Adaptive optics imaging applications to understand the structure and function of the human visual system

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Introduction

Optical Coherence Tomography (OCT) is a form of optical imaging employing light interference to visualize the retinal layers. The retina is composed of several layers; however, the primary layer of interest for this study is the outer nuclear layer (ONL). The nuclei of the light-sensitive photoreceptor cells are located in the ONL; these cone and rod cells enable humans to see.

Objective

The goal of this research study is to analyze the OCT images of a dataset of 50 normal-sighted individuals to quantify ONL thickness within the OCT images.

Methods

ITK-SNAP is a software program specifically designed for OCT analysis. The ONL was manually segmented out from each of the OCT scans in the dataset using this software in preparation for volume and density measurements.

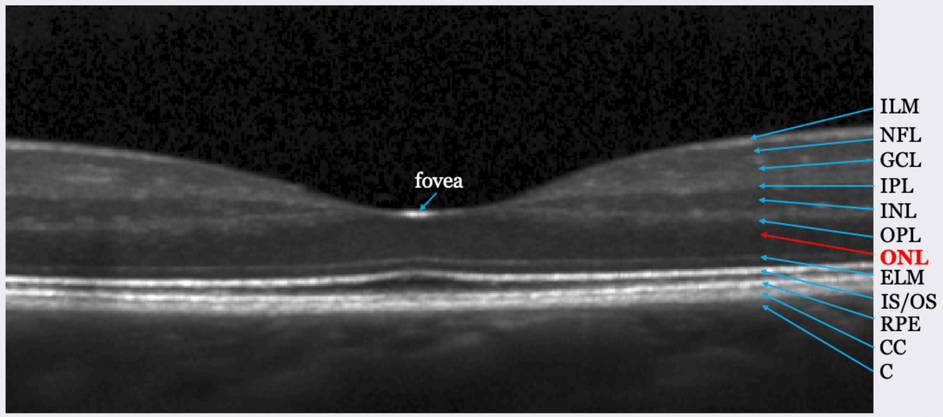

Figure 1: OCT scan from dataset with all retinal layers labelled

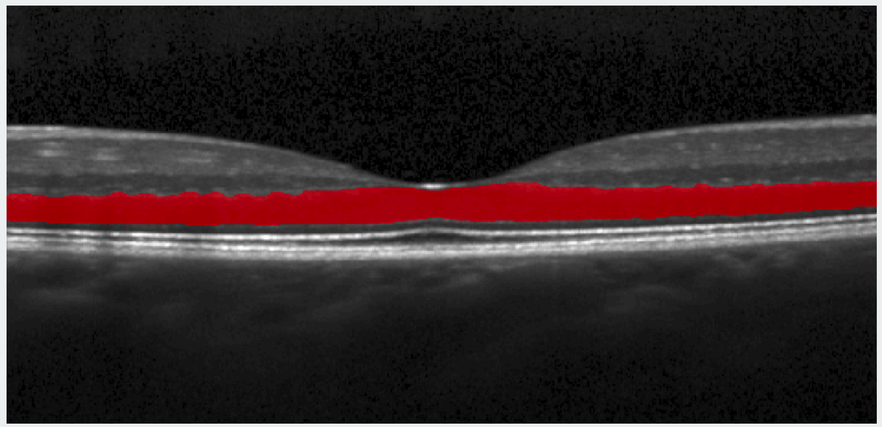

Figure 2: Same OCT scan with ONL segmentation identified in red

Discussion

The ONL segmentations performed in this research serve as a primary step to calculate and analyze the thickness of the retinal layer housing the photoreceptor nuclei. These measurements will enable a normative measure of ONL thickness across the population, and will allow us to examine individual variability within normal-sighted controls, and will enable comparison to retinal disease.

Future Research

This OCT images used in this research constitute part of a larger dataset examining the full visual system. Future work will correlate ONL thickness findings to measures of photoreceptor density, ganglion cell tissue volumes, and visual cortex area. The data analysis completed in this project will contribute to our overarching goal of creating a comprehensive database of the human visual system from cones to cortex.

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