

Connect 4 AI Write-Up

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Introduction

The premise of the AI Connect 4 project is to create an artificial intelligence program that can successfully navigate and play a game of connect 4, and, ideally, win. The game Connect 4 starts with an empty board of 6 rows and 7 columns, and players take turns dropping pieces into the board. The objective of the game is to create a line of 4 of your own pieces, whether vertical, horizontal, or diagonal. With every move, the intention is either to get closer to your own line of 4 pieces, or to block your opponent from creating their own line of 4.

A big reason we picked this project is that we both are majoring in computer science, and saw this project as an opportunity to combine our interests in the AI field with our interests in cognitive and psychological sciences. We wanted to see how the fields intersected and work with an AI related program in order to learn first hand how to code a project of this level.

Program

Our Connect 4 AI program allows users to play against the computer through a Web-Socket server for communication. It keeps track of the game itself, updating the board with received messages of the opponent's turn and plays its own turn accordingly. The aim is to align four pieces in a horizontal, vertical, or diagonal line. Our program calculates the best possible move as either getting closer to the winning goal or blocking the opponent from achieving their own line of four. It does this through an algorithm that looks at all possible columns where a move might be possible and then also calculates the opponent's best possible response move to that column. Then it scores how ideal the state of the board would be after each of the potential moves and responses. It eliminates the moves that are worse in order to save time, and then picks the one with the highest score. The only user input needed in this code is in connecting to the server and creating or joining a game. Beyond that, the AI takes care of actual gameplay.

Results

Our program worked as expected in connecting to the game. In terms of gameplay, our program did better than we had initially anticipated, as we had noticed but were unable to fix the fact that it sometimes missed moves that might've led to a quicker win. Despite this, it played very well in the tournament and made it to the final round.

Discussion

I think the program definitely satisfied our goals of learning more about the utilization of AI in game fields. We actually learned a lot about game strategy in choosing the best implementation of our program, in the recursive function that calculates the best possible move. While it was very time consuming to research and successfully implement the algorithms we used, I think it paid off well in the tournament. If we were to look back and improve our program, it might be interesting to see if we could let the AI play repeatedly and learn strategies and improve itself based on learnt strategies.

The program relates to our work in class through the use of AI. We talked in class a lot about the applications and ethics of AI and now are utilizing it in a much more lighthearted setting. Overall, I think this project tied in really well as a final for the class, and taught us a lot about the implementation of AI programming in a game setting. This program gave us valuable insights on what AI can do and shows us the vast possibilities in how AI makes decisions based on the behavior of an outside source. These skills are not only relevant to the Connect 4 game but also for real world applications. Our understanding of AI is reinforced as a powerful tool which has a lot of potential for the future. We are glad we were able to engage with these ideas in a practical way, allowing us to understand and gain a deeper appreciation as to how AI works. Projects like ours are stepping stones for more advanced AI systems for broader real world challenges.