training_NB

October 1, 2020

1 Naive Bayes - Supervised Machine Learning Algorithm

[1]:

```python
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
#from xgboost import plot_importance
from numpy import loadtxt
#from xgboost import XGBClassifier
from sklearn.model_selection import train_test_split
from sklearn.metrics import accuracy_score
from sklearn.metrics import f1_score
from sklearn.metrics import precision_score
import pickle
#from tqdm import tqdm
from sklearn.metrics import confusion_matrix
from sklearn.naive_bayes import GaussianNB
from sklearn.naive_bayes import BernoulliNB
from sklearn.metrics import recall_score
```

2 Reading the Data from the CSV File

[2]:

```python
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt

train = pd.read_csv("final_dataset.csv",index_col=0)
train.head()
```

```
/usr/local/Cellar/jupyterlab/2.2.8/libexec/lib/python3.8/site-
packages/numpy/lib/arraysetops.py:580: FutureWarning: elementwise comparison
failed; returning scalar instead, but in the future will perform elementwise
comparison
  mask |= (ar1 == a)
```

[2]:

```
                                    Flow ID          Src IP  Src Port  \
624   192.168.4.118-203.73.24.75-4504-80-6   192.168.4.118      4504
```

```
625  192.168.4.118-203.73.24.75-4504-80-6  192.168.4.118      4504
626  192.168.4.118-203.73.24.75-4505-80-6  192.168.4.118      4505
627  192.168.4.118-203.73.24.75-4505-80-6  192.168.4.118      4505
628  192.168.4.118-203.73.24.75-4506-80-6  192.168.4.118      4506

           Dst IP  Dst Port  Protocol               Timestamp  Flow Duration  \
624  203.73.24.75        80         6  12/06/2010 08:34:32 AM        3974862
625  203.73.24.75        80         6  12/06/2010 08:34:36 AM             63
626  203.73.24.75        80         6  12/06/2010 08:34:36 AM         476078
627  203.73.24.75        80         6  12/06/2010 08:34:37 AM            151
628  203.73.24.75        80         6  12/06/2010 08:34:37 AM         472507

     Tot Fwd Pkts  Tot Bwd Pkts  …  Fwd Seg Size Min  Active Mean  \
624            29            44  …                 0          0.0
625             1             1  …                 0          0.0
626             2             6  …                 0          0.0
627             2             1  …                 0          0.0
628             2             5  …                 0          0.0

     Active Std  Active Max  Active Min  Idle Mean  Idle Std  Idle Max  \
624         0.0         0.0         0.0        0.0       0.0       0.0
625         0.0         0.0         0.0        0.0       0.0       0.0
626         0.0         0.0         0.0        0.0       0.0       0.0
627         0.0         0.0         0.0        0.0       0.0       0.0
628         0.0         0.0         0.0        0.0       0.0       0.0

     Idle Min  Label
624       0.0   ddos
625       0.0   ddos
626       0.0   ddos
627       0.0   ddos
628       0.0   ddos

[5 rows x 84 columns]
```

3 Dimensions of the DataFrame read from the CSV file

[3]:

```
l = train.shape
print("Number of Rows: ",l[0])
print("Number of Columns: ",l[1])
```

```
Number of Rows:  12794627
Number of Columns:  84
```

4 Unique Elements in Label Section are DDOS and Benign

[4]:
```
train.Label.unique()
```

[4]:
```
array(['ddos', 'Benign'], dtype=object)
```

5 Labelling DDOS with 1 and Benign with 0 in the corresponding Label Column

[5]:
```
train['Label'] = train.Label.map({'ddos':1, 'Benign':0})
train.Label.unique()
```

[5]:
```
array([1, 0])
```

6 Finding out the count of NAN values in Flow Byts/s Column

[6]:
```
h = train['Flow Byts/s'].isna().sum()
p = train['Flow Byts/s'].dtype
print("Column Flow Byts/s has NAN values in it with count as",h)
```

```
Column Flow Byts/s has NAN values in it with count as 29713
```

7 Removing rows which have NAN values in Flow Byts/s column

[7]:
```
train.dropna(subset = ["Flow Byts/s"], inplace=True)
train.shape
```

[7]:
```
(12764914, 84)
```

8 Checking sum of NAN values in each column of the Train DataFrame

[8]:
```
h = train.isna().sum()
l = len(h)
for i in range (0,l):
    print(i,h[i])
```

```
0 0
1 0
2 0
3 0
4 0
5 0
```

```
6 0
7 0
8 0
9 0
10 0
11 0
12 0
13 0
14 0
15 0
16 0
17 0
18 0
19 0
20 0
21 0
22 0
23 0
24 0
25 0
26 0
27 0
28 0
29 0
30 0
31 0
32 0
33 0
34 0
35 0
36 0
37 0
38 0
39 0
40 0
41 0
42 0
43 0
44 0
45 0
46 0
47 0
48 0
49 0
50 0
51 0
52 0
53 0
```

```
54  0
55  0
56  0
57  0
58  0
59  0
60  0
61  0
62  0
63  0
64  0
65  0
66  0
67  0
68  0
69  0
70  0
71  0
72  0
73  0
74  0
75  0
76  0
77  0
78  0
79  0
80  0
81  0
82  0
83  0
```

9 Preprocessing for object and float data type columns

[9]:

```python
from sklearn import preprocessing
for f in train.columns:
    if train[f].dtype == 'object':
        lbl = preprocessing.LabelEncoder()
        lbl.fit(list(train[f].values))
        train[f] = lbl.transform(list(train[f].values))
    elif train[f].dtype == 'float64':
        lbl = preprocessing.LabelEncoder()
        lbl.fit(list(train[f].values))
        train[f] = lbl.transform(list(train[f].values))
train=np.array(train)
train = train.astype(float)
```

10 Conversion of Numpy array to Data Frame, Creating X and Y data frame by seperating Label Column

[10]:

```
d0 = pd.DataFrame(train)
X = d0.drop(83,axis=1)
Y = d0[83]
```

11 Dimension of d0, X and Y

[11]:

```
p = d0.shape
q = X.shape
r = Y.shape
print(p)
print(q)
print(r)
```

```
(12764914, 84)
(12764914, 83)
(12764914,)
```

12 Splitting of Train and Test data from the X and Y

[12]:

```
seed = 7
test_size = 0.33
X_train, X_test, y_train, y_test = train_test_split(X, Y, test_size=test_size,␣
 ↪random_state=seed)
```

13 Dimensions of Train and Test data in X and Y

[13]:

```
u = X_train.shape
v = y_train.shape
w = X_test.shape
z = y_test.shape
print(u)
print(v)
print(w)
print(z)
```

```
(8552492, 83)
(8552492,)
(4212422, 83)
(4212422,)
```

14 Time to model the data and predict the y values based on X_test dataset

[14]:

```
%%time
model=BernoulliNB(binarize=0.0)
model.fit(X_train, y_train)
y_pred = model.predict(X_test)
```

```
CPU times: user 31.8 s, sys: 1min 10s, total: 1min 41s
Wall time: 2min 7s
```

15 Evaluation Metrics of y_test score with y_pred score

[15]:

```
accuracy = accuracy_score(y_test, y_pred)
print("accuracy:",accuracy)

f1score=f1_score(y_test, y_pred)
print("f1-acore:",f1score)

cm=confusion_matrix(y_test, y_pred)
print("confusion matrix:\n",cm)
pr=precision_score(y_test,y_pred)
print("Precision:",pr)
rs=recall_score(y_test,y_pred)
print("Recall_score:",rs)
misclassified_samples = X_test[y_test != y_pred]
mc=misclassified_samples.shape[0]
print("Misclassified :",mc)
```

```
accuracy: 0.8486056240329197
f1-acore: 0.857094007058165
confusion matrix:
 [[1662237  414181]
 [ 223556 1912448]]
Precision: 0.8219823616055676
Recall_score: 0.8953391473049676
Misclassified : 637737
```

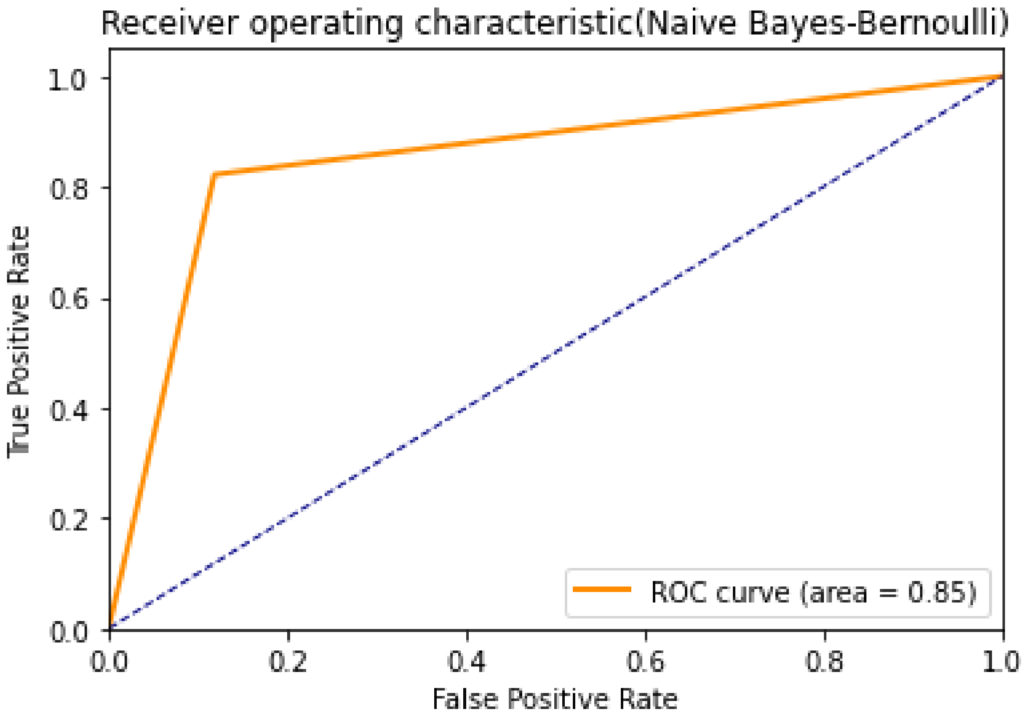
16 ROC curve for the evaluation metrics found above

[16]:

```
from sklearn.metrics import roc_curve, auc
fpr, tpr, thresholds = roc_curve(y_pred, y_test)
roc_auc = auc(fpr, tpr)

plt.figure()
plt.plot(fpr, tpr, color='darkorange', lw=2, label='ROC curve (area = %0.2f)' % roc_auc)
plt.plot([0, 1], [0, 1], color='navy', lw=1, linestyle='--')
plt.xlim([0.0, 1.0])
plt.ylim([0.0, 1.05])
plt.xlabel('False Positive Rate')
plt.ylabel('True Positive Rate')
plt.title('Receiver operating characteristic(Naive Bayes-Bernoulli)')
plt.legend(loc="lower right")
```

```
[16]: <matplotlib.legend.Legend at 0x131b7efa0>
```



```
[ ]:
```