Development of novel maritime navigation perception methods for autonomous surface vessels

Summary

In this position you will develop sea/ocean environment perception methods for future autonomous surface vessel (ships) navigation. Using novel deep learning models together with various environment sensing methods it is needed to create innovative solutions that can help interpret the environment for safter ship navigation. Detecting various moving objects (ships, yachts, sailboats, etc), stationary objects (buoy) and different sea states (ice infested, breaking waves, etc) are the vital constituents of situational awareness for the ships. Fusing different sensing approaches to derive a cohesive perception system is the goal of the work.

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 January 01, 2024 00:00 and January 22, 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 sub-systems with coarse and fine sensing methods, accurate navigational charts need to be developed. These high-resolution charts with high update frequencies lead to further development of simultaneous localization and mapping for the surface vessels.

Machine vision with RGB, thermal imaging, and perhaps spectral imaging could provide great detail of visuals that can be used to scene understanding by employing deep convolution neural network models. LiDARs, RADARs, AIS equipment 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.

Why is this research necessary?

- The future maritime transport will be highly relying on autonomous vessels.
- Improved situational awareness/environment perception could assist ship captains to make accurate decisions thus enhancing the safety of both crew and assets involved.
- Enhances greener transportation by optimization of routes, thus reducing energy consumption.
- Build advance technological competencies in maritime domain to be spearhead the development of ship autonomy.

Requirements & Qualifications

The call is open for candidates with a wide range of backgrounds inside and outside of Estonia. Most importantly, high level of interest and motivation towards, and deep understanding on, computer vision and mechatronics is required. A suitable background may come from mechanical, mechatronics, electrical engineering, computer science or related disciplines. The candidate should possess a good command in programming with Python and C#. Prior experience on working with computer/machine vision projects using computer vision libraries (OpenCV), machine learning frameworks (Pytorch and Tensorflow) are mandatory requirements. Furthermore, ROS (Robot Operating

System), and working on Linux environment are essential for the position. It would be highly desirable of having sound understanding on Point Cloud Libraries for LiDAR point clouds processing. The candidate should prove his/her capabilities in writing the technical report and scientific papers in high quality journals. Experience in collaborative research/publication with the existing TalTech staff is also a plus. The applicant for the position must have a Master's degree and must fulfil 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 your potential for research, motivation and personal suitability for the position.

Employment

The position is at the School of Engineering at 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 extended 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.

How to apply for a doctoral candidate position

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

Further information

- Job locations 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/742 or scan the the code on the left with your smartphone.