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The Institute  
of Photonic  
Sciences



## **Master in Photonics – “PHOTONICS BCN” Master ERASMUS Mundus “EuroPhotonics”**

### **MASTER THESIS PROPOSAL**

**Dates: April 2021 - September 2022**

**Laboratory:** Centre for Sensors, Instruments and Systems Development (CD6)

**Institution:** Universitat Politècnica de Catalunya (UPC)

**City, Country:** Terrassa, Spain

**Title of the master thesis:** *Multispectral imaging for automatic eye fundus evaluation*

**Name of the master thesis supervisor and co-supervisor:** Francisco J. Burgos, Meritxell Vilaseca

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**Keywords:** photonics, multispectral imaging, artificial intelligence, eye fundus.

### **Summary of the subject (maximum 1 page):**

The evaluation of the eye fundus through Photonics provides fast and precise information by means of non-invasive techniques. Recently, multispectral imaging has been applied to this purpose, becoming very valuable for ophthalmologists. This technology acquires images for more than three channels or spectral bands, which allows to obtain spectral data and not only colour information. This analysis is extremely useful since the spectral response depends on the chemical composition of the tissue, offering a better discrimination among healthy and diseased structures such as drusen or epithelial atrophies. Latest advances have been focused on using smartphones to assess the eye fundus since images with high spatial resolution can be obtained, a minimum training is required and they are economically more affordable than conventional eye fundus cameras. Additionally, artificial intelligence algorithms (machine and deep learning) have proven to be very efficient when applied to the classification of biomedical images in different fields. The preliminary results obtained when applying these techniques to multispectral eye fundus images have shown an accurate classification between healthy and diseased patients. For the next steps of this project, we look for a motivated and enthusiastic student with good team working skills.



The main points that will be carried out by the student during the completion of the M.Sc. thesis are the following ones:

1. Look for bibliographic information to be able to offer more ideas in the design of a new smartphone-based multispectral camera.
2. Characterization of the different elements of the device: illumination system, optics and imaging sensor.
3. Participate in the first tests of the developed device with patients.
4. Image processing and evaluation of the multispectral data obtained.
5. Testing the performance of deep learning techniques for the classification of multispectral eye fundus images.
6. Discuss the results with other works in the state of the art for similar approaches.

It is desirable that the student has the following knowledge/skills in:

1. Optometric/ophthalmological background for eye fundus diagnosis.
2. Spectral and spectroscopic analysis of biological tissue.
3. Clinical training for using ophthalmological equipment.
4. Image processing.