Initial Plan – English Draughts AI

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Project Description

English draughts is played on an 8X8 chequered board with twelve pieces per side. The pieces move and capture diagonally forward, until they reach the opposite end of the board, when they are crowned and may thereafter move and capture both backward and forward. This project aims to develop different forms of artificial intelligence (AI) capable of playing English Draughts.

There are multiple approaches to take when creating an AI for solving deterministic games such as draughts. This project will use three methods- random plays, graph searching and machine learning. Several different methods of graph searching will be implemented, ranging from simplistic to more complex, and likely a single implementation of a machine learning algorithm, assuming that there will not be time for more. The game user interface and virtual board will also be made before attempting to create any AI players. Random plays will function as a baseline and should be demonstrably worse than the most basic graph searcher.

Creation of AI capable of playing human games serves several purposes. Firstly, it demonstrates to the public at large the power, or potential power, of AI. The public is more likely to be impressed/ interested in an AI that outperforms or competes with top tier human players in a game that everyone understands, rather than AI that serves a more abstract scientific purpose. Securing public interest means research into AI will be more invested in and hopefully move faster as a result. Secondly, whilst developing this AI, new problems and solutions to those problems will arise, along with new approaches to creating AI. These solutions can likely be applied to more practical applications of AI, and not just used for playing games. Finally the video game industry is worth vast sums of money, and game playing AI is critical to its success, so continued development stands to be profitable even if the technology is never used outside of gaming.

Project Aims and Objectives

The Project aims to deliver:

1. A fully playable game of English Draughts via a virtual board and GUI.
2. A set of different AI players that can play draughts to varying degrees of effectiveness and efficiency.
    a. An AI player that randomly selects legal moves and plays them.
    b. An AI player that implements minimax graph searching to select moves.
    c. An AI player that uses minimax and alpha – beta pruning to improve efficiency. The time saved by not searching useless branches of the tree by pruning should allow this player to explore more possible plays than basic minimax, therefore resulting in better plays overall.
    d. An AI player that uses a heuristic function to evaluate the game state, and uses an algorithm like A* (for example) that takes this heuristic into account before selecting a play.
    e. An AI player that plays draughts against itself and, using data from its many games with machine learning, learns which moves are good choices in various circumstances.
3. A final report that describes how all of the deliverables were made and how they satisfy the project goals. The report should also show how well each type of AI player can play the game, and my understanding of why some players make better plays than others.

Work Plan

Week 1 (30th Jan – 5th Feb)

Creation of user interface and virtual board, involves creating the shape of the pieces, the shape and style of the board, and style of the user interface. The design is intended to be mostly functional as the project is concerned with AI development rather than game development. However some effort will be made to make the design attractive.

Week 2 (6th Feb – 12th Feb)

Gameplay developed. The game is now playable by two human players. Once this has been achieved, implementing the basic random AI player will be simple, so it is possible that this will also be accomplished in this week.

Week 3 (13th Feb – 19Th Feb)

Implementing the minimax player and the alpha – beta minimax player. Finishing implementing the random AI player if that was not achieved in the last week. Finishing both minimax players should be possible within one week because the alpha – beta player is a modification of the basic minimax player, hence it should not take too much time, and should be achievable in the same week.

<u>Week 4 (20th Feb – 26th Feb)</u>

Creation of the heuristic function and the search algorithm which incorporates it into its play selection. Research into heuristic functions will be necessary here, and the heuristic must be demonstrably effective.

<u>Week 5 (27th Feb – 5th March)</u>

Research into machine learning. This topic and how it relates to implementing an AI has not been covered in depth in lectures, so research is required before attempting to create a programme that can learn by playing itself. It is possible this will take less than a week, however week 5 can also act as a buffer for previous tasks that are not yet completed.

<u>Week 6 (6th March – 12th March)</u>

Start on implementation of machine learning algorithm. Having not attempted this before, it is difficult to estimate how much time it will take. Thus leaving two weeks to work on it is a precaution – it is likely this will take at least the two weeks to complete.

<u>Week 7 (13th March – 19th March)</u>

Continue to work on machine learning algorithm.

<u>Week 8 (20th march – 26th March)</u>

Buffer week for machine learning algorithm – if it is incomplete, it can be worked on in this week. Otherwise, final testing of all algorithms can commence. A thorough comparison of performance in terms of gameplay and efficiency will be made, in order to determine which approaches are effective. Evaluation of why these approaches are more/ less effective will be made. This would be included in the final report.

<u>Week 9 (27th March – 2nd April)</u>

Writing of final report to commence. The results of the investigations in week 8 will form part of the report.

<u>Week 10 (3rd April – 9th April)</u>

Continuation of final report.

<u>Easter Break</u>

The weeks of the Easter break will be used as buffer time if the project does not go according to this work plan. It is likely that writing of the final report will spill into the Easter weeks, but hopefully little else will. If the project is completed according to this plan, then after meeting with Dr. Lai the next steps will be determined – for example adding extra elements to the project. Having the Easter break as a time buffer will be a strong backup in the case of delays etc.

Supervisor Meetings

Dr. Lai and myself agreed on weekly meetings, most likely on Wednesdays. This is subject to change as the term progresses however. Two possible/ likely dates are the 1st February and 8th February.

Delays

It is expected that certain tasks will take longer than planned for, although conversely others may take less time. Furthermore there is coursework for the Emerging Technologies module that must be completed this term. Hence the work plan was designed with the intention of leaving the Easter break as free time for any part of the project that has overrun.