

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

[Trace|Baseline Algorithms|Link|Implementation|Status|] :-----😞:--😞:-----😞:--😞 |TD-lambda|TD(1)|[Sutton & Barto](#)|[TD1amb.py](#)|Requires tuning| |Replacing Trace|

- ☒ Sarsa
- ☒ Q-learning
- ☒ Expected Sarsa
- ☒ Double Sarsa
- ☒ Double Q-learning
- ☒ Double Expected Sarsa

[[Sutton & Barto](#)]|[traces.py](#)|✓| |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 xxxxxxxx}  
}
```