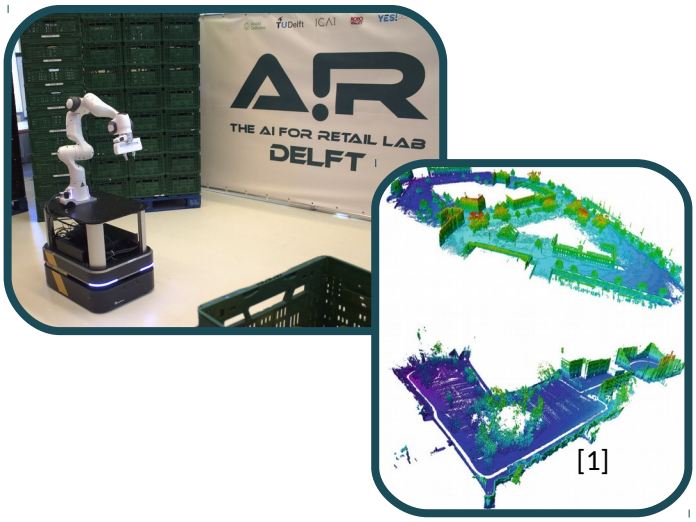
3D Semantic Labeling In Dynamic Environments

MSc. Project Proposal at the Autonomous Multi-Robots Lab, Cognitive Robotics, TU Delft

Brief description:

As the usage of mobile manipulators is shifting from confined environments towards more dynamic ones, autonomous robots require constant updates of their surrounding. In this context, multiple sensor inputs must be fused to create a representation of the free space. In contrast to mobile robots for which a 2D map is usually sufficient, mobile manipulators benefit from 3D-knowledge. Existing approaches are often limited to distinguish only between free and occupied space [1]. However, an interacting robot must be able to classify objects into different categories, such as static, dynamic, other agent or movable. Motion planners could benefit from such a classification as it increases the options for reaching a goal. Semantic labeling is a well known method in computer vision [2], but less explored in the context of mobile manipulation [3].

To allow a mobile manipulator to safely navigate in dynamic environments, methods for 3D map generation and updating should be explored and implemented. In a second step, obstacles should be identified and classified according to their level of possible interaction with the robot. After a theoretical description of the classification method, it should be implemented into the Robot Operating System (ROS) and tested with a given simulation environment. In the final stage, testing in a realistic mock-up store is desirable to verify the robustness and efficiency of the labeling method.



[1]

Desired qualities:

- Motivated and independent
- Good problem solving skills
- Experience in computer vision
- Preferably Experience ROS

Start Date: September 2020

For further questions or to apply, please contact M.Spahn <m.spahn@tudelft.nl>. When applying, please provide a short motivation, up to date CV, a transcript of your current degree program and intended start date.

Group information: http://www.autonomousrobots.nl/

References:

[1] A. Hornung, K. M. Wurm, M. Bennewitz, C. Stachniss, and W. Burgard. OctoMap: An efficient probabilistic 3D mapping framework based on octrees, 2013

[2] A. Garcia-Garcia, S. Orts-Escolano, S. Oprea, V. Villena-Martinez and J. Garcia-Rodriguez. A Review on Deep Learning Techniques Applied to Semantic Segmentation, 2017

[3] M. Grinvald, F. Furrer, T. Novkovic, J. J. Chung, C. Cadena, R. Siegwart, and J. Nieto. Volumetric instance-aware semantic mapping and 3D object discovery, 2019