

SLAM on small grid world

Your Name

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1 Summary

SLAM refers to self localisation and mapping. It is a chicken-egg problem but can be solved rather easily by humans so there should be a way of solving it computationally. In this project, I will investigate the Hidden Markov model for self localisation on a grid world.

I will consider a model similar to the circular corridor/prime number tiles example of the assignments. My model will be on a 2-d grid world instead. In the assignment, the robot knew the map via the observation model $p(y_k|x_k)$, where y_k were the colors of the tiles. In this study I will first repeat this on this larger problem. Then I will try to learn the parameters of the kinematic model and the observation models. My goal is to understand the forward-backward and parameter training algorithms for HMM's.

2 Problems

We will consider the following problems:

1. Estimating robots position from generated measurements given true observation and kinematic model
2. Given measurements from the true model and the true observation model, estimating the kinematic model $p(y|x)$
3. (Optional) Given measurements from the true model and the kinematic model $p(x_k|x_{k-1})$, estimating the observation model $p(y|x)$. This seems hard to me but I will try.

I will try to construct a method first in batch mode, and then try to extend to online mode.

3 Deliverables

I will deliver the following:

1. Matlab implementations of the forward-backward algorithm and the parameter estimation for the model.
2. A program to visualise and illustrate the progress of the algorithms and a program to calculate and produce the graphs used in the final report.

3. A Report about the size of a conference paper describing the details of the model, the derivation of the parameter estimation algorithm. I will also write a short paragraph about my results and the findings.