CMSC 360: Intelligent Robotics and Perception

Lab 2: Ants – Behavior-Based Control

Due October 7, 2009

Overview

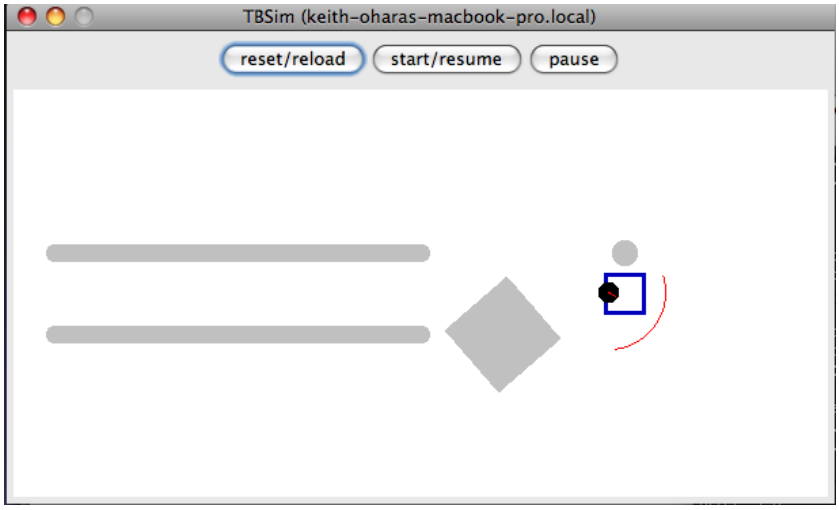
In the second unit of the course we are studying reactively controlled robots that have a tight coupling of sensing to action. The purpose of this lab is to explore some of the different behavior-based architectures for controlling mobile robots. For this assignment you will work with the teambots[1] simulation environment.

Learning Objectives

- Implement a robot control system.
- Understand the strengths and weaknesses of the reactive paradigm.
- Implement competitive and cooperative control strategies.
- Implement a strategy for robot soccer.

Architecture Comparison

In the first part of the lab, you will be working with a simple, simulated mobile robot. The robot's task is find its way to some goal location while avoiding static obstacles. It should rely on its sensors to safely guide itself to its goal location. We'll use the `Walls` domain in teambots for the first part of the lab.



The Walls Teambots Domain

[1] http://www.teambots.org

Motor Schemas

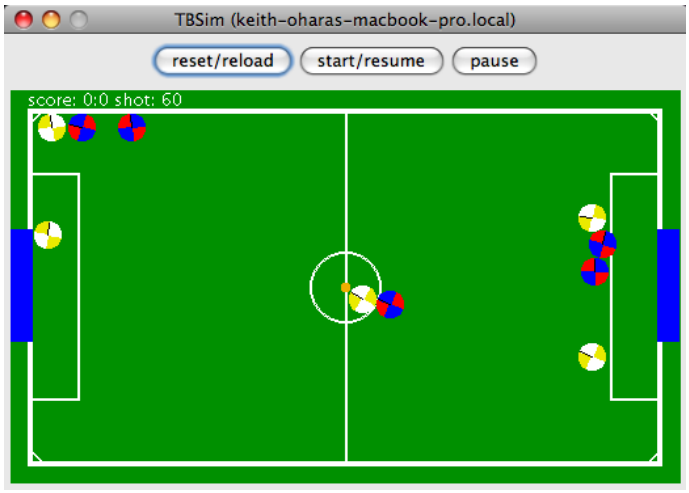
Experiment with the motor schema-based control system in the `Walls` demonstration directory in the teambots distribution. Find an environment that results in the robot becoming stuck – the motor potential becoming zero – at a place other than the goal. Experiment with different gains for the motor schemas, how do they change the robot's behavior? What is the purpose of the noise motor schema?

Subsumption or Voting

For the next part of the lab, implement a subsumption-style or voting-style reactive controller for the robot. The robot should be able to accomplish the `Walls` demo in the teambots distribution (i.e. it should be able to drive toward some goal location while avoiding obstacles). The voting based controller (as opposed to the winner-take-all style of subsumption or the vector summation style of motor schemas) should have at least three behaviors voting: goto-goal, avoid-obstacles, and noise, but feel free to add others.

Robot Soccer

In the last part of the lab, you will implement a control system for a team of soccer playing robots. You should use one of the three types of control systems you implemented earlier in the lab. Although you are free to change the player's behavior based on its position, you should use the same program for each agent. I'll run a tournament of all the teams and we'll have the final and consolation matches in class. You can start with one of the teams in the `SoccerBots` Domain in teambots. More information can be found at `teambots/Domains/SoccerBots/index.html`.



Teambots Soccer

Lab Report

After you finish the programming parts of this lab write a page or two reflecting on the strengths and weaknesses of the different architectures and the behavior-based paradigm, in general. How do you think they will scale with more complicated tasks? Describe your soccer strategy and how you used one of the control architectures to realize it. Submit an electronic copy (PDF) of your report and your code as a tar ball or zip file on moodle.