

Purpose

How does an AI learn to play mario?

Abstract

The purpose of this project is to look at how an AI makes decisions in the form of Mario. To show this I used the BizHawk emulator and a copy of Super Mario World in which I ran a script containing Mario's "Brain". This experiment resulted in an AI that could beat the first level of super Mario as if it were a pro. Originally the AI started roughly because it did not know how to do anything but slowly it learned what learned and what didn't work to the point (which I already mentioned) where it was almost pro-like. in this project, I learned how an AI makes decisions and how it learns I also learned a little bit about the scripting language Lua. After this experiment, I concluded that yes an AI can learn to play Mario, yes it is better than I could be, and yes my hypothesis turned out to be true

Introduction/Background information/Research

I wanted to do this project because I wanted to learn more about the choices an Ai makes and how it makes them. I also wanted to see how an AI learns.

For this project, I researched Machine learning, Neural networks, reinforcement learning, and Lua. An AI needs to learn and there are multiple ways to do It for example I learned about Supervised learning type, where the AI learns from videos or inputs (like the CS: GO bots which learn from twitch streams) Unsupervised learning where it just does its own thing, And lastly, Reinforcement learning, where the AI learns from rewards and it follows a pattern input, observation, action, and reward (that was simplified this diagram I found is more detailed).

Each time the AI does an action that diagram repeats itself and eventually it learns since pressing (insert button) moves it forwards and gives it a reward then it knows that pressing (insert button) is good, and it does that for hours until it learns how everything interacts so it can beat the level.

With the neural network, our AI uses reinforcement to learn but our neural network also simulates evolution for example during each generation the AI learns that pressing B makes you jump and it gets farther with that so after that gen. is done it takes the three best species (each group of AI) and duplicates them into the next gen. to the point where there is only one species but there a species of speedrunning machines.

my hypothesis for this project would be that my Mario AI after training for multiple hours would be able to be faster than me at a game of Super Mario, If Mario trains long enough he would know far more than me but not only that but since it's an AI it has that capacity to make decisions as I would.

Its not a pro its a Robot??

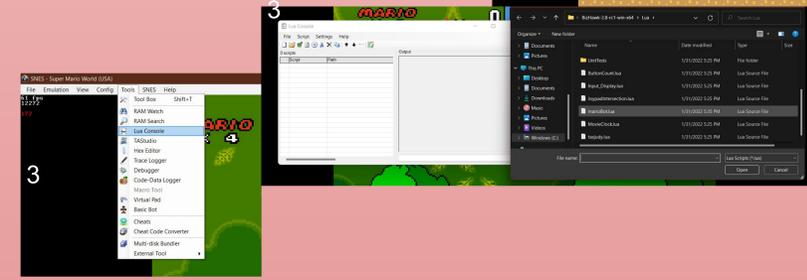
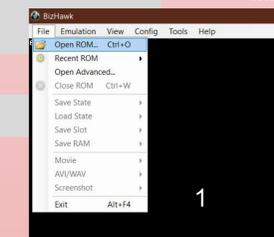
Materials/Procedure

- Modded EmuHawk Emulator
- Lua (with machine learning packages)
- Edited Mar/IO lua script
- Super Mario World ROM file



- 1.) Open emuHawk.exe and load in your Super mario world ROM
- 2.) Make a save of the game in the level you want then Locate it and duplicate it into main directory and lua directory
- 3.) Load the lua script through the Console

OPTIONAL: turn on or off pop up display



Conclusion

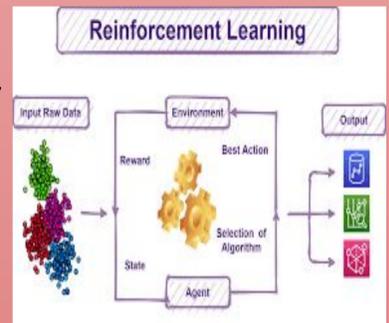
This experiment to see whether an AI could play mario proved my hypothesis right because indeed my AI was better than me and my hypothesis was "My Mario AI would be able to beat me in mario after ample training". If I were to do this experiment again I would definitely make it play a more advanced mario game but also make it so it also learns from my inputs that way I could have a more effective mario that could beat more complicated levels. I definitely learned a lot and believe that AI is part of our future with how rapidly its growing.

Future Applications

A future application may be medical AI for example you could use supervised learning and basically teach an AI about the human body than use that AI at some point replicating it and eventually it may be able to spot an anomaly or abnormality such as broken bones, punctured lungs, etc. this is important especially in that field because it results in faster action which may lead to higher success rate of surgery or recovery.

Results and Data Analysis

- In the first test Mario was almost completely unresponsive other than a few jumps.
- By the second/third test mario was walking in a straight line towards a koopa troopa or crouching.
- About an hour later mario got past the koopas mut gets stuck on the steps towards Chargin Chucks or get hit by him.
- About two and a half or three hours after that mario is able to get past Chargin Chucks
- 5-6 hours and Mario is jumping over the stair jump
- By the next day mario is able to complete the first level without trouble
- By the next year theres an AI revolution (Just kidding that would be impossible with the AI we have today)



References

- [Mario](#) by SethBling (used this as a base script for my mario)
- [Blog on reinforcement learning](#) page written by Jason Stemmler (Mario is based on reinforcement learning)
- [Lua](#) (mario was written in lua)
- [BizHawkEmulator](#) made by TASVideos (mario runs in this emulator)
- [VisualStudioCode](#) made by Microsoft (this is the code editor I use)