PRIFYSGOL BANGOR UNIVERSITY

A Python tool for investigating agent-oriented embodied human-like maze solving in 3D virtual environments

Student: Kian Burnell, Supervisor: William J. Teahan.

Background & Motivation

Searching is an integral part of artificial intelligence, particularly when said artificial intelligence is faced with problem-solving tasks. Search is also a fundamental part of computer science in general [1].

Maze environments are often a well-used environment to test and evaluate the searching and navigation capabilities of an agent in the environment. With that being said, is it possible to devise a novel algorithm based upon human behaviour? There are many maze searching algorithms which find the shortest route, however, these algorithms do not model human behaviour. Modelling human behaviour can be used for more true to life problem solving in areas such as robotics, AI, and psychology [2].

Aims & Objectives

The aim of this project is to improve on or develop a new maze solving algorithm to help improve future human-inspired algorithms.

The following is a list of objectives for the project:

- Design reactive maze solving algorithms using the sense-think-react, embodied paradigm.
- Implement a new human-inspired maze solving algorithm in Python.
- Produce a set of virtual mazes in Python to test the abilities of new and existing maze solving algorithms.
- Evaluate the effectiveness of the newly developed algorithm against the other maze solving algorithms on the new set of virtual mazes.

Methodology

The algorithms which inspiration will be taken from for the novel search algorithm are:

- Tremaux's Algorithm
- Random Mouse Algorithm
- Wall Following Algorithm
- Pledge Algorithm

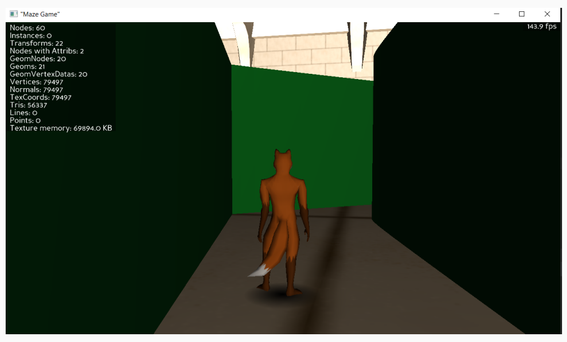
These algorithms have been chosen as a starting point for the new algorithm as they are all embodied algorithms which are "human do-able". The algorithm will be measured using a sample set of mazes and using scientific methods to evaluate the effectiveness of the new algorithm.

Work Done

Due to the usage of Python and Panda3D has allowed for the completion of many tasks so far, these tasks include but are not limited to:

- Modelling of the set of test mazes, see Figures 2, 3, 4 & 5
- Modelling of surrounding environment.
- Set-up of the agent, including:
  - First-person camera,
  - Third-Person camera,
  - Movement of the agent.

Figure 1: Third-person view of the agent inside the maze.



Future Work

The next step in the project is to start developing the new human-inspired maze solving algorithm. Once the algorithm has been developed it will be evaluated using the test set of mazes seen on the right. Once the tests have been carried out the new algorithm's effectiveness will be compared to other embodied maze solving algorithms such as the previosly mentioned algorithms.

References

[1] Leveen Kanal and Vipin Kumar. *Search in artificial intelligence*. Springer Science & Business Media, 2012.

[2] Sabine Gillner and Hanspeter A Mallot. "Navigation and acquisition of spatial knowledge in a virtual maze". In: *Journal of cognitive neuroscience* 10.4 (1998), pp. 445–463.

Figure 2: Birds-eye view of Hampton Court Maze

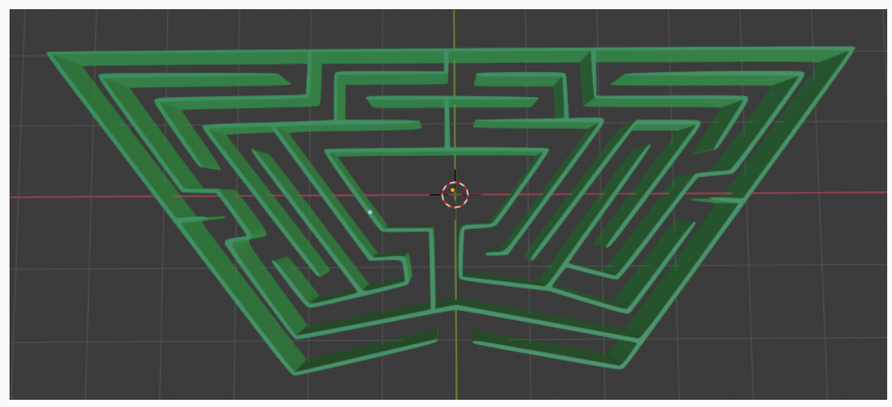


Figure 3: 3D model of the small 15x15 cell maze used in the project

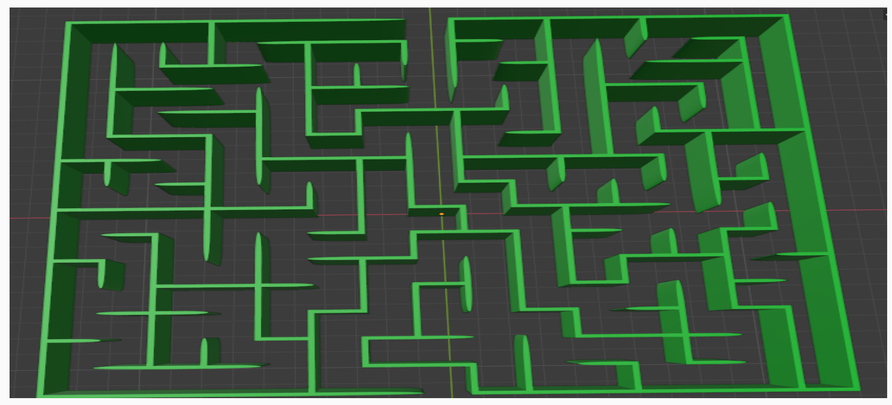


Figure 4: 3D model of the medium 25x25 cell maze used in the project

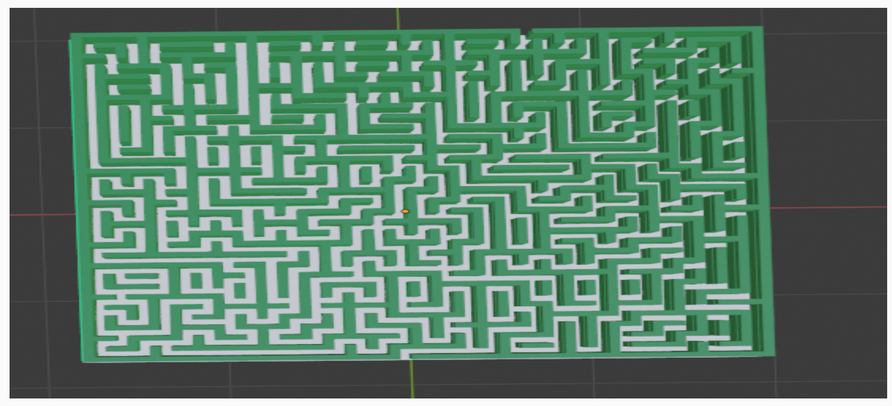


Figure 5: 3D model of the large 35x35 cell maze used in the project