NANYANG TECHNOLOGICAL UNIVERSITY
SINGAPORE

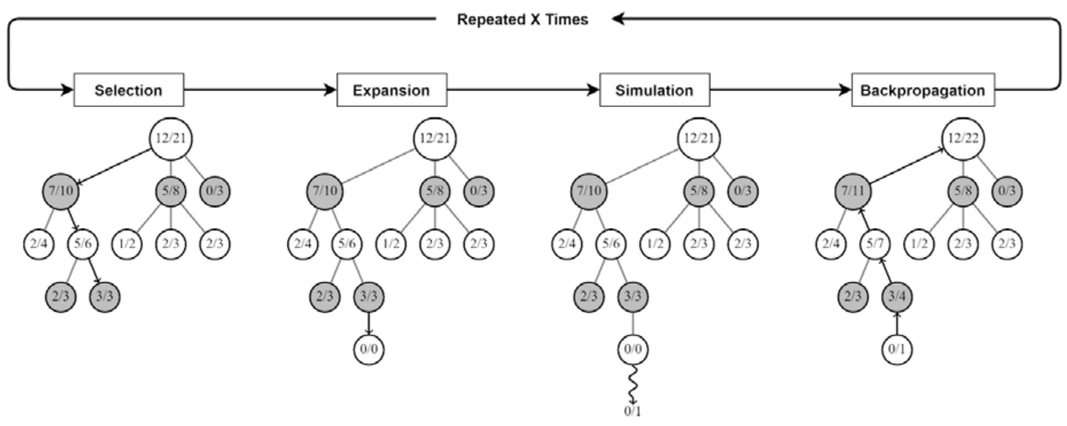
School of Computer Science and Engineering
College of Engineering

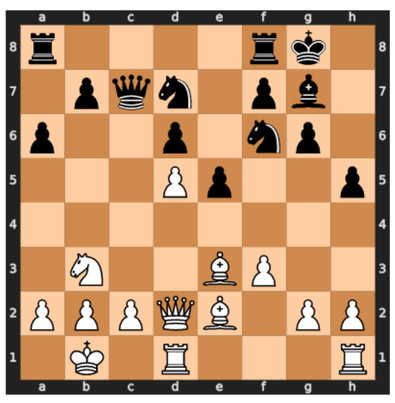
(Part 2)

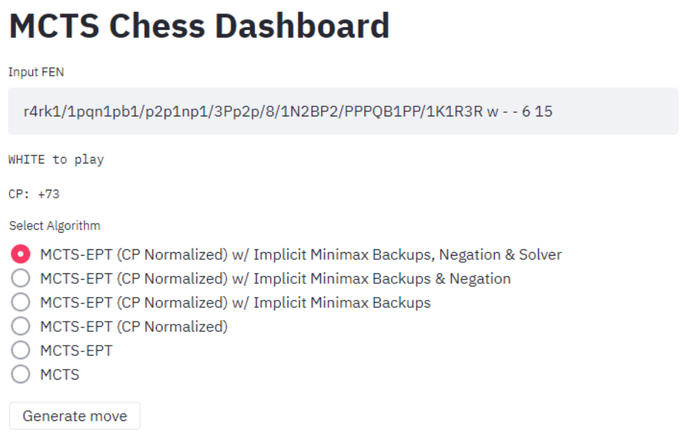
Deep Learning & Computer Chess

An MCTS Chess Engine with Heuristic Enhancements

Student: Ngoh Guang Wei **Supervisor: Dr He Ying**



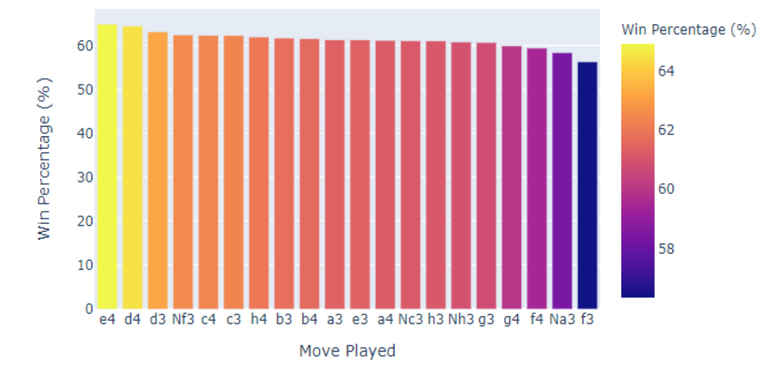




Project Objectives:

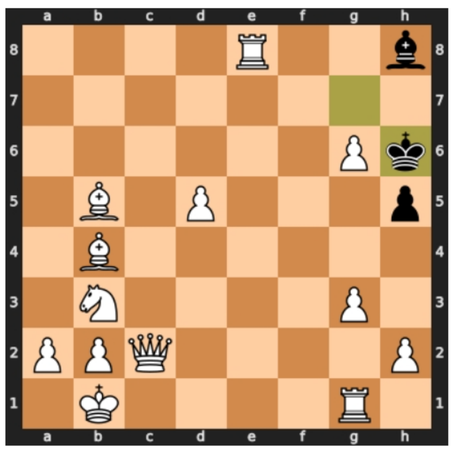
Monte Carlo Tree Search (MCTS) is a probabilistic algorithm that has gained traction in recent years. MCTS uses lightweight random simulations to selectively grow a game tree and has experienced a lot of success in domains with vast search spaces, such as chess, which historically, have challenged deterministic algorithms.

This project aims to explore the usage of the MCTS algorithm in chess engines and also the various ways MCTS can be improved beyond the base algorithm through the use of a static board state evaluation function along with various existing enhancement methods as well as newly suggested novel enhancement methods



Best Move: e4

	move	win/sim	score
15	e4	421.27/649	64.910000
16	d4	398.55/618	64.490000
8	d3	336.67/533	63.160000
1	Nf3	309.29/495	62.480000
17	c4	305.54/490	62.360000
9	c3	303.6/487	62.340000
12	h4	291.4/470	62.000000
10	b3	284.09/460	61.760000
18	b4	279.12/453	61.620000
11	a3	270.58/441	61.360000
7	e3	271.21/442	61.360000
19	a4	266.86/436	61.210000
2	Nc3	264.77/433	61.150000
4	h3	264.05/432	61.120000
0	Nh3	259.35/426	60.880000
5	g3	252.69/416	60.740000
13	g4	232.11/387	59.980000
14	f4	219.43/369	59.470000
3	Na3	196.25/336	58.410000
6	f3	159.99/284	56.340000



3 Game Playout

MCTS-EPT (CP Normalized) w/ Implicit Minimax Backups & Negation vs MCTS

Moves played: 17

Stockfish Eval: +4270 Static Eval: 3860

Wins: 2
Losses: 0
Draws: 0

Game 1 - Won (Checkmate) - 15 Moves

Game 2 - Won (Checkmate) - 19 Moves

Features:

- Dashboard built to deliver data in a clearer and more visually appealing way.
- Adjust and tune parameters of MCTS engines.
- Generate and view move statistics for any board state.
- Perform playouts against own MCTS engines, minimax engines and various commercial engines.

Results & Conclusion:

With the various enhancements , the improved engine manages to easily defeat the basic MCTS engine and is able to hold its own against conventional minimax engines. With further development and improvement of the engine in the future, it could potentially outperform commercial chess engines.