



COLLEGE OF SCIENCE & ENGINEERING

# What Is Go?

• **Go** is a Chinese board game for two players, in which the aim is to surround more territory than the opponent. One player plays with white stones, and the other plays with black stones. The official grid comprises 19x19 lines, containing 361 points.



#### Strategy

 Strategy deals with global influence, interaction between distant stones, keeping the whole board in mind during local fights, and other issues that involve the overall game. It is therefore possible to allow a tactical loss when it confers a strategic advantage.

#### Area Scoring

 A player's (final) score is the number of stones that the player has on the board plus the number of empty intersections surrounded by that player's stones.



# Goals

- Obtain optimal solutions for board sizes from 3x3 to 9x9.
- Integrate the project idea into teaching in mathematic topics.

# Challenges

- The complete understanding of the source code.
- The investigation and modification of the source code.

# **Conclusions and Future Work**

- Convert the original 19x19 board size into smaller odd ones.
- Use the original weight file provided by Pascutto to run the program and investigate the structure of the weight files and convert them to fit the training with different board sizes.
- Investigate the weight files and modify the source code to achieve the goal.
- Move on to train the program on different board sizes, record the results to find out the optimal solutions, and compare with the mathematically proven results.





# **Technologies Used**



C++ is the programming language used to write the LeelaZero program.



**Python** is the programming language used to train the program using TensorFlow

### Authors: Kien Nguyen, Quang Truong, Kimon Vogt, Megan Phan, Khiem Nguyen

Advisors: Dr. Liran Ma, Dr. Ze-Li Dou



### References

Go Game Overview: https://en.wikipedia.org/wiki/Go\_(game) LeelaZero GitHub Repository: https://github.com/gcp/leela-zero Sabaki GitHub Repository: https://github.com/SabakiHQ/LeelaSabaki AlphaZero Overview: https://deepmind.com/documents/119/ agz\_unformatted\_nature.pdf

The New Yorker's Article About AlphaZero and LeelaZero: https:// www.newyorker.com/science/elements/how-the-artificial-intelligenceprogram-alphazero-mastered-its-games

Monte Carlo Tree Search Overview: http://mcts.ai/







• The main idea of the reinforcement learning algorithm is to use these search operators repeatedly in a policy iteration procedure: the network's parameters are updated to make the **move probabilities** and **value** (p, v) more closely match the improved **search probabilities** and **self-play winner** ( $\pi$ , z).

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