Identifying Age-Related Macular Degeneration from OCT Images

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Introduction

- Age-related macular degeneration (AMD):
  - Affects 8 million people in the United States
  - Early diagnosis leads to earlier treatment
  - Indicated by deposits called drusen
  - Symptoms – drusen structures
 - Diagnosis
  - Treatment

Introduction

- Stages of AMD:
  - 1: No AMD – a few small or no drusen
  - 2: Early AMD – several small, some intermediate
  - 3: Intermediate AMD – several intermediate 1+ large
  - 4: Advanced AMD – geographic atrophy and/or choroidal neovascularization – vision loss

Introduction

- Optical Coherence Tomography (OCT):
  - Uses interferometry to obtain images
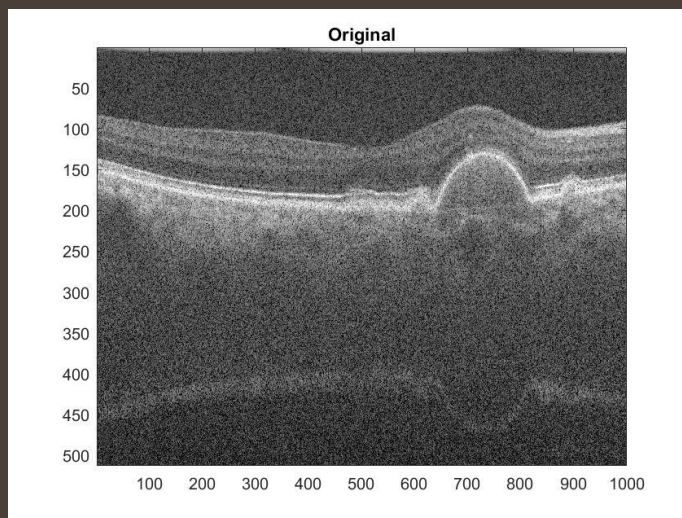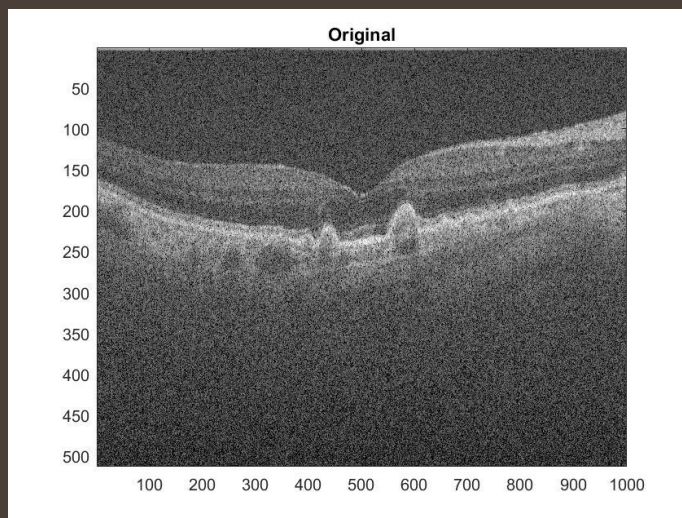 - Very high resolution of surface features
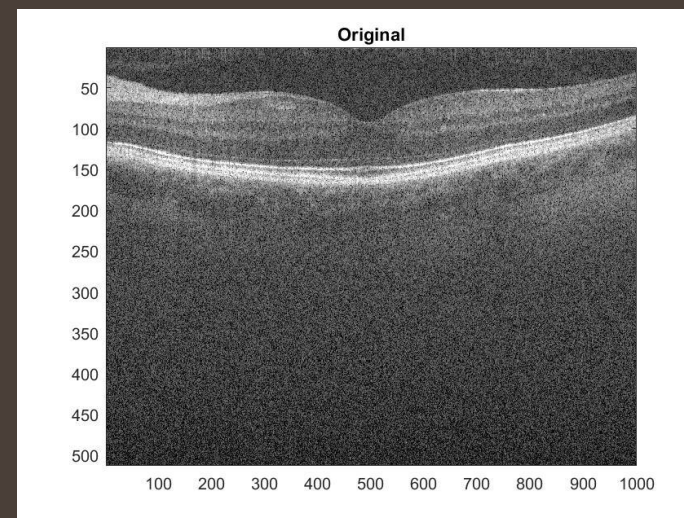
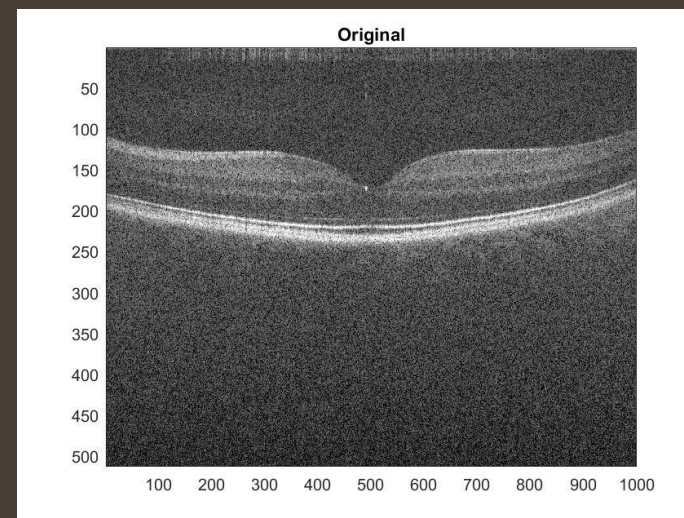# Introduction
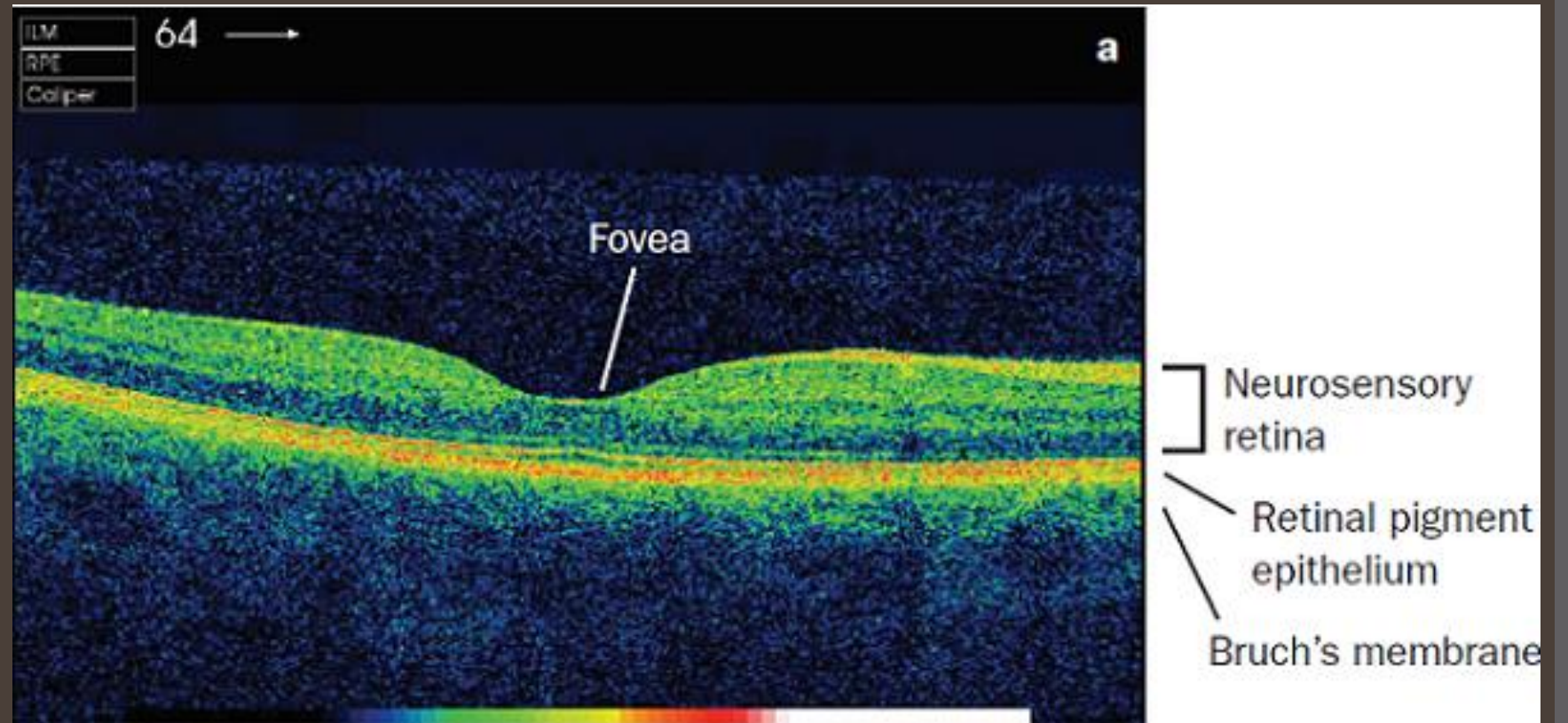
Introduction

- Dataset from Duke University
  - 384 patients
  - 269 AMD patients
  - 115 control
  - 100 images per patient
  - Depth varies with center of fovea at image 50
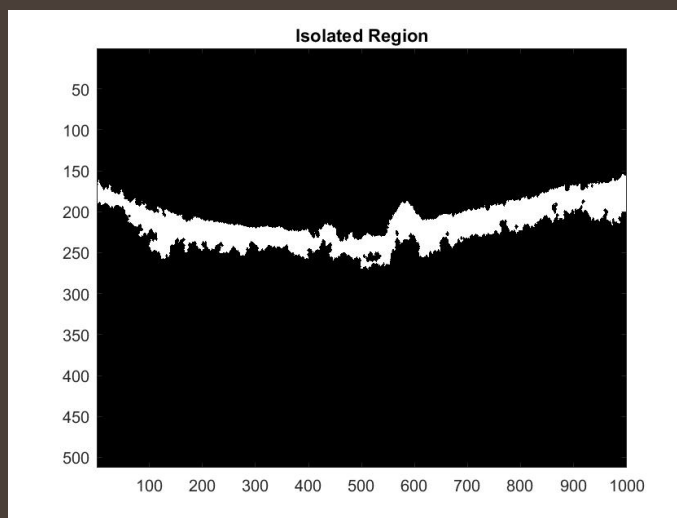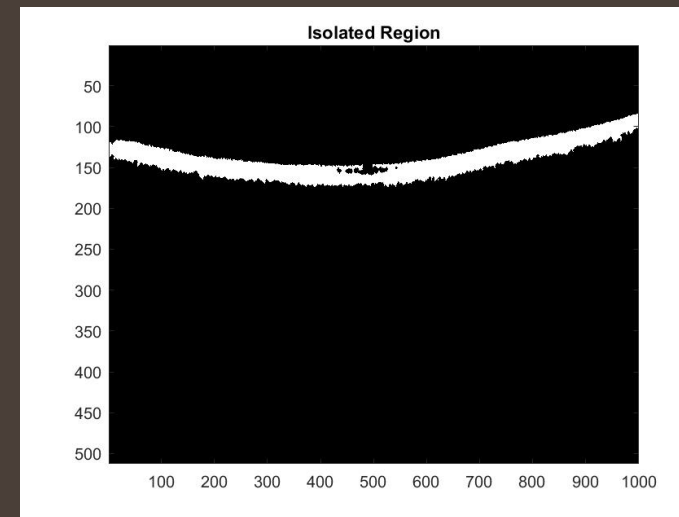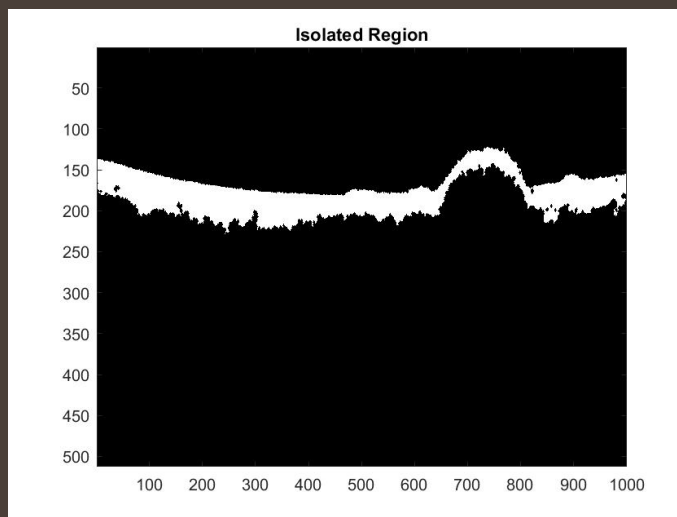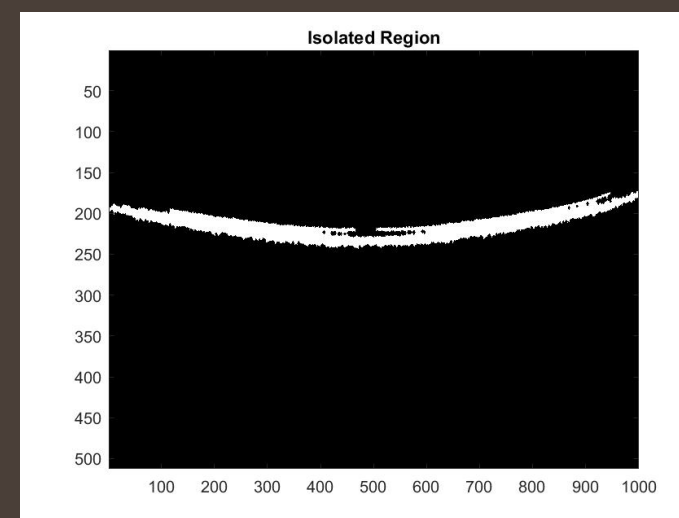
AMD

Control

Original Images

Methods

- Image filtering and binarization
- Isolating Retinal Pigment Epithelium
- Isolating RPEDC upper boundary as the working signal
- Filtering the signal
- Analyzing the power spectra and autocovariance of the signal
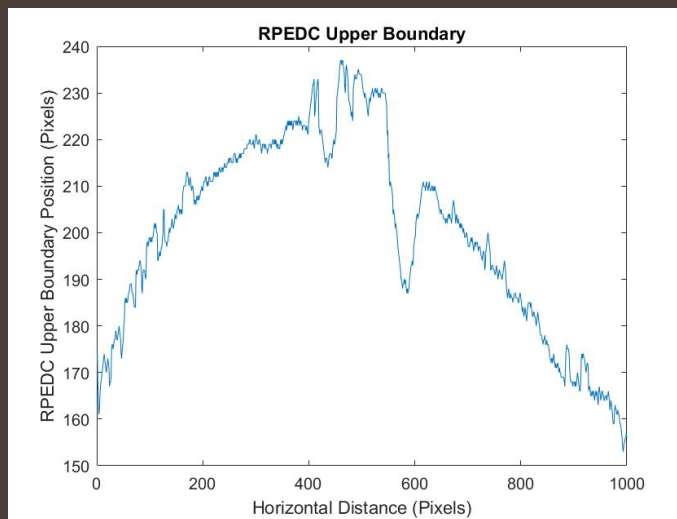
AMD

Control

Processed Images
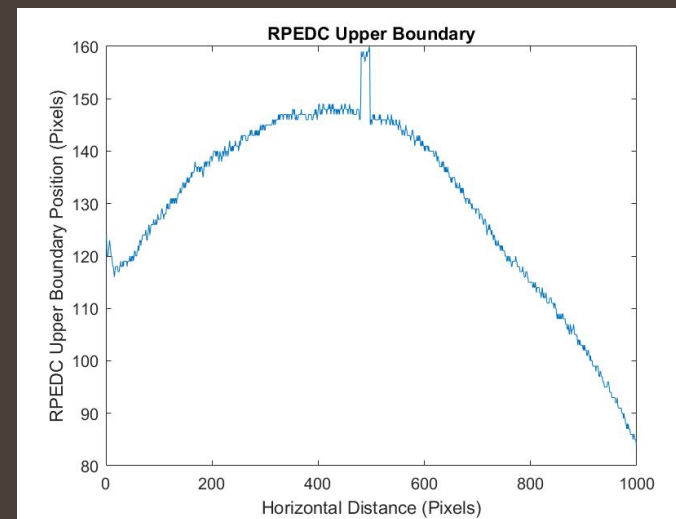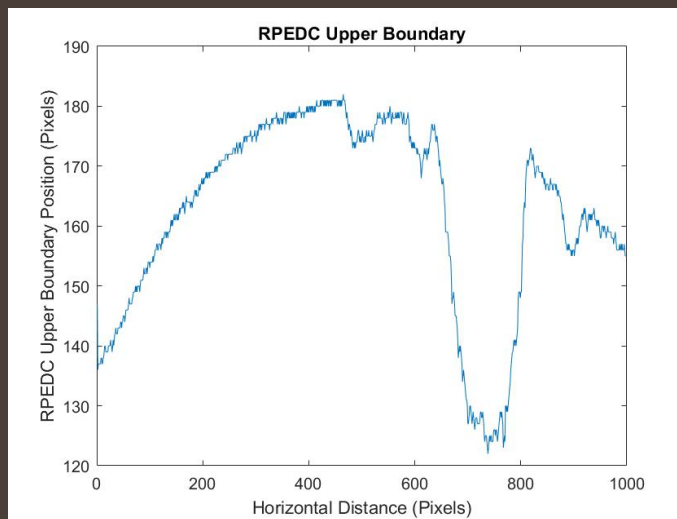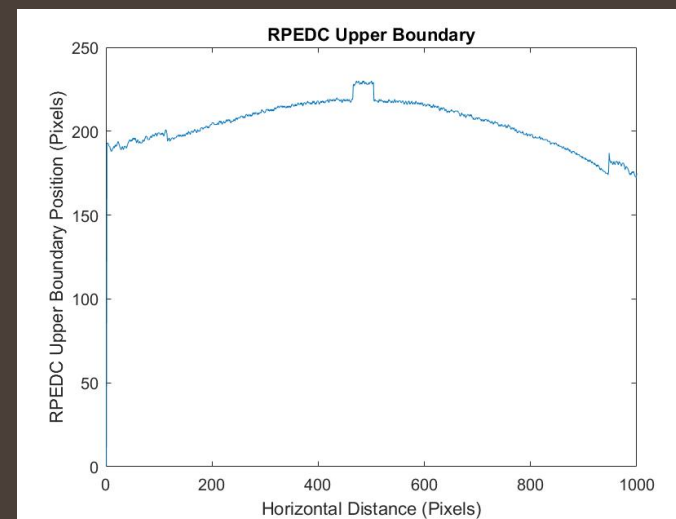
Methods - Signal Acquisition

- Windowing / Thresholding – treat everything below 50% as black – "imadjust" function

- Fill Holes – Morphological operation

- Wiener Filter – adaptive low pass filter for smoothness – "wiener2" function

- Removing small image regions "bwareaopen" function

- Erosion and dilation – small disk – "imclose" function
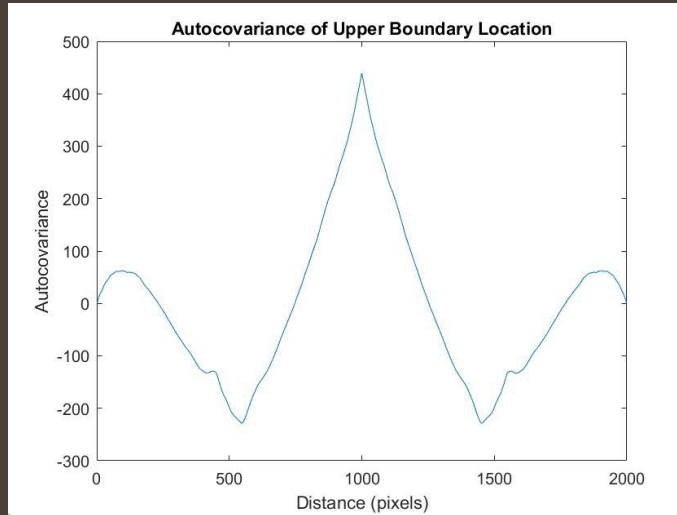
AMD

Control

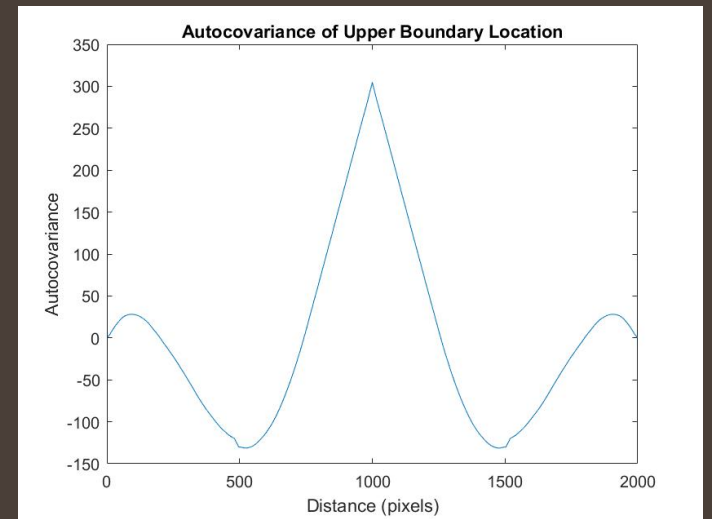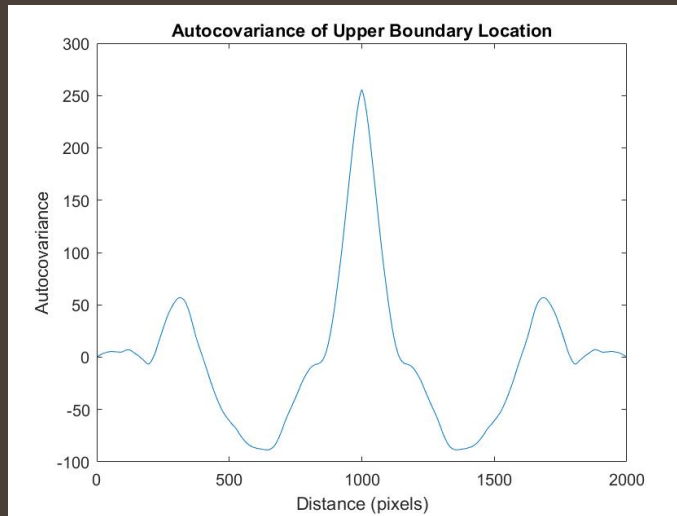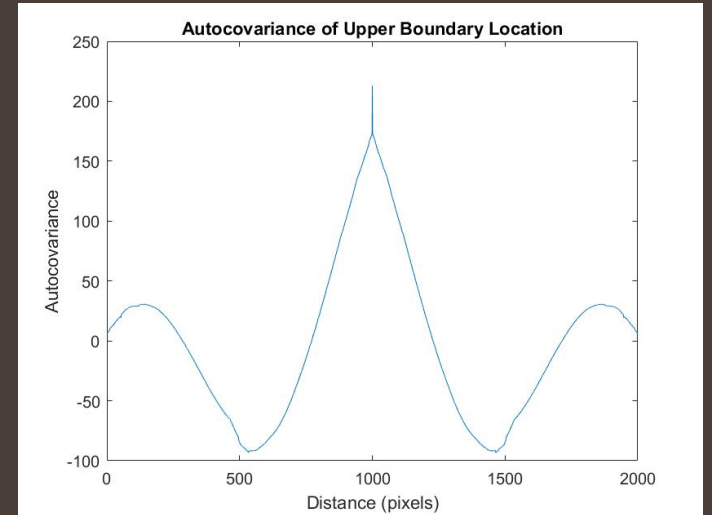Signals

Methods – Signal Processing

- Removal of the mean

- Differentiation

- Median filtering

- Autocovariance calculation

- Power spectrum calculation

- Average power calculation

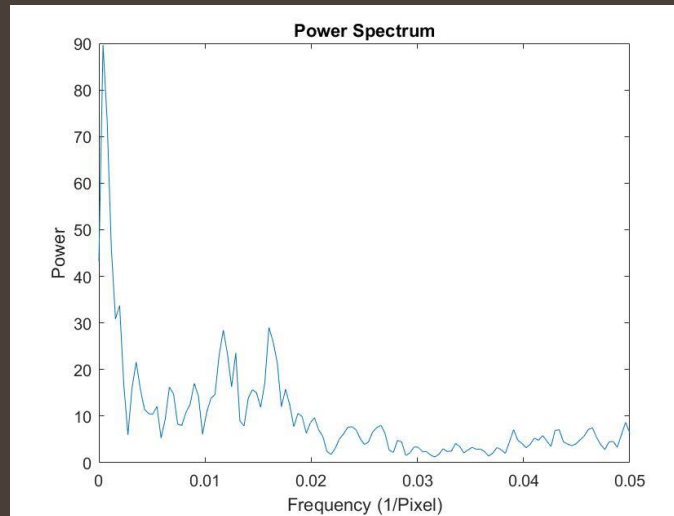- Comparison of average Power for AMD vs Control Samples
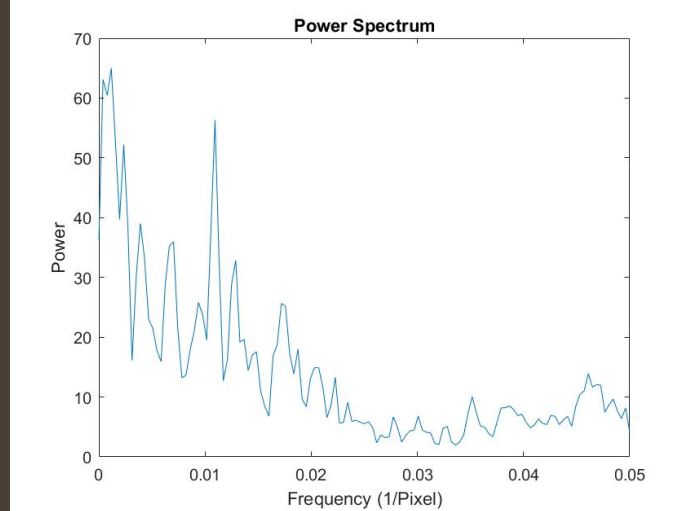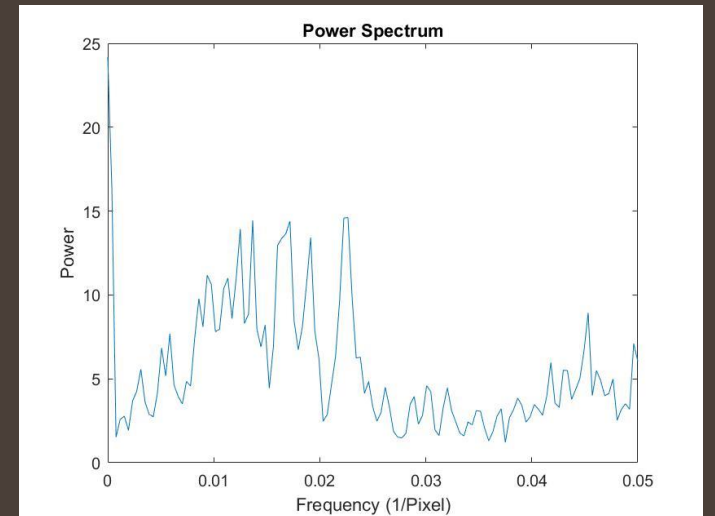
Results - Autocovariances

AMD

Control

Results - Power Spectra

AMD

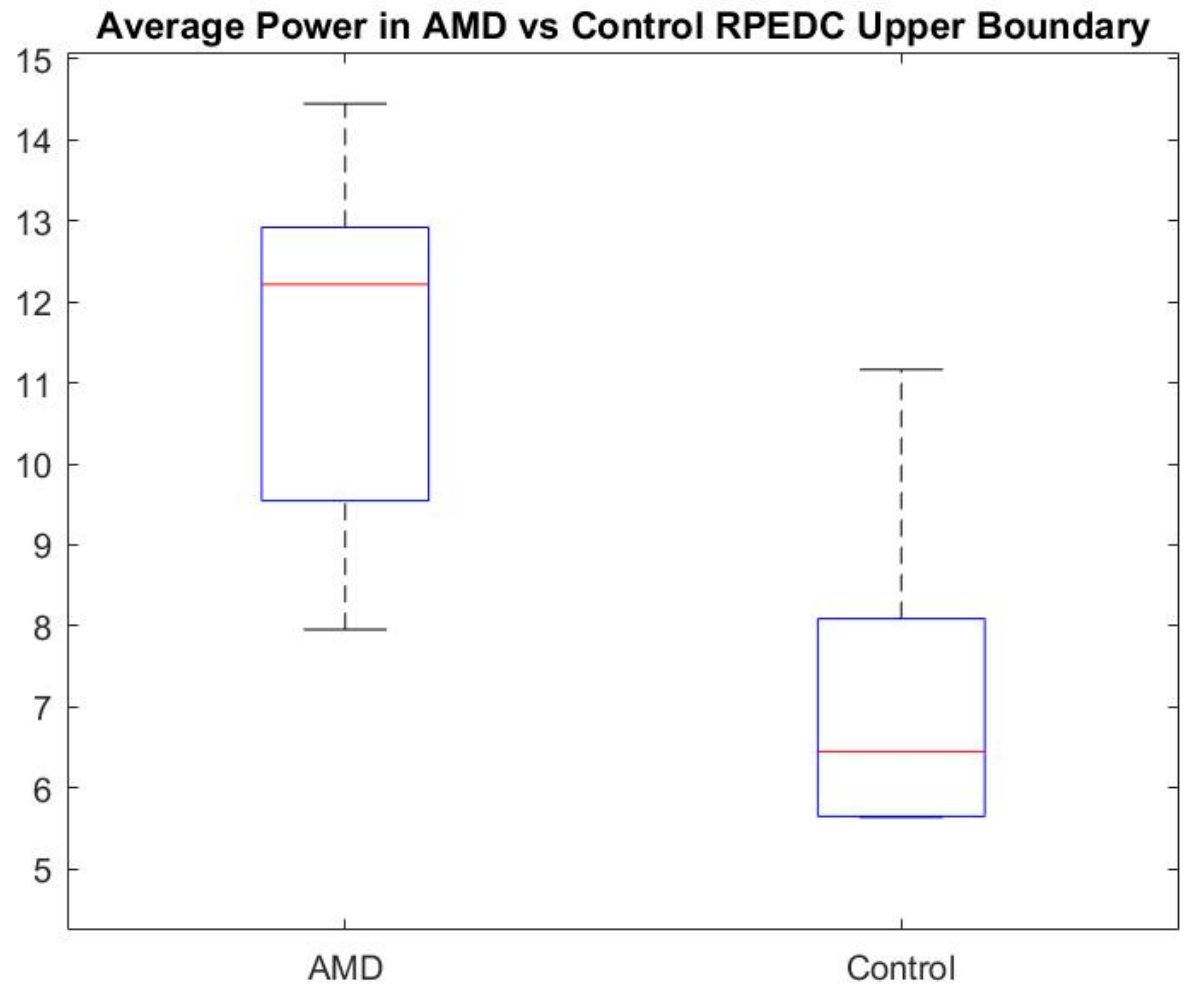Control

Results - Comparisons

Average Power in AMD vs Control RPEDC Upper Boundary
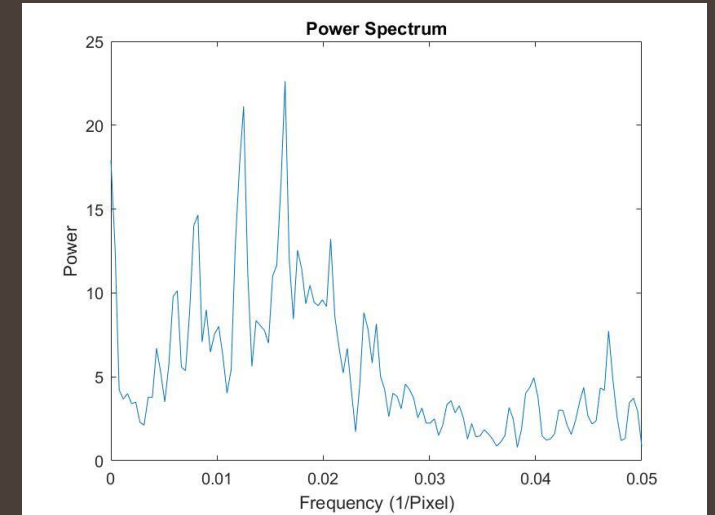
Summary

- RPEDC suggests useful clinical information for eye diseases

- OCT yields eye high quality images including RPEDC

- Processing OCT eye images provided a signal: RPEDC upper boundary

- Signal processing provided autocovariances and power spectra for analysis

Conclusions

- Autocovariance provided little information

- Average power was significantly higher in AMD samples than in control samples

- Greater number of samples need to be processed to create a classifier from the signal

- Average power may represent a useful method for classifying AMD from OCT images

References

- [1] Farsiu, S., Chiu, S. J., Oconnell, R. V., Folgar, F. A., Yuan, E., Izatt, J. A., & Toth, C. A. (2014). Quantitative Classification of Eyes with and without Intermediate Age-related Macular Degeneration Using Optical Coherence Tomography. *Ophthalmology*, *121*(1), 162–172. doi: 10.1016/j.ophtha.2013.07.013.