Semantic Labeling for SLAM

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1 Abstract

One of the abilities that an autonomous robot has to possess is the capacity of creating a map (that can be 2D or 3D) of its environment and knowing its own location in that map. This is called SLAM (Simultaneous Localization And Mapping) [2].

In this thesis we are interested in enriching the map with further information collected by the robot as it navigates the scene: it can record that a certain person is usually at a given room, so when it enters the room it can search for that person and update the probability of finding the person in that room.

The idea is to have a robot keeping a record of the probabilities of events in it's "world". This helps it interact with the world and can allow it to answer questions such as: "Where is Mary?" with "Mary is usually in room X".

So we are interested in doing SLAM and simultaneously learning the probabilities of occurrence of certain events in the map. Some recent work along these lines can be found in [1, 3].

2 Goals

The main goal of this thesis is to create a ROS [4] node that complements existing SLAM methods with semantic information obtained through learning the probability of events that the robot notices as it goes around in it's "world".

The student will use a Turtlebot 2 robot that is available at SOCIA lab for the real world experiments.

The information from the world is captured by the robot's sensors and we are particularly interested in using visual information from a Kinect camera.

The robot already has nodes for navigation and object detection and recognition (among others) that can be leveraged for the goal of this thesis.

3 Tasks

T1: State-of-the-art in semantic labeling of robotic maps.

T2: Implement the proposed method.

T3: Make extensive evaluation on real world scenarios.

T4: Write the thesis and a scientific paper.

4 Schedule

Task	Start date	Duration
T1	2017-10-01	2 months
T2	2017-12-01	3 months
T3	2018-03-01	1 month
T4	2018-04-01	3 months

References

[1] S. L. Bowman, N. Atanasov, K. Daniilidis, and G. J. Pappas. Probabilistic data association for semantic slam. In *Proc. IEEE Conference on Robotics and Automation (ICRA '17)*, Singapore, May 2017.

[2] M. Fernandes and L.A. Alexandre. SLAMfusion: Fusing SLAM methods for improved robustness. In *IEEE International Conference on Autonomous Robot Systems and Competitions, ICARSC 2016*, May 2016.

[3] John McCormac, Ankur Handa, Andrew J. Davison, and Stefan Leutenegger. Semanticfusion: Dense 3d semantic mapping with convolutional neural networks. *CoRR*, abs/1609.05130, 2016.

[4] Morgan Quigley, Ken Conley, Brian Gerkey, Josh Faust, Tully B. Foote, Jeremy Leibs, Rob Wheeler, and Andrew Y. Ng. ROS: an open-source robot operating system. In *ICRA Workshop on Open Source Software*, 2009.