

✓ Hindsight Experience Replay (HER)

```
!apt-get install -y libgl1-mesa-dev
```

```
Selecting previously unselected package libegl-dev:amd64.  
⇒ Preparing to unpack .../2-libegl-dev_1.4.0-1_amd64.deb ...  
Unpacking libegl-dev:amd64 (1.4.0-1) ...  
Selecting previously unselected package libgles1:amd64.  
Preparing to unpack .../3-libgles1_1.4.0-1_amd64.deb ...  
Unpacking libgles1:amd64 (1.4.0-1) ...  
Selecting previously unselected package libgles-dev:amd64.  
Preparing to unpack .../4-libgles-dev_1.4.0-1_amd64.deb ...  
Unpacking libgles-dev:amd64 (1.4.0-1) ...  
Selecting previously unselected package libopengl-dev:amd64.  
Preparing to unpack .../5-libopengl-dev_1.4.0-1_amd64.deb ...  
Unpacking libopengl-dev:amd64 (1.4.0-1) ...  
Selecting previously unselected package libglvnd-core-dev:amd64.  
Preparing to unpack .../6-libglvnd-core-dev_1.4.0-1_amd64.deb ...  
Unpacking libglvnd-core-dev:amd64 (1.4.0-1) ...  
Selecting previously unselected package libglvnd-dev:amd64.  
Preparing to unpack .../7-libglvnd-dev_1.4.0-1_amd64.deb ...  
Unpacking libglvnd-dev:amd64 (1.4.0-1) ...  
Selecting previously unselected package libgl1-mesa-dev:amd64.  
Preparing to unpack .../8-libgl1-mesa-dev_23.2.1-1ubuntu3.1~22.04.2_amd64.deb ...  
Unpacking libgl1-mesa-dev:amd64 (23.2.1-1ubuntu3.1~22.04.2) ...  
Setting up libglvnd-core-dev:amd64 (1.4.0-1) ...  
Setting up libgles1:amd64 (1.4.0-1) ...  
Setting up libglx-dev:amd64 (1.4.0-1) ...
```

```
/sbin/ldconfig.real: /usr/local/lib/libumf.so.0 is not a symbolic link
```

```
/sbin/ldconfig.real: /usr/local/lib/libtcm_debug.so.1 is not a symbolic link
```

```
!apt-get install -y libgl1-mesa-glx
```

```

⇒ Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following NEW packages will be installed:
  libgl1-mesa-glx
0 upgraded, 1 newly installed, 0 to remove and 49 not upgraded.
Need to get 5,584 B of archives.
After this operation, 74.8 kB of additional disk space will be used.
Get:1 http://archive.ubuntu.com/ubuntu jammy-updates/universe amd64 libgl1-mesa-glx a
Fetched 5,584 B in 0s (27.5 kB/s)
Selecting previously unselected package libgl1-mesa-glx:amd64.
(Reading database ... 123722 files and directories currently installed.)
Preparing to unpack .../libgl1-mesa-glx_23.0.4-0ubuntu1~22.04.1_amd64.deb ...
Unpacking libgl1-mesa-glx:amd64 (23.0.4-0ubuntu1~22.04.1) ...
Setting up libgl1-mesa-glx:amd64 (23.0.4-0ubuntu1~22.04.1) ...

```

```
!apt-get install -y libglew-dev
```

```

⇒ Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following additional packages will be installed:
  libglu1-mesa libglu1-mesa-dev
The following NEW packages will be installed:
  libglew-dev libglu1-mesa libglu1-mesa-dev
0 upgraded, 3 newly installed, 0 to remove and 49 not upgraded.
Need to get 663 kB of archives.
After this operation, 4,058 kB of additional disk space will be used.
Get:1 http://archive.ubuntu.com/ubuntu jammy/main amd64 libglu1-mesa amd64 9.0.2-1 [1
Get:2 http://archive.ubuntu.com/ubuntu jammy/main amd64 libglu1-mesa-dev amd64 9.0.2-
Get:3 http://archive.ubuntu.com/ubuntu jammy/universe amd64 libglew-dev amd64 2.2.0-4
Fetched 663 kB in 1s (770 kB/s)
Selecting previously unselected package libglu1-mesa:amd64.
(Reading database ... 123728 files and directories currently installed.)
Preparing to unpack .../libglu1-mesa_9.0.2-1_amd64.deb ...
Unpacking libglu1-mesa:amd64 (9.0.2-1) ...
Selecting previously unselected package libglu1-mesa-dev:amd64.
Preparing to unpack .../libglu1-mesa-dev_9.0.2-1_amd64.deb ...
Unpacking libglu1-mesa-dev:amd64 (9.0.2-1) ...
Selecting previously unselected package libglew-dev:amd64.
Preparing to unpack .../libglew-dev_2.2.0-4_amd64.deb ...
Unpacking libglew-dev:amd64 (2.2.0-4) ...
Setting up libglu1-mesa:amd64 (9.0.2-1) ...
Setting up libglu1-mesa-dev:amd64 (9.0.2-1) ...
Setting up libglew-dev:amd64 (2.2.0-4) ...
Processing triggers for libc-bin (2.35-0ubuntu3.4) ...
/sbin/ldconfig.real: /usr/local/lib/libhwloc.so.15 is not a symbolic link

```

```
/sbin/ldconfig.real: /usr/local/lib/libtbbmalloc.so.2 is not a symbolic link

/sbin/ldconfig.real: /usr/local/lib/libtbbbind_2_5.so.3 is not a symbolic link

/sbin/ldconfig.real: /usr/local/lib/libtbbmalloc_proxy.so.2 is not a symbolic link

/sbin/ldconfig.real: /usr/local/lib/libur_adapter_opengl.so.0 is not a symbolic link

/sbin/ldconfig.real: /usr/local/lib/libtcm.so.1 is not a symbolic link

/sbin/ldconfig.real: /usr/local/lib/libtbbbind_2_0.so.3 is not a symbolic link

/sbin/ldconfig.real: /usr/local/lib/libur_loader.so.0 is not a symbolic link

/sbin/ldconfig.real: /usr/local/lib/libtbb.so.12 is not a symbolic link

/sbin/ldconfig.real: /usr/local/lib/libur_adapter_level_zero.so.0 is not a symbolic l

/sbin/ldconfig.real: /usr/local/lib/libtbbbind.so.3 is not a symbolic link

/sbin/ldconfig.real: /usr/local/lib/libumf.so.0 is not a symbolic link

/sbin/ldconfig.real: /usr/local/lib/libtcm_debug.so.1 is not a symbolic link
```

```
!apt-get install -y xvfb
```



```

/sbin/ldconfig.real: /usr/local/lib/libtbbmalloc.so.2 is not a symbolic link
/sbin/ldconfig.real: /usr/local/lib/libtbbbind_2_5.so.3 is not a symbolic link
/sbin/ldconfig.real: /usr/local/lib/libtbbmalloc_proxy.so.2 is not a symbolic link
/sbin/ldconfig.real: /usr/local/lib/libur_adapter_opengl.so.0 is not a symbolic link
/sbin/ldconfig.real: /usr/local/lib/libtcm.so.1 is not a symbolic link
/sbin/ldconfig.real: /usr/local/lib/libtbbbind_2_0.so.3 is not a symbolic link
/sbin/ldconfig.real: /usr/local/lib/libur_loader.so.0 is not a symbolic link
/sbin/ldconfig.real: /usr/local/lib/libtbb.so.12 is not a symbolic link
/sbin/ldconfig.real: /usr/local/lib/libur_adapter_level_zero.so.0 is not a symbolic link
/sbin/ldconfig.real: /usr/local/lib/libtbbbind.so.3 is not a symbolic link
/sbin/ldconfig.real: /usr/local/lib/libumf.so.0 is not a symbolic link
/sbin/ldconfig.real: /usr/local/lib/libtcm_debug.so.1 is not a symbolic link

```

```
!apt-get install -y libosmesa6-dev
```



```

Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following additional packages will be installed:
  libosmesa6
The following NEW packages will be installed:
  libosmesa6 libosmesa6-dev
0 upgraded, 2 newly installed, 0 to remove and 49 not upgraded.
Need to get 3,130 kB of archives.
After this operation, 12.7 MB of additional disk space will be used.
Get:1 http://archive.ubuntu.com/ubuntu jammy-updates/main amd64 libosmesa6 amd64 23.2
Get:2 http://archive.ubuntu.com/ubuntu jammy-updates/main amd64 libosmesa6-dev amd64
Fetched 3,130 kB in 0s (10.5 MB/s)
Selecting previously unselected package libosmesa6:amd64.
(Reading database ... 124313 files and directories currently installed.)
Preparing to unpack .../libosmesa6_23.2.1-1ubuntu3.1~22.04.2_amd64.deb ...
Unpacking libosmesa6:amd64 (23.2.1-1ubuntu3.1~22.04.2) ...
Selecting previously unselected package libosmesa6-dev:amd64.
Preparing to unpack .../libosmesa6-dev_23.2.1-1ubuntu3.1~22.04.2_amd64.deb ...
Unpacking libosmesa6-dev:amd64 (23.2.1-1ubuntu3.1~22.04.2) ...
Setting up libosmesa6:amd64 (23.2.1-1ubuntu3.1~22.04.2) ...
Setting up libosmesa6-dev:amd64 (23.2.1-1ubuntu3.1~22.04.2) ...
Processing triggers for libc-bin (2.35-0ubuntu3.4) ...
/sbin/ldconfig.real: /usr/local/lib/libhwloc.so.15 is not a symbolic link

/sbin/ldconfig.real: /usr/local/lib/libtbbmalloc.so.2 is not a symbolic link

/sbin/ldconfig.real: /usr/local/lib/libtbbbind_2_5.so.3 is not a symbolic link

```

```
/sbin/ldconfig.real: /usr/local/lib/libtbbmalloc_proxy.so.2 is not a symbolic link

/sbin/ldconfig.real: /usr/local/lib/libur_adapter_openc1.so.0 is not a symbolic link

/sbin/ldconfig.real: /usr/local/lib/libtcm.so.1 is not a symbolic link

/sbin/ldconfig.real: /usr/local/lib/libtbbbind_2_0.so.3 is not a symbolic link

/sbin/ldconfig.real: /usr/local/lib/libur_loader.so.0 is not a symbolic link

/sbin/ldconfig.real: /usr/local/lib/libtbb.so.12 is not a symbolic link

/sbin/ldconfig.real: /usr/local/lib/libur_adapter_level_zero.so.0 is not a symbolic l

/sbin/ldconfig.real: /usr/local/lib/libtbbbind.so.3 is not a symbolic link

/sbin/ldconfig.real: /usr/local/lib/libumf.so.0 is not a symbolic link

/sbin/ldconfig.real: /usr/local/lib/libtcm_debug.so.1 is not a symbolic link
```

```
!apt-get install -y software-properties-common
```



```
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
software-properties-common is already the newest version (0.99.22.9).
0 upgraded, 0 newly installed, 0 to remove and 49 not upgraded.
```

```
!apt-get install -y patchelf
```



```
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following NEW packages will be installed:
  patchelf
0 upgraded, 1 newly installed, 0 to remove and 49 not upgraded.
Need to get 72.1 kB of archives.
After this operation, 186 kB of additional disk space will be used.
Get:1 http://archive.ubuntu.com/ubuntu jammy/universe amd64 patchelf amd64 0.14.3-1 [
Fetched 72.1 kB in 0s (610 kB/s)
Selecting previously unselected package patchelf.
(Reading database ... 124332 files and directories currently installed.)
Preparing to unpack .../patchelf_0.14.3-1_amd64.deb ...
Unpacking patchelf (0.14.3-1) ...
Setting up patchelf (0.14.3-1) ...
Processing triggers for man-db (2.10.2-1) ...
```

```
!pip install free-mujoco-py
```



```
Collecting free-mujoco-py
  Downloading free_mujoco_py-2.1.6-py3-none-any.whl.metadata (586 bytes)
Collecting Cython<0.30.0,>=0.29.24 (from free-mujoco-py)
  Downloading Cython-0.29.37-cp310-cp310-manylinux_2_17_x86_64.manylinux2014_x86_64.r
Requirement already satisfied: cffi<2.0.0,>=1.15.0 in /usr/local/lib/python3.10/dist-
```

```

Collecting fasteners==0.15 (from free-mujoco-py)
  Downloading fasteners-0.15-py2.py3-none-any.whl.metadata (2.6 kB)
Collecting glfw<2.0.0,>=1.4.0 (from free-mujoco-py)
  Downloading glfw-1.12.0-py2.py27.py3.py30.py31.py32.py33.py34.py35.py36.py37.py38-n
Requirement already satisfied: imageio<3.0.0,>=2.9.0 in /usr/local/lib/python3.10/dis
Requirement already satisfied: numpy<2.0.0,>=1.21.3 in /usr/local/lib/python3.10/dist
Requirement already satisfied: six in /usr/local/lib/python3.10/dist-packages (from f
Collecting monotonic>=0.1 (from fasteners==0.15->free-mujoco-py)
  Downloading monotonic-1.6-py2.py3-none-any.whl.metadata (1.5 kB)
Requirement already satisfied: pycparser in /usr/local/lib/python3.10/dist-packages (
Requirement already satisfied: pillow>=8.3.2 in /usr/local/lib/python3.10/dist-packag
Downloading free_mujoco_py-2.1.6-py3-none-any.whl (14.1 MB)
    14.1/14.1 MB 80.7 MB/s eta 0:00:00
Downloading fasteners-0.15-py2.py3-none-any.whl (23 kB)
Downloading Cython-0.29.37-cp310-cp310-manylinux_2_17_x86_64.manylinux2014_x86_64.man
    1.9/1.9 MB 58.1 MB/s eta 0:00:00
Downloading glfw-1.12.0-py2.py27.py3.py30.py31.py32.py33.py34.py35.py36.py37.py38-non
    203.7/203.7 kB 14.3 MB/s eta 0:00:00
Downloading monotonic-1.6-py2.py3-none-any.whl (8.2 kB)
Installing collected packages: monotonic, glfw, fasteners, Cython, free-mujoco-py
  Attempting uninstall: Cython
    Found existing installation: Cython 3.0.11
    Uninstalling Cython-3.0.11:
      Successfully uninstalled Cython-3.0.11
Successfully installed Cython-0.29.37 fasteners-0.15 free-mujoco-py-2.1.6 glfw-1.12.0

```

```
!pip install gym==0.25.2
```



```

Requirement already satisfied: gym==0.25.2 in /usr/local/lib/python3.10/dist-packages
Requirement already satisfied: numpy>=1.18.0 in /usr/local/lib/python3.10/dist-packag
Requirement already satisfied: cloudpickle>=1.2.0 in /usr/local/lib/python3.10/dist-p
Requirement already satisfied: gym-notices>=0.0.4 in /usr/local/lib/python3.10/dist-p

```



```
!pip install pytorch-lightning
```



```

Collecting pytorch-lightning
  Downloading pytorch_lightning-2.4.0-py3-none-any.whl.metadata (21 kB)
Requirement already satisfied: torch>=2.1.0 in /usr/local/lib/python3.10/dist-package
Requirement already satisfied: tqdm>=4.57.0 in /usr/local/lib/python3.10/dist-package
Requirement already satisfied: PyYAML>=5.4 in /usr/local/lib/python3.10/dist-packages
Requirement already satisfied: fsspec>=2022.5.0 in /usr/local/lib/python3.10/dist-pac
Collecting torchmetrics>=0.7.0 (from pytorch-lightning)
  Downloading torchmetrics-1.6.0-py3-none-any.whl.metadata (20 kB)
Requirement already satisfied: packaging>=20.0 in /usr/local/lib/python3.10/dist-pack
Requirement already satisfied: typing-extensions>=4.4.0 in /usr/local/lib/python3.10/
Collecting lightning-utilities>=0.10.0 (from pytorch-lightning)
  Downloading lightning_utilities-0.11.8-py3-none-any.whl.metadata (5.2 kB)
Requirement already satisfied: aiohttp!=4.0.0a0,!4.0.0a1 in /usr/local/lib/python3.1
Requirement already satisfied: setuptools in /usr/local/lib/python3.10/dist-packages
Requirement already satisfied: filelock in /usr/local/lib/python3.10/dist-packages (f
Requirement already satisfied: networkx in /usr/local/lib/python3.10/dist-packages (f
Requirement already satisfied: Jinja2 in /usr/local/lib/python3.10/dist-packages (frc
Requirement already satisfied: sympy==1.13.1 in /usr/local/lib/python3.10/dist-packag
Requirement already satisfied: mpmath<1.4,>=1.1.0 in /usr/local/lib/python3.10/dist-p
Requirement already satisfied: numpy>1.20.0 in /usr/local/lib/python3.10/dist-package
Requirement already satisfied: aiohappyeyeballs>=2.3.0 in /usr/local/lib/python3.10/d

```

```
Requirement already satisfied: aiosignal>=1.1.2 in /usr/local/lib/python3.10/dist-packages
Requirement already satisfied: attrs>=17.3.0 in /usr/local/lib/python3.10/dist-packages
Requirement already satisfied: frozenlist>=1.1.1 in /usr/local/lib/python3.10/dist-packages
Requirement already satisfied: multidict<7.0, >=4.5 in /usr/local/lib/python3.10/dist-packages
Requirement already satisfied: yarl<2.0, >=1.12.0 in /usr/local/lib/python3.10/dist-packages
Requirement already satisfied: async-timeout<5.0, >=4.0 in /usr/local/lib/python3.10/dist-packages
Requirement already satisfied: MarkupSafe>=2.0 in /usr/local/lib/python3.10/dist-packages
Requirement already satisfied: idna>=2.0 in /usr/local/lib/python3.10/dist-packages
Requirement already satisfied: propcache>=0.2.0 in /usr/local/lib/python3.10/dist-packages
Downloading pytorch_lightning-2.4.0-py3-none-any.whl (815 kB)
815.2/815.2 kB 13.0 MB/s eta 0:00:00
Downloading lightning_utilities-0.11.8-py3-none-any.whl (26 kB)
Downloading torchmetrics-1.6.0-py3-none-any.whl (926 kB)
926.4/926.4 kB 36.6 MB/s eta 0:00:00
Installing collected packages: lightning-utilities, torchmetrics, pytorch-lightning
Successfully installed lightning-utilities-0.11.8 pytorch-lightning-2.4.0 torchmetrics
```

```
!pip install optuna
```



```
Collecting optuna
  Downloading optuna-4.1.0-py3-none-any.whl.metadata (16 kB)
Collecting alembic>=1.5.0 (from optuna)
  Downloading alembic-1.14.0-py3-none-any.whl.metadata (7.4 kB)
Collecting colorlog (from optuna)
  Downloading colorlog-6.9.0-py3-none-any.whl.metadata (10 kB)
Requirement already satisfied: numpy in /usr/local/lib/python3.10/dist-packages (from optuna)
Requirement already satisfied: packaging>=20.0 in /usr/local/lib/python3.10/dist-packages (from optuna)
Requirement already satisfied: sqlalchemy>=1.4.2 in /usr/local/lib/python3.10/dist-packages (from optuna)
Requirement already satisfied: tqdm in /usr/local/lib/python3.10/dist-packages (from optuna)
Requirement already satisfied: PyYAML in /usr/local/lib/python3.10/dist-packages (from optuna)
Collecting Mako (from alembic>=1.5.0->optuna)
  Downloading Mako-1.3.6-py3-none-any.whl.metadata (2.9 kB)
Requirement already satisfied: typing-extensions>=4 in /usr/local/lib/python3.10/dist-packages (from alembic)
Requirement already satisfied: greenlet!=0.4.17 in /usr/local/lib/python3.10/dist-packages (from alembic)
Requirement already satisfied: MarkupSafe>=0.9.2 in /usr/local/lib/python3.10/dist-packages (from alembic)
Downloading optuna-4.1.0-py3-none-any.whl (364 kB)
364.4/364.4 kB 7.0 MB/s eta 0:00:00
Downloading alembic-1.14.0-py3-none-any.whl (233 kB)
233.5/233.5 kB 14.5 MB/s eta 0:00:00
Downloading colorlog-6.9.0-py3-none-any.whl (11 kB)
Downloading Mako-1.3.6-py3-none-any.whl (78 kB)
78.6/78.6 kB 5.2 MB/s eta 0:00:00
Installing collected packages: Mako, colorlog, alembic, optuna
Successfully installed Mako-1.3.6 alembic-1.14.0 colorlog-6.9.0 optuna-4.1.0
```

```
!pip install gym-robotics
```



```
Collecting gym-robotics
  Downloading gym-robotics-1.0.1.tar.gz (1.5 MB)
1.5/1.5 MB 13.4 MB/s eta 0:00:00
Installing build dependencies ... done
Getting requirements to build wheel ... done
Preparing metadata (pyproject.toml) ... done
Collecting mujoco==2.2.2 (from gym-robotics)
  Downloading mujoco-2.2.2-cp310-cp310-manylinux_2_17_x86_64.manylinux2014_x86_64.whl
Requirement already satisfied: numpy>=1.18.0 in /usr/local/lib/python3.10/dist-packages (from gym-robotics)
```



```

Collecting gym>=0.26 (from gym-robotics)
  Downloading gym-0.26.2.tar.gz (721 kB)
    721.7/721.7 kB 38.3 MB/s eta 0:00:00
  Installing build dependencies ... done
  Getting requirements to build wheel ... done
  Preparing metadata (pyproject.toml) ... done
Requirement already satisfied: absl-py in /usr/local/lib/python3.10/dist-packages (fr
Requirement already satisfied: glfw in /usr/local/lib/python3.10/dist-packages (from
Requirement already satisfied: pyopengl in /usr/local/lib/python3.10/dist-packages (f
Requirement already satisfied: cloudpickle>=1.2.0 in /usr/local/lib/python3.10/dist-p
Requirement already satisfied: gym-notices>=0.0.4 in /usr/local/lib/python3.10/dist-p
Downloading mujoco-2.2.2-cp310-cp310-manylinux_2_17_x86_64.manylinux2014_x86_64.whl (
    3.8/3.8 MB 11.9 MB/s eta 0:00:00
Building wheels for collected packages: gym-robotics, gym
  Building wheel for gym-robotics (pyproject.toml) ... done
  Created wheel for gym-robotics: filename=gym_robotics-1.0.1-py3-none-any.whl size=1
  Stored in directory: /root/.cache/pip/wheels/4f/e1/bc/8961befbb6f3c20e3b0b7005767a8
  Building wheel for gym (pyproject.toml) ... done
  Created wheel for gym: filename=gym-0.26.2-py3-none-any.whl size=827627 sha256=6e5d
  Stored in directory: /root/.cache/pip/wheels/b9/22/6d/3e7b32d98451b4cd9d12417052aff
Successfully built gym-robotics gym
Installing collected packages: mujoco, gym, gym-robotics
  Attempting uninstall: gym
    Found existing installation: gym 0.25.2
    Uninstalling gym-0.25.2:
      Successfully uninstalled gym-0.25.2
ERROR: pip's dependency resolver does not currently take into account all the package
dopamine-rl 4.0.9 requires gym<=0.25.2, but you have gym 0.26.2 which is incompatible
Successfully installed gym-0.26.2 gym-robotics-1.0.1 mujoco-2.2.2

```

```
!pip install pyvirtualdisplay
```

```

⇒ Collecting pyvirtualdisplay
  Downloading PyVirtualDisplay-3.0-py3-none-any.whl.metadata (943 bytes)
  Downloading PyVirtualDisplay-3.0-py3-none-any.whl (15 kB)
Installing collected packages: pyvirtualdisplay
Successfully installed pyvirtualdisplay-3.0

```

```
!pip install PyOpenGL
```

```

⇒ Requirement already satisfied: PyOpenGL in /usr/local/lib/python3.10/dist-packages (3

```

```
!pip install PyOpenGL-accelerate
```


```

⇒ Collecting PyOpenGL-accelerate
  Downloading PyOpenGL_accelerate-3.1.7-cp310-cp310-manylinux_2_5_x86_64.manylinux1_x
  Downloading PyOpenGL_accelerate-3.1.7-cp310-cp310-manylinux_2_5_x86_64.manylinux1_x86
    2.3/2.3 MB 20.7 MB/s eta 0:00:00
Installing collected packages: PyOpenGL-accelerate
Successfully installed PyOpenGL-accelerate-3.1.7

```


✓ Setup virtual display

```
from pyvirtualdisplay import Display
Display(visible=False, size=(1400, 900)).start()
```

 <pyvirtualdisplay.display.Display at 0x7ec7d8b9e290>

✓ Import the necessary code libraries

```
import copy
import gym
import torch
import itertools
import random
```

```
import numpy as np
import torch.nn.functional as F
```


```
from collections import deque, namedtuple
from IPython.display import HTML
from base64 import b64encode
```

```
from torch import nn
from torch.utils.data import DataLoader
from torch.utils.data.dataset import IterableDataset
from torch.optim import AdamW
from torch.distributions.normal import Normal
```

```
from pytorch_lightning import LightningModule, Trainer
```

```
from gym.wrappers import RecordVideo, RecordEpisodeStatistics
```

```
device = 'cuda:0' if torch.cuda.is_available() else 'cpu'
num_gpus = torch.cuda.device_count()
```

 /usr/local/lib/python3.10/dist-packages/gym/envs/registration.py:307: DeprecationWarn
fn()

```
def display_video(episode=0):
    video_file = open(f'/content/videos/rl-video-episode-{episode}.mp4', "r+b").read()
    video_url = f"data:video/mp4;base64,{b64encode(video_file).decode()}"
    return HTML(f"<video width=600 controls><source src='{video_url}'></video>")
```

✓ Create the replay buffer

```

class ReplayBuffer:

    def __init__(self, capacity, her_probability=0.8):
        self.her_probability = her_probability
        self.buffer = deque(maxlen=capacity//2)
        self.her_buffer = deque(maxlen=capacity//2)

    def __len__(self):
        return len(self.buffer) + len(self.her_buffer)

    def append(self, experience, her=False):
        if her:
            self.her_buffer.append(experience)
        else:
            self.buffer.append(experience)

    def sample(self, batch_size):
        her_batch_size = int(batch_size * self.her_probability)
        regular_batch_size = batch_size - her_batch_size

        batch = random.sample(self.buffer, regular_batch_size)
        her_batch = random.sample(self.her_buffer, her_batch_size)
        full_batch = list(batch + her_batch)
        random.shuffle(full_batch)
        return full_batch

```

```

class RLDataset(IterableDataset):

    def __init__(self, buffer, sample_size=400):
        self.buffer = buffer
        self.sample_size = sample_size

    def __iter__(self):
        for experience in self.buffer.sample(self.sample_size):
            yield experience

```

✓ Create the environment

```

def create_environment(name, render_mode=None):
    env = gym.make(name, render_mode=render_mode)
    env = RecordVideo(env, video_folder='./videos', episode_trigger=lambda x: x % 50 == 0)
    env = RecordEpisodeStatistics(env)
    return env

```

✓ Update the target network

```

def polyak_average(net, target_net, tau=0.01):
    for qp, tp in zip(net.parameters(), target_net.parameters()):
        tp.data.copy_(tau * qp.data + (1 - tau) * tp.data)

```

✓ Create the Deep Q-Network

```
class DQN(nn.Module):

    def __init__(self, hidden_size, obs_size, out_dims):
        super().__init__()
        self.net = nn.Sequential(
            nn.Linear(obs_size + out_dims, hidden_size),
            nn.ReLU(),
            nn.Linear(hidden_size, hidden_size),
            nn.ReLU(),
            nn.Linear(hidden_size, 1),
        )

    def forward(self, state, action):
        if isinstance(state, np.ndarray):
            state = torch.from_numpy(state).to(device)
        if isinstance(action, np.ndarray):
            action = torch.from_numpy(action).to(device)
        in_vector = torch.hstack((state, action))
        return self.net(in_vector.float())
```

✓ Create the gradient policy

```
class GradientPolicy(nn.Module):

    def __init__(self, hidden_size, obs_size, out_dims, max):
        super().__init__()

        self.max = torch.from_numpy(max).to(device)

        self.net = nn.Sequential(
            nn.Linear(obs_size, hidden_size),
            nn.ReLU(),
            nn.Linear(hidden_size, hidden_size),
            nn.ReLU()
        )
        self.linear_mu = nn.Linear(hidden_size, out_dims)
        self.linear_log_std = nn.Linear(hidden_size, out_dims)

    def forward(self, obs):
        if isinstance(obs, np.ndarray):
            obs = torch.from_numpy(obs).to(device)
        x = self.net(obs.float())
        mu = self.linear_mu(x)

        log_std = self.linear_log_std(x)
        log_std = log_std.clamp(-20, 2)
        std = log_std.exp()
```

```

dist = Normal(mu, std)
action = dist.rsample()
log_prob = dist.log_prob(action)
log_prob = log_prob.sum(dim=-1, keepdim=True)
log_prob -= (2* (np.log(2) - action - F.softplus(-2*action))).sum(dim=-1, keepdim=True)

action = torch.tanh(action) * self.max
return action, log_prob

```

✓ Soft actor-critic algorithm

```

class SACHER(LightningModule):

    def __init__(self, env_name, capacity=100_000, batch_size=256, lr=1e-3,
                  hidden_size=256, gamma=0.99, loss_fn=F.smooth_l1_loss, optim=AdamW,
                  samples_per_epoch=1_000, tau=0.05, alpha=0.02, her=0.8):

        super().__init__()

        self.env = create_environment(env_name, render_mode="rgb_array")

        ag_size = self.env.observation_space['achieved_goal'].shape[0]
        dg_size = self.env.observation_space['desired_goal'].shape[0]
        obs_size = self.env.observation_space['observation'].shape[0]

        action_dims = self.env.action_space.shape[0]
        max_action = self.env.action_space.high

        self.q_net1 = DQN(hidden_size, obs_size + dg_size, action_dims)
        self.q_net2 = DQN(hidden_size, obs_size + dg_size, action_dims)
        self.policy = GradientPolicy(hidden_size, obs_size + dg_size, action_dims, max_action)

        self.target_policy = copy.deepcopy(self.policy)
        self.target_q_net1 = copy.deepcopy(self.q_net1)
        self.target_q_net2 = copy.deepcopy(self.q_net2)

        self.buffer = ReplayBuffer(capacity=capacity, her_probability=her)

        self.save_hyperparameters()

        self.automatic_optimization = False

        while len(self.buffer) < self.hparams.samples_per_epoch * 2:
            print(f"{len(self.buffer)} samples in experience buffer. Filling...")
            self.play_episodes()

        @torch.no_grad()
        def play_episodes(self, policy=None):
            state = list(self.env.reset())[0]
            #print(state)

            done = False

```

```

while not done:
    desired_state = np.hstack([state['observation'], state['desired_goal']])
    achieved_state = np.hstack([state['observation'], state['achieved_goal']])

    if policy and random.random() > 0.1:
        action, _ = self.policy(desired_state)
        action = action.cpu().numpy()
    else:
        action = self.env.action_space.sample()

    step_output = self.env.step(action)
    if len(step_output) == 5:
        next_state, reward, terminated, truncated, info = step_output
        # Combine terminated and truncated to align with the original 'done' logic.
        done = terminated or truncated
    else:
        next_state, reward, done, info = step_output

    next_desired_state = np.hstack([next_state['observation'], next_state['desired_go
    next_achieved_state = np.hstack([next_state['observation'], next_state['achieved_

    # Desired goal.
    exp = (desired_state, action, reward, done, next_desired_state)
    self.buffer.append(exp)

    # Achieved goal.
    reward = self.env.compute_reward(next_state['achieved_goal'], next_state['achieve
    exp = (achieved_state, action, reward, done, next_achieved_state)
    self.buffer.append(exp, her=True)

    state = next_state

def forward(self, x):
    output = self.policy(x)
    return output

def configure_optimizers(self):
    q_net_parameters = itertools.chain(self.q_net1.parameters(), self.q_net2.parameters())
    q_net_optimizer = self.hparams.optim(q_net_parameters, lr=self.hparams.lr)
    policy_optimizer = self.hparams.optim(self.policy.parameters(), lr=self.hparams.lr)
    return [q_net_optimizer, policy_optimizer]

def train_dataloader(self):
    dataset = RLDataset(self.buffer, self.hparams.samples_per_epoch)
    dataloader = DataLoader(
        dataset=dataset,
        batch_size=self.hparams.batch_size,
    )
    return dataloader

def training_step(self, batch, batch_idx):
    states, actions, rewards, dones, next_states = batch
    rewards = rewards.unsqueeze(1)
    dones = dones.unsqueeze(1)

```

```

# Optimize Q-networks
opt_q, opt_policy = self.optimizers() # Access optimizers
opt_q.zero_grad() # Zero gradients for Q-networks optimizer

action_values1 = self.q_net1(states, actions)
action_values2 = self.q_net2(states, actions)

target_actions, target_log_probs = self.target_policy(next_states)

next_action_values = torch.min(
    self.target_q_net1(next_states, target_actions),
    self.target_q_net2(next_states, target_actions)
)
next_action_values[dones] = 0.0

expected_action_values = rewards + self.hparams.gamma * (next_action_values - self.hp

q_loss1 = self.hparams.loss_fn(action_values1, expected_action_values)
q_loss2 = self.hparams.loss_fn(action_values2, expected_action_values)

q_loss_total = q_loss1 + q_loss2

self.log("episode/Q-Loss", q_loss_total)

self.manual_backward(q_loss_total) # Manually backpropagate the loss
opt_q.step() # Update Q-network parameters

# Optimize Policy
opt_policy.zero_grad() # Zero gradients for policy optimizer

actions, log_probs = self.policy(states)

action_values = torch.min(
    self.q_net1(states, actions),
    self.q_net2(states, actions)
)

policy_loss = (self.hparams.alpha * log_probs - action_values).mean()
self.log("episode/Policy Loss", policy_loss)

self.manual_backward(policy_loss) # Manually backpropagate the loss
opt_policy.step()

def on_train_epoch_end(self):
    self.play_episodes(policy=self.policy)

    polyak_average(self.q_net1, self.target_q_net1, tau=self.hparams.tau)
    polyak_average(self.q_net2, self.target_q_net2, tau=self.hparams.tau)
    polyak_average(self.policy, self.target_policy, tau=self.hparams.tau)

    self.log("episode/episode_return", self.env.return_queue[-1])

```

```

# Start tensorboard.
!rm -r /content/lightning_logs/

```

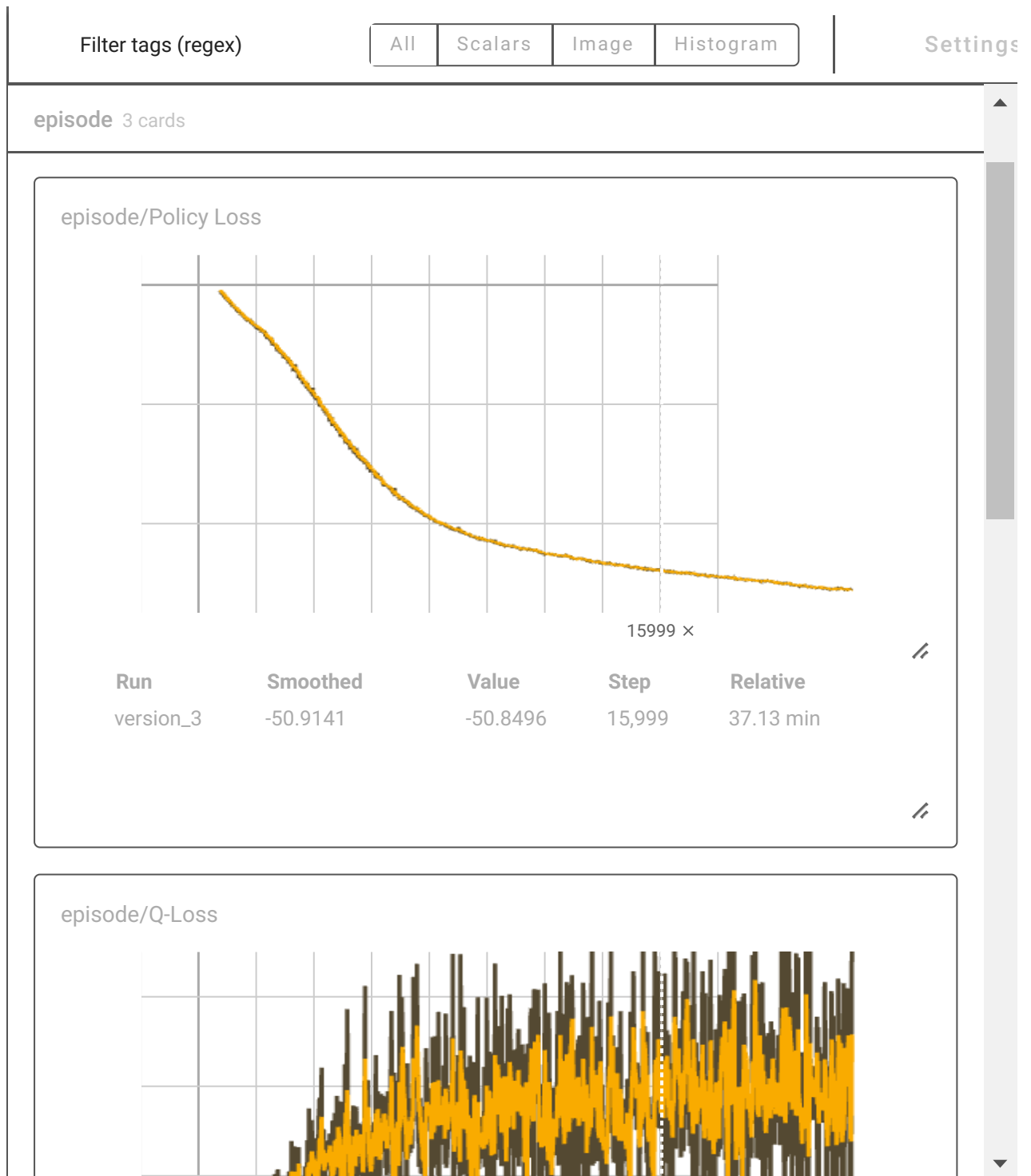
```
!rm -r /content/videos/  
%load_ext tensorboard  
%tensorboard --logdir /content/lightning_logs/
```

```
rm: cannot remove '/content/lightning_logs/': No such file or directory  
rm: cannot remove '/content/videos/': No such file or directory
```

TensorBoard

TIME SERIES

SCALAR INACTIVE



```
import pytorch_lightning as pl  
import warnings  
warnings.filterwarnings('ignore')
```



```
algo = SACHER('FetchReach-v1', lr=1e-3, alpha=0.2, tau=0.1)

trainer = pl.Trainer(
    accelerator="gpu" if num_gpus else "cpu", # Use 'gpu' if num_gpus is greater than 0,
    devices=1, # Specify the number of GPUs or 'auto' for automatic detection
    max_epochs=4000,
    log_every_n_steps=10
)
trainer.fit(algo)
```



0 samples in experience buffer. Filling...

Moviepy - Building video /content/videos/rl-video-episode-0.mp4.

Moviepy - Writing video /content/videos/rl-video-episode-0.mp4

Moviepy - Done !

Moviepy - video ready /content/videos/rl-video-episode-0.mp4

100 samples in experience buffer. Filling...

200 samples in experience buffer. Filling...

300 samples in experience buffer. Filling...

400 samples in experience buffer. Filling...

500 samples in experience buffer. Filling...

600 samples in experience buffer. Filling...

700 samples in experience buffer. Filling...

800 samples in experience buffer. Filling...

900 samples in experience buffer. Filling...

1000 samples in experience buffer. Filling...

1100 samples in experience buffer. Filling...

1200 samples in experience buffer. Filling...

1300 samples in experience buffer. Filling...

1400 samples in experience buffer. Filling...

1500 samples in experience buffer. Filling...

1600 samples in experience buffer. Filling...

1700 samples in experience buffer. Filling...

1800 samples in experience buffer. Filling...

INFO:pytorch_lightning.utilities.rank_zero:GPU available: False, used: False

INFO:pytorch_lightning.utilities.rank_zero:TPU available: False, using: 0 TPU cores

INFO:pytorch_lightning.utilities.rank_zero:HPU available: False, using: 0 HPUs

INFO:pytorch_lightning.callbacks.model_summary:

	Name	Type	Params	Mode

0	q_net1	DQN	70.7 K	train
1	q_net2	DQN	70.7 K	train
2	policy	GradientPolicy	71.4 K	train
3	target_policy	GradientPolicy	71.4 K	train
4	target_q_net1	DQN	70.7 K	train
5	target_q_net2	DQN	70.7 K	train

425 K Trainable params

0 Non-trainable params

425 K Total params

1.702 Total estimated model params size (MB)

44 Modules in train mode

0 Modules in eval mode

1900 samples in experience buffer. Filling...

Epoch 3999:

4/? [00:00<00:00, 9.38it/s, v_num=3]

Moviepy - Building video /content/videos/rl-video-episode-50.mp4.

Moviepy - Writing video /content/videos/rl-video-episode-50.mp4

t: 0% | 0/53 [00:00<?, ?it/s, now=None]

t: 30% | 16/53 [00:00<00:00, 152.23it/s, now=None]

t: 60% | 32/53 [00:00<00:00, 139.72it/s, now=None]

t: 89% | 47/53 [00:00<00:00, 124.42it/s, now=None]

Moviepy - Done !

Moviepy - video ready /content/videos/rl-video-episode-50.mp4

Moviepy - Building video /content/videos/rl-video-episode-100.mp4.

Moviepy - Writing video /content/videos/rl-video-episode-100.mp4

```
t: 0%|          | 0/53 [00:00<?, ?it/s, now=None]
t: 30%|██       | 16/53 [00:00<00:00, 151.24it/s, now=None]
t: 60%|██████    | 32/53 [00:00<00:00, 145.07it/s, now=None]
t: 89%|██████████| 47/53 [00:00<00:00, 122.12it/s, now=None]
```

Moviepy - Done !

```
Moviepy - video ready /content/videos/rl-video-episode-100.mp4
Moviepy - Building video /content/videos/rl-video-episode-150.mp4.
Moviepy - Writing video /content/videos/rl-video-episode-150.mp4
```

```
t: 0%|          | 0/53 [00:00<?, ?it/s, now=None]
t: 30%|██       | 16/53 [00:00<00:00, 156.41it/s, now=None]
t: 60%|██████    | 32/53 [00:00<00:00, 130.34it/s, now=None]
t: 87%|██████████| 46/53 [00:00<00:00, 123.70it/s, now=None]
```

Moviepy - Done !

```
Moviepy - video ready /content/videos/rl-video-episode-150.mp4
Moviepy - Building video /content/videos/rl-video-episode-200.mp4.
Moviepy - Writing video /content/videos/rl-video-episode-200.mp4
```

```
t: 0%|          | 0/53 [00:00<?, ?it/s, now=None]
t: 28%|██       | 15/53 [00:00<00:00, 143.60it/s, now=None]
t: 57%|██████    | 30/53 [00:00<00:00, 138.03it/s, now=None]
t: 83%|██████████| 44/53 [00:00<00:00, 136.48it/s, now=None]
```

Moviepy - Done !

```
Moviepy - video ready /content/videos/rl-video-episode-200.mp4
Moviepy - Building video /content/videos/rl-video-episode-250.mp4.
Moviepy - Writing video /content/videos/rl-video-episode-250.mp4
```

```
t: 0%|          | 0/53 [00:00<?, ?it/s, now=None]
t: 13%|██       | 7/53 [00:00<00:00, 63.39it/s, now=None]
t: 26%|██       | 14/53 [00:00<00:00, 61.42it/s, now=None]
t: 42%|██████    | 22/53 [00:00<00:00, 67.46it/s, now=None]
t: 55%|██████    | 29/53 [00:00<00:00, 64.63it/s, now=None]
t: 68%|██████    | 36/53 [00:00<00:00, 64.79it/s, now=None]
t: 81%|██████    | 43/53 [00:00<00:00, 64.75it/s, now=None]
t: 94%|██████████| 50/53 [00:00<00:00, 46.21it/s, now=None]
```

Moviepy - Done !

```
Moviepy - video ready /content/videos/rl-video-episode-250.mp4
Moviepy - Building video /content/videos/rl-video-episode-300.mp4.
Moviepy - Writing video /content/videos/rl-video-episode-300.mp4
```

```
t: 0%|          | 0/53 [00:00<?, ?it/s, now=None]
t: 32%|██       | 17/53 [00:00<00:00, 164.38it/s, now=None]
t: 64%|██████    | 34/53 [00:00<00:00, 126.35it/s, now=None]
t: 91%|██████████| 48/53 [00:00<00:00, 88.56it/s, now=None]
```

Moviepy - Done !

```
Moviepy - video ready /content/videos/rl-video-episode-300.mp4
Moviepy - Building video /content/videos/rl-video-episode-350.mp4.
Moviepy - Writing video /content/videos/rl-video-episode-350.mp4
```

```
t: 0%|          | 0/53 [00:00<?, ?it/s, now=None]
t: 30%|██       | 16/53 [00:00<00:00, 158.36it/s, now=None]
t: 60%|██████    | 32/53 [00:00<00:00, 151.36it/s, now=None]
t: 91%|██████████| 48/53 [00:00<00:00, 130.35it/s, now=None]
```

Moviepy - Done !

```
Moviepy - video ready /content/videos/rl-video-episode-350.mp4
Moviepy - Building video /content/videos/rl-video-episode-400.mp4.
```

```
Moviepy - Building video /content/videos/rl-video-episode-400.mp4.
Moviepy - Writing video /content/videos/rl-video-episode-400.mp4
```

```
t: 0%|          | 0/53 [00:00<?, ?it/s, now=None]
t: 30%|██       | 16/53 [00:00<00:00, 157.75it/s, now=None]
t: 60%|██████    | 32/53 [00:00<00:00, 150.57it/s, now=None]
t: 91%|█████████ | 48/53 [00:00<00:00, 117.98it/s, now=None]
```

Moviepy - Done !

```
Moviepy - video ready /content/videos/rl-video-episode-400.mp4
Moviepy - Building video /content/videos/rl-video-episode-450.mp4.
Moviepy - Writing video /content/videos/rl-video-episode-450.mp4
```

```
t: 0%|          | 0/53 [00:00<?, ?it/s, now=None]
t: 30%|██       | 16/53 [00:00<00:00, 159.86it/s, now=None]
t: 60%|██████    | 32/53 [00:00<00:00, 146.34it/s, now=None]
t: 89%|█████████ | 47/53 [00:00<00:00, 129.42it/s, now=None]
```

Moviepy - Done !

```
Moviepy - video ready /content/videos/rl-video-episode-450.mp4
Moviepy - Building video /content/videos/rl-video-episode-500.mp4.
Moviepy - Writing video /content/videos/rl-video-episode-500.mp4
```

```
t: 0%|          | 0/53 [00:00<?, ?it/s, now=None]
t: 17%|██       | 9/53 [00:00<00:00, 82.39it/s, now=None]
t: 34%|████     | 18/53 [00:00<00:00, 76.57it/s, now=None]
t: 49%|██████   | 26/53 [00:00<00:00, 74.59it/s, now=None]
t: 64%|████████ | 34/53 [00:00<00:00, 72.93it/s, now=None]
t: 79%|█████████ | 42/53 [00:00<00:00, 70.71it/s, now=None]
t: 94%|█████████ | 50/53 [00:00<00:00, 51.89it/s, now=None]
```

Moviepy - Done !

```
Moviepy - video ready /content/videos/rl-video-episode-500.mp4
Moviepy - Building video /content/videos/rl-video-episode-550.mp4.
Moviepy - Writing video /content/videos/rl-video-episode-550.mp4
```

```
t: 0%|          | 0/53 [00:00<?, ?it/s, now=None]
t: 19%|██       | 10/53 [00:00<00:00, 91.51it/s, now=None]
t: 38%|████     | 20/53 [00:00<00:00, 86.38it/s, now=None]
t: 55%|██████   | 29/53 [00:00<00:00, 82.67it/s, now=None]
t: 72%|████████ | 38/53 [00:00<00:00, 83.54it/s, now=None]
t: 89%|█████████ | 47/53 [00:00<00:00, 74.29it/s, now=None]
```

Moviepy - Done !

```
Moviepy - video ready /content/videos/rl-video-episode-550.mp4
Moviepy - Building video /content/videos/rl-video-episode-600.mp4.
Moviepy - Writing video /content/videos/rl-video-episode-600.mp4
```

```
t: 0%|          | 0/53 [00:00<?, ?it/s, now=None]
t: 28%|██       | 15/53 [00:00<00:00, 147.31it/s, now=None]
t: 57%|██████   | 30/53 [00:00<00:00, 134.71it/s, now=None]
t: 85%|█████████ | 45/53 [00:00<00:00, 133.03it/s, now=None]
```

Moviepy - Done !

```
Moviepy - video ready /content/videos/rl-video-episode-600.mp4
Moviepy - Building video /content/videos/rl-video-episode-650.mp4.
Moviepy - Writing video /content/videos/rl-video-episode-650.mp4
```

```
t: 0%|          | 0/53 [00:00<?, ?it/s, now=None]
t: 28%|██       | 15/53 [00:00<00:00, 141.19it/s, now=None]
```

```
t: 57%|███████| 30/53 [00:00<00:00, 137.22it/s, now=None]
t: 83%|██████████| 44/53 [00:00<00:00, 129.57it/s, now=None]
```

Moviepy - Done !

```
Moviepy - video ready /content/videos/rl-video-episode-650.mp4
Moviepy - Building video /content/videos/rl-video-episode-700.mp4.
Moviepy - Writing video /content/videos/rl-video-episode-700.mp4
```

```
t: 0%|          | 0/53 [00:00<?, ?it/s, now=None]
t: 28%|██████| 15/53 [00:00<00:00, 149.65it/s, now=None]
t: 57%|███████| 30/53 [00:00<00:00, 142.73it/s, now=None]
t: 85%|██████████| 45/53 [00:00<00:00, 132.23it/s, now=None]
```

Moviepy - Done !

```
Moviepy - video ready /content/videos/rl-video-episode-700.mp4
Moviepy - Building video /content/videos/rl-video-episode-750.mp4.
Moviepy - Writing video /content/videos/rl-video-episode-750.mp4
```

```
t: 0%|          | 0/53 [00:00<?, ?it/s, now=None]
t: 19%|██████| 10/53 [00:00<00:00, 90.09it/s, now=None]
t: 38%|███████| 20/53 [00:00<00:00, 85.22it/s, now=None]
t: 55%|███████| 29/53 [00:00<00:00, 82.36it/s, now=None]
t: 72%|████████| 38/53 [00:00<00:00, 77.55it/s, now=None]
t: 87%|██████████| 46/53 [00:00<00:00, 67.83it/s, now=None]
t: 100%|██████████| 53/53 [00:00<00:00, 54.58it/s, now=None]
```

Moviepy - Done !

```
Moviepy - video ready /content/videos/rl-video-episode-750.mp4
Moviepy - Building video /content/videos/rl-video-episode-800.mp4.
Moviepy - Writing video /content/videos/rl-video-episode-800.mp4
```

```
t: 0%|          | 0/53 [00:00<?, ?it/s, now=None]
t: 17%|██████| 9/53 [00:00<00:00, 88.34it/s, now=None]
t: 34%|███████| 18/53 [00:00<00:00, 81.68it/s, now=None]
t: 51%|███████| 27/53 [00:00<00:00, 79.32it/s, now=None]
t: 66%|████████| 35/53 [00:00<00:00, 75.26it/s, now=None]
t: 81%|██████████| 43/53 [00:00<00:00, 71.51it/s, now=None]
t: 96%|██████████| 51/53 [00:00<00:00, 59.96it/s, now=None]
```

Moviepy - Done !

```
Moviepy - video ready /content/videos/rl-video-episode-800.mp4
Moviepy - Building video /content/videos/rl-video-episode-850.mp4.
Moviepy - Writing video /content/videos/rl-video-episode-850.mp4
```

```
t: 0%|          | 0/53 [00:00<?, ?it/s, now=None]
t: 28%|██████| 15/53 [00:00<00:00, 149.48it/s, now=None]
t: 57%|███████| 30/53 [00:00<00:00, 138.36it/s, now=None]
t: 83%|██████████| 44/53 [00:00<00:00, 132.01it/s, now=None]
```

Moviepy - Done !

```
Moviepy - video ready /content/videos/rl-video-episode-850.mp4
Moviepy - Building video /content/videos/rl-video-episode-900.mp4.
Moviepy - Writing video /content/videos/rl-video-episode-900.mp4
```

```
t: 0%|          | 0/53 [00:00<?, ?it/s, now=None]
t: 26%|██████| 14/53 [00:00<00:00, 139.07it/s, now=None]
t: 53%|███████| 28/53 [00:00<00:00, 131.65it/s, now=None]
t: 79%|██████████| 42/53 [00:00<00:00, 135.02it/s, now=None]
```

Moviepy - Done !

```
Moviepy - video ready /content/videos/rl-video-episode-900.mp4
```

Moviepy - Building video /content/videos/rl-video-episode-950.mp4.

Moviepy - Writing video /content/videos/rl-video-episode-950.mp4

```
t: 0%|          | 0/53 [00:00<?, ?it/s, now=None]
t: 23%|██       | 12/53 [00:00<00:00, 117.19it/s, now=None]
t: 49%|██████    | 26/53 [00:00<00:00, 128.27it/s, now=None]
t: 75%|██████████| 40/53 [00:00<00:00, 132.35it/s, now=None]
```

Moviepy - Done !

Moviepy - video ready /content/videos/rl-video-episode-950.mp4

Moviepy - Building video /content/videos/rl-video-episode-1000.mp4.

Moviepy - Writing video /content/videos/rl-video-episode-1000.mp4

```
t: 0%|          | 0/53 [00:00<?, ?it/s, now=None]
t: 30%|███      | 16/53 [00:00<00:00, 153.98it/s, now=None]
t: 60%|██████    | 32/53 [00:00<00:00, 142.94it/s, now=None]
t: 89%|██████████| 47/53 [00:00<00:00, 132.42it/s, now=None]
```

Moviepy - Done !

Moviepy - video ready /content/videos/rl-video-episode-1000.mp4

Moviepy - Building video /content/videos/rl-video-episode-1050.mp4.

Moviepy - Writing video /content/videos/rl-video-episode-1050.mp4

```
t: 0%|          | 0/53 [00:00<?, ?it/s, now=None]
t: 15%|██       | 8/53 [00:00<00:00, 77.90it/s, now=None]
t: 30%|███      | 16/53 [00:00<00:00, 70.41it/s, now=None]
t: 45%|██████    | 24/53 [00:00<00:00, 68.28it/s, now=None]
t: 58%|███████   | 31/53 [00:00<00:00, 64.54it/s, now=None]
t: 74%|████████  | 39/53 [00:00<00:00, 67.79it/s, now=None]
t: 87%|██████████| 46/53 [00:00<00:00, 63.18it/s, now=None]
t: 100%|██████████| 53/53 [00:00<00:00, 52.24it/s, now=None]
```

Moviepy - Done !

Moviepy - video ready /content/videos/rl-video-episode-1050.mp4

Moviepy - Building video /content/videos/rl-video-episode-1100.mp4.

Moviepy - Writing video /content/videos/rl-video-episode-1100.mp4

```
t: 0%|          | 0/53 [00:00<?, ?it/s, now=None]
t: 30%|███      | 16/53 [00:00<00:00, 155.70it/s, now=None]
t: 60%|██████    | 32/53 [00:00<00:00, 149.84it/s, now=None]
t: 89%|██████████| 47/53 [00:00<00:00, 108.70it/s, now=None]
```

Moviepy - Done !

Moviepy - video ready /content/videos/rl-video-episode-1100.mp4

Moviepy - Building video /content/videos/rl-video-episode-1150.mp4.

Moviepy - Writing video /content/videos/rl-video-episode-1150.mp4

```
t: 0%|          | 0/53 [00:00<?, ?it/s, now=None]
t: 30%|███      | 16/53 [00:00<00:00, 155.70it/s, now=None]
t: 60%|██████    | 32/53 [00:00<00:00, 147.68it/s, now=None]
t: 89%|██████████| 47/53 [00:00<00:00, 123.28it/s, now=None]
```

Moviepy - Done !

Moviepy - video ready /content/videos/rl-video-episode-1150.mp4

Moviepy - Building video /content/videos/rl-video-episode-1200.mp4.

Moviepy - Writing video /content/videos/rl-video-episode-1200.mp4

```
t: 0%|          | 0/53 [00:00<?, ?it/s, now=None]
t: 30%|███      | 16/53 [00:00<00:00, 154.23it/s, now=None]
t: 60%|██████    | 32/53 [00:00<00:00, 139.51it/s, now=None]
```

t: 89% |██████████| 47/53 [00:00<00:00, 121.79it/s, now=None]

Moviepy - Done !

Moviepy - video ready /content/videos/rl-video-episode-1200.mp4

Moviepy - Building video /content/videos/rl-video-episode-1250.mp4.

Moviepy - Writing video /content/videos/rl-video-episode-1250.mp4

t: 0% |██████████| 0/53 [00:00<?, ?it/s, now=None]

t: 30% |██████████| 16/53 [00:00<00:00, 156.67it/s, now=None]

t: 60% |██████████| 32/53 [00:00<00:00, 148.46it/s, now=None]

t: 89% |██████████| 47/53 [00:00<00:00, 132.87it/s, now=None]

Moviepy - Done !

Moviepy - video ready /content/videos/rl-video-episode-1250.mp4

Moviepy - Building video /content/videos/rl-video-episode-1300.mp4.

Moviepy - Writing video /content/videos/rl-video-episode-1300.mp4

t: 0% |██████████| 0/53 [00:00<?, ?it/s, now=None]

t: 26% |██████████| 14/53 [00:00<00:00, 135.13it/s, now=None]

t: 55% |██████████| 29/53 [00:00<00:00, 140.02it/s, now=None]

t: 81% |██████████| 43/53 [00:00<00:00, 139.21it/s, now=None]

Moviepy - Done !

Moviepy - video ready /content/videos/rl-video-episode-1300.mp4

Moviepy - Building video /content/videos/rl-video-episode-1350.mp4.

Moviepy - Writing video /content/videos/rl-video-episode-1350.mp4

t: 0% |██████████| 0/53 [00:00<?, ?it/s, now=None]

t: 11% |██████████| 6/53 [00:00<00:00, 59.77it/s, now=None]

t: 26% |██████████| 14/53 [00:00<00:00, 71.01it/s, now=None]

t: 43% |██████████| 23/53 [00:00<00:00, 77.70it/s, now=None]

t: 58% |██████████| 31/53 [00:00<00:00, 74.95it/s, now=None]

t: 74% |██████████| 39/53 [00:00<00:00, 73.05it/s, now=None]

t: 91% |██████████| 48/53 [00:00<00:00, 76.93it/s, now=None]

Moviepy - Done !

Moviepy - video ready /content/videos/rl-video-episode-1350.mp4

Moviepy - Building video /content/videos/rl-video-episode-1400.mp4.

Moviepy - Writing video /content/videos/rl-video-episode-1400.mp4

t: 0% |██████████| 0/53 [00:00<?, ?it/s, now=None]

t: 17% |██████████| 9/53 [00:00<00:00, 87.86it/s, now=None]

t: 34% |██████████| 18/53 [00:00<00:00, 79.37it/s, now=None]

t: 51% |██████████| 27/53 [00:00<00:00, 80.59it/s, now=None]

t: 68% |██████████| 36/53 [00:00<00:00, 81.09it/s, now=None]

t: 85% |██████████| 45/53 [00:00<00:00, 72.85it/s, now=None]

t: 100% |██████████| 53/53 [00:00<00:00, 62.56it/s, now=None]

Moviepy - Done !

Moviepy - video ready /content/videos/rl-video-episode-1400.mp4

Moviepy - Building video /content/videos/rl-video-episode-1450.mp4.

Moviepy - Writing video /content/videos/rl-video-episode-1450.mp4

t: 0% |██████████| 0/53 [00:00<?, ?it/s, now=None]

t: 26% |██████████| 14/53 [00:00<00:00, 135.06it/s, now=None]

t: 53% |██████████| 28/53 [00:00<00:00, 133.07it/s, now=None]

t: 79% |██████████| 42/53 [00:00<00:00, 133.22it/s, now=None]

Moviepy - Done !

Moviepy - video ready /content/videos/rl-video-episode-1450.mp4

Moviepy - Building video /content/videos/rl-video-episode-1500.mp4.

Moviepy - Writing video /content/videos/rl-video-episode-1500.mp4

```
t: 0%|          | 0/53 [00:00<?, ?it/s, now=None]
t: 30%|██      | 16/53 [00:00<00:00, 154.92it/s, now=None]
t: 60%|██████   | 32/53 [00:00<00:00, 148.67it/s, now=None]
t: 89%|██████████| 47/53 [00:00<00:00, 123.72it/s, now=None]
```

Moviepy - Done !

Moviepy - video ready /content/videos/rl-video-episode-1500.mp4

Moviepy - Building video /content/videos/rl-video-episode-1550.mp4.

Moviepy - Writing video /content/videos/rl-video-episode-1550.mp4

```
t: 0%|          | 0/53 [00:00<?, ?it/s, now=None]
t: 25%|██       | 13/53 [00:00<00:00, 127.61it/s, now=None]
t: 53%|██████   | 28/53 [00:00<00:00, 137.53it/s, now=None]
t: 81%|██████████| 43/53 [00:00<00:00, 139.22it/s, now=None]
```

Moviepy - Done !

Moviepy - video ready /content/videos/rl-video-episode-1550.mp4

Moviepy - Building video /content/videos/rl-video-episode-1600.mp4.

Moviepy - Writing video /content/videos/rl-video-episode-1600.mp4

```
t: 0%|          | 0/53 [00:00<?, ?it/s, now=None]
t: 28%|██       | 15/53 [00:00<00:00, 147.96it/s, now=None]
t: 57%|██████   | 30/53 [00:00<00:00, 143.41it/s, now=None]
t: 85%|██████████| 45/53 [00:00<00:00, 131.28it/s, now=None]
```

Moviepy - Done !

Moviepy - video ready /content/videos/rl-video-episode-1600.mp4

Moviepy - Building video /content/videos/rl-video-episode-1650.mp4.

Moviepy - Writing video /content/videos/rl-video-episode-1650.mp4

```
t: 0%|          | 0/53 [00:00<?, ?it/s, now=None]
t: 28%|██       | 15/53 [00:00<00:00, 148.18it/s, now=None]
t: 57%|██████   | 30/53 [00:00<00:00, 148.65it/s, now=None]
t: 85%|██████████| 45/53 [00:00<00:00, 134.69it/s, now=None]
```

Moviepy - Done !

Moviepy - video ready /content/videos/rl-video-episode-1650.mp4

Moviepy - Building video /content/videos/rl-video-episode-1700.mp4.

Moviepy - Writing video /content/videos/rl-video-episode-1700.mp4

```
t: 0%|          | 0/53 [00:00<?, ?it/s, now=None]
t: 17%|██       | 9/53 [00:00<00:00, 82.13it/s, now=None]
t: 34%|████     | 18/53 [00:00<00:00, 83.69it/s, now=None]
t: 51%|██████   | 27/53 [00:00<00:00, 82.76it/s, now=None]
t: 68%|████████ | 36/53 [00:00<00:00, 75.57it/s, now=None]
t: 83%|██████████| 44/53 [00:00<00:00, 70.12it/s, now=None]
t: 98%|██████████| 52/53 [00:00<00:00, 60.01it/s, now=None]
```

Moviepy - Done !

Moviepy - video ready /content/videos/rl-video-episode-1700.mp4

Moviepy - Building video /content/videos/rl-video-episode-1750.mp4.

Moviepy - Writing video /content/videos/rl-video-episode-1750.mp4

```
t: 0%|          | 0/53 [00:00<?, ?it/s, now=None]
t: 17%|██       | 9/53 [00:00<00:00, 88.30it/s, now=None]
t: 34%|████     | 18/53 [00:00<00:00, 86.59it/s, now=None]
t: 51%|██████   | 27/53 [00:00<00:00, 81.70it/s, now=None]
```

```
t: 68%|██████████| 36/53 [00:00<00:00, 74.75it/s, now=None]
t: 83%|██████████| 44/53 [00:00<00:00, 72.35it/s, now=None]
t: 98%|██████████| 52/53 [00:00<00:00, 57.59it/s, now=None]
```

Moviepy - Done !

Moviepy - video ready /content/videos/rl-video-episode-1750.mp4

Moviepy - Building video /content/videos/rl-video-episode-1800.mp4.

Moviepy - Writing video /content/videos/rl-video-episode-1800.mp4

```
t: 0%|██████████| 0/53 [00:00<?, ?it/s, now=None]
t: 30%|██████████| 16/53 [00:00<00:00, 156.06it/s, now=None]
t: 60%|██████████| 32/53 [00:00<00:00, 141.71it/s, now=None]
t: 89%|██████████| 47/53 [00:00<00:00, 129.97it/s, now=None]
```

Moviepy - Done !

Moviepy - video ready /content/videos/rl-video-episode-1800.mp4

Moviepy - Building video /content/videos/rl-video-episode-1850.mp4.

Moviepy - Writing video /content/videos/rl-video-episode-1850.mp4

```
t: 0%|██████████| 0/53 [00:00<?, ?it/s, now=None]
t: 26%|██████████| 14/53 [00:00<00:00, 132.53it/s, now=None]
t: 55%|██████████| 29/53 [00:00<00:00, 140.06it/s, now=None]
t: 83%|██████████| 44/53 [00:00<00:00, 138.45it/s, now=None]
```

Moviepy - Done !

Moviepy - video ready /content/videos/rl-video-episode-1850.mp4

Moviepy - Building video /content/videos/rl-video-episode-1900.mp4.

Moviepy - Writing video /content/videos/rl-video-episode-1900.mp4

```
t: 0%|██████████| 0/53 [00:00<?, ?it/s, now=None]
t: 28%|██████████| 15/53 [00:00<00:00, 145.01it/s, now=None]
t: 57%|██████████| 30/53 [00:00<00:00, 138.29it/s, now=None]
t: 85%|██████████| 45/53 [00:00<00:00, 134.11it/s, now=None]
```

Moviepy - Done !

Moviepy - video ready /content/videos/rl-video-episode-1900.mp4

Moviepy - Building video /content/videos/rl-video-episode-1950.mp4.

Moviepy - Writing video /content/videos/rl-video-episode-1950.mp4

```
t: 0%|██████████| 0/53 [00:00<?, ?it/s, now=None]
t: 30%|██████████| 16/53 [00:00<00:00, 151.75it/s, now=None]
t: 60%|██████████| 32/53 [00:00<00:00, 147.41it/s, now=None]
t: 89%|██████████| 47/53 [00:00<00:00, 121.44it/s, now=None]
```

Moviepy - Done !

Moviepy - video ready /content/videos/rl-video-episode-1950.mp4

Moviepy - Building video /content/videos/rl-video-episode-2000.mp4.

Moviepy - Writing video /content/videos/rl-video-episode-2000.mp4

```
t: 0%|██████████| 0/53 [00:00<?, ?it/s, now=None]
t: 15%|██████████| 8/53 [00:00<00:00, 75.48it/s, now=None]
t: 30%|██████████| 16/53 [00:00<00:00, 75.88it/s, now=None]
t: 45%|██████████| 24/53 [00:00<00:00, 74.28it/s, now=None]
t: 60%|██████████| 32/53 [00:00<00:00, 73.83it/s, now=None]
t: 75%|██████████| 40/53 [00:00<00:00, 72.65it/s, now=None]
t: 91%|██████████| 48/53 [00:00<00:00, 60.77it/s, now=None]
```

Moviepy - Done !

Moviepy - video ready /content/videos/rl-video-episode-2000.mp4

Moviepy - Building video /content/videos/rl-video-episode-2050.mp4.

Moviepy - Writing video /content/videos/rl-video-episode-2050.mp4

```

t: 0%|          | 0/53 [00:00<?, ?it/s, now=None]
t: 9%|█         | 5/53 [00:00<00:01, 43.78it/s, now=None]
t: 21%|██        | 11/53 [00:00<00:00, 50.74it/s, now=None]
t: 32%|███       | 17/53 [00:00<00:00, 53.34it/s, now=None]
t: 43%|████      | 23/53 [00:00<00:00, 54.01it/s, now=None]
t: 55%|█████     | 29/53 [00:00<00:00, 51.38it/s, now=None]
t: 66%|██████    | 35/53 [00:00<00:00, 42.60it/s, now=None]
t: 75%|███████   | 40/53 [00:00<00:00, 40.92it/s, now=None]
t: 85%|████████  | 45/53 [00:01<00:00, 33.48it/s, now=None]
t: 92%|█████████ | 49/53 [00:01<00:00, 28.67it/s, now=None]
t: 100%|██████████| 53/53 [00:01<00:00, 26.91it/s, now=None]

```

Moviepy - Done !

```

Moviepy - video ready /content/videos/rl-video-episode-2050.mp4
Moviepy - Building video /content/videos/rl-video-episode-2100.mp4.
Moviepy - Writing video /content/videos/rl-video-episode-2100.mp4

```

```

t: 0%|          | 0/53 [00:00<?, ?it/s, now=None]
t: 15%|█         | 8/53 [00:00<00:00, 79.12it/s, now=None]
t: 30%|██        | 16/53 [00:00<00:00, 75.66it/s, now=None]
t: 45%|███       | 24/53 [00:00<00:00, 71.15it/s, now=None]
t: 60%|████      | 32/53 [00:00<00:00, 70.62it/s, now=None]
t: 75%|██████    | 40/53 [00:00<00:00, 67.39it/s, now=None]
t: 89%|████████  | 47/53 [00:00<00:00, 65.29it/s, now=None]

```

Moviepy - Done !

```

Moviepy - video ready /content/videos/rl-video-episode-2100.mp4
Moviepy - Building video /content/videos/rl-video-episode-2150.mp4.
Moviepy - Writing video /content/videos/rl-video-episode-2150.mp4

```

```

t: 0%|          | 0/53 [00:00<?, ?it/s, now=None]
t: 30%|██        | 16/53 [00:00<00:00, 155.57it/s, now=None]
t: 60%|████      | 32/53 [00:00<00:00, 145.42it/s, now=None]
t: 89%|████████  | 47/53 [00:00<00:00, 98.06it/s, now=None]

```

Moviepy - Done !

```

Moviepy - video ready /content/videos/rl-video-episode-2150.mp4
Moviepy - Building video /content/videos/rl-video-episode-2200.mp4.
Moviepy - Writing video /content/videos/rl-video-episode-2200.mp4

```

```

t: 0%|          | 0/53 [00:00<?, ?it/s, now=None]
t: 26%|██       | 14/53 [00:00<00:00, 135.75it/s, now=None]
t: 55%|█████    | 29/53 [00:00<00:00, 141.02it/s, now=None]
t: 83%|███████  | 44/53 [00:00<00:00, 140.26it/s, now=None]

```

Moviepy - Done !

```

Moviepy - video ready /content/videos/rl-video-episode-2200.mp4
Moviepy - Building video /content/videos/rl-video-episode-2250.mp4.
Moviepy - Writing video /content/videos/rl-video-episode-2250.mp4

```

```

t: 0%|          | 0/53 [00:00<?, ?it/s, now=None]
t: 28%|██       | 15/53 [00:00<00:00, 145.09it/s, now=None]
t: 57%|█████    | 30/53 [00:00<00:00, 100.62it/s, now=None]
t: 77%|██████   | 41/53 [00:00<00:00, 86.61it/s, now=None]
t: 96%|████████ | 51/53 [00:00<00:00, 67.88it/s, now=None]

```

Moviepy - Done !

```

Moviepy - video ready /content/videos/rl-video-episode-2250.mp4
Moviepy - Building video /content/videos/rl-video-episode-0.mp4.
Moviepy - Writing video /content/videos/rl-video-episode-0.mp4

```

```

t: 0%|          | 0/2 [00:00<?, ?it/s, now=None]
Moviepy - Done !
Moviepy - video ready /content/videos/rl-video-episode-0.mp4
Moviepy - Building video /content/videos/rl-video-episode-2300.mp4.
Moviepy - Writing video /content/videos/rl-video-episode-2300.mp4

t: 0%|          | 0/53 [00:00<?, ?it/s, now=None]
t: 28%|██       | 15/53 [00:00<00:00, 147.00it/s, now=None]
t: 57%|██████   | 30/53 [00:00<00:00, 146.46it/s, now=None]
t: 85%|██████████| 45/53 [00:00<00:00, 128.51it/s, now=None]
Moviepy - Done !
Moviepy - video ready /content/videos/rl-video-episode-2300.mp4
Moviepy - Building video /content/videos/rl-video-episode-2350.mp4.
Moviepy - Writing video /content/videos/rl-video-episode-2350.mp4

t: 0%|          | 0/53 [00:00<?, ?it/s, now=None]
t: 28%|██       | 15/53 [00:00<00:00, 146.92it/s, now=None]
t: 57%|██████   | 30/53 [00:00<00:00, 141.17it/s, now=None]
t: 85%|██████████| 45/53 [00:00<00:00, 126.57it/s, now=None]
Moviepy - Done !
Moviepy - video ready /content/videos/rl-video-episode-2350.mp4
Moviepy - Building video /content/videos/rl-video-episode-2400.mp4.
Moviepy - Writing video /content/videos/rl-video-episode-2400.mp4

t: 0%|          | 0/53 [00:00<?, ?it/s, now=None]
t: 26%|██       | 14/53 [00:00<00:00, 138.72it/s, now=None]
t: 55%|██████   | 29/53 [00:00<00:00, 141.37it/s, now=None]
t: 83%|██████████| 44/53 [00:00<00:00, 132.80it/s, now=None]
Moviepy - Done !
Moviepy - video ready /content/videos/rl-video-episode-2400.mp4
Moviepy - Building video /content/videos/rl-video-episode-2450.mp4.
Moviepy - Writing video /content/videos/rl-video-episode-2450.mp4

t: 0%|          | 0/53 [00:00<?, ?it/s, now=None]
t: 28%|██       | 15/53 [00:00<00:00, 147.30it/s, now=None]
t: 57%|██████   | 30/53 [00:00<00:00, 146.46it/s, now=None]
t: 85%|██████████| 45/53 [00:00<00:00, 137.96it/s, now=None]
Moviepy - Done !
Moviepy - video ready /content/videos/rl-video-episode-2450.mp4
Moviepy - Building video /content/videos/rl-video-episode-2500.mp4.
Moviepy - Writing video /content/videos/rl-video-episode-2500.mp4

t: 0%|          | 0/53 [00:00<?, ?it/s, now=None]
t: 17%|██       | 9/53 [00:00<00:00, 81.58it/s, now=None]
t: 34%|████     | 18/53 [00:00<00:00, 84.15it/s, now=None]
t: 51%|██████   | 27/53 [00:00<00:00, 84.68it/s, now=None]
t: 68%|██████████| 36/53 [00:00<00:00, 83.14it/s, now=None]
t: 85%|██████████| 45/53 [00:00<00:00, 80.50it/s, now=None]
Moviepy - Done !
Moviepy - video ready /content/videos/rl-video-episode-2500.mp4
Moviepy - Building video /content/videos/rl-video-episode-2550.mp4.
Moviepy - Writing video /content/videos/rl-video-episode-2550.mp4

```

```

t:  0%|          | 0/53 [00:00<?, ?it/s, now=None]
t: 30%|██        | 16/53 [00:00<00:00, 151.32it/s, now=None]
t: 60%|██████    | 32/53 [00:00<00:00, 146.28it/s, now=None]
t: 89%|██████████| 47/53 [00:00<00:00, 133.28it/s, now=None]
Moviepy - Done !
Moviepy - video ready /content/videos/rl-video-episode-2550.mp4
Moviepy - Building video /content/videos/rl-video-episode-2600.mp4.
Moviepy - Writing video /content/videos/rl-video-episode-2600.mp4

```

```

t:  0%|          | 0/53 [00:00<?, ?it/s, now=None]
t: 30%|██        | 16/53 [00:00<00:00, 154.74it/s, now=None]
t: 60%|██████    | 32/53 [00:00<00:00, 143.91it/s, now=None]
t: 89%|██████████| 47/53 [00:00<00:00, 129.29it/s, now=None]
Moviepy - Done !
Moviepy - video ready /content/videos/rl-video-episode-2600.mp4
Moviepy - Building video /content/videos/rl-video-episode-2650.mp4.
Moviepy - Writing video /content/videos/rl-video-episode-2650.mp4

```

```

t:  0%|          | 0/53 [00:00<?, ?it/s, now=None]
t: 28%|██        | 15/53 [00:00<00:00, 148.00it/s, now=None]
t: 57%|██████    | 30/53 [00:00<00:00, 145.66it/s, now=None]
t: 85%|██████████| 45/53 [00:00<00:00, 133.87it/s, now=None]
Moviepy - Done !
Moviepy - video ready /content/videos/rl-video-episode-2650.mp4
Moviepy - Building video /content/videos/rl-video-episode-2700.mp4.
Moviepy - Writing video /content/videos/rl-video-episode-2700.mp4

```

```

t:  0%|          | 0/53 [00:00<?, ?it/s, now=None]
t: 26%|██        | 14/53 [00:00<00:00, 132.71it/s, now=None]
t: 53%|██████    | 28/53 [00:00<00:00, 127.28it/s, now=None]
t: 77%|██████████| 41/53 [00:00<00:00, 126.77it/s, now=None]
Moviepy - Done !
Moviepy - video ready /content/videos/rl-video-episode-2700.mp4
Moviepy - Building video /content/videos/rl-video-episode-2750.mp4.
Moviepy - Writing video /content/videos/rl-video-episode-2750.mp4

```

```

t:  0%|          | 0/53 [00:00<?, ?it/s, now=None]
t: 26%|██        | 14/53 [00:00<00:00, 139.37it/s, now=None]
t: 53%|██████    | 28/53 [00:00<00:00, 132.07it/s, now=None]
t: 81%|██████████| 43/53 [00:00<00:00, 137.45it/s, now=None]
Moviepy - Done !
Moviepy - video ready /content/videos/rl-video-episode-2750.mp4
Moviepy - Building video /content/videos/rl-video-episode-2800.mp4.
Moviepy - Writing video /content/videos/rl-video-episode-2800.mp4

```

```

t:  0%|          | 0/53 [00:00<?, ?it/s, now=None]
t: 30%|██        | 16/53 [00:00<00:00, 154.39it/s, now=None]
t: 60%|██████    | 32/53 [00:00<00:00, 147.04it/s, now=None]
t: 89%|██████████| 47/53 [00:00<00:00, 131.86it/s, now=None]
Moviepy - Done !
Moviepy - video ready /content/videos/rl-video-episode-2800.mp4
Moviepy - Building video /content/videos/rl-video-episode-2850.mp4.
Moviepy - Writing video /content/videos/rl-video-episode-2850.mp4

```

```

t:  0%|          | 0/53 [00:00<?, ?it/s, now=None]
t: 13%|██        | 7/53 [00:00<00:00, 68.02it/s, now=None]
t: 26%|████      | 14/53 [00:00<00:00, 68.69it/s, now=None]
t: 42%|██████    | 22/53 [00:00<00:00, 70.97it/s, now=None]
t: 57%|████████  | 30/53 [00:00<00:00, 70.25it/s, now=None]
t: 72%|█████████ | 38/53 [00:00<00:00, 69.93it/s, now=None]
t: 85%|██████████| 45/53 [00:00<00:00, 63.95it/s, now=None]
t: 98%|███████████| 52/53 [00:00<00:00, 50.93it/s, now=None]

```

Moviepy - Done !

```

Moviepy - video ready /content/videos/rl-video-episode-2850.mp4
Moviepy - Building video /content/videos/rl-video-episode-2900.mp4.
Moviepy - Writing video /content/videos/rl-video-episode-2900.mp4

```

```

t:  0%|          | 0/53 [00:00<?, ?it/s, now=None]
t: 15%|██        | 8/53 [00:00<00:00, 73.70it/s, now=None]
t: 30%|████      | 16/53 [00:00<00:00, 75.51it/s, now=None]
t: 45%|██████    | 24/53 [00:00<00:00, 77.48it/s, now=None]
t: 60%|████████  | 32/53 [00:00<00:00, 75.68it/s, now=None]
t: 75%|█████████ | 40/53 [00:00<00:00, 76.79it/s, now=None]
t: 91%|██████████| 48/53 [00:00<00:00, 68.46it/s, now=None]

```

Moviepy - Done !

```

Moviepy - video ready /content/videos/rl-video-episode-2900.mp4
Moviepy - Building video /content/videos/rl-video-episode-2950.mp4.
Moviepy - Writing video /content/videos/rl-video-episode-2950.mp4

```

```

t:  0%|          | 0/53 [00:00<?, ?it/s, now=None]
t: 28%|██        | 15/53 [00:00<00:00, 148.68it/s, now=None]
t: 57%|████████  | 30/53 [00:00<00:00, 143.71it/s, now=None]
t: 85%|██████████| 45/53 [00:00<00:00, 136.62it/s, now=None]

```

Moviepy - Done !

```

Moviepy - video ready /content/videos/rl-video-episode-2950.mp4
Moviepy - Building video /content/videos/rl-video-episode-3000.mp4.
Moviepy - Writing video /content/videos/rl-video-episode-3000.mp4

```

```

t:  0%|          | 0/53 [00:00<?, ?it/s, now=None]
t: 28%|██        | 15/53 [00:00<00:00, 145.45it/s, now=None]
t: 57%|████████  | 30/53 [00:00<00:00, 141.65it/s, now=None]
t: 85%|██████████| 45/53 [00:00<00:00, 133.20it/s, now=None]

```

Moviepy - Done !

```

Moviepy - video ready /content/videos/rl-video-episode-3000.mp4
Moviepy - Building video /content/videos/rl-video-episode-3050.mp4.
Moviepy - Writing video /content/videos/rl-video-episode-3050.mp4

```

```

t:  0%|          | 0/53 [00:00<?, ?it/s, now=None]
t: 28%|██        | 15/53 [00:00<00:00, 149.15it/s, now=None]
t: 57%|████████  | 30/53 [00:00<00:00, 144.80it/s, now=None]
t: 85%|██████████| 45/53 [00:00<00:00, 126.93it/s, now=None]

```

Moviepy - Done !

```

Moviepy - video ready /content/videos/rl-video-episode-3050.mp4
Moviepy - Building video /content/videos/rl-video-episode-3100.mp4.
Moviepy - Writing video /content/videos/rl-video-episode-3100.mp4

```

```

t:  0%|          | 0/53 [00:00<?, ?it/s, now=None]
t: 28%|██        | 15/53 [00:00<00:00, 140.25it/s, now=None]
t: 57%|████████  | 30/53 [00:00<00:00, 134.22it/s, now=None]

```

t: 83%|██████████| 44/53 [00:00<00:00, 131.31it/s, now=None]

Moviepy - Done !

Moviepy - video ready /content/videos/rl-video-episode-3100.mp4

Moviepy - Building video /content/videos/rl-video-episode-3150.mp4.

Moviepy - Writing video /content/videos/rl-video-episode-3150.mp4

t: 0%| | 0/53 [00:00<?, ?it/s, now=None]

t: 28%|███| 15/53 [00:00<00:00, 145.64it/s, now=None]

t: 57%|██████| 30/53 [00:00<00:00, 140.92it/s, now=None]

t: 85%|██████████| 45/53 [00:00<00:00, 126.95it/s, now=None]

Moviepy - Done !

Moviepy - video ready /content/videos/rl-video-episode-3150.mp4

Moviepy - Building video /content/videos/rl-video-episode-3200.mp4.

Moviepy - Writing video /content/videos/rl-video-episode-3200.mp4

t: 0%| | 0/53 [00:00<?, ?it/s, now=None]

t: 26%|███| 14/53 [00:00<00:00, 138.85it/s, now=None]

t: 53%|██████| 28/53 [00:00<00:00, 137.93it/s, now=None]

t: 79%|██████████| 42/53 [00:00<00:00, 131.70it/s, now=None]

Moviepy - Done !

Moviepy - video ready /content/videos/rl-video-episode-3200.mp4

Moviepy - Building video /content/videos/rl-video-episode-3250.mp4.

Moviepy - Writing video /content/videos/rl-video-episode-3250.mp4

t: 0%| | 0/53 [00:00<?, ?it/s, now=None]

t: 15%|██| 8/53 [00:00<00:00, 79.01it/s, now=None]

t: 30%|████| 16/53 [00:00<00:00, 75.69it/s, now=None]

t: 45%|██████| 24/53 [00:00<00:00, 76.08it/s, now=None]

t: 60%|████████| 32/53 [00:00<00:00, 73.47it/s, now=None]

t: 75%|██████████| 40/53 [00:00<00:00, 75.28it/s, now=None]

t: 91%|██████████| 48/53 [00:00<00:00, 64.04it/s, now=None]

Moviepy - Done !

Moviepy - video ready /content/videos/rl-video-episode-3250.mp4

Moviepy - Building video /content/videos/rl-video-episode-3300.mp4.

Moviepy - Writing video /content/videos/rl-video-episode-3300.mp4

t: 0%| | 0/53 [00:00<?, ?it/s, now=None]

t: 28%|███| 15/53 [00:00<00:00, 149.63it/s, now=None]

t: 57%|██████| 30/53 [00:00<00:00, 137.98it/s, now=None]

t: 85%|██████████| 45/53 [00:00<00:00, 135.38it/s, now=None]

Moviepy - Done !

Moviepy - video ready /content/videos/rl-video-episode-3300.mp4

Moviepy - Building video /content/videos/rl-video-episode-3350.mp4.

Moviepy - Writing video /content/videos/rl-video-episode-3350.mp4

t: 0%| | 0/53 [00:00<?, ?it/s, now=None]

t: 28%|███| 15/53 [00:00<00:00, 145.08it/s, now=None]

t: 57%|██████| 30/53 [00:00<00:00, 144.26it/s, now=None]

t: 85%|██████████| 45/53 [00:00<00:00, 137.23it/s, now=None]

Moviepy - Done !

Moviepy - video ready /content/videos/rl-video-episode-3350.mp4

Moviepy - Building video /content/videos/rl-video-episode-3400.mp4.

Moviepy - Writing video /content/videos/rl-video-episode-3400.mp4

t: 0%| | 0/53 [00:00<?, ?it/s, now=None]


```
t: 0% | 0/53 [00:00<?, ?it/s, now=None]
t: 25% | 13/53 [00:00<00:00, 129.07it/s, now=None]
t: 53% | 28/53 [00:00<00:00, 139.11it/s, now=None]
t: 79% | 42/53 [00:00<00:00, 135.58it/s, now=None]
```

Moviepy - Done !

```
Moviepy - video ready /content/videos/r1-video-episode-3400.mp4
Moviepy - Building video /content/videos/r1-video-episode-3450.mp4.
Moviepy - Writing video /content/videos/r1-video-episode-3450.mp4
```

```
t: 0% | 0/53 [00:00<?, ?it/s, now=None]
t: 30% | 16/53 [00:00<00:00, 154.59it/s, now=None]
t: 60% | 32/53 [00:00<00:00, 147.35it/s, now=None]
t: 89% | 47/53 [00:00<00:00, 124.34it/s, now=None]
```

Moviepy - Done !

```
Moviepy - video ready /content/videos/r1-video-episode-3450.mp4
Moviepy - Building video /content/videos/r1-video-episode-3500.mp4.
Moviepy - Writing video /content/videos/r1-video-episode-3500.mp4
```

```
t: 0% | 0/53 [00:00<?, ?it/s, now=None]
t: 28% | 15/53 [00:00<00:00, 148.37it/s, now=None]
t: 57% | 30/53 [00:00<00:00, 141.20it/s, now=None]
t: 85% | 45/53 [00:00<00:00, 128.80it/s, now=None]
```

Moviepy - Done !

```
Moviepy - video ready /content/videos/r1-video-episode-3500.mp4
Moviepy - Building video /content/videos/r1-video-episode-3550.mp4.
Moviepy - Writing video /content/videos/r1-video-episode-3550.mp4
```

```
t: 0% | 0/53 [00:00<?, ?it/s, now=None]
t: 28% | 15/53 [00:00<00:00, 145.71it/s, now=None]
t: 57% | 30/53 [00:00<00:00, 116.95it/s, now=None]
t: 83% | 44/53 [00:00<00:00, 122.69it/s, now=None]
```

Moviepy - Done !

```
Moviepy - video ready /content/videos/r1-video-episode-3550.mp4
Moviepy - Building video /content/videos/r1-video-episode-3600.mp4.
Moviepy - Writing video /content/videos/r1-video-episode-3600.mp4
```

```
t: 0% | 0/53 [00:00<?, ?it/s, now=None]
t: 9% | 5/53 [00:00<00:01, 47.17it/s, now=None]
t: 23% | 12/53 [00:00<00:00, 56.96it/s, now=None]
t: 36% | 19/53 [00:00<00:00, 59.81it/s, now=None]
t: 49% | 26/53 [00:00<00:00, 63.15it/s, now=None]
t: 62% | 33/53 [00:00<00:00, 62.47it/s, now=None]
t: 75% | 40/53 [00:00<00:00, 60.99it/s, now=None]
t: 89% | 47/53 [00:00<00:00, 54.25it/s, now=None]
t: 100% | 53/53 [00:01<00:00, 45.90it/s, now=None]
```

Moviepy - Done !

```
Moviepy - video ready /content/videos/r1-video-episode-3600.mp4
Moviepy - Building video /content/videos/r1-video-episode-3650.mp4.
Moviepy - Writing video /content/videos/r1-video-episode-3650.mp4
```

```
t: 0% | 0/53 [00:00<?, ?it/s, now=None]
t: 15% | 8/53 [00:00<00:00, 77.59it/s, now=None]
t: 30% | 16/53 [00:00<00:00, 73.12it/s, now=None]
t: 45% | 24/53 [00:00<00:00, 74.27it/s, now=None]
t: 60% | 32/53 [00:00<00:00, 73.84it/s, now=None]
t: 75% | 40/53 [00:00<00:00, 69.76it/s, now=None]
```

t: 91% |██████████| 48/53 [00:00<00:00, 56.55it/s, now=None]

Moviepy - Done !

Moviepy - video ready /content/videos/rl-video-episode-3650.mp4

Moviepy - Building video /content/videos/rl-video-episode-3700.mp4.

Moviepy - Writing video /content/videos/rl-video-episode-3700.mp4

t: 0% | | 0/53 [00:00<?, ?it/s, now=None]

t: 28% |██| 15/53 [00:00<00:00, 144.88it/s, now=None]

t: 57% |██████| 30/53 [00:00<00:00, 143.27it/s, now=None]

t: 85% |██████████| 45/53 [00:00<00:00, 136.87it/s, now=None]

Moviepy - Done !

Moviepy - video ready /content/videos/rl-video-episode-3700.mp4

Moviepy - Building video /content/videos/rl-video-episode-3750.mp4.

Moviepy - Writing video /content/videos/rl-video-episode-3750.mp4

t: 0% | | 0/53 [00:00<?, ?it/s, now=None]

t: 26% |██| 14/53 [00:00<00:00, 132.66it/s, now=None]

t: 53% |██████| 28/53 [00:00<00:00, 135.80it/s, now=None]

t: 79% |██████████| 42/53 [00:00<00:00, 135.93it/s, now=None]

Moviepy - Done !

Moviepy - video ready /content/videos/rl-video-episode-3750.mp4

Moviepy - Building video /content/videos/rl-video-episode-3800.mp4.

Moviepy - Writing video /content/videos/rl-video-episode-3800.mp4

t: 0% | | 0/53 [00:00<?, ?it/s, now=None]

t: 28% |██| 15/53 [00:00<00:00, 142.71it/s, now=None]

t: 57% |██████| 30/53 [00:00<00:00, 141.72it/s, now=None]

t: 85% |██████████| 45/53 [00:00<00:00, 133.81it/s, now=None]

Moviepy - Done !

Moviepy - video ready /content/videos/rl-video-episode-3800.mp4

Moviepy - Building video /content/videos/rl-video-episode-3850.mp4.

Moviepy - Writing video /content/videos/rl-video-episode-3850.mp4

t: 0% | | 0/53 [00:00<?, ?it/s, now=None]

t: 28% |██| 15/53 [00:00<00:00, 147.14it/s, now=None]

t: 57% |██████| 30/53 [00:00<00:00, 138.75it/s, now=None]

t: 83% |██████████| 44/53 [00:00<00:00, 133.59it/s, now=None]

Moviepy - Done !

Moviepy - video ready /content/videos/rl-video-episode-3850.mp4

Moviepy - Building video /content/videos/rl-video-episode-3900.mp4.

Moviepy - Writing video /content/videos/rl-video-episode-3900.mp4

t: 0% | | 0/53 [00:00<?, ?it/s, now=None]

t: 30% |███| 16/53 [00:00<00:00, 157.83it/s, now=None]

t: 60% |██████| 32/53 [00:00<00:00, 144.96it/s, now=None]

t: 89% |██████████| 47/53 [00:00<00:00, 125.01it/s, now=None]

Moviepy - Done !

Moviepy - video ready /content/videos/rl-video-episode-3900.mp4

Moviepy - Building video /content/videos/rl-video-episode-3950.mp4.

Moviepy - Writing video /content/videos/rl-video-episode-3950.mp4

t: 0% | | 0/53 [00:00<?, ?it/s, now=None]

t: 30% |███| 16/53 [00:00<00:00, 151.33it/s, now=None]

t: 60% |██████| 32/53 [00:00<00:00, 142.53it/s, now=None]

t: 89% | ██████████ | 47/53 [00:00<00:00, 124.24it/s, now=None]

Moviepy - Done !

Moviepy - video ready /content/videos/rl-video-episode-3950.mp4

Moviepy - Building video /content/videos/rl-video-episode-4000.mp4.

Moviepy - Writing video /content/videos/rl-video-episode-4000.mp4

t: 0% | | 0/53 [00:00<?, ?it/s, now=None]

t: 30% | █████ | 16/53 [00:00<00:00, 151.36it/s, now=None]

t: 60% | ████████ | 32/53 [00:00<00:00, 141.87it/s, now=None]

t: 89% | ██████████ | 47/53 [00:00<00:00, 127.18it/s, now=None]

Moviepy - Done !

Moviepy - video ready /content/videos/rl-video-episode-4000.mp4



```
!zip -r /content/lightning_logs.zip /content/lightning_logs
```



```
adding: content/lightning_logs/ (stored 0%)
```

```
adding: content/lightning_logs/version_3/ (stored 0%)
```

```
adding: content/lightning_logs/version_3/events.out.tfevents.1731522763.2df74769f82
```