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Autonomous robotics: Action, Perception, and Cognition

May 15, 2025

Exercise 5 Navigation

Please upload solutions on the web page before midnight on **May 21, 2025** (Wednesday).

Read the paper "Mapping a Suburb With a Single Camera Using a Biologically Inspired SLAM System" by Milford and Wyeth, *IEEE Transactions on Robotics* 24:1038-1053 (2008) available as background reading on the webpage. This paper links the SLAM problem of autonomous robotics to the navigation problem in animals. It thus speaks to the core theme of the lecture, exploiting analogies to organisms in designing autonomous robots.

The introduction section I and SoA section II of this paper give brief surveys over both problems, a useful condensation of part of the associated lecture. Read this as background.

Section III describes what is known about the neural grounding of navigation in rodents with more detail than the lecture. Try to understand this, referring back to the lecture slides where needed.

Section IV on attractor networks will be familiar to those who head the WS coursse on neural dynamics. For those not familar, use Figure 1 to get an impression.

The "RatSLAM" section V presents the original work here. This is described quite well in language. You don't need to dig into the math. This is an exercise in understanding the gist of the method without understanding all the details.

You may skip "Vision system" section VI. But read "experimental setup" section VII and "Results" section VIII. These make the ideas more concrete and facilitate understanding the method described in Section V.

Your only task is to write down one question you have as you work through this paper.

We will use this to organize the discussion in the respective exercise session.