Komplexpraktikum Mobile Roboter
Mobile Robotics Lab
Summer 2004

Project Assignment

Axel Großmann
Outline

Markov and Monte Carlo localisation
  ● Summary
  ● Questions and Answers

Project assignment
  ● Suggested approach
  ● Evaluation criterion

Resources provided
  ● Source files
  ● Demonstration
Markov and Monte Carlo Localisation

Two methods for dealing with uncertainty in robot localisation

- **Markov localisation**
  

- **Monte Carlo localisation**
  
  S. Thrun, D. Fox, W. Burgard and F. Dellaert. 
  *Robust Monte Carlo localisation for mobile robots.* 

Main ingredients

- Probabilistic representations for belief on robot’s position
- Perceptual model, distance sensor model
- Action model, motion model, odometry sensor model

Questions and answers
Project Assignment

Implementation of the simplest form of MCL

- Described in Thrun et al., Table 1

Implementation of the odometry sensor model

- Described in Kurt Konolige’s Notes on Robot Motion, Sec. 1.4.5.
- For a sampling model see pages on Generating Gaussian Random Numbers

Implementation of the laser sensor model

- Described in Dieter Fox’s thesis, Chapter 2, Section 2.6.1, and the JAIR paper

Implementation of the resampling algorithm

- Described in Carpenter et al., Algorithm 1
Evaluation criteria

- To show a basic understanding of the localisation algorithm
- To implement the algorithm incrementally, for example, by
  - visualising the sensor models used
  - visualising the particle sets created by the prediction step only
- Evaluation of the implemented algorithm
  - Say what is working, what does not work, and how one could fix it
- Structured presentation of the work both in the written report and in the oral presentation
  - State clearly the contribution of each group member
  - Each one should contribute to the written work and the demonstration
  - Restrict the presentation only to those topics that are important to the solution and interesting
- Please note to get the highest mark we do not require the student to provide an ‘optimal’ version of the algorithm. Instead you should convince the examiners that in principle you are able to deliver such an implementation.
Recall: System Architecture

Vision system

Cognitive-level controller (FLUX)

Map module
Path planner

Position-tracking system

Reactive-level controller (Saphira)

Hardware-level controller (P2OS)
Robot hardware

- Camera image
- Position of detected objects
- Status information
- Sensor data
- Actuator settings
- Corrected position
- Sonar and odometry sensor readings
- Map symbol
- Target coordinates
- Behaviour parameter

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Programs Involved

Server for interprocess communication
  • TCA central server

Saphira simulator
  • Support for Laser Range Finder

Position tracking module
  • Receive sensor data (odometry, laser distance readings)
  • Maintain current belief on robot’s position
  • Correct robot’s position estimate

Saphira controller
  • Control robot
  • Make it move within the environment
  • Incorporate position updates
How To Proceed

Demonstration

- Source code
- Executables

Question and answer sessions

- Mondays, 7.30am to 9am, GRU 421
- Wednesdays, 4.40pm to 6.10pm, GRU 421

Meeting before project presentation

Project presentation

- Hand in project report one day before
- Second examiner