Homework 2: Reactive Robot Control

Comp 380

Overview

Assignment goals

The goal of this assignment is to experiment with the subsumption and potential field control methods on a couple of new tasks.

Preparing and handing in the assignment

This is a collaborative assignment! You may keep your teams from class; let me know if you're changing teams from Homework 1. Turn in one set of code and one write-up for the group.

For this assignment, you will (1) create a set of programs, (2) write a report analyzing the effectiveness of your programs, and (3) make a narrated video showing your robot in action.

Put the files containing your writeup and code in a folder, and name the folder with your team member names (first names only is fine), along with "HW2". Create a zip archive of the folder, and upload it to Moodle. The videos may be too big to upload to Moodle, you can put them on youtube and include a link in your writeup.

Tasks

Task one: Escape the Box (20 pts)

The task here is to program the Scribbler robot to escape from a dark box. I will make a big cardboard box/arena for you to use. Inside the box, it is dark. There will be one opening in the box through which the robot can exit the box. The robot should seek out the light coming in from the opening and should exit the box. It should avoid bumping into the walls of the box (or at least recognize when it has done so and take steps to move away). Ideally, the robot should recognize when the light is bright enough to indicate that it has exited the box, and it should stop (and maybe play a triumphant little tune).

Create one program that uses subsumption. Design behaviors for the hierarchy. In the writeup, explain your design choices here: why did you choose each behavior, and the order in the

hierarchy. Test your program on the robot in multiple locations: close to the exit, far away and facing away, close to walls. You should have at least 6 separate tests. Run each test multiple times. Describe the different tests you chose, and why they are a good set of tests. Summarize the result of these test runs: when is it successful, when does it fail?

Create a second program that uses potential fields. Design potential field behaviors for responding to infrared and light sensors. In the writeup, explain your design choices here: why did you choose each behavior, and the order in the hierarchy. Test your program the same was as the subsumption, and on the same set of locations, so you can compare results.

If you make any changes to the subsumption brain or potential field brain, report what you did in your writeup. Because the box is dark, if you find it impossible to make a video for this part, that's okay. But you could make a video without the box, just showing the behaviors in action in a somewhat darkened room.

Task two: Soccer or Honeybee Robot (20 pts)

Which of these two tasks, a soccer-playing robot or a honeybee robot, will depend on the feasibility of having the robot actually approach an object, like a ball, close enough to push it. Experiment with soccer first, and then fall back on honeybee if pushing the ball just isn't going to work.

We're really not thinking about all the behaviors exhibited by soccer players or honeybees, but just the most simple. The soccer-player behavior is just seeking out the ball, and pushing it, if possible. The honeybee behavior is just finding and approaching a brightly colored object. The robot should wander around, looking for a brightly colored object (a ball, one of the signs from the first homework, or my plush botball robot). The robot should approach as closely as possible to the object when it finds it. You should make an arena for the robot out of the board maze pieces from the robot lab (or the boxes we used for the Robot Game on the first day). Have the robot avoid hitting the walls of its arena. Because the camera is needed, and taking a picture is slow, I want you to keep in your imagination that the robot is a tortoise playing soccer or acting like a honeybee. The robot should move **slowly** so that it has time to react to pictures.

Create two programs, one using subsumption and one using the potential field method. You may modify either brain to make the robot move briefly and then stop, rather than having continuous movement. That will let the robot be stationary while taking pictures.

Describe your design for each method, just as in the first task. Just as in the previous task, you should design a series of tests for the robot: what if the robot is close to the ball at the start? What if it is facing away and far away? What if the ball is near a wall? Come up with at least six different scenarios, and test both programs on them, running each scenario multiple times. Write up what the scenarios were, and summarize the result of your tests, comparing the two methods with each other.