Connect Four Report

The Connect Four AI is built using the **Minimax algorithm**, enhanced by **alpha-beta pruning** to reduce unnecessary computation. The algorithm evaluates future game states up to a specified depth and selects the optimal move by:

- **Maximizing the AI's potential score** while minimizing the opponent's.
- **Pruning** branches that cannot affect the final outcome, increasing performance.

There's also four distinct themes including **Vintage Sunset, Retro Pixel, Monochrome and Cyberpunk.**

Heuristic Evaluation Function

The AI uses a custom heuristic function to evaluate board states. Scoring is based on three main factors:

1. Center Column Control

- AI gains +3 points per piece in the center column for its strategic value.

2. Pattern-Based Scoring (4-cell windows)

- **AI 4-in-a-row**: +100 (win)
- **AI 3 + 1 empty**: +5
- **AI 2 + 2 empty**: +2
- **Opponent 4-in-a-row**: -100 (threat)
- **Opponent 3 + 1 empty**: -10
- **Opponent 2 + 2 empty**: -1

3. Win/Loss Prioritization

- Immediate wins: `1,000,000 - depth`
- Immediate losses: `-1,000,000 + depth`

This encourages faster wins and delayed losses.

AI Behavior by Depth

- **Depth 0 (Easy)**: Relies only on heuristic scoring of the current board.
- **Depth 1 (Medium)**: Looks one move ahead; blocks threats and finds quick wins.
- **Depth 2 (Hard)**: Strategically plans two moves in advance, balancing defense and offense.