Data logging and processing using rosbag

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Overview

- So far we have covered the basic tools for running experiments with robots using ROS:
  - Running nodes (rosrun, roslaunch, rostopic)
  - Coding nodes (in Python and C++)
  - Analyzing node behavior (rosnode, rostopic, rqt_graph, ...)

  Experiments are performed to gather and analyze data
  - rosbag is the tool for logging data exchanged through ROS
  - How to access the data for processing, plotting etc?

Let’s record (bag) a dataset

- Run turtlesim and record some data

```
$ roscore
$ rosrun turtlesim turtlesim_node &
$ rosrun turtlesim turtle_teleop_key
$ rosbag record -a -O test
```

- Change the background color

```
$ rosparam set /background_g 255
$ rosservice call /clear
```

- Stop the recording with `Ctrl-C`

Playing back a bagged dataset

- Get info on bag contents

```
$ rosbag info test.bag
```

- Start playback

```
$ rosbag play test.bag
```

- Playback can be paused by pressing space
- Note that service calls are not recorded (directly :)

Exercise

Consult the rosbag documentation and find out how to skip the first 10 seconds when playing the bag.

Reading the data

- Let’s write a Python script `read_bag.py` to import the data

Don’t forget

Configure your editor to insert spaces instead of tabs!

```
#! /usr/bin/env python
""" A script for reading rosbag data. """

import rosbag

if __name__ == ’__main__’:
    bag = rosbag.Bag(’test.bag’)
    for (topic, msg, t) in bag.read_messages():
        print(topic, msg, t)
```

Importing the data into IPython

- We can filter the topics we are interested in

  ```
  bag.read_messages(topics=['/turtle1/cmd_vel'])
  ```

- Importing into IPython

  ```
  $ ipython --pylab
  In[1]: run read_bag.py
  In[2]: msg
  ```

- All the variables from our code are imported automatically

  ```
  In[3]: %whos
  ```

- Let's look at the `msg` variable

Obtaining an array of data

- The most efficient way is to use a list comprehension
- Think of it as a for loop that's compressed into a single command

```
x_vel = [msg.linear.x for (topic, msg, t)
                          in bag.read_messages(...)]
```

Processing the data

- IPython's pylab extension supports Matlab-like commands

  ```
  plot(t,x_vel,'b-')
  ```

Assignments

1. Plot the x, y and orientation coordinates of the turtle in three subplots.
2. Compute the total path travelled by the turtle during the experiment.
3. At which second (from the beginning of the recording) did the background color change?

Hint

In IPython, help is accessed by typing ?, followed by the command name, e.g., ?plot.

Homework

Homework Assignment

Download a bag of recorded data from the link provided on the course website. For this dataset do the following:

1. List all of the topic recorded within the provided bag. Store this list in a file.
2. Compute the total path travelled by the robot during the recorded experiment.
3. Run the gmapping algorithm on the recorded data and build a map of the environment the robot was exploring.

Other options for importing data

- The `matlab_rosbag` package
  - Let's you use all the power of Matlab
  - You need to have Matlab :)
  - Can be not-so-straightforward to install

Summary

- Rosbag provides tools to record and play back data exchanged within a ROS system
- The python API provides functions for accessing the data from Python programs
- IPython provides a Matlab-like environment for data analysis

Useful links

- Rosbag command line tool reference
- Rosbag code API
- Rosbag cookbook
- IPython tutorial