

CS405 Introduction to Empirical Modelling

Week 5: A Showcase Of Models

Empirical Modelling Research Group
<http://www.dcs.warwick.ac.uk/modelling/>

Introduction

This lab will be a showcase of a number of models. These models have been chosen to highlight the variety of the models that have been constructed and should provide interesting ideas for discussion about potential coursework projects. All of these demos began as either third year projects or as CS405 coursework.

1 Hunt the Wumpus

Hunt the Wumpus is an hide-and-seek computer game originally from the early 1970s. The game is now used to illustrate knowledge agents in the field of Artificial Intelligence (you may have seen this in CS328). In a maze of rooms, you hunt the 'wumpus', armed with arrows. As you move through the rooms, you use hints (noise, draughts and smell) as to the location of the wumpus (which you must shoot with arrows), bottomless pits and bats (which carry you to a random room).

The model displays a dodecahedron maze (you may be familiar with a square maze version) drawn with the DoNaLD notation. Players use the %wumpus interface, developed with the Agent Oriented Parser, to input game moves. The model helps you to track inferences for each room.

The model can be used to show how our inferences are not always sufficient and reliable. Our inferences will never be sufficient if our model is not properly grounded. Suppose we allow the wumpus to relocate to another room after we shoot an arrow and miss - we could walk unsuspecting into a room containing the wumpus! EM allows us to explore what assumptions our inferences make within the game, and how we explore the possibilities when something unexpected happens.

Good example of a relatively simple model exploring a good idea, also relevant to other areas of Computer Science.

This model was developed as a submission to the EM-WEB-1 (CS405 2004/2005).

1.1 EM technologies highlighted

- Eden
- DoNaLD
- the Agent Oriented Parser (AOP).

1.2 Related models

- Latest model of the wumpus game: (</dcs/emp/ant/public/wumpus2/>)
- <http://empubli.c.dcs.warwick.ac.uk/projects/wumpusPavelin2002/> (The original model)

2 The planimeter

The planimeter is a mathematical instrument that calculates the area of a plane figure. During the nineteenth century there was a need to provide a mechanisation of area calculation and this resulted in a number of planimeters being independently invented. The main application was land area calculations, needed for the purposes of tax collection and land registry. These land areas were usually derived from mapping and so an instrument that could be used to trace around a region on a map and provide a numerical value for an area was very desirable.

The model provides a three dimensional visualisation of the model using Sasami (a definitive notation for 3D graphics implemented in tkeden) which allows mechanical relationships between components of a real planimeter to be represented as dependencies between the 3D components. Users of the model can move the pointer of the planimeter by moving the mouse cursor in a motion sensitive SCOUT window. The position of the 3D pointer is implemented using dependency.

A number of planimeter models were created as part of a third year project and show how EM principles can be used to create interactive artefacts for learning about historical instruments.

2.1 EM technologies highlighted

- Eden
- SCOUT
- Sasami

2.2 Related models

- <http://empublic.dcs.warwick.ac.uk/projects/planimeterCare2004/>
- <http://empublic.dcs.warwick.ac.uk/projects/planimeterCare2005/>
- <http://empublic.dcs.warwick.ac.uk/projects/kaleidoscopeBeynon2005/>

3 Racing cars

This model reflects the considerable knowledge about Formula 1 racing possessed by the developer Simon Gardner in 1998-9. This knowledge is revealed in a series of seven 'conceptual layers' ranging from a very simple track with no physics to a rather elaborate, modifiable track with two cars, collision avoidance and many parameters for experimentation to achieve best lap times. The final model is close to being a complete 'product' in the sense that a great deal of the flexibility of the model has been made accessible to the user through the interface (rather than needing to modify scripts in the input window).

3.1 EM technologies highlighted

- Eden
- SCOUT
- DoNaLD

3.2 Related models

- <http://empublic.dcs.warwick.ac.uk/projects/racingGardner1999/>
- <http://empublic.dcs.warwick.ac.uk/projects/roadtrafficStein2005/>

4 Social Agents

There are many models that make use of agents and agent-based modelling, and here are two that relate specifically social interaction and the softer aspects of agents. The first is an investigation into crowd behaviour by modelling the interaction between agents walking down a corridor. The initial model enables experiments to be performed with two agents and using various techniques for avoiding collisions. Extensions of the model allow experiments with a larger number of agents. This was a third-year project by Chris Martin in 2003/4.

The second project aims to model the behaviour of ants when searching for food. Using detailed studies of ant behaviour, the ants in the model perform many of the abilities that real ants use to find and collect food. For example, ants use random search and smell to locate food, then they record the location of the food using landmarks to enable themselves and others to return to the food. Modelling navigation and landmarking in ants is a third-year project by Daniel Keer in 2004/5 (the model and report can be found in the projects archive).

4.1 Related models

- <http://empubpublic.dcs.warwick.ac.uk/projects/antnavigationKeer2005/>
- Chris Martin's project CD: `/dcs/emp/ant/public/chrismartin/`