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Development of System to Detect & Grade the Cataract Based on Image Processing

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ABSTRACT: Cataract is an eye disease. Cataract is caused by opacity of lens. Cataract is clouding or dullness of the lens in the eye which causes visual loss and blindness. Cataract is clouding of the lens in the eye which is painless and developed gradually over a long period. Cataract is an eye disorder which occurs when some of protein at lensclumped together that makes it dull and increases opacity of the lens, causing some loss of vision. Mostly cataracts are affected to aged peoples. Cataract is classified into three types namely, nuclear cataract, cortical cataract and posterior sub-capsular cataract. In this system from database These types are based on where cataract develops. By applying image processing on the database cataract is detected. To detect cataract Image acquisition, pre-processing, segmentation, extraction, classification and grading these are the main steps.For cataract detection this paper gives two algorithams.1) Development of cataract detection algorithm using Threshold based segmentation.2) Development of cataract detection algorithm using circular hough transform

KEY WORDS: Slit lamp, pupil, grading system

I.INTRODUCTION

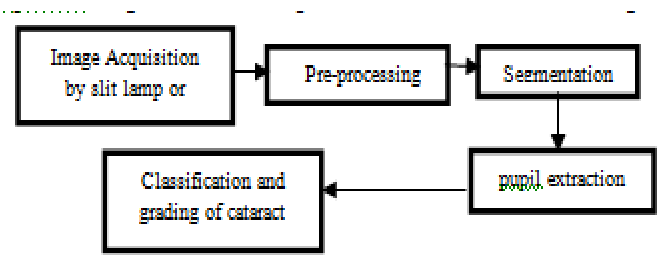
Cataracts are very general in older people. The main causes of cataracts are diabetes, optic nerve damage, and macular degeneration. It cannot spread from one eye to the other. Cataract is mainly affected to lens of retina. On retina the light is focused with the help of lens. the lens is clear part of eye. In a normal eye, We are able to see scene because light passes through the transparent lens to the retina .

Cataracts can be not easy to detect. The opacity of the lens of eye may be obvious to many people; it may not be noticeable to others. In clinics cataract is examination is done by slit lamp.

The slit lamp is an instrument consisting of a high-intensity light source that can be focused to shine a thin sheet of light into the eye. The lamp facilitates an examination of the anterior segment and posterior segment of the human eye.

II.PROPOSED METHOD

1]Block diagram for development of cataract detection algorithm using threshold based segmentation



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- Image acquisition by slit lamp or data base- The required image is taken by using slit lamp or database available from server.
- Pre-processing-The image in the RGB format. Crop the Iris part from eye for pupil. That will be converted in to gray scale image. Image is segmented by thresholding method. Segmented image is converted in to binary image. Rescale the image in 100*100 size. And calculate percentage of eye covered by cataract.
- Segmentation-

The main objective here is to remove any useful information, namely the pupil segment and the part outside the iris.

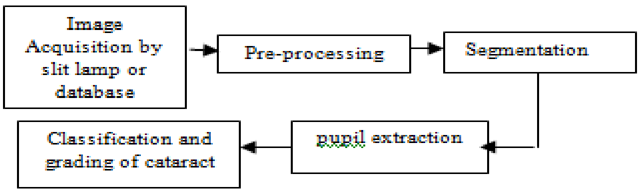
- Thresholding-

Thresholding is the simplest method of image segmentation. From a gray scale image, thresholding can be used to create binary images. This image analysis technique is type of image segmentation that isolates objects by converting gray scale image into binary image.

If

f(x,y)>T then f(x,y)=0 else f(x,y)=255

2]Block diagram development of pupil detection algorithm using hough circle detection transform



III.SYSTEM IMPLEMENTATION

I] System implementation for Development of cataract detection algorithm using Threshold based segmentation

- Flow chart

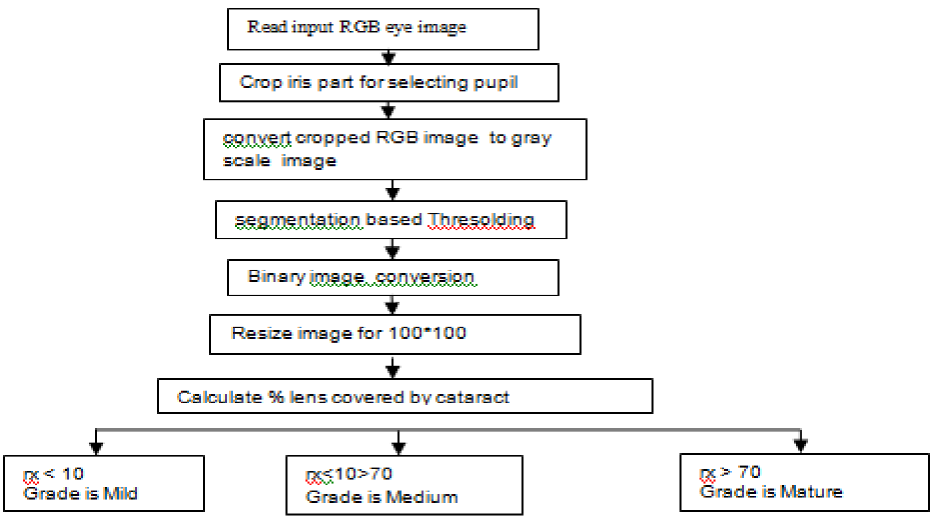


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Image:

This image is RGB image. The database is taken from Department of Ophthalmology and Visual science University of lowa

Fig.1.1 RGB image

Pre-processing:

The image in the RGB format. Crop the Iris part from eye for pupil. That will be converted in to gray scale image. Image is segmented by thresholding method. Segmented image is converted in to binary image. Rescale the image in 100*100 size. And calculate percentage of eye covered by cataract.

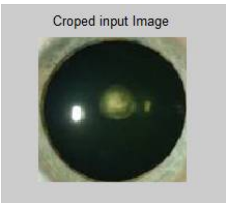

Fig.1.2 cropped pupil from RGB eye image

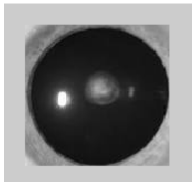

Fig.1.3 RGB cropped pupil to gray scale conversion

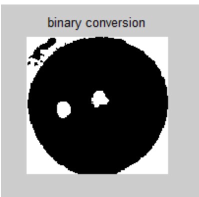

Fig. 1.4 binary conversion of gray scale

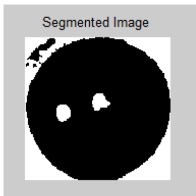

Fig. 1.5 segmented image pupil

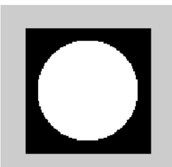

Fig.1.6 circular mask

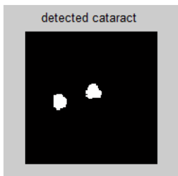

Fig.1.7 Detected cataract

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2] System implementation for Development of pupil detection algorithm using hough circle detection transform

Work flow

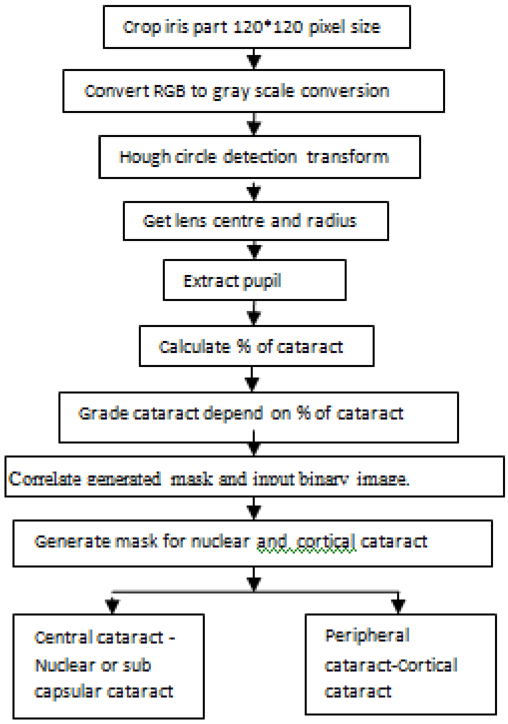
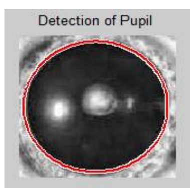


***Image*:**This image is RGB image.Fig.1.1 The database is taken from Department of Ophthalmology and Visual science University of lowa.This is dilated eye image.

PRE-PROCESSING:The image in the RGB format. Crop the pupil part from digital eye image. To process any image in MATLAB it has to convert in to gray scale image. To select region of interest image will be cropped. It will reduce mathematical complications. The cropped image will be converted in to gray scale image. Rescale the image in 120*120 size. This rescaling is required for minimize the computation complexity.

Thresholding:Thresholding is the simplest method of image segmentation. From a gray scale image, thresholding can be used to create binary images. This image analysis technique is type of image segmentation that isolates objects by converting gray scale image into binary image.adapthisteq enhances the contrast of the gray scale image by transforming the values of contrast limited adaptive histogram equalization.And calculate percentage of eye covered by cataract. This percentage is calculated by total area of lens and lens affected by cataract. This centre and radii is required for extraction of pupil. Circle creation on blank image by using this centre and radii blank mask is created. By inverting this mask pupil is extracted.



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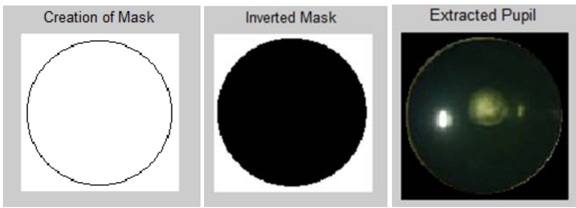
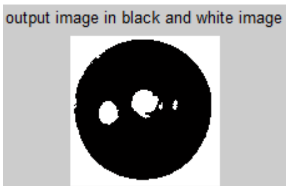
***Segmentation**:*The main objective here is to remove any useful information, namely the pupil segment and the part outside the iris Image segmentation is the process of partitioning a digital image into multiple segments. The goal of segmentation is to simplify and change the representation of an image into something that is more meaningful and easier to analyze. Pupil extraction is very important part in this process.

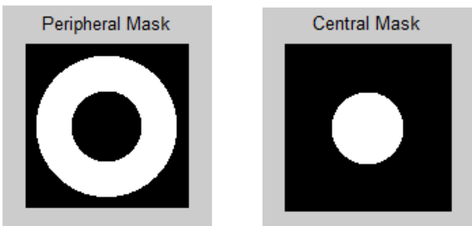
***Pupil extraction**:*Pupil is in the circular form. From the cropped image again area of interest is pupil part. We have to minimise iris part. For this circular hough transform is used.
The pupil is extraction is done by applying circular hough transform. By using imfindcircle it will provide centre and radii. imfindcircles to automatically detect circles or circular objects in an image. It also shows the use of viscircles to visualize the detected circles. By using centre and radius mask creation is done. circlePixels is a 2D "logical" array. By inverting mask pupil is extracted.



***Grading of catarcat*:**The extracted pupil is converted in to black and white image to calculate percentage of lens covered by cataract.By ORing the bits percentage is calculated. The grading is done on the based on percentage of cataract covered by lens. Here 0 to 12% early stage cataract grade 1 , 12.01 to 24% early stage cataract grade 2 , 24.01 to 36 early stage cataract grade 3 , 36.01 to 50% cataract is medium, above 50% cataract is mature this grading system is provided.



Categorization of cataract:In nuclear cataract the intensity variation is more at centre of pupil while less at periphery. In cortical cataract the intensity variation is more at the periphery and less at centre. The Hough circular detection transform gives information regarding centre coordinate and radius of pupil. This information is used to create binary masks for detection of nuclear and cortical cataract. These masks are correlated with input binary image obtained from pre processing. The value of correlation coefficient is between 0 and 1. If the result is towards 0, the cataract is at earlier stage and if towards 1, the cataract is at mature stage. The results are used to categorize the cataract.



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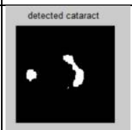
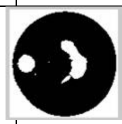
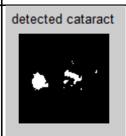
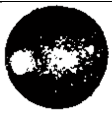
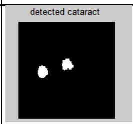
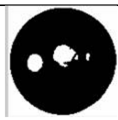
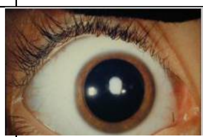
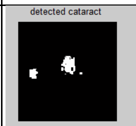
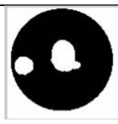
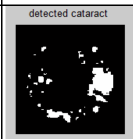
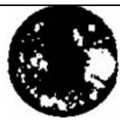
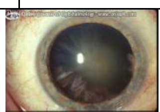
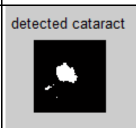
IV.RESULTS OF THRESHOLING METHOD AND CIRCULAR HOUGH DETECTION CATARACT

Sr.No.	RGB image	Thresholding method	Circular Hough Transform
1			
2			
3			
4			
5			
6			

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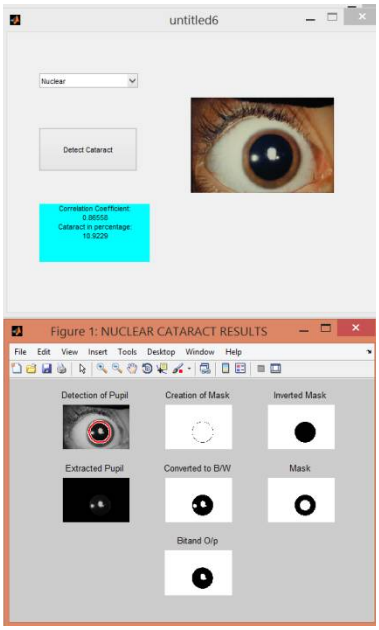
GUI RESULT



V.CONCLUSION

Main object is to develop an algorithm for early detection of cataract. And grading the cataract. For detection of cataract pupil extraction is done by using circular hough transform. Grading of cataract is done with the guidance of ophthalmologist. Results of this system is verified by ophthalmologist.

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