nb

October 10, 2022

[52]:
```
import datasets
import numpy as np
import pandas as pd
```

[53]:
```
df = pd.read_csv('newsapi_cleaned_data2.csv')
```

[54]:
```
df.columns
```

[54]:
```
Index(['Unnamed: 0', 'source', 'title', 'description', 'publishedAt',
       'content', 'labels', 'clean', 'tokenized', 'nonstop', 'stemmed',
       'lemmatized'],
      dtype='object')
```

[55]:
```
df=df.drop(['Unnamed: 0','source', 'title', 'description',
       'publishedAt', 'content','clean', 'tokenized',␣
 ↪'nonstop','stemmed',],axis=1)
df.columns
```

[55]:
```
Index(['labels', 'lemmatized'], dtype='object')
```

[56]:
```
df.head
```

[56]:
```
<bound method NDFrame.head of             labels
lemmatized
0    ENTERTAINMENT  ['youre', 'finally', 'ready', 'create', 'home'…
1    ENTERTAINMENT  ['sept', 'reuters', 'star', 'entertainment', '…
2    ENTERTAINMENT  ['sept', 'reuters', 'antihero', 'stepped', 'sp…
3    ENTERTAINMENT  ['hong', 'kong', 'sept', 'reuters', 'china', '…
4    ENTERTAINMENT  ['reuters', 'levine', 'plotkin', 'amp', 'menin…
..             …                                                 …
498     TECHNOLOGY  ['sept', 'reuters', 'federal', 'communication'…
499     TECHNOLOGY  ['brussels', 'sept', 'reuters', 'individual', …
500     TECHNOLOGY  ['oct', 'reuters', 'february', 'meeting', 'min…
501     TECHNOLOGY  ['devens', 'mass', 'sept', 'reuters', 'giant',…
502     TECHNOLOGY  ['hong', 'kong', 'sept', 'reuters', 'breakingv…

[503 rows x 2 columns]>
```

[58]:
```
df["lemmatized"] = df["lemmatized"].str.replace("[","")
df["lemmatized"] = df["lemmatized"].str.replace("]","")
df["lemmatized"] = df["lemmatized"].str.replace("'","")
df["lemmatized"] = df["lemmatized"].str.replace(",","")
```

```
/var/folders/g2/c89fdbmn2y54ly505k9slbm40000gn/T/ipykernel_69860/598862342.py:1:
FutureWarning: The default value of regex will change from True to False in a
future version. In addition, single character regular expressions will *not* be
treated as literal strings when regex=True.
  df["lemmatized"] = df["lemmatized"].str.replace("[","")
/var/folders/g2/c89fdbmn2y54ly505k9slbm40000gn/T/ipykernel_69860/598862342.py:2:
FutureWarning: The default value of regex will change from True to False in a
future version. In addition, single character regular expressions will *not* be
treated as literal strings when regex=True.
  df["lemmatized"] = df["lemmatized"].str.replace("]","")
```

[59]:
```
df.head
```

[59]:
```
<bound method NDFrame.head of             labels
lemmatized
0    ENTERTAINMENT  youre finally ready create home fitness gym ne…
1    ENTERTAINMENT  sept reuters star entertainment group sgrax tu…
2    ENTERTAINMENT  sept reuters antihero stepped spotlight saturd…
3    ENTERTAINMENT  hong kong sept reuters china tencent music ent…
4    ENTERTAINMENT  reuters levine plotkin amp menin new york ente…
..             …                                                …
498     TECHNOLOGY  sept reuters federal communication commission …
499     TECHNOLOGY  brussels sept reuters individual company suffe…
500     TECHNOLOGY  oct reuters february meeting mining executive …
501     TECHNOLOGY  devens mass sept reuters giant machine churnin…
502     TECHNOLOGY  hong kong sept reuters breakingviews bytedance…

[503 rows x 2 columns]>
```

[60]:
```
df['labels'].unique()
df=df.dropna(subset=['labels'])
```

[61]:
```
df['labels'].unique()
```

[61]:
```
array(['ENTERTAINMENT', 'HEALTH', 'SCIENCE', 'SPORTS', 'TECHNOLOGY'],
      dtype=object)
```

[62]:
```
from sklearn.preprocessing import LabelEncoder
labelencoder = LabelEncoder()
df['labels_cat'] = labelencoder.fit_transform(df['labels'])
df
```

```
/var/folders/g2/c89fdbmn2y54ly505k9slbm40000gn/T/ipykernel_69860/137229713.py:3:
```

```
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  df['labels_cat'] = labelencoder.fit_transform(df['labels'])
```

[62]:

	labels	lemmatized
0	ENTERTAINMENT	youre finally ready create home fitness gym ne…
1	ENTERTAINMENT	sept reuters star entertainment group sgrax tu…
2	ENTERTAINMENT	sept reuters antihero stepped spotlight saturd…
3	ENTERTAINMENT	hong kong sept reuters china tencent music ent…
4	ENTERTAINMENT	reuters levine plotkin amp menin new york ente…
..	…	…
498	TECHNOLOGY	sept reuters federal communication commission …
499	TECHNOLOGY	brussels sept reuters individual company suffe…
500	TECHNOLOGY	oct reuters february meeting mining executive …
501	TECHNOLOGY	devens mass sept reuters giant machine churnin…
502	TECHNOLOGY	hong kong sept reuters breakingviews bytedance…

	labels_cat
0	0
1	0
2	0
3	0
4	0
..	…
498	4
499	4
500	4
501	4
502	4

[500 rows x 3 columns]

[63]:
```
labelencoder.classes_
```

[63]:
```
array(['ENTERTAINMENT', 'HEALTH', 'SCIENCE', 'SPORTS', 'TECHNOLOGY'],
      dtype=object)
```

Split dataset into Train and Test sets

[65]:
```
from sklearn.model_selection import train_test_split

X_train, X_test, y_train, y_test = train_test_split(
    df['lemmatized'],
    df['labels_cat'],
```

```
    random_state = 1,test_size=0.1
)

print("Training dataset: ", X_train.shape[0])
print("Test dataset: ", X_test.shape[0])
```

```
Training dataset:  450
Test dataset:  50
```

convert text data into numeric data

[84]:
```
from sklearn.feature_extraction.text import CountVectorizer

count_vector = CountVectorizer(stop_words = 'english')
training_data = count_vector.fit_transform(X_train.values.astype('U'))
testing_data = count_vector.transform(X_test.values.astype('U'))
```

[85]:
```
from sklearn.naive_bayes import MultinomialNB

naive_bayes = MultinomialNB()
naive_bayes.fit(training_data, y_train)
```

[85]:
```
MultinomialNB()
```

[86]:
```
predictions = naive_bayes.predict(testing_data)
predictions
```

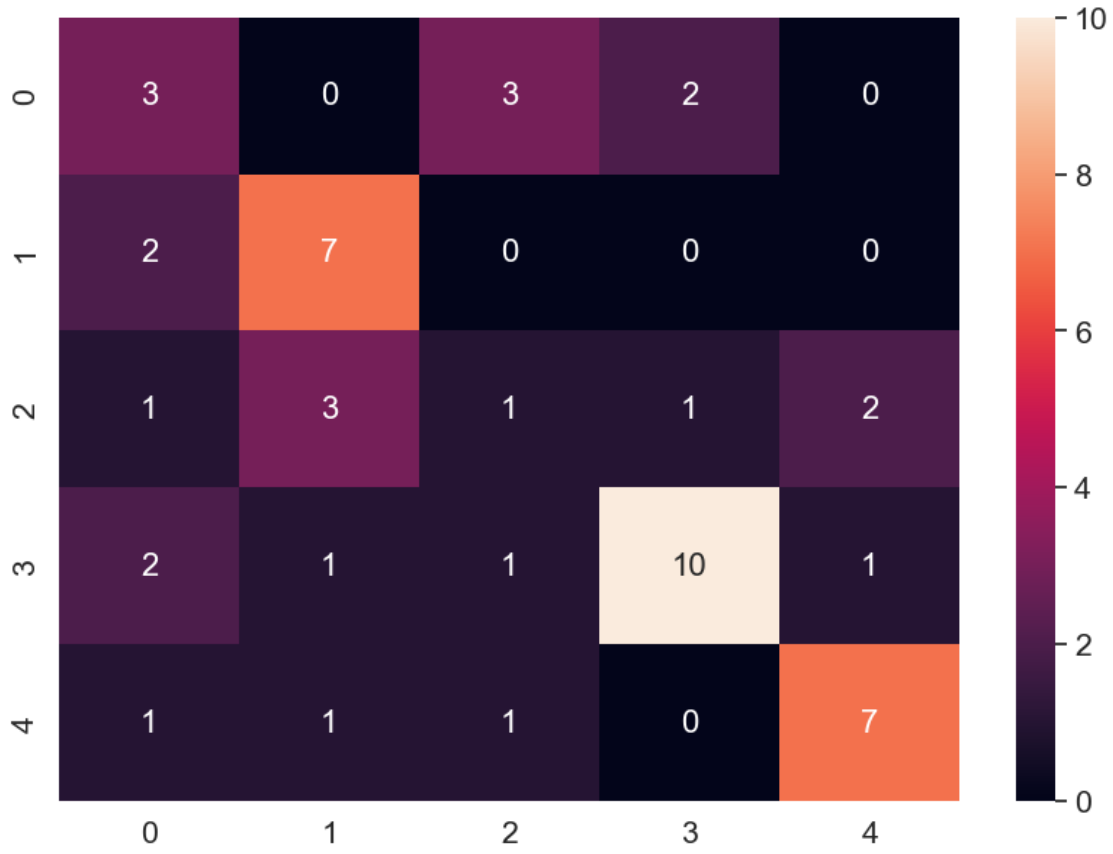
[86]:
```
array([3, 3, 2, 2, 4, 4, 0, 3, 3, 0, 3, 0, 1, 2, 3, 1, 2, 1, 1, 0, 1, 3,
       4, 4, 0, 3, 0, 3, 1, 4, 1, 0, 0, 4, 3, 1, 4, 3, 1, 2, 1, 4, 4, 1,
       3, 3, 2, 0, 4, 1])
```

[87]:
```
from sklearn.metrics import accuracy_score, recall_score, precision_score,␣
 ↪f1_score

print("Accuracy score: ", accuracy_score(y_test, predictions))
print("Recall score: ", recall_score(y_test, predictions, average = 'weighted'))
print("Precision score: ", precision_score(y_test, predictions, average =␣
 ↪'weighted'))
print("F1 score: ", f1_score(y_test, predictions, average = 'weighted'))
```

```
Accuracy score:  0.56
Recall score:  0.56
Precision score:  0.5557692307692308
F1 score:  0.5536134453781513
```

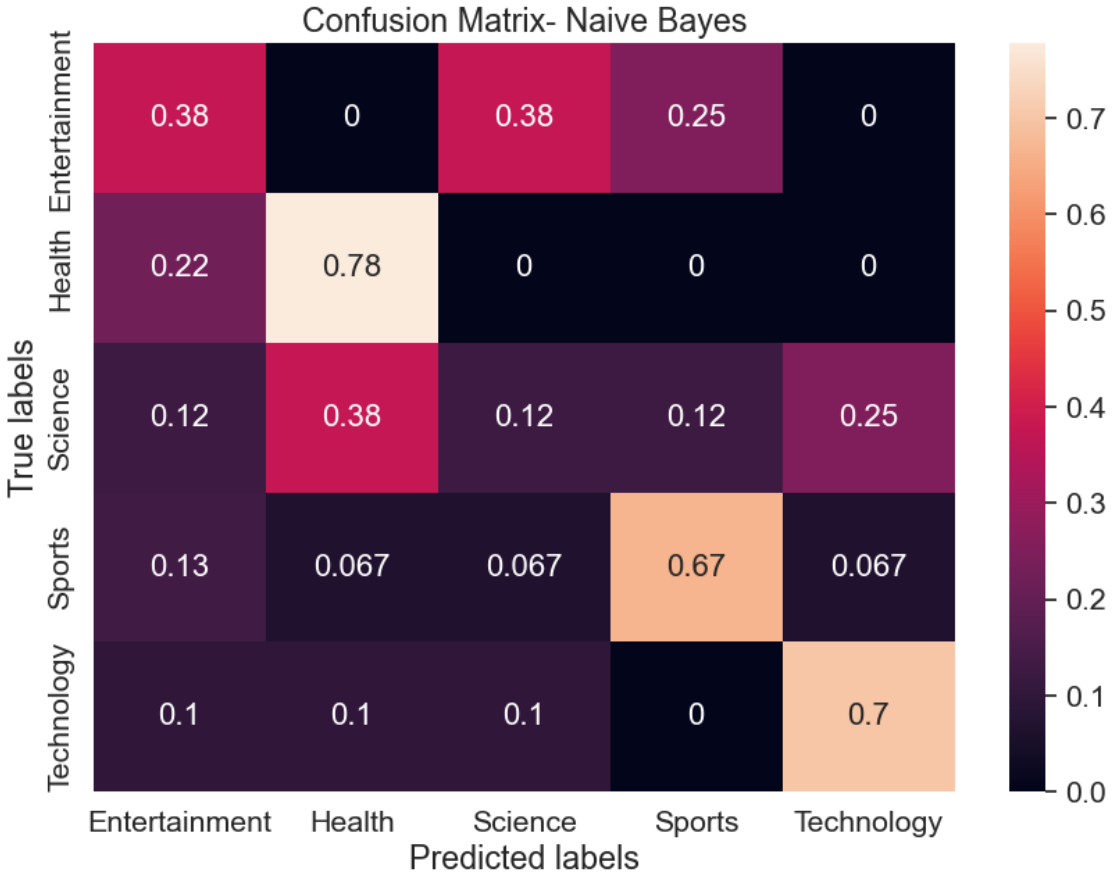
Confusion Matrix to check accuracy of training VS predicted labels

[88]:
```
from sklearn.metrics import confusion_matrix
cm=confusion_matrix(y_test, predictions)

import seaborn as sn
import matplotlib.pyplot as plt

df_cm = pd.DataFrame(cm, range(5), range(5))
plt.figure(figsize=(10,7))
sn.set(font_scale=1.4) # for label size
sn.heatmap(df_cm, annot=True, annot_kws={"size": 16}) # font size

plt.show()
```



[89]:
```
cmn = cm.astype('float') / cm.sum(axis=1)[:, np.newaxis]
plt.figure(figsize=(10,7))
ax= plt.subplot()
sn.set(font_scale=1.4) # for label size
sn.heatmap(cmn, annot=True, annot_kws={"size": 16}) # font size
ax.set_xlabel('Predicted labels')
ax.set_ylabel('True labels')
```

```
ax.set_title('Confusion Matrix- Naive Bayes')
ax.xaxis.set_ticklabels(['Entertainment',␣
 ↪'Health','Science','Sports','Technology'])
ax.yaxis.set_ticklabels(['Entertainment',␣
 ↪'Health','Science','Sports','Technology'])
plt.show()
```



From the Confusion Matrix it is clear that Health labels were predicted accuracy the best with 78% accuracy followed by Technology, sports, Entertainment and Science.