

6.836 Embodied Intelligence, 2003

Research Assignment 5

Issued April 11, Due April 24

In this research assignment you are to build a simulation of fish schooling based on material in the lecture from April 4th. We tried to make this assignment fairly light with only three questions as we assume you are already busy working on your projects.

You are encouraged to use Matlab and its graphics. You can take the code for the Braitenberg vehicles in RA1 as a basis for the graphics - the code is still linked from <http://www.ai.mit.edu/courses/6.836/handouts/handouts.html>. You may also write your own simulator in any language you like but please make sure that we can run this simulator. In addition to the writeup **please hand in your code** in a compressed archive as well as an executable (where applicable). For each of the questions that require coding, **we would like to be able to either run a file or press a button and see the answer to the question**. Please provide an option for such individual runs.

Simulate 50 fish in a two dimensional toroidal space. Each of the fish has sensors and obeys some simple local rules. Sensors should have range limitations. In particular, from far away the fish may not be able to tell in which direction other fish are swimming. Remember the lecture slide where we can see the concentric ranges of fish behavior patterns.

1. **[3.5 points]** Implement a rule that makes the fish do the average of what it sees its closest four neighbors doing. Set things up so that the fish have some randomized initial velocities and make them school. What do you observe? Show us some results.
2. **[3.5 points]** Add in a bias so that the fish tend to swim from west to east, creating a continuous left to right motion. Add an obstacle avoidance rule to the fish and have the school swim straight at an obstacle. Observe and report on what the school will do. Add a wrinkle (a small trick or modification) so that the school will reform on the other side.
3. **[3 points]** Distribute your fish randomly in the toroid and see what additional rule you need to add so that a school spontaneously forms. Tell us the rule and the consequences of its application.

This is the last research assignment in this class. Good luck on your projects!