COSC343: Assignment 2 – Evolve a Species

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Simulation

Number of turns: 100 - I left this as default as I thought it was a good number, when increased by too much it dropped the survival rate heavily and when I was running it at 80 I believed that it wasn't enough to truly test the fitness of the creatures.

Generations: 150 – I increased this number quite a lot to 300 and found that they weren't learning anymore after the first 150. In all honesty they have probably stopped learning before the 150 mark but it doesn't take to long to run and gives more data to have a look at.

Grid Size: 35 – I increased the grid size from the default 24 to get a population of 73. I tried values from 24 to above 35 but found that 35 illustrated the learning a lot more, 24 was too little and above 35 I felt was too much.

I ran the simulations all in world 1 because I didn't think I would be able to get it to work/learn in world 2.

Chromosome

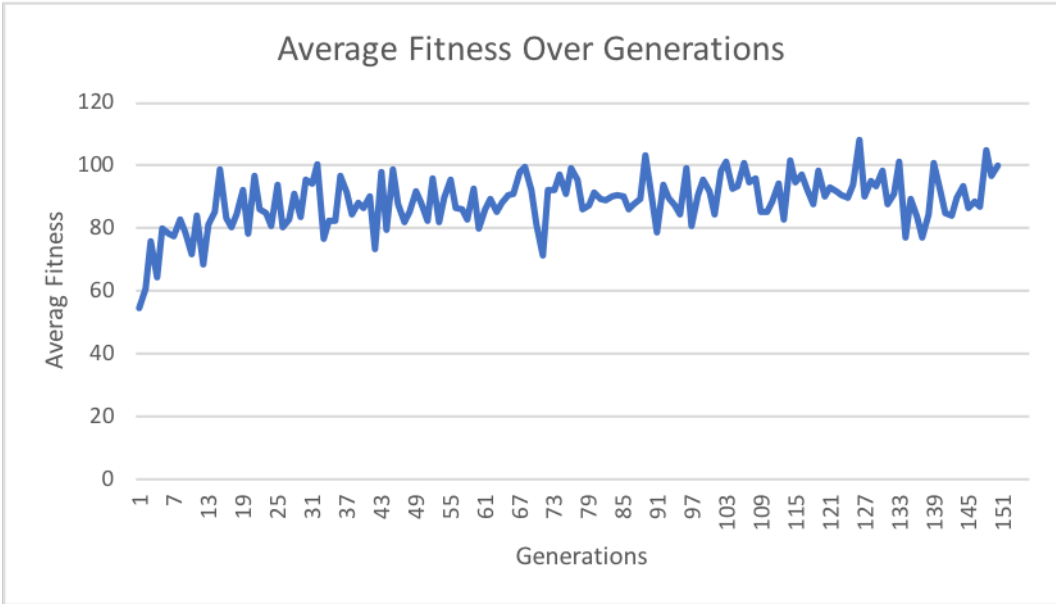
My chromosome model is a size 30 array of random floats. I chose 30 because different sections of the chromosome will apply in different scenarios when the percepts are giving different information. For instance, the first 9 elements are weight for reacting to monsters and the next nine for creatures and so on. This will be explained more in the agent function.

Agent Function

First I loop through the percepts to apply the movement actions to the creature. How it works is there is an individual chromosome to respond to any possible percept, for instance the first nine chromosomes adhere to reacting to monsters. For the other creatures and monsters the action weighting will actually be the inverse of the percept as we want to move away from them. So for instance, if there is a monster at percept[1] the action[8-1] (inversed to the opposite direction) will be chromosome[1]. And it will be like that for all the possible monsters at each percept. This is the same for the percepts that return indication of another creature, these chromosomes start at chromosome[9]. Then it's the same with surrounding food, with their chromosome starting at chromosome[18], except this time the action weight goes on the same square as the percept as we want to move towards the food. I moved initializing the monster weight to last as I could check if it was going to be smaller or larger than a possible chromosome already there. This way I can make sure the largest value will be in place making it more likely for that action to be taken and therefore avoiding a monster. I made the possibility of staying in there own square zero, as it was the easiest way that I could make sure they stop staying still and just starving. Then I did a condition for if a creature is on food with two weights, one for eating a red berry and one for a green one. Finally, I added a weight for a random move, this doesn't need a condition as it is always the just random.

Graph of Results

Here is a graph of the program with all the same settings as previously stated.



Genetic Algorithm

For the genetic algorithm I created a random sample of the population a quarter of the size, then there is a tournament selection to find the 'mum' and 'dad' of the sample. These are then the chromosomes used to create the whole new generation population whilst always keeping the mum and dad in the new generation. For the crossover selection a k-point crossover was used. This made the most sense to me to use as I had the chromosome already broken up into blocks of behaviors. I broke the chromosome up into sections of: avoiding monsters, avoiding creatures, finding food, eating food and finally a random move. Therefore for each section I generated a random Boolean to decide whether the the creature would take the father or the mother's chromosome relating to that behavior. I did give single-point crossover a try but found that this worked better for me in the end. My mutation probability is 10% and when that is made it applies a random Gaussian to a random chromosome element, the Gaussian value is divided by 10 to make sure it doesn't drastically change the element too much.

Discussion

I am happy with how the fitness and number of survivors nearly always has a good increase from the first element to the last. However, the creatures are not really learning gradually throughout the generations, often it increases notably to the second generation and then after that it's just randomly up and down until the last generation showing no real continual learning. It is obviously learning as it is always better from the first gen to the last, but maybe not as much as I would've liked. I noticed more creatures towards the end avoiding monsters well and eating red strawberries which is good to see but, there are still many creatures behaving weirdly. Overall I am happy but can see that there is definite room for improvement.