weighted-ddqn-stableb2-ddqnparms-feather-top4feat-1data

March 27, 2022

0.0.1 Exploration

```
[1]: !git clone https://github.com/openai/baselines.git
     %cd baselines
     !pip install -e .
     !pip install stable-baselines
     !pip install --upgrade tensorflow==1.14.0
     !pip install gym
     !pip install pyarrow
```

```
fatal: destination path 'baselines' already exists and is not an empty
directory.
/project/baselines
Obtaining file:///project/baselines
Requirement already satisfied: gym<0.16.0,>=0.15.4 in
/opt/conda/lib/python3.7/site-packages (from baselines==0.1.6) (0.15.7)
Requirement already satisfied: scipy in /opt/conda/lib/python3.7/site-packages
(from baselines==0.1.6) (1.4.1)
Requirement already satisfied: tqdm in /opt/conda/lib/python3.7/site-packages
(from baselines==0.1.6) (4.46.1)
Requirement already satisfied: joblib in /opt/conda/lib/python3.7/site-packages
(from baselines==0.1.6) (0.15.1)
Requirement already satisfied: cloudpickle in /opt/conda/lib/python3.7/site-
packages (from baselines==0.1.6) (1.2.2)
Requirement already satisfied: click in /opt/conda/lib/python3.7/site-packages
(from baselines==0.1.6) (7.1.2)
Requirement already satisfied: opencv-python in /opt/conda/lib/python3.7/site-
packages (from baselines==0.1.6) (4.5.5.64)
Requirement already satisfied: pyglet<=1.5.0,>=1.4.0 in
/opt/conda/lib/python3.7/site-packages (from
gym<0.16.0,>=0.15.4->baselines==0.1.6) (1.5.0)
Requirement already satisfied: six in /opt/conda/lib/python3.7/site-packages
(from gym<0.16.0,>=0.15.4->baselines==0.1.6) (1.15.0)
Requirement already satisfied: numpy>=1.10.4 in /opt/conda/lib/python3.7/site-
packages (from gym<0.16.0,>=0.15.4->baselines==0.1.6) (1.18.5)
Requirement already satisfied: future in /opt/conda/lib/python3.7/site-packages
(from pyglet<=1.5.0,>=1.4.0->gym<0.16.0,>=0.15.4->baselines==0.1.6) (0.18.2)
Installing collected packages: baselines
```

```
  Attempting uninstall: baselines
    Found existing installation: baselines 0.1.6
    Uninstalling baselines-0.1.6:
      Successfully uninstalled baselines-0.1.6
  Running setup.py develop for baselines
Successfully installed baselines
Requirement already satisfied: stable-baselines in
/opt/conda/lib/python3.7/site-packages (2.10.2)
Requirement already satisfied: matplotlib in /opt/conda/lib/python3.7/site-
packages (from stable-baselines) (3.2.1)
Requirement already satisfied: joblib in /opt/conda/lib/python3.7/site-packages
(from stable-baselines) (0.15.1)
Requirement already satisfied: gym[atari,classic_control]>=0.11 in
/opt/conda/lib/python3.7/site-packages (from stable-baselines) (0.15.7)
Requirement already satisfied: cloudpickle>=0.5.5 in
/opt/conda/lib/python3.7/site-packages (from stable-baselines) (1.2.2)
Requirement already satisfied: opencv-python in /opt/conda/lib/python3.7/site-
packages (from stable-baselines) (4.5.5.64)
Requirement already satisfied: pandas in /opt/conda/lib/python3.7/site-packages
(from stable-baselines) (1.0.4)
Requirement already satisfied: numpy in /opt/conda/lib/python3.7/site-packages
(from stable-baselines) (1.18.5)
Requirement already satisfied: scipy in /opt/conda/lib/python3.7/site-packages
(from stable-baselines) (1.4.1)
Requirement already satisfied: kiwisolver>=1.0.1 in
/opt/conda/lib/python3.7/site-packages (from matplotlib->stable-baselines)
(1.2.0)
Requirement already satisfied: pyparsing!=2.0.4,!=2.1.2,!=2.1.6,>=2.0.1 in
/opt/conda/lib/python3.7/site-packages (from matplotlib->stable-baselines)
(2.4.7)
Requirement already satisfied: cycler>=0.10 in /opt/conda/lib/python3.7/site-
packages (from matplotlib->stable-baselines) (0.10.0)
Requirement already satisfied: python-dateutil>=2.1 in
/opt/conda/lib/python3.7/site-packages (from matplotlib->stable-baselines)
(2.8.1)
Requirement already satisfied: pyglet<=1.5.0,>=1.4.0 in
/opt/conda/lib/python3.7/site-packages (from
gym[atari,classic_control]>=0.11->stable-baselines) (1.5.0)
Requirement already satisfied: six in /opt/conda/lib/python3.7/site-packages
(from gym[atari,classic_control]>=0.11->stable-baselines) (1.15.0)
Requirement already satisfied: atari-py~=0.2.0; extra == "atari" in
/opt/conda/lib/python3.7/site-packages (from
gym[atari,classic_control]>=0.11->stable-baselines) (0.2.9)
Requirement already satisfied: Pillow; extra == "atari" in
/opt/conda/lib/python3.7/site-packages (from
gym[atari,classic_control]>=0.11->stable-baselines) (7.1.2)
Requirement already satisfied: pytz>=2017.2 in /opt/conda/lib/python3.7/site-
packages (from pandas->stable-baselines) (2020.1)
```

Requirement already satisfied: future in /opt/conda/lib/python3.7/site-packages
(from pyglet<=1.5.0,>=1.4.0->gym[atari,classic_control]>=0.11->stable-baselines)
(0.18.2)
Requirement already up-to-date: tensorflow==1.14.0 in
/opt/conda/lib/python3.7/site-packages (1.14.0)
Requirement already satisfied, skipping upgrade: wrapt>=1.11.1 in
/opt/conda/lib/python3.7/site-packages (from tensorflow==1.14.0) (1.12.1)
Requirement already satisfied, skipping upgrade: numpy<2.0,>=1.14.5 in
/opt/conda/lib/python3.7/site-packages (from tensorflow==1.14.0) (1.18.5)
Requirement already satisfied, skipping upgrade: gast>=0.2.0 in
/opt/conda/lib/python3.7/site-packages (from tensorflow==1.14.0) (0.3.3)
Requirement already satisfied, skipping upgrade: astor>=0.6.0 in
/opt/conda/lib/python3.7/site-packages (from tensorflow==1.14.0) (0.8.1)
Requirement already satisfied, skipping upgrade: absl-py>=0.7.0 in
/opt/conda/lib/python3.7/site-packages (from tensorflow==1.14.0) (0.9.0)
Requirement already satisfied, skipping upgrade: six>=1.10.0 in
/opt/conda/lib/python3.7/site-packages (from tensorflow==1.14.0) (1.15.0)
Requirement already satisfied, skipping upgrade: tensorboard<1.15.0,>=1.14.0 in
/opt/conda/lib/python3.7/site-packages (from tensorflow==1.14.0) (1.14.0)
Requirement already satisfied, skipping upgrade: termcolor>=1.1.0 in
/opt/conda/lib/python3.7/site-packages (from tensorflow==1.14.0) (1.1.0)
Requirement already satisfied, skipping upgrade: keras-applications>=1.0.6 in
/opt/conda/lib/python3.7/site-packages (from tensorflow==1.14.0) (1.0.8)
Requirement already satisfied, skipping upgrade: grpcio>=1.8.6 in
/opt/conda/lib/python3.7/site-packages (from tensorflow==1.14.0) (1.29.0)
Requirement already satisfied, skipping upgrade: tensorflow-
estimator<1.15.0rc0,>=1.14.0rc0 in /opt/conda/lib/python3.7/site-packages (from
tensorflow==1.14.0) (1.14.0)
Requirement already satisfied, skipping upgrade: wheel>=0.26 in
/opt/conda/lib/python3.7/site-packages (from tensorflow==1.14.0) (0.34.2)
Requirement already satisfied, skipping upgrade: google-pasta>=0.1.6 in
/opt/conda/lib/python3.7/site-packages (from tensorflow==1.14.0) (0.2.0)
Requirement already satisfied, skipping upgrade: keras-preprocessing>=1.0.5 in
/opt/conda/lib/python3.7/site-packages (from tensorflow==1.14.0) (1.1.2)
Requirement already satisfied, skipping upgrade: protobuf>=3.6.1 in
/opt/conda/lib/python3.7/site-packages (from tensorflow==1.14.0) (3.11.4)
Requirement already satisfied, skipping upgrade: markdown>=2.6.8 in
/opt/conda/lib/python3.7/site-packages (from
tensorboard<1.15.0,>=1.14.0->tensorflow==1.14.0) (3.2.2)
Requirement already satisfied, skipping upgrade: setuptools>=41.0.0 in
/opt/conda/lib/python3.7/site-packages (from
tensorboard<1.15.0,>=1.14.0->tensorflow==1.14.0) (47.1.1.post20200529)
Requirement already satisfied, skipping upgrade: werkzeug>=0.11.15 in
/opt/conda/lib/python3.7/site-packages (from
tensorboard<1.15.0,>=1.14.0->tensorflow==1.14.0) (1.0.1)
Requirement already satisfied, skipping upgrade: h5py in
/opt/conda/lib/python3.7/site-packages (from keras-
applications>=1.0.6->tensorflow==1.14.0) (2.10.0)

```
Requirement already satisfied, skipping upgrade: importlib-metadata;
python_version < "3.8" in /opt/conda/lib/python3.7/site-packages (from
markdown>=2.6.8->tensorboard<1.15.0,>=1.14.0->tensorflow==1.14.0) (1.6.1)
Requirement already satisfied, skipping upgrade: zipp>=0.5 in
/opt/conda/lib/python3.7/site-packages (from importlib-metadata; python_version
< "3.8"->markdown>=2.6.8->tensorboard<1.15.0,>=1.14.0->tensorflow==1.14.0)
(3.1.0)
Requirement already satisfied: gym in /opt/conda/lib/python3.7/site-packages
(0.15.7)
Requirement already satisfied: pyglet<=1.5.0,>=1.4.0 in
/opt/conda/lib/python3.7/site-packages (from gym) (1.5.0)
Requirement already satisfied: numpy>=1.10.4 in /opt/conda/lib/python3.7/site-
packages (from gym) (1.18.5)
Requirement already satisfied: scipy in /opt/conda/lib/python3.7/site-packages
(from gym) (1.4.1)
Requirement already satisfied: six in /opt/conda/lib/python3.7/site-packages
(from gym) (1.15.0)
Requirement already satisfied: cloudpickle~=1.2.0 in
/opt/conda/lib/python3.7/site-packages (from gym) (1.2.2)
Requirement already satisfied: future in /opt/conda/lib/python3.7/site-packages
(from pyglet<=1.5.0,>=1.4.0->gym) (0.18.2)
Requirement already satisfied: pyarrow in /opt/conda/lib/python3.7/site-packages
(7.0.0)
Requirement already satisfied: numpy>=1.16.6 in /opt/conda/lib/python3.7/site-
packages (from pyarrow) (1.18.5)
```

[2]:
```python
import os
import gym
import time
import json
import random
import numpy as np
import pandas as pd
from tensorflow import keras
from tensorflow.keras import layers

from stable_baselines.deepq.policies import MlpPolicy
from stable_baselines.common.vec_env.dummy_vec_env import DummyVecEnv

from stable_baselines import deepq
from stable_baselines import bench
from stable_baselines import logger
import tensorflow as tf

from baselines.common.tf_util import make_session
```

```
/opt/conda/lib/python3.7/site-
packages/tensorflow/python/framework/dtypes.py:516: FutureWarning: Passing
```

```
(type, 1) or '1type' as a synonym of type is deprecated; in a future version of
numpy, it will be understood as (type, (1,)) / '(1,)type'.
  _np_qint8 = np.dtype([("qint8", np.int8, 1)])
/opt/conda/lib/python3.7/site-
packages/tensorflow/python/framework/dtypes.py:517: FutureWarning: Passing
(type, 1) or '1type' as a synonym of type is deprecated; in a future version of
numpy, it will be understood as (type, (1,)) / '(1,)type'.
  _np_quint8 = np.dtype([("quint8", np.uint8, 1)])
/opt/conda/lib/python3.7/site-
packages/tensorflow/python/framework/dtypes.py:518: FutureWarning: Passing
(type, 1) or '1type' as a synonym of type is deprecated; in a future version of
numpy, it will be understood as (type, (1,)) / '(1,)type'.
  _np_qint16 = np.dtype([("qint16", np.int16, 1)])
/opt/conda/lib/python3.7/site-
packages/tensorflow/python/framework/dtypes.py:519: FutureWarning: Passing
(type, 1) or '1type' as a synonym of type is deprecated; in a future version of
numpy, it will be understood as (type, (1,)) / '(1,)type'.
  _np_quint16 = np.dtype([("quint16", np.uint16, 1)])
/opt/conda/lib/python3.7/site-
packages/tensorflow/python/framework/dtypes.py:520: FutureWarning: Passing
(type, 1) or '1type' as a synonym of type is deprecated; in a future version of
numpy, it will be understood as (type, (1,)) / '(1,)type'.
  _np_qint32 = np.dtype([("qint32", np.int32, 1)])
/opt/conda/lib/python3.7/site-
packages/tensorflow/python/framework/dtypes.py:525: FutureWarning: Passing
(type, 1) or '1type' as a synonym of type is deprecated; in a future version of
numpy, it will be understood as (type, (1,)) / '(1,)type'.
  np_resource = np.dtype([("resource", np.ubyte, 1)])
/opt/conda/lib/python3.7/site-
packages/tensorboard/compat/tensorflow_stub/dtypes.py:541: FutureWarning:
Passing (type, 1) or '1type' as a synonym of type is deprecated; in a future
version of numpy, it will be understood as (type, (1,)) / '(1,)type'.
  _np_qint8 = np.dtype([("qint8", np.int8, 1)])
/opt/conda/lib/python3.7/site-
packages/tensorboard/compat/tensorflow_stub/dtypes.py:542: FutureWarning:
Passing (type, 1) or '1type' as a synonym of type is deprecated; in a future
version of numpy, it will be understood as (type, (1,)) / '(1,)type'.
  _np_quint8 = np.dtype([("quint8", np.uint8, 1)])
/opt/conda/lib/python3.7/site-
packages/tensorboard/compat/tensorflow_stub/dtypes.py:543: FutureWarning:
Passing (type, 1) or '1type' as a synonym of type is deprecated; in a future
version of numpy, it will be understood as (type, (1,)) / '(1,)type'.
  _np_qint16 = np.dtype([("qint16", np.int16, 1)])
/opt/conda/lib/python3.7/site-
packages/tensorboard/compat/tensorflow_stub/dtypes.py:544: FutureWarning:
Passing (type, 1) or '1type' as a synonym of type is deprecated; in a future
version of numpy, it will be understood as (type, (1,)) / '(1,)type'.
  _np_quint16 = np.dtype([("quint16", np.uint16, 1)])
```

```
/opt/conda/lib/python3.7/site-
packages/tensorboard/compat/tensorflow_stub/dtypes.py:545: FutureWarning:
Passing (type, 1) or '1type' as a synonym of type is deprecated; in a future
version of numpy, it will be understood as (type, (1,)) / '(1,)type'.
  _np_qint32 = np.dtype([("qint32", np.int32, 1)])
/opt/conda/lib/python3.7/site-
packages/tensorboard/compat/tensorflow_stub/dtypes.py:550: FutureWarning:
Passing (type, 1) or '1type' as a synonym of type is deprecated; in a future
version of numpy, it will be understood as (type, (1,)) / '(1,)type'.
  np_resource = np.dtype([("resource", np.ubyte, 1)])
/opt/conda/lib/python3.7/site-packages/stable_baselines/__init__.py:33:
UserWarning: stable-baselines is in maintenance mode, please use [Stable-
Baselines3 (SB3)](https://github.com/DLR-RM/stable-baselines3) for an up-to-date
version. You can find a [migration guide](https://stable-
baselines3.readthedocs.io/en/master/guide/migration.html) in SB3 documentation.
  "stable-baselines is in maintenance mode, please use [Stable-Baselines3
(SB3)](https://github.com/DLR-RM/stable-baselines3) for an up-to-date version.
You can find a [migration guide](https://stable-
baselines3.readthedocs.io/en/master/guide/migration.html) in SB3 documentation."
```

```python
[3]: cicddos2019 = pd.read_feather("/project/datasets/clean-ids-collection/
     ↪cic-ddos2019/clean/cicddos2019.feather")
     cicdos2017 = pd.read_feather("/project/datasets/clean-ids-collection/
     ↪cic-dos2017/clean/cicdos2017.feather")
     cicids2017 = pd.read_feather("/project/datasets/clean-ids-collection/
     ↪cic-ids2017/clean/cicids2017.feather")
     data = pd.concat([cicddos2019], ignore_index=True)
     print(len(data.columns))
     data.head(5)
```

```
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```

```
[3]:    Protocol                   Timestamp  Flow Duration  Total Fwd Packets  \
     0         0  2018-11-03 09:18:16.964447      114456999                 45
     1         0  2018-11-03 09:18:18.506537      114347504                 56
     2         6  2018-11-03 09:18:18.610576       36435473                  6
     3         6  2018-11-03 09:18:18.610579       36434705                  6
     4         6  2018-11-03 09:18:18.610581       36434626                  6

        Total Backward Packets  Fwd Packets Length Total  Bwd Packets Length Total  \
     0                       0                      0.0                       0.0
     1                       0                      0.0                       0.0
     2                       2                    116.0                      92.0
     3                       2                    116.0                      92.0
     4                       2                    116.0                      92.0

        Fwd Packet Length Max  Fwd Packet Length Min  Fwd Packet Length Mean  …  \
```

```
0                      0.0                0.0              0.000000  …
1                      0.0                0.0              0.000000  …
2                     46.0                6.0             19.333334  …
3                     46.0                6.0             19.333334  …
4                     46.0                6.0             19.333334  …

   Fwd Seg Size Min    Active Mean       Active Std  Active Max  Active Min  \
0                 0    8185.583496    28337.111328     98168.0          3.0
1                 0   35028.417969   121314.914062    420255.0          4.0
2                20   62416.000000        0.000000     62416.0      62416.0
3                20   62413.000000        0.000000     62413.0      62413.0
4                20   62409.000000        0.000000     62409.0      62409.0

      Idle Mean       Idle Std       Idle Max       Idle Min   Label
0     9529897.0    351582.62500    10001143.0      9048097.0  Benign
1     9493930.0    351541.09375     9978130.0      8820294.0  Benign
2    36373056.0         0.00000    36373056.0     36373056.0  Benign
3    36372292.0         0.00000    36372292.0     36372292.0  Benign
4    36372216.0         0.00000    36372216.0     36372216.0  Benign

[5 rows x 69 columns]
```

```python
[4]: cicdos2017_features = ["Init Bwd Win Bytes",  "Idle Min", "ACK Flag Count",
     →"Fwd Packet Length Min", "Fwd PSH Flags"]
     cicids2017_features = ["Protocol", "Avg Bwd Segment Size", "Packet Length Max",
     →"Bwd Packet Length Min", "Fwd IAT Mean"]
     cicddos2019_features = ["URG Flag Count", "Down/Up Ratio", "Bwd Packet Length
     →Min", "ACK Flag Count", "Fwd Packets Length Total"]
     important_features = cicddos2019_features + ["Label", "Timestamp"] # Adding
     →Timestamp for custom environment logic
     important_features = list(set(important_features))
     print(len(important_features))
```

```
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```

```python
[5]: removable_features = data.columns ^ important_features
     print(removable_features.shape)
     skinny_data = data.drop(labels=removable_features, axis='columns')
```

```
(62,)
```

```python
[6]: skinny_data.info()
     skinny_data.describe()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 138007 entries, 0 to 138006
Data columns (total 7 columns):
```

```
 #   Column                   Non-Null Count   Dtype
---  ------                   --------------   -----
 0   Timestamp                138007 non-null  datetime64[ns]
 1   Fwd Packets Length Total  138007 non-null  float32
 2   Bwd Packet Length Min    138007 non-null  float32
 3   ACK Flag Count           138007 non-null  int8
 4   URG Flag Count           138007 non-null  int8
 5   Down/Up Ratio            138007 non-null  float32
 6   Label                    138007 non-null  category
dtypes: category(1), datetime64[ns](1), float32(3), int8(2)
memory usage: 3.0 MB
```

[6]:

	Fwd Packets Length Total	Bwd Packet Length Min	ACK Flag Count
count	1.380070e+05	138007.000000	138007.000000
mean	4.018388e+03	25.685892	0.198584
std	5.148026e+04	52.287216	0.398936
min	0.000000e+00	0.000000	0.000000
25%	1.800000e+01	0.000000	0.000000
50%	8.600000e+01	0.000000	0.000000
75%	2.064000e+03	46.000000	0.000000
max	1.526642e+07	1460.000000	1.000000

	URG Flag Count	Down/Up Ratio
count	138007.000000	138007.000000
mean	0.275283	0.702986
std	0.446658	0.937449
min	0.000000	0.000000
25%	0.000000	0.000000
50%	0.000000	1.000000
75%	1.000000	1.000000
max	1.000000	23.000000

Preprocessing done by Laurens D'Hooge

0.1 Creating the model

- Build an agent to classify network flow automatically
- Feed a packet that gets classified
- Want the classification to be equal to the label

[7]:
```python
def balancing_dataset_sampler_df(df, train_frac=0.2, val_frac=0.1, test_frac=0.
  ↪7):
    col = df.columns[-1]
    print(col)
    cols = df.columns[:-1]
    print(cols)
    vc = df[col].value_counts()
```

```python
    print(vc)
    n = vc.iloc[-1]
    print(n)
    m = vc.iloc[0]
    print(m)
    print(int(m-n))
    initial_cut = df.loc[df[col] == vc.index[0]].sample(n=int(m-n),
 ↪replace=False)
    print(initial_cut.index)
    df = df.drop(index=initial_cut.index)
    vc = df[col].value_counts()
    print(vc)
    print(int(n*train_frac))
    train_df = df.groupby(col).apply(lambda x: x.sample(n=int(n*train_frac),
 ↪replace=False))
    train_df.reset_index(level=0, inplace=True, drop=True)
    df = df.drop(index=train_df.index)

    validation_df = df.groupby(col).apply(lambda x: x.sample(n=int(n*val_frac),
 ↪replace=False))
    validation_df.reset_index(level=0, inplace=True, drop=True)
    df = df.drop(index=validation_df.index)

    test_df = df.groupby(col).apply(lambda x: x.sample(n=int(n*test_frac),
 ↪replace=False))
    test_df.reset_index(level=0, inplace=True, drop=True)
    df = df.drop(index=test_df.index)

    return train_df[cols], train_df[col], validation_df[cols],
 ↪validation_df[col], test_df[cols], test_df[col]
```

```python
[8]: skinny_data.drop('Timestamp', inplace=True, axis=1)
     print(skinny_data['Label'].value_counts())
     skinny_data['Label'] = skinny_data['Label'].astype('object')
     atk_idx = skinny_data.loc[skinny_data['Label'] != "Benign"].index
     skinny_data.loc[atk_idx, 'Label'] = 1.0
     skinny_data.loc[skinny_data.index.difference(atk_idx), 'Label'] = 0.0
     skinny_data['Label'] = skinny_data['Label'].astype(dtype=np.float32)
```

```
Benign          95095
DrDoS_NTP       13687
TFTP            13027
Syn              6713
UDP              2158
MSSQL            1763
DrDoS_UDP        1174
UDP-lag          1097
```

```
DrDoS_MSSQL        927
DrDoS_DNS          552
LDAP               484
DrDoS_SSDP         413
DrDoS_SNMP         392
Portmap            215
DrDoS_LDAP         174
NetBIOS             73
DrDoS_NetBIOS       51
UDPLag              10
WebDDoS              2
Name: Label, dtype: int64
```

[9]:
```python
x_train, y_train, x_val, y_val, x_test, y_test  =␣
 →balancing_dataset_sampler_df(skinny_data, train_frac=0.9, val_frac=0.0,␣
 →test_frac=0.1)
```

```
Label
Index(['Fwd Packets Length Total', 'Bwd Packet Length Min', 'ACK Flag Count',
       'URG Flag Count', 'Down/Up Ratio'],
      dtype='object')
0.0    95095
1.0    42912
Name: Label, dtype: int64
42912
95095
52183
Int64Index([ 66440, 137072,  52008,  45575,  35271,   3956,  57362,  94770,
             50910, 117661,
             ...
             86466, 137695,  87177,  42512,  65868, 136315,  42003,  20968,
             22873, 125000],
           dtype='int64', length=52183)
1.0    42912
0.0    42912
Name: Label, dtype: int64
38620
```

[10]:
```python
print("Training")
print(x_train.shape)
print(y_train.shape)
print("Validation")
print(x_val.shape)
print(y_val.shape)
print("Testing")
print(x_test.shape)
print(y_test.shape)
```

```
Training
(77240, 5)
(77240,)
Validation
(0, 5)
(0,)
Testing
(8582, 5)
(8582,)
```

[11]:
```python
print(x_train.shape)
```

```
(77240, 5)
```

[12]:
```python
print(x_train.index)
print(y_train.index)
y_train = y_train.to_frame()
y_test = y_test.to_frame()
```

```
Int64Index([ 26300,  43924, 123314,  41911,  32336,  10257,  87829,   6181,
              2931,  48864,
             ...
            104494,  13510, 115072, 117315,  25647,  79157,  77023, 118032,
             77948,  26810],
           dtype='int64', length=77240)
Int64Index([ 26300,  43924, 123314,  41911,  32336,  10257,  87829,   6181,
              2931,  48864,
             ...
            104494,  13510, 115072, 117315,  25647,  79157,  77023, 118032,
             77948,  26810],
           dtype='int64', length=77240)
```

[13]:
```python
# custom keys -> replace by index

x_train = x_train.set_index([pd.Index(range (0, len(x_train)))])
y_train = y_train.set_index([pd.Index(range (0, len(y_train)))])
x_test = x_test.set_index([pd.Index(range (0, len(x_test)))])
y_test = y_test.set_index([pd.Index(range (0, len(y_test)))])
```

[14]:
```python
print(x_train.index)
print(y_train.index)
```

```
RangeIndex(start=0, stop=77240, step=1)
RangeIndex(start=0, stop=77240, step=1)
```

[15]:
```python
print(y_train)
```

```
        Label
```

```
0        0.0
1        0.0
2        0.0
3        0.0
4        0.0
...      ...
77235    1.0
77236    1.0
77237    1.0
77238    1.0
77239    1.0

[77240 rows x 1 columns]
```

[16]:
```python
print(y_train.iloc[17162,:])
```

```
Label    0.0
Name: 17162, dtype: float32
```

[17]:
```python
print(y_train.index)
print(x_train.index)
```

```
RangeIndex(start=0, stop=77240, step=1)
RangeIndex(start=0, stop=77240, step=1)
```

0.1.1 Custom environment

[18]:
```python
class IdsEnv(gym.Env):
    def __init__(self, images_per_episode=1, dataset=(x_train, y_train),
 ↪random=True):
        # Actions we can take, classify as malicious or non-malicious (later
 ↪also the correct attack)
        # change to 19 if detectiong all different attacks
        self.action_space = gym.spaces.Discrete(2)
        # All the features we have, len(important_features) - 1 features and 1
 ↪label. Label should not be included
        self.observation_space = gym.spaces.Box(low=float('-inf'),
 ↪high=float('inf'), shape=(len(important_features) - 2,))
        self.images_per_episode = images_per_episode
        self.step_count = 0

        self.x, self.y = dataset
        self.random = random
        self.dataset_idx = 0

    def step(self, action):
        done = False
```

```python
        reward = int(action == self.expected_action)

        obs = self._next_obs()

        self.step_count += 1
        if self.step_count >= self.images_per_episode:
            done = True

        return obs, reward, done, {}

    def _next_obs(self):
        if self.random:
            next_obs_idx = random.randint(0, len(self.x) - 1)
            self.expected_action = int(self.y.iloc[next_obs_idx,:])
            obs = self.x.iloc[next_obs_idx,:]

        else:
            obs = self.x.iloc[self.dataset_idx]
            self.expected_action = int(self.y.iloc[self.dataset_idx])

            self.dataset_idx += 1
            if self.dataset_idx >= len(self.x):
                raise StopIteration()

        return obs

    def reset(self):
        self.step_count = 0

        obs = self._next_obs()
        return obs
```

Train classifier using dqn

```python
[19]: def ids_dqn():
    #     logger.configure(dir=os.path.join(os.getcwd(),'Training/Logs/ids_dqn'),␣
    ↪format_strs=['stdout', 'tensorboard'])
        env = IdsEnv(images_per_episode=4096)
        env = bench.Monitor(env, logger.get_dir())

        model = deepq.DQN(
            MlpPolicy,
            env,
            verbose=1,
            learning_rate=0.00025,
            buffer_size=1000000,
            learning_starts=50000,
```

```
        batch_size=32,
        gamma=0.99,
        train_freq=4,
        target_network_update_freq=30000, # 10k to 30k
        exploration_fraction=0.01, # 0.1 to 0.01
        exploration_initial_eps=1.0,
        exploration_final_eps=0.05,
    ).learn(
        total_timesteps=int(1.0e6),
        log_interval=10
    )

    model.save('ddqn_stableb2_ids.pkl')
    env.close()

    return model

start_time = time.time()
dqn_model = ids_dqn()
print("DQN Training Time:", time.time() - start_time)
```

WARNING:tensorflow:From /opt/conda/lib/python3.7/site-
packages/stable_baselines/common/tf_util.py:191: The name tf.ConfigProto is
deprecated. Please use tf.compat.v1.ConfigProto instead.

WARNING:tensorflow:From /opt/conda/lib/python3.7/site-
packages/stable_baselines/common/tf_util.py:200: The name tf.Session is
deprecated. Please use tf.compat.v1.Session instead.

WARNING:tensorflow:From /opt/conda/lib/python3.7/site-
packages/stable_baselines/deepq/dqn.py:129: The name tf.train.AdamOptimizer is
deprecated. Please use tf.compat.v1.train.AdamOptimizer instead.

WARNING:tensorflow:From /opt/conda/lib/python3.7/site-
packages/stable_baselines/deepq/build_graph.py:358: The name tf.variable_scope
is deprecated. Please use tf.compat.v1.variable_scope instead.

WARNING:tensorflow:From /opt/conda/lib/python3.7/site-
packages/stable_baselines/deepq/build_graph.py:359: The name tf.placeholder is
deprecated. Please use tf.compat.v1.placeholder instead.

WARNING:tensorflow:From /opt/conda/lib/python3.7/site-
packages/stable_baselines/deepq/build_graph.py:139: The name tf.get_variable is
deprecated. Please use tf.compat.v1.get_variable instead.

WARNING:tensorflow:From /opt/conda/lib/python3.7/site-
packages/stable_baselines/deepq/policies.py:109: flatten (from

tensorflow.python.layers.core) is deprecated and will be removed in a future version.
Instructions for updating:
Use keras.layers.flatten instead.
WARNING:tensorflow:Entity <bound method Flatten.call of
<tensorflow.python.layers.core.Flatten object at 0x7f056fd77190>> could not be
transformed and will be executed as-is. Please report this to the AutgoGraph
team. When filing the bug, set the verbosity to 10 (on Linux, `export
AUTOGRAPH_VERBOSITY=10`) and attach the full output. Cause: converting <bound
method Flatten.call of <tensorflow.python.layers.core.Flatten object at
0x7f056fd77190>>: AttributeError: module 'gast' has no attribute 'Num'

/opt/conda/lib/python3.7/site-packages/gym/logger.py:30: UserWarning: WARN:

Box bound precision lowered by casting to float32
  warnings.warn(colorize('%s: %s'%('WARN', msg % args), 'yellow'))

WARNING: Entity <bound method Flatten.call of
<tensorflow.python.layers.core.Flatten object at 0x7f056fd77190>> could not be
transformed and will be executed as-is. Please report this to the AutgoGraph
team. When filing the bug, set the verbosity to 10 (on Linux, `export
AUTOGRAPH_VERBOSITY=10`) and attach the full output. Cause: converting <bound
method Flatten.call of <tensorflow.python.layers.core.Flatten object at
0x7f056fd77190>>: AttributeError: module 'gast' has no attribute 'Num'
WARNING:tensorflow:Entity <bound method Dense.call of
<tensorflow.python.layers.core.Dense object at 0x7f056fd771d0>> could not be
transformed and will be executed as-is. Please report this to the AutgoGraph
team. When filing the bug, set the verbosity to 10 (on Linux, `export
AUTOGRAPH_VERBOSITY=10`) and attach the full output. Cause: converting <bound
method Dense.call of <tensorflow.python.layers.core.Dense object at
0x7f056fd771d0>>: AssertionError: Bad argument number for Name: 3, expecting 4
WARNING: Entity <bound method Dense.call of <tensorflow.python.layers.core.Dense
object at 0x7f056fd771d0>> could not be transformed and will be executed as-is.
Please report this to the AutgoGraph team. When filing the bug, set the
verbosity to 10 (on Linux, `export AUTOGRAPH_VERBOSITY=10`) and attach the full
output. Cause: converting <bound method Dense.call of
<tensorflow.python.layers.core.Dense object at 0x7f056fd771d0>>: AssertionError:
Bad argument number for Name: 3, expecting 4
WARNING:tensorflow:Entity <bound method Dense.call of
<tensorflow.python.layers.core.Dense object at 0x7f056fd5bed0>> could not be
transformed and will be executed as-is. Please report this to the AutgoGraph
team. When filing the bug, set the verbosity to 10 (on Linux, `export
AUTOGRAPH_VERBOSITY=10`) and attach the full output. Cause: converting <bound
method Dense.call of <tensorflow.python.layers.core.Dense object at
0x7f056fd5bed0>>: AssertionError: Bad argument number for Name: 3, expecting 4
WARNING: Entity <bound method Dense.call of <tensorflow.python.layers.core.Dense
object at 0x7f056fd5bed0>> could not be transformed and will be executed as-is.
Please report this to the AutgoGraph team. When filing the bug, set the
verbosity to 10 (on Linux, `export AUTOGRAPH_VERBOSITY=10`) and attach the full

output. Cause: converting <bound method Dense.call of
<tensorflow.python.layers.core.Dense object at 0x7f056fd5bed0>>: AssertionError:
Bad argument number for Name: 3, expecting 4
WARNING:tensorflow:Entity <bound method Dense.call of
<tensorflow.python.layers.core.Dense object at 0x7f056fd77910>> could not be
transformed and will be executed as-is. Please report this to the AutgoGraph
team. When filing the bug, set the verbosity to 10 (on Linux, `export
AUTOGRAPH_VERBOSITY=10`) and attach the full output. Cause: converting <bound
method Dense.call of <tensorflow.python.layers.core.Dense object at
0x7f056fd77910>>: AssertionError: Bad argument number for Name: 3, expecting 4
WARNING: Entity <bound method Dense.call of <tensorflow.python.layers.core.Dense
object at 0x7f056fd77910>> could not be transformed and will be executed as-is.
Please report this to the AutgoGraph team. When filing the bug, set the
verbosity to 10 (on Linux, `export AUTOGRAPH_VERBOSITY=10`) and attach the full
output. Cause: converting <bound method Dense.call of
<tensorflow.python.layers.core.Dense object at 0x7f056fd77910>>: AssertionError:
Bad argument number for Name: 3, expecting 4
WARNING:tensorflow:Entity <bound method Dense.call of
<tensorflow.python.layers.core.Dense object at 0x7f056fd77fd0>> could not be
transformed and will be executed as-is. Please report this to the AutgoGraph
team. When filing the bug, set the verbosity to 10 (on Linux, `export
AUTOGRAPH_VERBOSITY=10`) and attach the full output. Cause: converting <bound
method Dense.call of <tensorflow.python.layers.core.Dense object at
0x7f056fd77fd0>>: AssertionError: Bad argument number for Name: 3, expecting 4
WARNING: Entity <bound method Dense.call of <tensorflow.python.layers.core.Dense
object at 0x7f056fd77fd0>> could not be transformed and will be executed as-is.
Please report this to the AutgoGraph team. When filing the bug, set the
verbosity to 10 (on Linux, `export AUTOGRAPH_VERBOSITY=10`) and attach the full
output. Cause: converting <bound method Dense.call of
<tensorflow.python.layers.core.Dense object at 0x7f056fd77fd0>>: AssertionError:
Bad argument number for Name: 3, expecting 4
WARNING:tensorflow:Entity <bound method Dense.call of
<tensorflow.python.layers.core.Dense object at 0x7f056fd77b50>> could not be
transformed and will be executed as-is. Please report this to the AutgoGraph
team. When filing the bug, set the verbosity to 10 (on Linux, `export
AUTOGRAPH_VERBOSITY=10`) and attach the full output. Cause: converting <bound
method Dense.call of <tensorflow.python.layers.core.Dense object at
0x7f056fd77b50>>: AssertionError: Bad argument number for Name: 3, expecting 4
WARNING: Entity <bound method Dense.call of <tensorflow.python.layers.core.Dense
object at 0x7f056fd77b50>> could not be transformed and will be executed as-is.
Please report this to the AutgoGraph team. When filing the bug, set the
verbosity to 10 (on Linux, `export AUTOGRAPH_VERBOSITY=10`) and attach the full
output. Cause: converting <bound method Dense.call of
<tensorflow.python.layers.core.Dense object at 0x7f056fd77b50>>: AssertionError:
Bad argument number for Name: 3, expecting 4
WARNING:tensorflow:Entity <bound method Dense.call of
<tensorflow.python.layers.core.Dense object at 0x7f056fd77b50>> could not be
transformed and will be executed as-is. Please report this to the AutgoGraph

team. When filing the bug, set the verbosity to 10 (on Linux, `export AUTOGRAPH_VERBOSITY=10`) and attach the full output. Cause: converting <bound method Dense.call of <tensorflow.python.layers.core.Dense object at 0x7f056fd77b50>>: AssertionError: Bad argument number for Name: 3, expecting 4
WARNING: Entity <bound method Dense.call of <tensorflow.python.layers.core.Dense object at 0x7f056fd77b50>> could not be transformed and will be executed as-is. Please report this to the AutgoGraph team. When filing the bug, set the verbosity to 10 (on Linux, `export AUTOGRAPH_VERBOSITY=10`) and attach the full output. Cause: converting <bound method Dense.call of <tensorflow.python.layers.core.Dense object at 0x7f056fd77b50>>: AssertionError: Bad argument number for Name: 3, expecting 4
WARNING:tensorflow:From /opt/conda/lib/python3.7/site-packages/stable_baselines/deepq/build_graph.py:149: add_dispatch_support.<locals>.wrapper (from tensorflow.python.ops.array_ops) is deprecated and will be removed in a future version.
Instructions for updating:
Use tf.where in 2.0, which has the same broadcast rule as np.where
WARNING:tensorflow:Entity <bound method Flatten.call of <tensorflow.python.layers.core.Flatten object at 0x7f056fce33d0>> could not be transformed and will be executed as-is. Please report this to the AutgoGraph team. When filing the bug, set the verbosity to 10 (on Linux, `export AUTOGRAPH_VERBOSITY=10`) and attach the full output. Cause: converting <bound method Flatten.call of <tensorflow.python.layers.core.Flatten object at 0x7f056fce33d0>>: AttributeError: module 'gast' has no attribute 'Num'
WARNING: Entity <bound method Flatten.call of <tensorflow.python.layers.core.Flatten object at 0x7f056fce33d0>> could not be transformed and will be executed as-is. Please report this to the AutgoGraph team. When filing the bug, set the verbosity to 10 (on Linux, `export AUTOGRAPH_VERBOSITY=10`) and attach the full output. Cause: converting <bound method Flatten.call of <tensorflow.python.layers.core.Flatten object at 0x7f056fce33d0>>: AttributeError: module 'gast' has no attribute 'Num'
WARNING:tensorflow:Entity <bound method Dense.call of <tensorflow.python.layers.core.Dense object at 0x7f056f3c8410>> could not be transformed and will be executed as-is. Please report this to the AutgoGraph team. When filing the bug, set the verbosity to 10 (on Linux, `export AUTOGRAPH_VERBOSITY=10`) and attach the full output. Cause: converting <bound method Dense.call of <tensorflow.python.layers.core.Dense object at 0x7f056f3c8410>>: AssertionError: Bad argument number for Name: 3, expecting 4
WARNING: Entity <bound method Dense.call of <tensorflow.python.layers.core.Dense object at 0x7f056f3c8410>> could not be transformed and will be executed as-is. Please report this to the AutgoGraph team. When filing the bug, set the verbosity to 10 (on Linux, `export AUTOGRAPH_VERBOSITY=10`) and attach the full output. Cause: converting <bound method Dense.call of <tensorflow.python.layers.core.Dense object at 0x7f056f3c8410>>: AssertionError: Bad argument number for Name: 3, expecting 4
WARNING:tensorflow:Entity <bound method Dense.call of <tensorflow.python.layers.core.Dense object at 0x7f056fd370d0>> could not be transformed and will be executed as-is. Please report this to the AutgoGraph

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team. When filing the bug, set the verbosity to 10 (on Linux, `export AUTOGRAPH_VERBOSITY=10`) and attach the full output. Cause: converting <bound method Dense.call of <tensorflow.python.layers.core.Dense object at 0x7f056fd370d0>>: AssertionError: Bad argument number for Name: 3, expecting 4
WARNING: Entity <bound method Dense.call of <tensorflow.python.layers.core.Dense object at 0x7f056fd370d0>> could not be transformed and will be executed as-is. Please report this to the AutgoGraph team. When filing the bug, set the verbosity to 10 (on Linux, `export AUTOGRAPH_VERBOSITY=10`) and attach the full output. Cause: converting <bound method Dense.call of <tensorflow.python.layers.core.Dense object at 0x7f056fd370d0>>: AssertionError: Bad argument number for Name: 3, expecting 4
WARNING:tensorflow:Entity <bound method Dense.call of <tensorflow.python.layers.core.Dense object at 0x7f056fd370d0>> could not be transformed and will be executed as-is. Please report this to the AutgoGraph team. When filing the bug, set the verbosity to 10 (on Linux, `export AUTOGRAPH_VERBOSITY=10`) and attach the full output. Cause: converting <bound method Dense.call of <tensorflow.python.layers.core.Dense object at 0x7f056fd370d0>>: AssertionError: Bad argument number for Name: 3, expecting 4
WARNING: Entity <bound method Dense.call of <tensorflow.python.layers.core.Dense object at 0x7f056fd370d0>> could not be transformed and will be executed as-is. Please report this to the AutgoGraph team. When filing the bug, set the verbosity to 10 (on Linux, `export AUTOGRAPH_VERBOSITY=10`) and attach the full output. Cause: converting <bound method Dense.call of <tensorflow.python.layers.core.Dense object at 0x7f056fd370d0>>: AssertionError: Bad argument number for Name: 3, expecting 4
WARNING:tensorflow:Entity <bound method Dense.call of <tensorflow.python.layers.core.Dense object at 0x7f056f3b2c10>> could not be transformed and will be executed as-is. Please report this to the AutgoGraph team. When filing the bug, set the verbosity to 10 (on Linux, `export AUTOGRAPH_VERBOSITY=10`) and attach the full output. Cause: converting <bound method Dense.call of <tensorflow.python.layers.core.Dense object at 0x7f056f3b2c10>>: AssertionError: Bad argument number for Name: 3, expecting 4
WARNING: Entity <bound method Dense.call of <tensorflow.python.layers.core.Dense object at 0x7f056f3b2c10>> could not be transformed and will be executed as-is. Please report this to the AutgoGraph team. When filing the bug, set the verbosity to 10 (on Linux, `export AUTOGRAPH_VERBOSITY=10`) and attach the full output. Cause: converting <bound method Dense.call of <tensorflow.python.layers.core.Dense object at 0x7f056f3b2c10>>: AssertionError: Bad argument number for Name: 3, expecting 4
WARNING:tensorflow:Entity <bound method Dense.call of <tensorflow.python.layers.core.Dense object at 0x7f056fcbcd90>> could not be transformed and will be executed as-is. Please report this to the AutgoGraph team. When filing the bug, set the verbosity to 10 (on Linux, `export AUTOGRAPH_VERBOSITY=10`) and attach the full output. Cause: converting <bound method Dense.call of <tensorflow.python.layers.core.Dense object at 0x7f056fcbcd90>>: AssertionError: Bad argument number for Name: 3, expecting 4
WARNING: Entity <bound method Dense.call of <tensorflow.python.layers.core.Dense object at 0x7f056fcbcd90>> could not be transformed and will be executed as-is.

Please report this to the AutgoGraph team. When filing the bug, set the verbosity to 10 (on Linux, `export AUTOGRAPH_VERBOSITY=10`) and attach the full output. Cause: converting <bound method Dense.call of <tensorflow.python.layers.core.Dense object at 0x7f056fcbcd90>>: AssertionError: Bad argument number for Name: 3, expecting 4
WARNING:tensorflow:Entity <bound method Dense.call of <tensorflow.python.layers.core.Dense object at 0x7f056fcbc090>> could not be transformed and will be executed as-is. Please report this to the AutgoGraph team. When filing the bug, set the verbosity to 10 (on Linux, `export AUTOGRAPH_VERBOSITY=10`) and attach the full output. Cause: converting <bound method Dense.call of <tensorflow.python.layers.core.Dense object at 0x7f056fcbc090>>: AssertionError: Bad argument number for Name: 3, expecting 4
WARNING: Entity <bound method Dense.call of <tensorflow.python.layers.core.Dense object at 0x7f056fcbc090>> could not be transformed and will be executed as-is. Please report this to the AutgoGraph team. When filing the bug, set the verbosity to 10 (on Linux, `export AUTOGRAPH_VERBOSITY=10`) and attach the full output. Cause: converting <bound method Dense.call of <tensorflow.python.layers.core.Dense object at 0x7f056fcbc090>>: AssertionError: Bad argument number for Name: 3, expecting 4
WARNING:tensorflow:Entity <bound method Flatten.call of <tensorflow.python.layers.core.Flatten object at 0x7f056fcbcd90>> could not be transformed and will be executed as-is. Please report this to the AutgoGraph team. When filing the bug, set the verbosity to 10 (on Linux, `export AUTOGRAPH_VERBOSITY=10`) and attach the full output. Cause: converting <bound method Flatten.call of <tensorflow.python.layers.core.Flatten object at 0x7f056fcbcd90>>: AttributeError: module 'gast' has no attribute 'Num'
WARNING: Entity <bound method Flatten.call of <tensorflow.python.layers.core.Flatten object at 0x7f056fcbcd90>> could not be transformed and will be executed as-is. Please report this to the AutgoGraph team. When filing the bug, set the verbosity to 10 (on Linux, `export AUTOGRAPH_VERBOSITY=10`) and attach the full output. Cause: converting <bound method Flatten.call of <tensorflow.python.layers.core.Flatten object at 0x7f056fcbcd90>>: AttributeError: module 'gast' has no attribute 'Num'
WARNING:tensorflow:Entity <bound method Dense.call of <tensorflow.python.layers.core.Dense object at 0x7f056f341b90>> could not be transformed and will be executed as-is. Please report this to the AutgoGraph team. When filing the bug, set the verbosity to 10 (on Linux, `export AUTOGRAPH_VERBOSITY=10`) and attach the full output. Cause: converting <bound method Dense.call of <tensorflow.python.layers.core.Dense object at 0x7f056f341b90>>: AssertionError: Bad argument number for Name: 3, expecting 4
WARNING: Entity <bound method Dense.call of <tensorflow.python.layers.core.Dense object at 0x7f056f341b90>> could not be transformed and will be executed as-is. Please report this to the AutgoGraph team. When filing the bug, set the verbosity to 10 (on Linux, `export AUTOGRAPH_VERBOSITY=10`) and attach the full output. Cause: converting <bound method Dense.call of <tensorflow.python.layers.core.Dense object at 0x7f056f341b90>>: AssertionError: Bad argument number for Name: 3, expecting 4
WARNING:tensorflow:Entity <bound method Dense.call of

<tensorflow.python.layers.core.Dense object at 0x7f056fd37e50>> could not be
transformed and will be executed as-is. Please report this to the AutgoGraph
team. When filing the bug, set the verbosity to 10 (on Linux, `export
AUTOGRAPH_VERBOSITY=10`) and attach the full output. Cause: converting <bound
method Dense.call of <tensorflow.python.layers.core.Dense object at
0x7f056fd37e50>>: AssertionError: Bad argument number for Name: 3, expecting 4
WARNING: Entity <bound method Dense.call of <tensorflow.python.layers.core.Dense
object at 0x7f056fd37e50>> could not be transformed and will be executed as-is.
Please report this to the AutgoGraph team. When filing the bug, set the
verbosity to 10 (on Linux, `export AUTOGRAPH_VERBOSITY=10`) and attach the full
output. Cause: converting <bound method Dense.call of
<tensorflow.python.layers.core.Dense object at 0x7f056fd37e50>>: AssertionError:
Bad argument number for Name: 3, expecting 4
WARNING:tensorflow:Entity <bound method Dense.call of
<tensorflow.python.layers.core.Dense object at 0x7f056f341b90>> could not be
transformed and will be executed as-is. Please report this to the AutgoGraph
team. When filing the bug, set the verbosity to 10 (on Linux, `export
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WARNING:tensorflow:From /opt/conda/lib/python3.7/site-
packages/stable_baselines/deepq/build_graph.py:415: The name tf.summary.scalar
is deprecated. Please use tf.compat.v1.summary.scalar instead.

WARNING:tensorflow:From /opt/conda/lib/python3.7/site-
packages/stable_baselines/deepq/build_graph.py:449: The name
tf.summary.merge_all is deprecated. Please use tf.compat.v1.summary.merge_all
instead.

--------------------------------------
| % time spent exploring  | 5        |
| episodes                | 10       |
| mean 100 episode reward | 1.14e+03 |
| steps                   | 36864    |
--------------------------------------
--------------------------------------
| % time spent exploring  | 5        |
| episodes                | 20       |
| mean 100 episode reward | 1.41e+03 |
| steps                   | 77824    |
--------------------------------------
--------------------------------------
| % time spent exploring  | 5        |
| episodes                | 30       |
| mean 100 episode reward | 1.76e+03 |
```

```
| steps                   | 118784   |
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| % time spent exploring  | 5        |
| episodes                | 40       |
| mean 100 episode reward | 1.97e+03 |
| steps                   | 159744   |
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| % time spent exploring  | 5        |
| episodes                | 50       |
| mean 100 episode reward | 2.1e+03  |
| steps                   | 200704   |
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| % time spent exploring  | 5        |
| episodes                | 60       |
| mean 100 episode reward | 2.22e+03 |
| steps                   | 241664   |
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| % time spent exploring  | 5        |
| episodes                | 70       |
| mean 100 episode reward | 2.3e+03  |
| steps                   | 282624   |
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| % time spent exploring  | 5        |
| episodes                | 80       |
| mean 100 episode reward | 2.39e+03 |
| steps                   | 323584   |
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| % time spent exploring  | 5        |
| episodes                | 90       |
| mean 100 episode reward | 2.47e+03 |
| steps                   | 364544   |
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-----------------------------------
| % time spent exploring  | 5        |
| episodes                | 100      |
| mean 100 episode reward | 2.54e+03 |
| steps                   | 405504   |
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-----------------------------------
| % time spent exploring  | 5        |
| episodes                | 110      |
| mean 100 episode reward | 2.75e+03 |
```

```
| steps                   | 446464   |
------------------------------------
------------------------------------
| % time spent exploring  | 5        |
| episodes                | 120      |
| mean 100 episode reward | 2.94e+03 |
| steps                   | 487424   |
------------------------------------
------------------------------------
| % time spent exploring  | 5        |
| episodes                | 130      |
| mean 100 episode reward | 3.05e+03 |
| steps                   | 528384   |
------------------------------------
------------------------------------
| % time spent exploring  | 5        |
| episodes                | 140      |
| mean 100 episode reward | 3.14e+03 |
| steps                   | 569344   |
------------------------------------
------------------------------------
| % time spent exploring  | 5        |
| episodes                | 150      |
| mean 100 episode reward | 3.23e+03 |
| steps                   | 610304   |
------------------------------------
------------------------------------
| % time spent exploring  | 5        |
| episodes                | 160      |
| mean 100 episode reward | 3.3e+03  |
| steps                   | 651264   |
------------------------------------
------------------------------------
| % time spent exploring  | 5        |
| episodes                | 170      |
| mean 100 episode reward | 3.38e+03 |
| steps                   | 692224   |
------------------------------------
------------------------------------
| % time spent exploring  | 5        |
| episodes                | 180      |
| mean 100 episode reward | 3.45e+03 |
| steps                   | 733184   |
------------------------------------
------------------------------------
| % time spent exploring  | 5        |
| episodes                | 190      |
| mean 100 episode reward | 3.5e+03  |
```

```
| steps                   | 774144   |
-------------------------------------
-------------------------------------
| % time spent exploring  | 5        |
| episodes                | 200      |
| mean 100 episode reward | 3.55e+03 |
| steps                   | 815104   |
-------------------------------------
-------------------------------------
| % time spent exploring  | 5        |
| episodes                | 210      |
| mean 100 episode reward | 3.57e+03 |
| steps                   | 856064   |
-------------------------------------
-------------------------------------
| % time spent exploring  | 5        |
| episodes                | 220      |
| mean 100 episode reward | 3.59e+03 |
| steps                   | 897024   |
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-------------------------------------
| % time spent exploring  | 5        |
| episodes                | 230      |
| mean 100 episode reward | 3.61e+03 |
| steps                   | 937984   |
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-------------------------------------
| % time spent exploring  | 5        |
| episodes                | 240      |
| mean 100 episode reward | 3.63e+03 |
| steps                   | 978944   |
-------------------------------------
DQN Training Time: 4089.9156403541565
```

```python
[20]: def ids_dqn_eval(dqn_model):
          attempts, correct = 0,0

          env = IdsEnv(images_per_episode=1, dataset=(x_test, y_test), random=False)

          try:
              while True:
                  obs, done = env.reset(), False
                  while not done:
                      obs, rew, done, _ = env.step(dqn_model.predict(obs)[0])

                      attempts += 1
                      if rew > 0:
```

```
                    correct += 1

    except StopIteration:
        print()
        print('validation done...')
        print('Accuracy: {0}%'.format((float(correct) / attempts) * 100))

ids_dqn_eval(dqn_model)
```

/opt/conda/lib/python3.7/site-packages/gym/logger.py:30: UserWarning: WARN:

Box bound precision lowered by casting to float32
  warnings.warn(colorize('%s: %s'%('WARN', msg % args), 'yellow'))

validation done…
Accuracy: 97.57575757575758%

[ ]: