Deep Eligibility Traces

Introduction

This repository consists of implementations of Eligiblity 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

Trace	Baseline Algorithms	Link	Implementation	Status
TD-lambda	TD(1)	Sutton & Barto	`TDlamb.py`	Requires tuning
Replacing Trace	• ☑ Sarsa • ☑ Q-learning • ☑ Expected Sarsa • ☑ Double Sarsa • ☑ Double Q-learning • ☑ Double Expected Sarsa	Sutton & Barto	`traces.py`	✓

Trace	Baseline Algorithms	Link	Implementation	Status
Accumulating Trace	• ☑ Sarsa • ☑ Q-learning • ☑ Expected Sarsa • ☑ Double Sarsa • ☑ Double Q-learning • ☑ Double Expected Sarsa	Sutton & Barto	`traces.py`	✔
Dutch Trace	• ☑ Sarsa • ☑ Q-learning • ☑ Expected Sarsa • ☑ Double Sarsa • ☑ Double Q-learning • ☑ Double Expected Sarsa	Sutton & Barto	``traces.py`	✔

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 xxxxxxx}
}
```