

Affordable and Reliable Automated Recognition and Tracking

Summary

The candidate will be part of a team developing a camera system which can detect, classify and track objects in real-time using embedded vision. The thesis will use commercial surveillance grade RGB and / or IR cameras such as the Mobotix S16 for observations both in air and underwater. The total cost of the system should not exceed 10,000 EUR. The focus of this project will be to address two major research questions: (1) How can we preprocess images in near real-time (e.g. homomorphic filtering, Gaussian blurring) in order to improve machine learning (e.g. YOLO) recognition and tracking performance for embedded vision? (2) Can multispectral (e.g. RGB+IR) increase the reliability of embedded vision recognition and tracking systems? The results of this 4-year PhD thesis are fundamental, and will be important to a broad range of disciplines including industrial automation, indoor and outdoor security, underwater robotics and environmental monitoring.

Research field:	Information and Communication Technology
Supervisors:	Jeffrey Andrew Tuhtan Mairo Leier
Availability:	This position has been occupied.
Offered by:	School of Information Technologies Department of Computer Systems
Application deadline:	Applications are accepted between September 01, 2020 00:00 and October 02, 2020 23:59 (Europe/Zurich)

Description

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The research carried out by the PhD candidate will create new embedded software to perform object recognition and tracking in near real-time, here defined as a delay of 60 seconds or less. The methods will incorporate data collected by commercial-grade RGB, IR and / or thermal imaging sensors such as those implemented by the Centre of Biorobotics in their commercialized "HYDROCAM" system, which uses Mobotix S16 surveillance cameras. A key component of this research work is to explore, develop and test new algorithms across different temporal and spatial scales, and make use of the interactions between these scales to improve the speed and robustness of embedded recognition and tracking in laboratory and outdoor conditions. Two real-world tests will be used: the first test site is on a ferry in Estonia and Denmark, where vehicles will be classified, tracked and the data will be used to automate a commercial cargo loading solution. TalTech has a 2 year project using embedded vision to automate the cargo loading procedure on Ro-Ro vessels. In December 2020, TalTech will also start a 3 year research project with DFDS Group (Det Forenede Dampskibs-Selskab) and Denmark Technical University as an external partner to develop automatic trailer handling solution on Ro-Ro vessels. The second test sites will be based on imagery collected by the 30+ HYDROCAMS already installed throughout Europe which monitor fish passage at large hydropower plants. Therefore, the research objectives in this PhD are tied to two different commercial applications, making the research outcomes directly beneficial to the Estonian company, Eksotec OÜ which is the main commercial partner in this project.

Responsibilities and tasks

- Develop, test and validate the proposed embedded vision system.
- The results of the candidates work require that they must be able to write high-level journal publications, attend and present their work at leading national and international conferences.
- Supervision of BSc, MSc students as well as assisting in lectures and tutorials is also an important part of the candidate's role in order to prepare themselves for academic and professional advancement after completion of their PhD degree (15% of the candidates workload is teaching and supervision).

Qualifications / requirements:

- This position requires a candidate with a strong educational (MSc or equivalent) and professional background in Software Engineering / Data Science / Machine Learning / Computer Vision (available by the date of application).
- Ability to read, write and teach in English at the level of an internationally active junior researcher.

- Coursework: 60 ECTS; PhD thesis: 180 ECTS; Teaching and student supervision load of 10 – 20%.



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