

Microscopic Agents – Traffic Simulation Projects

Prof Ken Hawick

k.a.hawick@massey.ac.nz, www.massey.ac.nz/~kahawick/student-projects.html

An “animat” agent is a software agent that has some physical location associated with it. We can use animat agents to simulate real animals like ants or the behaviours of systems like data packets in a computer network or vehicles in a road network. There is topical interest in **road traffic simulations** world-wide as **congestion problems** grow and it becomes important to understand collective driver patterns to help make better use of the existing road infrastructure. Graph theory has been employed in the past to model flow properties of road networks, but this only approximates the average behaviour of vehicles on a road. An interesting more recent possibility is the use of animat agents to **model traffic patterns at a microscopic level**.

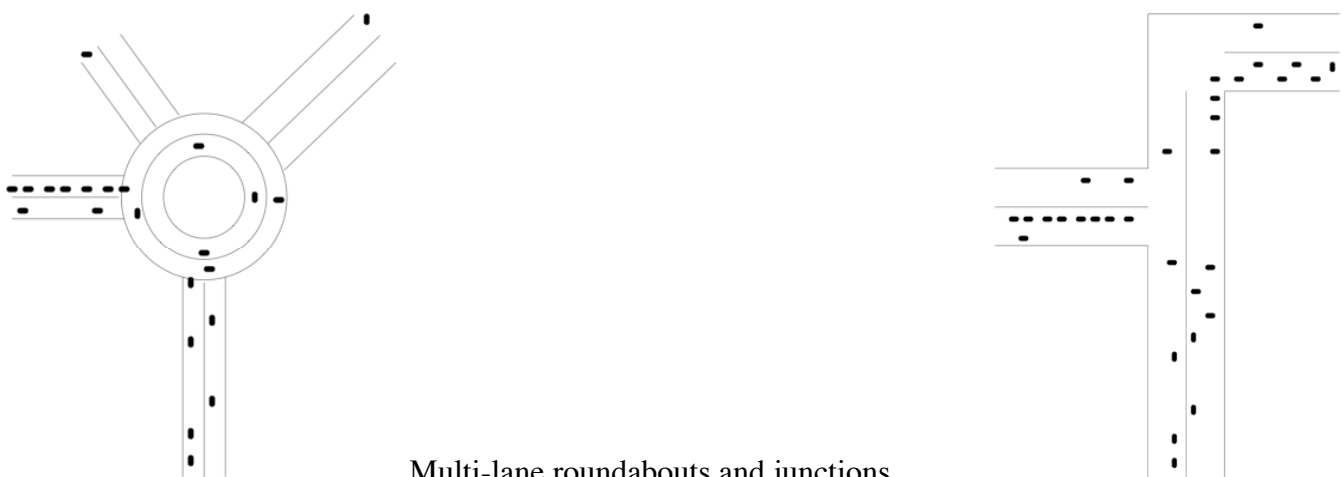
This project will involve development of a simple microscopic model of a road network and an investigation of what occurs when different patterns of road users are placed on it. An **interactive simulation** will be able to read a road network configuration file (essentially a map of the road connections) and display what happens when different patterns of road users compete.

There is scope for development of a sophisticated simulation program but also for its use in investigating a number of collective phenomena. **Emergence** is the notion that some often surprising and unusual behaviour “emerges” from a very simple model when there are many interacting microscopic parts. This project represents an **opportunity to join in an ongoing research programme** looking at **emergence and metrics for describing it in complex systems**.

Two road-traffic phenomenon of special interest are **multi-lane roads** where vehicles can change lanes, and **multi-lane roundabouts** connecting three or more roads together. You may be familiar with the recent innovation of dynamical speed limits that can help reduce congestion and surprisingly can speed up overall flow when individual vehicles are actually slowed down. This and other innovative ideas for managing congestion can be tested using a realistic microscopic traffic model. There is scope to study the road traffic problem in depth or to consider **other networked animat models** and to develop a broader simulation framework that can be generalised.

Parts of this project could be carried out at **honours, masters or PhD level** with obviously more work required to implement more of the aspects of the system at higher levels of study. These projects would suit a programmer with interests in simulation and in understanding collective and emergent phenomena. Longer term and more serious study will require development of statistical data analysis programs to model and describe particular behaviour patterns.

Software development work for this project could be carried out using C/C++ or Java. It would be best if you have taken and passed papers 159.234 (and its pre-requisite papers) to have any reasonable chance of carrying out enough work on this project at undergraduate or honours level.



Multi-lane roundabouts and junctions