

Assignment 1.4

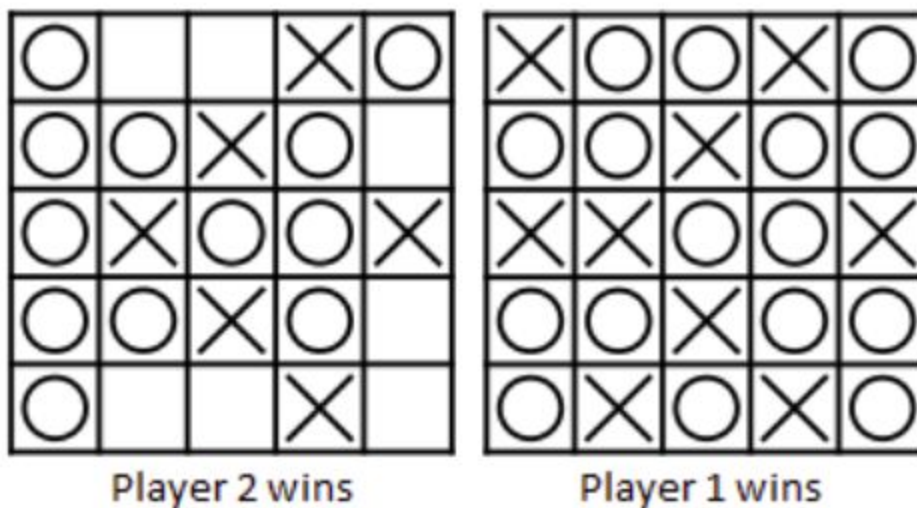
Design a learning system for a Tic-Tac-Toe player on a $5 \times 5 \times 5$ board analogous to the checkers player from the lecture (see also slide 30). Give reasons for your design decisions. What other possibilities for the design can you imagine?

Specification of the learning problem:

Task (T) - Play tic-tac-toe

Performance measure (P) - Number of games won (%)

Experience (E) - To play against self



Design Logic:

- If a block/tile has 4 values only from P1 (user) and one blank, then fill the leftover one tile and win the game.
- If a tile has 4 values from P2 (opponent) and one empty, then fill the leftover one tile from P1's move and stop from winning the game.

Design Decision: Target function (V): Board \rightarrow Score

Representing target function,

$$V'(b) = w_0 + w_1x_1 + w_2x_2 + w_3x_3 + w_4x_4 + w_5x_5 + w_6x_6 + w_7x_7 + w_8x_8 + w_9x_9 + w_{10}x_{10}$$

Where

x_1 = No. of rows that have 1 'X' and rest empty

x_2 = No. of rows that have 1 'O' and rest empty

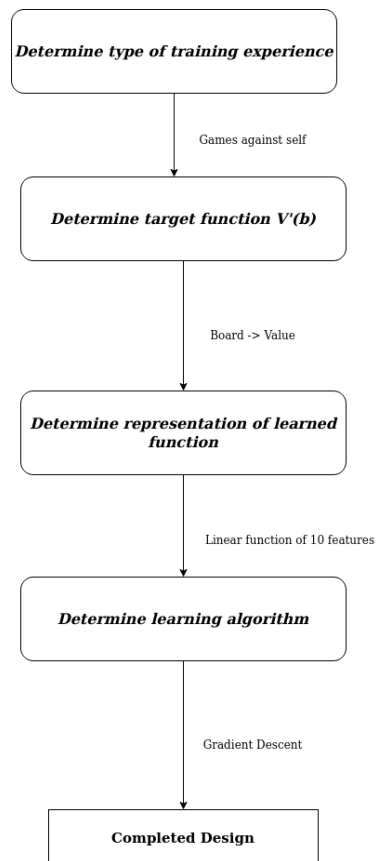
x_3 = No. of rows that have 2 'X' and rest empty

x_4 = No. of rows that have 2 'O' and rest empty

x_5 = No. of rows that have 3 'X' and rest empty

x_6 = No.of rows that have 3 `O` and rest empty
 x_7 = No.of rows that have 4 `X` and rest empty
 x_8 = No.of rows that have 4 `O` and rest empty
 x_9 = No.of rows that have 5 `X` and rest empty
 x_{10} = No.of rows that have 5 `O` and rest empty

If $V'(b) = 10$
 Then 'WIN'
Elif $V'(b) = 0$
 Then 'TIE'
Else $V'(b) = -10$
 Then 'LOST'



Other design possibilities using Genetic Algorithm

1. **Random approach** - picks all valid moves with an equal probability of winning.
2. **Monte Carlo simulation** - The idea is to prefer games that let us win sooner, and that we prefer wins over ties over losses. This strategy of playing has improvements over the random way.
3. **Weighted positions GA** - For each turn, we evaluate all valid moves and pick the one with the highest weight.