

# **Image Processing System for Ultrasound Images of the Eye**

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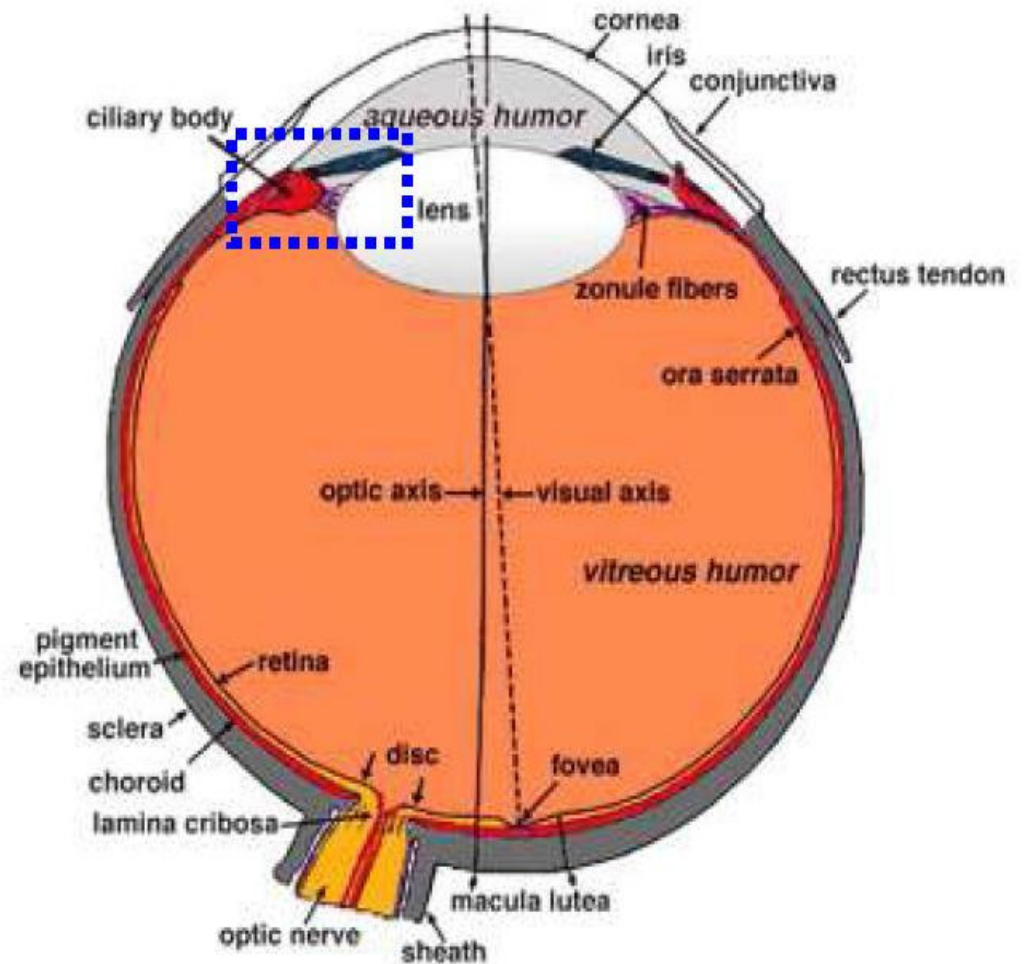
# Introduction

- Closed Angle Glaucoma causes an increase in fluid pressure in the eye due to a decrease in fluid flow between the iris and the cornea
- To diagnose, ultrasound images of the eye are taken
- Technicians study the images and measures parameters

# Objective

- The project extends the work accomplished in Youmaran *et al*, 2005
- Adds to the existing algorithm the capability to identify and measure the parameters important to a dose-response study of a drug to treat patients with Glaucoma.

# Ultrasound biomicroscopy

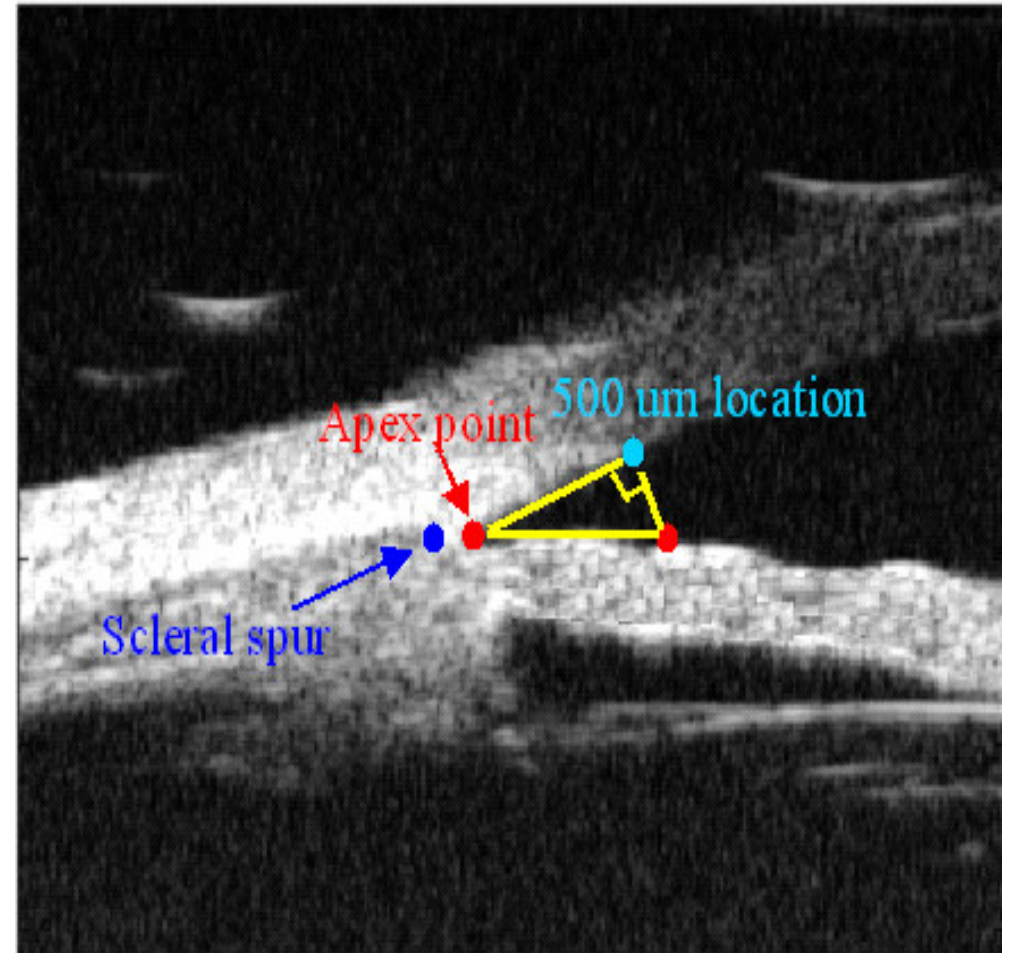


# Ultrasound biomicroscopy tools @ Freq 50MH

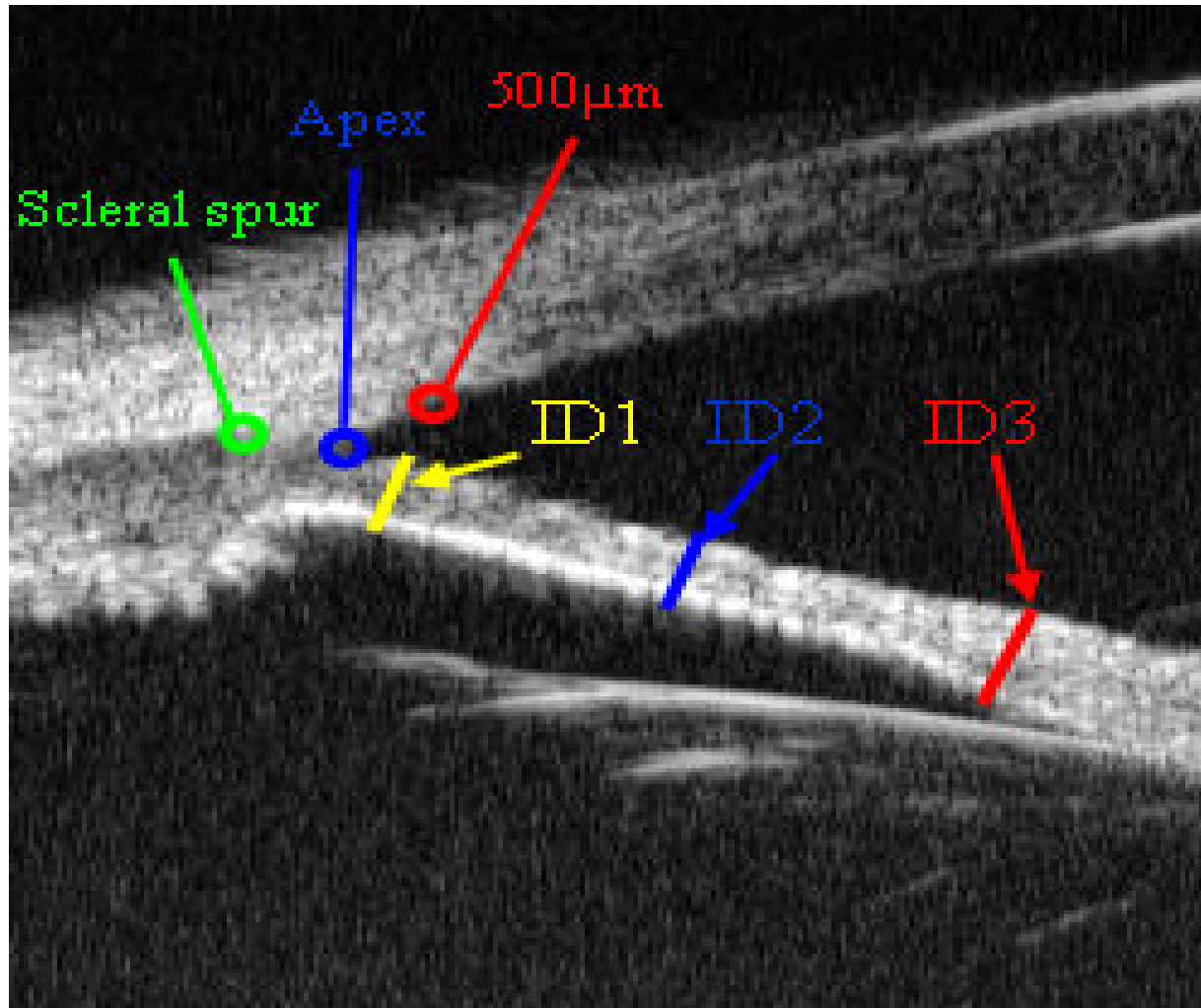


# Results of Youmaran, 2005

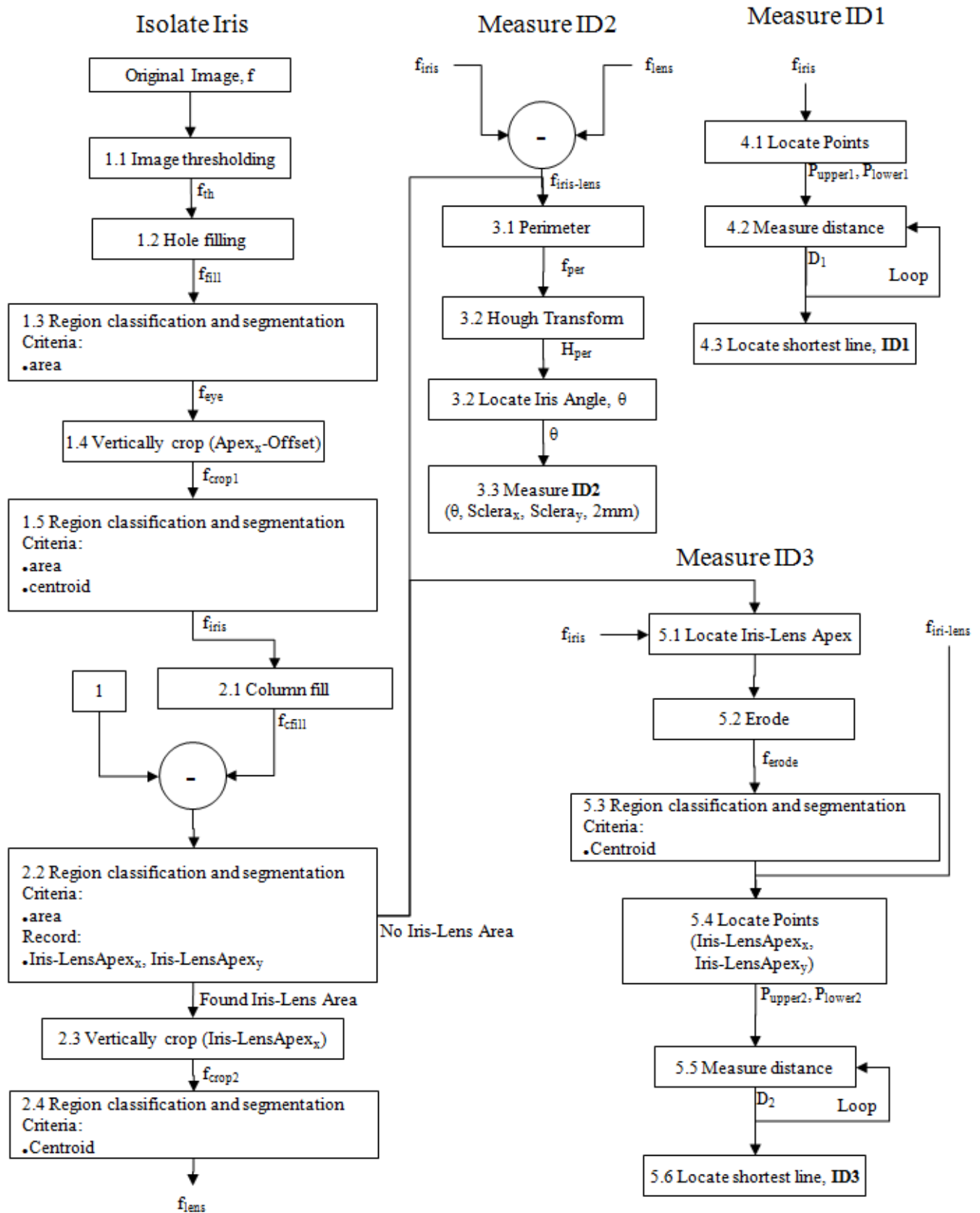
- The algorithm computes:
  - AOD 500
  - the open-angle parameters
  - Scleral spur
- Approximately 97% success rate



# Clinical Parameters

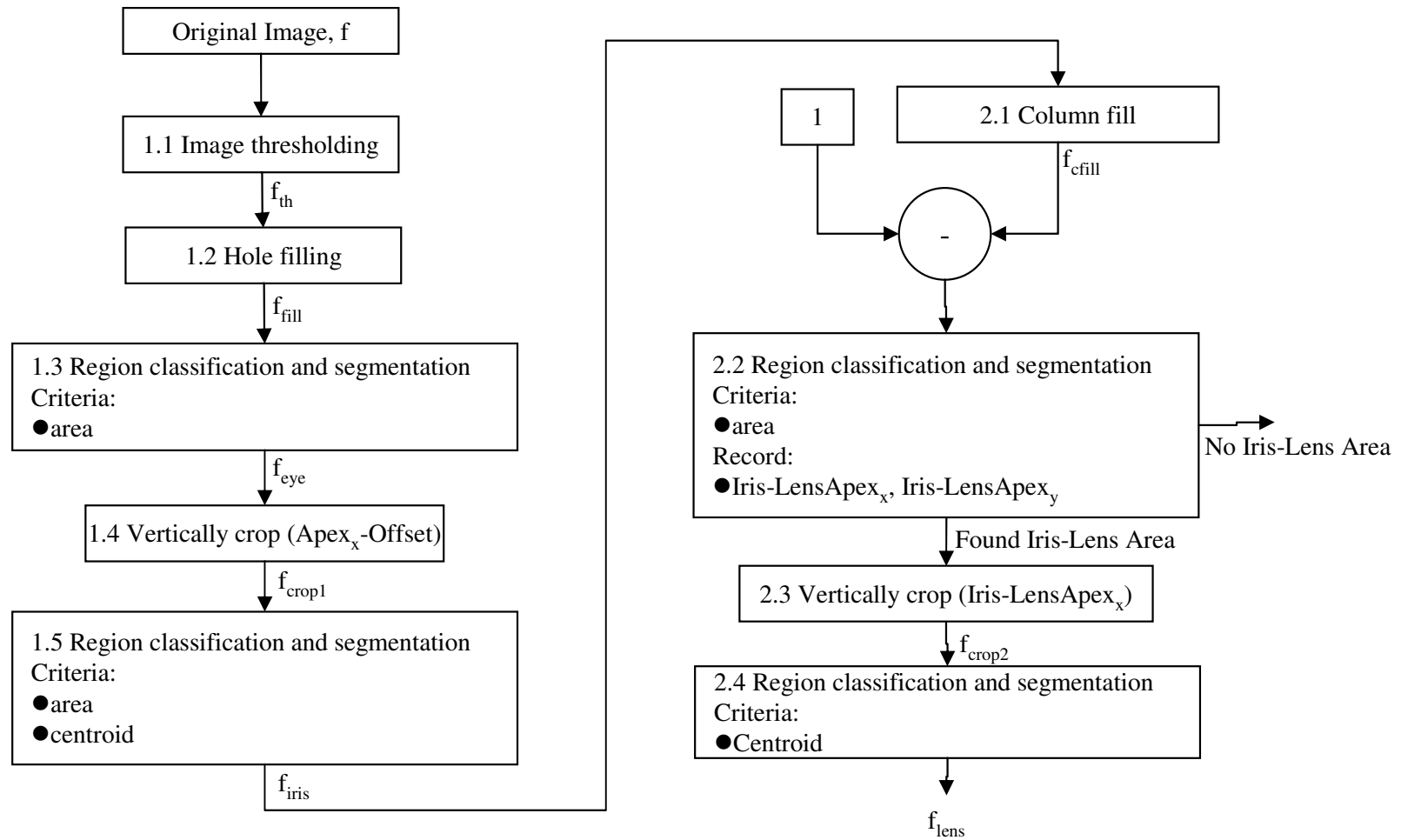


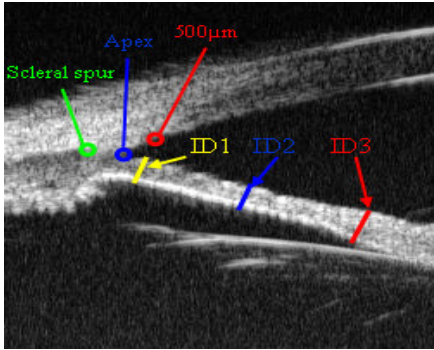
# ALGORITHM





# Isolating the iris





# Isolating the iris (cont.)

Image Thresholding



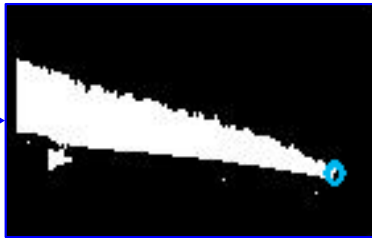
Crop at Apex



Segmentation of Iris and Lens



Segmentation of Iris Lens Area, Locate Iris lens Apex



Crop at Iris lens Apex



Iris

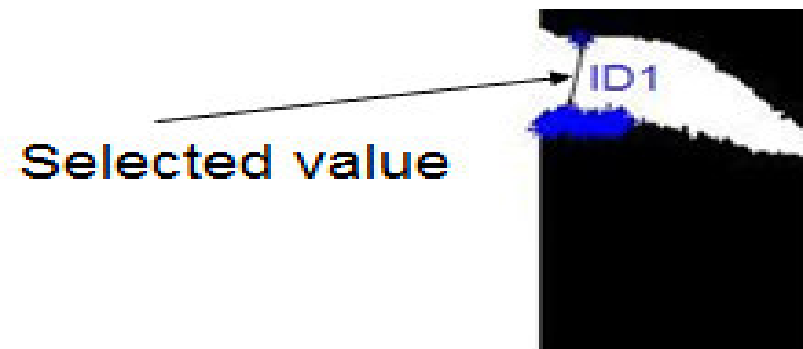
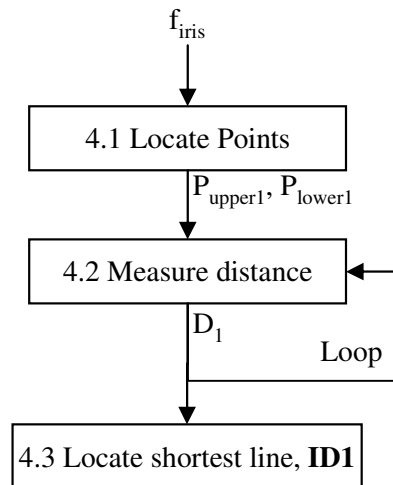
Lens



Segmentation of Iris

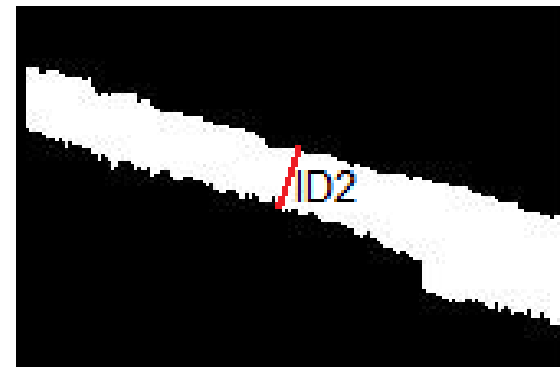
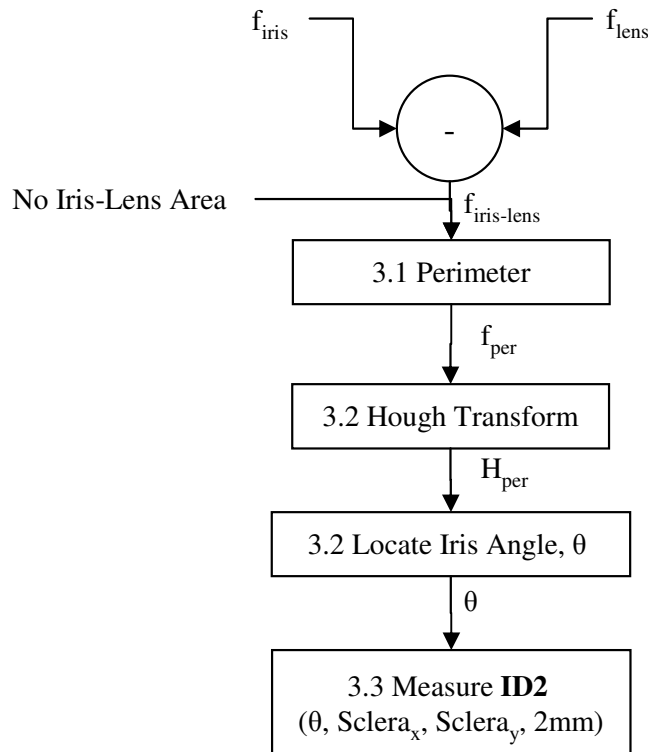
# Measuring ID1

- Uses the AOD 500 as a reference
- Iterates over possible ID1s
- Selects the shortest as ID1

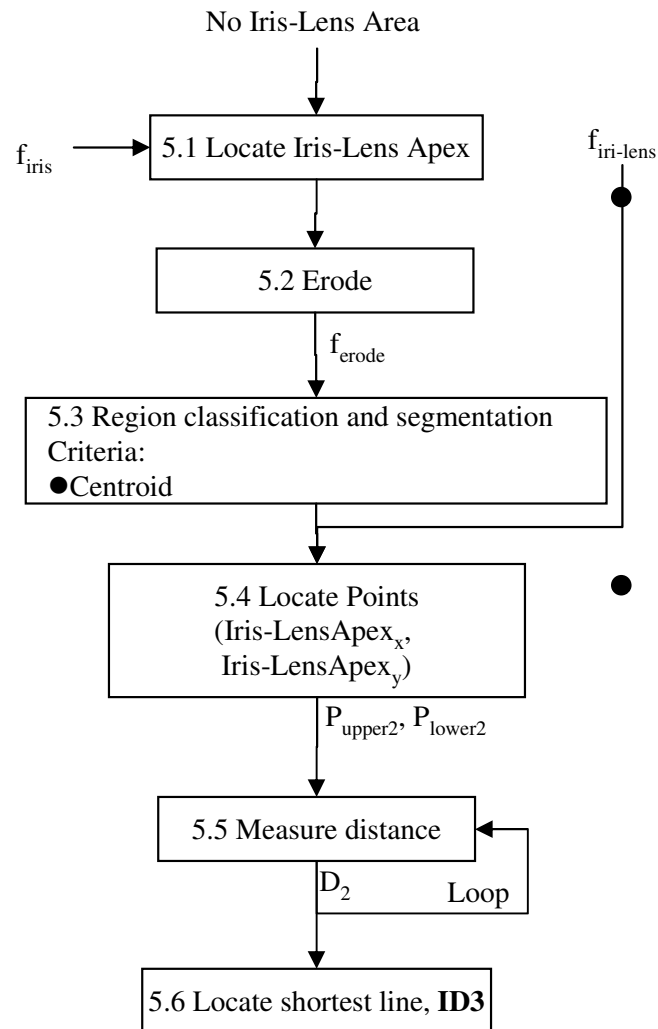
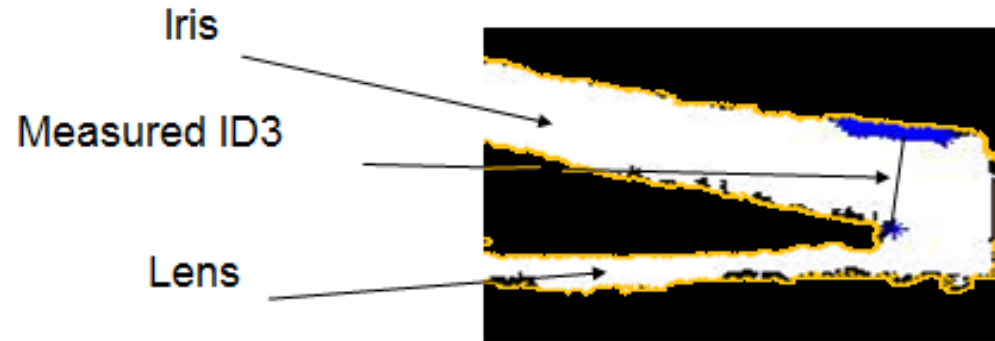


# Measuring ID2

- Subtracts the lens
- Determines The angle of the iris
- Overlays and measures a line perpendicular to the iris 2mm from the Scleral spur



# Measuring ID3



- Makes a second attempt to find the iris lens apex
- If not found
  - Measures ID3 as the longest line closest to the end of the iris
- Selects multiple points and selects the shortest as ID3, ensuring that it is perpendicular to the iris

# Results

- This system isolates the iris successfully and showed a percent difference from manually measured images:
  - ID1: 6.9%,
  - ID2: 8.7%,
  - ID3: 9.2%,
- Results are easily superimposed on the images
- Can be verified, and failures are visible.

# Conclusion

- This image processing system implements an algorithm to isolate and measure the thickness of the iris.
- It would be of interest in a dose-response study to assist patients at risk of Glaucoma.

# References

1. R.Youmaran, P.Dicorato, R.Munger, T.Hall, A.Adler, “Automatic Detection of Features in Ultrasound Images of the Eye”, *IEEE Conf Instrum Meas, pp. 1829-1834, Ottawa, Canada, 17-19 May, 2005*
2. Pavlin CJ, Harasiewicz K, Foster FS, “Ultrasound biomicroscopy of anterior segment Structure in normal and glaucomatous eyes”, *Am J Ophthalmology, 113:381-9, 1992*
3. Daneshvar H., Brownstein S., Mintsoulis G., Chialant D., Punja K., Damji KF., “Epithelial ingrowth following penetrating keratoplasty:A Clinical, Ultrasound Biomicroscopic and Histopathological Correlation”, *Can J Ophthalmology, 35:222-224, 2000*