Constructive Artificial Intelligence Practical session 8

by Lola Cañamero and Matthew Lewis
m.lewis4@herts.ac.uk

In this practical, you will work towards these goals:

a) Consolidate knowledge about using the Webots robot simulator that you will be using for your 2nd piece of course work.

b) Program sample exercises and "building blocks" that you can use as a guide for your coursework. You will do an exercise in which you implement a simple behaviour.

c) Put into practice the notions and robot architectures seen in lectures 7 and 8.

This practical assumes you have read through and worked on the document from practical sessions 6 and 7.

Exercise 1: Homeostatic variables and resources

This exercise works towards goals (a), (b) and (c) above. This exercise should be done in pairs.

As a step towards implementing a two-resource problem, similar to that seen in lecture 7, this exercise involves implementing a homeostatically controlled robot.

1. Add an essential (physiological) variable (e.g. "energy") on which the survival of the robot depends. This essential variable should have its set point coinciding with its upper limit. The value of the variable must be capped at the upper limit. The fatal limit is the lower limit. If the essential variable reaches its fatal limit, the robot "dies".
2. The essential variable should start at a random value within its range, and decay over time. (Optional advanced possibility: an energy variable could decay depending on the speed of the motors.)
3. Add a "resource" to the environment that will allow the robot to "recharge" its essential variable (e.g. simulated "food" or "drink" using light, or a coloured patch on the wall or ground).
4. Add a **behaviour** that allows the robot to consume the resource to improve its survival.
5. Link this behaviour to a **motivation** that will activate it, so that the essential variable is homeostatically controlled. Calculate the motivation by a method of your choice (e.g. the simplest option: as the difference between the current value of the essential variable and its

fixed point, which is a simpler version of the formula in the lecture slides for the case where the set point coincides with one of the limits).

6. When the robot is *not* motivated to satisfy its need (for example, when the error is smaller than 30% or some other small value), the robot executes a default behaviour of your choice (e.g. line following, wandering around, moving in a circle, wiggling, etc.).

Exercise 2: Controlling a homeostatic variable with two motivations (advanced, optional)

If you finish exercise 1, design and implement a similar homeostatically controlled architecture, with an essential variable that has its set point in the middle of the range, between upper and lower fatal limits. In this case you will need two motivations to control the variable.