

Three-In-A-Row with AI implementation

Razwan Ahmed Tanvir(2015-1-60-111)

Shantanu Kumar Rahut(2015-1-60-114)

Sharfi Rahman(2015-1-60-134)

Department of Computer Science and Engineering
East West University

August 8, 2017

Abstract

Four in a row is an age old game, mostly popular in 90s at the time of the Gameboy. The kernel of our motive of this project was to implement Artificial intelligence in the game as a three in a row version, so that the computer can generate optimal moves for itself and use them in the game to give its opponent a fair fight. It is a very easy and fun game, all you have to do is match three of the chosen object in a sequential manner (horizontally, vertically or diagonally) to win the game. If the opponent matches earlier, he/she is declared as the winner of the game. In this project we tried to demonstrate the machine learning approach to generate optimal moves for the machine. This game uses save and search approach to generate moves i.e. it saves the game patterns every time it plays a match and uses those patterns to generate the moves in future. By analyzing the results of various matches, we have observed that the game gets harder as more it is played. Machine plays more optimally than the previous game it played. So, we can easily interpret that the machine is actually learning from its previous experiences of playing and can engender optimal moves for ensuring a tough competition.

1 Introduction

In this project we ventured to see how machine learning can be implemented in a game. Applying machine learning in an already existing game was our main motivation to do carry the project. We were fancied to see how AI can be implemented in the project and how a machine behaves after the implementation. Before starting the project, we planned to program a machine in such a manner that it can learn new moves by the previous experiences. The learned moves can be from the opponent's or its own previous moves. By learning all the previous moves, machine will be able to play in its most optimal way. Machine will almost behave like a human as human tend to win any game they play and they think of how they can block the opponents opportunity to win. Moreover, the machine should be able to give the toughest challenge to the opponent by generating the most optimal move at the moment. It will have the ability to calculate by which move there will be the highest probability of winning the game.

2 Related work

There have been tons of work done by people to determine the optimal moves for a two players game in which computer itself takes part in that game to compete with human. Recently, tech giant Google has implemented reinforcement learning in AlphaGo (a complex Chinese game) that has successfully defeated the world champion of the game Ke Jie. Another example of determining computer moves for a game is Tic-Tac-Toe. Using Alpha Beta Pruning (enhancement of minimax algorithm) the optimal move can be generated for this 2-player Zero Sum game. Nowadays, numerous games are being designed with AI techniques to compete with human.

3 Proposed Work

When the game is started, machine asks the user for a username. After entering the name, there is a how to play option where the tutorial can be found. There are three modes of the game-Easy, Hard and AI mode. Who will give the first move, that can be chosen by the user at the beginning of the game. When you start the game, machine will ask for a username. At the very beginning (the very first time the machine is playing the game)

there are no previous moves in the machine's database. So, it will choose all the moves randomly. If the other player chooses to play optimally it is possible that machine will lose every time. The sequence or pattern of current game with every move made by both players will be stored in the database of the machine. We have used supervised learning method and have given some training data - instances of some games that made the machine more efficient player. Before each move, machine will check if it has a two in a row already so that with a new move it can win. Then, if that is not the case then the machine will check if its opponent has made a two in a row, so that if the opponent has then the machine can block the opponent from winning by its new move. If that is also not the case then machine uses its previous experience of playing the game. Here comes the machine learning part. From the database or the memory, machine will check for the sequence or pattern that matches with the current game pattern; with the highest utility (if the machine is first player then the utility is 50, if the machine is second player then the utility is 100). It will choose that sequence with the highest utility (50 if machine is first player and 100 if machine is second player) from the previously stored game moves. Machine will always think of its benefits, as a result it will sort out the best move by searching the previous moves. When the other player has already made their move, it will try to prevent the winning of the opponent by the blocking move. If the user chose easy mode, machine will only search for its winning move. But if the difficulty level is hard, it will also try to block the moves of the user. In the AI mode, machine search the database for the sequence or pattern which matches the present game and makes its move by the pattern found. The database will enrich as many times the game is played with a new pattern and the moves made by the machine will be tougher for the opponent to beat.

4 Conclusion

This game successfully uses machine learning and somewhat pattern recognition process to compete with its opponent and that was exactly our goal of this project. As we have already implemented Artificial intelligence in the game, we have also thought of some future developments that can be made. We can introduce the probabilistic search which is more efficient than the linear search we have used. Moreover, the searching can be more optimized by using the trie data structure. The database can be made more enriched

as it will be played many more times. Also, the dimension of the game can be enhanced to a higher level.

5 References

Machine Learning: https://en.wikipedia.org/wiki/Machine_learning

Pattern Recognition : https://en.wikipedia.org/wiki/Pattern_recognition

Deepmind AlphaGo defeats Ke Jie : https://en.wikipedia.org/wiki/AlphaGo_versus_Ke_Jie

Tic Tac Toe using Alpha Beta Pruning : <http://libeccio.di.unisa.it/AA/AlphaBetaSearch/>