

# Automated Intelligent Systems for the Analysis of Optical Coherence Tomography Images in Eye and Skin Applications

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**Abstract**— Optical coherence tomography allows *in vivo*, non-invasive imaging of tissue. We present two systems developed for the analysis of OCT images. AGARPLUS is developed for anterior segment ophthalmic imaging to automatically segment, measure and differentiate glaucoma subtypes. ASHIMA is developed for dermatological imaging to identify and separate the components of a skin OCT image for enhanced visualization and assessment of skin layers. Such systems could assist clinicians in the analysis of OCT images, with potential applications in screening and workflow improvement.

## I. INTRODUCTION

Optical coherence tomography (OCT) is an emerging optical imaging technique for *in vivo* two-dimensional or three dimensional imaging of tissue. OCT is based on interferometric principles, allowing the generation of a depth-resolved scan with axial resolutions of less than  $10\mu\text{m}$ . Unlike computed tomography which uses ionizing radiation, OCT is non-radiative, typically using light in the near infrared range of 800nm to 1500nm, depending on the optical scattering properties of the tissue being observed. One limitation of OCT is the limited penetration depth of a few millimeters compared to ultrasound, CT or MRI imaging. This makes the modality most suitable for the imaging of relatively thin or shallow tissue. These characteristics make OCT most suitable for use in ophthalmology, where it has found widespread use as a standard imaging protocol, as well as increasing use in dermatology, cardiology and gastroenterology.

## II. AUTOMATED INTELLIGENT ANALYSIS FOR OCT

Clinical use of OCT allows non-invasive imaging, often generating a three dimensional volumetric scan of the tissue. However, analysis and visualization of the acquired volume is still a time-consuming and manual task, and can be challenging for inexperienced users. We describe the motivation and development of intelligent systems for the imaging of the eye (AGARPLUS) and skin (ASHIMA).

### a. AGARPLUS

Imaging the anterior segment of the eye is an important part of the clinical workflow in the assessment and

differentiation of glaucoma subtypes. This is done by evaluating the region between iris and the cornea for open or closed angle glaucoma. AGARPLUS is an intelligent system which performs automated analysis of anterior segment OCT images. The system has been evaluated on major current AS-OCT, achieving a performance of more than 0.9 AUC using advanced deep learning techniques.

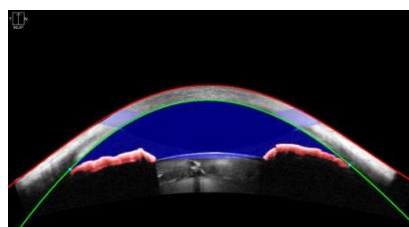


Figure 1. AGARPLUS Segmentation of AS-OCT Image.

### b. ASHIMA

Currently, the gold standard for analyzing skin lesions is via excision and biopsy of the excised tissue. This is not desirable for many conditions and patients, especially children and women. Recent advances in OCT could allow *in vivo* imaging of skin conditions to reduce or avoid the need for biopsies. ASHIMA is an automated system developed to aid dermatologists in the analysis of skin OCT images, through segmentation and visualization of the components of the image (air, epidermis, dermis). This allows clinicians to better identify and quantify the severity and extent of skin conditions.

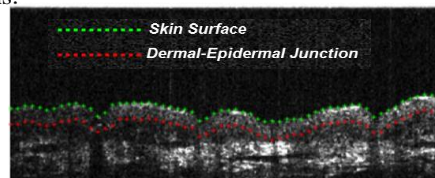


Figure 2. ASHIMA detection of skin layers in skin OCT

## III. CONCLUSION

We present two intelligent systems for the automated analysis of optical coherence tomography images in ophthalmological and dermatological applications.

## REFERENCES

- [1] Fujimoto J., Drexler W. (2008) Introduction to Optical Coherence Tomography. In: Drexler W., Fujimoto J.G. (eds) Optical Coherence Tomography. Biological and Medical Physics, Biomedical Engineering. Springer, Berlin, Heidelberg

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