IRIS RECOGNITION USING MIRLIN METHOD

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I. ABSTRACT

Eye is the important part in human body which is used to see the world. Most of the people donate eye after their death to help the people who need eye transplantation. This paper presents an independent iris recognition method to analyse genuine and impostor comparison scores and check the dynamics of iris quality decay over a period of up to 814 hours after death. The method we are going to use is Monros Iris recognition method in which first DCT (Discrete Cosine Transformation) is applied for the transformation of the image, later iris segmentation and normalisation is performed to separate iris from the pupil. The resultant iris codes are compared between two images the variations in the values decides the condition of eye. So it gives clear information about the damage of eye and weather it is useful for transplantation or not. In some cases after the eye are donated, stored in the eye bank may damage due to improper preservation, so we can use this method to find the damage and if possible it can reduced by using proper preservatives
.

Key terms: Discrete Cosine Transformation, Iris Recognition, Transplantation.

II. INTRODUCTION

In modern society, the ability to reliably identify individuals in real time is a fundamental requirement in many applications including international border crossing, transactions in automated teller machines, e-commerce and computer login . As people become increasingly mobile in a highly networked world, the process of accurately identifying individuals becomes even more critical as well as challenging. Failure to identify individuals correctly can have grave impacts in society ranging from terrorist attacks to identity fake where a citizen. Iris recognition is used to find iris pattern and other details related to iris which are helpful for the study. New technologies are being used in the study of iris, which are used to find the damage and other related factors.The numeric representation of information extracted from the iris images are then compared with the normal eye properties to find the level of damage. In this paper we are going to present a best to compare the iris of deceased eye and normal eye by using some of the image processing techniques with the help of Matlab software.

Firstly let us see what is image processing? - Image processing is a technique to convert an image into digital form and implement some procedures on it, in order to get an enhanced image or to extract some useful information from it. It is a type of signal allowance in which input may be in the form of video frame or photograph and output may be image or characteristics associated with that image. Usually Image processing system includes treating images as two dimensional signals while applying already set signal processing techniques to them. It is among fast growing technologies today, with its applications in various features of a business. Image processing forms core study area within engineering and computer science disciplines too. The process of image is fast and more cost-effective. One needs minus time for processing, as well as less film and other photographing tools.

Previously there are some algorithms which are used for iris recognition. But no clear description is mentioned about them. These algorithms generally compare the scores obtained from the images and decide whether eye was damaged or not. These algorithms do not give accurate results because of using improper methods to detect iris. Hence advanced iris recognition methods are implemented for accurate detection. Many people did lots of research on iris recognition and those details are discussed in next chapter

III.LITERATURE SURVEY

Post-Mortem Human Iris Recognition:

This is a unique analysis of post-mortem human iris recognition. Iris images were collected at the mortuary in three sessions separated by around 11 hours, with the first session planned from 5 to 7 hours after death. For analysis there are four independent iris recognition methods shows the common claim of the iris being unusable for biometric identification soon after death is not completely true. Meanwhile the pupil has a constant and neutral dilation after death; this makes the iris pattern clearly visible from the position of dilation. We found that more than 90% of irises are capable of correct recognition though they were captured a few hours after death, and that serious iris damage begins approximately 22 hours later, then the recognition rate drops to a range of 13.3-73.3%, when the cornea starts to be gloomy. There were only two failures to enrol (out of 104 images) observed for only a single method (out of four employed in this study). These results show that the dynamics of post-mortem fluctuations to the iris that are important for biometric identification are much more moderate than previously believed. To the best of our knowledge, this paper presents the first experimental study of how iris recognition works after death, and we hope that these initial results will stimulate further research in this area.

Bridging the Gap: From Biometrics to Forensics

Biometric recognition refers to automatic recognition of individuals based on their behavioural and biological features. The accomplishment of thumbprints in forensic science and law execution requests, common with growing distresses related to border control, economic scam and cyber security, has generated a vast interest in using fingerprints, as well as other natural qualities, for automatic person recognition. It is not quite surprising to see biometrics infusing various segments of our society. Many applications like smartphone security, mobile payment, border crossing, national civil registry and access to restricted facilities. Despite these positive deployments in various fields, there are several existing challenges and new opportunities for person recognition using biometrics. In detailed, when biometric data is acquired in an unhindered environment or if the subject is unhelpful, the quality of the ensuing biometric data may not be amenable for automated person recognition. This is particularly true in crime-scene inquiries, where the biological proof collected from a scene may be of less quality. In this study, first we have discussed about how biometrics changed from forensic science and how its focus is shifting back to its source in order to address some interesting problems. Next, we compute the resemblances and changes between biometrics and forensics. We then present some applications where the values of biometrics are being magnificently leveraged into forensics in order to crack serious problems in the law administration area. Finally, we discuss new cooperative chances for researchers in biometrics and forensics, in order discuss about previously mysterious problems that can benefit society at large.

Pupil and iris detection algorithm for near-infrared capture devices

A simple and strong solution for the pupil and iris detection is presented. The technique is based on simple operations, such as erosion, dilation, binarization, flood filling and Sobel filter and, with correct operation, is effective. The novelty of the approach is the use of distances of black points from nearest white points to estimate and then adjust the position of the centre and the radius of the pupil which is also used for iris recognition. The acquired results are capable, the pupil is extracted accurately and the entire information essential for human identification and confirmation can be extracted from the found parts of the iris. The paper, being both review and research, holds also a state of the art in the labelled topic.

Post-mortem iris recognition and its application in human identification

Iris recognition is a validated and non-invasive human identification technology currently implemented for the purposes of surveillance and security (i.e. border control, schools, military). Similar to deoxyribonucleic acid (DNA), irises are a highly individualizing component of the human body. Based on a lack of genetic penetrance, irises are unique between an individual's left and right iris and between identical twins, proving to be more individualizing than DNA. At this time, little to no research has been conducted on the use of post-mortem iris scanning as a biometric measurement of identification. The purpose of this pilot study is to explore the use of iris recognition as a tool for post-mortem identification. Objectives of the study include determining whether current iris recognition technology can locate and detect iris codes in post-mortem globes, and if iris scans collected at different post-mortem time intervals can be identified as the same iris initially enrolled.

Data from 43 decedents involving 148 subsequent iris scans demonstrated a subsequent match rate of approximately 80%, supporting the theory that iris recognition technology is capable of detecting and identifying an individual's iris code in a post-mortem setting. A chi-square test of independence showed no significant difference between match outcomes and the globe scanned (left vs. right), and gender had no bearing on the match outcome. There was a significant relationship between iris colour and match outcome, with blue/gray eyes yielding a lower match rate (59%) compared to brown (82%) or green/hazel eyes (88%), however, the sample size of blue/gray eyes in this study was not large enough to draw a meaningful conclusion. An isolated case involving an ante mortem initial scan collected from an individual on life support yielded an accurate identification (match) with a subsequent scan captured at approximately 10 hours post-mortem. Falsely rejected subsequent iris scans or "no match" results occurred in about 20% of scans; they were observed at each PMI range and varied from 19-30%. The false reject rate is too high to reliably establish non-identity when used alone and ideally would be significantly lower prior to implementation in a forensic setting; however, a "no match" could be confirmed using another method. Importantly, the data showed a false match rate or false accept rate (FAR) of zero, a result consistent with previous iris recognition studies in living individuals. The preliminary results of this pilot study demonstrate a plausible role for iris recognition in post-mortem human identification. Implementation of a universal iris recognition database would benefit the medico legal death investigation and forensic pathology communities, and has potential applications to other situations such as missing persons and human trafficking cases.

IV.EXISTING METHOD

Identifying deceased individuals through their biometric samples has long been used for scientific purposes; utilize the characteristics such as fingerprints, DNA, or dental records to recognize victims of accidents, or natural disasters and crimes. There is a strong link between a person and their biometric traits because biometric traits are inherent to an individual. A typical biometric system can be viewed as a 'real-time' automatic pattern matching system that acquires biological data from an individual like fingerprint using a sensor, extracts a set of biased features from this data (e.g. minutiae points) and compares the extracted feature set with those in a database in order to recognize the individual. It is assumed that each feature set in the database is connected to a distinct individual via an identifier, such as a name or an ID number. Comparison of the extracted feature set and the template results in a score representing the similarity between the two feature sets. Iris recognition, however has not received considerable attention, despite excellent presentation of this method when applied to live eyes.

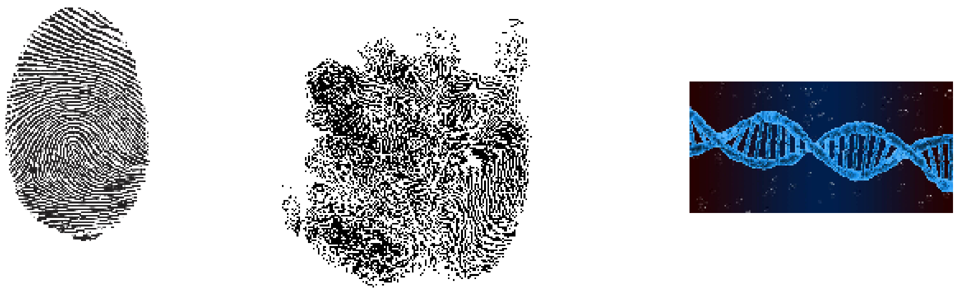

Figure 1: Existing methods

Previously there are two iris recognition methods, which do not have clear algorithms and theses methods are not accurate like our proposed method

VeriEye: This commercial product is offered by Neuro-technology in the form of the Software Development Kit (SDK). The manufacturer does not divulge algorithm details, apart from the claim that off-axis iris localization is employed with the use of active shape modelling.

IrisCore: Similarly to the VeriEye method, the IriCore matcher is offered commercially as the SDK. IriTech Inc. does not disclose any details on the underlying algorithm. IriCore returns contrast score from 0.0 to 2.0, with same eye scores expected to obtain in between 0 and 1.1, and different-eye (impostor) scores between 1.1 and 2.0.

V. PROPOSING METHOD

In this paper we are going to explain a key method which gives best result in iris recognition. To implement this method image processing places an important role. The flow of the algorithm is given below.

1. Image Acquisition.
2. Image transformation.
3. Iris segmentation and Normalization.
4. Liver part extraction
5. Classification

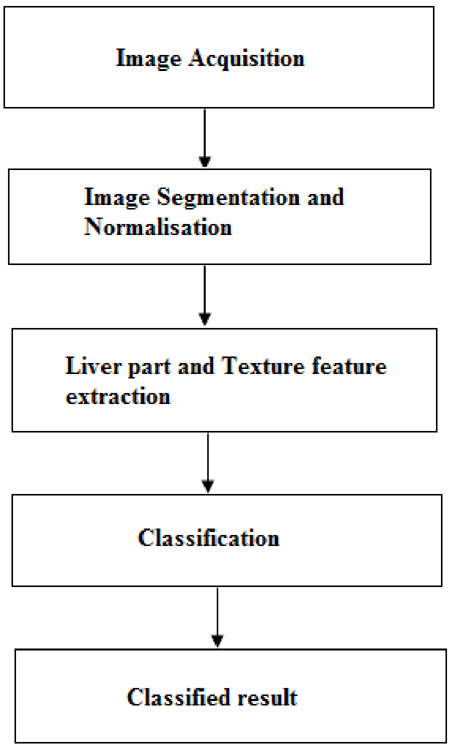

Figure 2: Algorithm

VI.EXPERIMENTAL STUDY

MIRLIN:

Monro Iris Recognition Library method is the accurate algorithm for iris recognition because advanced image processing techniques are used in it which gives best results. The underlying algorithm employs discrete cosine transform (DCT) calculated for overlapping iris image patches to deliver binary iris features. Likewise to Daugman's original method, the subsequent iris codes are compared using exclusive or operation and normalized by a number of valid bits (corresponding to iris portions that are not occluded), yielding a fractional Hamming distance. Comparing two images of the same eye should result in a score close to zero, while the distance between images of two different irises is expected to oscillate around 0.5.

a) Image acquisition:

To deal with images and before analysing them the most important thing is to capture the image. This is called as Image Acquisition. Image Acquisition is achieved by suitable camera. We use different cameras for different application. When we need an X-Ray image, we use a camera which is sensitive to X-rays. Similarly when we need Infra-red image, we use camera which are sensitive to Infra-red radiations. For normal images we use cameras which are sensitive to visual spectrum.

Figure 3: Test image

b) Image transformations:

DCT stands for Discrete Cosine Transformation. It is used to transform image from one domain to another domain, because images are in spatial domain so they are converted into frequency domain for mathematical convenience. In DCT the image is broken into 8*8 blocks, working from left to right and top to bottom, the DCT is applied for each and every block.

- DCT for 2D image is given as

f(x, y) (Spatial domain) F(u, v) (Frequency domain) **(1)**

$$\mathbf{D (i, j)} = \frac{1}{\sqrt{2N}} \mathbf{C (i) C (j)} \sum_{x=0}^{N-1} \sum_{y=0}^{N-1} \mathbf{p(x, y)} \cos\left[\frac{(2x+1)\pi i}{2N}\right] \cos\left[\frac{(2y+1)\pi j}{2N}\right] \quad \mathbf{(2)}$$

Where,

P(x, y) = is the x, yth element of the image represented by p matrix
N= is size of the block that DCT done.
D (i, j) = is the DCT transformed matrix

$$c(u) = \begin{cases} \frac{1}{\sqrt{2}}, & u = 0 \\ 1, & u > 0 \end{cases} \quad \mathbf{(3)}$$

- Simply it can be expressed as

$$\mathbf{F= T. M. T'} \quad \mathbf{(4)}$$

Where,

T= cosine transform matrix
M= original image matrix

$$T_{ij}=\begin{cases}\frac{1}{\sqrt{N}}, & i=0\\ \sqrt{\frac{2}{N}}\cos\left[\frac{(2j+1)\pi i}{2N}\right], & i>0\end{cases} \tag{5}$$

Where,

i= rows
j= columns

Figure 4: DCT Transformation

c) Image segmentation and normalisation:

Image segmentation is a procedure of splitting a digital image into several portions. The aim of segmentation is to make simpler or change the representation of an image into something that is more expressive and easier to analyse. Next, a segmentation algorithm is used, which would localize the iris region from an eye image and isolate eyelid, eyelash and reflection areas. Automatic segmentation is achieved using the circular Hough transform for localising the iris and pupil regions, and the linear Hough transform for localising occluding eyelids. Threshold is also employed for isolating eyelashes and reflections. Third, the segmented iris region is normalised to eliminate dimensional inconsistencies between iris regions. This is achieved by implementing a version of Daugman's rubber sheet model, where the iris is modelled as a flexible rubber sheet, which is unwrapped into a rectangular block with constant polar dimensions.

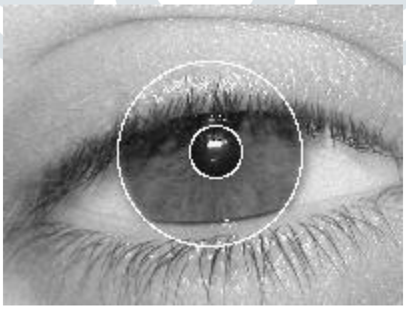

Figure 5: Segmentation

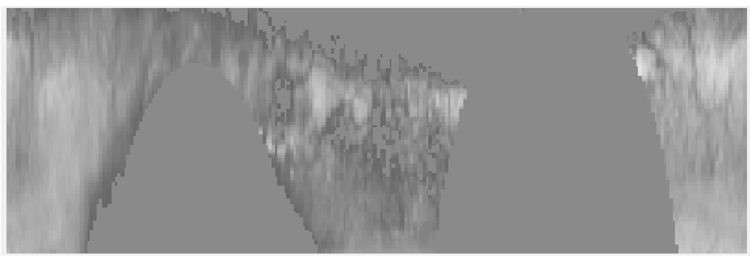

Figure 6: Normalisation

d) Liver part extraction:

In this module, iris normalized image divided into six parts. In that, 4th part is the liver part it is identified based on iris chart. After liver part identification, threshold method is used to detect the liver part and only detected liver part is extracted to further process.

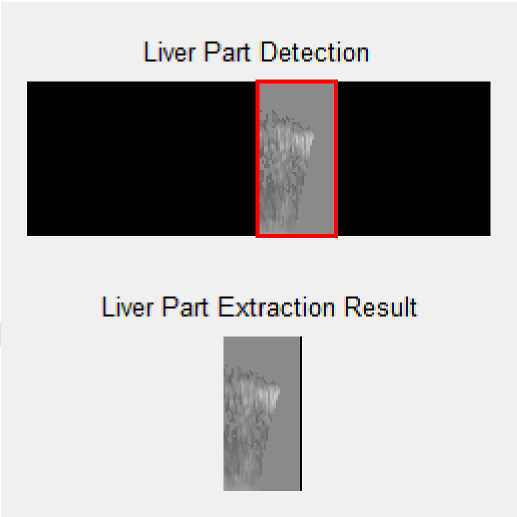

Figure 7: Liver Part Extraction

e) Feature extraction:

In this module, texture features like energy, contrast, correlation, homogeneity and mean features are extracted to liver part based on gray level co-occurrence matrix.

- **Energy:** Entropy shows the amount of information of the image.
- **Contrast:** Measure of the intensity contrast between a pixel and its neighbour over the whole image.
- **Correlation:** Correlation measures the linear dependency of grey levels of neighbouring pixels.
- **Homogeneity:** Homogeneity measures the closeness of the distribution of elements in the gray levels.
- **Mean:** Mean defined as the average colour value in the image.

Table 1: Variations in features among different methods

S. No	Method	Contrast	correlation	Energy
1.	Iriscore	0.3 & 0.7	-0.3 & -0.5	< 0.3
2.	VeriEye	0.3 & 0.7	-0.3 & -0.5	< 0.3
3.	MIRLIN	0.572187	0.260634	0.526407

The above table reresents the variations in the features among different algorithms. As we can observe the contrast levels in the table, it is clearly mentioned that good contrast levels are present in MIRLIN method when compared with IrisCore and VeriEye methods. If clearly observed correlation values are better in MIRLIN method.

f) Classification*:*

The classification process is done over the extracted features. The main novelty here is the adoption of K-nearest neighbour. KNN is applied over the features and the classification is done.

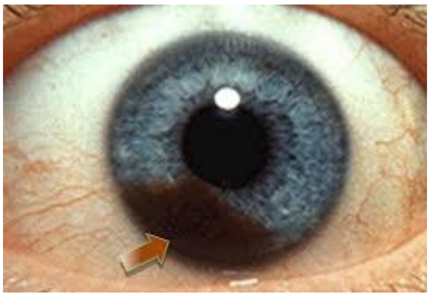

Figure 8: Abnormal Eye

VII. EXPERIMENT RESULTS

The figure consists of test image and the transformed image (by using DCT). Later image segmentation and normalisation are performed. First the image is imported for testing. Now the discrete cosine transformation is applied on the image, before applying DCT the colour image is converted into black and white image. Later by using equations (2, 3, 4, 5) the DCT operation is applied. Now after DCT image segmentation is performed to separate the pupil and the iris, later on image is normalised and the normalised part is extracted and the output is shown in the Fig 10. After normalisation, from the normalised output now the liver part is extracted. To extract the liver part first the normalised image is sub-divided into many parts as shown below among them based on the iris chart the liver part is identified, as shown in Fig 11. Later some features of the liver part like contrast, correlation, energy and mean. These features are very important to decide whether the eye is damaged or not. Based on the values obtained from the image, these values are compared with the values which are stored in the data base and then classify the output as normal or abnormal, as shown in Fig 12.

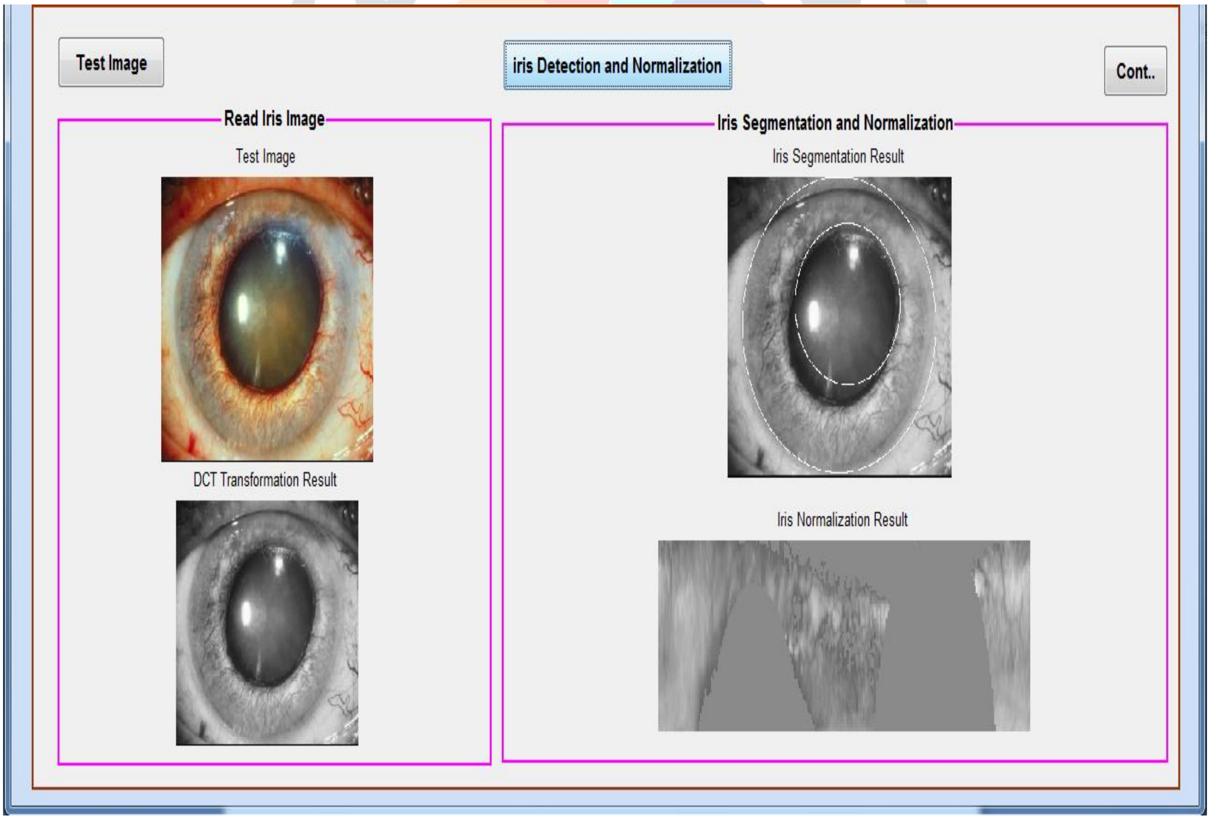

Figure 9: The figure shows the result of DCT and image segmentation & normalisation

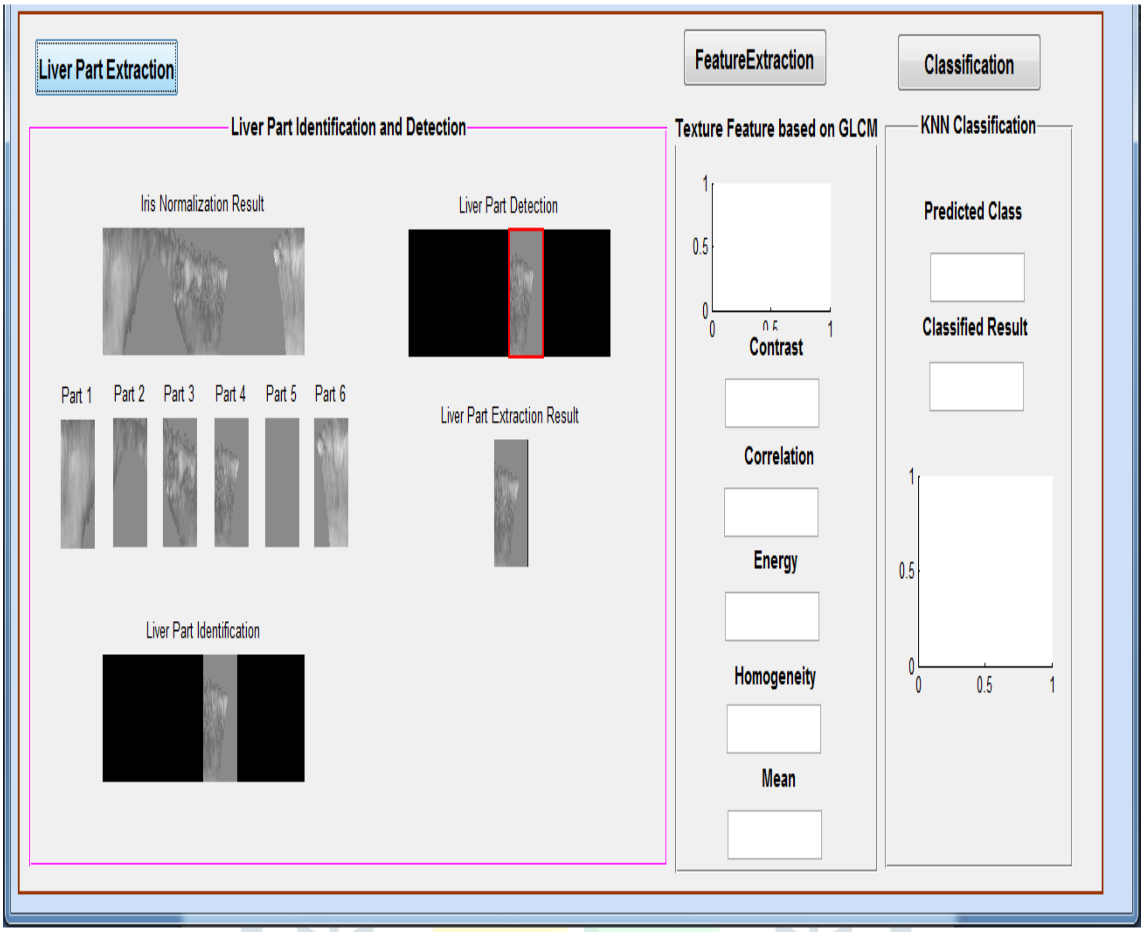

Figure 10: Shows the liver part extraction

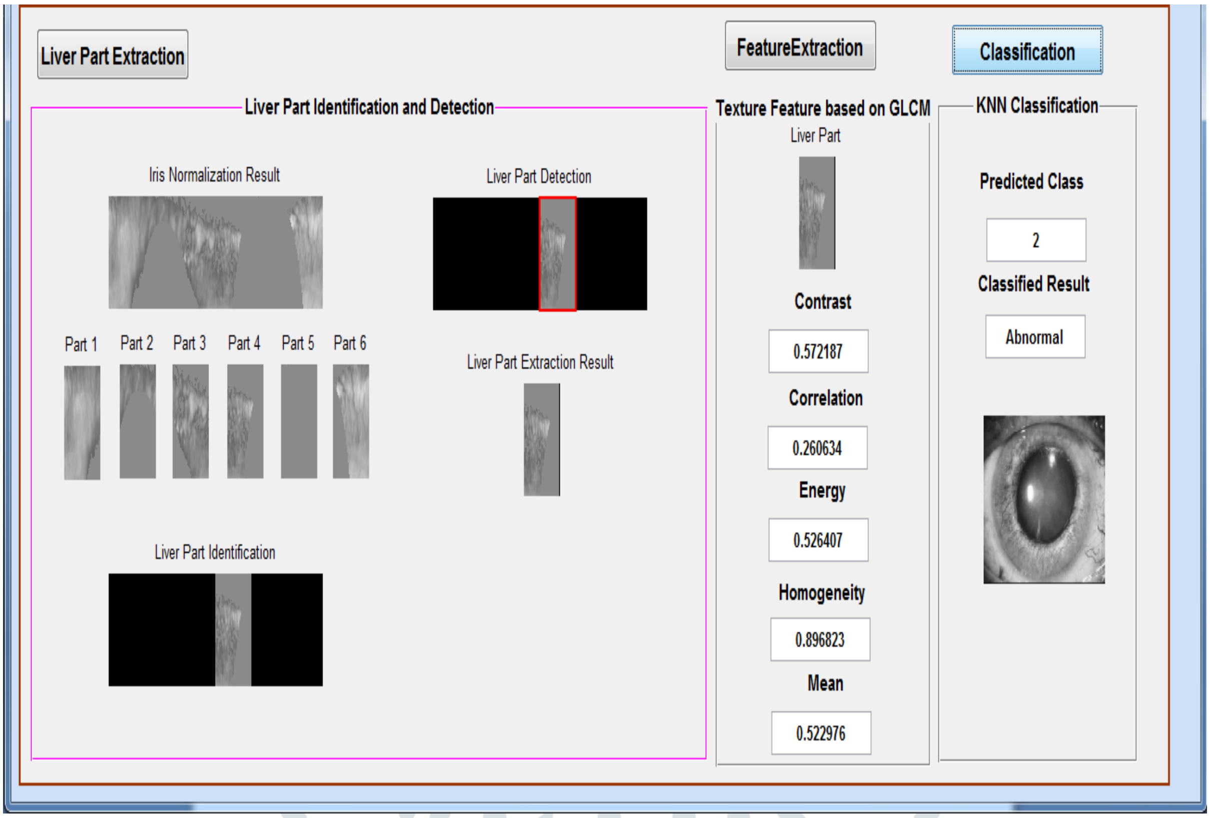

Figure 11: Classification of normal and abnormal eye

VIII. CONCLUSION:

We are proposing a new framework for detection of iris. This method is more efficient when compared with the previous algorithms. We are performing image transformation; later on image segmentation and normalisation used to extract iris region based on Canny and Hough transform and normalisation is done by using Daugman's rubber sheet model. Some of the features like contrast, correlation, energy and mean are extracted these features and a machine learning technique is used to classify the eye into normal or abnormal. This algorithm gives best results for iris recognition as we are using image processing techniques which give accurate results.

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