Final Paper

CS 541
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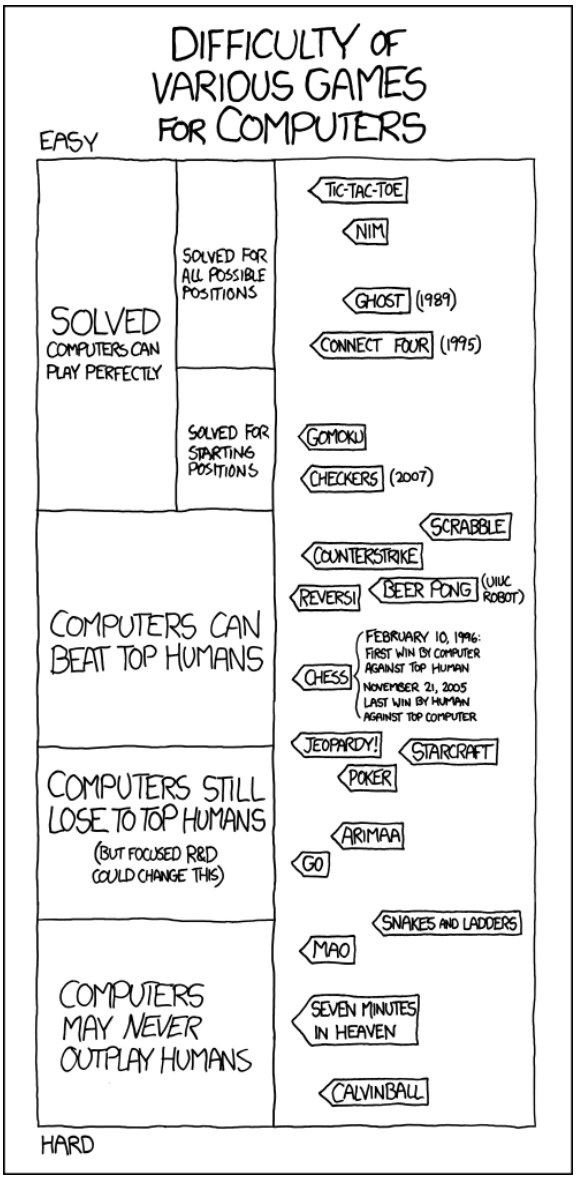


Reversi is a game that sits in the space of unsolved games, but games in which a computer can beat the best humans. The game is played by two players on an 8 by 8 board. The goal of the game is to covet more of the board with your tiles than your opponent.Tiles can only be placed so that they capture a row of opponent's tiles in between two of your own. That row is then transformed into tiles of your own color.

Our algorithm for Reversi takes three main elements into account. For each move, it looks at the number of pieces, the value of tile, and how many options it gives us for the next turn (mobility). These values are added up and used to determine the value of a move. The algorithm must properly weight each of the three main elements. Once that is done, These values are used in a MiniMax tree to try to find the best possible move.

The three elements used in determining a value for a move are not all equally important and must not be weighted equally. The number of pieces gained by making a move is very important, as in the end, this is the only thing

that matters in determining the winner. However, capturing too many pieces in one turn can give your opponent a lot of mobility, and allow him to take them back very quickly, as well as giving him many options to capture better tiles. Mobility is very important in the opening and mid-game, as it allows you the most options for taking pieces and positions from your opponent. In the end game however, mobility becomes less important as most of the good positions are already taken, and you need to concentrate on capturing pieces.

The value of the tiles is the most complicated of the three elements to deal with, as some tiles change value. The corners are the most valuable tiles, as pieces placed there cannot be captured by the opponent. The pieces directly next to the corners, on the other hand, can easily give your opponent control of the corner, and should be avoided unless you are sure that they won't give your opponent control of the corner, or are sure that sacrificing the corner is to your benefit.

X	C	7
C	*	8
7	8	

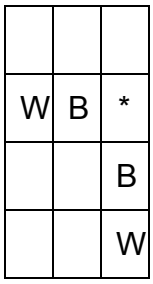
The bottom-right corner of the board. The corner tile itself is marked by an asterisk. The tile marked "X" played at the wrong time will usually guarantee the loss of that corner. The tiles marked "C" have the same problem but if you already have the corner, they gain all of the corner's benefits and increase in worth.

The sides of the board also change in worth as the game goes on.

W	B	*
		B

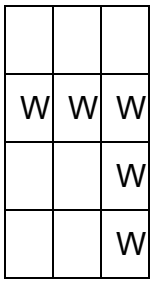
White to move

In this example, playing on the space marked by the asterisk is a terrible move, because Black can take edge piece very quickly and it will be difficult for white to recapture it.



White to move

The same is not true in this example. Here, if white plays the space marked by the asterisk, Black cannot take the piece, and he gains the protection of the side.



Black to move

Here, black has no efficient way of taking these pieces

As shown in the above examples, the sides of the board can be very powerful tiles if captured at the right time, but can also open up opportunities for your opponent to gain mobility and recapture the sides for himself.

After carefully debating, we decided that the value of the tile was the most important element, followed by the number of pieces and mobility in that order.

All three group members contributed equally to the algorithm design, and it was implemented by Dan. The GUI and the compatibility with the server were done by Josh, while Nick wrote the paper and planned the presentation. From this project we gained a better understanding of the minimax algorithm. In addition, we had to figure out how to give the AI a time limit for each turn, which was in itself a great learning experience, as it was something that we had never done before.