COMP813 Artificial Intelligence 2024

Project – 60 Marks

Choose either A or B

Choice A
Learning vs Planning in Game Playing

You can team up with up to two other students to complete this.

In this project, you are asked to evaluate the performance of reinforcement learning algorithms (such as Q-learning) and planning/searching algorithms (such as minimax and alpha-beta) in the context of game playing.

Requirements

- You can implement the learning and planning/searching algorithms on your own, or use generative AI tools to create an implementation (with a clear description of how the AI tools are used and how correctness is ensured).
- The game should have reasonable complexity. While Tic-Tac-Toe is sufficient, you can choose a different game.
- The evaluation should be your own work. You are expected to assess the impact of algorithm parameters, such as the number of training episodes, learning rate, discount factor, and exploration rate (e.g., in Q-learning), as well as search depth (e.g., in Minimax). The learning agents trained with different parameters will be evaluated against the planning agents and a random agent.

Format

You are expected to submit both the code and a report. Comments should be included in the code to facilitate understanding. Here is the suggested layout for the report:

- Introduction (the purpose of the project; Introduce the concepts of reinforcement learning (RL) and planning/searching algorithms; State the game chosen for the evaluation (e.g., Tic-Tac-Toe, Connect Four))
- Background (Provide an overview of the chosen algorithms and their implementations; Explain how the agents (e.g., Q-learning, Minimax, Random) interact with the game.)
- Evaluation Method (Define the parameters to be varied; Explain how performance will be measured)

- Results (Present the findings from the evaluation: Compare performance of Q-learning agents with different parameters. Compare Q-learning agents against Minimax and Random agents. Use graphs and tables to illustrate results clearly.)
- Discussion (Discuss how parameter changes impacted agent performance. Compare the strengths and weaknesses of RL vs. planning/searching. Reflect on the implications of findings. Suggest potential future work or improvements.)
- References (not included in the page count)

Report shall use Times New Roman, 11-12 point font size, with 1.0 line spacing. The document can be formatted in either single or double columns. The maximum page limit is 8 pages (references are not included in this page count). Reference style IEEE (preferred) or APA.

Marking will be based on the following aspects:

- Understanding of Concepts (15 points)

Demonstrates knowledge of reinforcement learning and planning/searching algorithms.
Justifies the choice of game complexity and explains key algorithm parameters.

- Implementation Quality (15 points)

Implements algorithms correctly and ensures functionality.
Organizes code logically and includes clear comments and documentation.

- Evaluation and Analysis (20 points)

Defines a systematic evaluation methodology with appropriate metrics.
Presents results clearly and provides insightful analysis of findings.

- Clarity and Presentation (10 points)

Follows a logical report structure and maintains clarity in writing.
Adheres to formatting guidelines and includes a properly formatted reference list.

- **Submission**: via Canvas. Deadline on Canvas.
  - ***Report Format***: a PDF document
  - ***Code Format***: Compress your project folder into a single ZIP file.
    - Contents: Include all your scripts and modules necessary to run your code. Do not include any dependency libraries or packages, such as virtual environment folders (e.g., venv, env, __pycache__), as this will make the ZIP file unnecessarily large.
    - Documentation: Include a README file with instructions on how to execute your code and any dependencies required. Comments should be included in the code to facilitate understanding.
  - ***Naming Convention***: xyz=pdf or zip : GroupID_LastName_StudentID_LastName_StudentID.xyz
- **AI usage policy**: see https://canvas.aut.ac.nz/courses/7624/pages/academic-integrity#artificialintelligenceandacademicintegrity

Choice B
AI for Social Good

You can team up with another student to complete this.

The AI for Social Good (AI4SG) movement aims to establish interdisciplinary partnerships centred around AI applications towards the United Nations' 17 Sustainable Development Goals (SDGs).

You are tasked with writing a review report on the topic of AI for Social Good. This assignment aims to deepen your understanding of how AI can be leveraged to address societal challenges and promote sustainable development.

Tasks:

Examine Influential Work:

- Research and identify influential people, organizations, initiatives, or projects that have significantly contributed to the field of AI for Social Good. E.g., Several scholars worked in this area have been recognized by this list of AAAI Award for Artificial Intelligence for the Benefit of Humanity:https://aaai.org/about-aaai/aaai-awards/aaai-award-for-artificial-intelligence-for-the-benefit-of-humanity (Note that you can use Generative AI as a research tool, but always check the correctness of its outputs.)
- Discuss the impact of these works on society and highlight specific examples.

Identify and Discuss AI Methods:

- Identify the various AI methods being used in the context of social good,
- Discuss how these methods are applied to tackle specific social issues.

Highlight a Specific Topic and **Identify Gaps**:

- Choose a particular sub-area within AI for Social Good that you are interested in exploring further.
- Describe why this topic is relevant and important.
- Analyze the current state of research and application in your chosen topic.
- Identify gaps or challenges that exist in this area and suggest a potential solution using an AI method.

Format

You are required to submit a report. Here is the suggested layout:

- Introduction
- Review of Influential Work
- Discussion of AI Methods
- Highlighted Topic and Identification of Gaps
- Conclusion

- References (not included in the page count)

Report shall use Times New Roman, 11-12 point font size, with 1.0 line spacing. The document can be formatted in either single or double columns. The maximum page limit is 6 pages (references are not included in this page count). Reference style IEEE (preferred) or APA.

Marking will be based on the following aspects:

- Research Depth and Insight (15 points)
  - Depth of research conducted.
  - Insightfulness of the analysis regarding influential work.
- Clarity and Relevance of AI Methods (15 points)
  - Clarity in the explanation of AI methods.
  - Relevance of methods discussed to the identified social issues.
- Critical Analysis of Highlighted Topic (20 points)
  - Depth of analysis regarding the selected sub-area.
  - Identification of gaps and challenges.
  - Reasonableness of suggested approach.
- Organization and Presentation (10 points)
  - Overall organization and coherence of the report.
  - Quality of writing, including grammar and formatting.

- **Submission**: via Canvas. Deadline on Canvas.
- **AI usage policy**: see https://canvas.aut.ac.nz/courses/7624/pages/academic-integrity#artificialintelligenceandacademicintegrity