

# PROJECT REPORT

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# Introduction

The project involves making a 1 player chess game with an AI. The aim of the project is to learn how Artificial Intelligence systems are applied in everyday programs. The project acts as an introduction in Artificial Intelligence design, and provides a basic starting point for further AI systems.

Chess has often been described as the *Drosophila Melanogaster* of Artificial Intelligence. Just as experiments and research with fruit flies (*Drosophila Melanogaster*) led to advances in the field of genetics, chess is an accessible, familiar, and relatively simple experimental technology that nonetheless can be used productively to produce valid knowledge about other, more complex Artificial Intelligence systems.

# Challenges

The various challenges posed by this program include :

- Getting the AI to play reasonably good moves.

For most humans, playing good moves isn't particularly easy. Thus designing an AI that can play at a reasonable level is quite a challenge.

- Reducing the time of computation and memory usage as far as possible.

Various brute force methods could be used to compute the computer's next move. However, these would not be very economical in terms of memory and time usage. These constraints make designing the AI even more difficult.

- Making the UI aesthetically pleasing and easy to use.

It is equally important that the program is easy to use. It is imperative that the program runs with minimal lag, thereby providing a smooth user-friendly interface without rendering issues.

# Project Overview

- First, 2 player chess is to be implemented. This stage has already been reached. (The sample code can be compiled and run.)
  - The board is implemented using an array of pointers to an object of class pieces.
  - Concepts of OOP are used to declare methods to check for validity of moves
  - The current display simply prints on the console.
- The graphics and AI come next. For the graphics, SDL(Simple DirectMedia Layer) is to be used.
  - The choice of the sprite sheet to be used has been made.
  - Attempts will be made to make the UI as minimalistic and intuitive as possible. The use of SDL will ensure portability across a wide range of systems.
- The chess engine i.e. the AI, is the final component of this program.
  - The chess AI is a fairly well documented problem and quite a few online resources relating to it exist.
  - The team is in the process of studying the well known algorithms relating to chess AI.
  - Algorithms like MiniMax algorithm and Alpha-Beta Pruning will be implemented.

# Artificial Intelligence

The Artificial Intelligence (AI) of the chess program has been designed using an algorithm called MiniMax algorithm with Alpha Beta Pruning.

The MiniMax algorithm is a tactic used in two-player games, which uses the fact that the two players are working towards opposite goals to make predictions about which future states will be reached as the game progresses, and then proceeds accordingly to optimize its chance of victory.

The theory behind MiniMax is that the algorithm's opponent will be trying to minimize whatever value the algorithm is trying to maximize (hence, "MiniMax"). Thus, the computer should make the move which leaves its opponent capable of doing the least damage.

The Alpha Beta Pruning algorithm is an enhancement to MiniMax which eliminates the need to check each and every possible move, by discarding certain branches in the game tree without overlooking any better moves.

References :

<http://cs/ucla/edu/~rosen/161/notes/alphabeta.html>

<http://web.stanford.edu/~msirota/soco/minimax.html>

# Scope

- This program can be used to play recreational chess. Several popular chess programs such as ChessMaster have been released over the last few decades, and are widely played even today.
- It can also be used to practice and get better at the game. Many young chess players around the world learn the game by playing against virtual chess engines of varying difficulties.
- Several chess engines have beaten some of the best human players in the world. The *Deep Blue* chess engine famously beat Russian Grandmaster and world champion Garry Kasparov, while Indian Grandmaster and former world champion Viswanathan Anand was defeated by the *Rebel 10* engine.