TIC TAC TOE

AI PROJECT

Designed using minimax
algorithm with alpha beta pruning

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GROUP MEMBERS

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Project Idea - Introduction

The Minimax algorithm with alpha-beta pruning for AI decision-making is used in the basic but timeless AI Tic-Tac-Toe project. With an emphasis on strategic depth, the game is made to let players battle against AI opponents. The Raylib library is used in the implementation of the user interface to create an eye-catching experience. The AI uses a strict search methodology to guarantee the best moves at every turn, making it impossible to defeat.

Scope of the Project

The project's main characteristics are as follows:

I. Play Tic-Tac-Toe on a 3x3 grid with AI and human opponents.
II. Alpha-beta pruning improves the Minimax method, which the AI opponent use to cut down on pointless computations and accelerate decision-making.
III. Graphical Interface: Using Raylib, the game's graphical user interface (GUI) has a clean, grid-based layout and recognizable X and O marks.
IV. Side Panel Display: A side panel shows real-time information about the status of the game, including the outcome (win, lose, or draw).
V. Dynamic Messaging: Humorous and motivational messages are displayed based on the player's and AI's performance, adding a unique, playful character to the game.
VI. Interactive Mascot: The game features a charming bear mascot displayed on the side panel, which dynamically reacts to the outcome of the game. The bear's expressions change based on whether the player wins, loses, or ties, providing an additional layer of engagement and personality.

Selected Data Structures

The following data structures will be employed in the project:

I. 2D Array: A 3x3 2D character array (char board[3][3]) to represent the Tic-Tac-Toe board. Each cell contains either 'X', 'O', or an empty space ' ' to represent the state of the game at any point.

II. Minimax Tree: The game makes use of a recursive decision tree (Minimax) to evaluate all possible game states, with alpha-beta pruning to eliminate unnecessary branches and optimize performance.

Limitations of the Project

I. Limited Complexity:
Due to the game's simplicity, the AI will always play optimally, making it impossible for a human player to win if the AI plays first. Nevertheless, TicTacToe is a great way to illustrate the Minimax algorithm. As the results become predictable, this restricts the opportunity to replay.

II. Small Scope: The project is intentionally simple, focusing on a 3x3 grid, meaning that the same logic and design would need to be extended for more complex games.

III. Lack of Multiplayer: The project is designed for a single player against an AI, with no provision for multiplayer or online play.

Distribution of work

Rania Imran and Fatima Khan

- Focused on designing and implementing the graphical elements of the game, including the layout of the grid, the X and O markers, and the visually appealing side panel.
- Contributed to auxiliary functions that enhance the overall aesthetics and functionality of the game.

Javeria Ziad Laiba Aminani

- Developed and integrated the AI functionality using the Minimax algorithm with alpha-beta pruning optimization, ensuring efficient decision-making and challenging gameplay.
- Designed and implemented related functions that support the Minimax algorithm, such as move evaluation and board state analysis.