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AI Assignment 3

Creating A Checkers Expert

My checkers expert is the culmination of six experts defined as follows:

M1. "The Accountant": Counts the difference between the total number of red pieces - the total black pieces.

M2. "Imperial": Counts the difference between the number of kings on the board. If a move creates a king for the player, that move has additional weight.

M3."Sidewinder": Rewards moving a piece onto the left or right sides of the board. If the piece is a king, it counts for double. This was the strongest original expert.

M4."King in the Castle": Rewards moving a piece onto either end of the board, similar to sidewinder. Grants bonus points if the piece becomes a king.

M5. "Warlord": Favors moves if they involve jumping an opponent's piece. Utility is equal to the square of the number of jumps a move can make. This was the second strongest expert.

M6. "Safety First": Avoids moving to any square where an enemy piece will immediately capture it, from any angle. Advancing moves that are judged "safe" are given priority.

All methods were complemented by a function that increased a move's utility by 1000 points if it resulted in the opponent's total piece count to become less than one.

fig. 1 "Win Percentages and Move Count Efficiency Among Initial Experts vs Random Player"

To test my experts, I played three sets of ten games between each method and a random player, alternating colors. When traversing the min-max tree, the random player's moves were all calculated as having 0 utility because they were selected at random from a list of available moves. Jumps were chosen at random if more than two pieces could be jumped by the random player. The average win percentages can be seen in figure 1, along with the average number of moves it took each expert to win a game. Players were limited to 150 moves per game before calling a tie. Players were given a maximum depth of 10 moves to search through.

Experts M1 - M6 were each tested against the random player until they won over 50% of the time, with their evaluation functions modified each series until they were stable. Experts were then grouped together. M1 and M2 both involved static counts and trying to optimize advantages against the opponent through sheer numbers. M3 and M4 were both concerned with what parts of the board were safest, regardless of how many pieces either player controlled. M5 and M6 were both concerned about a move's impact on the game, and whether it would result in massive combo moves or keeping pieces from setting up combo moves. Each of these pairs were pitted against each other. Losing players were recorded, and a new expert was created with an initial value of MWL = MW + alpha \* ML , where alpha began as "1". The new expert then played against MW and the alpha value was adjusted between 0 and 1 until MWL beat MW more than a maximal of the time. Each pair of experts played an average of six individual 10 game series, three games per color.

Alpha Values:

**M12 = M1 + 0.5 \* M2**

M1 won approx. 70% of games, with an average 45 moves.

M12 beat M1 in approx 85% of games when alpha = 0.5, with an average of 48 moves.

**M34 = M3 \* 0.8 + M4**

M4 won approx. 60% of games, with an average 50 moves.

M34 beat M4 in approx 76% of games when alpha = 0.8, with an average of 52 moves.

**M56 = M5 + 0.7 \* M6**

M5 won approx. 66% of games, with an average 58 moves.

M56 beat M5 in approx 60% of games when alpha = 0.7, with an average of 68 moves.

These new experts were then combined into M1234 and M56. Games began getting longer between experts. M12 seemed to be the weakest expert, and was combined with M34.

Alpha Values:

**M1234 = M34 + 0.4\* M12**

M34 won approx. 98% of games, with an average 35 moves.

M1234 beat M34 in approx 80% of games when alpha = 0.4, with an average of 34 moves.

Finally, M56 and M1234 played 3 series of 10 games per color. The winning expert was M56.

Alpha Values:

**M123456 = M56 + 0.9 \* M1234**

M56 won approx. 55% of games, with an average 44 moves.

M1234 beat M34 in approx 66% of games when alpha = 0.9, with an average of 49 moves.

Thus, my final checkers expert M123456 is defined as such:

**M123456 = 0.9 \* (0.4\* ( M1 + 0.5 \* M2 ) + ( M3 \* 0.8 + M4 )) + (M5 + 0.7 \* M6)**

Versus a Random player, M123456 wins an average 71% of games, in an average of 25 moves.