

## MASTER IN PHOTONICS – PHOTONICS BCN EUROPHOTONICS-POESII MASTER COURSE

### PROPOSAL FOR A MASTER THESIS

Dates: 2019

**Laboratory:** Center for Sensors, Instruments and Systems Development (CD6)  
**Institution:** Universitat Politècnica de Catalunya  
**City, Country:** Terrassa

**Title of the master thesis:** Segmentation and extraction of clinical features from ophthalmic OCT images.

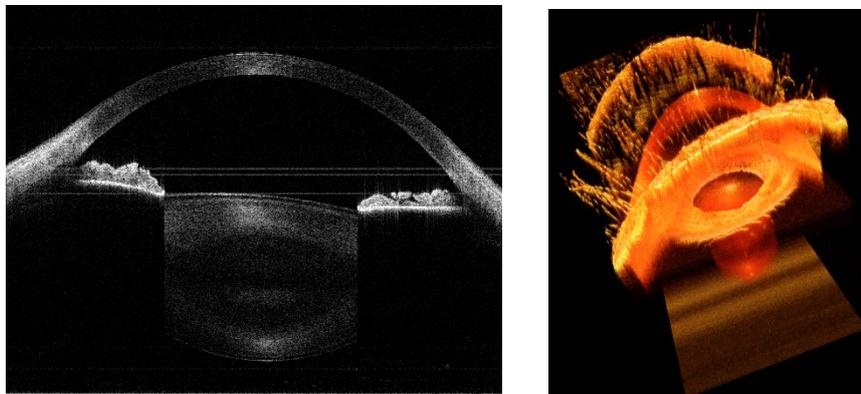
**Name of the master thesis supervisors:**

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**Summary of the subject:**

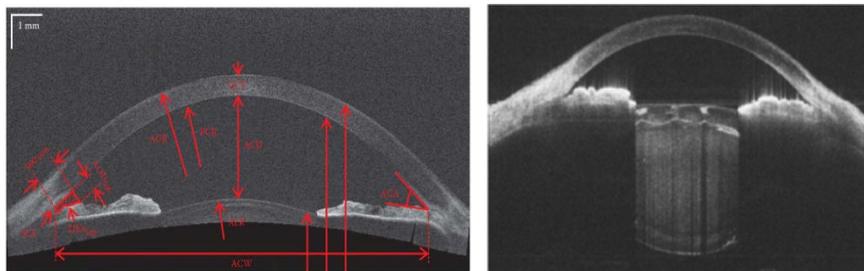
Optical coherence tomography (OCT) has revolutionized ophthalmology since its invention around 25 years ago, providing in vivo non-invasive images of the structures of the eye with unprecedented axial resolution and penetration depth. At CD6 we have developed a custom OCT system with extended coherence length that permits to image the whole anterior segment, which is the most external part of the eye, see Fig. 1.



**Fig. 1** left) OCT image of a healthy subject, right) Volume rendering of a set of 2D tomograms.

Your master thesis project will consist in analysing the images provided by the system and extract quantitative information of clinical relevance from them. You will segment the images and extract biometric parameters of the anterior segment, such as the thickness of the cornea, the depth of the anterior chamber, the wideness of the iridocorneal angle..., as in Fig. 2 left). These parameters are of utmost importance in the diagnosis of ocular pathologies and in the clinical decision making and planning of eye surgeries. You will also analyse the presence of opacities in the ocular media, which degrades the patients' vision quality. Ocular opacities typically cause the OCT signal to be backscattered into the detection channel, appearing as bright regions in the OCT images, as you can see in Fig. 2 right).

Our system will be tested in a clinical environment at the Institute of Ocular Microsurgery (IMO), a renowned Ophthalmology hospital located in Barcelona. We will compare our system's performance with a commercial OCT for anterior segment imaging. You will have the opportunity to participate in this clinical study.



**Fig. 2** left) OCT image of a healthy subject, middle) Biometric parameters of the anterior segment of the eye [1] and right) cataract patient [2].

**Keywords:** optical coherence tomography, OCT, anterior segment imaging, ophthalmic imaging, segmentation of clinical images, biomedical photonics

#### **Additional information :**

\* Required skills: Self-motivated, objective-driven, capable of autonomous working within a multidisciplinary team. Basic concepts in Signal Processing and Image segmentation and MATLAB/Labview knowledge will be considered, but are not essential.

\*Do you want more information? Check the references below or contact us!

[1] Artal, P. (2017) Handbook of Visual Optics, Volume Two: Instrumentation and vision correction. Chapter 4: Anterior Segment. CRC Press – Taylor and Francis group.

[2] Grulkowski, I., Manzanera, S., Cwiklinski, L., Mompeán, J., de Castro, A., Marin, J. M., & Artal, P. (2018). Volumetric macro- and micro-scale assessment of crystalline lens opacities in cataract patients using long-depth-range swept source optical coherence tomography. *Biomedical Optics Express*, 9(8), 3821. <https://doi.org/10.1364/BOE.9.003821>