In the name of Allah, Most Gracious, Most Merciful.

INTERNATIONAL ISLAMIC UNIVERSITY CHITTAGONG

Department of Computer Science & Engineering

Course Code: CSE-3636

Course Title: Artificial Intelligence Lab

Project Presentation

Submitted To:

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Team Introduction

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Project Title

AI based Chess Game using Python

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Introduction

- **Chess,** a renowned classical two player strategy board game, involves two players maneuvering armies on a square board to attack each other's king.

- The rise of artificial intelligence has transformed chess, enabling AI-powered games with sophisticated algorithms.

- Our project is a chess game with a user-interactive interface that allows users to play against AI-generated opponents. It uses AI algorithms to analyze the current state of the game and make strategic moves based on that analysis, enabling it to play at a high level without relying on human input.

Objective

- Our aim was to complete a project that is a Complex Engineering Problem, so we have built a gaming software - **Chess AI using Python**, which satisfies the criteria.

Language & Tools

Pycharm Community Edition 2021.2.3	Python	Pygame
IDE	Language	Library

Python 3.9.7
INTERPRETER

Main Modules

CHESS Python Package

ChessMain

Python script for a chess game GUI built with the Pygame library

ChessEngine

Contains a class called GameState() which is responsible for storing all the information about the current state of game

ChessAI

Script that implements the NegaMax algorithm with alpha-beta pruning to improve the efficiency of the chess AI

Features and Functionalities

Reset Feature

keystroke command: (Ctrl+R)

Before Reset

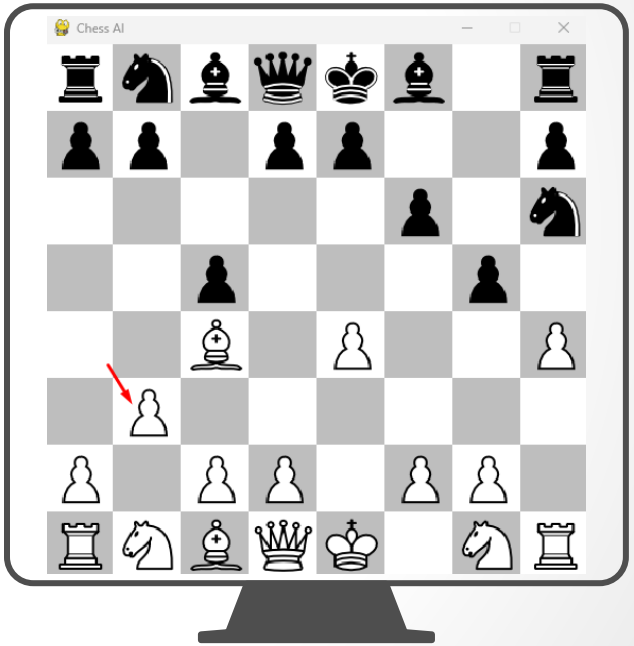
After Reset

Features and Functionalities

Undo Feature

keystroke command: (Ctrl+Z)

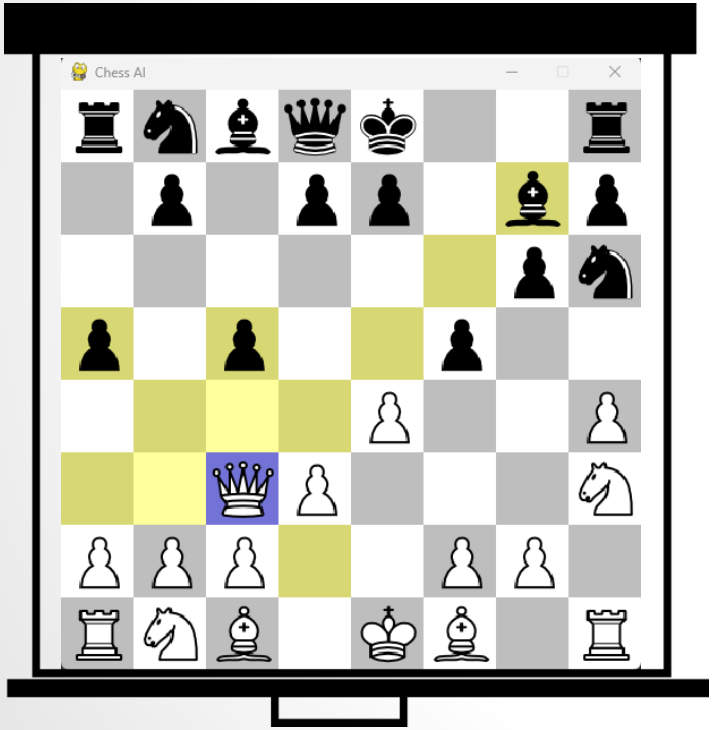
Before Undo



After Undo

Features and Functionalities

Square Highlighting



This function **highlights** the selected square and all the valid moves from that square in **blue** and **yellow** colors respectively. This feature adds a visual element to the game and enhances the user experience.

Features and Functionalities

Game Alert
(Checkmate)

Checkmate is a game position in chess in which a player's **king is in check** (threatened with capture) and there is no possible escape.

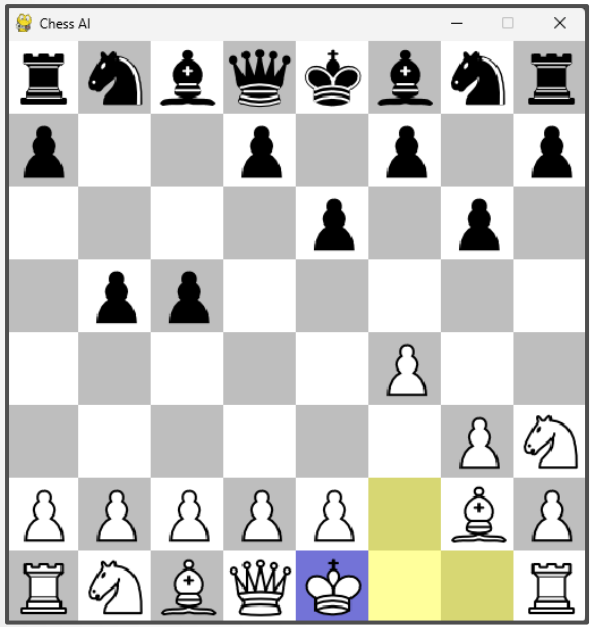
Features and Functionalities

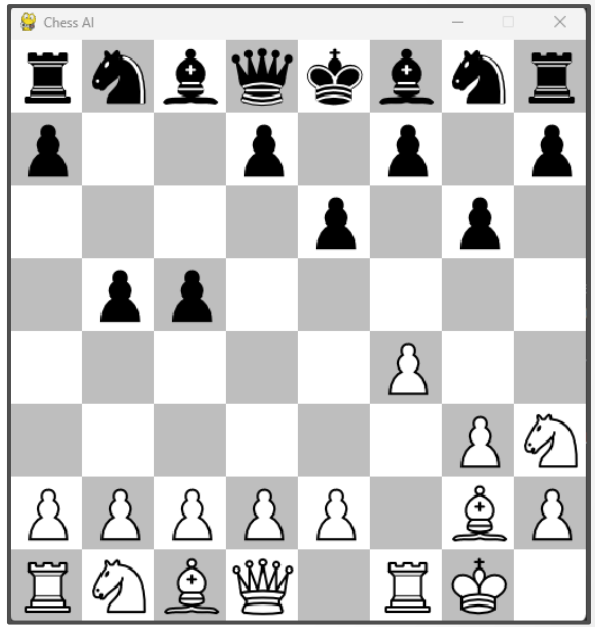
Game Alert
(Stalemate)

Stalemate is a type of Draw in the game of Chess. This means that if a Stalemate happens while playing a game, neither side wins or loses and the game ends in a **Draw**.

Special Moves

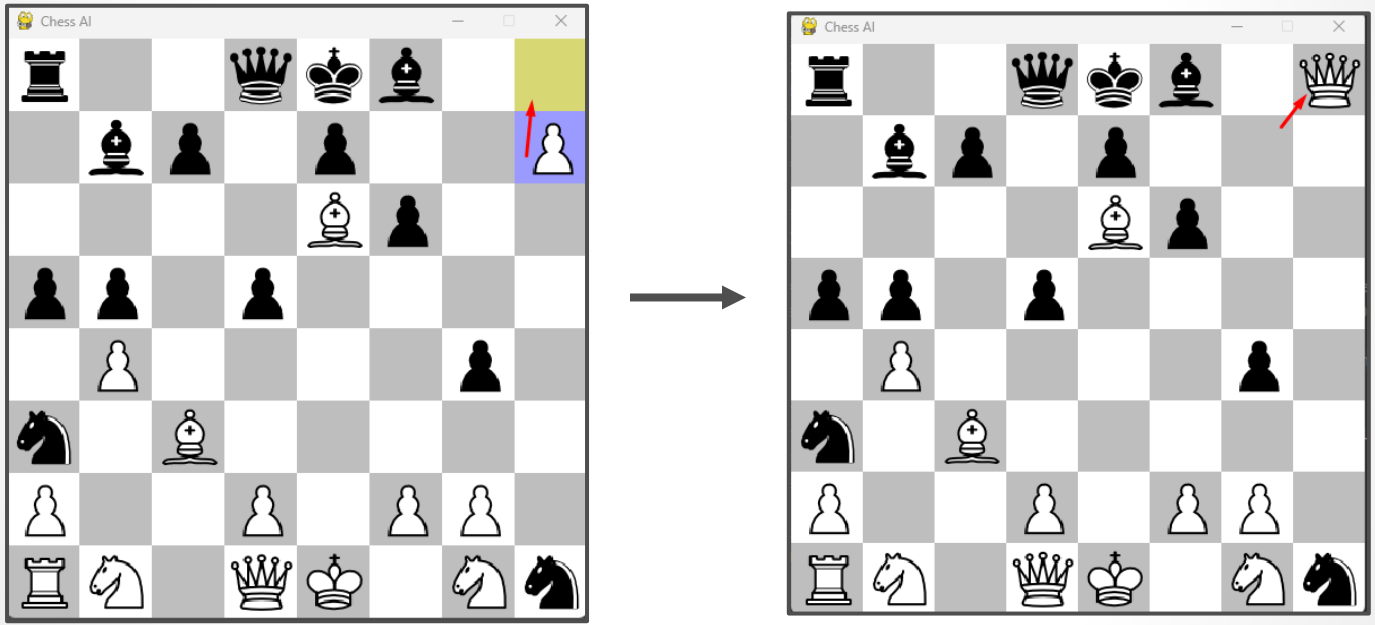
Castling





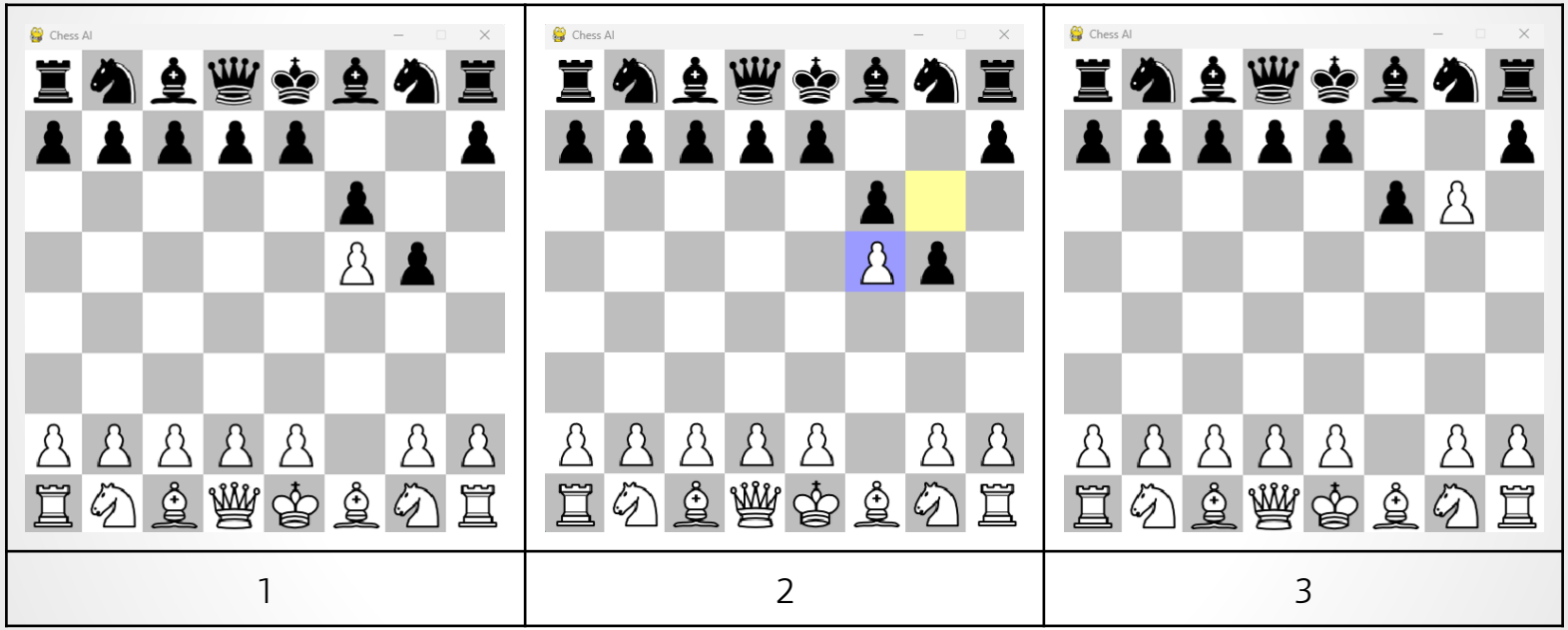
Special Moves

Pawn promotion



Special Moves

En-passant



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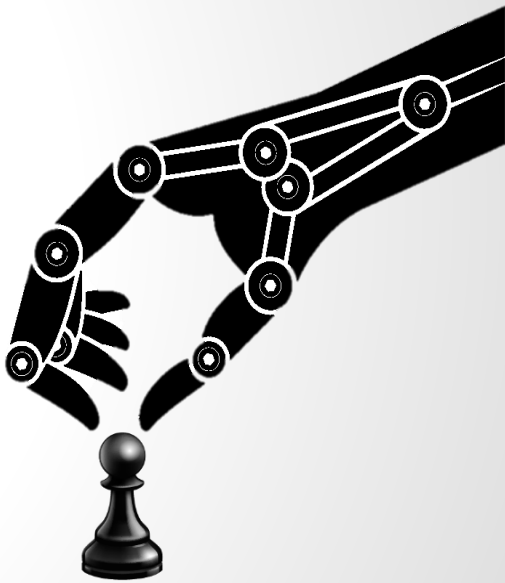
Being Artificial Intelligence

Algorithm Implementation

If we want our chess game to play as a computer vs. human version rather than a human vs. human version, we need the computer to be able to make intelligent decisions. This is why we implemented a decision-making algorithm called **Nega Max Alpha Beta Pruning**.

It enables better decision-making in games like chess by considering multiple move possibilities, evaluating positions, and selecting the optimal moves based on an efficient search process.



Being Artificial Intelligence

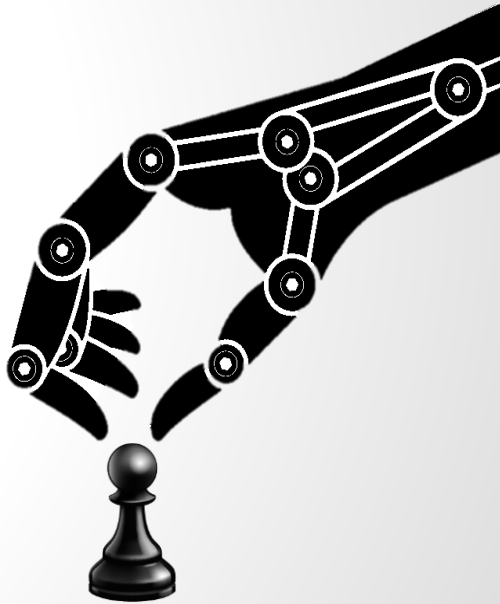
What qualifies this game as an implementation of Artificial Intelligence ?

Move Generation: The game generates valid moves adhering to chess rules and strategically selects the move that maximizes success through exploration of multiple options.

Decision-Making: The game uses advanced algorithms like Minimax with Alpha-Beta Pruning or NegaMax to intelligently decide the optimal move, considering future game states and potential outcomes.

Evaluation Function: The game uses an evaluation function to assess position quality, considering factors like piece development, king safety, center control, and material advantage.

Depth and Complexity: The game dives deep into the game tree, exploring multiple moves and countermoves, resulting in sophisticated and strategic gameplay that poses a challenge for human players.



Future Work

UI Improvements

- **Creating a Menu** to select AI/Human
- **Flip Board** options (display from black perspective)

Engine improvements

- **Move Ordering**: Start with moves that previously scored higher which will also improve pruning.
- **AI's Adaptive Learning**: This capability enhances decision-making by analyzing previous games and adjusting strategies.

Thank You