Perception methods and navigation algorithms to enhance situational awareness and autonomous navigation capabilities of manned/unmanned surface vessels.

Summary

In this position, PhD candidate is expected to develop sea/ocean environment perception, navigation methods for future autonomous surface vessels. Using state-of-the-art deep learning models together with various environment sensing methods, the candidate is required to devise novel solutions that can help interpret the environment for safter ship navigation. Detection and recognition of diverse moving objects (ships, yachts, sailboats, etc), stationary objects (buoy) and characterization of different sea states (ice infested, breaking waves, etc) are the vital constituents of situational awareness for the ships which need to be addressed in this research.

Research field:	Environmental, marine and coastal technology
Supervisors:	Kristjan Tabri Dr. Dhanushka Chamara Liyanage
Availability:	This position is available.
Offered by:	School of Engineering Kuressaare College
Application deadline:	Applications are accepted between June 01, 2024 00:00 and June 30, 2024 23:59 (Europe/Zurich)

Description

The project focuses on the development of novel solutions to accelerate ship autonomy development. Using various sensing modalities, the aim is to research into state-of-the-art methods that can solve the ship perception problem under demanding sea conditions.

Thus far, maritime transport heavily depended on human capabilities in decision making with the help of marine sensors readouts, charts, etc. With the recent developments in deep learning, sophisticated intelligent vessels developments are making significant advances. As further advances are challenged by inadequacy of situational awareness methods for smart ships, it is vital to develop needy technologies. Combining long-range, short-range perception subsystems with coarse and fine sensing methods, accurate navigational charts need to be developed. Environment perception with navigational inputs will lead to further development of simultaneous localization and mapping algorithms for the surface vessels.

Machine vision incorporating RGB, thermal imaging, and perhaps spectral imaging could provide a significant amount of detailed visual data that can be used to scene understanding by employing deep convolution neural network models. LiDARs, RADARs, AIS equipment could further augment the perception by adding more details about the objects in the environment. ROS (Robot Operating System) provides a comprehensive array of tools that can easily implement required sensor signal processing algorithms. Optimizing those algorithms to run on embedded Linux devices is an essential step to implement and carry out field tests for validation of the outcomes.

Tasks

- Develop sea-state characterization methods.
- Develop navigational algorithms with multi-objective optimization.
- Plan and carryout experiments to validate the developed perception methods in virtual and or real physical environments.

Requirements

The call is open for candidates with necessary backgrounds inside and outside of Estonia who fulfils following requirements.

- A master’s degree in mechanical engineering, mechatronics, electrical engineering, computer science or a related discipline.

- Should possess a strong command in Python, C++, and C# programming languages.
- Prior experience on computer/machine vision projects using computer vision libraries (OpenCV), machine learning frameworks (Pytorch and Tensorflow)
- Good understanding of ROS, ROS2 (Robot Operating System) and ability to work on Linux environments.
- Competent in developing mechatronics systems by integrating various sensors.
- It would be highly desirable of having sound understanding on Point Cloud Libraries for LiDAR point clouds processing.
- Familiarity with OpenGL is a plus.
- Excellent academic writing skills with proven record of scientific publications in high impact journals and conferences. Experience in collaborative research/publication with the existing TalTech staff is considered as a plus.
- Must meet the requirements for doctoral students at the Tallinn University of Technology (https://taltech.ee/en/phd-admission).

During the assessment emphasis will be put on the candidate's potential for research, motivation, and personal suitability for the position.

Employment

The position is offered by the Marine Technology Competence Centre of Kuressaare College which belongs to School of Engineering of Tallinn University of Technology. The expected duration of doctoral studies is four years. Following the standard practice in the School of Engineering, the contract will be made initially for one year, then it will be extended further after a successful progress review. The salary is according to the salary system of Tallinn University of Technology.

The position will be fulfilled as soon as a suitable candidate is found. TalTech reserves the right for justified reasons to leave the position open or to extend the application period.

How to apply for a doctoral candidate position

Please read the admission guidelines at https://taltech.ee/en/phd-admission.

Further information

• Job location: Kuressaare, Estonia.

• For additional information, please contact Dhanushka Liyanage (email: dhanushka.liyanage@taltech.ee).

To get more information or to apply online, visit https://taltech.glowbase.com/positions/772 or scan the the code on the left with your smartphone.