

```
!sudo apt-get update
```

```
Hit:1 https://cloud.r-project.org/bin/linux/ubuntu bionic-cran40/ InRelease
Hit:2 http://security.ubuntu.com/ubuntu bionic-security InRelease
Ign:3 https://developer.download.nvidia.com/compute/machine-learning/repos/ubuntu1804/x86_64 InRelease
Hit:4 https://developer.download.nvidia.com/compute/cuda/repos/ubuntu1804/x86_64 InRelease
Hit:5 https://developer.download.nvidia.com/compute/machine-learning/repos/ubuntu1804/x86_64 Release
Hit:6 http://ppa.launchpad.net/c2d4u.team/c2d4u4.0+/ubuntu bionic InRelease
Hit:8 http://archive.ubuntu.com/ubuntu bionic InRelease
Hit:9 http://archive.ubuntu.com/ubuntu bionic-updates InRelease
Hit:10 http://ppa.launchpad.net/cran/libgit2/ubuntu bionic InRelease
Hit:11 http://archive.ubuntu.com/ubuntu bionic-backports InRelease
Hit:12 http://ppa.launchpad.net/deadsnakes/ppa/ubuntu bionic InRelease
Hit:13 http://ppa.launchpad.net/graphics-drivers/ppa/ubuntu bionic InRelease
Reading package lists... Done
```

```
!pip install gym==0.26
```

```
Looking in indexes: https://pypi.org/simple, https://us-python.pkg.dev/colab-wheels/public/simple/
Collecting gym==0.26
  Downloading gym-0.26.0.tar.gz (710 kB)
    |████████████████████| 710 kB 19.0 MB/s
Installing build dependencies ... done
Getting requirements to build wheel ... done
Preparing wheel metadata ... done
Requirement already satisfied: importlib-metadata>=4.8.0 in /usr/local/lib/python3.7/dist-packages (from gym==0.26) (4.13.0)
Requirement already satisfied: gym-notices>=0.0.4 in /usr/local/lib/python3.7/dist-packages (from gym==0.26) (0.0.8)
Requirement already satisfied: numpy>=1.18.0 in /usr/local/lib/python3.7/dist-packages (from gym==0.26) (1.21.6)
Requirement already satisfied: cloudpickle>=1.2.0 in /usr/local/lib/python3.7/dist-packages (from gym==0.26) (1.5.0)
Requirement already satisfied: typing-extensions>=3.6.4 in /usr/local/lib/python3.7/dist-packages (from importlib-metadata>=4.8.0->gym==0.26) (3.10.0)
Requirement already satisfied: zipp>=0.5 in /usr/local/lib/python3.7/dist-packages (from importlib-metadata>=4.8.0->gym==0.26) (3.10.0)
Building wheels for collected packages: gym
  Building wheel for gym (PEP 517) ... done
  Created wheel for gym: filename=gym-0.26.0-py3-none-any.whl size=826303 sha256=f12b5ed51d42b89b03fb9c5937932b642a7f2292ff0ff4d9d68f99f
  Stored in directory: /root/.cache/pip/wheels/39/f9/03/534b6090f62aefc42cfa9bdf20009b7f2e5ba7557ed511a055
Successfully built gym
Installing collected packages: gym
  Attempting uninstall: gym
    Found existing installation: gym 0.25.2
    Uninstalling gym-0.25.2:
      Successfully uninstalled gym-0.25.2
Successfully installed gym-0.26.0
```

```
!pip install gym==0.21.0
!pip install highway-env==1.5
!pip install sb3-contrib==1.5.0
!pip install importlib-metadata==4.8.1
```

```
Looking in indexes: https://pypi.org/simple, https://us-python.pkg.dev/colab-wheels/public/simple/
Collecting gym==0.21.0
  Downloading gym-0.21.0.tar.gz (1.5 MB)
    |████████████████████| 1.5 MB 26.8 MB/s
Requirement already satisfied: numpy>=1.18.0 in /usr/local/lib/python3.7/dist-packages (from gym==0.21.0) (1.21.6)
Requirement already satisfied: cloudpickle>=1.2.0 in /usr/local/lib/python3.7/dist-packages (from gym==0.21.0) (1.5.0)
Requirement already satisfied: importlib-metadata>=4.8.1 in /usr/local/lib/python3.7/dist-packages (from gym==0.21.0) (4.13.0)
Requirement already satisfied: typing-extensions>=3.6.4 in /usr/local/lib/python3.7/dist-packages (from importlib-metadata>=4.8.1->gym==0.21.0) (3.10.0)
Requirement already satisfied: zipp>=0.5 in /usr/local/lib/python3.7/dist-packages (from importlib-metadata>=4.8.1->gym==0.21.0) (3.10.0)
Building wheels for collected packages: gym
  Building wheel for gym (setup.py) ... done
  Created wheel for gym: filename=gym-0.21.0-py3-none-any.whl size=1616823 sha256=90e26090a34718256d56b3e2b028a203327fe2778a72e056921
  Stored in directory: /root/.cache/pip/wheels/76/ee/9c/36bfe3e079df99acf5ae57f4e3464ff2771b34447d6d2f2148
Successfully built gym
Installing collected packages: gym
  Attempting uninstall: gym
    Found existing installation: gym 0.26.0
    Uninstalling gym-0.26.0:
      Successfully uninstalled gym-0.26.0
Successfully installed gym-0.21.0
Looking in indexes: https://pypi.org/simple, https://us-python.pkg.dev/colab-wheels/public/simple/
Collecting highway-env==1.5
  Downloading highway_env-1.5-py3-none-any.whl (103 kB)
    |████████████████████| 103 kB 39.6 MB/s
Requirement already satisfied: pandas in /usr/local/lib/python3.7/dist-packages (from highway-env==1.5) (1.3.5)
Requirement already satisfied: gym in /usr/local/lib/python3.7/dist-packages (from highway-env==1.5) (0.21.0)
Collecting pygame
  Downloading pygame-2.1.2-cp37-cp37m-manylinux_2_17_x86_64.manylinux2014_x86_64.whl (21.8 MB)
    |████████████████████| 21.8 MB 64.6 MB/s
Requirement already satisfied: numpy in /usr/local/lib/python3.7/dist-packages (from highway-env==1.5) (1.21.6)
Requirement already satisfied: matplotlib in /usr/local/lib/python3.7/dist-packages (from highway-env==1.5) (3.2.2)
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Requirement already satisfied: scipy in /usr/local/lib/python3.7/dist-packages (from highway-env==1.5) (1.7.3)
Requirement already satisfied: cloudpickle>=1.2.0 in /usr/local/lib/python3.7/dist-packages (from gym->highway-env==1.5) (1.5.0)
Requirement already satisfied: importlib-metadata>=4.8.1 in /usr/local/lib/python3.7/dist-packages (from gym->highway-env==1.5) (4.13.0)
Requirement already satisfied: typing-extensions>=3.6.4 in /usr/local/lib/python3.7/dist-packages (from importlib-metadata>=4.8.1->gym->highway-env==1.5) (4.1.1)
Requirement already satisfied: zipp>=0.5 in /usr/local/lib/python3.7/dist-packages (from importlib-metadata>=4.8.1->gym->highway-env==1.5) (0.11.0)
Requirement already satisfied: pyparsing!=2.0.4,!=2.1.2,!=2.1.6,>=2.0.1 in /usr/local/lib/python3.7/dist-packages (from matplotlib->highway-env==1.5) (2.4.2)
Requirement already satisfied: python-dateutil>=2.1 in /usr/local/lib/python3.7/dist-packages (from matplotlib->highway-env==1.5) (2.8.1)
Requirement already satisfied: cycler>=0.10 in /usr/local/lib/python3.7/dist-packages (from matplotlib->highway-env==1.5) (0.11.0)
Requirement already satisfied: kiwisolver>=1.0.1 in /usr/local/lib/python3.7/dist-packages (from matplotlib->highway-env==1.5) (1.4.4)
Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.7/dist-packages (from python-dateutil>=2.1->matplotlib->highway-env==1.5) (1.16.0)
Requirement already satisfied: pytz>=2017.3 in /usr/local/lib/python3.7/dist-packages (from pandas->highway-env==1.5) (2022.6)
Installing collected packages: pygame, highway-env
Successfully installed highway-env-1.5 pygame-2.1.2
Looking in indexes: https://pypi.org/simple, https://us-python.pkg.dev/colab-wheels/public/simple/
Collecting sb3-contrib==1.5.0
  Downloading sb3_contrib-1.5.0-py3-none-any.whl (62 kB)
    |#####| 62 kB 1.3 MB/s
Collecting stable-baselines3>=1.5.0
  Downloading stable_baselines3-1.6.2-py3-none-any.whl (170 kB)
    |#####| 170 kB 33.4 MB/s
Requirement already satisfied: torch>=1.11 in /usr/local/lib/python3.7/dist-packages (from stable-baselines3>=1.5.0->sb3-contrib==1.5.0) (1.12.0)
Requirement already satisfied: numpy in /usr/local/lib/python3.7/dist-packages (from stable-baselines3>=1.5.0->sb3-contrib==1.5.0) (1.21.0)
Requirement already satisfied: gym==0.21 in /usr/local/lib/python3.7/dist-packages (from stable-baselines3>=1.5.0->sb3-contrib==1.5.0) (0.21.0)
Requirement already satisfied: importlib-metadata<=4.13 in /usr/local/lib/python3.7/dist-packages (from stable-baselines3>=1.5.0->sb3-contrib==1.5.0) (4.13.0)

```

```

import gym
import torch as th
from stable_baselines3 import PPO
from torch.distributions import Categorical
import torch
import torch.nn as nn
import numpy as np
from torch.nn import functional as F
from stable_baselines3.common.env_util import make_vec_env
from stable_baselines3.common.torch_layers import BaseFeaturesExtractor
from stable_baselines3.common.vec_env import SubprocVecEnv
import highway_env

if __name__ == "__main__":
    train = True
    if train:
        n_cpu = 6
        batch_size = 64
        env = make_vec_env("highway-fast-v0")
        model = PPO("MlpPolicy",
                    env,
                    policy_kwargs=dict(net_arch=[dict(pi=[256, 256], vf=[256, 256])]),
                    n_steps=batch_size * 12 // n_cpu,
                    batch_size=batch_size,
                    n_epochs=10,
                    learning_rate=5e-4,
                    gamma=0.8,
                    verbose=2,
                    tensorboard_log="highway_ppo/")
        # Train the agent
        model.learn(total_timesteps=int(2e4))
        # Save the agent
        model.save("highway_ppo/model")

    model = PPO.load("highway_ppo/model")
    env = gym.make("highway-fast-v0")

```

INFO: Making new env: highway-fast-v0  
 Using cuda device  
 Logging to highway\_ppo/PPO\_1

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rollout/		
ep_len_mean	12.8	
ep_rew_mean	9.38	
time/		
fps	10	
iterations	1	
time_elapsed	11	
total_timesteps	128	
-----		

-----		
rollout/		
ep_len_mean	13.1	
ep_rew_mean	9.49	
time/		
fps	13	
iterations	2	
time_elapsed	19	
total_timesteps	256	
train/		
approx_kl	0.012987971	
clip_fraction	0.37	
clip_range	0.2	
entropy_loss	-1.59	
explained_variance	0.0147	
learning_rate	0.0005	
loss	0.328	
n_updates	10	
policy_gradient_loss	-0.0295	
value_loss	1.62	
-----		

-----		
rollout/		
ep_len_mean	13.5	
ep_rew_mean	9.82	
time/		
fps	13	
iterations	3	
time_elapsed	27	
total_timesteps	384	
train/		
approx_kl	0.016296579	
clip_fraction	0.0992	
clip_range	0.2	
entropy_loss	-1.59	
explained_variance	0.0857	
learning_rate	0.0005	
loss	0.428	
n_updates	20	
policy_gradient_loss	-0.0128	
value_loss	0.958	
-----		

-----		
rollout/		
ep_len_mean	15.1	
ep_rew_mean	11	
time/		
fps	14	
iterations	4	
time_elapsed	35	
total_timesteps	512	
train/		
approx_kl	0.009739686	
clip_fraction	0.107	
clip_range	0.2	
entropy_loss	-1.55	
explained_variance	-0.163	
learning_rate	0.0005	
loss	0.447	
n_updates	30	
policy_gradient_loss	-0.0112	
value_loss	1.01	
-----		

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rollout/		
ep_len_mean	15.4	
ep_rew_mean	11.3	
time/		
fps	14	
iterations	5	
time_elapsed	43	
total_timesteps	640	
-----		

```
|      total_timesteps      | 640      |  
  
from tqdm.notebook import trange  
from utils import record_videos, show_videos  
env = gym.make("highway-fast-v0")  
env = record_videos(env)  
for episode in trange(3, desc="Test episodes"):  
    obs, done = env.reset(), False  
    while not done:  
        action, _ = model.predict(obs, deterministic=True)  
        obs, reward, done, info = env.step(int(action))  
env.close()  
show_videos()
```

```
INFO: Making new env: highway-fast-v0
Test episodes: 100%
3/3 [00:08<00:00, 2.62s/it]
INFO: Starting new video recorder writing to /content/rl-agents/scripts/videos/rl-video-episode-0.mp4
INFO: Starting new video recorder writing to /content/rl-agents/scripts/videos/rl-video-episode-1.mp4
INFO: Starting new video recorder writing to /content/rl-agents/scripts/videos/rl-video-episode-2.mp4
```

```
%tensorboard --logdir "highway_ppo/"
```

TensorBoard

SCALARS

TIME SERIES

INACTIVE

☐ Show data download links

☐ Ignore outliers in chart scaling

Tooltip sorting method:

default

Smoothing

0.6

Horizontal Axis

STEP

RELATIVE

WALL

Runs

Write a regex to filter runs

☐ ☐ PPO\_1

TOGGLE ALL RUNS

highway\_ppo

Filter tags (regular expressions supported)

rollout

rollout/ep\_len\_mean  
tag: rollout/ep\_len\_mean

rollout/ep\_rew\_mean  
tag: rollout/ep\_rew\_mean

time

time/fps  
tag: time/fps

0:00 / 0:15