Artificial Intelligence Coding Homework (Cartpole)

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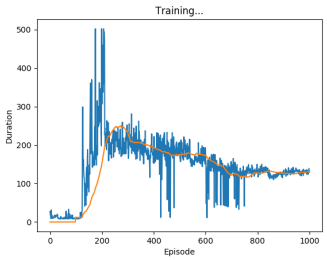
Base Case

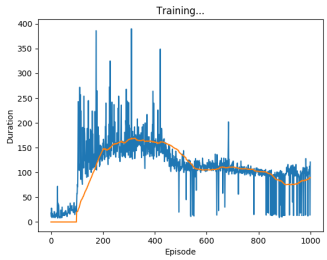
The base that was run was

```
BATCH_SIZE = 128
GAMMA = 0.999
EPS_START = 0.9
EPS_END = 0.05
EPS_DECAY = 200
TARGET_UPDATE = 30
learning_rate = 5e-4
weight_decay = 5e-5
NN hidden size = 24
Replay Memory = 50000
```

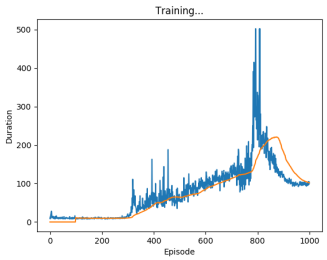
This yields the following graphs in 5 runs



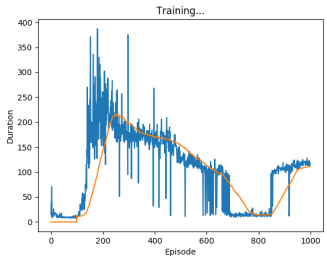
(a) 24 by 24 Run 1



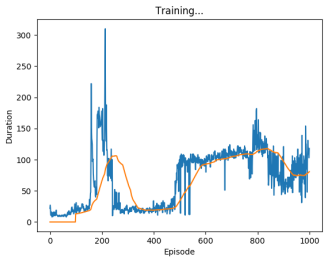
(b) 24 by 24 Run 2



(c) 24 by 24 Run 3



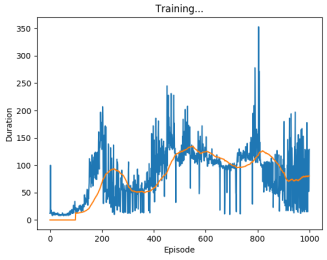
(d) 24 by 24 Run 4



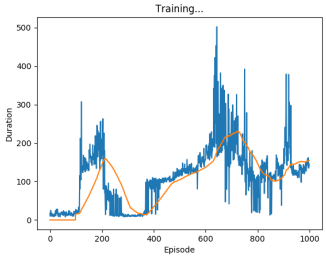
(e) 24 by 24 Run 5

Learning Rate Exploration

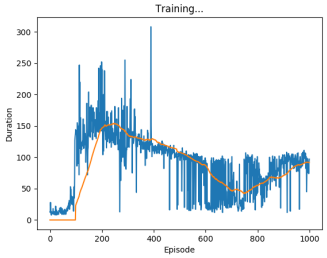
2 other learning rates were tested, the first was 1e-3



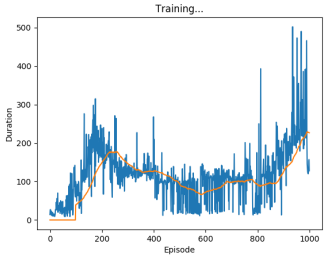
(a) 1e-3 Run 1



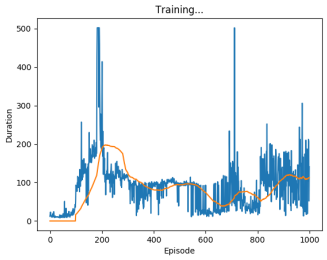
(b) 1e-3 Run 2



(c) 1e-3 Run 3

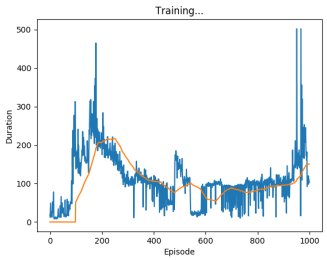


(d) 1e-3 Run 4

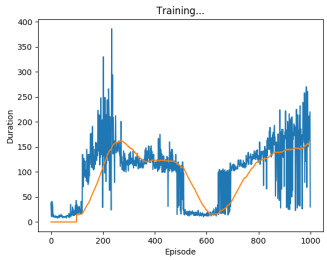


(e) 1e-3 Run 5

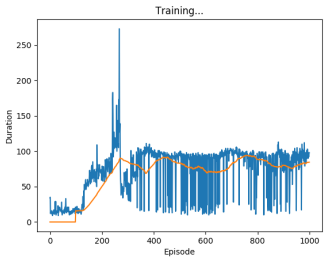
The 2nd was 9e-4



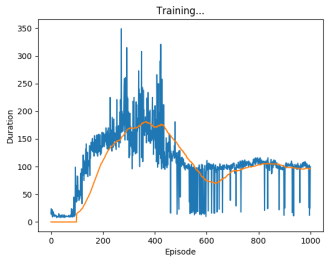
(a) 9e-4 Run 1



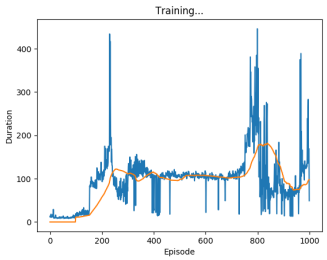
(b) 9e-4 Run 2



(c) 9e-4 Run 3



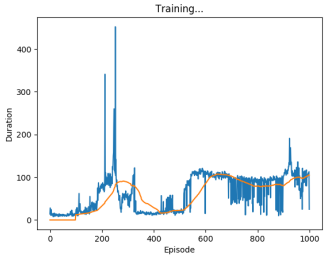
(d) 9e-4 Run 4



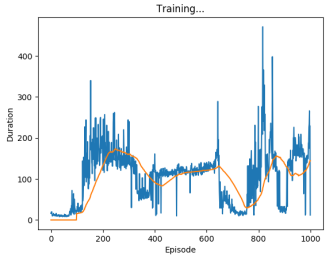
(e) 9e-4 Run 5

Memory Size Exploration

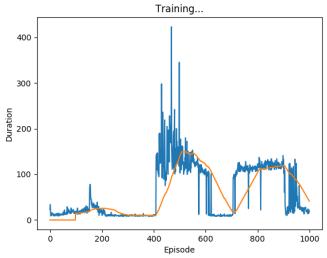
2 other memory size were ran, the first was 10000



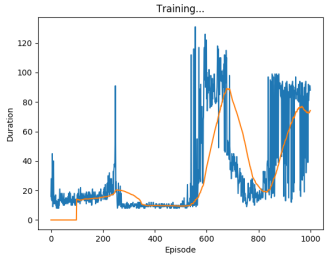
(a) Replay Memory 10000 Run 1



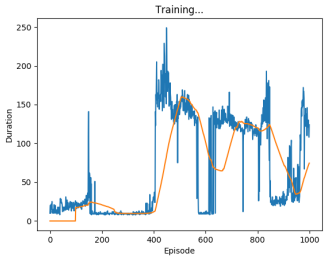
(b) Replay Memory 10000 Run 2



(c) Replay Memory 10000 Run 3

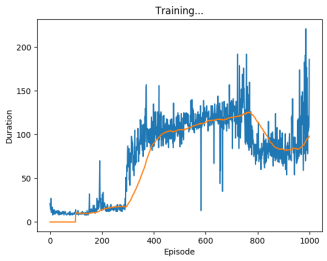


(d) Replay Memory 10000 Run 4

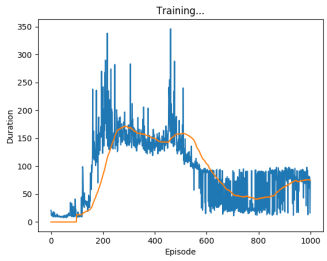


(e) Replay Memory 10000 Run 5

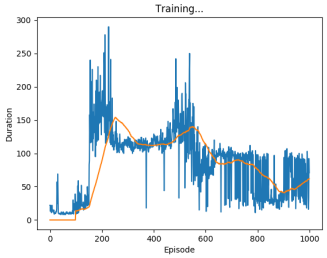
2nd memory size was 100000



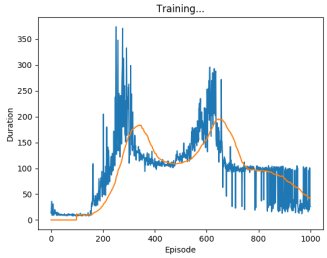
(a) Replay Memory 100000 Run 1



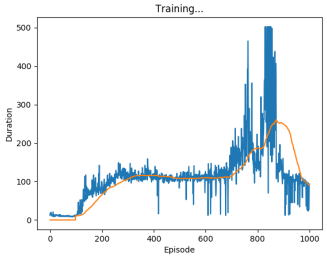
(b) Replay Memory 100000 Run 2



(c) Replay Memory 100000 Run 3



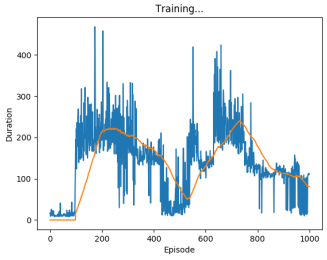
(d) Replay Memory 100000 Run 4



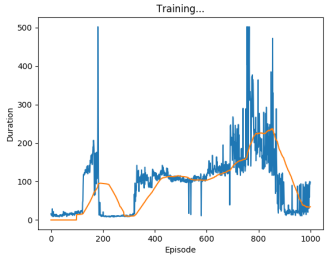
(e) Replay Memory 100000 Run 5

Hidden Size Exploration

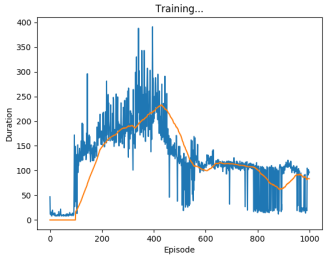
For neural net settings, a hidden size of 64 was tested



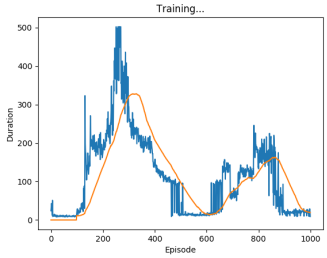
(a) 64 by 64 Run 1



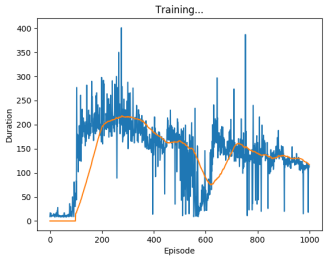
(b) 64 by 64 Run 2



(c) 64 by 64 Run 3



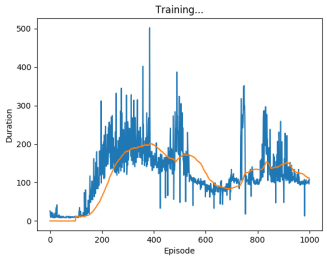
(d) 64 by 64 Run 4



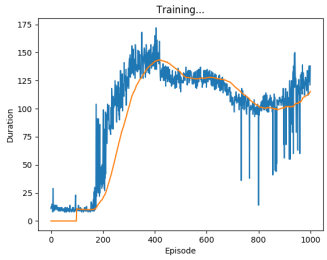
(e) 64 by 64 Run 5

Loss Function Exploration

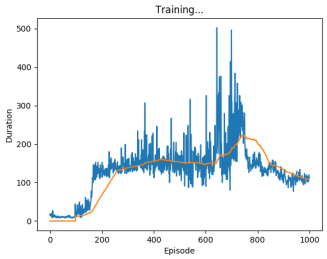
The other loss function that was tested is MSE loss. This is because smoothed l1 loss makes the model less sensitive to anomaly. By using MSE, we can account for these anomalies



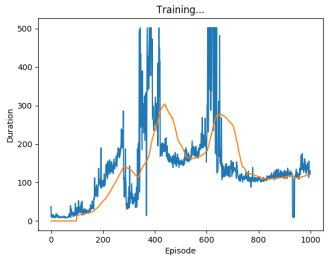
(a) MSE Run 1



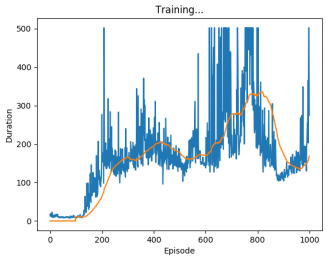
(b) MSE Run 2



(c) 2MSE Run 3



(d) MSE Run 4



(e) MSE Run 5

Conclusion

From all the exploration, we can see that the larger the neural net hidden size, the more likely it is able to hit higher rewards. This however is a trade off for computation cost. We can also observe that too small a memory size results in worse results. This is likely due to the the loss of information when memory runs out. For learning rate, the learning rate cannot be too large or too small. Finally, we can also observe that in general MSE Loss seems to work better than Smoothed L1 Loss