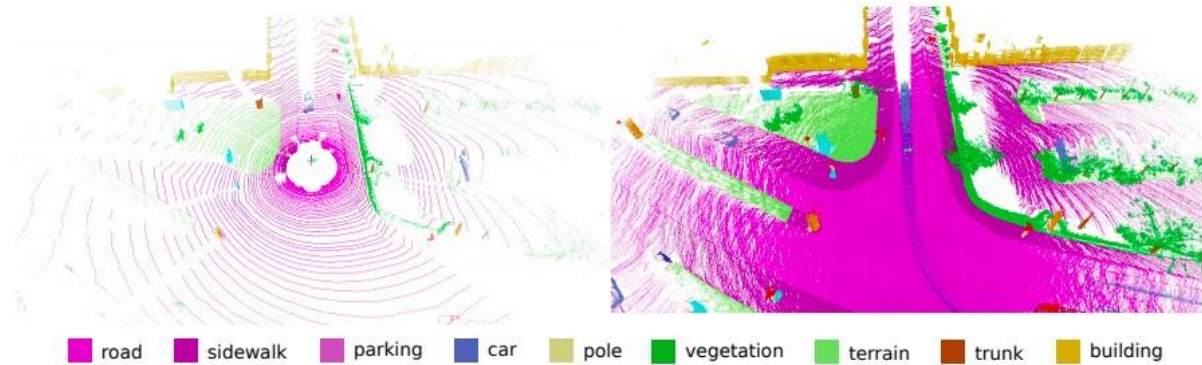


ROBIN Exchange Student Master Projects

Supervisor in UFRGS: [Ass. Prof. Renan de Queiroz Maffei](#)

ROBIN internal supervisor: [Jim Tørresen](#)

Semantic Localization/Mapping with Automotive LIDAR+Vision Data



Covered topics: position estimation, classification, place recognition, 3D point clouds, deep learning.

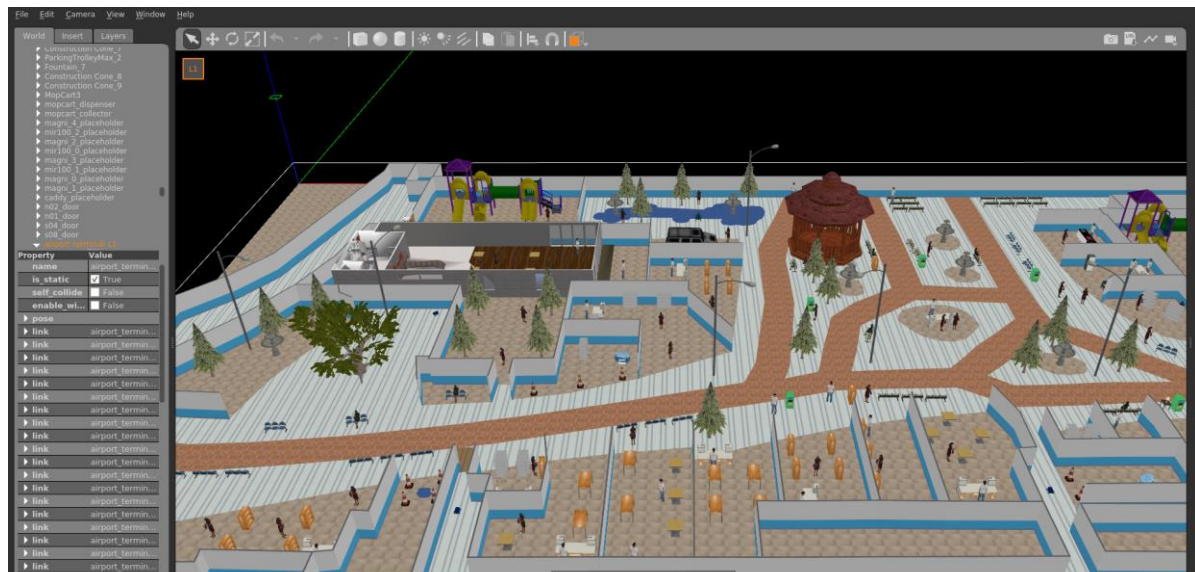
Objective: Improve Localization and/or Mapping approaches providing a robust classification and place recognition module.

Suggested tools: ROS, C++, OpenCV, PCL, TensorFlow, Yolo

Instructions:

1. Get familiar with place recognition methods.
2. Get familiar with methods to identify objects according to LIDAR or LIDAR+Image data
3. Prepare the dataset to use the features that you want to.
<http://www.semantic-kitti.org/index.html>
<https://www.a2d2.audi/a2d2/en/dataset.html>
4. Build/train a deep/machine learning algorithm with the dataset.
5. Evaluate the results and try to improve it.
6. Use the environment recognition algorithm in a place recognition approach for localization/mapping.
7. Evaluate the results and try to improve it.
8. Report the results, including the precision-recall graph.

Semantic Exploration with Multiple Robots



Covered topics: multi-robot exploration, classification, data association, visual features, deep learning.

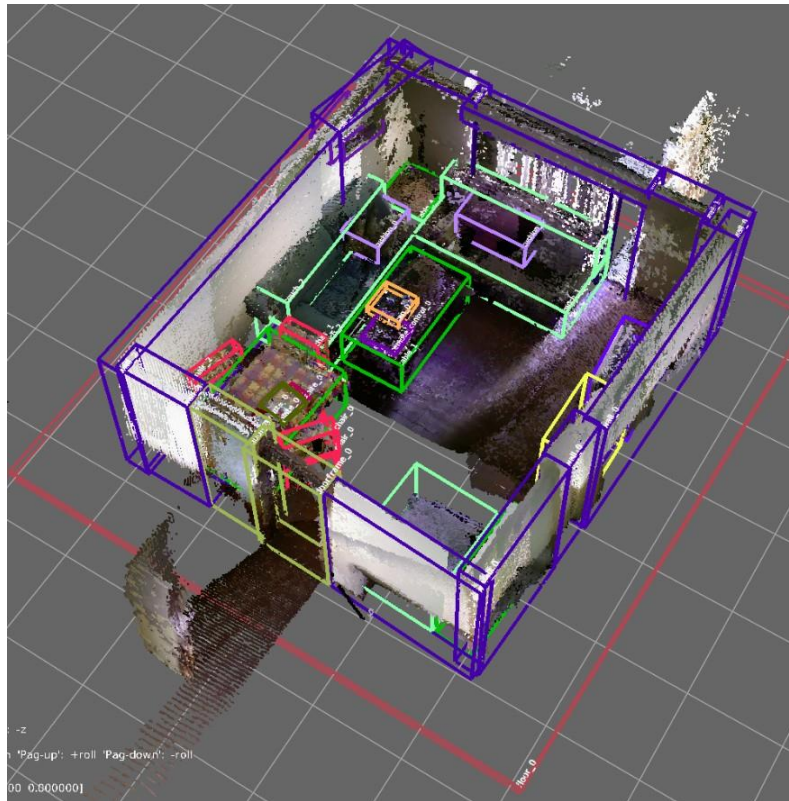
Objective: Propose multi-robot exploration approach using semantic information to improve data association.

Suggested tools: ROS2, C++, TensorFlow, Yolo

Instructions:

1. Get familiar with ROS2 and the Robotics Middleware Framework (RMF)
<https://osrf.github.io/ros2multirobotbook>
2. Get familiar with navigation algorithms
3. Get familiar with methods to identify objects according to their color, texture, gradient or any other feature.
4. Build/train a deep/machine learning algorithm with the images captured by the robots.
5. Evaluate the results and try to improve it.
6. Use the object recognition algorithm to perform data association between images captured from different robots.
7. Evaluate the results and try to improve it.
8. Report the results, including the precision-recall graph

Semantic Mapping in Home Environments



Covered topics: mapping, classification, object detection, visual features, deep learning.

Objective: Build robust environment maps with the addition of semantic information.

Suggested tools: ROS, C++, OpenCV, TensorFlow, Yolo

Instructions:

1. Get familiar with grid mapping methods.
2. Get familiar with methods to identify objects according to their color, texture, gradient or any other feature.
3. Prepare the dataset:
<http://mapir.isa.uma.es/mapirwebsite/index.php/mapir-downloads/203-robot-at-home-dataset.html>
4. Build/train a deep/machine learning algorithm with the dataset.
5. Evaluate the results and try to improve it.
6. Use the object recognition algorithm in the 2D mapping approach.
7. Evaluate the results and try to improve it.
8. Report the results, including a qualitative analysis of the final map