

PHOTONICS - EUROPHOTONICS MASTER COURSE

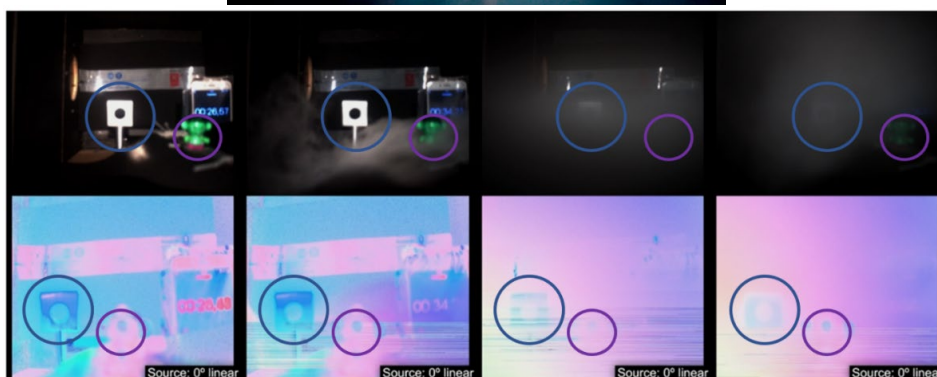
PROPOSAL FOR A MASTER THESIS

Dates: April 1st, 2020 – September 30th, 2020

Laboratory: Centre for Sensors, Instrumentation and systems Development (UPC-CD6)
City, Country: Terrassa, Spain

Title of the master thesis:

EVALUATION OF IMAGING CONDITIONS THROUGH FOGGY SCENES FOR OBSTACLE RECOGNITION



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Keywords :3D imaging, lidar, polarimetric imaging, optical metrology, scattering, bad weather, AI training

Summary of the subject (maximum 1 page):

Which is the problem?

In outdoor scenarios, imaging systems may become limited by adverse atmospheric conditions which partially or completely degrade light detection procedures. Applications involving fog, rain, sand or smoke get severely hampered by absorption or scattering phenomena happening in the propagation. In the currently outstanding field of self-driving, detection under degraded vision conditions is an unsolved problem that is being tackled by many companies and research groups around the world.

At CD6, a line of research is focused in improving detection under those conditions using non-standard techniques, such as polarimetric imaging. Due to this, a fog experimental set-up is already operative to study adverse weather conditions at small scale and in controlled conditions.

What will you do?

This project aims to perform the identification and characterization of the different imaging conditions available (RGB cameras, polarization, active imaging...), depending on the different features of real-world scenes, and to investigate which has better performance and potential using the experimental set-up available at CD6. Special interest will be given to polarimetric acquisitions since polarized beams are known to penetrate better into this type of media, and thus to be able to provide better observation methods under scattering.

First of all, a characterization of the experimental set-up will be necessary. A simple acquisition environment for performing tests and the related image processing procedures will be developed to enable a fast interchange of the different imaging modes within a given scene. Then, different designed experiments will be carried out. Finally, a theoretical interpretation of the results will be obtained as well as the development of a comprehensive comparison among the different used techniques. As final goal, exploring the development of object recognition algorithms using deep learning could be explored using the results obtained from the experiments.

Is this TFM for you?

This is an applied thesis work with unsolved challenges. It involves a variety of optics, image processing and simulation techniques applied towards the solution of a real-world problem. This Thesis is for you if you are interested in applications of imaging for degraded visibility conditions, active imaging, and if you like technical challenges solved within a team using the latest technology developments.

Additional information

* A monthly allowance is possible depending on value of candidate. In any case allowance requires full-time dedication and early incorporation, even part-time in the first months. Contact for details.

* Recommended skills:

Interest in application-driven experimental work for solving real-world problems.

Search of resources, both scientific and technical.

Self-motivated, objective-driven, capable of autonomous working within a multidisciplinary team.

Basic concepts in optical metrology and optical engineering.

Programming (C++, MatLab) and use of scientific software packages (Labview) recommended.

* Miscellaneous :

This thesis contents will be considered confidential due to its closeness to market.

Consolidated research team with several years of experience in the topic.

Multidisciplinary environment with electronics and mechanics workshops, and specialists and technicians in metrology, optics, mechatronics, and electronics.

Possibility of joining the Centre for a PhD/Project Manager career in case of common interest.

Early incorporation welcome.