UNIVERSITÄT BONN
RHEINISCHE FRIEDRICH-WILHELMS-UNIVERSITÄT BONN
COMPUTER SCIENCE VI AUTONOMOUS INTELLIGENT SYSTEMS
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Robot Learning

Assignment 1

Due Tuesday, April 28th, before class.

1.1) In the game of Tic-Tac-Toe, two players alternate placing crosses and circles on a 3x3 grid, until one player has a row, column, or diagonal of three own pieces, which is a win.

X	O	
O	X	
	O	X

Implement this game so that you can play crosses against a random opponent who plays circles.
You will start and your opponent always places its piece uniformly among the empty fields.
Detect after each move if there is a win and terminate when this is the case.
Document one run of your implementation!

5 Points

1.2) Design an encoding for the game state s after you played a piece, such that you can maintain a value V(s).
Document this encoding!

5 Points

1.3) Initialize for V(s) for all states with 0.1.
Play 10 games and set V(s)=1 when there is a win and V(s)=0 when there is a loss or the game ends in a draw, i.e. no further pieces can be placed.
At the end of each game, go through all states that you visited in reverse order and set
$V(s) \leftarrow V(s) + 0.2 (V(s') - V(s))$, where s' is the successor state.
Document V(s) for all nine states where you can place your first piece!

5 Points

1.4) Replace your placement selection by an automated procedure that
with probability 0.9 places your piece such that V(s) is maximized (break ties randomly) and
with probability 0.1 places your piece uniformly among the empty fields.
Play 1000 automated games. For every 100 games compute how often your player won and document this learning curve!
Document again V(s) for all nine states where you can place your first piece!

5 Points