Brian_Reppeto_DSC550_Week_5

April 14, 2024

0.0.1 DSC 550 Week :

Activity 5.2

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[1]:
```
# import libraries

import pandas as pd
from textblob import TextBlob
import re
import nltk
from nltk.corpus import stopwords
from nltk.tokenize import word_tokenize
from nltk.stem import PorterStemmer
from sklearn.feature_extraction.text import CountVectorizer
from sklearn.feature_extraction.text import TfidfVectorizer
from sklearn.model_selection import train_test_split
from sklearn.metrics import accuracy_score
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import confusion_matrix
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.metrics import precision_recall_fscore_support
from sklearn.metrics import roc_curve, auc
```

[2]:
```
# import movie file

data_path='labeledTrainData.tsv'
movie_df=pd.read_csv(data_path, delimiter='\t')
```

[3]:
```
# head new df

movie_df.head()
```

[3]:

	id	sentiment	review
0	5814_8	1	With all this stuff going down at the moment w…
1	2381_9	1	\The Classic War of the Worlds\" by Timothy Hi…
2	7759_3	0	The film starts with a manager (Nicholas Bell)…

```
3  3630_4          0  It must be assumed that those who praised this…
4  9495_8          1  Superbly trashy and wondrously unpretentious 8…
```

[4]:
```
# create function to classify sentiment

def classify_review(review):
    blob=TextBlob(review)
    return 'positive' if blob.sentiment.polarity >= 0 else 'negative'
```

[5]:
```
# apply function to each review

movie_df['predicted_sentiment']=movie_df['review'].apply(classify_review)
```

[6]:
```
# create function to change the calc sent to number

def classify_review(review):
    blob=TextBlob(review)
    return 1 if blob.sentiment.polarity >= 0 else 0
```

[7]:
```
# apply function to each review

movie_df['predicted_sentiment_num']=movie_df['review'].apply(classify_review)
```

[8]:
```
# head df

movie_df.head()
```

[8]:
```
        id  sentiment                                             review  \
0  5814_8          1  With all this stuff going down at the moment w…
1  2381_9          1  \The Classic War of the Worlds\" by Timothy Hi…
2  7759_3          0  The film starts with a manager (Nicholas Bell)…
3  3630_4          0  It must be assumed that those who praised this…
4  9495_8          1  Superbly trashy and wondrously unpretentious 8…

  predicted_sentiment  predicted_sentiment_num
0            positive                        1
1            positive                        1
2            negative                        0
3            positive                        1
4            negative                        0
```

[9]:
```
# convert text to lowercase

movie_df['review']=movie_df['review'].str.lower()
```

[10]:
```
# head column
```

```
movie_df['review'].head(15)
```

[10]:
```
0     with all this stuff going down at the moment w…
1     \the classic war of the worlds\" by timothy hi…
2     the film starts with a manager (nicholas bell)…
3     it must be assumed that those who praised this…
4     superbly trashy and wondrously unpretentious 8…
5     i dont know why people think this is such a ba…
6     this movie could have been very good, but come…
7     i watched this video at a friend's house. i'm …
8     a friend of mine bought this film for £1, and …
9     <br /><br />this movie is full of references. …
10    what happens when an army of wetbacks, towelhe…
11    although i generally do not like remakes belie…
12    \mr. harvey lights a candle\" is anchored by a…
13    i had a feeling that after \submerged\", this …
14    note to george litman, and others: the mystery…
Name: review, dtype: object
```

[11]:
```
# Remove punctuation and special characters

movie_df['review']=movie_df['review'].apply(lambda x: re.sub(r'[^\w\s]', '', x)␣
 ↪if pd.notnull(x) else x)
```

[12]:
```
# head df

movie_df.head(15)
```

[12]:

	id	sentiment	review	\
0	5814_8	1	with all this stuff going down at the moment w…	
1	2381_9	1	the classic war of the worlds by timothy hines…	
2	7759_3	0	the film starts with a manager nicholas bell g…	
3	3630_4	0	it must be assumed that those who praised this…	
4	9495_8	1	superbly trashy and wondrously unpretentious 8…	
5	8196_8	1	i dont know why people think this is such a ba…	
6	7166_2	0	this movie could have been very good but comes…	
7	10633_1	0	i watched this video at a friends house im gla…	
8	319_1	0	a friend of mine bought this film for 1 and ev…	
9	8713_10	1	br br this movie is full of references like ma…	
10	2486_3	0	what happens when an army of wetbacks towelhea…	
11	6811_10	1	although i generally do not like remakes belie…	
12	11744_9	1	mr harvey lights a candle is anchored by a bri…	
13	7369_1	0	i had a feeling that after submerged this one …	
14	12081_1	0	note to george litman and others the mystery s…	

	predicted_sentiment	predicted_sentiment_num
0	positive	1

```
1             positive                      1
2             negative                      0
3             positive                      1
4             negative                      0
5             positive                      1
6             negative                      0
7             positive                      1
8             positive                      1
9             positive                      1
10            negative                      0
11            positive                      1
12            positive                      1
13            positive                      1
14            positive                      1
```

[13]:
```
# Remove stop words

# download stop words

nltk.download('punkt')
nltk.download('stopwords')
```

```
[nltk_data] Downloading package punkt to
[nltk_data]     /Users/brianreppeto/nltk_data…
[nltk_data]   Package punkt is already up-to-date!
[nltk_data] Downloading package stopwords to
[nltk_data]     /Users/brianreppeto/nltk_data…
[nltk_data]   Package stopwords is already up-to-date!
```

[13]:
```
True
```

[14]:
```
# load stop words

stop_words = set(stopwords.words('english'))
```

[15]:
```
# function to remove stopwords

def remove_stopwords(text):
    if pd.notnull(text):
        # Tokenize the text string
        word_tokens = word_tokenize(text)
        # Remove stop words
        filtered_sentence = [word for word in word_tokens if word.lower() not␣
 ↪in stop_words]
        # Rejoin words
        return ' '.join(filtered_sentence)
    return text
```

```
# apply function to remove stop words from the column

movie_df['review'] = movie_df['review'].apply(remove_stopwords)
```

[16]:
```
# head df

movie_df.head()
```

[16]:
```
       id  sentiment                                             review  \
0  5814_8          1  stuff going moment mj ive started listening mu…
1  2381_9          1  classic war worlds timothy hines entertaining …
2  7759_3          0  film starts manager nicholas bell giving welco…
3  3630_4          0  must assumed praised film greatest filmed oper…
4  9495_8          1  superbly trashy wondrously unpretentious 80s e…

  predicted_sentiment  predicted_sentiment_num
0            positive                        1
1            positive                        1
2            negative                        0
3            positive                        1
4            negative                        0
```

[17]:
```
# apply NLTK porterstemmer

# initialize the porterstemmer

stemmer = PorterStemmer()
```

[18]:
```
# function to stem words in the text

def stem_text(text):
    if pd.notnull(text):

        # tokenize the text string into words

        word_tokens = word_tokenize(text)

        # stem each word

        stemmed_words = [stemmer.stem(word) for word in word_tokens]

        # rejoin the stemmed words into a single string

        return ' '.join(stemmed_words)
    return text
```

```
movie_df['review'] = movie_df['review'].apply(stem_text)
```

[19]:
```
# head df

movie_df.head(15)
```

[19]:

	id	sentiment	review	\
0	5814_8	1	stuff go moment mj ive start listen music watc…	
1	2381_9	1	classic war world timothi hine entertain film …	
2	7759_3	0	film start manag nichola bell give welcom inve…	
3	3630_4	0	must assum prais film greatest film opera ever…	
4	9495_8	1	superbl trashi wondrous unpretenti 80 exploit …	
5	8196_8	1	dont know peopl think bad movi got pretti good…	
6	7166_2	0	movi could good come way short cheesi special …	
7	10633_1	0	watch video friend hous im glad wast money buy…	
8	319_1	0	friend mine bought film 1 even grossli overpr …	
9	8713_10	1	br br movi full refer like mad max ii wild one…	
10	2486_3	0	happen armi wetback towelhead godless eastern …	
11	6811_10	1	although gener like remak believ remak wast ti…	
12	11744_9	1	mr harvey light candl anchor brilliant perform…	
13	7369_1	0	feel submerg one wouldnt better right must loo…	
14	12081_1	0	note georg litman other mysteri scienc theater…	

	predicted_sentiment	predicted_sentiment_num
0	positive	1
1	positive	1
2	negative	0
3	positive	1
4	negative	0
5	positive	1
6	negative	0
7	positive	1
8	positive	1
9	positive	1
10	negative	0
11	positive	1
12	positive	1
13	positive	1
14	positive	1

[20]:
```
# Splitting the dataset into training and testing sets

train_df, test_df = train_test_split(movie_df, test_size=0.2, random_state=42)
```

[21]:
```
# shapes of the training and testing sets to verify the split

train_df.shape, test_df.shape
```

[21]: ((20000, 5), (5000, 5))

[22]:
```
# Initializing the TF-IDF Vectorizer
tfidf_vectorizer = TfidfVectorizer()

# Fit the vectorizer to the training data and transforming the 'review' column
X_train_tfidf = tfidf_vectorizer.fit_transform(train_df['review'])

# Check the shape
X_train_tfidf.shape
```

[22]: (20000, 80932)

[23]:
```
# Apply the TF-IDF transformation to the test set
X_test_tfidf = tfidf_vectorizer.transform(test_df['review'])

# Check the shape
X_test_tfidf.shape
```

[23]: (5000, 80932)

[24]:
```
# Initializ the logistic regression model
logistic_model = LogisticRegression(random_state=42, max_iter=1000)

# Train the logistic regression model on the TF-IDF vectorized training data
# 'sentiment' column is the target variable
logistic_model.fit(X_train_tfidf, train_df['sentiment'])
```

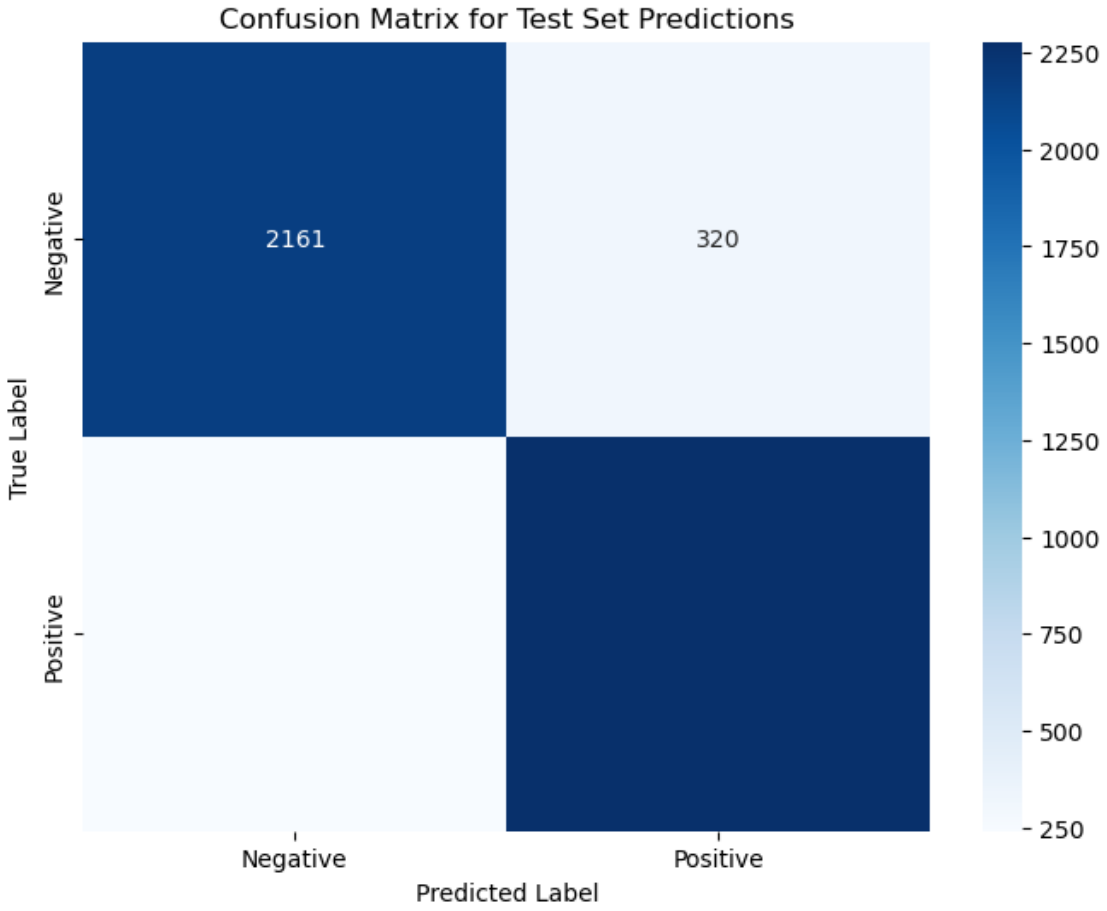
[24]: LogisticRegression(max_iter=1000, random_state=42)

[25]:
```
# Evaluat the model's accuracy on the test set
test_accuracy = logistic_model.score(X_test_tfidf, test_df['sentiment'])

test_accuracy
```

[25]: 0.8878

[26]:
```
# Make predictions on the test set
test_predictions = logistic_model.predict(X_test_tfidf)

# Generate the confusion matrix
conf_matrix = confusion_matrix(test_df['sentiment'], test_predictions)

# Plot the confusion matrix
plt.figure(figsize=(8, 6))
sns.heatmap(conf_matrix, annot=True, fmt='d', cmap='Blues',␣
 ↪xticklabels=['Negative', 'Positive'], yticklabels=['Negative', 'Positive'])
plt.title('Confusion Matrix for Test Set Predictions')
```

```
plt.xlabel('Predicted Label')
plt.ylabel('True Label')
plt.show()
```

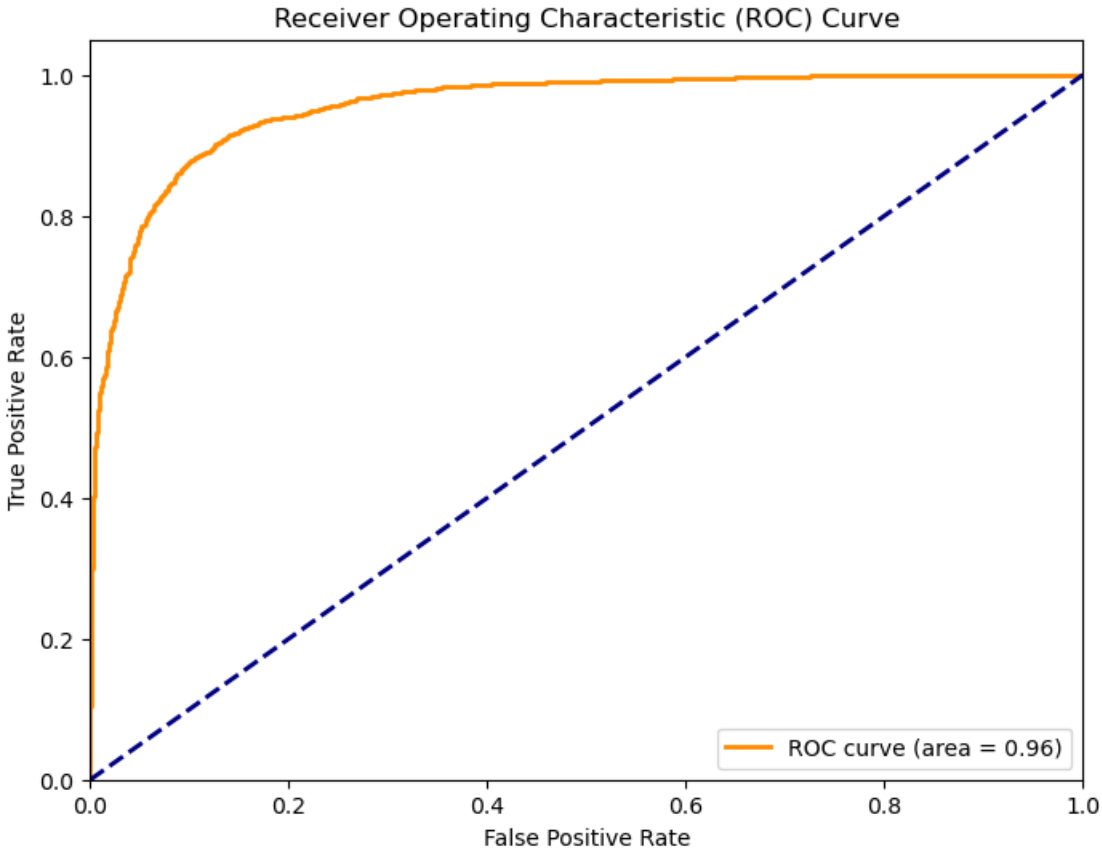


[27]:
```
# Calc precision, recall, and F1-score for the test set predictions
precision, recall, f1_score, _ =␣
  ↪precision_recall_fscore_support(test_df['sentiment'], test_predictions,␣
  ↪average='binary')

precision, recall, f1_score
```

[27]: (0.8768283294842186, 0.9043271139341008, 0.8903654485049834)

[28]:
```
# Get the probabilities of positive class predictions
test_probabilities = logistic_model.predict_proba(X_test_tfidf)[:, 1]

# Calc ROC curve and AUC
fpr, tpr, thresholds = roc_curve(test_df['sentiment'], test_probabilities)
```

```
roc_auc = auc(fpr, tpr)

# Plot the ROC curve
plt.figure(figsize=(8, 6))
plt.plot(fpr, tpr, color='darkorange', lw=2, label='ROC curve (area = %0.2f)' %␣
 ↪roc_auc)
plt.plot([0, 1], [0, 1], color='navy', lw=2, linestyle='--')
plt.xlim([0.0, 1.0])
plt.ylim([0.0, 1.05])
plt.xlabel('False Positive Rate')
plt.ylabel('True Positive Rate')
plt.title('Receiver Operating Characteristic (ROC) Curve')
plt.legend(loc="lower right")
plt.show()
```

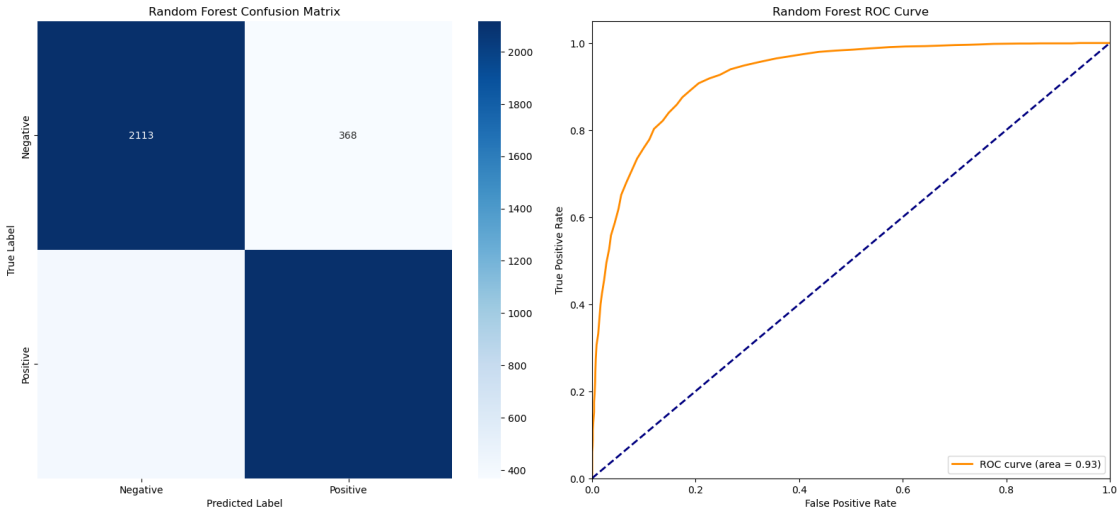


Pick another classification model you learned about this week and repeat steps (5) – (9)

[29]:
```
from sklearn.ensemble import RandomForestClassifier
```

```
# Initializing the Random Forest Classifier
random_forest_model = RandomForestClassifier(random_state=42, n_estimators=100)

# Train the Random Forest model on the TF-IDF vectorized training data
random_forest_model.fit(X_train_tfidf, train_df['sentiment'])

# Evaluate the model's accuracy on the test set
rf_test_accuracy = random_forest_model.score(X_test_tfidf, test_df['sentiment'])

# Make predictions on the test set
rf_test_predictions = random_forest_model.predict(X_test_tfidf)

# Generate the confusion matrix
rf_conf_matrix = confusion_matrix(test_df['sentiment'], rf_test_predictions)

# Calc precision, recall, and F1-score
rf_precision, rf_recall, rf_f1_score, _ =␣
 ↪precision_recall_fscore_support(test_df['sentiment'], rf_test_predictions,␣
 ↪average='binary')

# Get the probabilities of positive class predictions for ROC curve
rf_test_probabilities = random_forest_model.predict_proba(X_test_tfidf)[:, 1]
rf_fpr, rf_tpr, rf_thresholds = roc_curve(test_df['sentiment'],␣
 ↪rf_test_probabilities)
rf_roc_auc = auc(rf_fpr, rf_tpr)

# Plot metrics including the ROC curve
plt.figure(figsize=(16, 14))

# Confusion Matrix Plot
plt.subplot(2, 2, 1)
sns.heatmap(rf_conf_matrix, annot=True, fmt='d', cmap='Blues',␣
 ↪xticklabels=['Negative', 'Positive'], yticklabels=['Negative', 'Positive'])
plt.title('Random Forest Confusion Matrix')
plt.xlabel('Predicted Label')
plt.ylabel('True Label')

# ROC Curve Plot
plt.subplot(2, 2, 2)
plt.plot(rf_fpr, rf_tpr, color='darkorange', lw=2, label='ROC curve (area = %0.
 ↪2f)' % rf_roc_auc)
plt.plot([0, 1], [0, 1], color='navy', lw=2, linestyle='--')
plt.xlim([0.0, 1.0])
plt.ylim([0.0, 1.05])
plt.xlabel('False Positive Rate')
plt.ylabel('True Positive Rate')
plt.title('Random Forest ROC Curve')
```

```
plt.legend(loc="lower right")

plt.tight_layout()
plt.show()

(rf_test_accuracy, rf_precision, rf_recall, rf_f1_score)
```



[29]: (0.8458, 0.8518518518518519, 0.8400158793171894, 0.8458924645212873)

[ ]: