

# Senior Project Proposal

1<sup>th</sup> April 2022

## OBJECTIVE

The objective of this senior project is to develop an AI program that can play chess at a level high enough to beat human players. The program must only play legal moves, be able to analyze board positions in order to select the 'best' move to play, and be able to handle special rules in chess such as castling, pins, en passant, etc.

## GOALS

1. Construct a program with which a person can play chess
2. The program will be able to analyze positions and make moves in response
3. The program will utilize some of the latest techniques in chess AI, potentially:
  - a. Alpha beta pruning
  - b. Neural Networks (Convolutional, ResNet)
  - c. Monte Carlo Tree Search
  - d. Chess opening books

## TASK SPECIFICATIONS

- Chess board
  - Machine representation
  - Legal move checking
  - Special rules (en passant, castling, checks and mates)
  - GUI
  - Position Evaluation
- AI
  - Determine type of Algorithms (CNN? ResNet? Searches, etc)
  - Alpha beta pruning
  - Training time
  - Data gathering method for training if needed

---

## TENTATIVE TIMELINE

### Quarter 1 (Spring 2022)

Weekly Meetings: Tuesdays 3:30pm

- Week of Apr 4, 2022
  - Decide upon machine representation of chess board
  - Begin implementation of preliminary chess board coding
- Week of Apr 11, 2022
  - Code GUI and begin working on regular chess rules
- Week of Apr 18, 2022
  - Finish coding regular rules (ignores castling, collision, pins, en passant)
- Week of Apr 25, 2022
  - Finish coding ALL chess rules, begin work on eval
- Week of May 2, 2022
  - Complete implementation of chess board with rules, position evaluation
  - Begin research on algorithms to use, possible implementations, etc.
- Week of May 9, 2022
  - Decide upon which algorithms to use and begin work on implementing them
- Week of Jun 6, 2022 (End of Quarter Expectations)
  - Majority of algorithms should be implemented, and Neural Network implementation should be nearly complete

---

## TENTATIVE TIMELINE

### Quarter 2 (Fall 2022)

Weekly Meetings: TBD

- Week of Sep 19, 2022
  - Classes begin
- Week of Sep 26, 2022
  - Ideal Neural Network training start
- Week of Oct 3, 2022
  - Neural Network must start training by this date
  - Monitor progress occasionally and make adjustments if necessary
- Week of Oct 24, 2022
  - Check in on neural network progress, can test vs existing programs and make adjustments
- Week of Nov 14, 2022
  - Training and final results should be complete
- Week of Nov 28, 2022
  - Work on publishing results, etc
- Week of Dec 5, 2022
  - Project complete

---

## EVALUATION OF SUCCESS

In order to be considered successful, the program must pass several checks. First, it must be able to play chess well enough to defeat human opponents (an estimated rating of 1000-1200 would suffice, a rating of 1600+ would be considered very successful). This rating can be determined by playing versus various existing chess programs that have ratings, and aiming for a roughly 50% win rate. Naturally, in order to beat humans, the program must possess some sort of evaluation system to be able to evaluate a given chess position. The program must also only give legal moves as outputs, and be capable of playing every possible move in chess. Professor Foaad Khosmood, the faculty advisor of this project, must also find the methods, algorithms used, and work done for this senior project suitable.