nctdc3gii

December 11, 2023

Task-04

- Analyze and visualize sentiment patterns in social media data to understand public opinion and attitudes towards specific topics or brands.

Sample Dataset :- https://www.kaggle.com/datasets/jp797498e/twitter-entity-sentiment-analysis

1 Description

About Dataset: this is the Twitter Sentiment Analysis Dataset.

Overview: This is an entity-level sentiment analysis dataset of twitter. Given a message and an entity, the task is to judge the sentiment of the message about the entity. There are three classes in this dataset: Positive, Negative and Neutral. We regard messages that are not relevant to the entity (i.e. Irrelevant) as Neutral.

Problem Statement:A Twitter sentiment analysis uses NLP and ML models to classify tweets into negative, positive or neutral emotions.

#Table of contents: * Import Modules * Exploratory data analysis(EDA) * Data cleaning * Data Visualization of Target Variables * Preprocessed text * Machine Learning Model

2 Import Modules

[73]:
```
import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
from sklearn.preprocessing import LabelEncoder
from sklearn.feature_extraction.text import TfidfVectorizer
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import␣
 ↪classification_report,accuracy_score,confusion_matrix
from mlxtend.plotting import plot_confusion_matrix
from sklearn.naive_bayes import MultinomialNB
import nltk
from nltk.sentiment.vader import SentimentIntensityAnalyzer
```

[74]:
```
# Load the dataset
df=pd.read_csv('twitter_training.csv')
```

[75]:
```
df
```

[75]:
```
        2401  Borderlands  Positive  \
0       2401  Borderlands  Positive
1       2401  Borderlands  Positive
2       2401  Borderlands  Positive
3       2401  Borderlands  Positive
4       2401  Borderlands  Positive
…      …           …        …
74676  9200       Nvidia  Positive
74677  9200       Nvidia  Positive
74678  9200       Nvidia  Positive
74679  9200       Nvidia  Positive
74680  9200       Nvidia  Positive

       im getting on borderlands and i will murder you all ,
0       I am coming to the borders and I will kill you…
1       im getting on borderlands and i will kill you …
2       im coming on borderlands and i will murder you…
3       im getting on borderlands 2 and i will murder …
4       im getting into borderlands and i can murder y…
…                                                     …
74676  Just realized that the Windows partition of my…
74677  Just realized that my Mac window partition is …
74678  Just realized the windows partition of my Mac …
74679  Just realized between the windows partition of…
74680  Just like the windows partition of my Mac is l…

[74681 rows x 4 columns]
```

[76]:
```
# Exploratory data analysis(EDA)
```

[77]:
```
df.columns=['id','country','label','text']
```

[78]:
```
# shallow copy
df2=df.copy()
```

[79]:
```
#shape of a DataFrame.
df.shape
```

[79]:
```
(74681, 4)
```

[80]:
```
# displays the top rows of a DataFrame
df.head()
```

[80]:
```
      id      country     label  \
0   2401   Borderlands  Positive
1   2401   Borderlands  Positive
2   2401   Borderlands  Positive
3   2401   Borderlands  Positive
4   2401   Borderlands  Positive

                                                 text
0   I am coming to the borders and I will kill you…
1   im getting on borderlands and i will kill you …
2   im coming on borderlands and i will murder you…
3   im getting on borderlands 2 and i will murder …
4   im getting into borderlands and i can murder y…
```

[81]:
```
#shows the bottom rows
df.tail()
```

[81]:
```
         id country     label  \
74676  9200  Nvidia  Positive
74677  9200  Nvidia  Positive
74678  9200  Nvidia  Positive
74679  9200  Nvidia  Positive
74680  9200  Nvidia  Positive

                                                  text
74676  Just realized that the Windows partition of my…
74677  Just realized that my Mac window partition is …
74678  Just realized the windows partition of my Mac …
74679  Just realized between the windows partition of…
74680  Just like the windows partition of my Mac is l…
```

[82]:
```
# specific rows of a DataFrame ( "integer location" Method)
df.iloc[100:200]
```

[82]:
```
       id      country       label  \
100  2417  Borderlands    Negative
101  2418  Borderlands  Irrelevant
102  2418  Borderlands  Irrelevant
103  2418  Borderlands  Irrelevant
104  2418  Borderlands  Irrelevant
..    …           …          …
195  2433  Borderlands     Neutral
196  2433  Borderlands     Neutral
197  2434  Borderlands    Negative
198  2434  Borderlands    Negative
199  2434  Borderlands    Negative
```

```
                                                  text
100  Grounded almost was pretty cool even despite t…
101  Appreciate the (sonic) concepts / praxis Valen…
102  Appreciate the (sound) concepts / practices th…
103  Evaluate the (sound) concepts / concepts of Va…
104  Appreciate the (sonic) concepts / praxis Valen…
..                                                 …
195  i then enter in that gunner seat and i fear fo…
196     i enter that gunner seat and i fear for a life
197               fuck it .  pic.twitter.com/Wav1bacr5j
198               Fuck it. pic.twitter.com / Wav1bacr5j
199            fuck it. pic.wikipedia.org / Wav1bacr5j

[100 rows x 4 columns]
```

[83]:
```
# prints information about the DataFrame.
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 74681 entries, 0 to 74680
Data columns (total 4 columns):
 #   Column   Non-Null Count  Dtype
---  ------   --------------  -----
 0   id       74681 non-null  int64
 1   country  74681 non-null  object
 2   label    74681 non-null  object
 3   text     73995 non-null  object
dtypes: int64(1), object(3)
memory usage: 2.3+ MB
```

[84]:
```
# Dispaly (string) columns in the summary statistics.
df.describe(include=object)
```

[84]:

	country	label	text
count	74681	74681	73995
unique	32	4	69490
top	TomClancysRainbowSix	Negative	
freq	2400	22542	172

3 Data cleaning

[85]:
```
# To check for duplicate values in a DataFrame
df.duplicated().sum()
```

[85]: 2700

[86]:
```
# Remove duplicates based on all columns
df.drop_duplicates(inplace=True)
```

[87]:
```
# again To check for duplicate values in a DataFrame agein
df.duplicated().sum()
```

[87]:
```
0
```

[88]:
```
# The number of missing values in the dataset.
df.isnull().sum()
```

[88]:
```
id           0
country      0
label        0
text       326
dtype: int64
```

[89]:
```
# Drop rows with NaN values in-place
df.dropna(inplace=True)
```

[90]:
```
# our dataset remove null values
df.isnull().any()
```

[90]:
```
id         False
country    False
label      False
text       False
dtype: bool
```

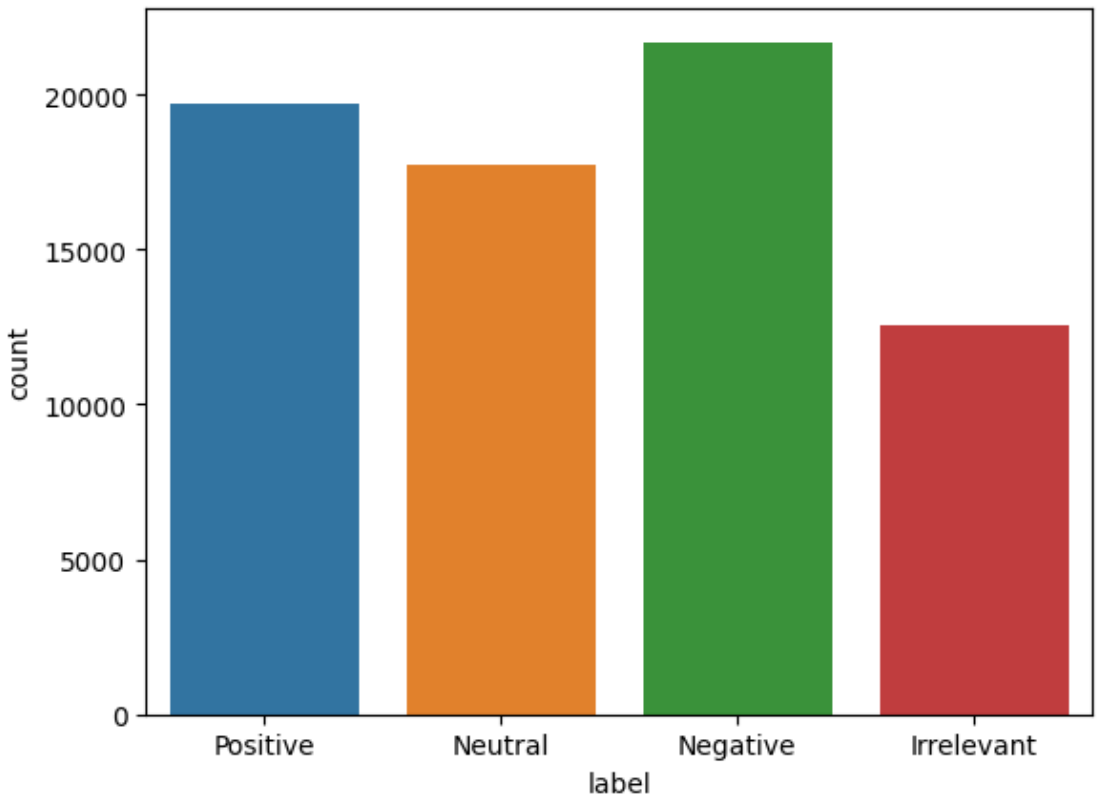
#Data Visualization of Target Variables

[91]:
```
# Check unique target values
df['label'].value_counts()
```

[91]:
```
Negative      21698
Positive      19712
Neutral       17708
Irrelevant    12537
Name: label, dtype: int64
```

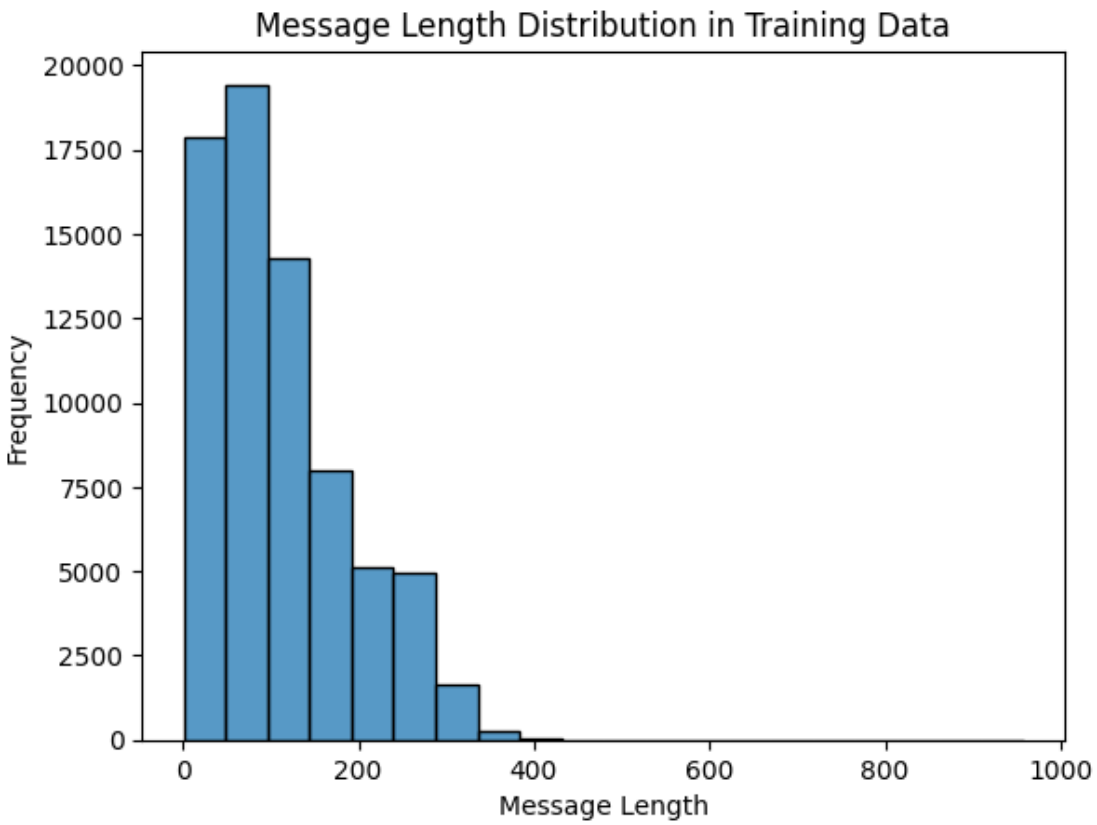
[92]:
```
sns.countplot(x=df['label'])
```

[92]:
```
<Axes: xlabel='label', ylabel='count'>
```



[93]:
```
# Calculate the length of each message
message_length=(df['text']).apply(len)
sns.histplot(x=message_length,bins=20)
plt.title('Message Length Distribution in Training Data')
plt.ylabel('Frequency')
plt.xlabel('Message Length')
```

[93]: Text(0.5, 0, 'Message Length')



#Preprocessed text

[94]:
```
import spacy
# load english language model and create nlp object from it
nlp = spacy.load("en_core_web_sm")
# use this utility function to get the preprocessed text data
def preprocess(text):
    # remove stop words and lemmatize the text
    doc = nlp(text)
    filtered_tokens = []
    for token in doc:
        if token.is_stop or token.is_punct:
            continue
        filtered_tokens.append(token.lemma_)

    return " ".join(filtered_tokens)
```

[95]:
```
df['Preprocessed text'] = df['text'].apply(preprocess)
```

[96]:
```
lb=LabelEncoder()
df['label']=lb.fit_transform(df['label'])
```

[97]:
```
df
```

[97]:
```
          id      country  label  \
0       2401  Borderlands      3
1       2401  Borderlands      3
2       2401  Borderlands      3
3       2401  Borderlands      3
4       2401  Borderlands      3
…        …           …    …
74676   9200       Nvidia      3
74677   9200       Nvidia      3
74678   9200       Nvidia      3
74679   9200       Nvidia      3
74680   9200       Nvidia      3

                                                    text  \
0      I am coming to the borders and I will kill you…
1      im getting on borderlands and i will kill you …
2      im coming on borderlands and i will murder you…
3      im getting on borderlands 2 and i will murder …
4      im getting into borderlands and i can murder y…
…                                                    …
74676  Just realized that the Windows partition of my…
74677  Just realized that my Mac window partition is …
74678  Just realized the windows partition of my Mac …
74679  Just realized between the windows partition of…
74680  Just like the windows partition of my Mac is l…

                                    Preprocessed text
0                                        come border kill
1                                   m get borderland kill
2                                 m come borderland murder
3                               m get borderland 2 murder
4                                 m get borderland murder
…                                                    …
74676  realize Windows partition Mac like 6 year Nvid…
74677  realize Mac window partition 6 year Nvidia dri…
74678  realize window partition Mac 6 year Nvidia dri…
74679  realize window partition Mac like 6 year Nvidi…
74680  like window partition Mac like 6 year driver i…

[71655 rows x 5 columns]
```

[98]:
```
tv=TfidfVectorizer()
df_tv=tv.fit_transform(df['Preprocessed text'])
```

[99]:
```
print(df_tv)
```

```
(0, 14186)    0.5019686782389964
(0, 4300)     0.7503332981844422
(0, 5882)     0.43014809973153667
(1, 4303)     0.6308352317883091
(1, 10718)    0.4731922339217186
(1, 14186)    0.6149276543551802
(2, 16730)    0.7359220742014858
(2, 4303)     0.519630312809822
(2, 5882)     0.4340541886817236
(3, 16730)    0.7497229075893237
(3, 4303)     0.5293750013057333
(3, 10718)    0.3970864765115596
(4, 16730)    0.7497229075893237
(4, 4303)     0.5293750013057333
(4, 10718)    0.3970864765115596
(5, 16356)    0.32986143201396134
(5, 5868)     0.0950308449908003
(5, 25306)    0.12371465037450177
(5, 18780)    0.12279967472353039
(5, 8680)     0.17199301599436456
(5, 6478)     0.31519414526267836
(5, 26163)    0.2882003846504435
(5, 12710)    0.23515040647542382
(5, 17993)    0.2103819690143733
(5, 18508)    0.17463994232150065
:     :
(71652, 17401)        0.335661757431383
(71652, 12602)        0.28873546946764583
(71652, 20209)        0.3195397101596675
(71652, 27556)        0.21093083092118967
(71653, 18390)        0.41917259340568874
(71653, 17512)        0.20004410985809554
(71653, 26966)        0.30984190903656667
(71653, 8064) 0.2857211695158495
(71653, 4956) 0.2711117868352008
(71653, 7524) 0.31837801158630585
(71653, 15399)        0.32982978949582387
(71653, 17401)        0.2933694892495072
(71653, 12602)        0.25235575793365683
(71653, 20209)        0.2792787664637086
(71653, 10264)        0.19437024500723696
(71653, 27556)        0.18435424579749274
(71653, 14875)        0.15320656386788417
(71654, 18390)        0.48735842343812535
(71654, 26966)        0.36024317113922943
(71654, 8064) 0.3321987670681811
(71654, 15399)        0.3834824335856304
(71654, 17401)        0.34109122116939317
```

```
  (71654, 12602)        0.29340588165087583
  (71654, 27556)        0.21434272182731726
  (71654, 14875)        0.3562566379656403
```

[100]:
```
x_train, x_test, y_train, y_test = train_test_split(df_tv,␣
 ↪df['label'],test_size=0.2, random_state=42)
```

[101]:
```
x_test.shape
```

[101]: (14331, 28054)

[102]:
```
y_test.shape
```

[102]: (14331,)

#Machine Learning Model

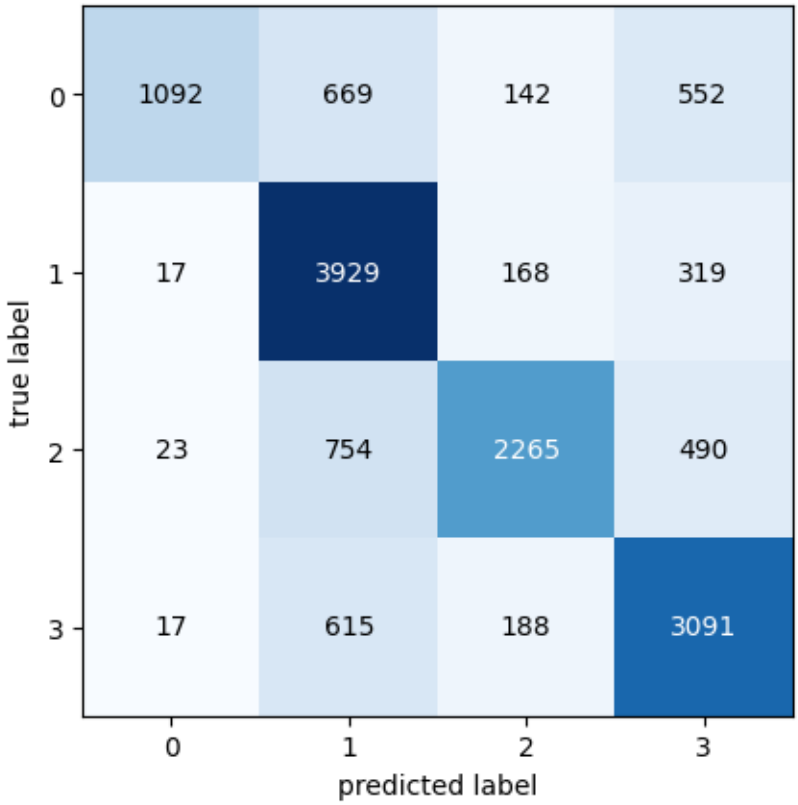
##naive bayes

[103]:
```
nb=MultinomialNB()
nb.fit(x_train,y_train)
y_pred_nb=nb.predict(x_test)
print('classification_report:\n',classification_report(y_test,y_pred_nb))
print('accuracy:',accuracy_score(y_test,y_pred_nb)*100)
print('Error value',np.mean(y_pred_nb!=y_test)*100)
print('confusion_matrix\n',confusion_matrix(y_test,y_pred_nb))
```

```
classification_report:
               precision    recall  f1-score   support

           0       0.95      0.44      0.61      2455
           1       0.66      0.89      0.76      4433
           2       0.82      0.64      0.72      3532
           3       0.69      0.79      0.74      3911

    accuracy                           0.72     14331
   macro avg       0.78      0.69      0.71     14331
weighted avg       0.76      0.72      0.72     14331

accuracy: 72.40946200544275
Error value 27.590537994557252
confusion_matrix
 [[1092  669  142  552]
 [  17 3929  168  319]
 [  23  754 2265  490]
 [  17  615  188 3091]]
```

[104]:
```
plot_confusion_matrix(confusion_matrix(y_test,y_pred_nb))
```

[104]: (<Figure size 640x480 with 1 Axes>,
 <Axes: xlabel='predicted label', ylabel='true label'>)



3.1 logistic regression

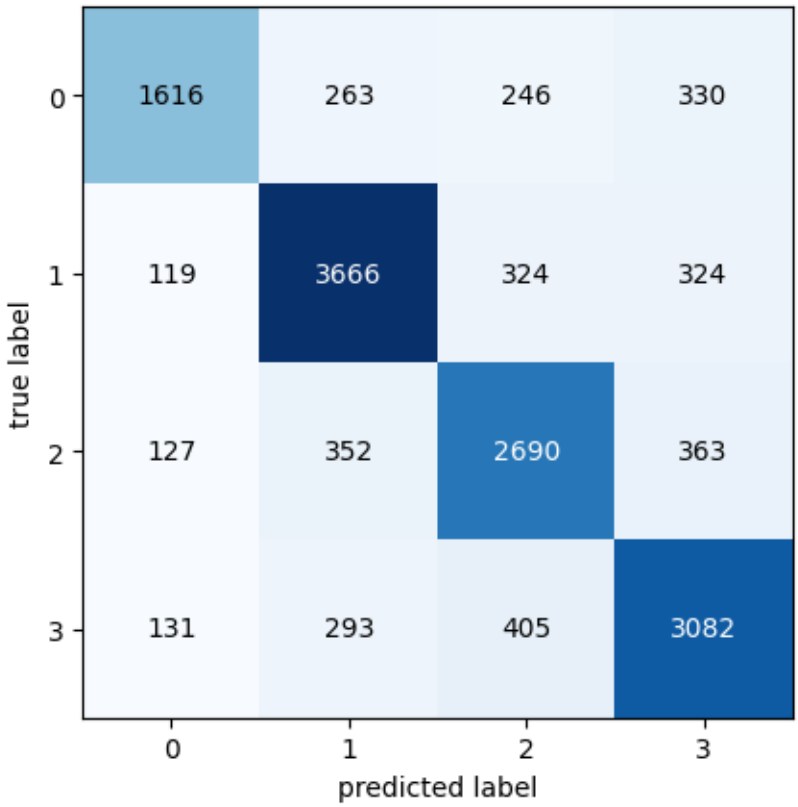
[105]:
```
lg=LogisticRegression()
lg.fit(x_train,y_train)
y_pred_lg=lg.predict(x_test)
print('classification_report:\n',classification_report(y_test,y_pred_lg))
print('accuracy:',accuracy_score(y_test,y_pred_lg)*100)
print('Error value',np.mean(y_pred_lg!=y_test)*100)
print('confusion_matrix\n',confusion_matrix(y_test,y_pred_lg))
```

```
classification_report:
              precision    recall  f1-score   support

           0       0.81      0.66      0.73      2455
           1       0.80      0.83      0.81      4433
           2       0.73      0.76      0.75      3532
           3       0.75      0.79      0.77      3911
```

```
    accuracy                           0.77     14331
   macro avg       0.77      0.76      0.76     14331
weighted avg       0.77      0.77      0.77     14331

accuracy: 77.13348684669597
Error value 22.866513153304027
confusion_matrix
 [[1616  263  246  330]
 [ 119 3666  324  324]
 [ 127  352 2690  363]
 [ 131  293  405 3082]]
/usr/local/lib/python3.10/dist-packages/sklearn/linear_model/_logistic.py:458:
ConvergenceWarning: lbfgs failed to converge (status=1):
STOP: TOTAL NO. of ITERATIONS REACHED LIMIT.

Increase the number of iterations (max_iter) or scale the data as shown in:
    https://scikit-learn.org/stable/modules/preprocessing.html
Please also refer to the documentation for alternative solver options:
    https://scikit-learn.org/stable/modules/linear_model.html#logistic-
regression
  n_iter_i = _check_optimize_result(
```

[106]:
```
plot_confusion_matrix(confusion_matrix(y_test,y_pred_lg))
```

[106]:
```
(<Figure size 640x480 with 1 Axes>,
 <Axes: xlabel='predicted label', ylabel='true label'>)
```



#VADER Sentiment Analysis

[107]:
```
nltk.download('vader_lexicon')
sid = SentimentIntensityAnalyzer()
```

```
[nltk_data] Downloading package vader_lexicon to /root/nltk_data…
[nltk_data]   Package vader_lexicon is already up-to-date!
```

[108]:
```
# Function to get sentiment scores for a given text
def get_sentiment_scores(text):
    sentiment_scores = sid.polarity_scores(text)
    return sentiment_scores
```

[109]:
```
df3=df.copy()
```

[110]:
```
# Apply the sentiment analysis function to the 'text' column and create new␣
 ↪columns for scores
df3['sentiment_scores'] = df3['text'].apply(get_sentiment_scores)
```

[111]:
```
df3['sentiment_scores']
```

[111]:
```
0        {'neg': 0.343, 'neu': 0.657, 'pos': 0.0, 'comp…
1        {'neg': 0.37, 'neu': 0.63, 'pos': 0.0, 'compou…
2        {'neg': 0.37, 'neu': 0.63, 'pos': 0.0, 'compou…
3        {'neg': 0.343, 'neu': 0.657, 'pos': 0.0, 'comp…
4        {'neg': 0.37, 'neu': 0.63, 'pos': 0.0, 'compou…
                              …
74676    {'neg': 0.086, 'neu': 0.817, 'pos': 0.097, 'co…
74677    {'neg': 0.104, 'neu': 0.896, 'pos': 0.0, 'comp…
74678    {'neg': 0.091, 'neu': 0.909, 'pos': 0.0, 'comp…
74679    {'neg': 0.074, 'neu': 0.842, 'pos': 0.084, 'co…
74680    {'neg': 0.09, 'neu': 0.728, 'pos': 0.182, 'com…
Name: sentiment_scores, Length: 71655, dtype: object
```

[112]:
```
# Extract individual sentiment scores into separate columns
df3['compound'] = df3['sentiment_scores'].apply(lambda x: x['compound'])
df3['positive'] = df3['sentiment_scores'].apply(lambda x: x['pos'])
df3['neutral'] = df3['sentiment_scores'].apply(lambda x: x['neu'])
df3['negative'] = df3['sentiment_scores'].apply(lambda x: x['neg'])
```

[113]:
```
df3['sentiment'] = df3['compound'].apply(lambda x: 'Positive' if x >= 0.05 else␣
↪('Negative' if x <= -0.05 else 'Neutral'))
```

[121]:
```
df3
```

[121]:

	id	country	label	\
0	2401	Borderlands	3	
1	2401	Borderlands	3	
2	2401	Borderlands	3	
3	2401	Borderlands	3	
4	2401	Borderlands	3	
…	…	…	…	
74676	9200	Nvidia	3	
74677	9200	Nvidia	3	
74678	9200	Nvidia	3	
74679	9200	Nvidia	3	
74680	9200	Nvidia	3	

	text	\
0	I am coming to the borders and I will kill you…	
1	im getting on borderlands and i will kill you …	
2	im coming on borderlands and i will murder you…	
3	im getting on borderlands 2 and i will murder …	
4	im getting into borderlands and i can murder y…	
…	…	
74676	Just realized that the Windows partition of my…	
74677	Just realized that my Mac window partition is …	
74678	Just realized the windows partition of my Mac …	

```
74679  Just realized between the windows partition of…
74680  Just like the windows partition of my Mac is l…

                                      Preprocessed text  \
0                                        come border kill
1                                   m get borderland kill
2                                 m come borderland murder
3                                m get borderland 2 murder
4                                  m get borderland murder
…                                                      …
74676  realize Windows partition Mac like 6 year Nvid…
74677  realize Mac window partition 6 year Nvidia dri…
74678  realize window partition Mac 6 year Nvidia dri…
74679  realize window partition Mac like 6 year Nvidi…
74680  like window partition Mac like 6 year driver i…

                                       sentiment_scores  compound  positive  \
0      {'neg': 0.343, 'neu': 0.657, 'pos': 0.0, 'comp…   -0.6908     0.000
1      {'neg': 0.37, 'neu': 0.63, 'pos': 0.0, 'compou…   -0.6908     0.000
2      {'neg': 0.37, 'neu': 0.63, 'pos': 0.0, 'compou…   -0.6908     0.000
3      {'neg': 0.343, 'neu': 0.657, 'pos': 0.0, 'comp…   -0.6908     0.000
4      {'neg': 0.37, 'neu': 0.63, 'pos': 0.0, 'compou…   -0.6908     0.000
…                                                      …       …       …
74676  {'neg': 0.086, 'neu': 0.817, 'pos': 0.097, 'co…    0.0772     0.097
74677  {'neg': 0.104, 'neu': 0.896, 'pos': 0.0, 'comp…   -0.2960     0.000
74678  {'neg': 0.091, 'neu': 0.909, 'pos': 0.0, 'comp…   -0.2960     0.000
74679  {'neg': 0.074, 'neu': 0.842, 'pos': 0.084, 'co…    0.0772     0.084
74680  {'neg': 0.09, 'neu': 0.728, 'pos': 0.182, 'com…    0.3687     0.182

       neutral  negative sentiment
0        0.657     0.343  Negative
1        0.630     0.370  Negative
2        0.630     0.370  Negative
3        0.657     0.343  Negative
4        0.630     0.370  Negative
…        …       …       …
74676    0.817     0.086  Positive
74677    0.896     0.104  Negative
74678    0.909     0.091  Negative
74679    0.842     0.074  Positive
74680    0.728     0.090  Positive

[71655 rows x 11 columns]
```

[115]:
```
df['sentiment']
```

```
----------------------------------------------------------------------
```

```
KeyError                                  Traceback (most recent call last)
/usr/local/lib/python3.10/dist-packages/pandas/core/indexes/base.py in␣
 ↪get_loc(self, key, method, tolerance)
   3801             try:
-> 3802                 return self._engine.get_loc(casted_key)
   3803             except KeyError as err:

/usr/local/lib/python3.10/dist-packages/pandas/_libs/index.pyx in pandas._libs.
 ↪index.IndexEngine.get_loc()

/usr/local/lib/python3.10/dist-packages/pandas/_libs/index.pyx in pandas._libs.
 ↪index.IndexEngine.get_loc()

pandas/_libs/hashtable_class_helper.pxi in pandas._libs.hashtable.
 ↪PyObjectHashTable.get_item()

pandas/_libs/hashtable_class_helper.pxi in pandas._libs.hashtable.
 ↪PyObjectHashTable.get_item()

KeyError: 'sentiment'

The above exception was the direct cause of the following exception:

KeyError                                  Traceback (most recent call last)
<ipython-input-115-2c4e406e7c6a> in <cell line: 1>()
----> 1 df['sentiment']

/usr/local/lib/python3.10/dist-packages/pandas/core/frame.py in␣
 ↪__getitem__(self, key)
   3805             if self.columns.nlevels > 1:
   3806                 return self._getitem_multilevel(key)
-> 3807             indexer = self.columns.get_loc(key)
   3808             if is_integer(indexer):
   3809                 indexer = [indexer]

/usr/local/lib/python3.10/dist-packages/pandas/core/indexes/base.py in␣
 ↪get_loc(self, key, method, tolerance)
   3802                 return self._engine.get_loc(casted_key)
   3803             except KeyError as err:
-> 3804                 raise KeyError(key) from err
   3805             except TypeError:
   3806                 # If we have a listlike key, _check_indexing_error will␣
 ↪raise

KeyError: 'sentiment'
```

[ ]:
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# by CHANDRASEKAR
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[ ]:
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#HAPPY CODING!!!
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