Complexity Science mini-project proposal 2013

Project title: Assessing behaviour of C. elegans through video analysis using a worm tracking system.

Background: Caenorhabditis elegans is a free-living, transparent nematode (roundworm), about 1 mm in length, which lives in temperate soil environments [1]. Research into the molecular and developmental biology of C. elegans was begun in 1974 by Sydney Brenner and it has since been used extensively as a model organism. It is desired to objectify measures of behaviour of C. elegans through automated analysis of video microscopy. Our lab recently finished designing and assembling a low cost worm tracking station. This consists of a low-cost microscope video (connected to PC via USB) mounted on an articulated arm with 2 servo motors, giving 2 degrees of freedom covering a horizontal plane. The aim is to monitor the video output in real time and move the microscope/camera to keep the worm in the centre of field of vision. Once the worm is being tracked, the worm behaviour can be analysed using the stored position and direction information.

Objectives: The objectives of this project are to: a) track the worm using the existing worm tracking system; b) calculate and store the worm coordinates and vectors; c) used stored worm trajectories to develop measures of worm behaviour patterns; and d) do a performance analysis of the system developed to assess suitability/ fitness for purpose.

What the student will do:

a) Familiarise themselves with the system designed and the access of images/ control of servo-motors.
b) Run simplistic trials in the Neural Engineering lab on worm samples.
c) Develop data analysis algorithm to infer worm behaviour from activity.
d) Assess performance of the system and present results.

Possible PhD project:

There is much scope for continuing this project into a PhD, there is a clear need to have a low-cost, portable, worm tracker – applications could venture into drug testing/ drug discovery etc. Once a worm tracker is fully functioning the analysis of worm behaviour through observed patterns is very pertinent and will advance worm research by leaps and bounds.

References

[1] Wood, William Barry (1988). "Chapter 1: Introduction to C. elegans Bioloogy". In Wood, William Barry. The Nematode Caenorhabditis elegans. Cold Spring Harbor Laboratory Press. p. 1. ISBN 0-87969-433-5.