nz5qoe4ab

December 18, 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

[ ]:

```
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
```

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

[ ]:
```
df
```

[ ]:
```
       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]
```

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

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

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

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

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

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

[ ]:

```
     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…
```

[ ]:

```
#shows the bottom rows
df.tail()
```

[ ]:

```
         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…
```

[ ]:

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

[ ]:

```
       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]
```

```
[ ]: # 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
```

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

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

3 Data cleaning

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

```
[ ]: 2700
[ ]: # Remove duplicates based on all columns
     df.drop_duplicates(inplace=True)
```

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

```
[ ]: 0
```

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

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

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

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

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

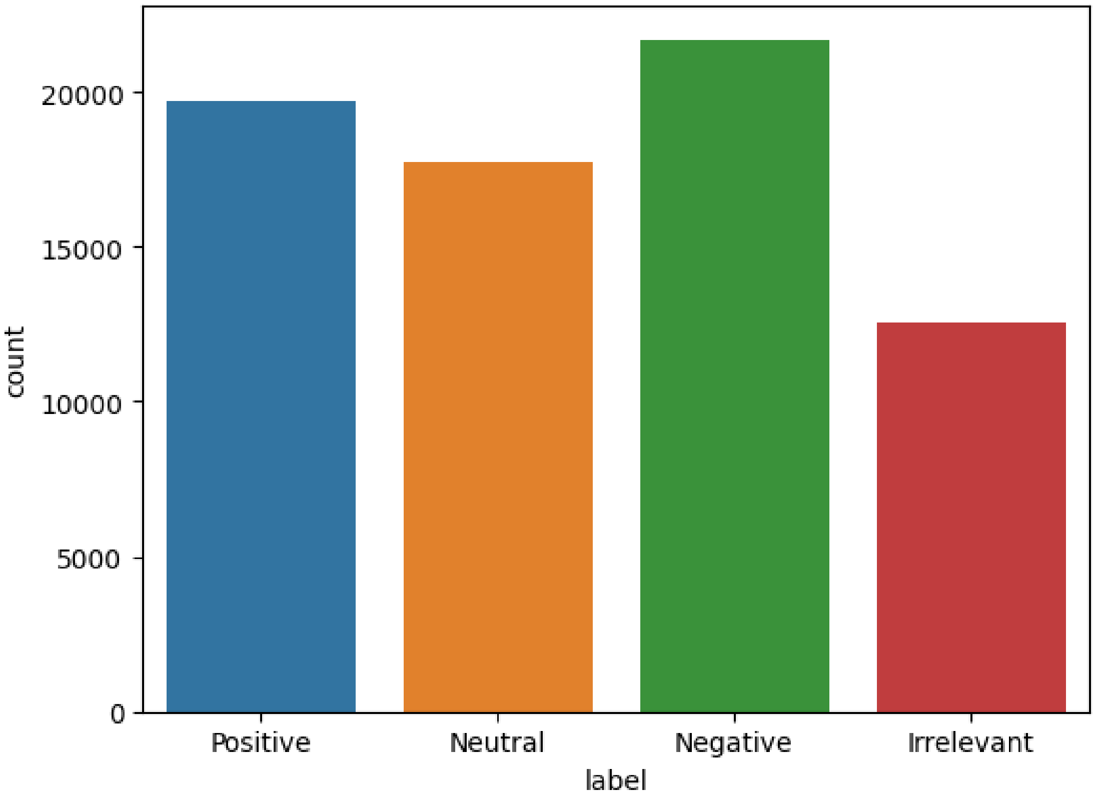
#Data Visualization of Target Variables

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

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

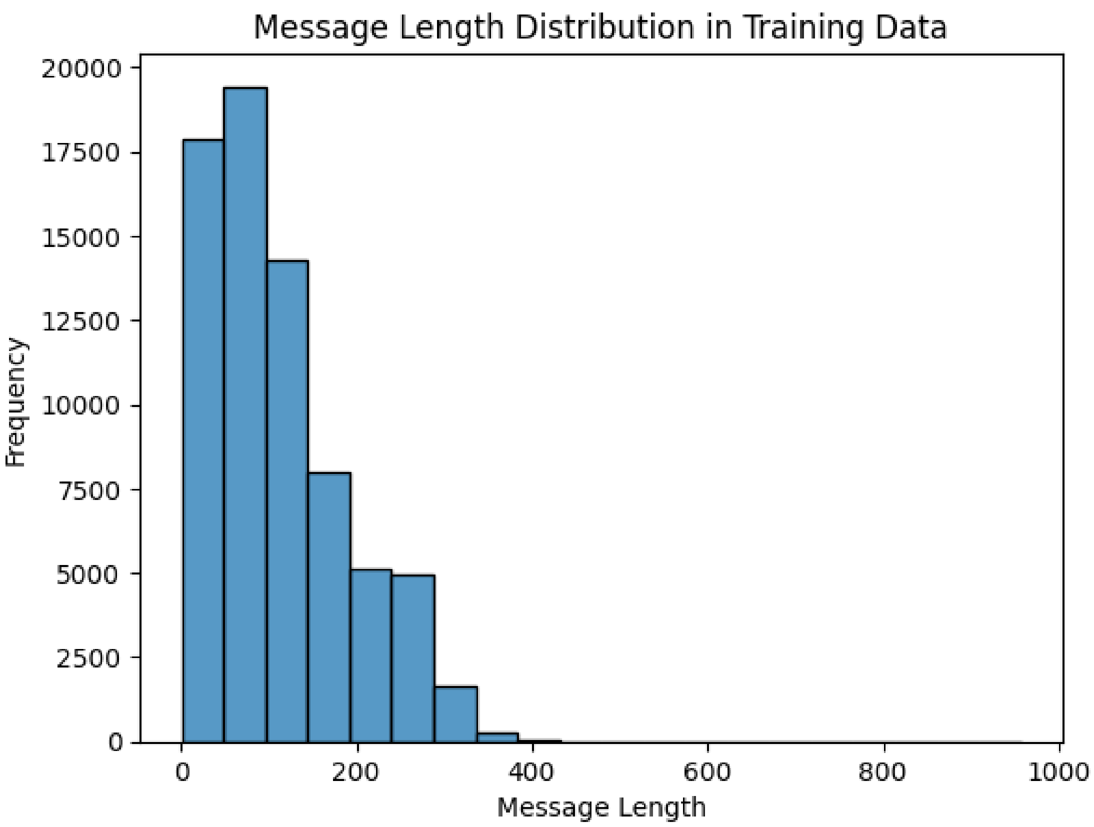
```
[ ]: sns.countplot(x=df['label'])
```

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



```
[ ]: # 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')
```

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



#Preprocessed text

```
[ ]: 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)
```

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

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

```
[ ]: df
```

```
[ ]:          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]
```

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

```
[ ]: 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
```

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

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

```
[ ]: (14331, 28054)
```

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

```
[ ]: (14331,)
```

#Machine Learning Model

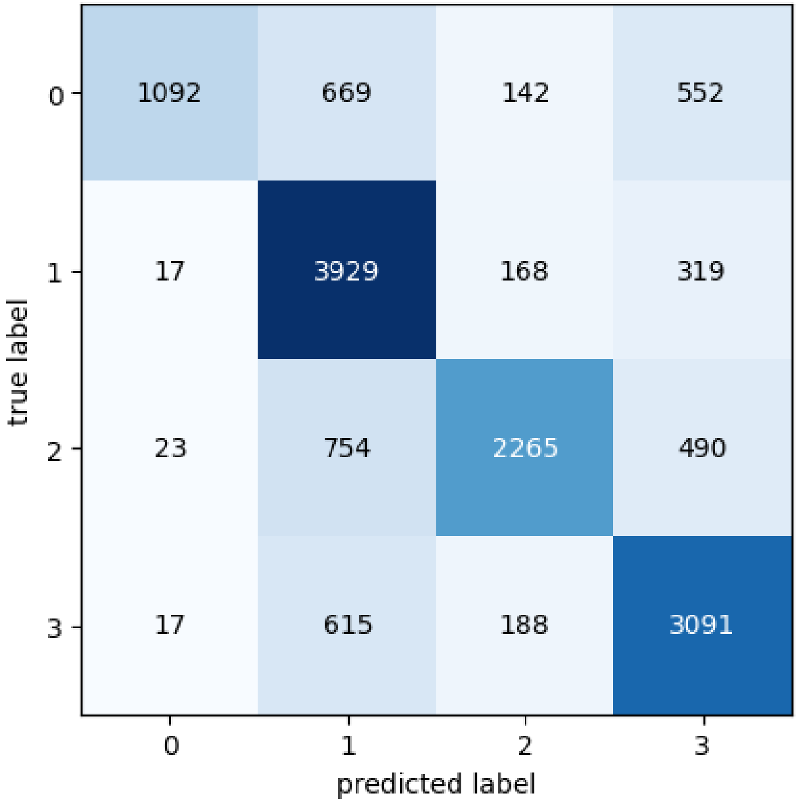
##Naive bayes

```
[ ]: 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]]
```

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

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



3.1 Logistic regression

[ ]:
```
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))
```

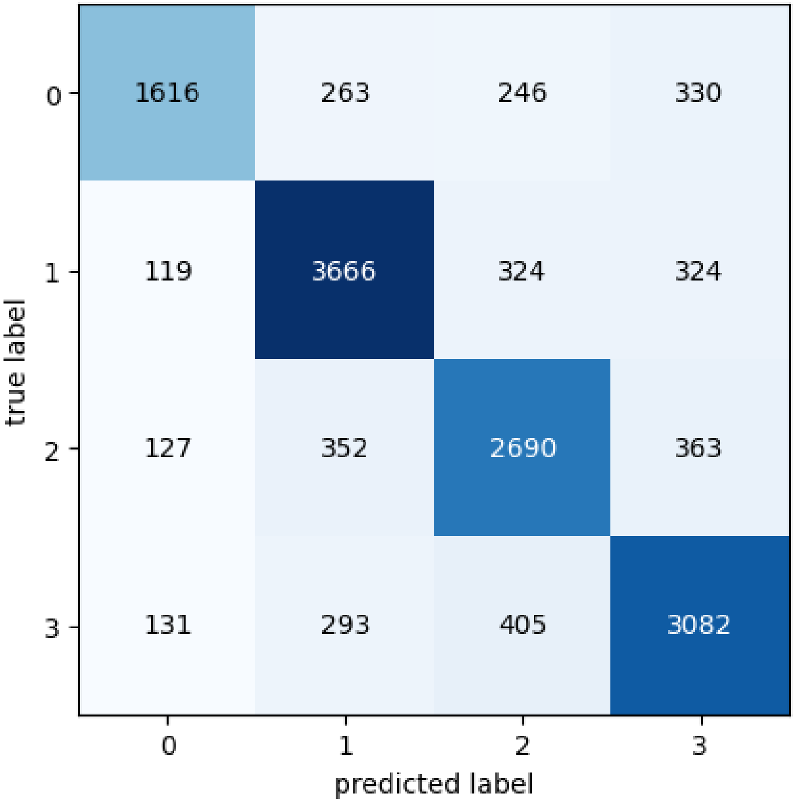
```
classification_report:
               precision    recall  f1-score   support

           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(
```

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

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



#VADER Sentiment Analysis

[ ]:
```
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!
```

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

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

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

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

```
[ ]: 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
```

```
[ ]: # 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'])
```

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

```
[ ]: df3
```

```
[ ]:          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]
```

```
[ ]: df3['sentiment']
[ ]: 0        Negative
     1        Negative
     2        Negative
     3        Negative
     4        Negative
                ...
     74676    Positive
     74677    Negative
     74678    Negative
     74679    Positive
     74680    Positive
     Name: sentiment, Length: 71655, dtype: object
```

```
[ ]: # by HARI
```

```
[ ]: #HAPPY CODING!!!
```