

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

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: 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: pygame<=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: 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 pygame<=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: pandas in /opt/conda/lib/python3.7/site-packages
(from stable-baselines) (1.0.4)
Requirement already satisfied: cloudpickle>=0.5.5 in
/opt/conda/lib/python3.7/site-packages (from stable-baselines) (1.2.2)
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: opencv-python in /opt/conda/lib/python3.7/site-
packages (from stable-baselines) (4.5.5.64)
Requirement already satisfied: scipy in /opt/conda/lib/python3.7/site-packages
(from stable-baselines) (1.4.1)
Requirement already satisfied: numpy in /opt/conda/lib/python3.7/site-packages
(from stable-baselines) (1.18.5)
Requirement already satisfied: matplotlib in /opt/conda/lib/python3.7/site-
packages (from stable-baselines) (3.2.1)
Requirement already satisfied: python-dateutil>=2.6.1 in
/opt/conda/lib/python3.7/site-packages (from pandas->stable-baselines) (2.8.1)
Requirement already satisfied: pytz>=2017.2 in /opt/conda/lib/python3.7/site-
packages (from pandas->stable-baselines) (2020.1)
Requirement already satisfied: pygame<=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: 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: kiwisolver>=1.0.1 in
/opt/conda/lib/python3.7/site-packages (from matplotlib->stable-baselines)
(1.2.0)
Requirement already satisfied: cycler>=0.10 in /opt/conda/lib/python3.7/site-
packages (from matplotlib->stable-baselines) (0.10.0)
Requirement already satisfied: future in /opt/conda/lib/python3.7/site-packages

```

```

(from pygame<=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: 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: 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: wheel>=0.26 in
/opt/conda/lib/python3.7/site-packages (from tensorflow==1.14.0) (0.34.2)
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: 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: 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: 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: 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: 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: 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: 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: 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: 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: 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: 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: 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: setuptools in
/opt/conda/lib/python3.7/site-packages (from
protobuf>=3.6.1->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: 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: 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: six in /opt/conda/lib/python3.7/site-packages
(from gym) (1.15.0)
Requirement already satisfied: pygamelet<=1.5.0,>=1.4.0 in
/opt/conda/lib/python3.7/site-packages (from gym) (1.5.0)
Requirement already satisfied: cloudpickle~=1.2.0 in
/opt/conda/lib/python3.7/site-packages (from gym) (1.2.2)
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: future in /opt/conda/lib/python3.7/site-packages
(from pygamelet<=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]: 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."

```

```

[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)

```

69

```

[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]

```
[4]: ciccdo2017_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))
```

7

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

(62,)

```
[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]: 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()
    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]

```

```

[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]: 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([ 19374,  43361,  97654,  15914,  39048,  11154, 121300,  86914,
            59517,  22352,
            ...,
            137702, 136363, 132396,  98712,  65215,  65343,  90889, 128051,
            14398, 127833],
            dtype='int64', length=52183)
1.0    42912
0.0    42912
Name: Label, dtype: int64
38620

```

```

[10]: 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]: print(x_train.shape)
```

```
(77240, 5)
```

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

```
Int64Index([ 9137,  51570, 125436,  49633,  95426,  25212,  51797,  84451,
            134552,  88354,
            ...,
            74374, 116577, 104883, 117272,  12728,  96512, 109301,  67988,
            13635,  85080],
            dtype='int64', length=77240)
Int64Index([ 9137,  51570, 125436,  49633,  95426,  25212,  51797,  84451,
            134552,  88354,
            ...,
            74374, 116577, 104883, 117272,  12728,  96512, 109301,  67988,
            13635,  85080],
            dtype='int64', length=77240)
```

```
[13]: # 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]: print(x_train.index)
print(y_train.index)
```

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

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

```

Label      0.0
Name: 17162, dtype: float32

```

```
[17]: 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]: 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 detecting 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
        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

```

[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 0x7f251b14c510>> could not be transformed and will be executed as-is. Please report this to the AutoGraph 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 0x7f251b14c510>>: 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 0x7f251b14c510>> could not be transformed and will be executed as-is. Please report this to the AutoGraph 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 0x7f251b14c510>>: AttributeError: module 'gast' has no attribute 'Num'

WARNING:tensorflow:Entity <bound method Dense.call of <tensorflow.python.layers.core.Dense object at 0x7f2521538c90>> could not be transformed and will be executed as-is. Please report this to the AutoGraph 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 0x7f2521538c90>>: AssertionError: Bad argument number for Name: 3, expecting 4
WARNING: Entity <bound method Dense.call of <tensorflow.python.layers.core.Dense object at 0x7f2521538c90>> could not be transformed and will be executed as-is. Please report this to the AutoGraph 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 0x7f2521538c90>>: AssertionError: Bad argument number for Name: 3, expecting 4

WARNING:tensorflow:Entity <bound method Dense.call of <tensorflow.python.layers.core.Dense object at 0x7f251b1355d0>> could not be transformed and will be executed as-is. Please report this to the AutoGraph 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 0x7f251b1355d0>>: AssertionError: Bad argument number for Name: 3, expecting 4
WARNING: Entity <bound method Dense.call of <tensorflow.python.layers.core.Dense object at 0x7f251b1355d0>> could not be transformed and will be executed as-is. Please report this to the AutoGraph 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 0x7f251b1355d0>>: AssertionError:
Bad argument number for Name: 3, expecting 4
WARNING:tensorflow:Entity <bound method Dense.call of
<tensorflow.python.layers.core.Dense object at 0x7f251b14c610>> 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
0x7f251b14c610>>: AssertionError: Bad argument number for Name: 3, expecting 4
WARNING: Entity <bound method Dense.call of <tensorflow.python.layers.core.Dense
object at 0x7f251b14c610>> 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 0x7f251b14c610>>: AssertionError:
Bad argument number for Name: 3, expecting 4
WARNING:tensorflow:Entity <bound method Dense.call of
<tensorflow.python.layers.core.Dense object at 0x7f251b135310>> 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
0x7f251b135310>>: AssertionError: Bad argument number for Name: 3, expecting 4
WARNING: Entity <bound method Dense.call of <tensorflow.python.layers.core.Dense
object at 0x7f251b135310>> 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 0x7f251b135310>>: AssertionError:
Bad argument number for Name: 3, expecting 4
WARNING:tensorflow:Entity <bound method Dense.call of
<tensorflow.python.layers.core.Dense object at 0x7f251b0d0dd0>> 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
0x7f251b0d0dd0>>: AssertionError: Bad argument number for Name: 3, expecting 4
WARNING: Entity <bound method Dense.call of <tensorflow.python.layers.core.Dense
object at 0x7f251b0d0dd0>> 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 0x7f251b0d0dd0>>: AssertionError:
Bad argument number for Name: 3, expecting 4
WARNING:tensorflow:Entity <bound method Dense.call of
<tensorflow.python.layers.core.Dense object at 0x7f251b135990>> 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 0x7f251b135990>>: AssertionError: Bad argument number for Name: 3, expecting 4
WARNING: Entity <bound method Dense.call of <tensorflow.python.layers.core.Dense object at 0x7f251b135990>> 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 0x7f251b135990>>: 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 0x7f251a8c4dd0>> 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 0x7f251a8c4dd0>>: AttributeError: module 'gast' has no attribute 'Num'
WARNING: Entity <bound method Flatten.call of <tensorflow.python.layers.core.Flatten object at 0x7f251a8c4dd0>> 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 0x7f251a8c4dd0>>: AttributeError: module 'gast' has no attribute 'Num'
WARNING:tensorflow:Entity <bound method Dense.call of <tensorflow.python.layers.core.Dense object at 0x7f251b109390>> 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 0x7f251b109390>>: AssertionError: Bad argument number for Name: 3, expecting 4
WARNING: Entity <bound method Dense.call of <tensorflow.python.layers.core.Dense object at 0x7f251b109390>> 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 0x7f251b109390>>: AssertionError: Bad argument number for Name: 3, expecting 4
WARNING:tensorflow:Entity <bound method Dense.call of <tensorflow.python.layers.core.Dense object at 0x7f251a907650>> 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 0x7f251a907650>>: AssertionError: Bad argument number for Name: 3, expecting 4
WARNING: Entity <bound method Dense.call of <tensorflow.python.layers.core.Dense object at 0x7f251a907650>> could not be transformed and will be executed as-is. Please report this to the AutoGraph 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 0x7f251a907650>>: AssertionError: Bad argument number for Name: 3, expecting 4
WARNING:tensorflow:Entity <bound method Dense.call of <tensorflow.python.layers.core.Dense object at 0x7f251b039f10>> could not be transformed and will be executed as-is. Please report this to the AutoGraph 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 0x7f251b039f10>>: AssertionError: Bad argument number for Name: 3, expecting 4
WARNING:tensorflow:Entity <bound method Dense.call of <tensorflow.python.layers.core.Dense object at 0x7f251b039f10>> could not be transformed and will be executed as-is. Please report this to the AutoGraph 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 0x7f251b039f10>>: AssertionError: Bad argument number for Name: 3, expecting 4
WARNING:tensorflow:Entity <bound method Dense.call of <tensorflow.python.layers.core.Dense object at 0x7f251b094f10>> could not be transformed and will be executed as-is. Please report this to the AutoGraph 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 0x7f251b094f10>>: AssertionError: Bad argument number for Name: 3, expecting 4
WARNING:tensorflow:Entity <bound method Dense.call of <tensorflow.python.layers.core.Dense object at 0x7f251b094f10>> could not be transformed and will be executed as-is. Please report this to the AutoGraph 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 0x7f251b094f10>>: AssertionError: Bad argument number for Name: 3, expecting 4
WARNING:tensorflow:Entity <bound method Dense.call of <tensorflow.python.layers.core.Dense object at 0x7f251a907e10>> could not be transformed and will be executed as-is. Please report this to the AutoGraph 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 0x7f251a907e10>>: AssertionError: Bad argument number for Name: 3, expecting 4
WARNING:tensorflow:Entity <bound method Dense.call of <tensorflow.python.layers.core.Dense object at 0x7f251a907e10>> could not be transformed and will be executed as-is. Please report this to the AutoGraph 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 0x7f251a907e10>>: AssertionError: Bad argument number for Name: 3, expecting 4
 WARNING:tensorflow:Entity <bound method Dense.call of <tensorflow.python.layers.core.Dense object at 0x7f251b111690>> could not be transformed and will be executed as-is. Please report this to the AutoGraph 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 0x7f251b111690>>: AssertionError: Bad argument number for Name: 3, expecting 4
 WARNING: Entity <bound method Dense.call of <tensorflow.python.layers.core.Dense object at 0x7f251b111690>> could not be transformed and will be executed as-is. Please report this to the AutoGraph 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 0x7f251b111690>>: AssertionError: Bad argument number for Name: 3, expecting 4
 WARNING:tensorflow:Entity <bound method Flatten.call of <tensorflow.python.layers.core.Flatten object at 0x7f251a907e10>> could not be transformed and will be executed as-is. Please report this to the AutoGraph 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 0x7f251a907e10>>: AttributeError: module 'gast' has no attribute 'Num'
 WARNING: Entity <bound method Flatten.call of <tensorflow.python.layers.core.Flatten object at 0x7f251a907e10>> could not be transformed and will be executed as-is. Please report this to the AutoGraph 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 0x7f251a907e10>>: AttributeError: module 'gast' has no attribute 'Num'
 WARNING:tensorflow:Entity <bound method Dense.call of <tensorflow.python.layers.core.Dense object at 0x7f251b07fe90>> could not be transformed and will be executed as-is. Please report this to the AutoGraph 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 0x7f251b07fe90>>: AssertionError: Bad argument number for Name: 3, expecting 4
 WARNING: Entity <bound method Dense.call of <tensorflow.python.layers.core.Dense object at 0x7f251b07fe90>> could not be transformed and will be executed as-is. Please report this to the AutoGraph 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 0x7f251b07fe90>>: AssertionError: Bad argument number for Name: 3, expecting 4
 WARNING:tensorflow:Entity <bound method Dense.call of <tensorflow.python.layers.core.Dense object at 0x7f251b07f250>> could not be

transformed and will be executed as-is. Please report this to the AutoGraph 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 0x7f251b07f250>>: AssertionError: Bad argument number for Name: 3, expecting 4
WARNING: Entity <bound method Dense.call of <tensorflow.python.layers.core.Dense object at 0x7f251b07f250>> could not be transformed and will be executed as-is. Please report this to the AutoGraph 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 0x7f251b07f250>>: AssertionError: Bad argument number for Name: 3, expecting 4
WARNING:tensorflow:Entity <bound method Dense.call of <tensorflow.python.layers.core.Dense object at 0x7f251b07f250>> could not be transformed and will be executed as-is. Please report this to the AutoGraph 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 0x7f251b07f250>>: AssertionError: Bad argument number for Name: 3, expecting 4
WARNING:tensorflow:Entity <bound method Dense.call of <tensorflow.python.layers.core.Dense object at 0x7f251b031250>> could not be transformed and will be executed as-is. Please report this to the AutoGraph 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 0x7f251b031250>>: AssertionError: Bad argument number for Name: 3, expecting 4
WARNING:tensorflow:Entity <bound method Dense.call of <tensorflow.python.layers.core.Dense object at 0x7f251b031250>> could not be transformed and will be executed as-is. Please report this to the AutoGraph 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 0x7f251b031250>>: AssertionError: Bad argument number for Name: 3, expecting 4
WARNING:tensorflow:Entity <bound method Dense.call of <tensorflow.python.layers.core.Dense object at 0x7f251b0311d0>> could not be transformed and will be executed as-is. Please report this to the AutoGraph 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 0x7f251b0311d0>>: AssertionError: Bad argument number for Name: 3, expecting 4
WARNING: Entity <bound method Dense.call of <tensorflow.python.layers.core.Dense

object at 0x7f251b0311d0>> 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 0x7f251b0311d0>>: AssertionError: Bad argument number for Name: 3, expecting 4

WARNING:tensorflow:Entity <bound method Dense.call of <tensorflow.python.layers.core.Dense object at 0x7f251b031250>> 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 0x7f251b031250>>: AssertionError: Bad argument number for Name: 3, expecting 4

WARNING: Entity <bound method Dense.call of <tensorflow.python.layers.core.Dense object at 0x7f251b031250>> 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 0x7f251b031250>>: AssertionError: Bad argument number for Name: 3, expecting 4

WARNING:tensorflow:Entity <bound method Flatten.call of <tensorflow.python.layers.core.Flatten object at 0x7f251b094b50>> 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 0x7f251b094b50>>: AttributeError: module 'gast' has no attribute 'Num'

WARNING: Entity <bound method Flatten.call of <tensorflow.python.layers.core.Flatten object at 0x7f251b094b50>> 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 0x7f251b094b50>>: AttributeError: module 'gast' has no attribute 'Num'

WARNING:tensorflow:Entity <bound method Dense.call of <tensorflow.python.layers.core.Dense object at 0x7f251a520c90>> 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 0x7f251a520c90>>: AssertionError: Bad argument number for Name: 3, expecting 4

WARNING: Entity <bound method Dense.call of <tensorflow.python.layers.core.Dense object at 0x7f251a520c90>> 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 0x7f251a520c90>>: AssertionError: Bad argument number for Name: 3, expecting 4

WARNING:tensorflow:Entity <bound method Dense.call of <tensorflow.python.layers.core.Dense object at 0x7f251a5e8ed0>> 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 0x7f251a5e8ed0>>: AssertionError: Bad argument number for Name: 3, expecting 4

WARNING: Entity <bound method Dense.call of <tensorflow.python.layers.core.Dense object at 0x7f251a5e8ed0>> 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 0x7f251a5e8ed0>>: AssertionError: Bad argument number for Name: 3, expecting 4

WARNING:tensorflow:Entity <bound method Dense.call of <tensorflow.python.layers.core.Dense object at 0x7f251a82ee90>> 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 0x7f251a82ee90>>: AssertionError: Bad argument number for Name: 3, expecting 4

WARNING: Entity <bound method Dense.call of <tensorflow.python.layers.core.Dense object at 0x7f251a82ee90>> 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 0x7f251a82ee90>>: AssertionError: Bad argument number for Name: 3, expecting 4

WARNING:tensorflow:Entity <bound method Dense.call of <tensorflow.python.layers.core.Dense object at 0x7f251a5ca8d0>> 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 0x7f251a5ca8d0>>: AssertionError: Bad argument number for Name: 3, expecting 4

WARNING: Entity <bound method Dense.call of <tensorflow.python.layers.core.Dense object at 0x7f251a5ca8d0>> 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 0x7f251a5ca8d0>>: AssertionError: Bad argument number for Name: 3, expecting 4

WARNING:tensorflow:Entity <bound method Dense.call of <tensorflow.python.layers.core.Dense object at 0x7f251b1027d0>> 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 0x7f251b1027d0>>: AssertionError: Bad argument number for Name: 3, expecting 4

```

0x7f251b1027d0>>: AssertionError: Bad argument number for Name: 3, expecting 4
WARNING: Entity <bound method Dense.call of <tensorflow.python.layers.core.Dense
object at 0x7f251b1027d0>> 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 0x7f251b1027d0>>: AssertionError:
Bad argument number for Name: 3, expecting 4
WARNING:tensorflow:Entity <bound method Dense.call of
<tensorflow.python.layers.core.Dense object at 0x7f251b1027d0>> 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
0x7f251b1027d0>>: AssertionError: Bad argument number for Name: 3, expecting 4
WARNING: Entity <bound method Dense.call of <tensorflow.python.layers.core.Dense
object at 0x7f251b1027d0>> 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 0x7f251b1027d0>>: 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: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 | 2.05e+03   |
| steps                  | 36864      |
-----
| % time spent exploring | 5          |
| episodes               | 20         |
| mean 100 episode reward | 1.91e+03   |
| steps                  | 77824      |
-----
| % time spent exploring | 5          |
| episodes               | 30         |
| mean 100 episode reward | 2.1e+03    |
| steps                  | 118784     |
-----

```


% time spent exploring	5	
episodes	40	
mean 100 episode reward	2.23e+03	
steps	159744	

% time spent exploring	5	
episodes	50	
mean 100 episode reward	2.33e+03	
steps	200704	

% time spent exploring	5	
episodes	60	
mean 100 episode reward	2.42e+03	
steps	241664	

% time spent exploring	5	
episodes	70	
mean 100 episode reward	2.5e+03	
steps	282624	

% time spent exploring	5	
episodes	80	
mean 100 episode reward	2.56e+03	
steps	323584	

% time spent exploring	5	
episodes	90	
mean 100 episode reward	2.62e+03	
steps	364544	

% time spent exploring	5	
episodes	100	
mean 100 episode reward	2.68e+03	
steps	405504	

% time spent exploring	5	
episodes	110	
mean 100 episode reward	2.83e+03	
steps	446464	

% time spent exploring	5	
episodes	120	
mean 100 episode reward	3.01e+03	
steps	487424	

% time spent exploring	5	
episodes	130	
mean 100 episode reward	3.11e+03	
steps	528384	

% time spent exploring	5	
episodes	140	
mean 100 episode reward	3.2e+03	
steps	569344	

% time spent exploring	5	
episodes	150	
mean 100 episode reward	3.28e+03	
steps	610304	

% time spent exploring	5	
episodes	160	
mean 100 episode reward	3.35e+03	
steps	651264	

% time spent exploring	5	
episodes	170	
mean 100 episode reward	3.41e+03	
steps	692224	

% time spent exploring	5	
episodes	180	
mean 100 episode reward	3.46e+03	
steps	733184	

% time spent exploring	5	
episodes	190	
mean 100 episode reward	3.52e+03	
steps	774144	

% time spent exploring	5	
episodes	200	
mean 100 episode reward	3.56e+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	

% time spent exploring	5	
episodes	230	
mean 100 episode reward	3.61e+03	
steps	937984	

% time spent exploring	5	
episodes	240	
mean 100 episode reward	3.63e+03	
steps	978944	

DQN Training Time: 4326.327658891678

```
[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: 96.10722610722611%

[]:

