

Homework Set 4

Due date: Monday, Feb. 3.

Written Exercises

HW4.1. Suppose you are at a party and meet a fellow student who asks you about your courses. You mention that you are taking a course on genetic algorithms. Your fellow student says that she has heard of both neural networks and genetic algorithms but doesn't know much about either one. "What exactly is the difference between genetic algorithms and neural networks?" she asks. Draft a one-paragraph reply for her (i.e., aimed at someone with her level of knowledge.) (10 points)

HW4.2. Textbook, Chapter 2, Thought Exercise 4. Check your answer with the solutions. (10 points)

HW4.3. Textbook, Chapter 2, Thought Exercise 5. Check your answer with the solutions. (10 points)

HW4.4. Briefly describe two domains other than visual art in which an "interactive" genetic algorithm (like Karl Sims' project) could be used to evolve interesting or useful structures. (10 points)

Computer Exercises

HW4.5. Building on the function you wrote for Homework 3 that generates a random tree, implement a function that is given a bit string ($s_0 s_1 s_2 s_3 s_4 s_5$) and a tree as input, and outputs the result (a single bit, representing a move in a Prisoner's Dilemma game) of running the logical function encoded by that tree on the bit string. (30 points)

HW 4.6 Now write a function that will evaluate the fitness of a tree on a given set of M Prisoner's dilemma strategies, the "opponent set," where M is a parameter. The fitness of a tree is its total score over N games with each opponent, where N is a parameter. You can represent the opponent set however you want, but, as in the "prisoners-dilemma-in-C" code, for each

opponent, you need to generate a random “3 first games” that will be used to determine the moves in the first game (and in part in the second and third games). Also write functions that will scale fitnesses (i.e., assign weights) according to fitness-proportionate selection and linear-rank selection, as in the Simple-GA-in-C code. (30 points)