to be most satisfactory than the photographic technique for image enhancement, because of the precision and wide variety of digital processes.

VI.CONTRAST:

Contrast generally refers to the difference in luminance or grey level values in an image and is an important characteristic. It can be defined as the ratio of the maximum intensity to the minimum intensity over an image. Contrast ratio has a strong bearing on the resolving power and detectability of an image. Larger this ratio, more easy it is to interpret the image. Satellite images lack adequate contrast and require contrast improvement.

Contrast Enhancement :

Contrast enhancement techniques expand the range of brightness values in an image so that the image can be efficiently displayed in a manner desired by the analyst. The density values in a scene are literally pulled farther apart, that is, expanded over a greater range. The effect is to increase the visual contrast between two areas of different uniform densities. This enables the analyst to discriminate easily between areas initially having a small difference in density.

The features or details that were obscure on the original image will be clear in the contrast stretched image. Linear contrast stretch operation can be represented graphically as shown in Fig. To provide optimal contrast and colour variation in colour composites the small range of grey values in each band is stretched to the full brightness range of the output or display unit.

Non-Linear Contrast Enhancement

In these methods, the input and output data values follow a non-linear transformation. The general form of the non-linear contrast enhancement is defined by $y = f(x)$, where x is the input data value and y is the output data value. The non-linear contrast enhancement techniques have been found to be useful for enhancing the colour contrast between the nearly classes and subclasses of a main class.

A type of non linear contrast stretch involves scaling the input data logarithmically. This enhancement has greatest impact on the brightness values found in the darker part of histogram. It could be reversed to enhance values in brighter part of histogram by scaling the input data using an inverse log function.

Histogram equalization is another non-linear contrast enhancement technique. In this technique, histogram of the original image is redistributed to produce a uniform population density. This is obtained by grouping certain adjacent grey values. Thus the number of grey levels in the enhanced image is less than the number of grey levels in the original image.

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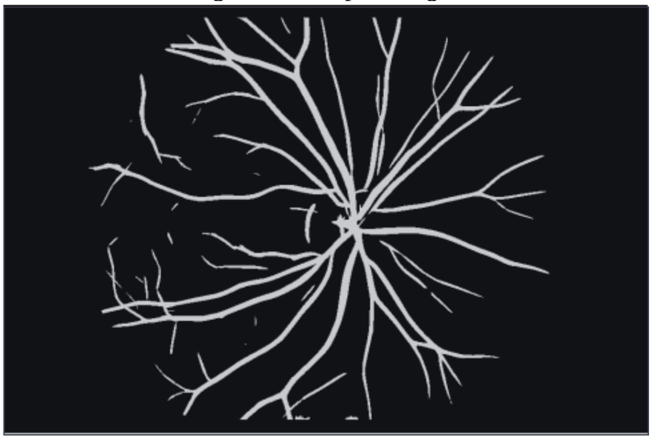
VII.VESSEL SEGMENTATION

Multi-scale line detection technique is used for retinal vascular network extraction which is very effective . The method combines line detectors at varying scales to produce an enhanced retinal image and a thresholding is then performed on the enhanced image to extract the blood vessels from its background. Generalized multiscale line detector is defined and thresholding is applied to obtain the vessel segmented output images.



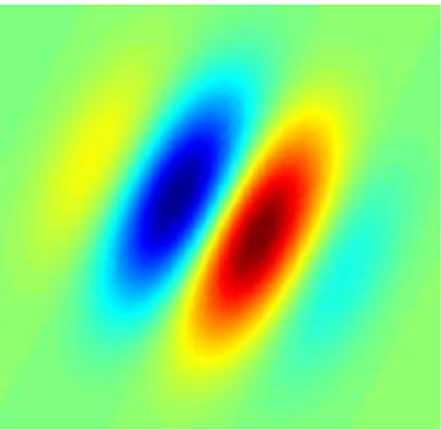
Retinal vessel segmented image.

We note that for our image set, central reflexeffects in the output images which leaves somepixels in the vessel centre undetected. For this artifact, the method can detect branch point in the vesselcentreline. Therefore, we apply a post processing technique to map these regions in the vessel and applyregion filling operation based on the centroid of the region and region boundary

VIII.Gabor Filter

In image processing, a Gabor filter, named after Dennis Gabor, is a linear filter used for texture analysis, which means that it basically analyses whether there are any specific frequency content in the image in specific directions in a localized region around the point or region of analysis. Frequency and orientation representations of Gabor filters are claimed by many contemporary vision scientists to be similar to those of the human visual system, though there is no empirical evidence and no functional rationale to support the idea. They have been found to be particularly appropriate for texture representation and discrimination. In the spatial domain, a 2D Gabor filter is a Gaussian kernel function modulated by a sinusoidal plane wave.

Some authors claim that simple cells in the visual cortex of mammalian brains can be modeled by Gabor functions.Thus, image analysiswith Gabor filters is thought by some to be similar to perceptionin thehuman visual system.



Example of a two-dimensional Gabor filter

Its impulse response is defined by a sinusoidal wave (a plane wave for 2D Gabor filters) multiplied by a Gaussian function.[3] Because of the multiplication-convolution property (Convolution theorem), the Fourier transform of a Gabor filter's impulse response is the convolution of the Fourier transform of the harmonic function (sinusoidal

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function) and the Fourier transform of the Gaussian function. The filter has a real and an imaginary component representing orthogonal directions.[4] The two components may be formed into a complex number or used individually.

IX.KNN CLASSIFIER

In patternrecognition, the k-nearest neighbors algorithm (k-NN) is a non-parametric method used for classification and regression. In both cases, the input consists of the k closest training examples in the feature space. The output depends on whether k-NN is used for classification or regression:

- In k-NN classification, the output is a class membership. An object is classified by a majority vote of its neighbors, with the object being assigned to the class most common among its k nearest neighbors (k is a positive integer, typically small). If k = 1, then the object is simply assigned to the class of that single nearest neighbor.
- In k-NN regression, the output is the property value for the object. This value is the average of the values of its k nearest neighbors.

KNN is a type of instance-based learning, or lazy learning, where the function is only approximated locally and all computation is deferred until classification. The k-NN algorithm is among the simplest of all machine learning algorithms.

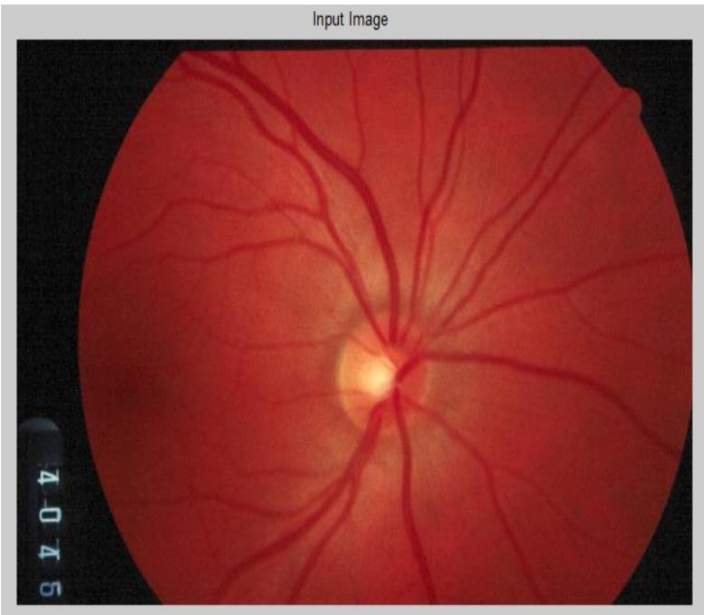
Both for classification and regression, a useful technique can be to assign weight to the contributions of the neighbors, so that the nearer neighbors contribute more to the average than the more distant ones. For example, a common weighting scheme consists in giving each neighbor a weight of 1/d, where d is the distance to the neighbor.

The neighbors are taken from a set of objects for which the class (for k-NN classification) or the object property value (for k-NN regression) is known. This can be thought of as the training set for the algorithm, though no explicit training step is required.

A peculiarity of the k-NN algorithm is that it is sensitiveto the local structure of the data. The algorithm is not to be confused with k-means, another popular machine learning technique.

X. RESULTS

The proposed algorithm using image processing and KNN classifier was trained with 66 recognized images and 35 unrecognized images The proposed algorithm is tested with 20 images and the output represents if the input image is a recognized one or not.ROC curve is plotted. This accuracy of the algorithm can be extended with more number of training images. This method of biometric recognition using retinal images finds more use in this Covid pandemic situation compared to the fingerprint biometric recognition system. The input retinal image and preprocessed images are shown in the below figures



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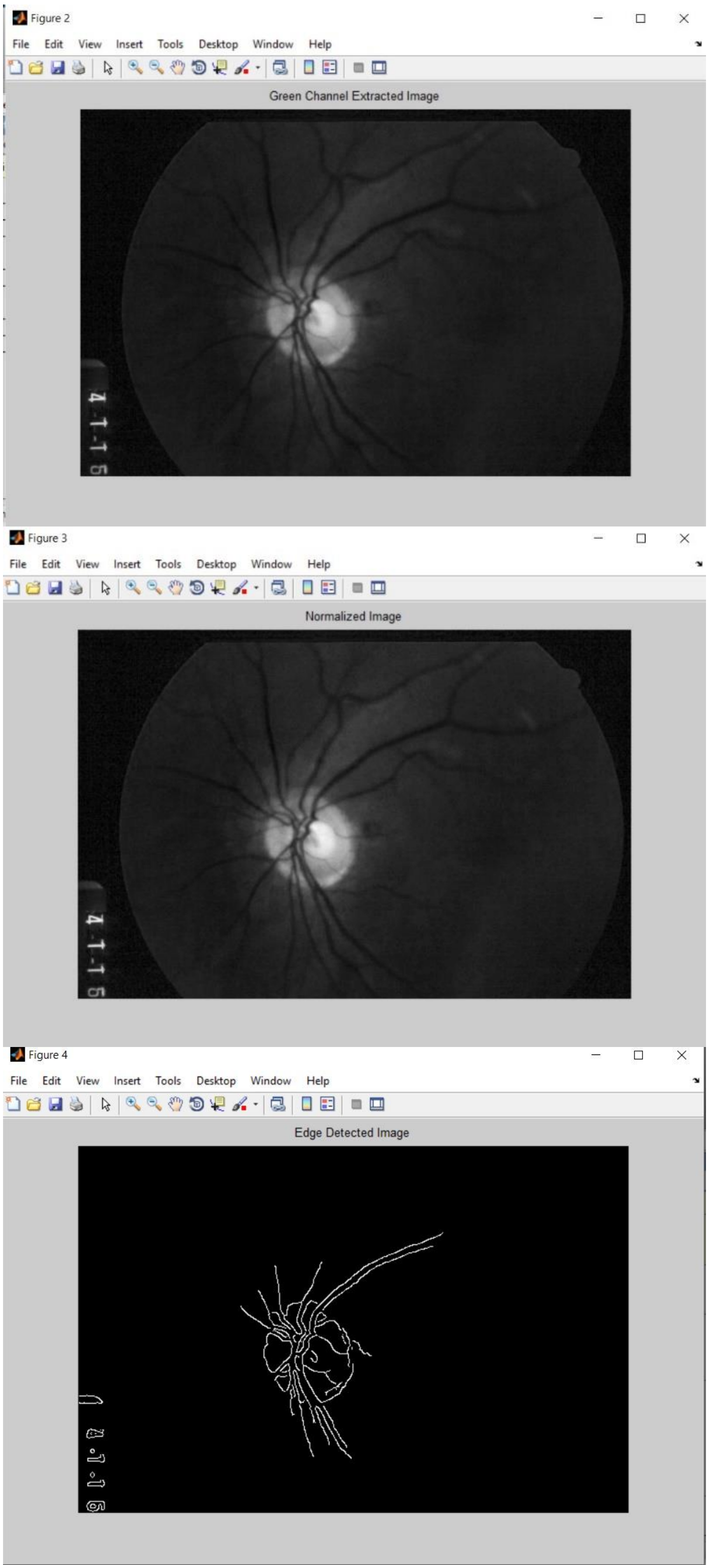

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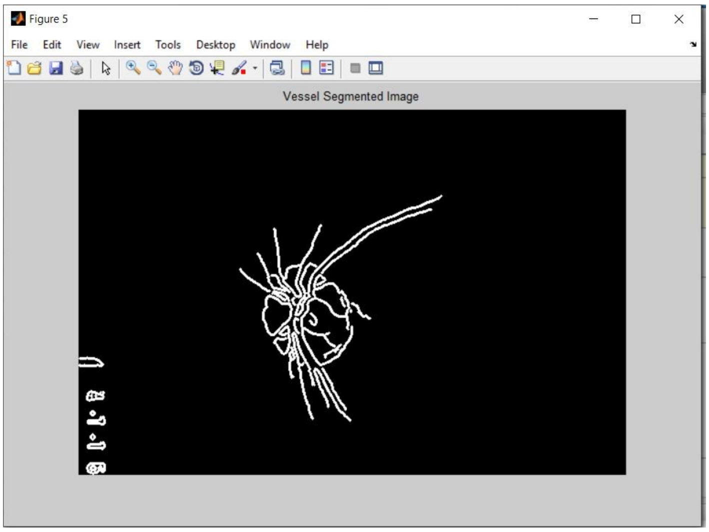
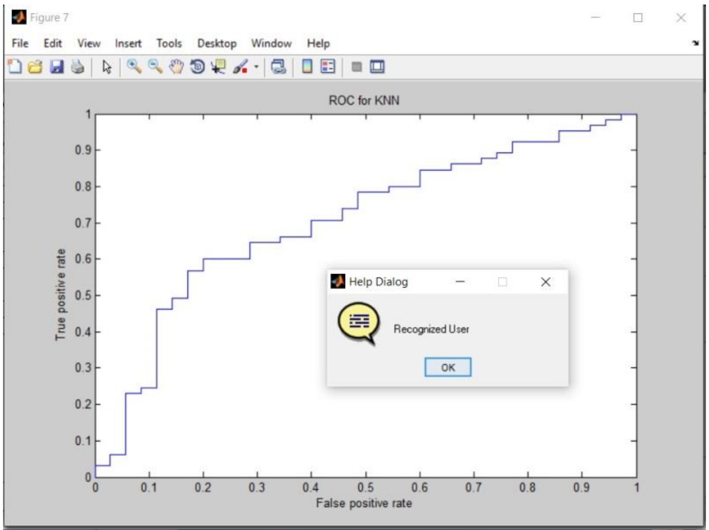


ROC curve for the experimental results for a recognized image and unrecognized image is plotted in the below given figures (a) and(b) respectively.

Fig a: ROC curve for the recognized image



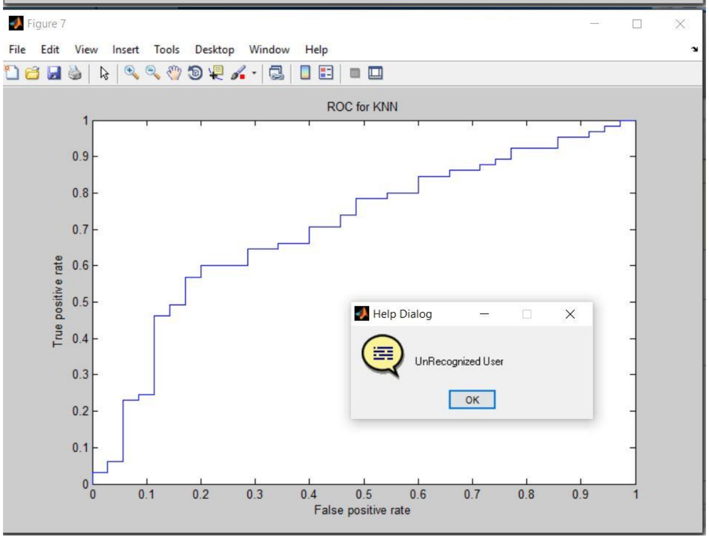


Fig b: ROC curve for the unrecognized image

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XII.CONCLUSION

Iris recognition stands as a vital topic in biometrics, holding marvelous potential intended for a vast array of real-life applications.Machine Learning and segmentation approaches that have the potential to cause the iris recognition easier.
An enhanced algorithm that employs KNN CLASSIFIER is presented in this work for the biometric recognition of retinal images of human beings.. The method was tested. This shows that the methodology is effective, and it could be used to develop biometric attendance system using retinal image recognition in all educational and industrial sectors in this Covid pandemic situation.
It will be motivating in the forthcoming years to compare the performance and computational demand with that of more customary algorithms

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