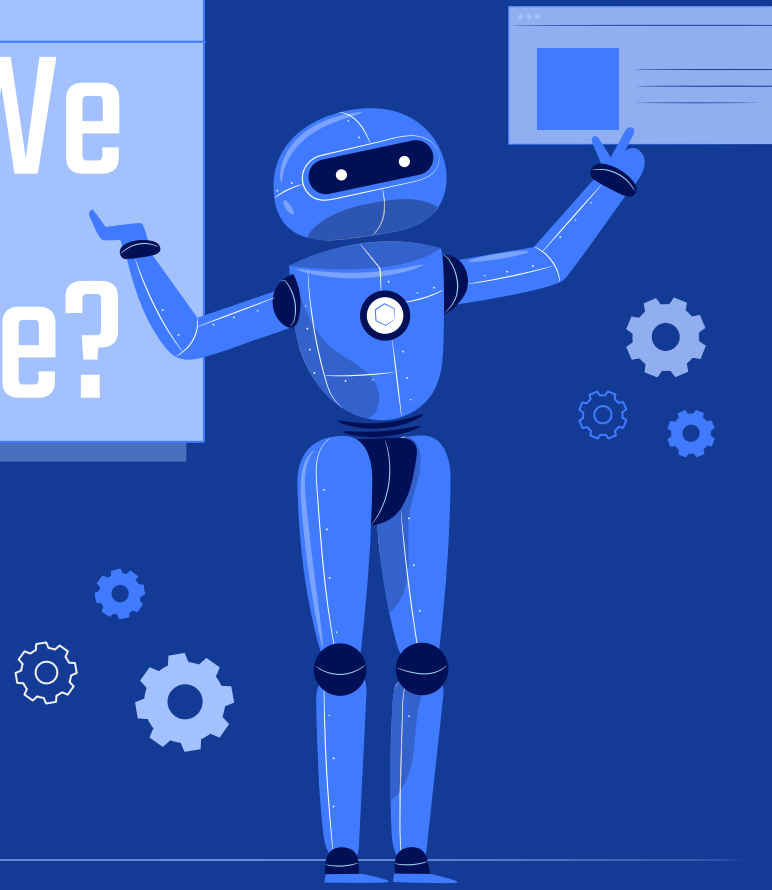
Shall We Play a Game?

Reinforcement Learning through game play



About me

My name is Lee Schlesinger.

I am a Data Scientist with a career in IT. I have worked in solving problems by using data effectively in several industries to provide answers that are clear and easy to use.

Data is at the heart of IT. Understanding data and using it is what technology is about. It is what I do.

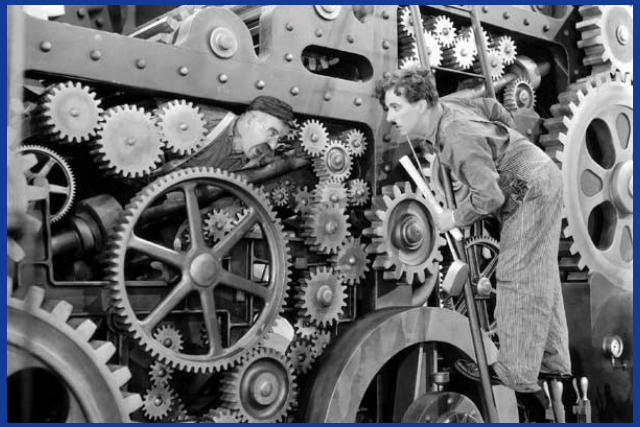
MACHINE LEARNING

Given a collection of data, how does the computer learn about the data?

Unsupervised learning: put data into groups

Supervised learning: Training a model to arrive at a known correct answer. Then, seeing how well it works with new data

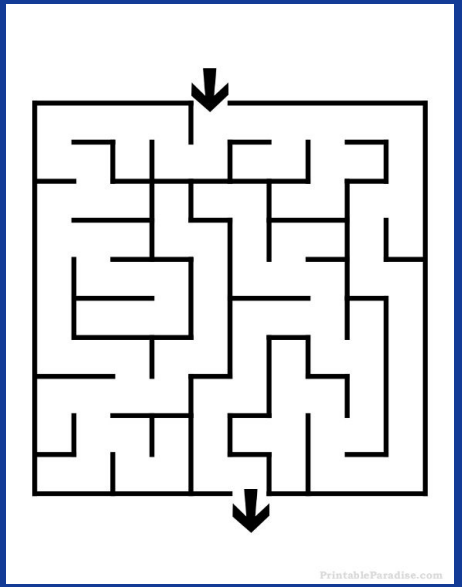
Reinforcement learning: a single choice is neither right or wrong. Feedback comes as rewards (and punishments).



REINFORCEMENT LEARNING

Reinforcement Learning starts with little knowledge of an environment. There are acceptable actions for the computer to choose. Through experimentation, feedback is given with ‘rewards’. Rewards guide further experiments.

People learn how to play games, by playing games. Improvement only comes from practice and experimentation. Reinforcement Learning mimics human strategies. The only differences is that computers are faster and can play more games.



Q - VALUES

One of the approaches required to achieve the highest reward is to have a long term view. Rewards are the goal in Reinforcement Learning. But, a short-term small reward can miss a large reward elsewhere.

This requires exploration down paths that may be dead ends. Without considering other choices, large rewards would remain unknown.

As experience is built, less random exploration occurs.

TETRIS

Alexey Pajitnov created Tetris in 1984.

The name of the game "Tetris" was the combination of 2 words: the original game — "tetramino" and the creator ' s favorite sport — "tennis".

Tetris has had continued interest through the years.

Its familiar environment makes it a good choice to implement Reinforcement Learning.

THE PLAN

01 OBJECTIVES

Have the computer become a Tetris expert

02 METHODOLOGY

Have Reinforcement Learning play Tetris

03 RESULTS ANALYSIS

Track the algorithm ' s progress

04 CONCLUSIONS

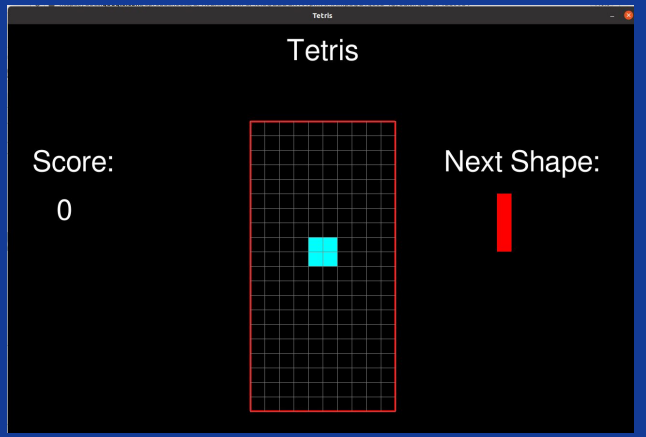
Review the effectiveness of this approach

BUILDING THE GAME

Before teaching software to play the game, I have to have a game to play.

The game was first created for a person to play. The screen shot on the right is from that game. For anyone who wants to play Tetris, the code is in the public github environment for this project.

With a people version working, the next step was a version for the Reinforcement Learning software to use as it grows in skill.

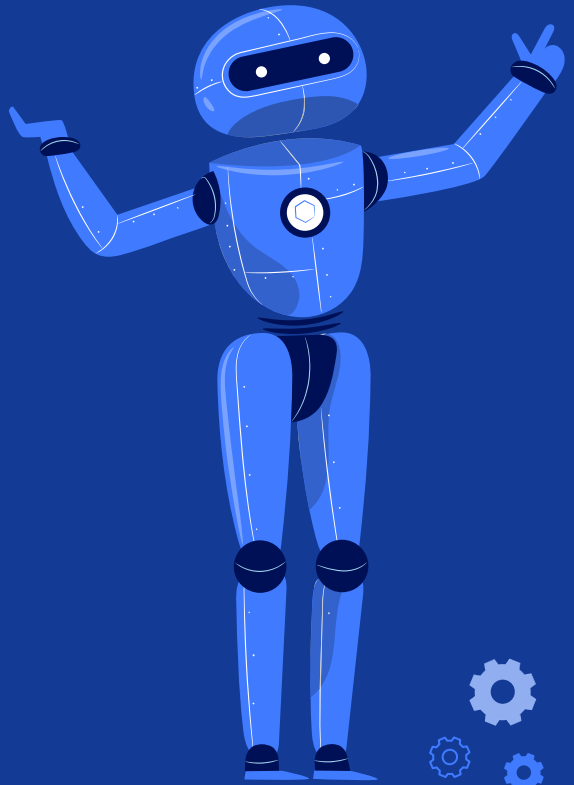


NEW PLAYER

Reinforcement Learning requires information of the playing field (observation), a set of possible actions (rotate, drop to bottom, left, right, wait). It receives the game's status and reward (score).

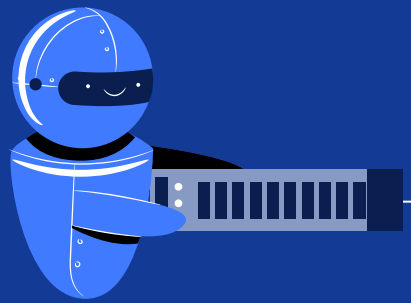
There are settings to influence length and rate of progress to control how the software learns.

For each game, the final score is recorded to monitor advancement.



OBSTACLE !

Having interaction between player and game work



CODE CAN LEARN

Code can learn to play.

Because Reinforcement Learning does not even begin with instructions, early attempts are low scores. Each game played is called an ‘episode’.

When a neural network finds a successful strategy, it continues along that path and improves on what works.

NEXT STEPS

- Learn more about Pytorch, Gym, and TensorFlow to better understand how Reinforcement Learning environments are set up and interact.
- Experiment with changing values, such as learning rate and epsilon decay, to study how quickly learning can occur
- For my next Reinforcement Learning project, remember to build the environment as a class to simplify the overall process

QUESTIONS? (or just play another game?)

REFERENCES

- https://history-computer.com/ModernComputer/Software/Tetris.html
- Python and Pygame Tutorial - Build Tetris! Full GameDev Course (https://www.youtube.com/watch?v=zfvxp7PgQ6c)
- Deep Q Learning is Simple with PyTorch | Full Tutorial 2020 (https://www.youtube.com/watch?v=wc-FxNENg9U)

THANKS

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