Restaurant Review Sentiment Analysis

August 10, 2024

0.1 Sentiment Analysis on Restaurant Reviews

Importing Necessary Libraries.

[4]:
```
import numpy as np
import pandas as pd
```

0.1.1 Exploratory Data Analysis (EDA)

Data Loading

[7]:
```
df = pd.read_csv('Restaurant_Reviews.tsv', delimiter='\t', quoting=3)
```

Descriptive Data Analysis

[9]:
```
df.shape
```

[9]:
```
(1000, 2)
```

[10]:
```
df.columns
```

[10]:
```
Index(['Review', 'Liked'], dtype='object')
```

[11]:
```
df.head()
```

[11]:

	Review	Liked
0	Wow… Loved this place.	1
1	Crust is not good.	0
2	Not tasty and the texture was just nasty.	0
3	Stopped by during the late May bank holiday of…	1
4	The selection on the menu was great and so wer…	1

[12]:
```
df.tail()
```

[12]:

	Review	Liked
995	I think food should have flavor and texture an…	0
996	Appetite instantly gone.	0
997	Overall I was not impressed and would not go b…	0
998	The whole experience was underwhelming, and I …	0
999	Then, as if I hadn't wasted enough of my life …	0

[13]:
```
df.sample(5)
```

[13]:
```
                                                Review  Liked
778                 My girlfriend's veal was very bad.       0
69                      A great way to finish a great.       1
273  Stopped by this place while in Madison for the…      1
375                          Best tacos in town by far!!      1
836    Just had lunch here and had a great experience.      1
```

[14]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1000 entries, 0 to 999
Data columns (total 2 columns):
 #   Column  Non-Null Count  Dtype 
---  ------  --------------  ----- 
 0   Review  1000 non-null   object
 1   Liked   1000 non-null   int64 
dtypes: int64(1), object(1)
memory usage: 15.8+ KB
```

[163]:
```
df['Liked'].value_counts()
```

[163]:
```
Liked
1    500
0    500
Name: count, dtype: int64
```

[161]:
```
df.describe()
```

[161]:
```
             Liked       Length
count  1000.00000  1000.000000
mean      0.50000    58.315000
std       0.50025    32.360052
min       0.00000    11.000000
25%       0.00000    33.000000
50%       0.50000    51.000000
75%       1.00000    80.000000
max       1.00000   149.000000
```

[17]:
```
df.isnull().sum()
```

[17]:
```
Review    0
Liked     0
dtype: int64
```

[18]:
```
df.duplicated().sum()
```

[18]:
```
4
```

0.1.2 Feature Engineering

[165]:
```
df['Length'] = df['Review'].apply(len)
df.head(5)
```

[165]:

	Review	Liked	Length
0	Wow… Loved this place.	1	24
1	Crust is not good.	0	18
2	Not tasty and the texture was just nasty.	0	41
3	Stopped by during the late May bank holiday of…	1	87
4	The selection on the menu was great and so wer…	1	59

0.1.3 Data Preprocessing

Importing Essential NLP Libraries

[178]:
```
import nltk
import re

# Download stopwords
nltk.download('stopwords')

# Import stopwords and PorterStemmer
from nltk.corpus import stopwords
from nltk.stem.porter import PorterStemmer
```

```
[nltk_data] Downloading package stopwords to
[nltk_data]     C:\Users\user\AppData\Roaming\nltk_data…
[nltk_data]   Package stopwords is already up-to-date!
```

[180]:
```
print(list(stopwords.words('english')))
```

```
['i', 'me', 'my', 'myself', 'we', 'our', 'ours', 'ourselves', 'you', "you're",
"you've", "you'll", "you'd", 'your', 'yours', 'yourself', 'yourselves', 'he',
'him', 'his', 'himself', 'she', "she's", 'her', 'hers', 'herself', 'it', "it's",
'its', 'itself', 'they', 'them', 'their', 'theirs', 'themselves', 'what',
'which', 'who', 'whom', 'this', 'that', "that'll", 'these', 'those', 'am', 'is',
'are', 'was', 'were', 'be', 'been', 'being', 'have', 'has', 'had', 'having',
'do', 'does', 'did', 'doing', 'a', 'an', 'the', 'and', 'but', 'if', 'or',
'because', 'as', 'until', 'while', 'of', 'at', 'by', 'for', 'with', 'about',
'against', 'between', 'into', 'through', 'during', 'before', 'after', 'above',
'below', 'to', 'from', 'up', 'down', 'in', 'out', 'on', 'off', 'over', 'under',
'again', 'further', 'then', 'once', 'here', 'there', 'when', 'where', 'why',
'how', 'all', 'any', 'both', 'each', 'few', 'more', 'most', 'other', 'some',
'such', 'no', 'nor', 'not', 'only', 'own', 'same', 'so', 'than', 'too', 'very',
's', 't', 'can', 'will', 'just', 'don', "don't", 'should', "should've", 'now',
'd', 'll', 'm', 'o', 're', 've', 'y', 'ain', 'aren', "aren't", 'couldn',
"couldn't", 'didn', "didn't", 'doesn', "doesn't", 'hadn', "hadn't", 'hasn',
"hasn't", 'haven', "haven't", 'isn', "isn't", 'ma', 'mightn', "mightn't",
'mustn', "mustn't", 'needn', "needn't", 'shan', "shan't", 'shouldn',
```

```
"shouldn't", 'wasn', "wasn't", 'weren', "weren't", 'won', "won't", 'wouldn',
"wouldn't"]
```

[222]:
```
# Initialize an empty list to store the clean reviews
corpus = []

# Initialize the PorterStemmer
ps = PorterStemmer()

# Loop through the first 1000 reviews
for i in range(0, 1000):
    # Step 1: Removing non-alphabetical characters
    review = re.sub(pattern='[^a-zA-Z]', repl=' ', string=df['Review'][i])

    # Step 2: Converting text to lowercase
    review = review.lower()

    # Step 3: Tokenization
    review_words = review.split()

    # Step 4: Removing stopwords
    review_words = [word for word in review_words if word not in set(stopwords.
 ↪words('english'))]

    # Step 5: Stemming
    review_words = [ps.stem(word) for word in review_words]

    # Step 6: Rejoining Tokens
    review = ' '.join(review_words)

    # Step 7: Appending to the Corpus
    corpus.append(review)
```

[223]:
```
corpus[:20]
```

[223]:
```
['wow love place',
 'crust good',
 'tasti textur nasti',
 'stop late may bank holiday rick steve recommend love',
 'select menu great price',
 'get angri want damn pho',
 'honeslti tast fresh',
 'potato like rubber could tell made ahead time kept warmer',
 'fri great',
 'great touch',
 'servic prompt',
 'would go back',
```

```
'cashier care ever say still end wayyy overpr',
'tri cape cod ravoli chicken cranberri mmmm',
'disgust pretti sure human hair',
'shock sign indic cash',
'highli recommend',
'waitress littl slow servic',
'place worth time let alon vega',
'like']
```

0.2 Word Cloud

[226]:
```python
# importing library
# positive review
from wordcloud import WordCloud
import matplotlib.pyplot as plt
word_cloud = df.loc[df['Liked']==1,:]
text=''.join([text for text in word_cloud['Review']])
#Generating a WordCloud object
wordcloud = WordCloud (width=800, height=400, background_color='white').
    ↪generate(text)
#Displaying the wordcloud using matplotlib
plt.figure(figsize=(10,5))
plt.imshow(wordcloud, interpolation='bilinear')
plt.axis('off')
plt.show()
```

[228]:
```
# Creating a Bag of Words Model (BoW) from the corpus of cleaned tex review
from sklearn.feature_extraction.text import CountVectorizer

# Initializing a CountVectorizer with a specified maximum number of features␣
 ↪(max_features)
cv = CountVectorizer(max_features=1500)

# Applying the CountVectorizer to the corpus to transform the text data into a␣
 ↪numerical representation
X = cv.fit_transform(corpus).toarray()

#Extracting the target variable 'y' from the DataFrame 'df' containing target␣
 ↪values
y = df.iloc[:, 1].values
```

0.2.1 Data Splitting

[231]:
```
from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.20,␣
 ↪random_state=0)
```

[233]:
```
X_train.shape, X_test.shape, y_train.shape, y_test.shape
```

[233]:
```
((800, 1500), (200, 1500), (800,), (200,))
```

0.2.2 Model Training

[235]:
```
#Create a Multinomial Naive Bayes classifier
from sklearn.naive_bayes import MultinomialNB
model = MultinomialNB()
```

[237]:
```
from sklearn.metrics import accuracy_score
# Training the model
model.fit(X_train, y_train)

# Making predictions on the test set
y_test_pred = model.predict(X_test)

# Calculating the testingb accuracy for the fold
test_accuracy = accuracy_score(y_test, y_test_pred)
```

[239]:
```
# Print the testing accuracy
print(f'MultinomialNB: Testing Accuracy= {test_accuracy * 100:2f}%')
```

```
MultinomialNB: Testing Accuracy= 76.500000%
```

[241]:
```
# Printing the tests set results

y_pred = model.predict(X_test)
y_pred
```

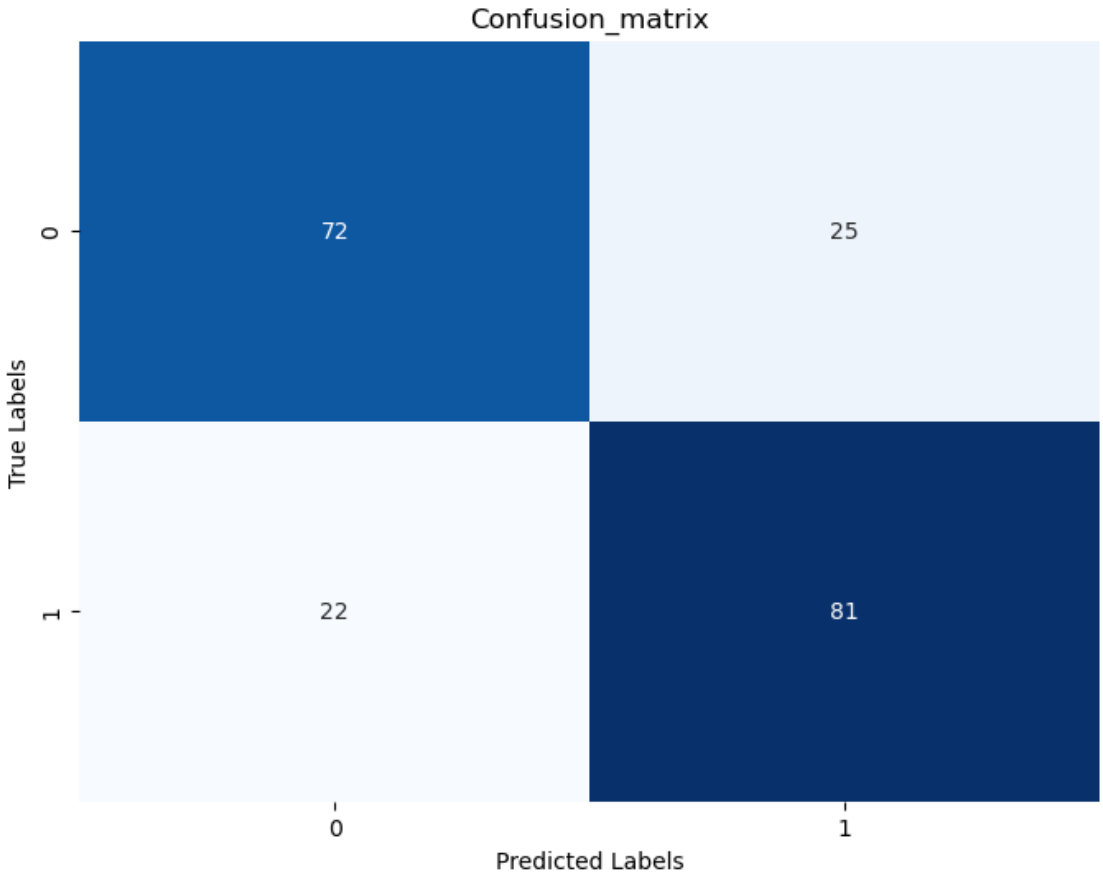
[241]:
```
array([0, 0, 0, 0, 0, 0, 1, 0, 0, 1, 1, 1, 1, 1, 1, 1, 0, 0, 0, 1, 0, 0,
       1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 0, 0, 0, 1, 1, 1, 1, 0,
       0, 0, 1, 1, 0, 0, 1, 1, 1, 1, 1, 0, 1, 1, 0, 1, 1, 0, 0, 1, 0, 0,
       1, 0, 1, 0, 1, 1, 1, 0, 0, 0, 0, 1, 0, 1, 1, 1, 1, 0, 1, 1, 1, 0,
       1, 1, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 1, 1, 0, 1, 1, 1, 0, 0,
       0, 1, 0, 1, 1, 0, 1, 1, 1, 1, 1, 0, 1, 1, 0, 0, 1, 1, 0, 0, 1, 1,
       0, 0, 1, 1, 1, 1, 1, 1, 0, 1, 1, 0, 0, 0, 0, 0, 1, 0, 1, 0, 1, 1,
       1, 0, 1, 0, 1, 1, 0, 0, 1, 1, 0, 0, 1, 0, 0, 0, 0, 1, 1, 0, 0, 1,
       0, 1, 0, 0, 1, 0, 0, 1, 0, 0, 0, 1, 0, 1, 1, 0, 1, 0, 0, 0, 1, 1,
       0, 1], dtype=int64)
```

[245]:
```
from sklearn.metrics import accuracy_score , precision_score, recall_score,␣
↪f1_score, confusion_matrix, classification_report
confusion = confusion_matrix(y_test, y_test_pred)
print(confusion)
```

```
[[72 25]
 [22 81]]
```

[247]:
```
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.metrics import confusion_matrix

plt.figure(figsize=(8, 6))
sns.heatmap(confusion, annot=True, fmt="d", cmap="Blues", cbar=False)
plt.xlabel("Predicted Labels")
plt.ylabel("True Labels")
plt.title("Confusion_matrix")
plt.show()
```



[267]:
```
from sklearn.metrics import classification_report
classification = classification_report(y_test,y_test_pred)
print(classification)
```

```
              precision    recall  f1-score   support

           0       0.77      0.74      0.75        97
           1       0.76      0.79      0.78       103

    accuracy                           0.77       200
   macro avg       0.77      0.76      0.76       200
weighted avg       0.77      0.77      0.76       200
```

0.2.3 Predictions

[273]:
```
import re
from nltk.corpus import stopwords
from nltk.stem.porter import PorterStemmer
def predict_sentiment(sample_review, model, cv):
```

```
    sample_review = re.sub(pattern='[^a-zA-Z]', repl=' ', string=sample_review )
    sample_review = sample_review.lower()
    sample_review_words = sample_review.split()
    sample_review_words = [word for word in sample_review_words if word not in␣
 ↪set(stopwords.words('english'))]
    ps=PorterStemmer()
    final_review = [ps.stem(word) for word in sample_review_words]
    final_review = ' '.join(final_review)

    temp = cv.transform([final_review]).toarray()
    sentiment = model.predict(temp)
    return sentiment[0]
```

[288]:
```
# Assuming you have a trained NLP model named "model" and a CountVectorizer␣
 ↪named "cv"
sample_text = "The food is really good and delicious"
predicted_sentiment = predict_sentiment(sample_text, model, cv)
print(f'Predicted Sentiment: {predicted_sentiment}')
```

```
Predicted Sentiment: 1
```

[290]:
```
sample_text = "The food is tasteless and bad"
predicted_sentiment = predict_sentiment(sample_text, model, cv)
print(f'Predicted Sentiment: {predicted_sentiment}')
```

```
Predicted Sentiment: 0
```

[ ]: