Real-time multimodal semantic scene understanding for autonomous UGV navigation.

Speciality: Instrumentation and Computer Vision

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Project description
Semantic scene understanding is a crucial requirement for safe autonomous navigation of robots and vehicles. Several methods and techniques have been developed and some are currently being used in commercial cars for pedestrian detection, road features detection, etc.
However, even in structured environments such as urban roads, these methods still face several challenges such as the detection of water and puddles, or the detection of glass and other reflective surfaces.
The main goal of this thesis proposal is to demonstrate the benefits of using different imaging modalities, including color and polarimetric imaging, for semantic description of a UGV (unmanned ground vehicle) environment. In particular, we would like to address the following issues:
- the best exploitation of polarimetric information
- the best fusion strategy of the different information
- the detection and classification of objects of interest in the scene

The PhD thesis will involve both theoretical and experimental works. The selected student will have to conduct real outdoor experiments to validate the proposed algorithms. The research team will provide all necessary guidance, training and technical assistance.

Note also that this thesis work will be aligned with currents projects of the team, including the VIPer project funded by the National Research Agency (ANR) and whose main goal is to develop an experimental platform using polarimetric vision.

Application
The thesis will take place at Le2i laboratory of Université de Bourgogne Franche-Comté (Le Creusot). Interested candidates must send to the contacts, **in a single PDF file, before 5th June 2017**:
- a detailed CV,
- a motivation letter explaining the interest in the topic and suggesting ideas for solutions,
- the names and contacts of at least two referees.

Requirements for application
- Candidates must hold, or be about to obtain before September 2017, a master degree in vision, robotics, computer vision, mathematics, electrical engineering or related fields.
- Candidates must show excellent programming skills in C++ and/or Python. Knowladge of OpenCV/PCL libraries and ROS Middleware would be highly appreciated.
- **Knowledge of French is not a prerequisite**.

References

[1] Rankin, A. L. & Matthies, L. H. Passive sensor evaluation for unmanned ground vehicle mud detection J. Field Robotics, 2010, 473-490

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[3] Scherer, S.; Rehder, J.; Achar, S.; Cover, H.; Chambers, A.; Nuske, S. & Singh, S. River mapping from a flying robot: state estimation, river detection, and obstacle mapping Autonomous Robots, Springer, 2012, 33, 189-214

[4] Eitel, Andreas, et al. "Multimodal deep learning for robust rgb-d object recognition." Intelligent Robots and Systems (IROS), 2015 IEEE/RSJ International Conference on. IEEE, 2015.