Iris Recognition by Using Image Processing Techniques and Feature Extraction

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***Abstract*— Iris recognition system has become very important, especially in the field of security, because it provides high reliability. Many researchers have suggested new methods to iris recognition system in order to increase the efficiency of the system. Various methods have been proposed to achieve high performance in iris recognition. In the proposed system, three feature extraction approaches, Histogram of Oriented Gradient (HOG), Gray Level Co-Occurrence Matrix (GLCM) and Local Binary Pattern (LBP) are used to extract the features from iris image. On other hand, two classifiers; K-Nearest Neighbors (KNN) and Support Vector Machine (SVM) are used in the classification stage. The iris image passes through several stages before extracting features stage; first, pre-processing stage which includes image resizing that unifies all images' size, second, segmentation stage which determines the iris region in eye image, finally, normalization stage which converts the iris region to suitable shape with specific dimensions. The proposed methods have been applied on iris database.However, the proposed system achieved recognition rate of 100% when HOG+KNN method is used.**

***IndexTerms*— Iris Recognition; Histogram of Oriented Gradient; Gray Level Co-Occurrence Matrix; Local Binary Pattern.**

I. INTRODUCTION

A term "Biometric" indicates to the identification and authentication of an individual identity based on unique features or characteristics in the individuals. Biometric systems consist of physiological characteristics and behavioral characteristics. Physiological characteristics are a group of biometrics which include the physiological and biological features as dominated by a biometric system. It specifically contains DNA, Hand, Face, Earlobe, and iris. Behavioral characteristics are a group of biometrics which is concerned by the non-physiological or non-biological features as dominated by a biometric system. It consists of four categories: Signature, Voice, Gait and Keystroke recognition.

To meet security requirements of the current networked society, personal identifiers are becoming more important. Conventional methods that are used for personal identifiers can be either token-based methods or knowledge based methods. Token based methods use keys or ID cards for authentication, and knowledge-based methods use preset code or password by the user. However, conventional methods become not reliable if, for example the token is lost or the password is forgotten, therefore; the needs of new & developed reliable methods for personal identification become more and more important research area.

The iris is one of the most reliable methods that used to identify individuals because it is fixed and does not change throughout life. Moreover, it is impossible to find two persons have the same iris features even for the twins. The iris is a circular anatomical structure which is located between the cornea and the lens of the eye. The iris's task is to control the light that is entering through the pupil; this is done by the sphincter and the dilator muscles, which regulated the size of the pupil.

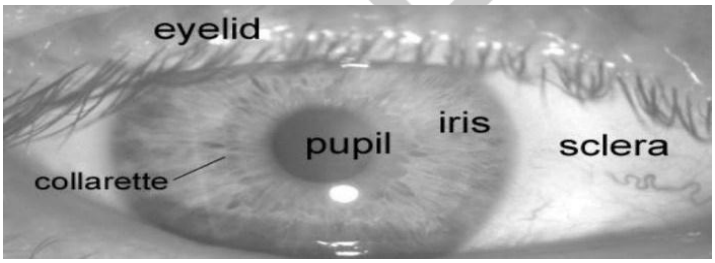

Figure 1: A Front Image of Human Iris

Iris recognition is a method that is used to identify people based on unique features within the iris. Moreover, the iris usually has a grey, blue, brown or green color. Iris recognition is considered a form of biometric verification. The first concept in iris recognition was proposed in 1987 by Flom and Safir. They proposed highly controlled and non-functional conditions to change the illumination so that size of the pupil in all images remains same for suitable Iris segmentation. They outlined the basic subsystems of Iris recognition system, namely image acquisition phase, preprocessing, Iris segmentation phase, Iris analysis, feature extraction phase, classification phase along with appropriate image processing, and pattern recognition techniques. This theoretical work on Iris recognition system has considered as a basis for all practical approaches of Iris recognition system .

A typical iris recognition system includes six main stages.The first stage, image acquisition that is done with capturing the series of images of the iris using cameras, in order to ensure acquiring the best images to increase flexibility and provide strong recognition. The second stage, image preprocessing that means the control of size, color and light of the image in order to be ready for segmentation stage. The third stage, segmentation which includes iris and pupil boundary detection, and additionally detect eyelids and eyelashes. The fourth stage, normalization means converting the iris region into a form like a rectangle.

The fifth stage, feature extraction, extracts features from the normalized iris image and encodes these features to a design that is suitable for recognition.

The last stage in iris recognition system, classification, that means comparison the features created by imaging the iris with stored features in the database

PROBLEM DESCRIPTION

The main problem studied here is iris recognition. Thus, our main challenge is to propose a methodology, design, and implementation of iris recognition system in order to achieve high accuracy in recognizing human iris by using three separate approaches. There are many studies focusing on iris recognition using images that are taken from eyes of individuals. However, many of the negative results occur because of errors in the method of capturing images, image dimensions, quality, shadows, image background, eyes color, in addition to contact lenses in the eyes, etc. All of these characteristics may lead to incorrect classification, and thus negative results will be obtained.

2. SYSTEM ANALYSIS

2.1 EXISTING SYSTEM

Conventional methods that are used for personal identifiers can be either token based methods or knowledge based methods. Token based methods use keys or ID cards for authentication, and knowledge based methods use preset code or password by the user.

2.2DISADVANTAGES

❖The conventional methods become not reliable if, for example the token is lost or the password is forgotten.
❖DNA, Hand, Face, Earlobe, Signature, Voice, Gait and Keystroke which are used for security can be modified or destroyed.

2.3 PROPOSED SYSTEM

❖The iris is one of the most reliable methods that used to identify individuals because it is fixed and does not change throughout life.
❖Moreover, it is impossible to find two persons having the same iris features even for the twins.
❖For example, fight against crime, increase of terrorist threats, and security measures in airports. Therefore; it is considered to be better than other biometric applications to define the individual's identity .

2.4 ADVANTAGES

❖The iris is considered suitable for an individual's identity because it has many advantages such as, it is an internal organ of the eye, therefore; it is a highly protected, the iris is a visible organ, therefore; remote imaging is possible.

3. IMPLEMENTATION

I.Image Pre-processing
II. Segmentation
III. Normalization
IV. Feature Extraction
V. Classification

MODULES DESRIPTION

IMAGE PRE-PROCESSING

Achieving high performance of iris recognition system requires overcoming some of the major difficulties, such as choosing the appropriate database and unifies dimensions of the image. In this section, the technique used is image resizing, and unify dimensions for images in each database

IMAGE RESIZING

Image resizing means changing the image size from smallest to largest and from largest to smallest in order to solve the problem of a different image sizes in a single database. This leads to get the same number of features from all images. Decreasing of the size of the images helps to decrease the processing time, and hence increases the system performance.

SEGMENTATION

Iris segmentation refers to an Automatic detection of the boundaries of iris and the boundaries of pupil of an iris in eye image in order to exclude the surrounding regions. In other words, the major aim of segmentation is removing non useful regions such as the parts outside the iris (eyelids, eyelashes and skin).

The success of the segmentation process depends on the quality of eye image. The first group of studies suggested that segmentation process starts from pupil, because it is the darkest part in the image. The second group of studies suggested that segmentation process starts from the sclera part , because the sclera is less saturated (white) than other parts of the image. The third group suggested to determine the iris directly using edge operators.

NORMALIZATION

The normalization process creates iris regions, which have the same fixed dimensions, so that two images of the same iris in different conditions will have distinctive features at the same spatial location. Dimensional inconsistencies in the normalized iris may occur due the expansion in pupil size which causes the stretching of iris size. Factors such as, the varying levels of illumination falling on the eye, imaging distance, head tilt, and camera rotation may cause incorrect normalization process for iris.

FEATURE EXTRACTION

After the completion of the normalization process for iris part, iris pattern is ready for feature extraction stage. Extracting features from the iris image is the most important stage in iris recognition system. Three approaches are used to extract the features from the iris; these approaches differ from each other in terms of method of extracting features. These approaches are HOG approach, GLCM approach and LBP approach.

CLASSIFICATION

For classification two different classifiers are used. They are Support Vector Machine (SVM) and K-Nearest Neighbor (KNN). These classifiers are trained and tested by features extracted from iris pattern, each classifier is trained several times by the set of iris images then tested by other set of iris images.

4. RESULTS

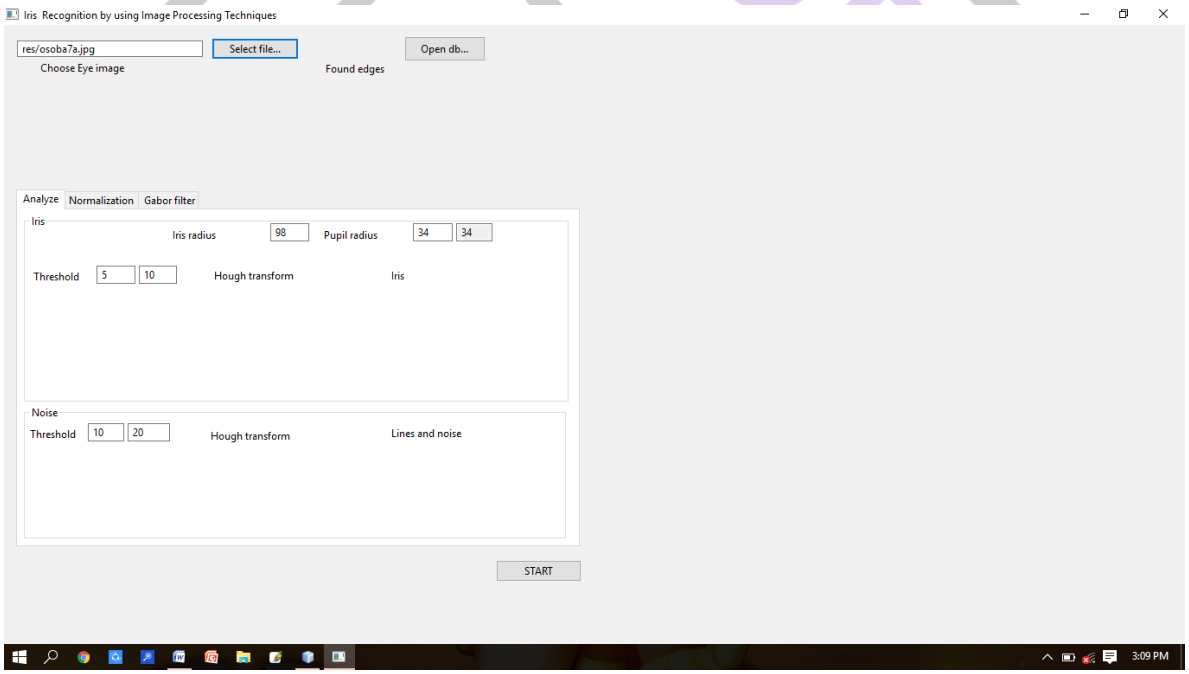

Fig 4.1: Main Page

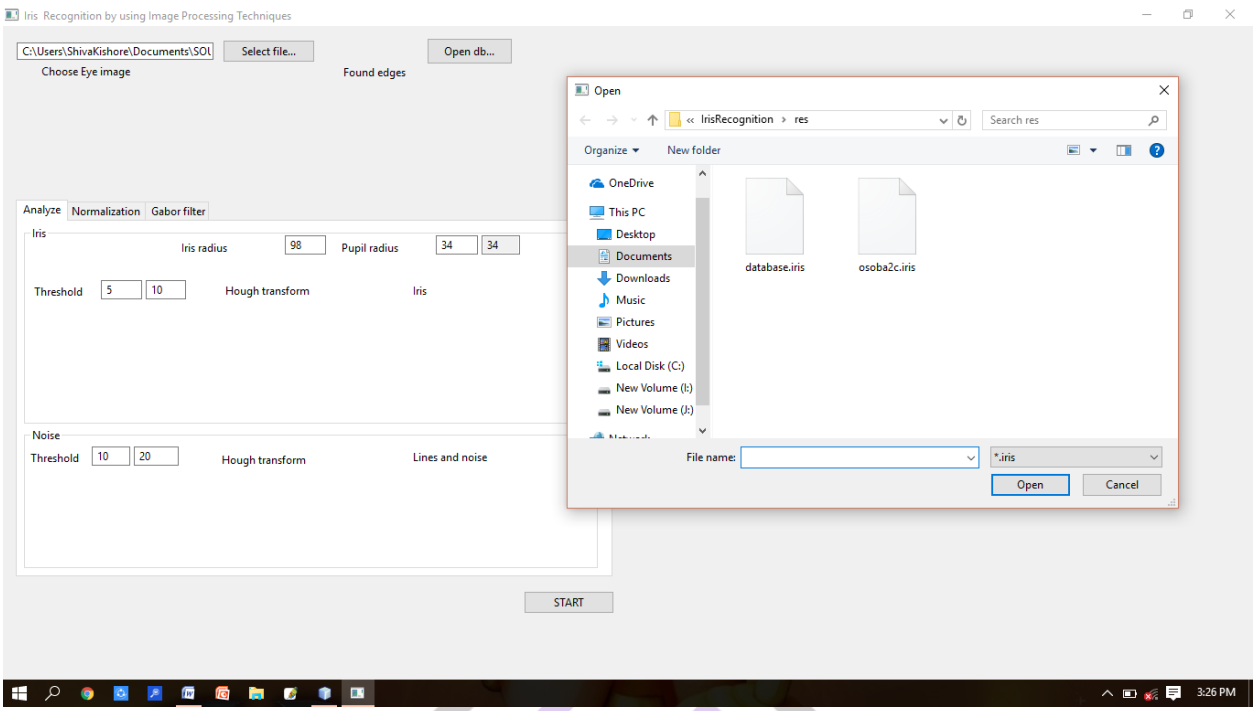

Fig 4.2 :Choosing and Opening database

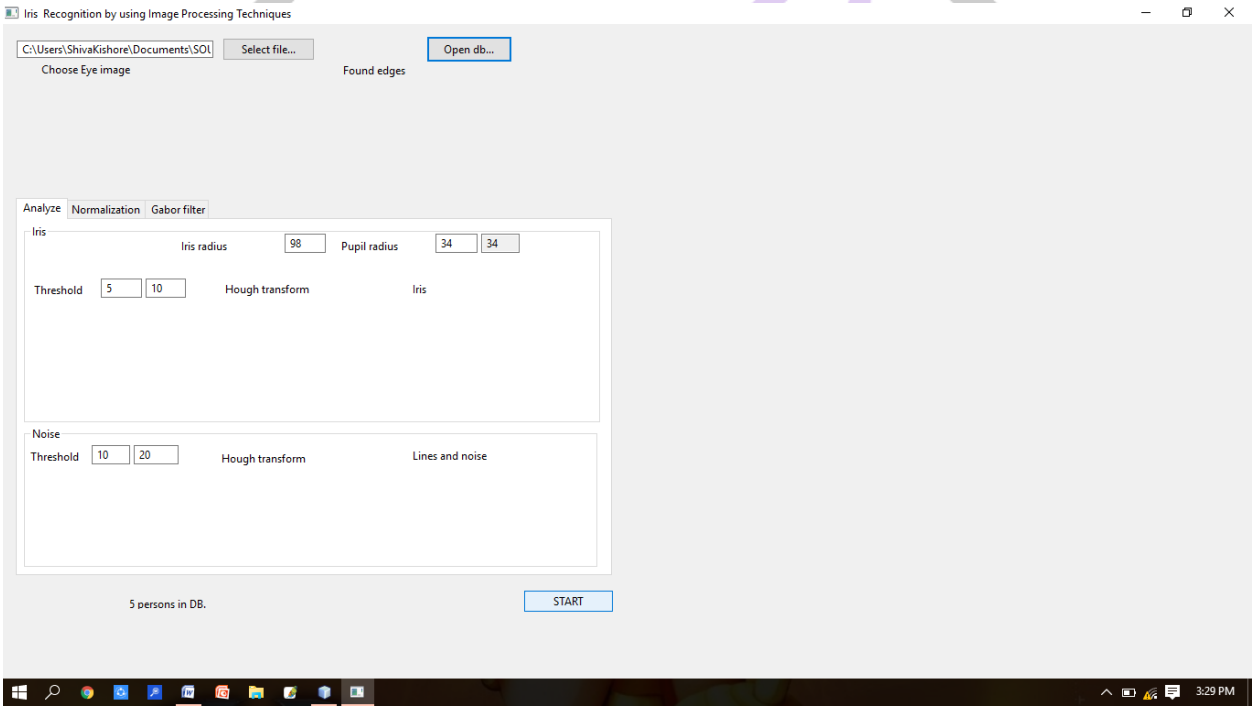

Fig 4.3: Start project

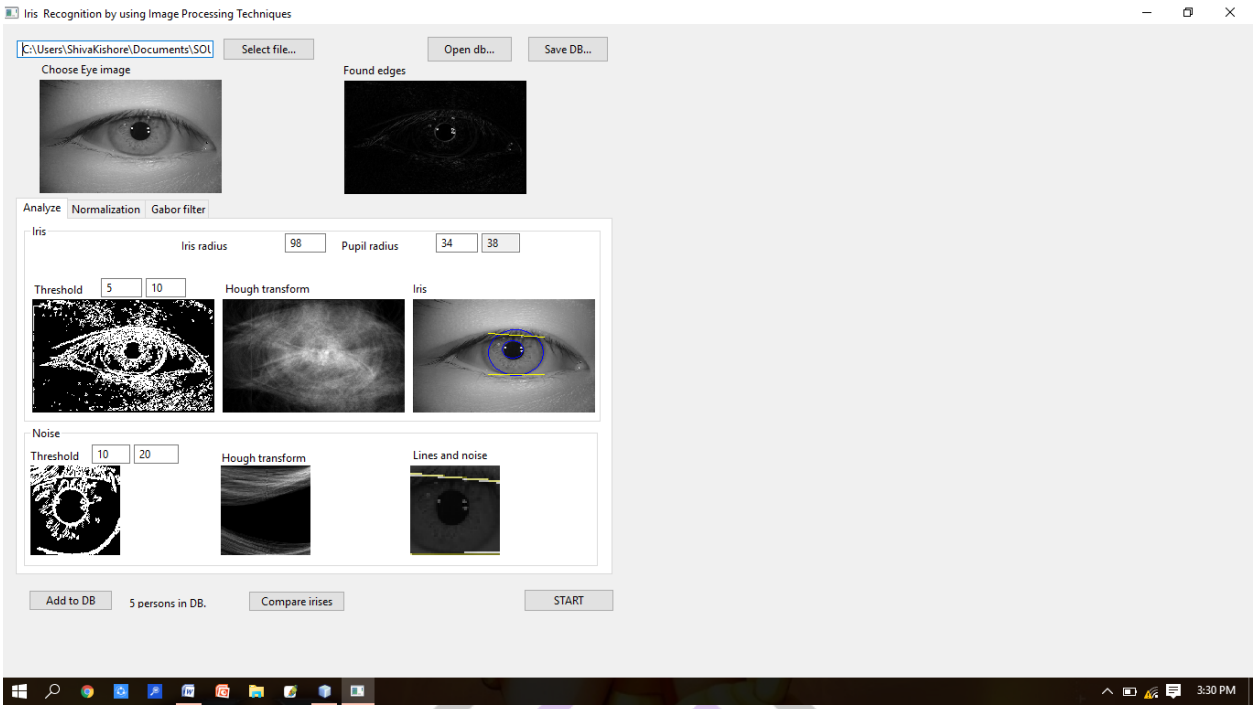

Fig 4.4 Executing project

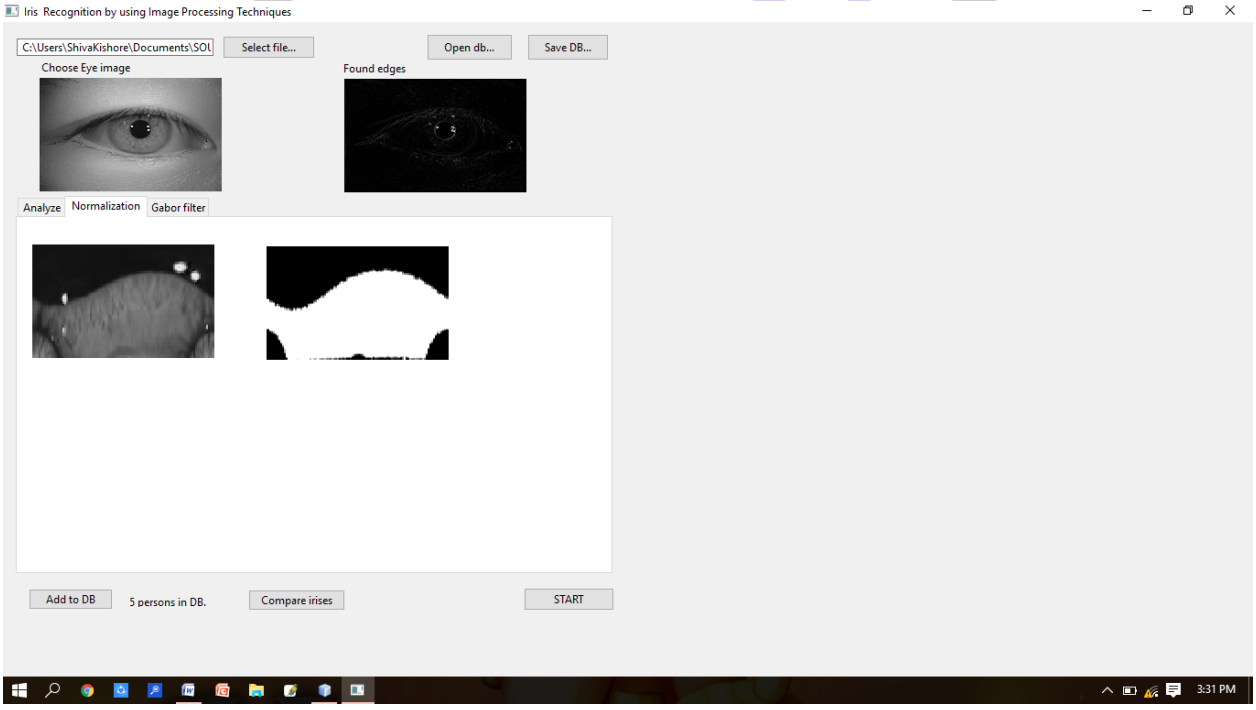

Fig 4.5 Normalization

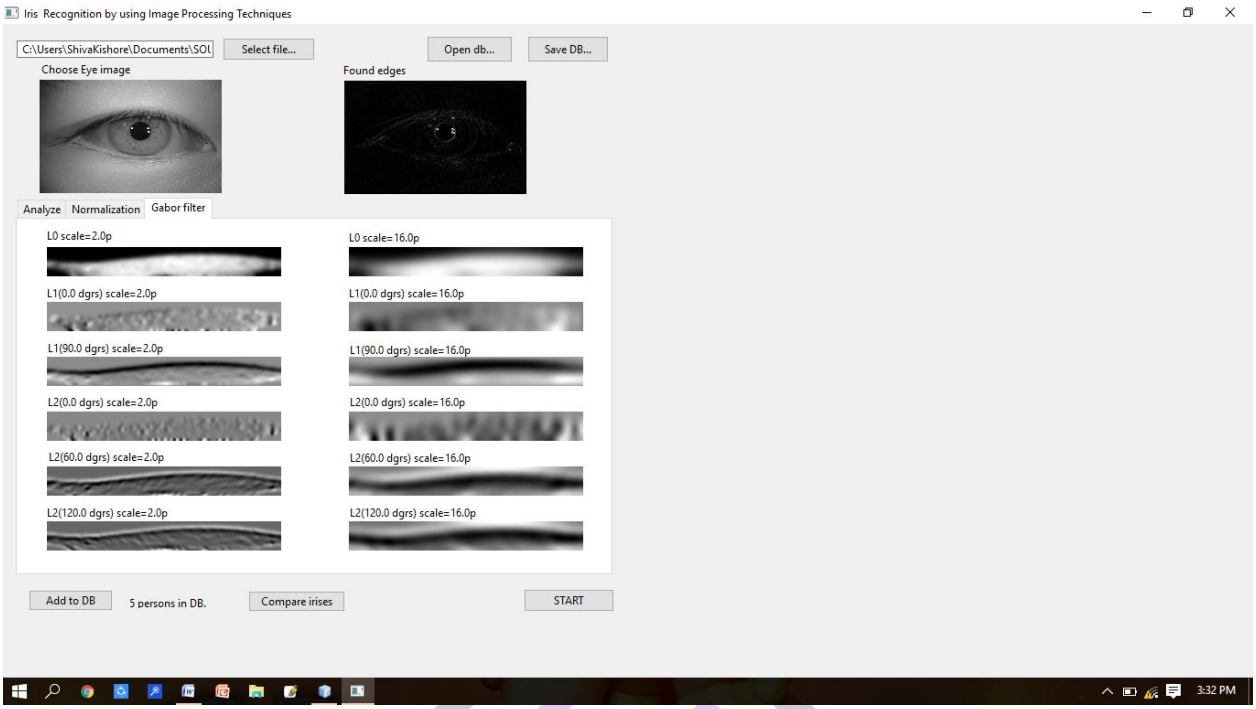

Fig 4.6 Gaber filter

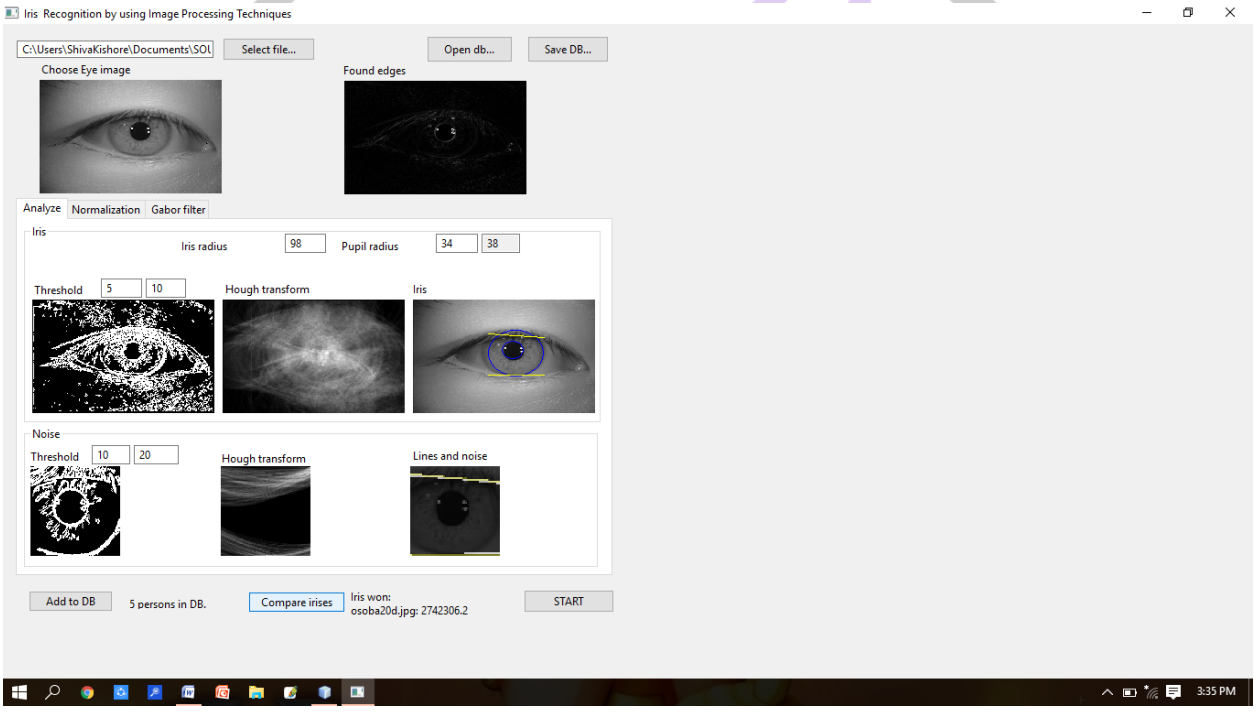

Fig 4.7 Comparing IRIS

CONCLUSION

Iris recognition system has been investigated using various techniques. Three approaches are applied in order to extract features from iris image, these approaches are HOG, GLCM and LBP. However, these approaches differ from each other in extraction features method and its performance. In addition, KNN & SVM classifiers are used to classify the iris features. All proposed methods achieved different performances, the best accuracy was 100%, which is achieved by HOG+KNN method. However, based on the performance of the proposed methods, the performance of HOG and LBP are close to each other. In

addition, the performance of combining (HOG & LBP) is lower than the performance of each one of them separately. On the other hand, the performance of GLCM approach is lower than HOG & LBP approaches.

The proposed methods are able to achieve high performance, but there are some issues that still hinder the achievement of better performance such as type of databases and quality of images in these databases. Also, the techniques that are used in preprocessing, segmentation and normalization stages. However, several suggestions are introduced below in order to improve the performance of the proposed system such as: applying the proposed system on different databases such as CASIA database and compare the obtained results with the results in the project.

Using another feature extraction algorithms such as Principal Component Analysis (PCA), and using other classifiers such as Artificial Neural Network (ANN) and compare the results with the results obtained.Implementing the proposed system on a small organization; where the iris images are taken from the employees in this organization, and stored in the database, then apply the proposed system to identify the employees by their iris.

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