SMS Classifier_Bernoulli NB

October 6, 2020

0.1 SMS Spam Classifier: Bernoulli Naive Bayes

The notebook is divided into the following sections: 1. Importing and preprocessing data 2. Building the model: Bernoulli Naive Bayes

```
In [2]: import pandas as pd
        docs = pd.read_table('SMSSpamCollection', header=None, names=['Class', 'sms'])
        docs.head()
```

```
Out[2]:   Class                                                sms
        0   ham  Go until jurong point, crazy.. Available only ...
        1   ham                      Ok lar... Joking wif u oni...
        2  spam  Free entry in 2 a wkly comp to win FA Cup fina...
        3   ham  U dun say so early hor... U c already then say...
        4   ham  Nah I don't think he goes to usf, he lives aro...
```

```
In [3]: #df.column_name.value_counts() - gives no. of unique inputs in that columns
        docs.Class.value_counts()
```

```
Out[3]: ham     4825
        spam     747
        Name: Class, dtype: int64
```

```
In [4]: ham_spam=docs.Class.value_counts()
        ham_spam
```

```
Out[4]: ham     4825
        spam     747
        Name: Class, dtype: int64
```

```
In [5]: print("Spam % is ",(ham_spam[1]/float(ham_spam[0]+ham_spam[1]))*100)
```

```
Spam % is  13.406317300789663
```

```
In [6]: # mapping labels to 1 and 0
        docs['label'] = docs.Class.map({'ham':0, 'spam':1})
```

```
In [7]: docs.head()
```

```
Out[7]:   Class                                                sms  label
        0   ham  Go until jurong point, crazy.. Available only ...      0
        1   ham                      Ok lar... Joking wif u oni...      0
        2  spam  Free entry in 2 a wkly comp to win FA Cup fina...      1
        3   ham  U dun say so early hor... U c already then say...      0
        4   ham  Nah I don't think he goes to usf, he lives aro...      0

In [8]: X=docs.sms
        y=docs.label

In [9]: X = docs.sms
        y = docs.label
        print(X.shape)
        print(y.shape)

(5572,)
(5572,)


In [10]: # splitting into test and train

         from sklearn.model_selection  import train_test_split
         X_train, X_test, y_train, y_test = train_test_split(X, y, random_state=1)

In [11]: X_train.head()

Out[11]: 710     4mths half price Orange line rental & latest c...
         3740                          Did you stitch his trouser
         2711    Hope you enjoyed your new content. text stop t...
         3155    Not heard from U4 a while. Call 4 rude chat pr...
         3748    Ü neva tell me how i noe... I'm not at home in...
         Name: sms, dtype: object

In [12]: from sklearn.feature_extraction.text import CountVectorizer

         # vectorising the text
         vect = CountVectorizer(stop_words='english')

In [13]: vect.fit(X_train)

Out[13]: CountVectorizer(analyzer='word', binary=False, decode_error='strict',
                dtype=<class 'numpy.int64'>, encoding='utf-8', input='content',
                lowercase=True, max_df=1.0, max_features=None, min_df=1,
                ngram_range=(1, 1), preprocessor=None, stop_words='english',
                strip_accents=None, token_pattern='(?u)\\b\\w\\w+\\b',
                tokenizer=None, vocabulary=None)

In [14]: vect.vocabulary_
```

```
Out[14]: {'shocking': 5675,
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'amt',
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'anand',
'anderson',
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'andres',
'andrews',
'angry',
```

```
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'annie',
'anniversary',
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'announcement',
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'appear',
```

```
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 'area',
 'aren',
 'arent',
 'arestaurant',
 'aretaking',
 'argentina',
 'argh',
 'argue',
 'arguing',
 ...]
```

```
In [16]: # transform
         X_train_transformed = vect.transform(X_train)
         X_test_tranformed =vect.transform(X_test)
```

```
In [17]: from sklearn.naive_bayes import BernoulliNB

         # instantiate bernoulli NB object
         bnb = BernoulliNB()

         # fit
```

```
bnb.fit(X_train_transformed,y_train)

# predict class
y_pred_class = bnb.predict(X_test_tranformed)

# predict probability
y_pred_proba =bnb.predict_proba(X_test_tranformed)

# accuracy
from sklearn import metrics
metrics.accuracy_score(y_test, y_pred_class)
```

Out[17]:
```
0.9770279971284996
```

In [18]:
```
bnb
```

Out[18]:
```
BernoulliNB(alpha=1.0, binarize=0.0, class_prior=None, fit_prior=True)
```

In [19]:
```
metrics.confusion_matrix(y_test, y_pred_class)
```

Out[19]:
```
array([[1207,    1],
       [  31,  154]])
```

In [20]:
```
confusion = metrics.confusion_matrix(y_test, y_pred_class)
print(confusion)
#[row, column]
TN = confusion[0, 0]
FP = confusion[0, 1]
FN = confusion[1, 0]
TP = confusion[1, 1]
```

```
[[1207    1]
 [  31  154]]
```

In [21]:
```
sensitivity = TP / float(FN + TP)
print("sensitivity",sensitivity)
```

```
sensitivity 0.8324324324324325
```

In [22]:
```
specificity = TN / float(TN + FP)

print("specificity",specificity)
```

```
specificity 0.9991721854304636
```

In [23]:
```
precision = TP / float(TP + FP)

print("precision",precision)
print(metrics.precision_score(y_test, y_pred_class))
```

```
precision 0.9935483870967742
0.9935483870967742
```

```
In [24]: print("precision",precision)
         print("PRECISION SCORE :",metrics.precision_score(y_test, y_pred_class))
         print("RECALL SCORE :", metrics.recall_score(y_test, y_pred_class))
         print("F1 SCORE :",metrics.f1_score(y_test, y_pred_class))
```

```
precision 0.9935483870967742
PRECISION SCORE : 0.9935483870967742
RECALL SCORE : 0.8324324324324325
F1 SCORE : 0.9058823529411765
```

```
In [25]: y_pred_proba
```

```
Out[25]: array([[1.00000000e+00, 1.54647985e-10],
                [1.00000000e+00, 1.69177313e-10],
                [9.99999997e-01, 2.52488636e-09],
                ...,
                [9.99994219e-01, 5.78141360e-06],
                [3.64570741e-06, 9.99996354e-01],
                [1.00000000e+00, 2.90374743e-12]])
```

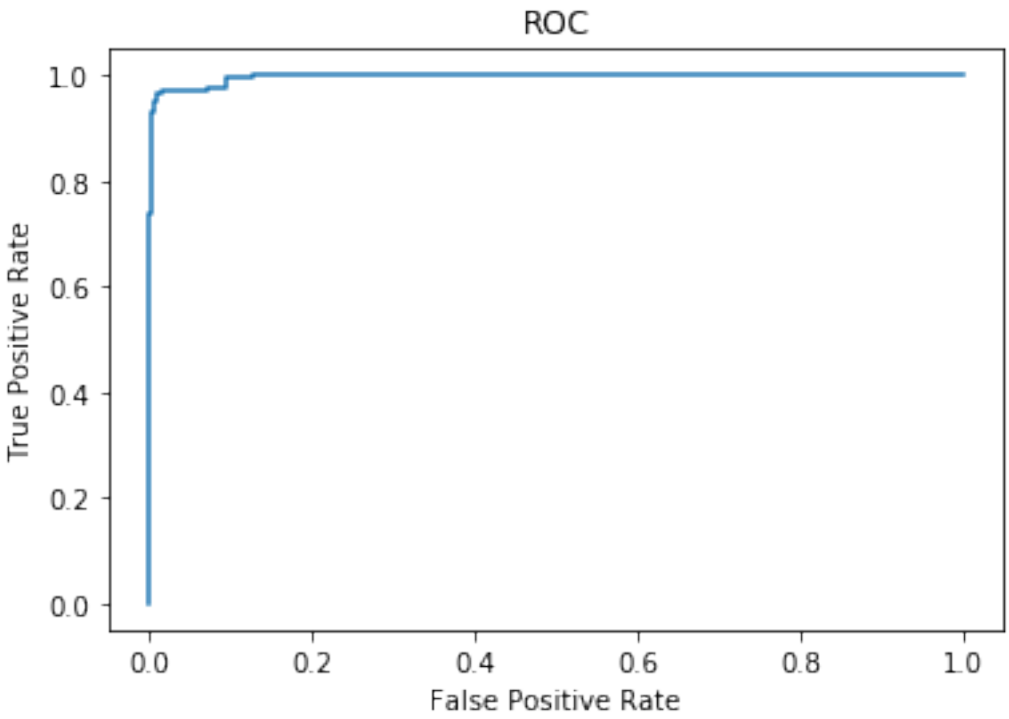
```
In [26]: from sklearn.metrics import confusion_matrix as sk_confusion_matrix
         from sklearn.metrics import roc_curve, auc
         import matplotlib.pyplot as plt
         false_positive_rate, true_positive_rate, thresholds = roc_curve(y_test, y_pred_proba[
         roc_auc = auc(false_positive_rate, true_positive_rate)
```

```
In [27]: print (roc_auc)
```

```
0.9967692858421334
```

```
In [31]: %matplotlib inline
         plt.ylabel('True Positive Rate')
         plt.xlabel('False Positive Rate')
         plt.title('ROC')
         plt.plot(false_positive_rate, true_positive_rate)
```

```
Out[31]: [<matplotlib.lines.Line2D at 0x1a1d720978>]
```


ROC
True Positive Rate
False Positive Rate
0.0
0.2
0.4
0.6
0.8
1.0