

Artificial Intelligence and Machine Learning Fundamentals

Activity 3: Fixing the First and Second Moves of the AI to make it Invincible

Follow these steps to complete the activity:

1. We will count the number of empty fields in the board and make a hard-coded move in case there are 9 or 7 empty fields. You can experiment with different hard coded moves. We found that occupying any corner, then occupying the opposite corner leads to no losses. If the opponent occupied the opposite corner, making a move in the middle results in no losses.

```
def all_moves_from_board(board, sign):
    if sign == AI_SIGN:
        empty_field_count = board.count(EMPTY_SIGN)
        if empty_field_count == 9:
            return [sign + EMPTY_SIGN * 8]
        elif empty_field_count == 7:
            return [
                board[:8] + sign if board[8] == \
                EMPTY_SIGN else
                board[:4] + sign + board[5:]
            ]
        move_list = []
        for i, v in enumerate(board):
            if v == EMPTY_SIGN:
                new_board = board[:i] + sign + board[i+1:]
                move_list.append(new_board)
            if game_won_by(new_board) == AI_SIGN:
                return [new_board]
        if sign == AI_SIGN:
            safe_moves = []
            for move in move_list:
                if not player_can_win(move, OPPONENT_SIGN):
                    safe_moves.append(move)
            return safe_moves if len(safe_moves) > 0 else \
                move_list[0:1]
        else:
            return move_list
```

2. Let's verify the state space
countPossibilities()
3. The output is as follows:
 - step 0. Moves: 1
 - step 1. Moves: 1
 - step 2. Moves: 8
 - step 3. Moves: 8
 - step 4. Moves: 48
 - step 5. Moves: 38

step 6. Moves: 108
step 7. Moves: 76
step 8. Moves: 90
First player wins: 128
Second player wins: 0
Draw 60

4. After fixing the first two steps, we only need to deal with 8 possibilities instead of 504. We also guided the AI into a state, where the hard-coded rules were sufficient for never losing a game.
5. Fixing the steps is not important because we would give the AI hard coded steps to start with, but it is important, because it is a tool to evaluate and compare each step.
6. After fixing the first two steps, we only need to deal with 8 possibilities instead of 504. We also guided the AI into a state, where the hard-coded rules were sufficient for never losing a game.