Connect N Project Update

Lucy Cheng, Angela Fan, Andre Nguyen

1 Baseline Description and Performance

We implemented two baselines: randomly choosing a column to put the next token in and an AI algorithm, Minimax. At each time step, minimax builds a tree based on the current board state that branches into all possible next moves by the player and the opponent, and assigns a value to each node. Traditionally, wins have value +infinity and losses have value -infinity. However, often the algorithm needs to take an action rapidly, or the full game tree is too complicated to simulate, so our version of Minimax takes a depth parameter to simulate the tree branching to that depth. Additionally, our version of Minimax implements a static evaluation, using a heuristic (number of possible ways to win horizontally, vertically, and diagonally), to assign intermediate values to the nodes in the tree.

2 Results

Agent 1	**Agent 2**	**Winner**
Random	Minimax, Depth 3	Minimax, Depth 3
Minimax, Depth 4	Minimax, Depth 2	Minimax, Depth 4

Questions: Do you have any graph ideas for us? We were thinking of plotting cumulative reward on the Y axis and number of games played on the X axis, but Minimax basically always wins so it's not a very interesting graph, plus Minimax doesn't do much learning as the tree covers most of the possibilities.

3 Further Baseline Exploration

To have more thorough evaluation, we will implement these more advanced baselines to compare our RL algorithms against:

1. Minimax with alpha-beta pruning, to stop computing branches of the tree that would immediately lead to loss or contain nodes with low values that would never be chosen as actions

2. Minimax with different weighting functions for each streak of length 1, 2, 3, 4, etc. We can change these weights to make the AI prioritize decimating opponent streaks rather than extending its own

3. We will explore Minimax with different depth parameters to simualte an "easy", "medium", and "difficult" computer to play against

4. A naive agent that just attempts to extend its longest streak vertically or horizontally