IRIS RECOGNATION USING MATLAB

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Abstract: Iris recognition is a reliable and accurate biometric identification system for user authentication. It is used for capturing an image of an individual's eye. The performance of iris recognition systems is measured using segmentation. Segmentation is used to localize the correct iris region in the particular portion of an eye and it should be done accurately and correctly for removing the eyelids, eyelashes, reflection and pupil noises present in iris region. In our paper we are using Daughman's Algorithm segmentation method for Iris Recognition. The segmented iris region was normalized to minimize the dimensional inconsistencies between iris regions. The features of the iris were encoded using convolution theorem. The Hamming distance was included as a matching metric, which gave the measure of how many bits disagreed between the templates of the iris.

***Index Terms* - Iris Recognition, Methodology.**

I. INTRODUCTION

Iris recognition is the technique of recognizing a person by analyzing the random pattern of the iris. The automated method of iris recognition is relatively new, existing in patent only since 1994. The muscle of the eye that regulates the size of the pupil, controlling the amount of light that enters the eye. It is the colored portion of the eye with coloring based on the amount of melatonin pigment of the muscle. The coloration and structure of the iris is genetically linked, the details of the patterns are not. The iris develops during prenatal growth through a process of tight forming and folding of the tissue membrane. At the time birth degeneration occurs, resulting in the pupil opening and the random, unique patterns of the iris. Although genetically identical, an individual's irises are unique and structurally distinct, which allows for it to be used for recognition purposes.

II. Iris Recognition

Iris recognition is used for identifying people based on unique patterns within the ring-shaped region surrounding the pupil of the eye. The iris can be a brown, blue, gray, or greenish color, with complex patterns that are visible upon close inspection. Because it makes use of a biological characteristic, iris recognition is considered a form of biometric verification.

In iris recognition, the identification process is carried out by gathering one or more detailed images of the eye with a sophisticated, high-resolution digital camera at visible or infrared (IR) wavelengths, and then using a specialized computer program called a matching engine to compare the subject's iris pattern with images stored in a database. The matching engine can compare millions of images per second with a level of precision comparable to conventional fingerprinting or digital finger scanning.

III. IRIS FEATURE ENCODING WITH WAVELET DEMODULATION

Each isolated iris pattern is demodulated to extract its phase information using quadrature 2D Gabor wavelets. It leads to a patch-wise phase quantization of the iris pattern, by identifying in which quadrant of the complex plane each resultant pharos lays when a given area of the iris is projected onto complex-valued 2D Gabor wavelets.

Altogether 2,048 such phase bits are calculated for each iris. Also, an equal number of masking bits are calculated to signify whether any iris region is obscured by eyelids contains any eyelash occlusions, secular reflections, boundary artifacts of hard contact lenses, or poor signal-to-noise ratio and thus should be ignored in the demodulation code as artifact. Only phase information is used for recognizing irises because amplitude information is not very discriminating, and it depends upon extraneous factors such as imaging contrast, illumination, and camera gain. The extraction of phase has the further advantage that phase angles are assigned regardless of how low the image contrast may be. The benefit, which arises from the fact that phase bits are set also for, a poorly focused image, even if based only on random CCD noise, is that different poorly focused irises never become confused with each other when their phase codes are compared. By contrast, images of different faces look increasingly alike when poorly resolved and may be confused with each other by appearance-based face recognition algorithms.

3. Methodology

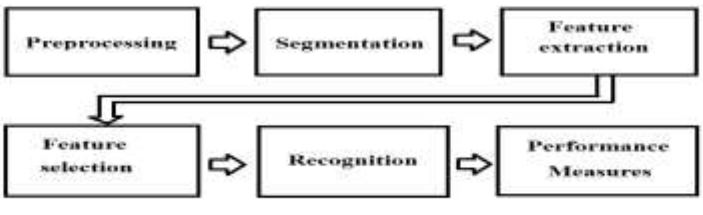


Figure 1: Steps of Recognition

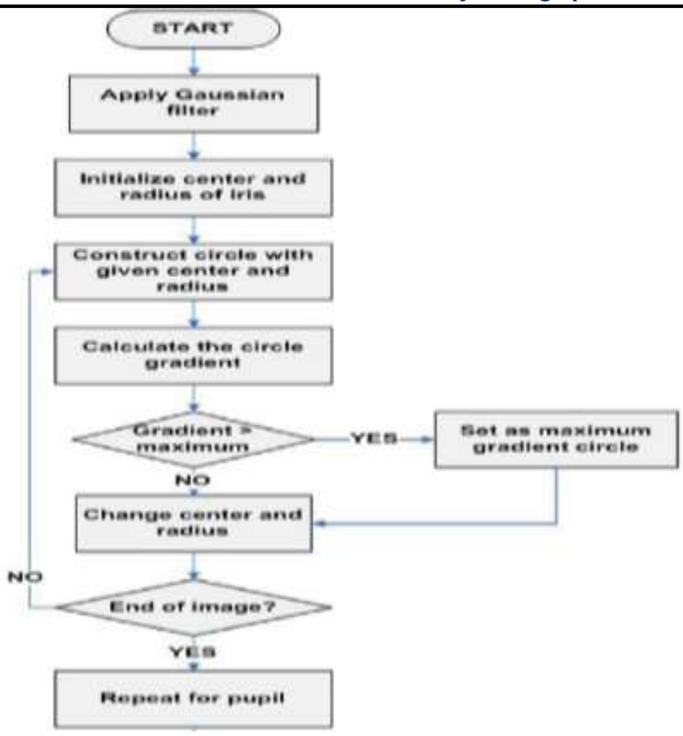


Figure 2: Flow chart of Iris recognition

3.1 Daughman's algorithm description

The task is to find the center coordinates and the radius of the iris and the pupil and Daughman's equation is employed for this task. The center point of Daughman's theory of border recognition is the integrodifferential equation as follows:

$$\max_{(r,x_0,y_0)}\left|G_\sigma(r)*\frac{\partial}{\partial r}\oint_{r,x_0,y_0}\frac{I(x,y)}{2\pi r}ds\right|$$

I(x, y) is the intensity of the pixel at coordinates (x, y) in the image of an iris.
r denotes the radius of various circular regions with the center coordinates at (x0, y0).
σ is the standard deviation of the Gaussian distribution.
Gσ(r) denotes a Gaussian filter of scale sigma (σ).
(x0, y0) is the assumed center coordinates of the iris.
s is the contour of the circle given by the parameters (r, x0, y0).

3.2 Image Acquisition:

Digital imaging or digital image acquisition is the creation of photographic images, such as of a physical scene or of the interior structure of an object. The term is often assumed to imply or include the processing, compression, storage, printing, and display of such images.

3.3 Acquire images from industry-standard hardware

Image Acquisition Toolbox provides functions and blocks that enable you to connect industrial and scientific cameras to MATLAB and Simulink. It includes a MATLAB app that lets you interactively detect and configure hardware properties. The toolbox enables acquisition modes such as processing in-the-loop, hardware triggering, background acquisition, and synchronizing acquisition across multiple devices. Image Acquisition Toolbox supports all major standards and hardware vendors, including USB3 Vision. You can connect to 3D depth cameras, machine vision cameras, and frame grabbers, as well as high-end scientific and industrial devices

3.4 Converting into Gray Image

Descriptive Statics has been used to find the maximum, minimum, standard deviation, mean and normally distribution of the data of all the variables of the study. Normal distribution of data shows the sensitivity of the variables towards the periodic changes and speculation. When the data is not normally distributed it means that the data is sensitive towards periodic changes and speculations which create the chances of arbitrage and the investors have the chance to earn above the normal profit. But the assumption of the APT is that there should not be arbitrage in the market and the investors can earn only normal profit.

3.5 Subtract Gray Image:

Subtract one image from another or subtract constant from image.
Z = imsubtract(X, Y) subtracts each element in array Y from the corresponding element in array X and returns the difference in the corresponding element of the output array Z.

If X is an integer array, elements of the output that exceed the range of the integer type are truncated, and fractional values are rounded.

Process Steps:
1.Reading background image then foreground image.
2. Converting both images from rgb to hsv.
3. Bixoring background and foreground image.
4. Converting rgb to grayscale.
5. Reading rows and coloumns of image.
6. Conveting it to binary image.
7. Applying median filter to remove noise.
8. Labeling boundary.
9. Removing noise.

3.6 Histogram:

An image histogram is a type of histogram that acts as a graphical representation of the tonal distribution in a digital image. It plots the number of pixels for each tonal value. By looking at the histogram for a specific image a viewer will be able to judge the entire tonal distribution at a glance.
Image histograms are present on many modern digital cameras. Photographers can use them as an aid to show the distribution of tones captured, and whether image detail has been lost to blown-out highlights or blacked-out shadows. This is less useful when using a raw image format, as the dynamic range of the displayed image may only be an approximation to that in the raw file.
The horizontal axis of the graph represents the tonal variations, while the vertical axis represents the number of pixels in that particular tone. The left side of the horizontal axis represents the black and dark areas, the middle represents medium grey and the right hand side represents light and pure white areas. The vertical axis represents the size of the area that is captured in each one of these zones. Thus, the histogram for a very dark image will have the majority of its data points on the left side and center of the graph. Conversely, the histogram for a very bright image with few dark areas and/or shadows will have most of its data points on the right side and center of the graph.

3.7 Image Segmentation:

In computer vision, image segmentation is the process of partitioning a digital image into multiple segments (sets of pixels, also known as super-pixels). The goal of segmentation is to simplify and/or change the representation of an image into something that is more meaningful and easier to analysis .Image segmentation is typically used to locate objects and boundaries (lines, curves, etc.) in images. More precisely, image segmentation is the process of assigning a label to every pixel in an image such that pixels with the same label share certain characteristics.
The result of image segmentation is a set of segments that collectively cover the entire image, or a set of contours extracted from the image (see edge detection). Each of the pixels in a region are similar with respect to some characteristic or computed property, such as color, intensity, or texture. Adjacent regions are significantly different with respect to the same characteristic(s). When applied to a stack of images, typical in medical imaging, the resulting contours after image segmentation can be used to create 3D reconstructions with the help of interpolation algorithms like marching cubes.

3.8 Cropped Image:

Cropping is the removal of the outer parts of an image to improve framing, accentuate subject matter or change aspect ratio. Depending on the application, this may be performed on a physical photograph, artwork or film footage, or achieved digitally using image editing software. The practice is common to the film, broadcasting, photographic, graphic design and printing industries.
J = imcrop creates an interactive Crop Image tool associated with the image displayed in the current figure. With this syntax and the other interactive syntaxes, the Crop Image tool blocks the MATLAB® command line until you complete the operation. Imcrop returns the cropped image, J.
For more information about using the Crop Image tool, see Interactive Behavior.

3.9 Resized Image:

Changing the size at which the image will print without changing the number of pixels in the image —instead the pixels are printed further apart or closer together. Resizing (scaling) an image will not affect screen display. Image Re sampling: Changing the number of pixels in the image.

3.10 Smoothing Image using Gaussian Filter:

Gaussian smoothing filters are commonly used to reduce noise.
Filter the image with isotropic Gaussian smoothing kernels of increasing standard deviations. Gaussian filters are generally isotropic, that is, they have the same standard deviation along both dimensions. An image can be filtered by an isotropic Gaussian **filter by specifying a scalar value for sigma.**

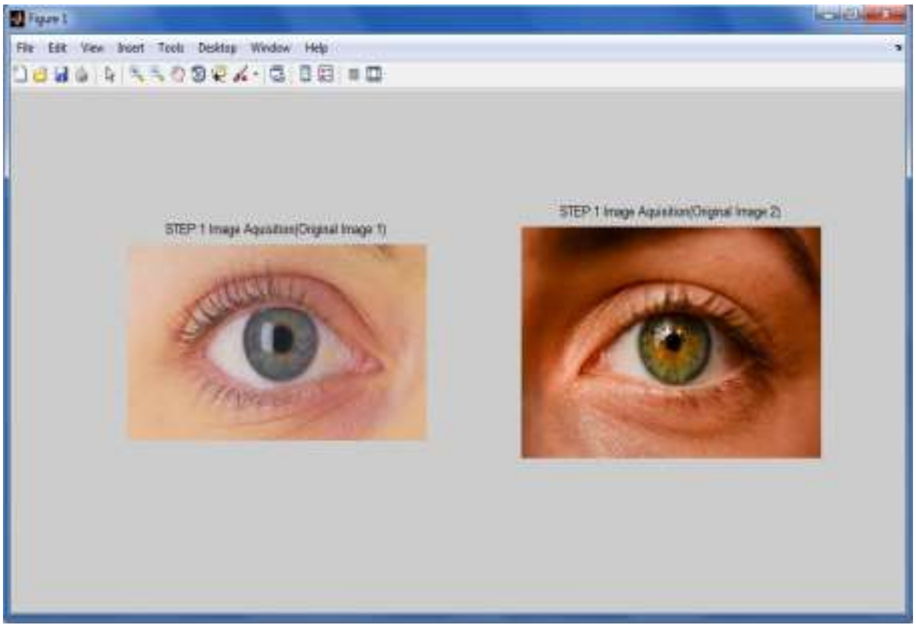
Filter the image with anisotropic Gaussian smoothing kernels, imgaussfilt allows the Gaussian kernel to have different standard deviations along row and column dimensions. These are called axis-aligned anisotropic Gaussian filters. Specify a 2-element **vector for sigma when using anisotropic filters**.

Low pass filtering (smoothing), is employed to remove high spatial frequency noise from a digital image. The low-pass filters usually employ moving window operator which affects one pixel of the image at a time, changing its value by some function of a local region (window) of pixels.

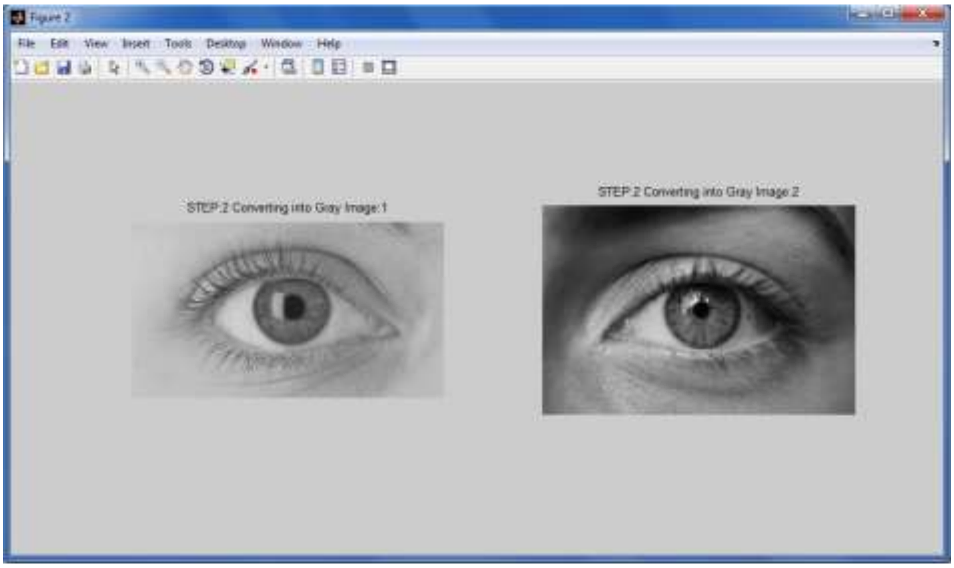
3.10 Edge Detection Canny Filter:

Edge detection is an image processing technique for finding the boundaries of objects within images. It works by detecting discontinuities in brightness. Edge detection is used for image segmentation and data extraction in areas such as image processing, computer vision, and machine vision.

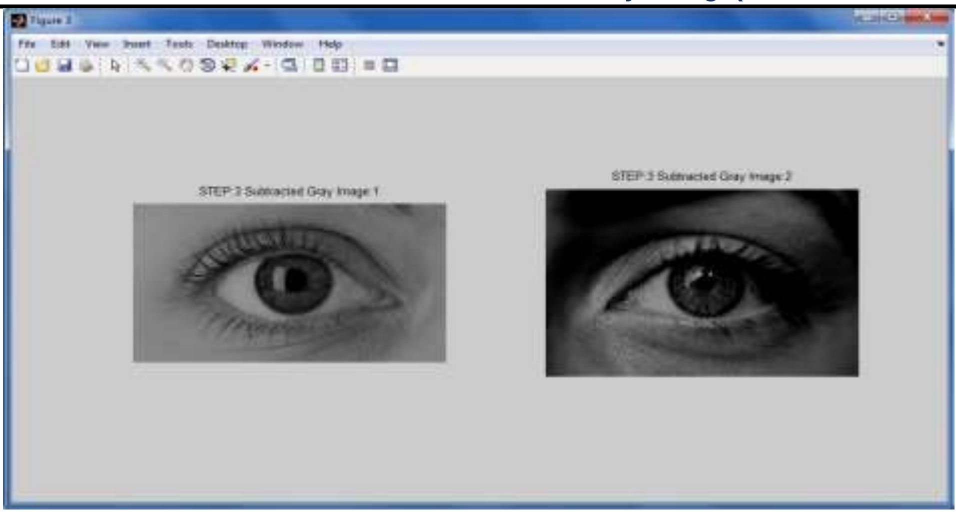
IV. RESULTS AND DISCUSSION



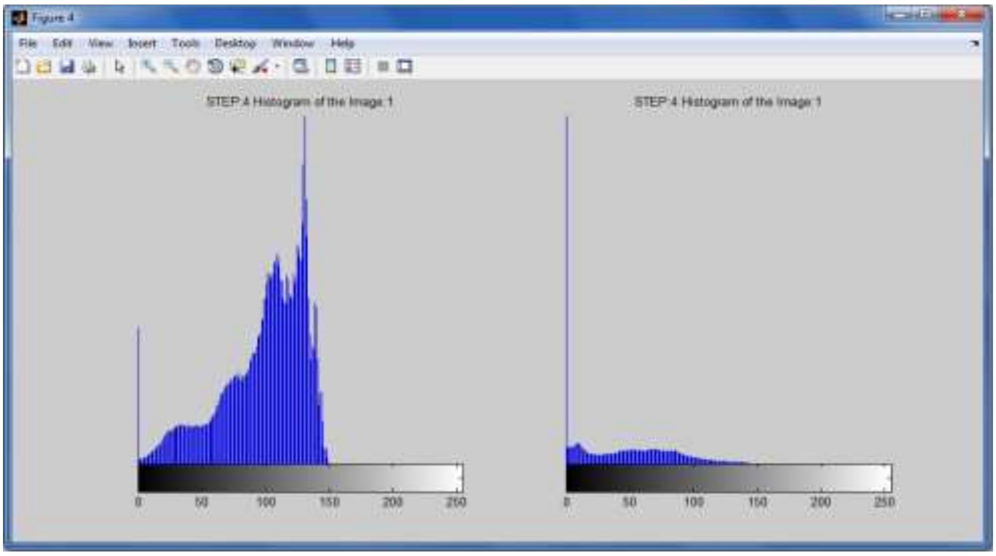
OUTPUT IMAGE-1: IMAGE AQUISITION



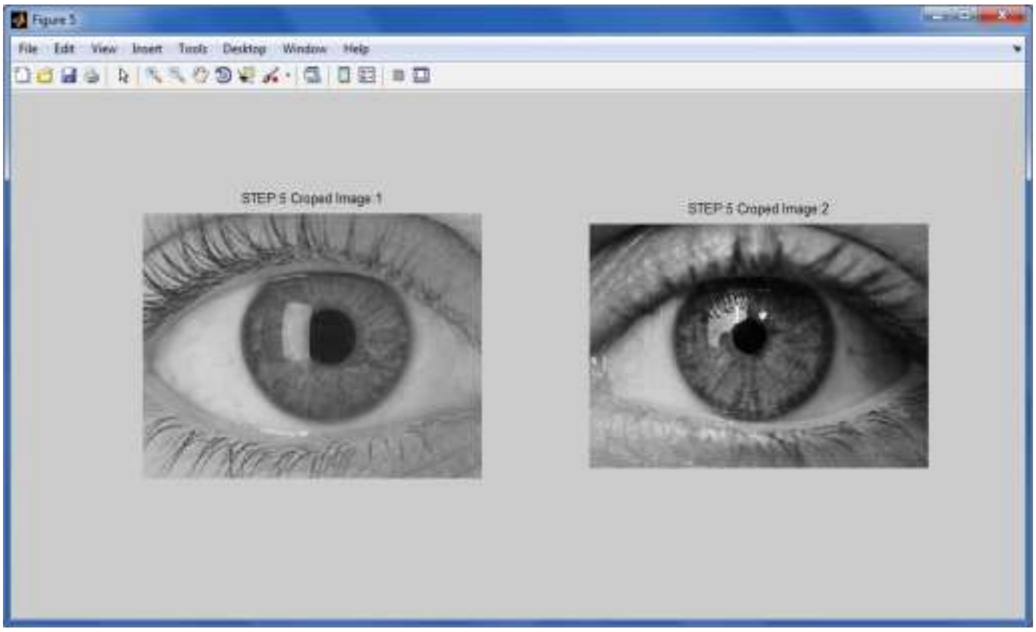
OUTPUT IMAGE-2: CONVERTING INTO GRAY IMAGE



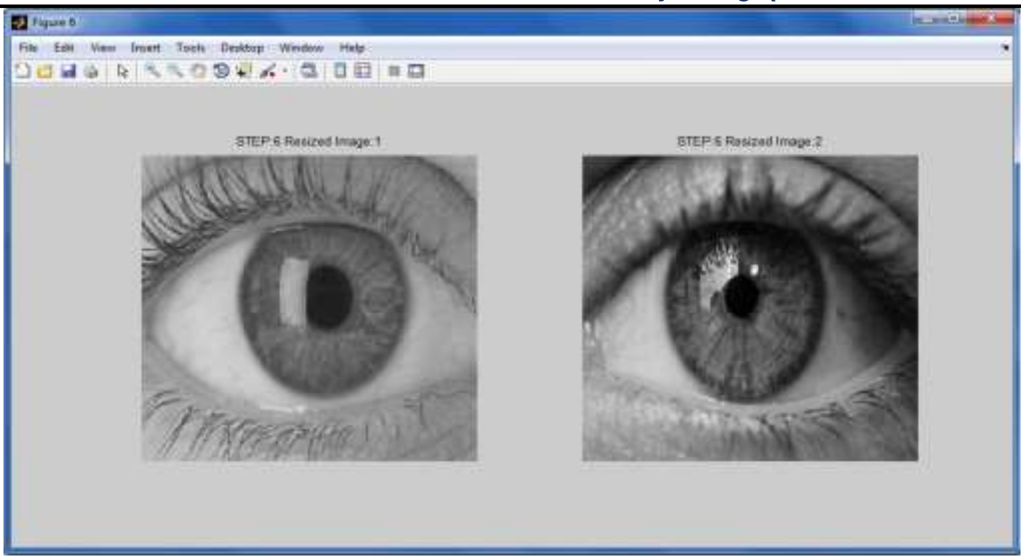
OUTPUT IMAGE-3: SUBTRACT GRAY IMAGE



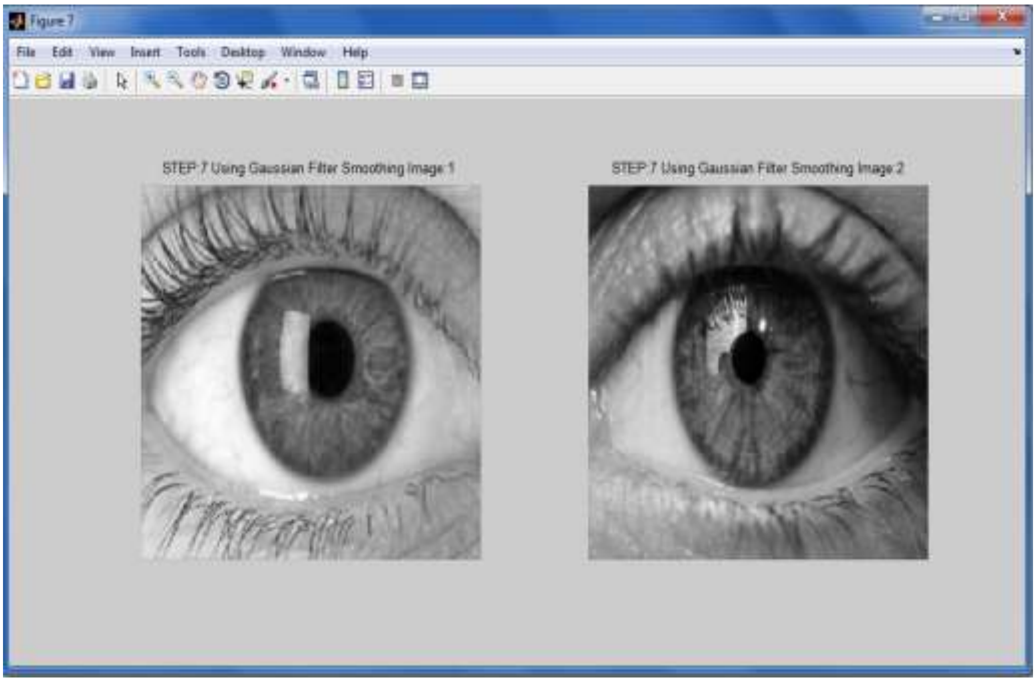
OUTPUT IMAGE-4: HISTOGRAM



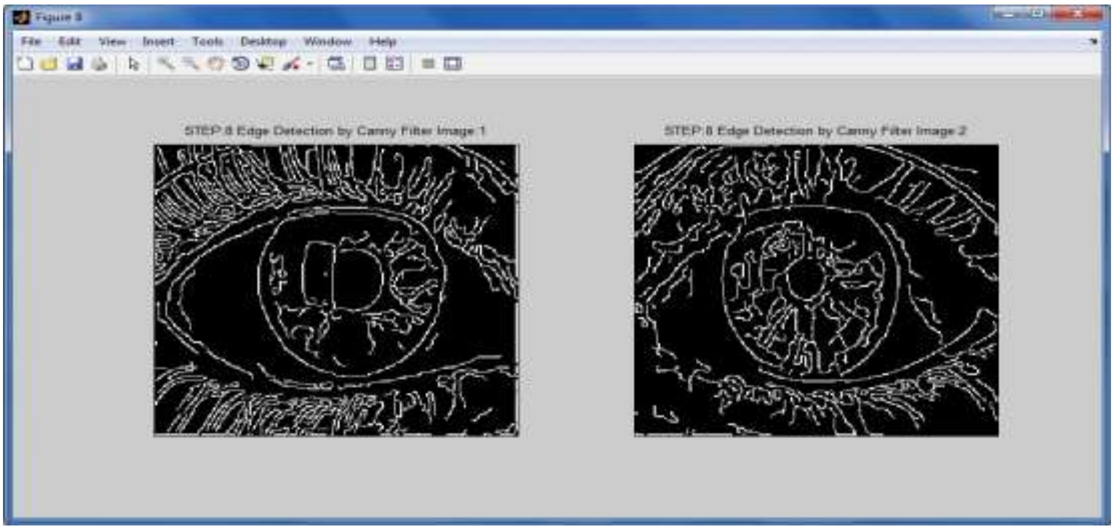
OUTPUT IMAGE-5: CROPPED IMAGE



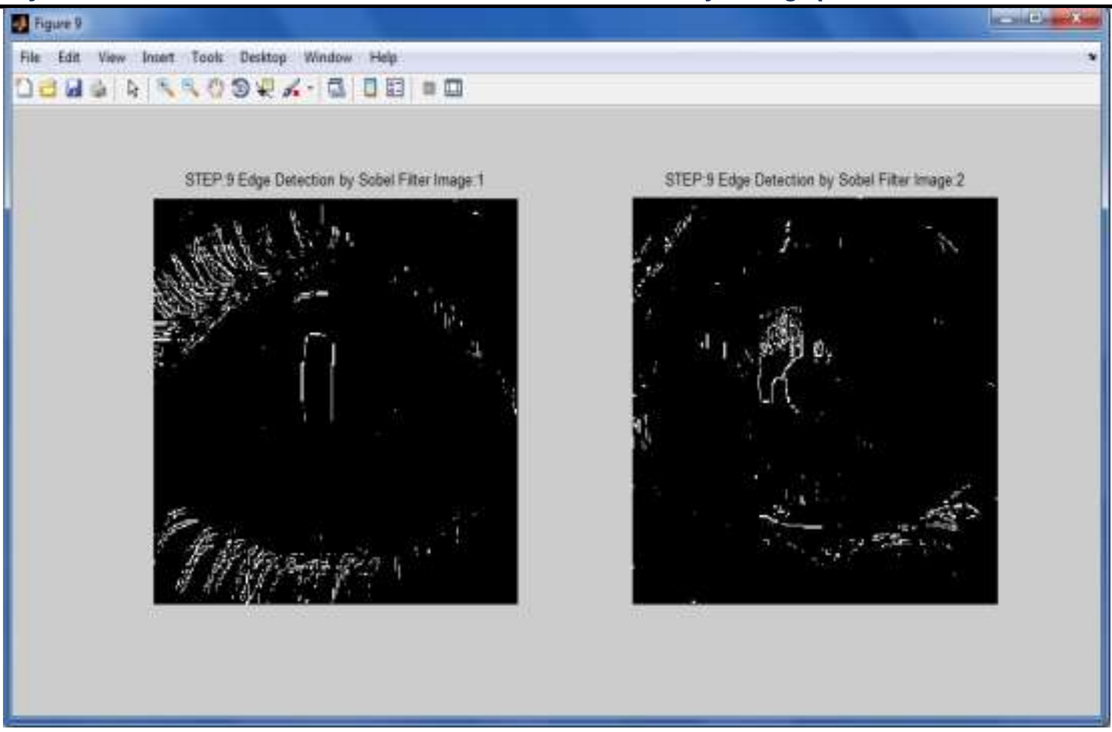
OUTPUT IMAGE-6: RESIZED IMAGE



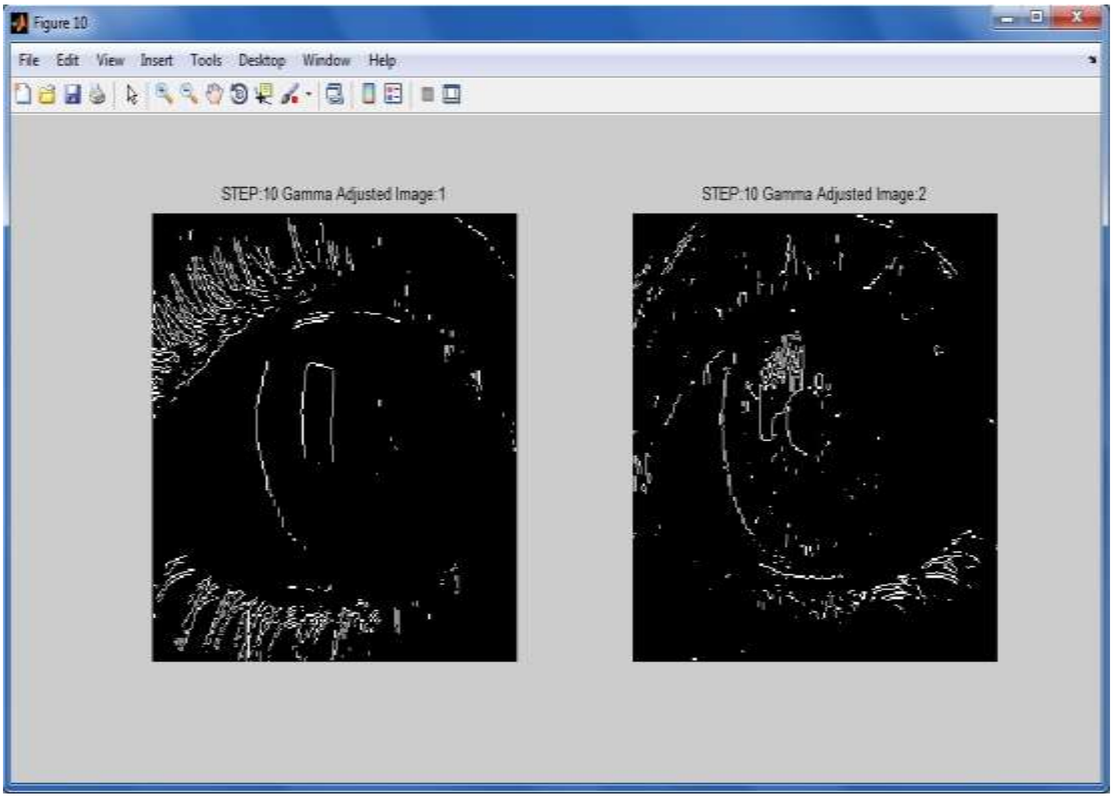
OUTPUT IMAGE-7: SMOOTHING USING GAUSSIAN FILTER



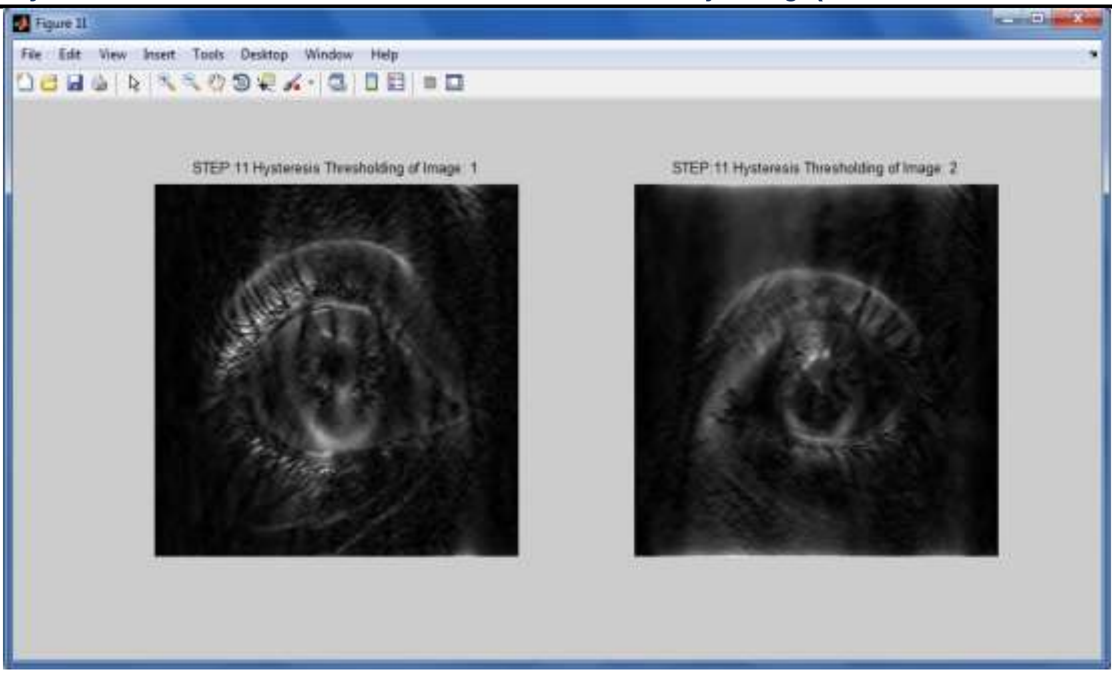
OUTPUT IMAGE-8: EDGE DETECTION USING CANNY FILTER



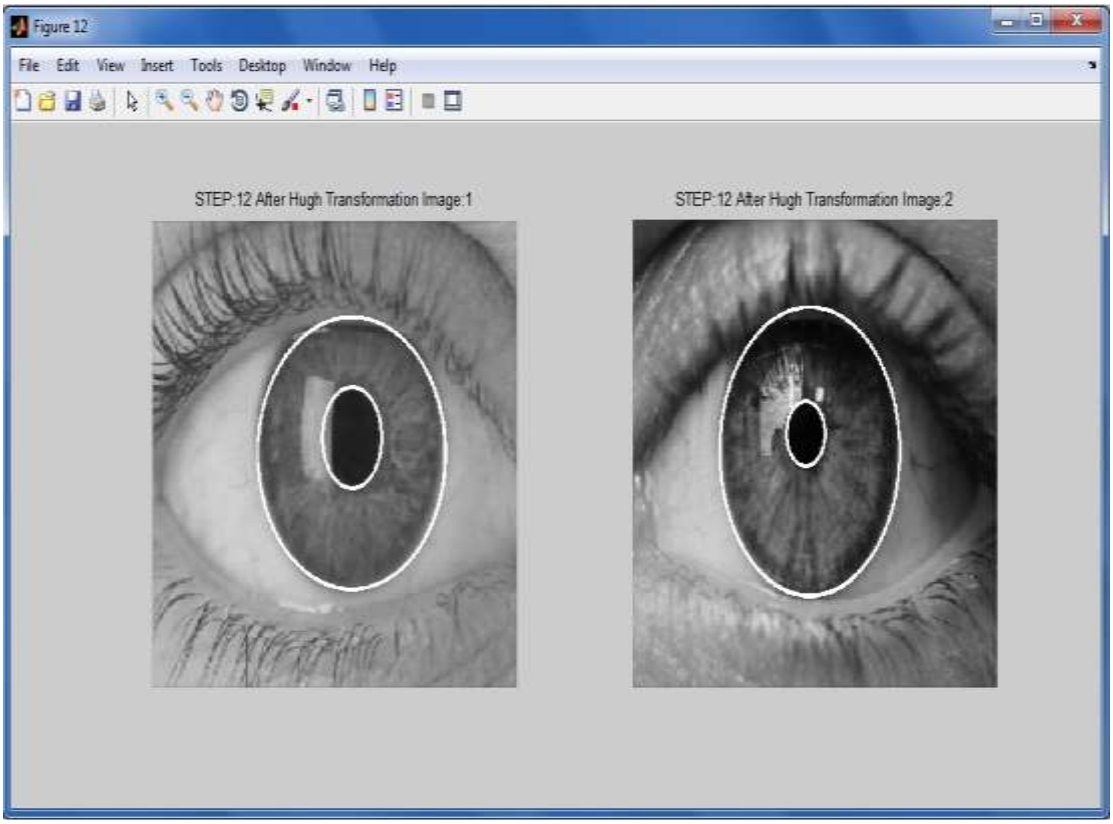
OUTPUT IMAGE-9: EDGE DETECTION BY SOBEL FILTER



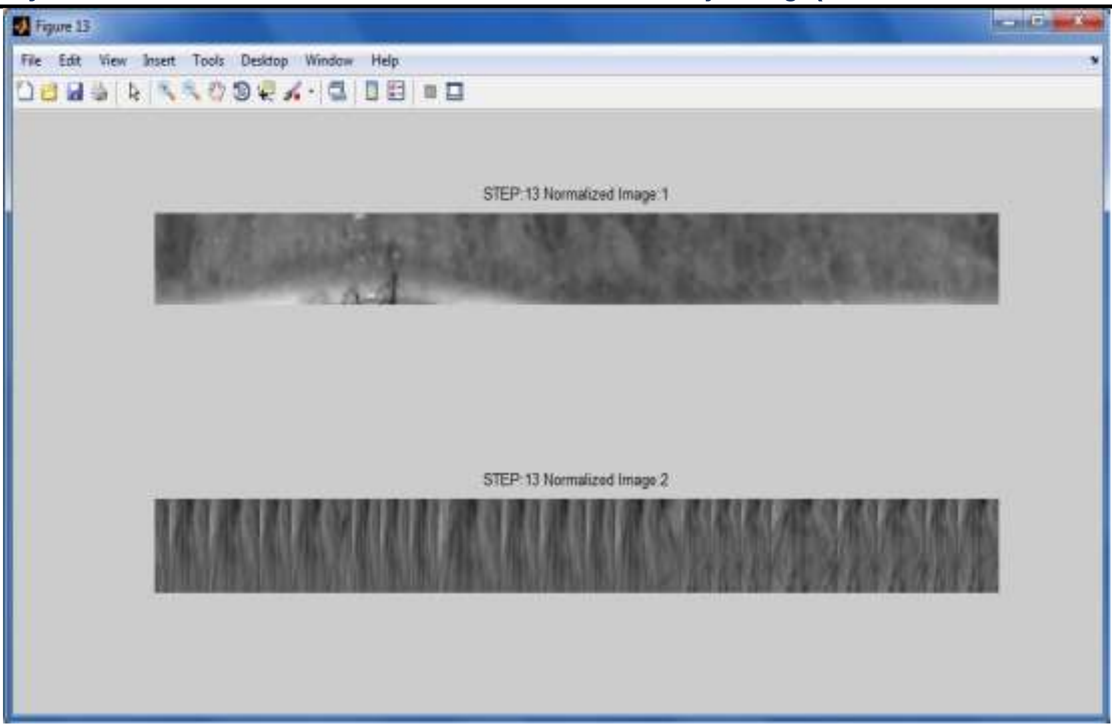
OUTPUT IMAGE-10: GAMMA ADJUSTMENT



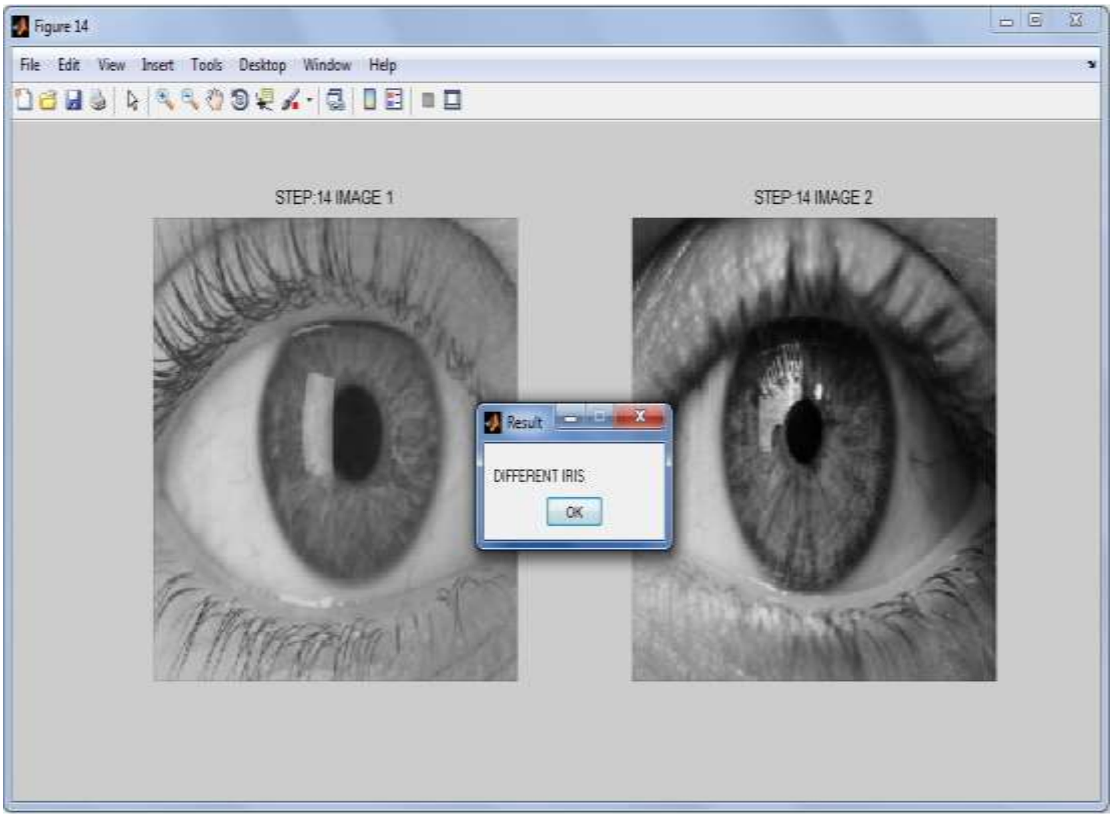
OUTPUT IMAGE-11: HYSTERSIS THRESHOLD



OUTPUT IMAGE-12: HUGH TRANSFORMATION



OUTPUT IMAGE-13: NORMALIZED IMAGE



OUTPUT IMAGE-14: FINAL RESULT

FUTURE ENHANCEMENT:

In order to increase both accuracy and robustness; a multimodal biometric system could be used. This confusion may be a combination of iris and fingerprint biometrics. This allows the integration of two or more types of biometric recognition and verification systems in order to meet stringent performance requirements. Such systems are expected to be more reliable due to the presence of multiple independent pieces of evidence. These systems are also able to meet the strict performance requirements imposed by various applications.

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