



#### 4th Term - MSc Proposal

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| MSc title:<br>Robotic navigation using stereoscopic vision and polarization imaging | Host University:<br>Burgundy |
|   | Supervisor:<br>Olivier Morel |

#### Brief description of the project:

**Abstract :**

The project consists in studying and developing a stereoscopic bench prototype that both combines stereoscopic vision and imaging polarimetry in order to detect water bodies. In real time, the system has to provide three-dimensional information and has to prevent the robot from moving towards stretch of water.

Polarization imaging has emerged over the past two decades as a powerful tool to enhance the information available in a variety of remote sensing applications. After being reflected, an unpolarized light becomes partially linearly polarized. Contrary to sand or grass, water bodies provide highly polarized light and can be detected by measuring the degree of polarization of the reflected light.

We plan to use polarizing filters with 120° step in front of three cameras. The first step of the project is to carefully calibrate the cameras. Then, the second step is to develop robust matching algorithms : since the cameras have polarizers with different orientation, the gray level will change when the light is partially linearly polarized. Finally, the polarization parameters and the three-dimensional information will be computed.

**References :**

J. Scott Tyo, Dennis L. Goldstein, David B. Chenault, and Joseph A. Shaw, « Review of passive imaging polarimetry for remote sensing applications », Applied Optics, Vol. 45, No. 22, 5453-5469, 2006.

L. B. Wolff, « Polarization Vision: a New Sensory Approach to Image Understanding », Image and Vision Computing, Vol. 15, 81-93, 1997.

L. B. Wolff, « Applications of Polarization Camera Technology » IEEE Expert: Intelligent Systems and Their Applications, Vol. 105, 30-38, 1995.

D. Scharstein and R. Szeliski : A Taxonomy and Evaluation of Dense Two-Frame Stereo Correspondence Algorithms, International Journal on Computer Vision, Vol 47, num 1-2-3, April-June 2002

#### Software/Hardware needs:

The candidate must be trained in stereovision and should have some programming skills.

#### Special remarks:

The candidate will also be supervised by Simon Lacroix (LAAS CNRS). He will spend some weeks in Toulouse in the LAAS Laboratory.

Submit a single page proposal.

Host University: Bourgogne/Heriot-Watt/Girona

Software/Hardware needs: Detail the programming platform (matlab, C++, etc) and the lab facilities required for the project (cameras, acquisition cards, lasers, etc).