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University of AL-Qadisiyah

College of Computer Science and Information Technology

Multimedia department

Iris Recognition System

A graduation project is submitted to the Multimedia department in partial fulfillment of the requirements for the degree of Bachelor in information technology in multimedia

By.

Zaid Mohammed & Asaad Jamal & Ameer Kadhim

SUPERVISOR

assistant lecturer Rasha Falah

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بسم الله الرحمن الرحيم

﴿ قَالُوا سُبحَانكَ لا عِلمَ لنَاَ إِلا مَا عَلمتنَاَ إِنكَ أَنَتَ العلِيمُ الحَكِيمُ ﴾

صدق الله العلي العظيم

سورة البقرة (32)

شكر و تقدير

لابد لنا ونحن نخطو خطواتنا الأخيرة في الحياة الجامعية من وقفة نعود بها إلى أعوام قضيناها في رحاب الجامعة مع أساتذتنا الكرام الذين قدموا لنا الكثير باذلين بذلك جهودا كبيره في بناء جيلا لغد...

وقبل أن نمضي أتقدم بأسمى آيات الشكر والامتنان والتقدير والمحبة إلى الذين حملوا أقدس رسالة في الحياة ..إلى الذين مهدوا لنا طريق العلم والمعرفة إلى جميع أساتذتنا الأفاضل أهديكم هذا المشروع

Abstract

In a biometric system a person is identified automatically by processing the unique features that are posed by the individual. Iris Recognition is regarded as the most reliable and accurate biometric identification system available. In Iris Recognition a person is identified by the iris which is the part of eye using pattern matching or image processing using concepts of neural networks. The aim is to identify a person in real time, with high efficiency and accuracy by analysing the random patters visible within the iris if an eye from some distance, by implementing modified Canny edge detector algorithm. The major applications of this technology so far have been: substituting for passports (automated international border crossing); aviation security and controlling access to restricted areas at airports; database access and computer login.

1.1 Introduction

Iris recognition is the process of recognizing a person by analyzing the random pattern of the iris (Figure 1). The automated method of iris recognition is relatively young, existing in patent only since 1994. The iris is a muscle within the eye that regulates the size of the pupil, controlling the amount of light that enters the eye.

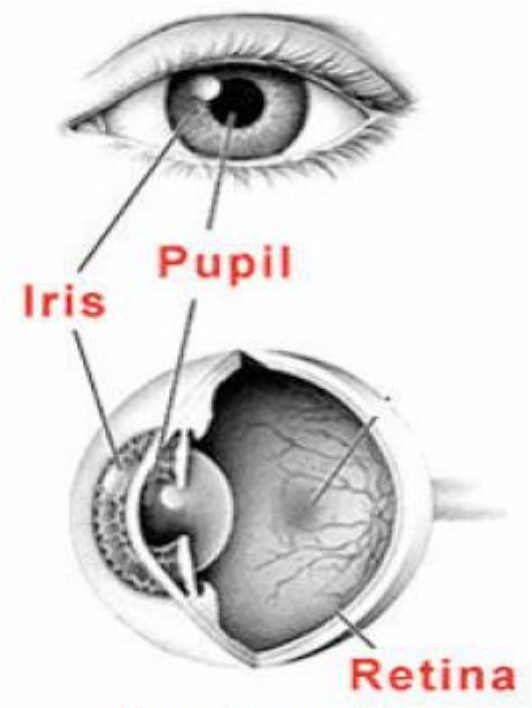


Figure.1 Human Eye

1.2 THE IRIS AS A BIOMETRICS

The iris is an overt body that is available for remote assessment with the aid of a machine vision system to do automated iris recognition.

A. Iris recognition technology combines computer vision, pattern recognition, statistical inference and optics.

B. The spatial patterns that are apparent in the human iris are highly distinctive to an individual.

- Clinical observation
- Developmental biology

Although the coloration and structure of the iris is genetically linked, the details of the pattern are not. The iris develops during prenatal growth through a process of tight forming and folding of the tissue membrane. Prior to birth, degeneration occurs, resulting in the pupil opening and the random, unique patterns of the iris. Although genetically identical, an individual's irides are unique and structurally distinct, which allows for it to be used for recognition purposes.[1][2]

1.3 The aim of iris recognition system

Several hundred million persons in several countries around the world have been enrolled in iris recognition systems for convenience purposes such as passport-free automated border-crossings and some national ID programs. A key advantage of iris recognition, besides its speed of matching and its extreme resistance to false matches, is the stability of the iris as an internal and protected, yet externally visible organ of the eye

1.4 Advantages of Iris Recognition

Iris recognition is one of the most secure biometric modalities for the purposes of identification and the subsequent authentication of an individual. It is extremely difficult to forge an iris scanner reading because of the unique characteristics of the iris. Compared to other modalities, it has a significantly lower false acceptance rate and false rejection rate. It is a highly useful technology in areas such as border security, membership authentication, financial institutes, and information security to name just a few of its many uses.

The following are some of the core advantages of iris recognition:

1. Accuracy: Iris recognition is one of the best biometric modalities in terms of accuracy. The false acceptance rate and false rejection rate is very low in this modality, thus ensuring a higher rate of accuracy in its results.

2. Scalability: This technology is highly scalable and can be used in both large and small scale programs. It has been deployed in many large scale programs including the respective government's biometric authentication programs in several countries across the world.

3. Distance: Unlike retina scanning, iris scanning can be done from a normal distance. It is like taking a normal photo, which can be taken from the regular distance of taking pictures.

4. Stable: Iris patterns remains stable throughout an individual's life. It is protected by the body's own mechanism.

5. Easy to use: Iris recognition system is plug & play compared to other modalities of biometric recognition. A person needs to stand still in front of the camera and the job is done instantly. It is a comfortable process for everyone.

1.5 Disadvantages of Iris Recognition:

Apart from all the advantages, every technology has some disadvantages too, iris recognition is no different.

The key disadvantages of iris recognition are the following:

1. Expensive: Iris scanners are relatively higher in cost compared to other biometric modalities. As one of the leading and latest technology of the modern times, the cost of the iris devices are fairly high. Large companies, agencies or Governments can afford that price, but the general public can't afford to pay that price. Some say that it costs five times higher than fingerprint scanning which is more readily available to the general public.

2. Distance: Iris is small in size and can't be located from a few meters distance. A person needs to be in close distance with the iris scanning device to be enrolled on the system properly. So, a proper setup is needed for initiating an iris recognition process.

3. Movement: A person has to be steady in front of the device to be enrolled by iris scanners. It means this device can't be used like face recognition devices to scan anybody, regardless of their movements. Sometimes it is quite difficult to be steady enough to complete the scanning process in first attempt.

4. Reflection: In some cases, it is hard to perform an iris scanning due to the presence of reflections. It could happen in case of eyelashes, lenses, and anything in general that would cause a reflection. These aren't very uncommon in our society, so people would face some difficult during iris scanning process.

5. Infrared light: The constant use of this system may cause harm to the iris because it is constantly being scanned with infrared light.

6. Location: The placement of iris is somewhat bizarre. It is situated behind a curved, wet, reflecting surface.

7. A lot of memory is required for the data to be stored and later accessed.

8. Obscure: It is obscured by eyelashes, lenses and reflections, which create a problem, more often than not.

9. Eyelids: Iris is partially blocked by eyelids which is difficult to control by individuals due to frequent blinking.

10. Transformation: Iris may deform non-elastically as the pupil may change its size due to medical or other conditions.

2.1 METHODOLOGY

The system is to be composed of a number of sub-systems, which correspond to each stage of iris recognition. These stages are:

• Image acquisition-capturing eye image

• segmentation – locating the iris region in an eye image

• normalization – creating a dimensionally consistent representation of the iris region

• feature encoding – creating a template containing only the most discriminating features of the iris.[9][2]

The input to the system will be an eye image, and the output will be an iris template, which will provide a mathematical representation of the iris region.[2]

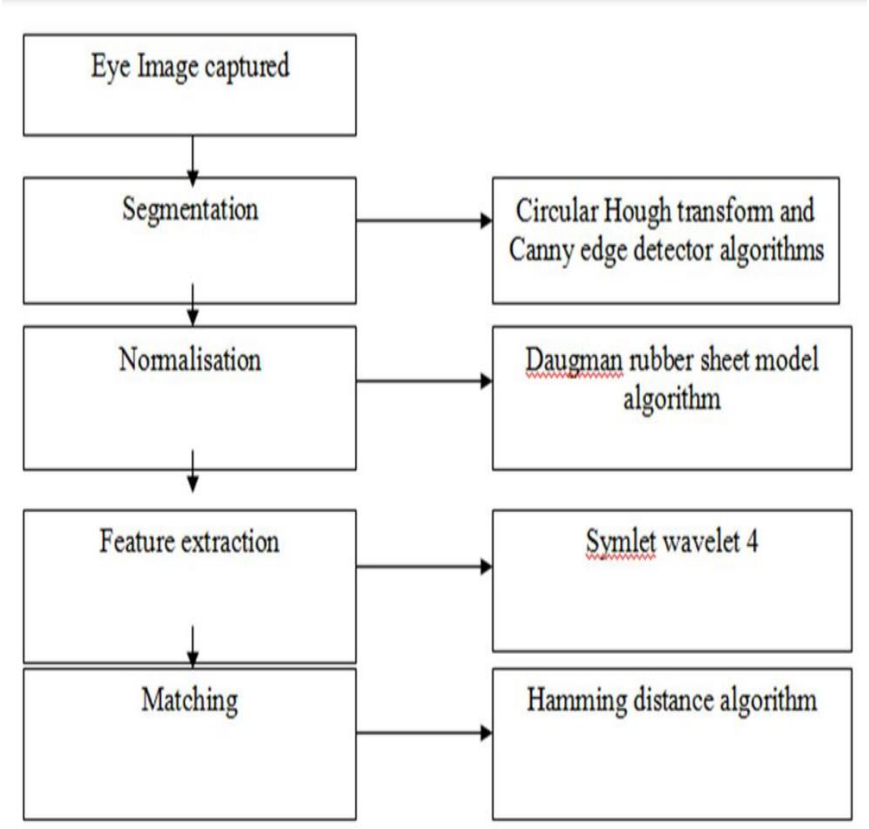


Figure:2 .Methodology steps

2.2 IMAGE ACQUISITION

The iris image should be rich in iris texture as the feature extraction stage depends upon the image quality. Thus, the image is acquired by a camera placed at a distance of approximately 9 cm from the user eye. The approximate distance between the user and the source of light is about 12cm. The image acquisition setup is given in Figure 1. The following attentions have been taken care at the time of grabbing the image

-High resolution and good sharpness: It is necessary for the accurate detection of outer and inner circle boundaries

-Good lighting condition: The system of diffused light is used to prevent spotlight effect.[10]

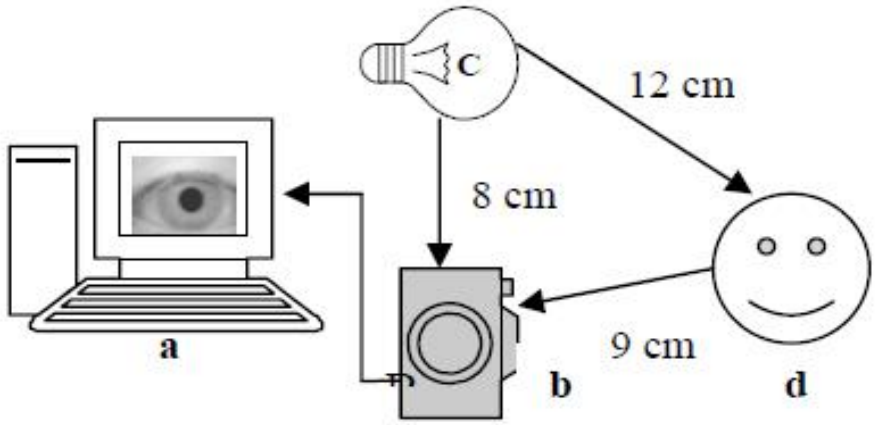


Figure3. Image acquisition System (a) System with frame grabber (b)

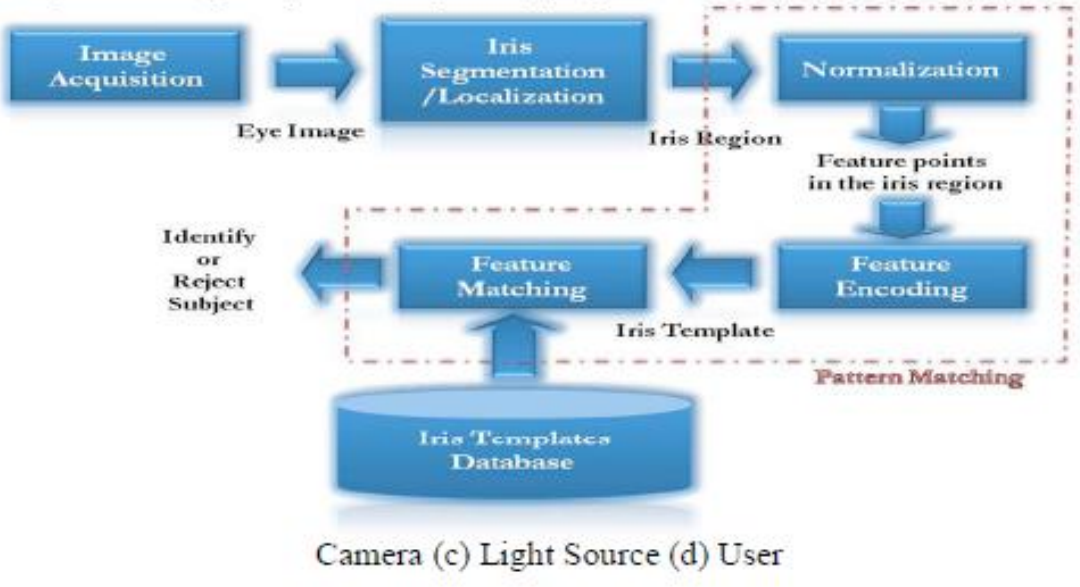


Figure4. Schematic diagram of iris recognition

2.3 SEGMENTATION

The first stage of iris recognition is to isolate the actual iris region in a digital eye image. The iris region, shown in the above figure, can be approximated by two circles, one for the iris/sclera boundary and another, interior to the first, for the iris/pupil boundary.[5][6]

The success of segmentation depends on the imaging quality of eye images. The center of pupil can be used to detect the outer radius of iris patterns. The iris inner and outer boundaries are located by finding the edge image using the Canny edge detector.[6]

2.3.1 MODIFIED CANNY EDGE DETECTOR

The algorithm runs in 5 separate steps:

1. Smoothing: Filtering and blurring of the image to remove noise, such that pixels creating indifferent spots can be reduced.

Figure5. Blurred and filtered image

2. Finding gradients: At the points/pixels where colour pattern fall in the similar threshold region are grouped together.

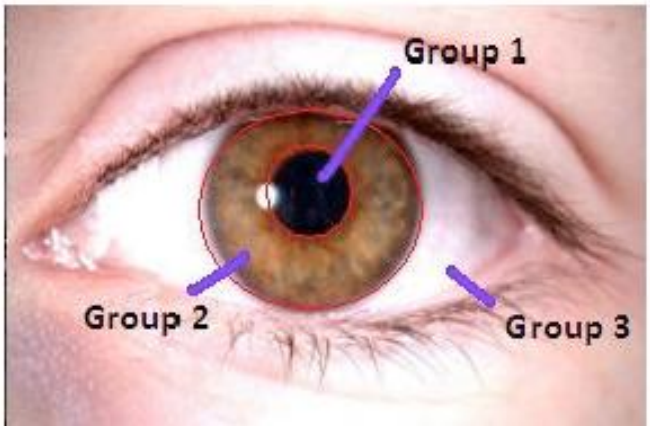


Figure6 Grouping of various regions of eye on the basis of colour differences.

The edges should be marked where the gradients of the image has large magnitudes.

3. Non-maximum suppression: The image portion to be processed is non linear and circular or convex hence, boundary region matching the closets shape is taken out for only local maxima and then should be marked as edges.

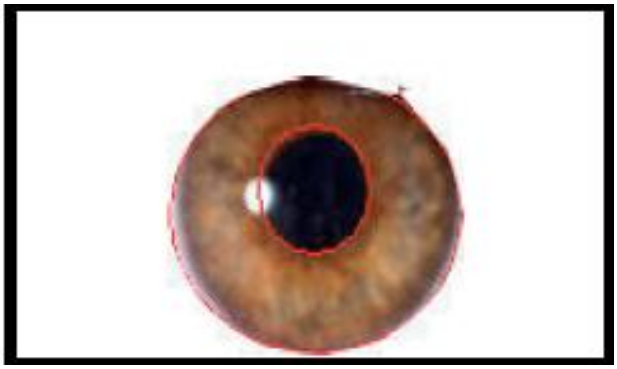


Figure7. Crop out portion of eye that needs processing.

4. Double thresholding : Potential edges are determined by thresholding.

5. Edge tracking by hysteresis: Final edges are determined by suppressing all edges that are not connected to a very certain (strong) edge.[12]

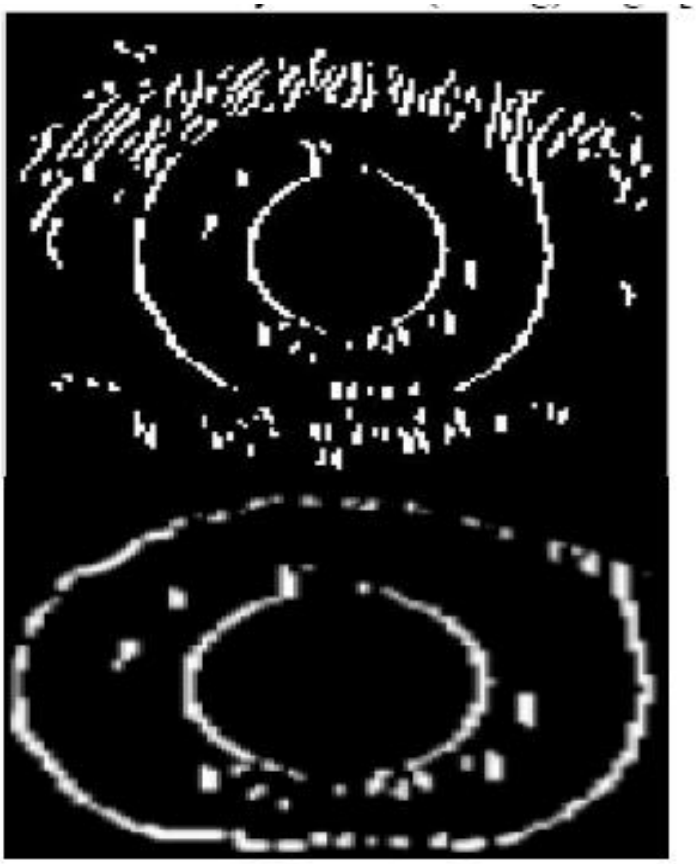


Fig-8. Canny edge image with result of modified image using algorithm

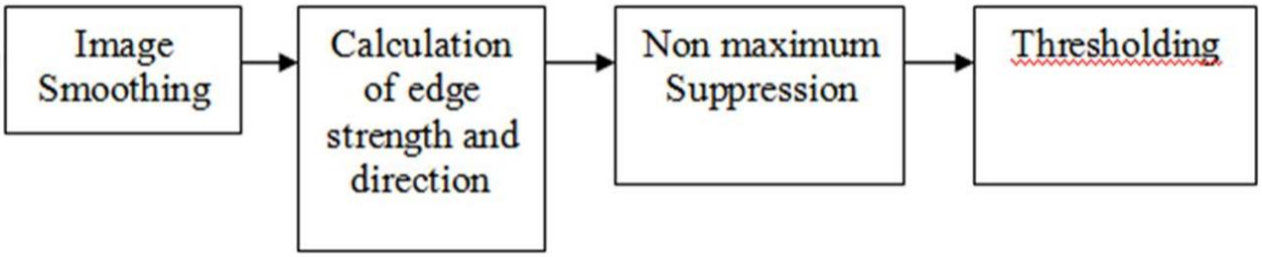


Figure 8. canny edge detection

2.4 HOUGH TRANSFORM

The Hough transform is a standard computer vision algorithm that can be used to determine the parameters of simple geometric objects, such as lines and circles, present in an image. The circular Hough transform can be employed to deduce the radius and centre coordinates of the pupil and iris regions.[1][7]

Firstly, an edge map is generated by calculating the first derivatives of intensity values in an eye image and then thresholding the result. From the edge map, votes are cast in Hough space for the parameters of circles passing through each point. These parameters are the centre coordinates xc and yc, and the radius r, which are able to define any circle according to the equation

$$x^2_C + y2_C - r^2 = 0$$

2.5 IMAGE NORMALIZATION

Once the iris region is segmented, the next stage is to normalize this part, to enable generation of the iris code and their comparisons. Since variations in the eye, like optical size of the iris, position of pupil in the iris, and the iris orientation change person to person, it is required to normalize the iris image, so that the representations common to all, with similar dimensions.[8] Normalization process involves unwrapping the iris and converting it into its polar equivalent. It is done using Daugman's Rubber sheet model. The centre of the pupil is considered as the reference point and a Remapping formula is used to convert the points on the Cartesian scale to the polar scale.

2.6 PATTERN MATCHING

- Purpose: to establish a precise correspondence between characteristic structures across the two images.

- Both of the systems under discussion compensate for image shift, scaling, and rotation.

- For both systems, iris localization is charged with isolating an iris in a larger acquired image and thereby accomplishes alignment for image shift.

In pattern matching of pixels with the databases will be done using the following algorithm:

An emerging technique in this particular application area is the use of Artificial Neural Network implementations with networks employing specific guides (learning rules) to update the links (weights) between their nodes. Such networks can be fed the data from the graphic analysis of the input picture and trained to output characters in one or another form. Specifically some network models use a set of desired outputs to compare with the output and compute an error to make use of in adjusting their weights. Such learning rules are termed as Supervised Learning.

2.7 APPLICATIONS

• Today's e-security is 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 . [3]

• Biometric solutions address these fundamental problems, because an individual's biometric data is unique and cannot be transferred and therefore can be used for identifying a person or verifying the identity of a person.

• For an enterprise, biometrics provides value in two ways. First, a biometric device automates entry into secure locations, relieving or at least reducing the need for full-time monitoring by personnel. Second, when rolled into an authentication scheme, biometrics adds a strong layer of verification for user names and passwords.

• Biometrics adds a unique identifier to network authentication, one that is extremely difficult to duplicate. Smart cards and tokens also provide a unique identifier, but biometrics has an advantage over these devices.

• It is being implemented and substituted for passports (automated international border crossing), aviation security and controlling access to restricted areas at airports, database access and computer login, premises access control.

3.1 RESULTS

The results for the proposed methods are shown in the figures below

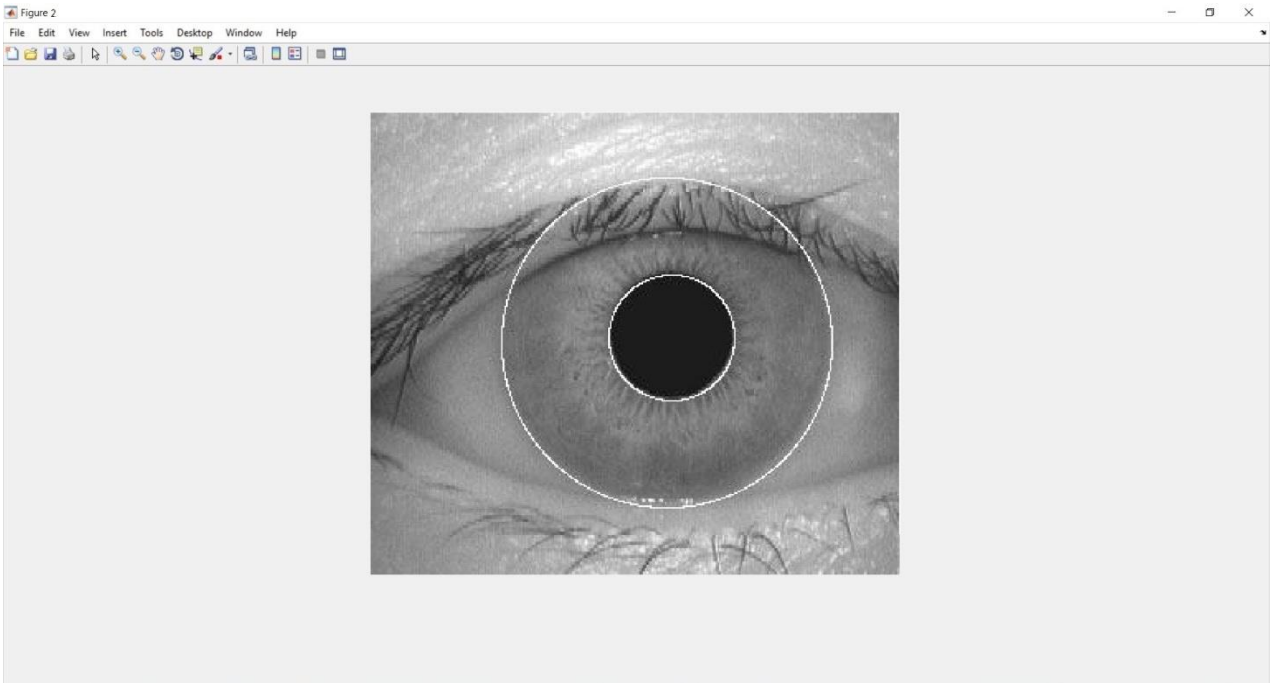


Figure:6 Segmented eye image

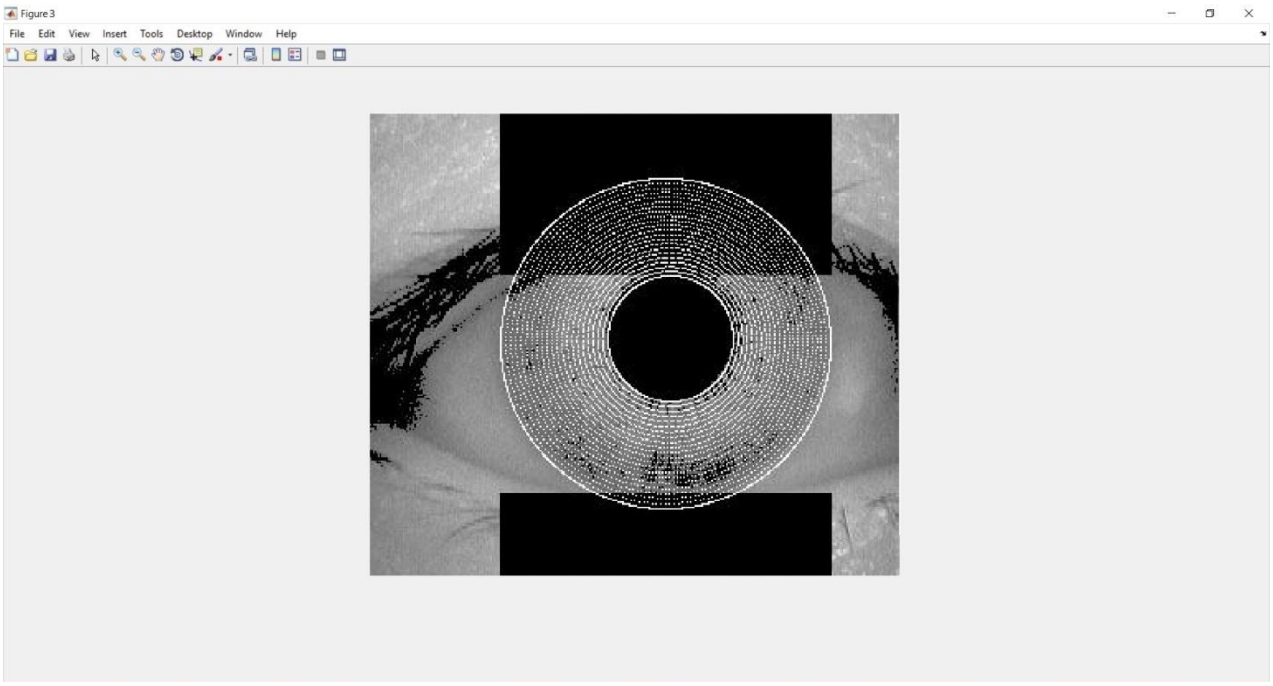


Figure:7 Normalized iris image

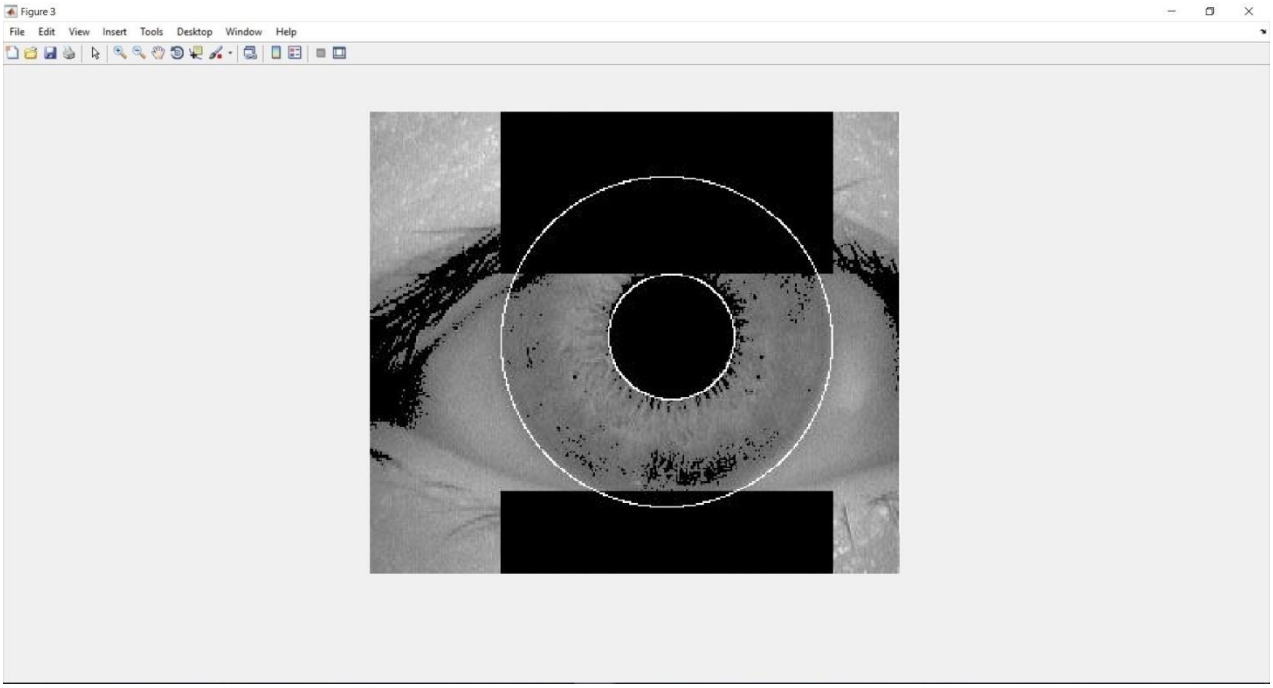
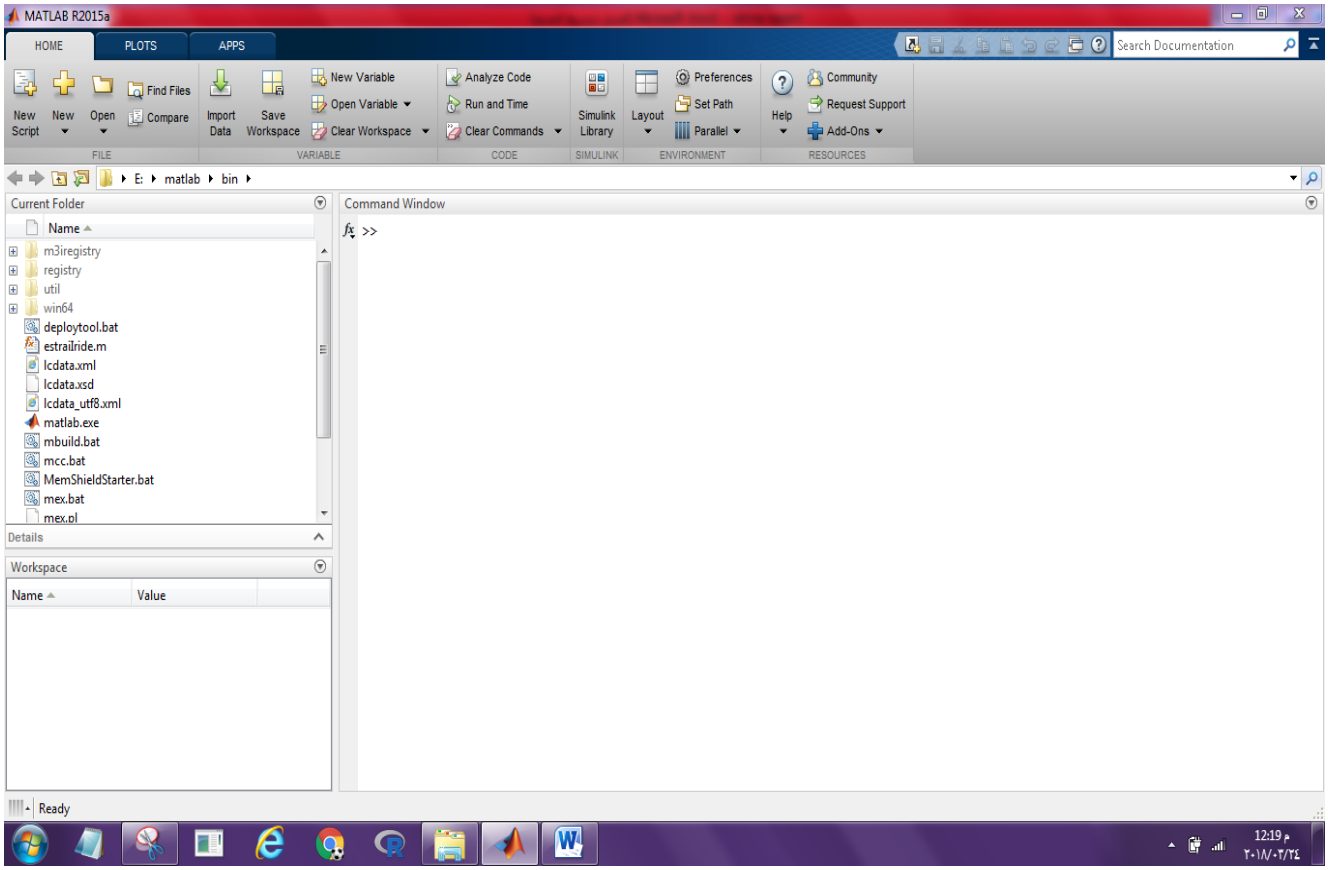


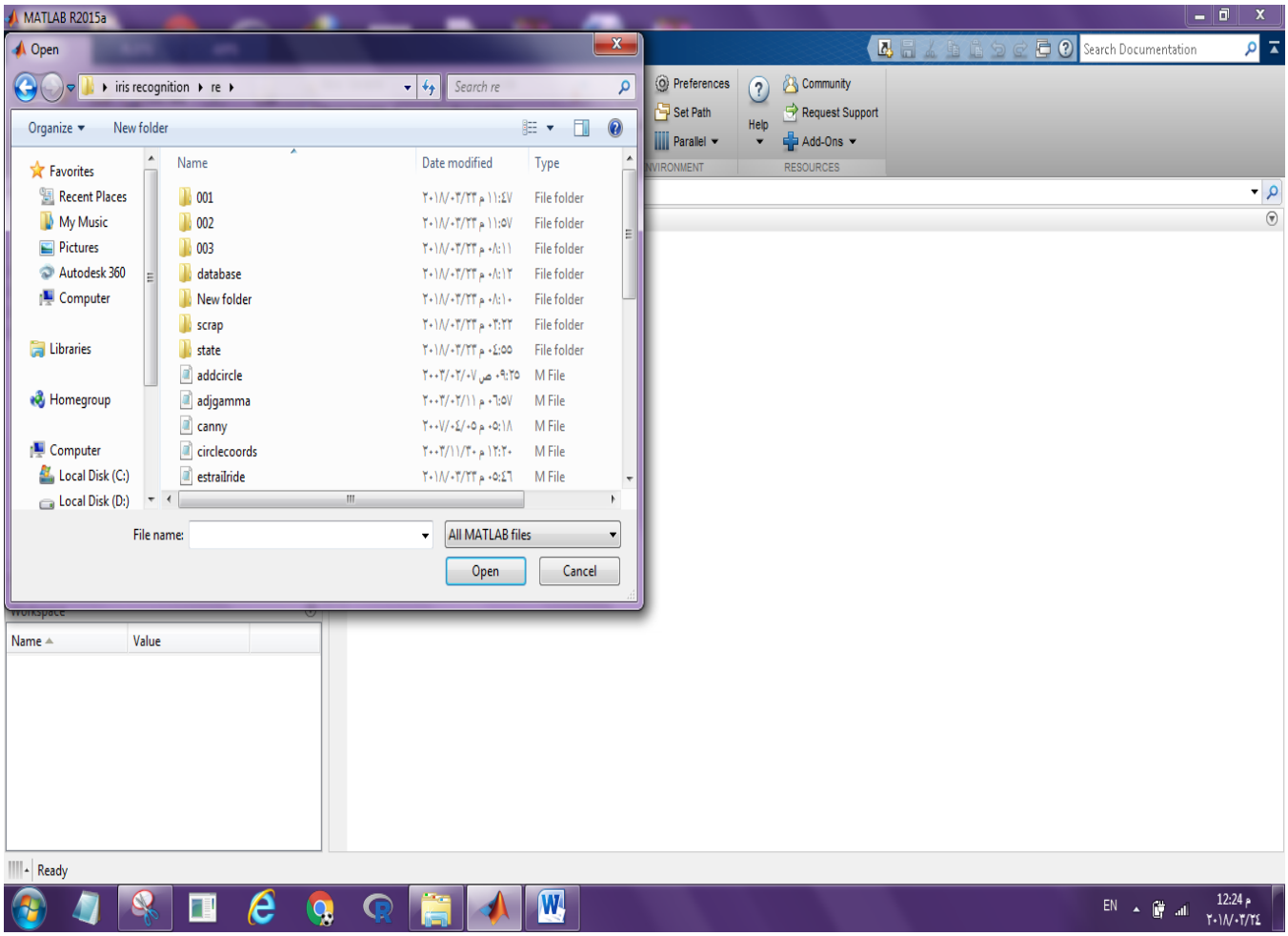
Figure:8 noise removed

3.1*How to execution program

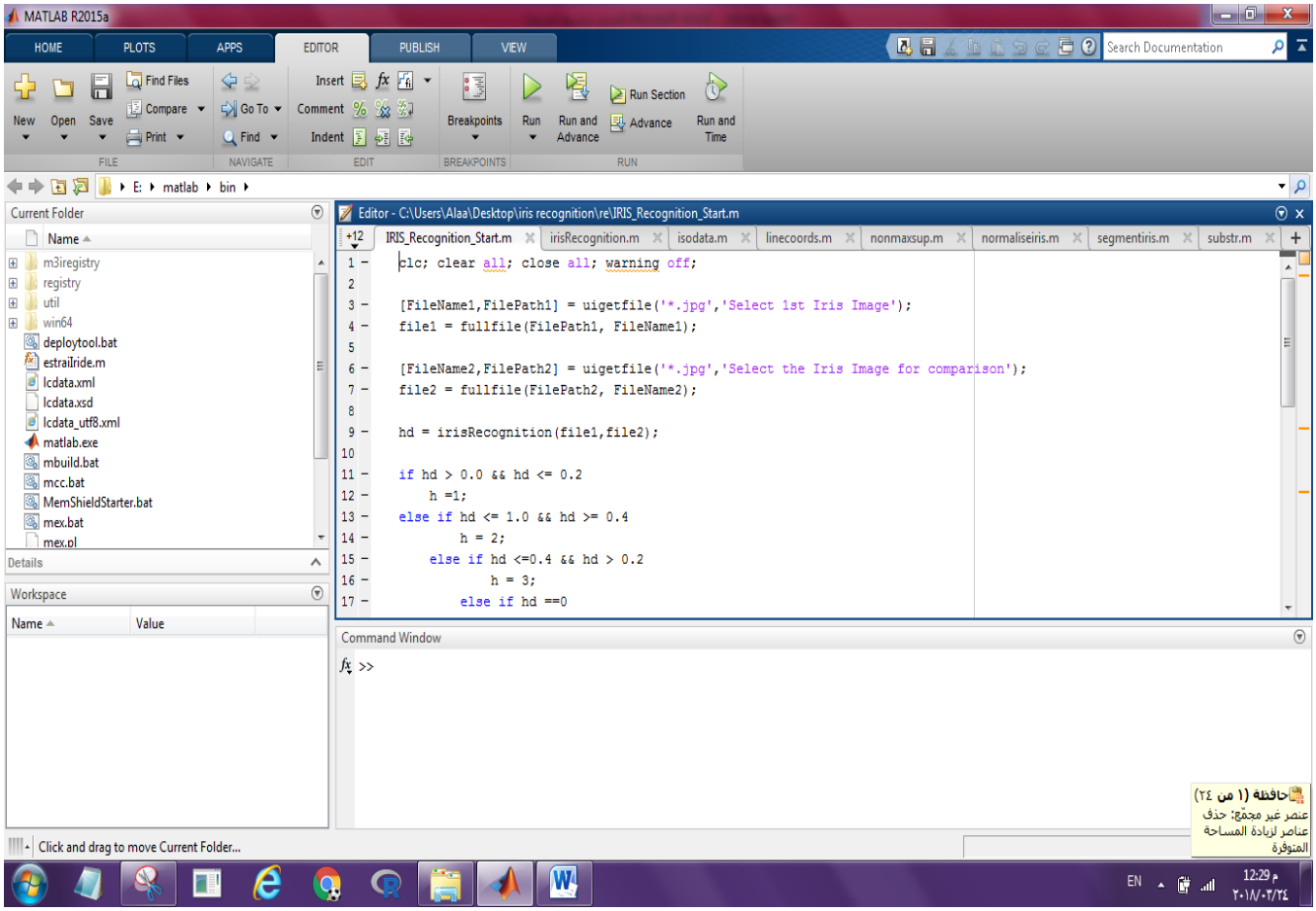
(1) Open matlab version 2015



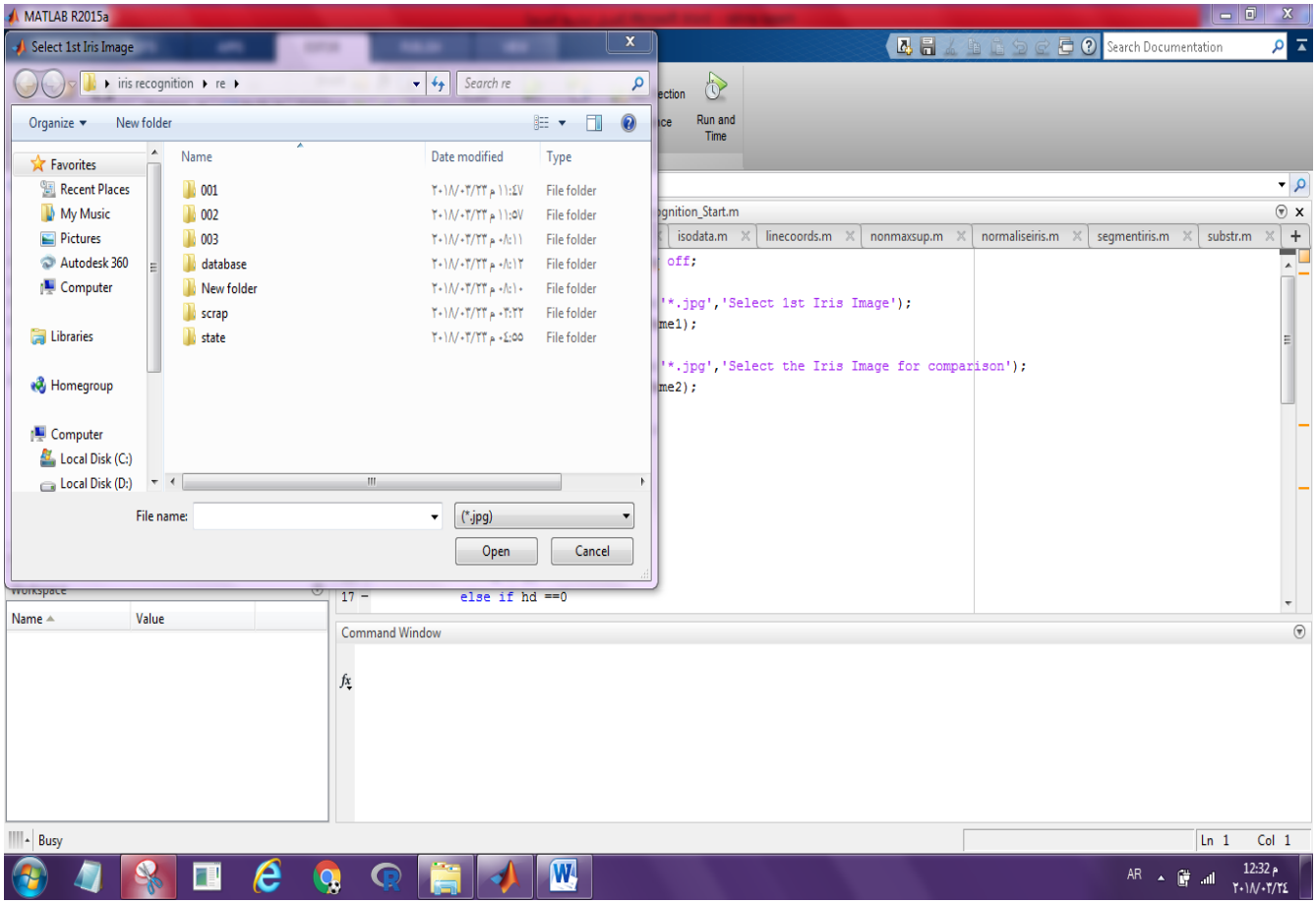
(2) Open the program from “open” choise



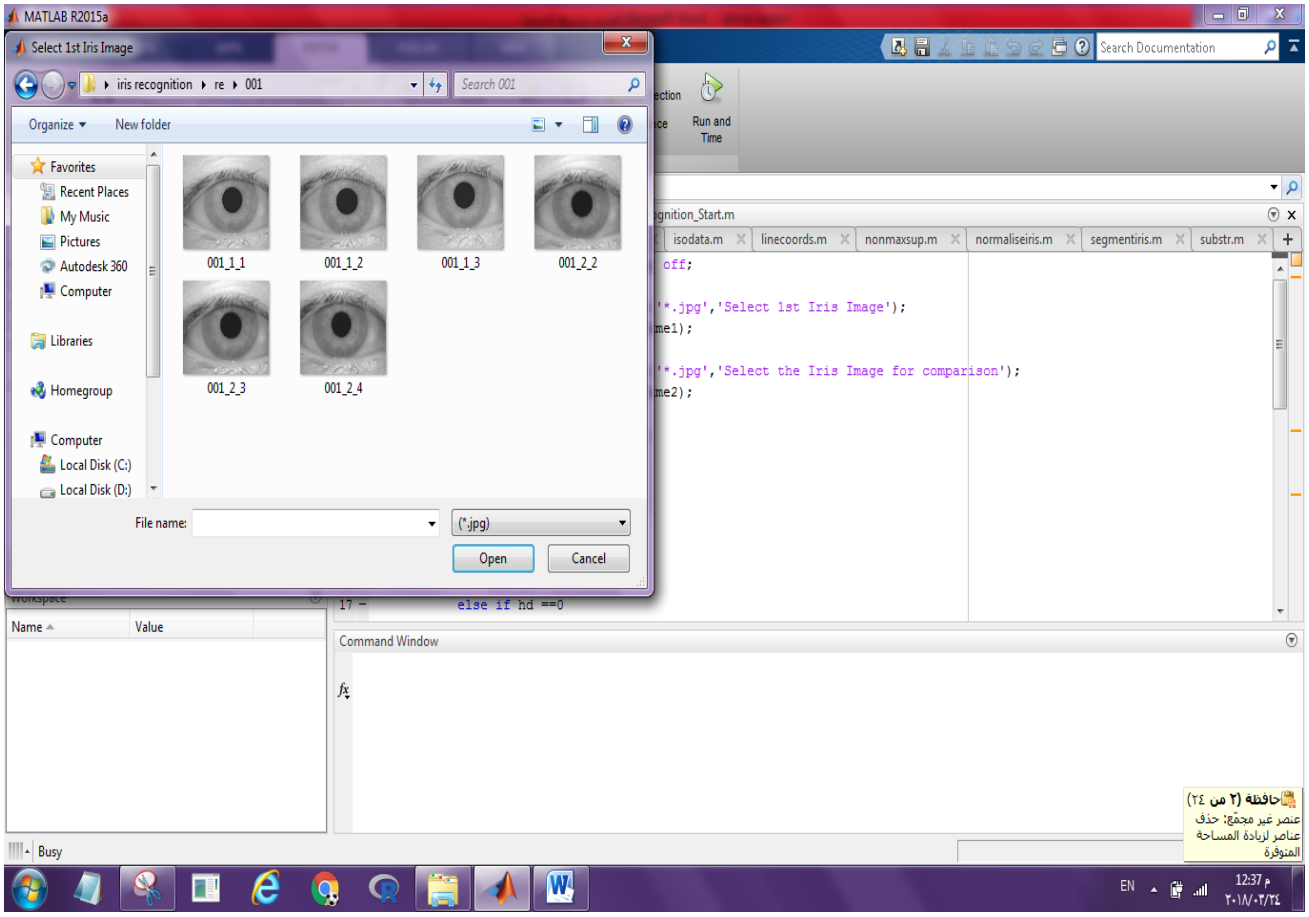
(3) choose “iris recognition start”



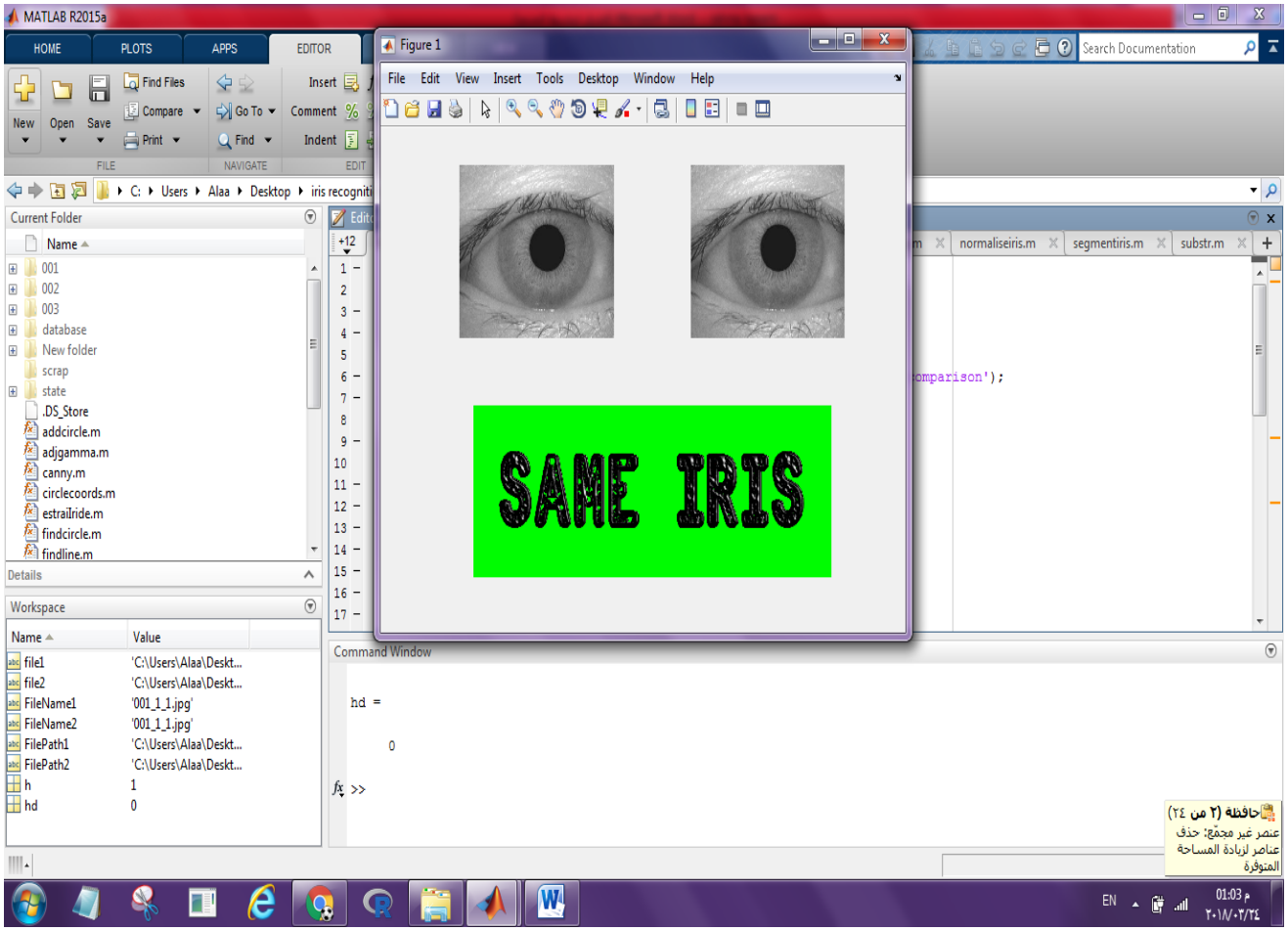
(4) Click on “Run”



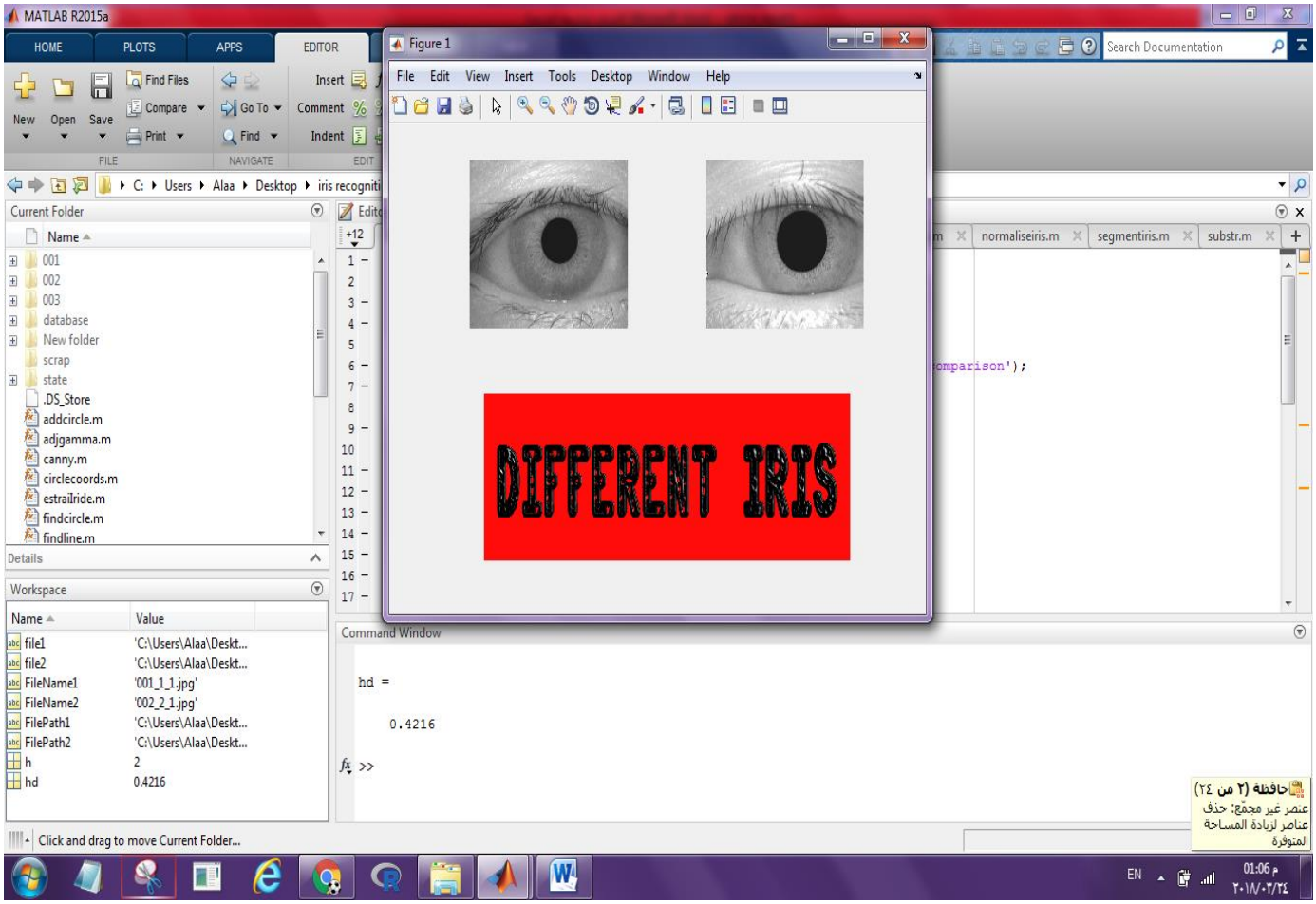
(5) Choose tow image



(6) If the tow eye image for same person it tell us “same iris”



(7) If the tow image for two persons it tell us “different iris”



3.2 CONCLUSION

In this paper we have analysed how the network behaves when an input is given and for that error rate specified was. The network has been trained and tested for a number of eye images. our project is a system that can take a image(as input of human eye) and can distinguish between papillary body and iris part of the human eye. For this we had use different mathematical functions and calculations to detect various eye boundaries and it encircles outer boundary of pupil which is inner boundary for the iris using modified Canny edge detector algorithm. After this the detection of outer boundary of the iris is done. The development tool used is c# using windows application, matlab and emphasis given on software for performing recognition, and not hardware for capturing an eye image.

A.Performance Observation.

1. Increasing the number of images in the training network generally slowed down the learning rate.

2. The size of the input states is also another direct factor influencing the performance. It is natural that the more number of input symbol set the network is required to be trained for the more it is susceptible for error.

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