Raziel Siegman

11/6/2022

For the Connect 4 algorithm, there is a deterministic score based on a given board state. At a given state, the score is checked for each of the seven choices that the adversary can make, and the adversary moves in the column with the highest score.

The score is comprised of three components.

The first component is, in a sense, an “objective” score, in that only takes into account the column number. Columns near the edge are awarded less points, and the middle column is awarded the most points. Even the maximum possible number of points allocated for this component is very small, and this component is mostly relevant in the very beginning of the game, to enable the adversary to begin in the middle of the board when all else is equal.

The next component is an offensive component. Points are allocated in every direction—horizontal, vertical and diagonal, for streaks of two and three, with the number of points being based both on the direction and the length of the streak. Note that for these purposes, X\_X\_ or X\_ \_ X are both considered two in a row, even though there are spaces separating the pieces, since there are two available spaces remaining. The number of points given is of course higher for three in a row than two, and is also higher for diagonal and horizontal than vertical, as vertical streaks are easier for the opponent to spot and defend against.

The third component is the defensive component. The defensive component is similar to the inverse of the offensive component, with negative points allocated instead of positive for the opponent’s streaks. However, the points subtracted are not necessarily the same as the points added for a similar streak. For example, a board state that has three in a row of the opponent’s piece after the adversary finishes his turn is synonymous with a defeat, unless the opponent makes a flagrant error. Therefore, three in a row for the opponent is penalized severely.

One of the drawbacks with this approach is that it only takes into account the current turn, and not future outcomes, which, amongst other pitfalls, can allow a smart opponent to set double trap. An additional flaw is that it is possible for there to be a three in a row for the opponent, let’s say horizontally in rows 3,4 and 5, and this is penalized as severely if the opponent can then win by placing a tile in column 6 as a scenario where the streak is high up on the board, and there are no pieces yet in the sixth row to immediately win.