Final Project Ideas

This is a collection of starting points for ideas for your Final Project. There are two for each level 6 module.

Scroll through, or use the navigation bar within your pdf viewer to jump quickly to modules and project briefs you might be interested in.

You need to choose one of the following ideas and use it as the starting point for your project proposal – which will still need to be written and submitted by yourself as part of your assessment for the Final Project module.

CM3020 - Artificial Intelligence

Project Idea Title 1: Kane and Abel: AIs that play games

What problem is this project solving?

Write this as one SHORT question.

What is the background and context to the question above in 150 words or fewer?

The problem is to implement and compare different approaches to playing games with AIs.

This project involves the implementation of two AI systems (Kane and Abel) which can play the same game. One system should have a pre-programmed, behaviour, for example using a finite state machine or other appropriate method. The other system should use some sort of statistical machine learning techniques to learn how to play the game. It is acceptable to adapt the second, machine learning based AI from published source code but the first AI should be written by the student.

AI researchers have long seen game playing as an excellent testbed for AI techniques, and as a marker of the state of the art in AI. There is a wealth of background work covering a wide range of AI techniques and how they can be used to develop game playing AIs. In this project, the student has an opportunity to dive into this fascinating body of work and to attempt to build their own systems.

List some recommended sources for students to begin their research

- Świechowski, Maciej. "Game AI competitions: Motivation for the imitation game-playing competition." 2020 15th Conference on Computer Science and Information Systems (FedCSIS). IEEE, 2020.
  → great recent reference for the various AI game player competitions out there

- Justesen, Niels, Michael S. Debus, and Sebastian Risi. "When are we done with games?." 2019 IEEE Conference on Games (CoG). IEEE, 2019.
  → Some interesting thoughts about the motivations and future of AI game players

- Mnih, Volodymyr, et al. "Human-level control through deep reinforcement learning." nature 518.7540 (2015): 529-533.
  → classic paper about DQN and Atari

What would the final product look like?

(e.g. presentation, usability, functionality, results)?

Presentation: We would expect the student to present in various media, detailed information about the following:

- Review of related work, especially the background to the two game playing system designs
- Description of the game that the AIs will play
- Description of the implementation of the two AI systems
- Properly organised and commented source code for the two implementations

- Evaluation of the two systems, and comparison to human players if appropriate

What would a prototype look like?

What would it show?
What does it need to prove?
*What **IS** important to make clear?*
*What is **NOT** important at this stage?*

We recommend that at the prototype stage, the student should have the simulation environment up and running and that they should have at least one of the AI systems interacting with the environment.

What kinds of techniques/processes are relevant to this project?

- Review of relevant literature and description of the problem domain
- Explaining how the systems interact with the game environment
- Programming the two AI systems, noting that the machine-learning based one might be adapted from published code (e.g. DQN etc.)
- Describing the implementation of the two systems
- Evaluating the performance of the two systems and measuring the effect of different settings

What would the output of these techniques/processes look like?

- Review of relevant literature and description of the problem domain
    - Section in the report describing similar work in the literature and describing the problem domain
- Explaining how the systems interact with the game environment
    - Section in the report
- Programming the two AI systems, noting that the machine-learning based one might be adapted from published code (e.g. DQN etc.)
    - Well organised and commented code
- Describing the implementation of the two systems
    - Detailed technical description in the report
- Evaluating the performance of the two systems and measuring the effect of different settings
    - Presentation of appropriate tables, graphs and commentary showing how the systems perform

How will this project be evaluated and assessed by the student (i.e. during iteration of the project)?

What criteria are important?

We would expect the student to evaluate the following elements:

- Are the AIs able to interact with the game?

- Are the AIs well described and implemented according to a specification?
- How well do the AIs perform?
- Is the code well organised and well commented?
- Is it absolutely clear which code has been written by the student and which has not?
- Are the descriptions in the report sufficient for a tutor to understand how the code works and how the system has been evaluated?

For this brief, what would a minimum pass (e.g. 3rd) student project look like?

- Brief but limited review of the literature
- Working but simplistic attempt at implementing at least one AI game player
- Limited evidence of evaluation
- Limited but complete report

For this brief, what would a good (e.g. 2:2 – 2:1) student project look like?

- Review of the literature which shows evidence of wide reading
- Working attempts at implementing two AI game players, with evidence of significant, iterated development effort on the part of the student
- Well presented evidence of meaningful evaluation of the two AIs
- Complete, clearly written report

For this brief, what would an outstanding (e.g. 1st) student project look like?

- Extensive review of the literature which shows evidence of wide reading and critique of previous work
- Two fully working AI game players, with significant and challenging technical effort involved in their implementation by the student
- Evidence of extensive evaluation and iterated development of different aspects of the AI game players.
- Complete, clearly written report