COS30002 AI for Games

Semester 1, 2018
Learning Summary Report

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Introduction

This report summarises what I learnt in COS30002 AI for games. It includes a self-assessment against the criteria described in the unit outline, a justification of the pieces included, details of the coverage of the unit intended learning outcomes, and a reflection on my learning.

Self-Assessment Details

The following checklists provide an overview of my self-assessment for this unit.

	Adequate (Pass)	Good (Credit)	Outstanding (Distinction)	Exemplary (High Distinction)
Self-Assessment (please tick)	✓			

Self-assessment Statement

	Included? (tick)
Learning Summary Report	✓
Lab Test (TBDA) + Responses (optional)	✓
Lab Work Report + Lab Work (lab notes, code, figures etc)	✓
All required (“core”), completed and signed, Spike Work.	✓

Minimum Pass Checklist

	Included? (tick)
Additional non-core Spike Work, Extensions or equivalent	

Minimum Credit Checklist, in addition to Pass Checklist

	Included? (tick)
Game AI technique/realisation(s) of your own design (working code)	
Supporting documents for your design and implementation	

Minimum Distinction Checklist, in addition to Credit Checklist

	Included? (tick)
Research report, and associated pieces	

Minimum High Distinction Checklist, in addition to Distinction Checklist

Overview of Pieces Included

This section outlines the pieces that I have included in my portfolio…

- All the scans of planning done for Labs and Spikes, as well as all code for the same can be found at: https://github.com/stormcroe/AIForGames2018
- Lab Report that explains how I saw each lab fitting into the ILOs
- Lab Test that demonstrates a basic knowledge on several ILOs
- Lab01: Finite State Machine. This is a simple lab exercise that demonstrated my knowledge on how to put together an FSM.
- Lab02: TicTacToe. This lab is used to demonstrate basic AI interacting with the Game Loop. It also has a rules system for the AI to follow in order to achieve its goals.
- Lab04: Planet Wars Lab. This Lab is the Basis for the work Completed in Lab11_Spike05. It demonstrates simple tactical analysis included in one of its agents that plays the Planet Wars game.
- Lab05: Simple Steering Behaviour. This Lab is included to show building a model for force based movement of agents.
- Lab06: Paths and Wandering. This lab expands the agent's options from Lab05 and gives it more complex force based behaviours.
- Lab10: Graphs, Paths and Search. This Lab introduced algorithms used to search graphs. It included Dijkstra's, A*, Breadth First and Depth First algorithms to search for a target point from a starting point.
- Lab03_Spike01: Goal Oriented Behaviour. This spike demonstrates my knowledge of the strengths and limitations of Simple Goal Insistence based Goal Oriented Behaviour.
- Lab07_Spike02: Emergent Group Behaviour. This Spike Extends the code built in Lab 05 and 06. It takes the force models in those labs and applies it to a group. It demonstrates flocking behaviour as well as using weighted averages in force based movement of agents
- Lab08_Spike03: Tactical Steering. This Spike also extends Spikes 05 and 06. It demonstrates tactical behaviour of a prey object hiding from a hunter object. The prey uses tactical analysis to determine the best choice to survive being hunted on top of using a force model for movement.
- Lab09_Spike04: Agent Marksmanship. This Spike demonstrates how an agent has to calculate weapon trajectories against both a moving and stationary target, as well as switching this calculation to account for the weapons properties
- Lab11_Spike05: Tactical Analysis with Planet Wars: This spike uses the agents created in Lab 04 to provide for statistical analysis of how the use of strategy and tactics determines how and agent will perform in a given situation.
- Lab12_Spike06: Graphs and Search. This spike expands on lab 10, as it explores the differences between Dijkstra's and A*; and in which situations each is useful in.
- Lab13_Spike07: Goal Oriented Action Planning. This spike demonstrates my knowledge of combining different techniques to plan different actions based on several external variables.
- Planning for Lab14_Spike08: This was to show that I knew how to create a hierarchical finite state machine and how that would look like, even If the rest of the spike is not in the portfolio

Coverage of the Intended Learning Outcomes

This section outlines how the pieces I have included demonstrate the depth of my understanding in relation to each of the unit's intended learning outcomes.

ILO 1: Software Development for Game AI

"Discuss and implement software development techniques to support the creation of AI behaviour in games"

- *Lab01, Lab Test, Spike08 Planning: Using Finite State Machines to support creation of AI in Games*
- *Spike01: Uses Simple Goal Insistence to create intelligent behaviour in its agents*
- *All other Labs and Spikes have some measure of support for the creation of intelligent behaviour in their agents.*

ILO 2: Graphs and Path Planning

"Understand and utilise a variety of graph and path planning techniques."

- *Lab10: The code here shows a variety of graph search techniques that are used to plan a path from one point to another*
- *The Lab Report: In the ILO2 Section, goes over my knowledge of the difference of the techniques used in Lab10*
- *Spike06: Shows an analysis on where and when Dijkstra's and A* algorithms could be used.*

ILO 3: Force-based Agent Movement

"Create realistic movement for agents using steering force models."

- *Lab05, Lab06, Spike02, Spike03: All use steering force models to create movement for the agents involved to various levels of complexity*
- *Spike03 and Spike04 applies the force models to predicting the path of a target. Spike 04 also accounts for more complexity in shooting at the target*
- *Spike07 uses the Force Based Agent Movement modes from Lab05 and Lab06 as a basis for each of the states that the agents go between*
- *The Lab Test shows some of my understanding of the vector mechanics behind the force based movement*

ILO 4: Goals and Planning Actions

"Create agents that are capable of planning actions in order to achieve goals."

- *Lab01 and Spike08 Planning demonstrates the use of Finite State Machines as the architecture for the agent to plan its actions*
- *Lab02 demonstrates a simple rule based system for the agent to play TicTacToe*
- *Spike01 demonstrates the Simple Goal Insistence architecture for its agent to achieve its goals*
- *Lab04 demonstrates tactical analysis and how that is used to plan actions. Spike05 extends on this using basic statistical analysis on the lab04 agents*
- *Spike07 demonstrates more complex planning, by having the agent change between Seeking, Wandering and Fleeing based off of distance from both a stationary point and a moving hunter*

ILO 5: Combine AI Techniques

"Combine AI techniques to create more advanced game AI."

- *Spike03 Combines the Force Model behaviour with tactical analysis to create an agent that flees and hides using the cover of objects in the world*
- *Spike07 Combines an abstracted State Machine with Simple goal insistence to create an agent that wanders until a need occurs and then switches state. Eg. When it gets close to the target point it will become curious and seek it until it gets too close and then becomes scared and flees.*

Reflection

The most important things I leant:

- *Graphing and Searching algorithms and in which ways they work in different scenarios. I believe this was the most important thing that I learnt because of the use that these algorithms can be used in many non-game situations which allows me to use them in many pieces of work that need something that they could solve, and not be relegated to being just for a video game. An example would be their use in robotics technology.*

The things that helped me most were:

- *I am currently a developer on the capstone game La Gata Y La Luna and we changed it to a point and click game right around the time we were learning about the graph and searching stuff. This allowed me to give better advice to my designers about how the games mechanics would be built and how they could design about it. Lab 10 helped here as it neatly showed how each of the different algorithms are used and thus which one we should be pairing with a waypoint system for La Gata Y La Luna.*

I found the following topics particularly challenging:

- *The topic I found most challenging would probably have been the soldiers on patrol spike. The fact that I had not enough time to complete coding the actual state machine, meant that because I tend to learn algorithms best by playing with them meant that my knowledge of incorporating a state machine with a hierarchical model is still limited and is something that I wish to pursue further when I get more time.*

I found the following topics particularly interesting:

- *The most interesting topic for me was about balance and bias. As I am an avid strategy game fan and follower of games with a meta-game, knowing about things like player bias showed me some ways to improve myself in those areas as well as for making agents that would reside in those style of games or for creating interesting decisions for players of those games. It has been something that has been reinforced by my viewing habits of game design articles and videos that I have viewed.*

I feel I learnt these topics, concepts, and/or tools really well:

- *The main topic that I feel went really well for me was the path planning and graphs topic.*
- *In this portfolio my understanding of Path Planning is shown in the Lab Report where I detail the different algorithms that were shown to us and their differences between each other; and in the Spike 06 report where I get into where you could use Dijkstra's vs A*.*

I still need to work on the following areas:

- *One of the areas that I absolutely need work on is complex AI structures. I was not able to take the time to immerse myself into some of the spikes that allowed for the exploration of these structures (Spikes 05 and 07 especially) where I all I did was the barest minimum of content that was asked of me. Some of the areas that I would like to explore with these complex AI structures would be the hierarchical FSMs in spike 08. As I was unable to code this spike it would be good for me to finish spike 08 in my own time with the plan that is in this portfolio. As well as have more of a play with the extensions of spikes 05 and 07 later.*

My progress in this unit was …:

Decent until about week 8 or 9, where upon the full-time study load took its toll and I was spending too much time on other subjects compared to AI for Games. After Week 13 when I had completed all my required work

in each of the other classes I spent the week prior to the due date getting all the spikes I had not yet completed done. Unfortunately, Doubtfire's burndown chart is still broken[1] and does not show the difference between a submitted task and a marked off one, thus not showing the work that was completed in week 13 rather than in weeks 1 – 12.

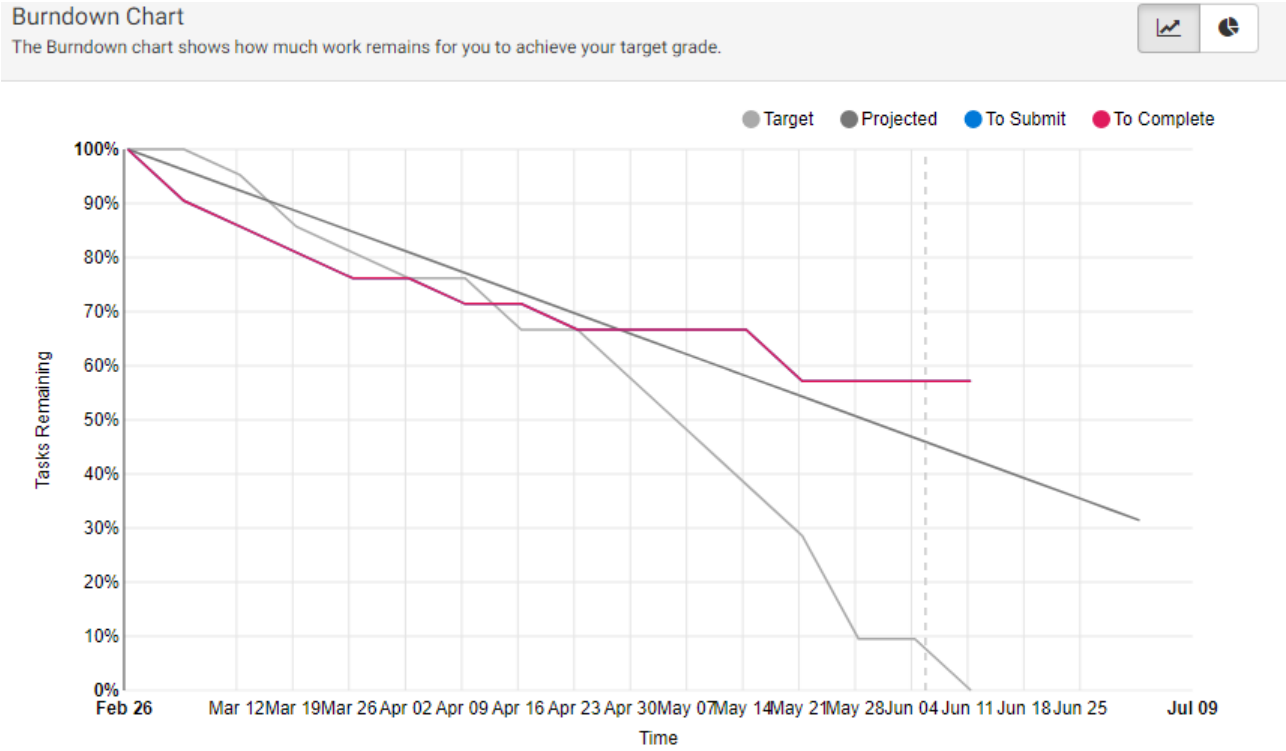

Figure 1 My burn-down chart

This unit will help me in the future:

The main areas this unit will be helping in my future career will be giving me a good understanding on many different basic AI areas and allowing me to follow up and think about how to go about implementing an AI to not look stupid in either game development or in business applications. In particular I referenced my Capstone Game, La Gata Y La Luna, where having the knowledge of the different path finding algorithms (Dijkstra and A) allowed me to understand both how we could build a waypoint system for the point and click game, as well as the knowledge of how to pick a specific waypoint system asset in the store over others. In addition to this, the fact that we were coding in python allowed me to find more references that I can use in future endeavours if I end up using Python for other projects.*

If I did this unit again I would do the following things differently:

I think if I were to do this unit again, I would do in a semester where I had either less subjects or not including such a time intensive subject as the Capstone Project. I had a little trouble during the crunch time of the semester with multiple reports and projects due, as well as a lot on my plate as lead developer of our capstone game. I think I would also choose to not take the tutorial straight after the lecture as by that time in the day I had been at University for far too long at once, and never did get as much done as I could have if I had one of the afternoon tutorials the next day.

Conclusion

In summary, I believe that I have clearly demonstrate that my portfolio is sufficient to be awarded a passing grade. I completed all but one of the tasks in Doubtfire, but did complete the planning for that task.

[1] Doubtfire has been broken for the past 3 years at least in this respect. When I took Games Programming while Clinton was away, because the teacher rarely marked off any work there were large jumps for the red line that did not accurately reflect my learning experience.