UNSW, School of Computer Science and Engineering

COMP3431: Mapping Tutorial

August 2015

1 Overview

This tutorial is to give you some experience using the available mapping algorithms in ROS.
In this tutorial you will put the following 4 algorithms to the test:

1. GMapping
2. Hector SLAM
3. Fast SLAM
4. Graph SLAM

2 Generating Maps from Logs

For the sake of expedience we will begin using a prerecorded bag file. In this tutorial is is assumed that every shell/terminal is configured to use the `/opt/ros/comp3431` workspace. In separate terminals run these commands:

1. `roscore` - We'll run a separate rosmaster so we can keep RVIZ open.
2. `rosrun rviz rviz -d /opt/ros/indigo/share/comp3431/turtlebot.rviz` - This opens RVIZ with a configuration for viewing the turtlebot. While using the bags you're better of enabling the TF view rather than the robot model.
3. `roslaunch comp3431 gmapping.launch` - We'll start with the standard ROS gmapping algorithm.

4. `rosbag play clock /opt/ros/indigo/share/comp3431/michelangelo-simple-maze.bag` - This is where we replay the bag. The `-clock` option is so that all the nodes can know the time being replayed in the bag.

You should see the map appear and the robot move through it. Now repeat steps 3 and 4 but using the launch file `hector.launch` to see Hector SLAM in action.
To use Fast SLAM and Graph SLAM you need to checkout the code into you own workspace. So go into the `src` of your workapace and run the command:

```
git clone git://robolab.ai.cse.unsw.edu.au/ros/crosbot
```

Then compile the code using `catkin_make` to build your workspace. Now repeat steps 2, 3 and 4 but with the launch files `crosbot-fastslam.launch` and `crosbot-graphslam.launch`. We need to restart RVIZ because the crosbot maps use a slightly different transformation tree to the other 2 mapping algorithms.
Rerun the logs a couple of times with the various maps to get an understanding of how variable the maps can be, even with the same data.
If you're curious about the GUI that the Fast SLAM map uses. If you watch the map you will see a series of lines moving, these represent each particle being used. The red line is the most likely, the blue shows where the icp thinks it is, the green lines are the rest. At the bottom of the screen is a menu saying max you can change this in order to select which particle's map you'd like to view.

3 Live Mapping

Once you're tired of creating maps using bagged data you can try your hand at creating a map using a robot.

1. SSH to the turtlebot you wish to use and run `roslaunch comp3431 turtlebot.launch`
2. Open a terminal and set the ROS_MASTER_URI so that it points to the robot you wish to use. Run step 2 from above. This time enable to robot model rather than the tf view.
3. Run: `roslaunch turtlebot_teleop keyboard_teleop.launch` - Either on the robot or by setting the ROS_MASTER_URI.
4. Copy the launch file for the mapping algorithm you wish to use. Then edit it to set the parameter `use_sime_time` to `false`. This parameter is used to tell things like tf listeners whether to use the wall time or the `/clock` topic that rosbag publishes to.
5. Run the modified launch file.
6. Drive the robot around.

4 Data Logs

Now that you can run the robot and use it to build maps you should have a go at recording a log of your own. Be aware though that as your home directory on the lab's desktops is shared via the network it is usually better to record and play the data from another location. For recording I would record on the robot itself to avoid bandwith problems. For playback I'd recommend copying the bag file to `/tmp` on your desktop or to a portable drive. Be aware though that a simple 1 minute log can be a few gigabytes in size, so copying them around can take some time.
Some topics you should consider including are:

1. `/tf` - The transformations.
2. `/scan` - The laser scans
3. `/camera/rgb/image_color` - The colour images from the Kinect

5 For Assignment 1

Before closing everything down you should take a look at some of the data you're going to be using in assignment 1. Try using the `rostopic echo` command to look at these topics: `/camera/rgb/image_color`, `/map`, `/tf`. You may need to pipe the output through a program like `less` or `more`.