

Deep Eligibility Traces

Introduction

This repository consists of implementations of Eligibility Traces and corresponding algorithms in the deep learning setting. Algorithms are implemented in [PyTorch](#) and [Tensorflow 2.0](#) on a range of problems. Custom toy problems are provided in the [MDPs](#) folder.

Baseline Algorithms

Following are the baseline algorithms combined with trace-based updates-

| Algorithm | Link | Implementation | Status |
|-----------------------|------------------------------------|--|--------|
| Sarsa | Sutton & Barto | sarsa.py | ✓ |
| Double Sarsa | Sutton & Barto | doublesarsa.py | ✓ |
| Q-Learning | Sutton & Barto | qlearning.py | ✓ |
| Double Q-Learning | Sutton & Barto | doubleqlearning.py | ✓ |
| Expected Sarsa | Sutton & Barto | expectedsarsa.py | ✓ |
| Double Expected Sarsa | Sutton & Barto | doubleexpectedsarsa.py | ✓ |

Trace Algorithms

Following algorithms are available in the current version-

PyTorch

| Algorithm | Link | Implementation | Status |
|-----------|--|---------------------------|-----------------|
| TD-lambda | Sutton & Barto, Chapter 12 | TD1amb.py | Requires tuning |

Custom Environments

Following is the list of custom toy environments-

| Environment Name | Link | Implementation |
|------------------------|------------------------------------|----------------------|
| Cyclic MDP | ESAC | link |
| One-state MDP | Sutton & Barto | link |
| One-state Gaussian MDP | Sutton & Barto | link |

Usage

To run an implementation, use the following command-

```
python main.py --alg <ALGORITHM> --env <ENV> --lib <LIBRARY> --trace <TRACE> --  
lamb <LAMBDA> --num_steps <STEPS>
```

For example, to run Q-Learning on the CartPole-v0 environment using PyTorch library with replacing trace and lambda=0.5, use the following-

```
python main.py --alg QLearning --env CartPole-v0 --lib torch --trace replacing --  
lamb 0.5 --num_steps 10000
```

To view the full list of arguments run the following-

```
python main.py --help
```

Citation

If you find these implementations helpful then please cite the following-

```
@misc{karush17eligibilitytraces,  
  author = {Karush Suri},  
  title = {Deep Eligibility Traces},  
  year = {2021},  
  howpublished = {\url{https://github.com/karush17/Deep-Eligibility-Traces}},  
  note = {commit xxxxxxxx}  
}
```