Deep Learning Lab Course

Exercise 1 : Imitation Learning and Reinforcement Learning

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1.2 Imitation Learning

Problems Faced

- Agent was mostly stuck at the beginnings of the episodes.
- Agent slows down significantly while going over turn markers.

Handling Imbalance

Each class is given same sampling probability of 1/L, where L is the number of classes. Sampling probability of a class is distributed across the samples. Then, probability of sampling a single data point x, belonging to class C is given by,

$$P(x) = 1 /(L * N), \quad \text{where N is the \#samples in class C}$$

Therefore, each mini-batch has similar number of samples from each class.

Improvements

Most noticeable difference due to sampling by weights is that the agent's chance of failure to accelerate at the beginning of the episode is significantly reduced.

With longer history length agents tends to stick more strictly to the track, minimizing deviations.

Hyperparameter Optimization

The network was optimized mainly for two hyperparameters, 1. Learning Rate 2. History Length. Best test time performance obtained on configuration:

Mean : 778.8932380727578 and Standard deviation: 229.9508871951905, for History length: 5 and learning rate: 0.01

Observations:

Though the agent was better at following the track with larger history lengths, in case of deviations larger was the impact when agent goes off-track.

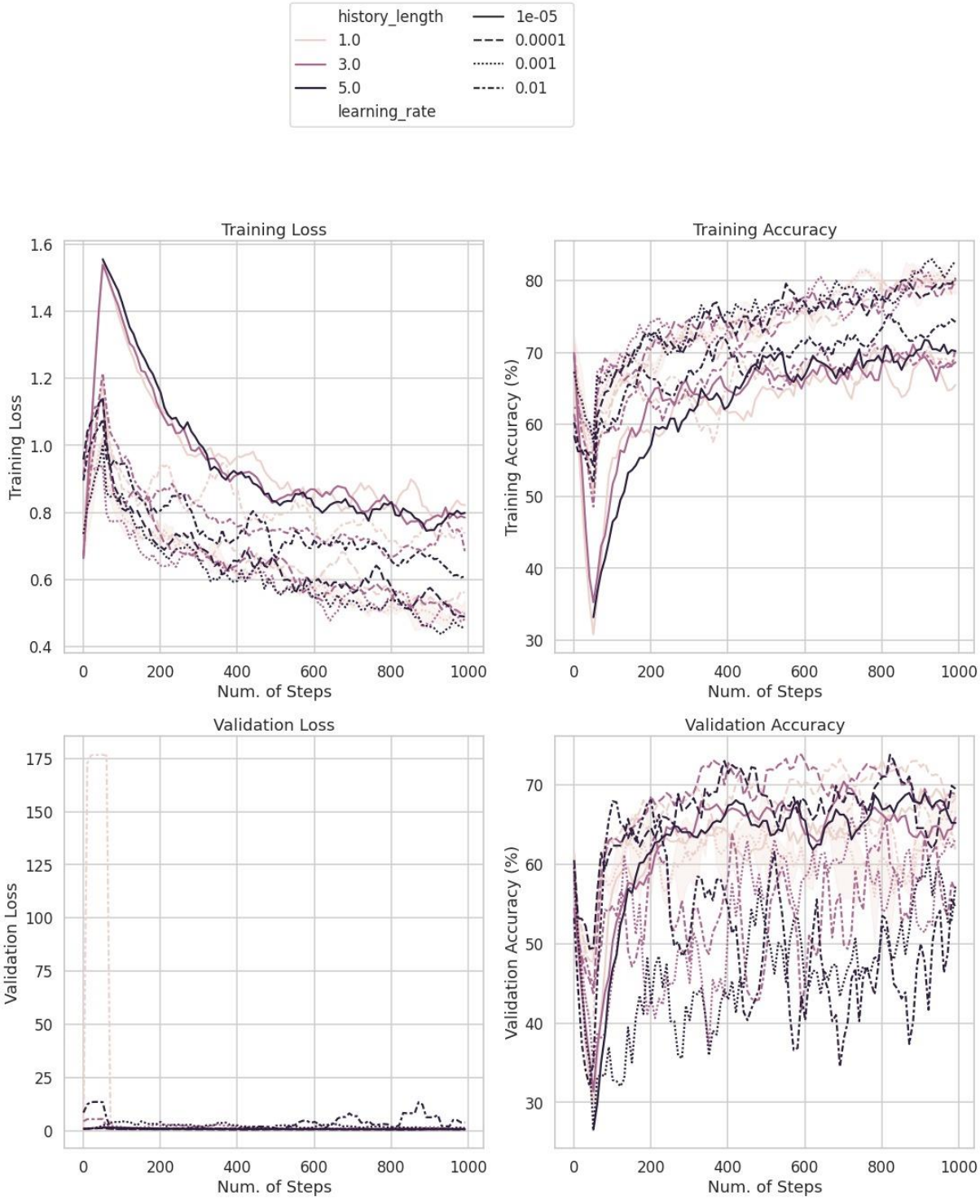
At high learning rates, the agent was able to better return to track.

Limitations

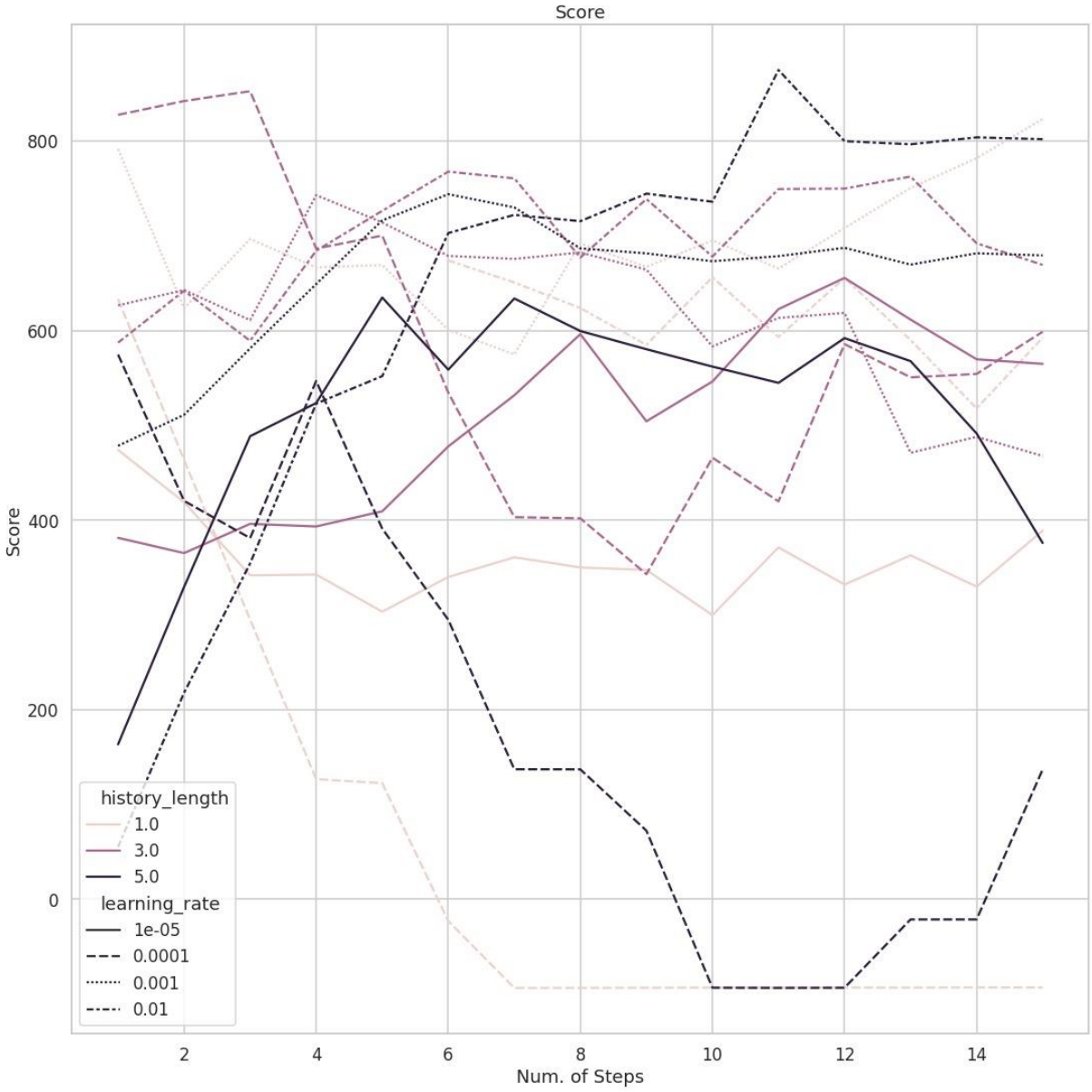
Agent seems to rely heavily on markers (bents) on the image.

Agent is poor at returning to the track once gone off-track.

Visualization of Results



The agent performed best at higher history length and learning rates. Very low learning lead to deteriorating performance for all history lengths.



Test time performance of the agent across 15 episodes

Best top score 923 was obtained learning rate 0.01 and history length 3.

1.2 Reinforcement Learning

I apologize, I was unable to get it to working on time. I got stuck at the CartPole problem. I have still uploaded the code to show the progress.