

## **MSc PROJECT DEFINITION 2021-22**

***This project definition must be undertaken in consultation with your supervisor. The feasibility of the project should have been assessed and the project aims should be clearly defined.***

***Submission of this document implies that you have discussed the specification with your supervisor.***

**Project Title:** Enabling Computer to Play Go Against a Human Player

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### **PROJECT AIMS:**

*State the design, development or research challenge (problem) that the project aims to solve.*

This project is to enable a computer to play the board game Go against a human player via an algorithm. I will consider various alpha-beta search algorithms and possibly also Monte-Carlo search algorithms which could allow the computer to play, and attempt to implement one using the coding language Python.

### **PROJECT OBJECTIVES:**

*List a series of objectives you need to achieve in order to fulfil the aims of your project.*

#### **Minimum objectives:**

- Use an algorithm to implement a variation of the game of Go in which the aim is to place five stones in a row ahead of one's opponent
- Maintain all other usual rules of a Go game, including how to capture the opponent's stones and the Ko rule
- Game playable on a 9x9 board
- Rudimentary user interface allowing the human player to enter the coordinates they wish to play on the board and then receive the coordinates the computer has replied with for its move

#### **Ways the project could be extended:**

- use a more sophisticated algorithm to play the game, such as Monte-Carlo search

- implement the full game of Go rather than only the five-in-a-row variation
- allow play on a full size 19x19 board
- allow computer to provide the score at the end of a game, even when the human player passes early
- allow the computer to establish whether passing or continuing play is the optimum tactic
- create a sophisticated user interface which allows user to visualise board and visually display where they would like to place their stone

## **METHODOLOGY:**

*Describe the various steps that you intend to follow in order for you to achieve your project aims.*

- Review literature on two-player games including learning about various alpha-beta search methods and possibly Monte-Carlo search
- Implement five-in-a-row human-to-human interface in which coordinates are provided by each player and computer detects when game has ended and displays who the winner was
- Computer should also not allow illegal moves in the game (in particular by recognising the Ko rule)
- Use existing interface in order to implement a game in which a human plays the computer via an algorithm
- Unit test all parts of the code during development to allow for easier debugging
- Write up report

## **PROJECT MILESTONES**

*Indicate what measurable/tangible components you will produce as part of this project. This may take the form of deliverable document(s) or developmental milestones such as a working piece of software/hardware.*

A piece of software written in Python which allows a human to play the five-in-a-row variation of the game Go on a 9x9 board against a computer based on an algorithm. The software will be made up of the following four parts:

- 1) code to handle game moves and storing of game position
- 2) code containing algorithm to choose next move
- 3) code for visual user interface for the human to interact with
- 4) code for test suite including unit tests, integration tests and system tests

An extension to the above software could be implemented to allow playing of the full game of Go on varying board sizes up to 19x19

- a report outlining the steps taken to achieve this goal, including literature review, challenges and solutions found along the way

**REQUIRED KNOWLEDGE/ SKILLS/TOOLS/RESOURCES:**

*Indicate as far as possible the skills that are required for you to undertake this project. Also include any software, hardware or other tools or resources that you believe you will need.*

- understanding of various alpha-beta search algorithms
- Extension possibility to also develop understanding of Monte-Carlo search algorithm
- understanding of the Python programming language
- understanding of command-line interface for Unix-style systems

**TIMEPLAN**

*This can be a GANTT chart submitted with this document or a list of tasks, milestones and deliverables with timings.*

See Gantt chart