Project 4 IT3708:

Evolving Neural Networks for a Minimally-Cognitive Agent

a) Implementation

The genotype is a simple bit vector. For every ANN parameter there are 8 bit. To convert that bit vector into the phenotype, 8 bit each are treated as an integer, which can be between 0 and 255. These are mapped to numbers in the ranges given by the project instructions. These are given to the CTRNN class in its constructor, which uses the resulting CTRNN to process given sensor information into a motor output. This is done using the given formulas. The parameter are sorted into seperate arrays to make the code easier to read and maintain.

b) Performance

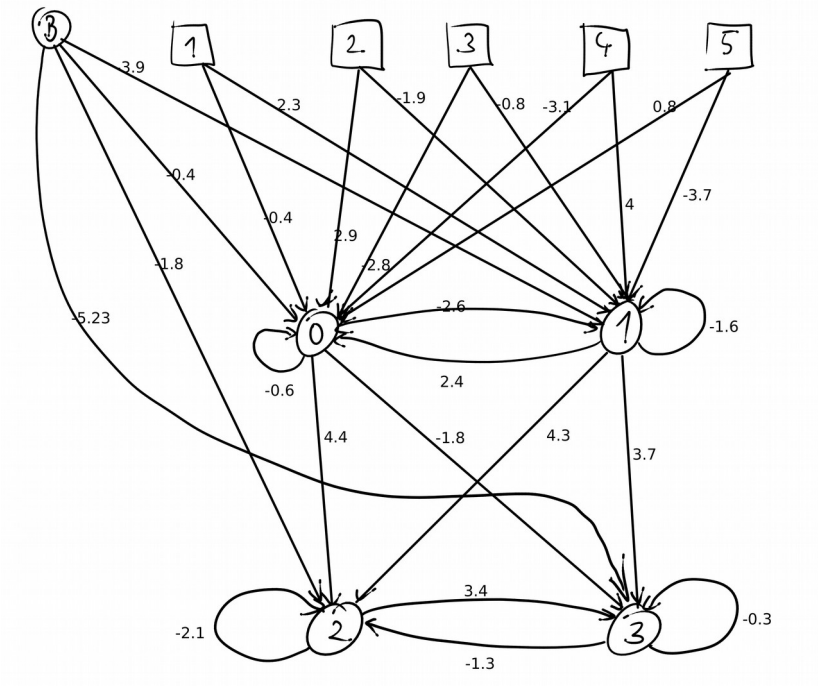
The evolved agent for the standard scenario walks to the left in steps of three. If he finds himself under an object, he slows down and catches it centrally. If it is too big, he continues moving. After collecting an obhect, he rests for one timestep before he continues moving. The fitness function rewards every catch with two points and the avoidance of a big object with one point. If the agent misses to catch an object, one point is substracted, being hit by a big object has a penalty of 4 points. This is done for 600 timesteps and the final score is divided by 100. The described agent scored a fitness of 0.53.

c) Analyzation

The evolved parameters of the best evolved standard scenario ANN are

-0.390625,-3.8671875,-1.7578125,-5.234375,-0.3515625,2.8515625,-2.7734375,-3.0859375,0.78125,2.3046875,-1.875,-0.8203125,4.0625,-3.7109375,-0.5859375,2.421875,-2.6171875,-1.640625,4.375,4.296875,-2.0703125,-1.2890625,-1.8359375,3.7109375,3.3984375,-0.2734375,3.03125,2.78125,1.4375,3.15625,1.27734375,1.0078125,1.609375,1.82421875.

This encodes to the ANN with the shown weights



The gains are

$$g_0 = 3, g_1 = 2.8, g_2 = 1.4, g_3 = 3.2$$

and the time constants are

$$\tau_0 = 1.3, \tau_1 = 1, \tau_2 = 1.6, \tau_3 = 1.8 \quad .$$