AI SEMESTER PROJECT - GOMOKU AI

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Gomoku is a strategy board game played on a square grid. The objective is to be the first to form a continuous line of five pieces horizontally, vertically, or diagonally. In this report, we explore an AI system designed to play Gomoku effectively.

Compete.py is a Python file responsible for running competitions to evaluate the effectiveness of the AI system for Gomoku. It pits the AI system against a Minimax baseline player. Minimax is a classic algorithm used in game theory to make optimal decisions in turn-based games. It explores all possible moves, assuming the opponent plays optimally, and selects the move that leads to the best outcome.

To compete with the Minimax baseline, the AI system in Gomoku utilises a heuristic algorithm. This algorithm calculates the potential of each move by evaluating if the next vacant space can result in a win. The system considers the potential win for both the current player and the opponent and decides the next move based on this calculation. By taking into account the ability to create winning sequences, the AI system makes informed decisions in playing Gomoku.

1. Evaluate_Potential: This method evaluates the potential of each action for a given player. It uses a numpy array to store the potentials of each position on the board. By iterating through all positions and checking if they are empty, the method calculates the potential based on the consecutive marks the player can achieve in different directions.

2. Count_Consecutive: This method counts the number of consecutive marks for a given player in a specific direction. It iterates through a certain number of steps in that direction and checks if the positions contain the player's marks. By counting the consecutive marks, the method determines the potential of creating a winning sequence.

To evaluate the AI system's performance, the performance.py file runs compete.py in 30 repetitions. The min player is the Submission.py, representing the AI system, and the max player is the minimax player, representing the baseline. Each repetition records the final game scores and run times. The final score graph shows the average of these repetitions, with a negative value indicating better performance. This approach provides valuable insights into the AI system's effectiveness in playing Gomoku.

The AI system for Gomoku demonstrates effectiveness in playing the game through its heuristic algorithm and competition against the Minimax baseline. The competitions provide valuable insights into the system's performance, allowing improvements to be made. This report provides a clear overview of the AI system's functionality and overall performance. Hence we can say this AI system serves as a strong model for effective Gomoku gameplay.

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Results

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Starting competition, may take a while...
rep 0 of 30: score=-198.0, min time (Submission) = 0.3755699149999996, max time (Minimax) = 0.6733578340000002
rep 1 of 30: score=-178.0, min time (Submission) = 0.5315268779999935, max time (Minimax) = 15.066047080999994
rep 2 of 30: score=-174.0, min time (Submission) = 0.610252709000008, max time (Minimax) = 1.8767093789999976
rep 3 of 30: score=-198.0, min time (Submission) = 0.3323731240000001, max time (Minimax) = 1.206060335999993
rep 4 of 30: score=-150.0, min time (Submission) = 0.8188592060000097, max time (Minimax) = 7.209680123999991
rep 5 of 30: score=133.0, min time (Submission) = 0.9242129179999914, max time (Minimax) = 6.694691586999987
rep 6 of 30: score=189.0, min time (Submission) = 0.4277474159999741, max time (Minimax) = 5.273823003000011
rep 7 of 30: score=-144.0, min time (Submission) = 0.8611850389999773, max time (Minimax) = 16.131947081999996
rep 8 of 30: score=179.0, min time (Submission) = 0.5562172519999606, max time (Minimax) = 10.264992454000009
rep 9 of 30: score=-144.0, min time (Submission) = 0.8752729159999575, max time (Minimax) = 5.060842918999938
rep 10 of 30: score=0, min time (Submission) = 1.4381927009999629, max time (Minimax) = 14.137408543000035
rep 11 of 30: score=157.0, min time (Submission) = 0.7617885800000153, max time (Minimax) = 9.818251126000035
rep 12 of 30: score=201.0, min time (Submission) = 0.28598970800000245, max time (Minimax) = 0.22653920999999855
rep 13 of 30: score=163.0, min time (Submission) = 0.6846834189999527, max time (Minimax) = 12.09521129100004
rep 14 of 30: score=199.0, min time (Submission) = 0.30714312399999244, max time (Minimax) = 6.876038793000006
rep 15 of 30: score=0, min time (Submission) = 1.3515594129999045, max time (Minimax) = 11.821020294000007
rep 16 of 30: score=0, min time (Submission) = 1.370731666999717, max time (Minimax) = 13.207402954000173
rep 17 of 30: score=-170.0, min time (Submission) = 0.6820856669999955, max time (Minimax) = 5.382958626000004
rep 18 of 30: score=89.0, min time (Submission) = 1.1768975839998461, max time (Minimax) = 22.529150541999968
rep 19 of 30: score=-174.0, min time (Submission) = 0.5894271240000251, max time (Minimax) = 8.077226664999841
rep 20 of 30: score=-198.0, min time (Submission) = 0.32722691700007545, max time (Minimax) = 0.8064074180000489
rep 21 of 30: score=-174.0, min time (Submission) = 0.574276875000038, max time (Minimax) = 6.746924288999992
rep 22 of 30: score=-190.0, min time (Submission) = 0.4257586650000178, max time (Minimax) = 1.1386889149999604
rep 23 of 30: score=-32.0, min time (Submission) = 1.3896232049998787, max time (Minimax) = 12.247202961999932
rep 24 of 30: score=-178.0, min time (Submission) = 0.5990407500000288, max time (Minimax) = 3.8763134990000765
rep 25 of 30: score=101.0, min time (Submission) = 1.1556002070000204, max time (Minimax) = 12.960516784000049
rep 26 of 30: score=0, min time (Submission) = 1.3532042029998195, max time (Minimax) = 13.929647043000074
rep 27 of 30: score=-98.0, min time (Submission) = 1.1423736240000721, max time (Minimax) = 11.08186671199985
rep 28 of 30: score=-200.0, min time (Submission) = 0.3147310839999591, max time (Minimax) = 5.940993666000111
rep 29 of 30: score=177.0, min time (Submission) = 0.540177291000191, max time (Minimax) = 5.100842874999785
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