Lehrstuhl Steuerung,
Regelung und Systemdynamik

Master Thesis

Theory, Progamming

Analysis and extension of simultaneous localization and mapping (SLAM) algorithm

Conditions

Duration: 6 months
Rquirements: MATLAB/C/C++
Language: english/german
Target group: Master students

Content

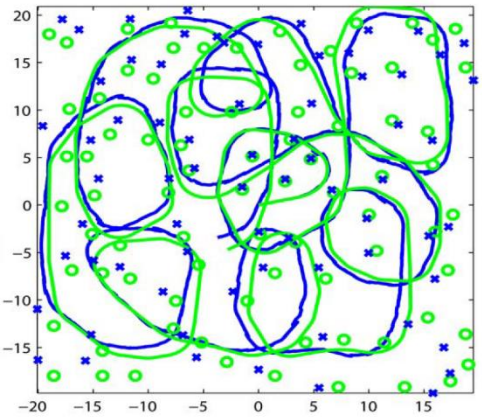

Fig. 1 Visualization of true positions of landmarks (green circles), true vehicle track (green line), estimated landmarks (blue crosses) and estimated track (blue line) [Ba-Tuong Vo et al., 2011]

Simultaneous localization and mapping (SLAM) is typically related to an autonomous vehicle or robot, which operates in an unknown environment. The vehicle is equipped with a sensor e.g. a laser-range sensor to measured relative distances to static or dynamic land features. Based on the measurements a map of the surroundings can be build (mapping process) and the vehicle itself can be localized in the map (localization process). The generated map can be used for path planning and collision avoidance. Main applications of SLAM are: fire fighting, rescue and cleaning operations, mine removal, maintenance, surveillance and exploration. Challenges of SLAM are: the measurement-landmark association problem and the loop-closure detection problem.

In this thesis, a SLAM algorithm should be analysed and extended. A brief overview about existing types of SLAM approaches is required. The theoretical background of SLAM, and the data and loop closure problem should be studied. The existing SLAM program has to be extended regarding: addition of new more complex landmarks, modification of the vehicle trajectory, support for different kind of sensor data.

The main tasks of the work are summarized as follows:

- Literature review of SLAM algorithms
  with focus on data association, loop closure and sensor fusion
- Analysis of a conventional, standard SLAM approach
- Extension of existing SLAM program
  regarding: landmarks, vehicle trajectory, sensor data
- Documentation and presentation of results

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