Evolution Design

* Each step of evolution will involve a ‘generation’ of creatures
* Each creature will be an object, which holds a neural net (i.e a set of weight value by which to multiply the inputs to get the outputs), a current amount of energy, a current size, and a current movement speed
* Each generation of creatures will compete to survive for the most time.
* Each creature starts with 1.0 energy (which is also their radius in metres), and loses 0.001 energy per tick of the logic thread.
* If a creature drops below 0.1 energy, they die.
* Creatures can regain energy by moving into food pellets (they gain 0.05 energy), or by moving into other creatures (They gain a quarter of the creature’s total energy)
* The creature’s size is directly proportional to the creature’s energy, and creatures can only eat creatures that are smaller than them. A creature dies once it is eaten.
* A creature’s movement speed is inversely proportional to its size.
* Once all creatures are dead, the competition is stopped, and the creatures are sorted from longest to shortest survival time. After 3000 ticks have elapsed, if all the creatures are not dead, the walls will begin to move inwards, forcing all creatures to move towards the centre or die.
* The top 45% of creatures are the selected, and new ones are generated, making slight mutations to the weights in the neural net.
* Generation n will consist of the top 45% from generation n-1, the children of those top 45%, and the last 10% is completely random creatures, in order to maintain diversity.

Neural Net Design

U0 will use the hardlim transfer fuction, as a Boolean value is wanted. However, turning will use the tanh transfer function as negative values are needed.

I4 – movement speed

All nodes in the Input layer and Hidden layer will use the sigmoid transfer function

I0 – bearing

Additionally, all nodes will have a bias value, which will be added on when calculating it’s output.

I1 – distance to object

I2 – size of object

I3 – creature’s size / energy level

H0

H3

H2

H1

U1 – movement

U0 – turning

Inputs

Outputs

Hidden Layer 1