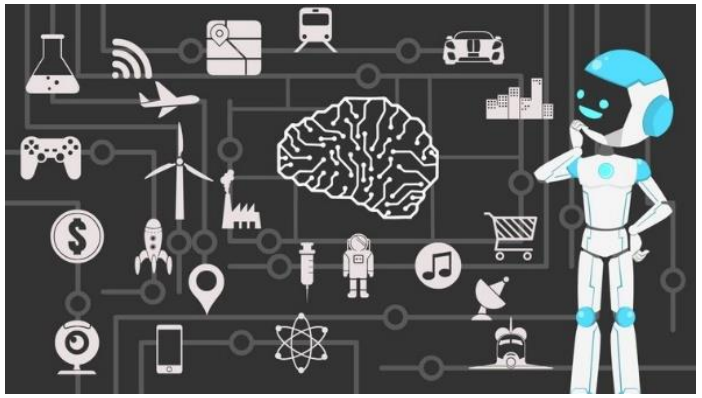


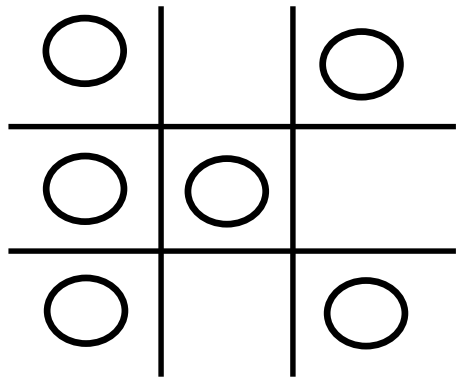
FORMAÇÃO INTELIGÊNCIA ARTIFICIAL E MACHINE LEARNING

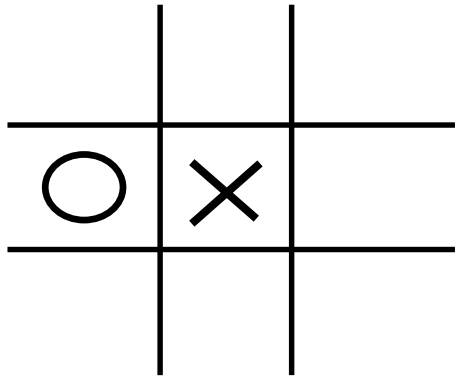
JOGO DA VELHA COM REINFORCEMENT LEARNING

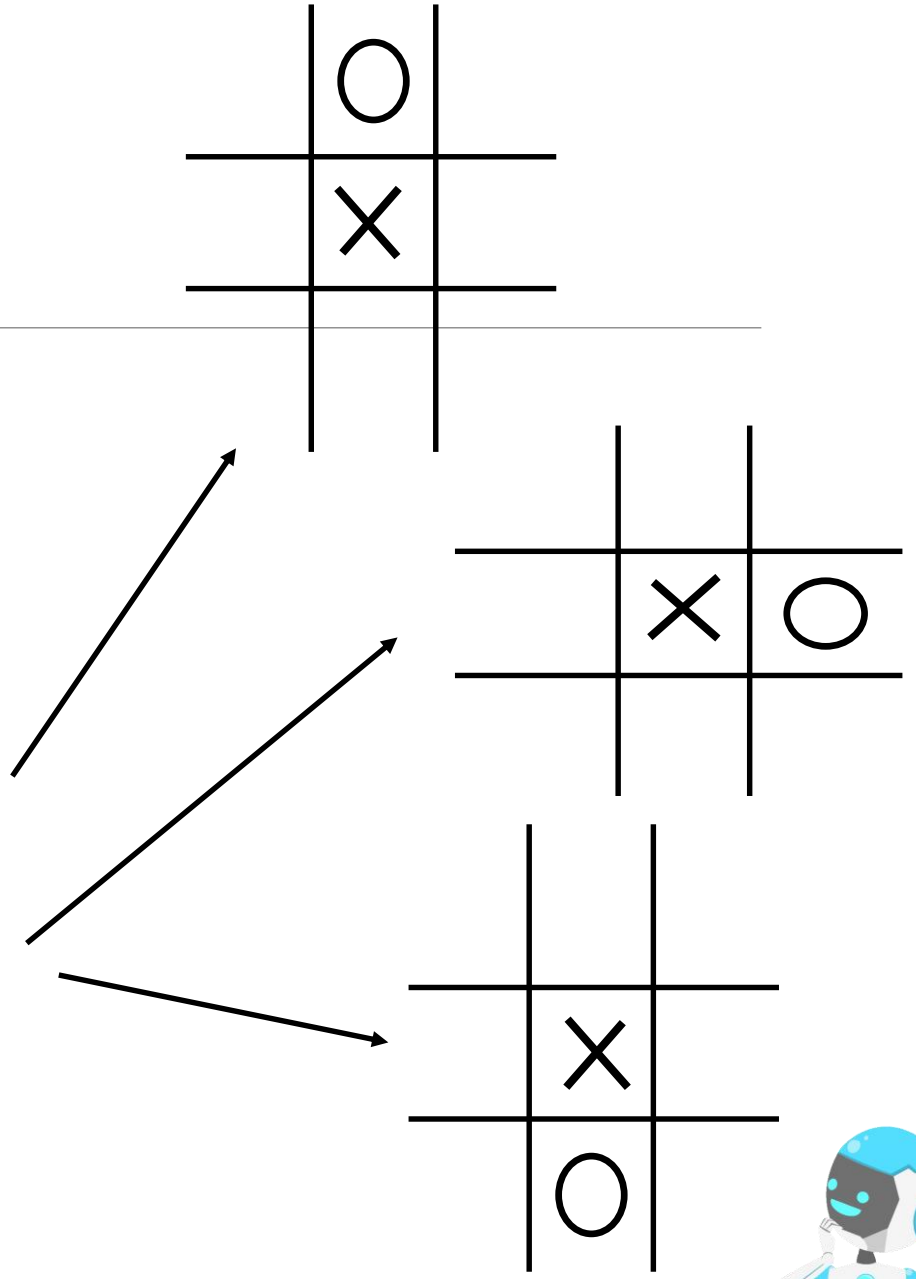
PARTE I

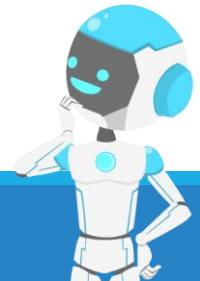
Tic Tac Toe

- Estados: 3^9 = 19,683 <- posições ilegais
  - 5,478 <- posições legais
  - 765 <- rotação e reflexão



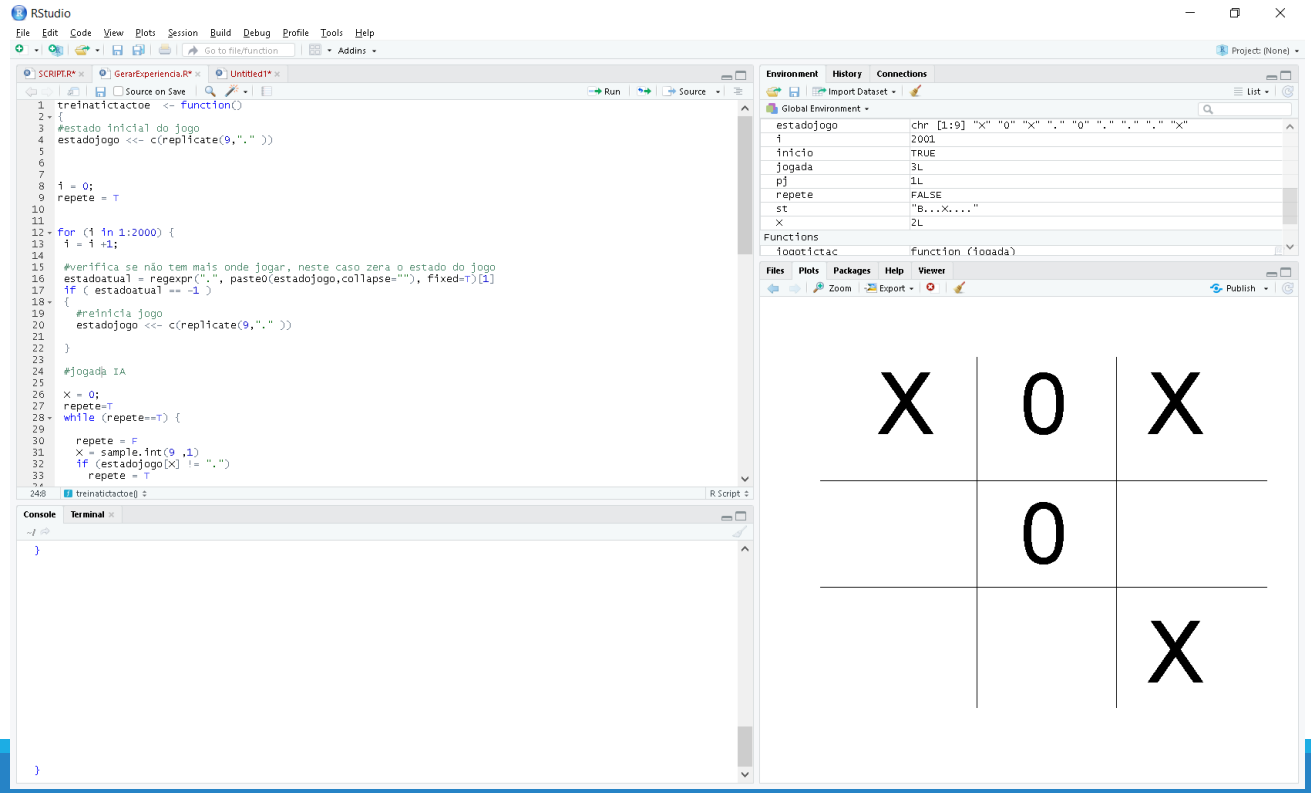


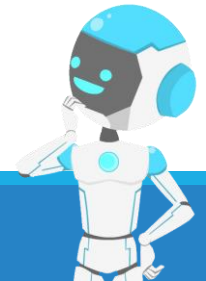




Objetivo

- Criar aplicação no R para jogar TTT contra um agente de IA
- O agente vai utilizar Policies de um modelo criado com ReinforcementLearning

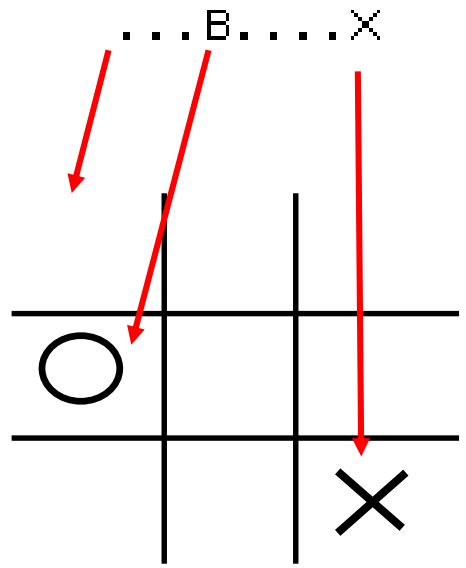


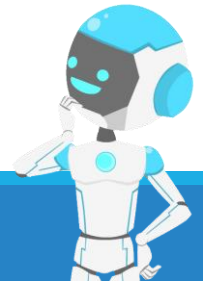


Pacote ReinforcementLearning

- Tictactoe (406541)

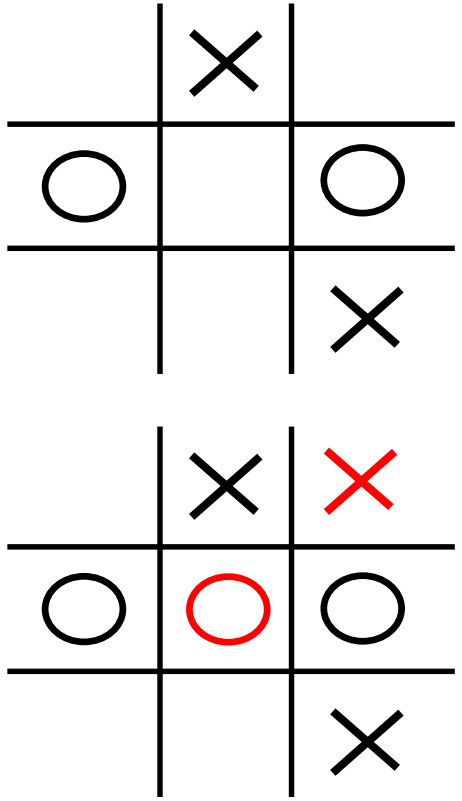
```
(tictactoe)
     State Action NextState Reward
 .........     c9 ...B....X      0
 ...B....X     c2 .X.B.B..X      0
 .X.B.B..X     c3 .XXBBB..X     -1
 .........     c8 .B.....X.      0
 .B.....X.     c7 .BB...XX.      0
 .BB...XX.     c9 .BB...XXX      1
```



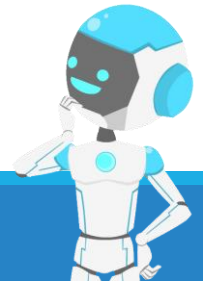


Pacote ReinforcementLearning

```
(tictactoe)
     State Action NextState Reward
 .........     c9 ...B....X      0
 ...B....X     c2 .X.B.B..X      0
 .X.B.B..X     c3 .XXBBB..X     -1
 .........     c8 .B.....X.      0
 .B.....X.     c7 .BB...XX.      0
 .BB...XX.     c9 .BB...XXX      1
```

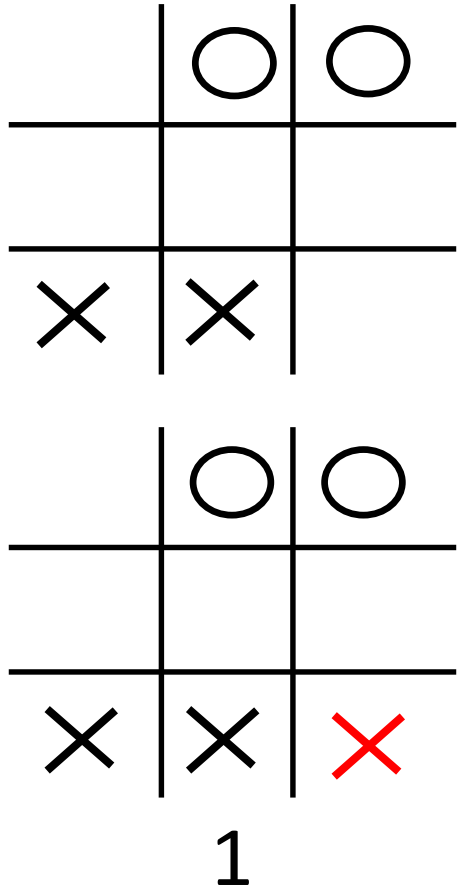


-1



Pacote ReinforcementLearning

```
(tictactoe)
      State Action NextState Reward
.........     c9 ...B....X       0
...B....X     c2 .X.B.B..X       0
.X.B.B..X     c3 .XXBBB..X      -1
.........     c8 .B.....X.       0
.B.....X.     c7 .BB...XX.       0
.BB...XX.     c9 .BB...XXX       1
```



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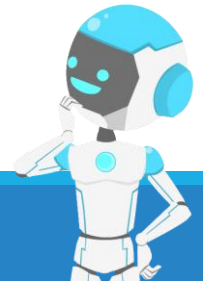
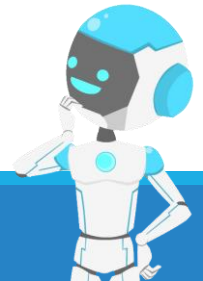


Modelo – Opção 1: Criar modelo

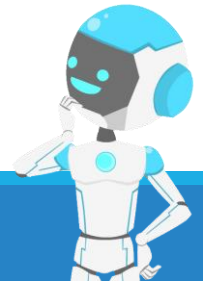
```
install.packages("ReinforcementLearning")

library(ReinforcementLearning)

control <- list(alpha = 0.2, gamma = 0.4, epsilon = 0.1)

modelottt <- ReinforcementLearning(tictactoe, s = "State", a = "Action", r = "Reward",
                                   s_new = "NextState", iter = 2, control = control)
```



Modelo – Opção 2: Carregar Modelo

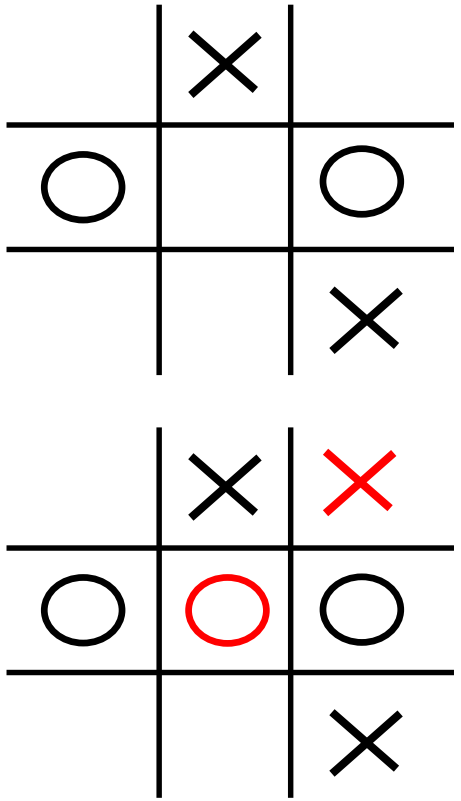
- Arquivo modelottt no material do curso

load(file.choose())



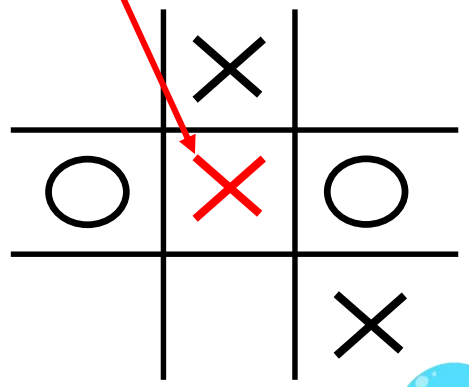
Consultado o Modelo

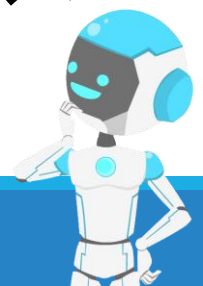
```
> tail(tictactoe)
             State Action NextState Reward
406536 .........      c9 ...B....X      0
406537 ...B....X      c2 .X.B.B..X      0
406538 .X.B.B..X      c3 .XXBBB..X     -1
406539 .........      c8 .B.....X.      0
406540 .B.....X.      c7 .BB...XX.      0
406541 .BB...XX.      c9 .BB...XXX      1
```



-1

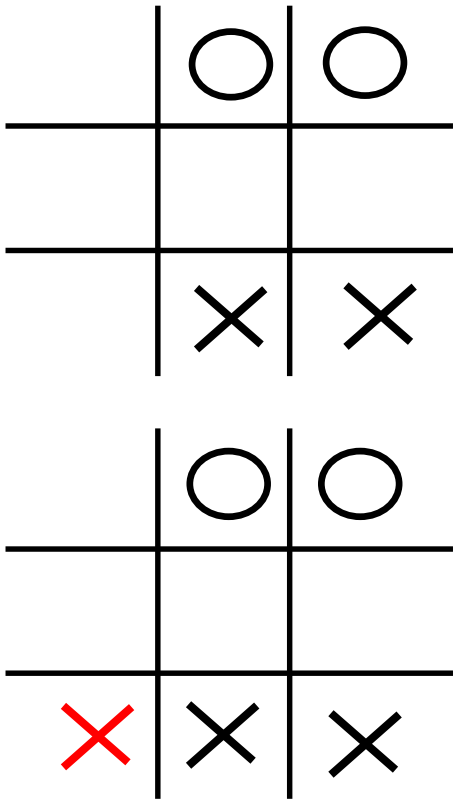
```
> modelottt$Policy[".X.B.B..X"]
.X.B.B..X
     "c5"
```





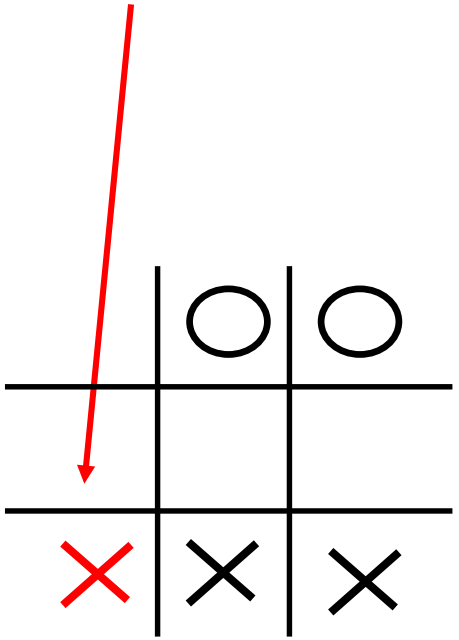
Consultado o Modelo

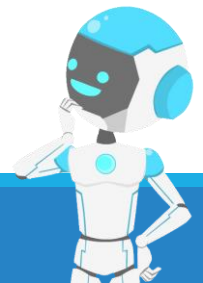
```
> tail(tictactoe)
            State Action NextState Reward
406536 .........      c9 ...B....X      0
406537 ...B....X      c2 .X.B.B..X      0
406538 .X.B.B..X      c3 .XXBBB..X     -1
406539 .........      c8 .B.....X.      0
406540 .B.....X.      c7 .BB...XX.      0
406541 .BB...XX.      c9 .BB...XXX      1
```



1

> modelottt$Policy[".BB...XX."]
.BB...XX.
"c9"





Consultado o Modelo: Possibilidades

- Encontrar politica

```
> modelottt$Policy[".BB...XX."]
.BB...XX.
    "c9"
```

- Encontrar uma politica e ela ser ilegal

```
> modelottt$Policy["XBXBBXX.B"]
XBXBBXX.B
    "c1"
```

- Não encontrar uma politica

```
> modelottt$Policy[".X.B....."]
<NA>
  NA
```