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CS 4100 - Artificial Intelligence

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Project Milestone

My project is training an AI agent to play Atari Breakout using reinforcement learning. I plan to implement a DQN and potentially a Double DQN if time permits. To accomplish this, I am using OpenAI's Gymnasium along with PyTorch. After getting everything installed and working, I needed to decide on how I wanted to represent the game state. I was considering either using images of the game's current state or the RAM representation. I originally favored the image representation as all the papers I found on Atari reinforcement learning use this, but I ultimately decided on using the RAM observation type as it would require significantly less computational power. This is because each state in the image representation is 100,800 bytes as opposed to 128 bytes in the RAM representation. After deciding on which representation to use, I wrote the code to train an agent using a DQN. This took significantly longer than I originally expected, but I got it to run. However, I have struggled to get consistent results from the training. I can get the agent's average score to increase after enough training episodes, but the average scores remain significantly lower than in any of the papers. Below is a graph of the rolling average score of the agent after over 40,000 episodes. These are the best results I have been able to obtain so far after many tweaks of the hyperparameters.
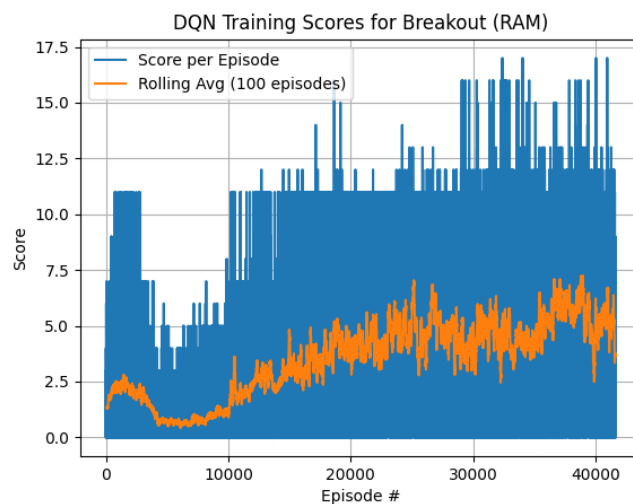
I would say that I have made progress toward my goal but have not fully reached the level that I originally wanted to. Achieving an average score that I would consider successful has been challenging due to the hyperparameters. I want to test out many different combinations, but I also want to let it run for enough episodes so that I can see if any learning is done. I also believe training on the RAM state has limitations compared to the image representation.

Based on what I have learned so far, I will change my plan to try training on the image representation of the state instead of RAM. I believe this will allow me to obtain higher average scores. In the next several days, I hope to have functioning code for training on the RGB representation using a CNN and DQN. Once this code is working, I can spend the remaining time tweaking the hyperparameters and training to hopefully get significantly better results than I currently have. If I can get this working faster than expected, I might try implementing a Double DQN, but I will not plan on it.