University of Lincoln Assessment Framework
Assessment Briefing 2022-2023

Module Code & Title: CMP2020 - Artificial Intelligence

Contribution to Final Module Mark:
60%

Description of Assessment Task and Purpose:
This is Assessment 2, and is an individual assignment.

This assessment requires you to apply your theoretical knowledge of artificial intelligence to the problem of controlling agents in a game of Pac-Man Capture the Flag. You are required to modify the provided Netlogo model to improve the autonomy of the agents. Your submission should include the code you develop and a concise report of 2 pages in font size 11pt. The purpose of this assessment is to judge your knowledge of the subject area, and your ability to apply your theoretical knowledge of AI to a given problem.

GAME DESCRIPTION

In Pac-Man Capture the Flag, each team consists of a pacman agent and one or more ghost agents. The pacman agents eat the food on the far side of the map (i.e., the red pacman eats the red food and the blue pacman eats the blue food), while the ghosts defend the food on the home side. Figure 1 shows an example environment.

The food eaten by the pacman is stored inside the pacman, until the pacman returns to its side of the map. Upon the pacman's return the food is deposited, earning one point per food pellet delivered. The game ends when all of either team's food has been consumed and delivered. Note, the free space on the red pacman's home area (i.e. the left side of the environment shown in Figure 1) has a pcolor of 10, the free space on the blue pacman's home area (i.e. the right side) has a pcolor of 100 and the middle column of patches (with x=0) has a pcolor of 0.

If a pacman is captured by a ghost before reaching its side of the board, the pacman explodes and the food it has gathered so far is redistributed onto the map. After capturing a pacman, the ghost is no longer dangerous; the ghost must visit its home/initial location to be reactivated. While a ghost is inactive, it can walk through walls.

For pacman agents, the environment is fully observable; they know the current state of the whole world. The ghost agents know the initial state of the environment (i.e. they know the location of the walls, the start location of the pacman and the location of the pellets) and if a pellet has been eaten or not. When a pacman is within a ghost's line of sight (i.e. the walls do not obscure its view), the ghost can see the pacman.

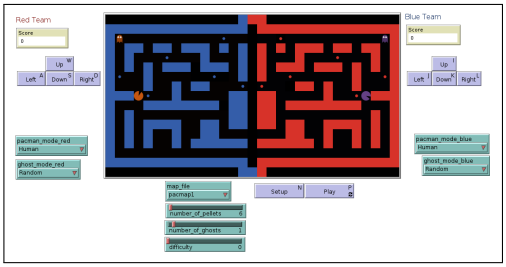

Figure 1. Example Pac-Man Capture the Flag game.

YOUR TASK

We have provided you with a version of this game in which humans/users control the pacman agents, and the ghosts randomly wander around the environment until the opponent's pacman is in view, they then move towards the opponent's pacman. Your challenge is to develop a method for deciding which actions the pacman and ghost agents should perform. The method you develop should met the following criteria:

- Your AI approach must be capable of selecting the direction of travel for the pacman and ghost agents. You can choose any method and could opt to use different approaches/algorithms for each type of agent. However, you must justify your approach and marks will be awarded based on the performance of your agents and the ingenuity of your approach.
- Your approach must be able to handle different Pac-Man Capture the Flag environments. Several map files have been provided (in the zip file on Blackboard) as examples with varying levels of complexity (i.e. size and layout). The map file and the number of pellets (pieces of food) within the environment can be selected within the Netlogo interface we have provided.
- Ideally, your approach should be able to handle each team consisting of >1 ghost (as well as the single pacman agent). Within the provided interface, you can control the number of ghosts within both teams.
- Using the four drop-down lists (*pacman_mode_red, ghost_mode_red, pacman_mode_blue and ghost_mode_blue*), a user should be able to select which method (e.g., human, random, your AI) each of the agents is controlled by. Do not change the functionality of the approaches that we provide you with – instead add new approaches to these lists.

Hint: You have covered Netlogo and search algorithms in your workshops; you could choose to re-use the code you have developed during the workshops.

Along with your code, you must submit a report consisting of a description and justification of the approach(es) you have developed for controlling the pacman and ghost agents. This should include discussing the capabilities (i.e., limitations/disadvantages and advantages) of your approach(es), what alternatives you considered, and why you chose your method over those alternatives. More detail on what is required for the report may be found below under "Additional Information".

Please see the Criterion Reference Grid for details of how the presentation will be graded.

Learning Outcomes Assessed:

- [LO1] Explain the theoretical capabilities of Artificial Intelligence

Knowledge & Skills Assessed:

Subject Specific Knowledge, Skills and Understanding:
Techniques and Skills Subject-specific knowledge.
Professional Graduate Skills:
independence and personal responsibility, written communication, creativity, IT skills, problem solving, effective time management, working under pressure to meet deadlines.
Emotional Intelligence:
self-awareness, self-management, motivation, resilience, self-confidence.

Assessment Submission Instructions:

An electronic submission is required for both parts of this assignment. The report should be submitted via Blackboard through the CMP2020 Assessment Item 2 submission area. Your should put your code is a zip file and submit it via the Assessment Item 2 Supporting Documentation Upload. This zip file should be called `<student id>_CMP2020.zip`.

Date for Return of Feedback:

Please see the School assessment dates spreadsheet.

Format for Assessment:

Your report should be submitted as a PDF file and your code as a Netlogo file.

Feedback Format:

Feedback will be provided to every student via blackboard

Additional Information for Completion of Assessment:

The report should be ∼1000 words, and include the following sections:

- **Introduction (∼300 words)**:
  - Outline the approach you took for implementing the pacman and ghost agents.
- **Justification (∼300 words)**:
  - Comment on what alternative approaches you considered.
  - Mention why you chose your approach instead of these alternatives.
- **Critical Evaluation (∼400 words)**:
  - Discuss the limitations of your approach. Talk about how well your approach performs on different (e.g. larger) environments.
  - Comment of the challenges you faced when implementing your approach and (if you resolved them) how you resolved those challenges.
- **References:**
  - A list of references, in accordance with the University of Lincoln Harvard Referencing Guide: https://lncn.ac/ref.

- **Word Count:**
  - The total number of words in the body text of your proposal document (e.g., excluding headings, captions, tables, references).

Assessment Support Information:
Students should ask the delivery team should they have any queries related to this assessment.

Important Information:
Presentation Guidelines:
You should ensure that your submission conforms to the guidelines in 'Presentation of Assessed Written Work' (Blackboard > School of Computer Science > Useful Documents > Regulations and Policies)
Dishonesty and Plagiarism:
University of Lincoln Regulations define plagiarism as 'the passing off of another person's thoughts, ideas, writings or images as one's own...Examples of plagiarism include the unacknowledged use of another person's material whether in original or summary form. Plagiarism also includes the copying of another student's work'. Plagiarism is a serious offence and is treated by the University as a form of academic dishonesty. Students are directed to the University Regulations for details of the procedures and penalties involved.
For further information, see www.plagiarism.org.