Self-Localization with the use of a Dynamic Tree
Robo World Cup 2011, Open Challenge

Dutch Nao Team

Introduction

In the Standard Platform League the most used self-localization algorithms are Particle Filter based (for an overview see [1]). Such a filter *needs* to sample the state space. Sampling a state-space results in the need of filter extentions which enables the possibility for re-location after e.g. kidnapping. Building extensions on a method results in slower estimation. To get rid of the need-for-extension problem a method should be used which incorporates the complete state space. One of such methods would be Dynamic Tree Localization (DTL) [1].

The Algorithm

With DTL the belief of a robot is represented by a (kd)-tree. The root node represents the complete environment. Each subnode (child) represents a smaller region of the parent node. The represented space of all children of a node equals the represented space of the parent node. Using a probability to determine how likely the robot is in a node, estimating the robot pose is done easily. Collapsing and expanding of nodes is done using sets of rules (constraints). Using such a representation has multiple (assumed) advantages:

- The complete state space is described without the need of extenstions.
- A complex belief can be represented
- Convergence to small regions is done exponentional (as with a kd-tree)
- Due to inhabiting probabilities the method is able the handle noisy data
- Online computational cost can be reduced by creating the complete tree in advance

Demonstration

For the Open Challenge we'll demonstrate the Algorithm, using the Gutmann [2] data-set and/or a live demonstration with the robot walking in the field.

References

[1] H. van der Molen. "self-localization in the robocup soccer standerd platform league with the use of a dynamic tree". Bachelor Thesis, University Of Amsterdam.

[2] de Bos D. van der Molen. H. Visser, A. "an experimental comparison of mapping methods, the gutmann dataset. In *RoboCup IranOpen 2011 Symposium (RIOS11)*, 2011.