

Intelligent Connect 4



Team Members

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Under Supervision of

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Game Description

- Simple Connect 4 game programmed in Python using the graphical library Tkinter.
- It allows human player to play against computer and allows either players to start first.
- it's with AI using the Minimax algorithm with alpha-beta pruning and depth limited search technique to explore the game tree.
- The yellow pieces for computer player and red pieces for human player.

Minimax pseudo code

```
function alphabeta(node, depth,  $\alpha$ ,  $\beta$ , maximizingPlayer) is
  if depth = 0 or node is a terminal node then
    return the heuristic value of node
  if maximizingPlayer then
    value :=  $-\infty$ 
    for each child of node do
      value := max(value, alphabeta(child, depth - 1,  $\alpha$ ,  $\beta$ , FALSE))
       $\alpha$  := max( $\alpha$ , value)
      if  $\alpha \geq \beta$  then
        break (*  $\beta$  cut-off *)
    return value
  else
    value :=  $+\infty$ 
    for each child of node do
      value := min(value, alphabeta(child, depth - 1,  $\alpha$ ,  $\beta$ , TRUE))
       $\beta$  := min( $\beta$ , value)
      if  $\alpha \geq \beta$  then
        break (*  $\alpha$  cut-off *)
    return value
```

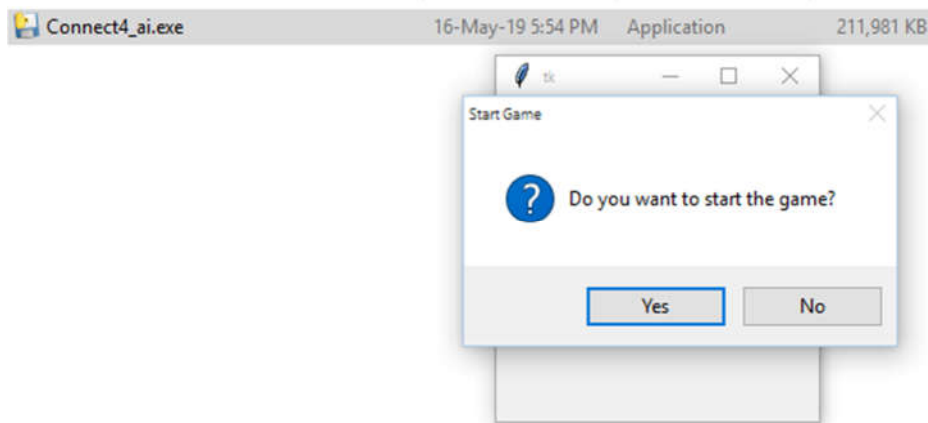
Utility function

- It calculate the score of the AI player in order to pick the best move.
- **This is how the algorithm works:**
 - 1 - It counts center pieces and gives 3 points for each one.
 - 2 - For the horizontal direction, it creates a row window of length 4 to count the number of adjacent pieces in each row and gives a specific score according to the number:
 - 4 yellow pieces (winning move) => 50 points
 - 3 yellow pieces and 1 empty => 10 points
 - 2 yellow pieces and 2 empty => 5 points
 - 3 red pieces and 1 empty => -6 points
 - 3 - Same as previous for vertical direction, positive diagonals and negative diagonals.

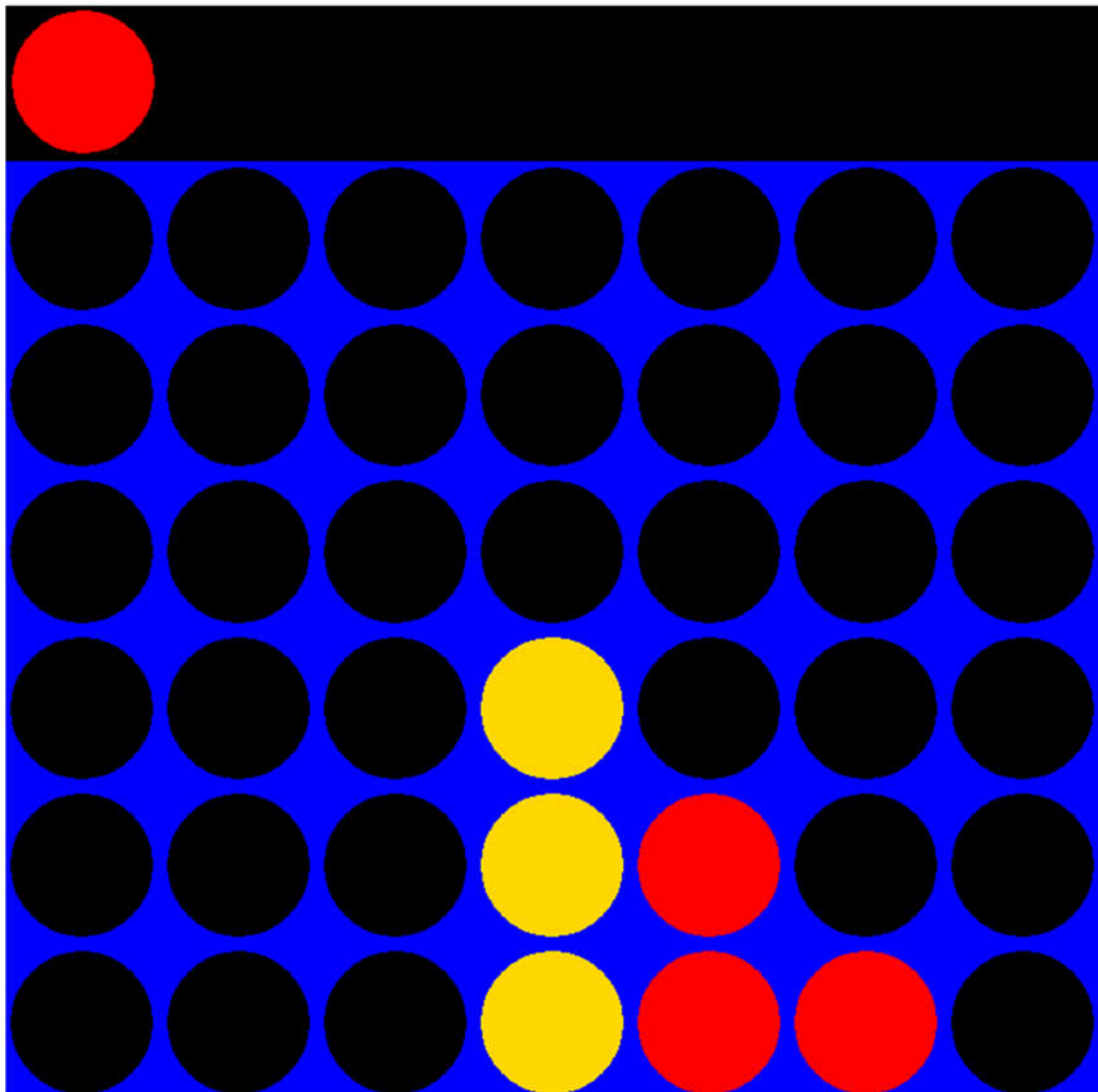
User Guide

1- Run Connect4_ai.exe

2 - Choose if you want to start the game.



3 - Simply, drop the red piece where ever you want.



4 - At the end of the game, a message pops up telling you the result of the game which will be one of these (You wins - Computer wins - Game over)

