hausaTweet

July 3, 2021

[1]:

```
#import libraries

import pandas as pd
import numpy as np
import sklearn.metrics as metrics
import matplotlib.pyplot as plt
import seaborn as sns
import nltk

#import Sckit-helper functions
from sklearn.model_selection import train_test_split
from sklearn.feature_extraction.text import TfidfVectorizer, CountVectorizer

#import Scikit-learn models
from sklearn.naive_bayes import MultinomialNB
from sklearn.linear_model import LogisticRegression

#import performance metrics functions
from sklearn.metrics import confusion_matrix, accuracy_score, precision_score,␣
 ↪recall_score
from sklearn.metrics import classification_report
from sklearn.metrics import auc, roc_auc_score, roc_curve
```

[2]:

```
#importing dataset

data = pd.read_csv('sentiment_analysis_ouptut.csv')
data
```

[2]:

```
      linenumber  sentiment                                        tweet_text
0              1          2  Wllh ana biya sbd kudin beli yawa ne dasu har …
1              2          3              Kowa yayi da damisa ya duba jikinsa.
2              3          3  Duk wanda ka gani a cikin motar kai shi ka yi …
3              4         -1                      Allah ya tsinewa masu 'karya
4              5         -2  Mutane Basu D Adalcin Magana, Shugaba Yace Zai…
…            …        …                                                  …
2944        4193          1  Muma burin haka. Domain wanna makircine ga zam…
2945        4194         -2  Ay dama raini ne da rashin hankali.. Amma in b…
```

```
2946        4196         -1  Shikenan Wanda aka konawa ababen hawa sai dai …
2947        4198          7  Wannan abun a yaba ne, domin hakan zai sake in…
2948        4199         -1                     Na zata rivers bata cikin IPOB

[2949 rows x 3 columns]
```

[3]:

```
#Categorizing sentiments
#(-1 downward as negative sentiment category[0])
#(+1 upward as positive sentiment category [1])

data.loc[(data['sentiment'] <0 ), 'sentiment'] = 0
data.loc[(data['sentiment'] >0), 'sentiment'] = 1

j = 0
for i in range(0,1):
    data.loc[(data["sentiment"] >= j) & (data["sentiment"] <= i*10),␣
 ↪"sentiment"] = i*10
    i = i + 1
    j = j + 10

data
```

[3]:

```
      linenumber  sentiment                                         tweet_text
0              1          1  Wllh ana biya sbd kudin beli yawa ne dasu har …
1              2          1                Kowa yayi da damisa ya duba jikinsa.
2              3          1  Duk wanda ka gani a cikin motar kai shi ka yi …
3              4          0                        Allah ya tsinewa masu 'karya
4              5          0  Mutane Basu D Adalcin Magana, Shugaba Yace Zai…
…            …          …                                                …
2944        4193          1  Muma burin haka. Domain wanna makircine ga zam…
2945        4194          0  Ay dama raini ne da rashin hankali.. Amma in b…
2946        4196          0  Shikenan Wanda aka konawa ababen hawa sai dai …
2947        4198          1  Wannan abun a yaba ne, domin hakan zai sake in…
2948        4199          0                     Na zata rivers bata cikin IPOB

[2949 rows x 3 columns]
```

[4]:

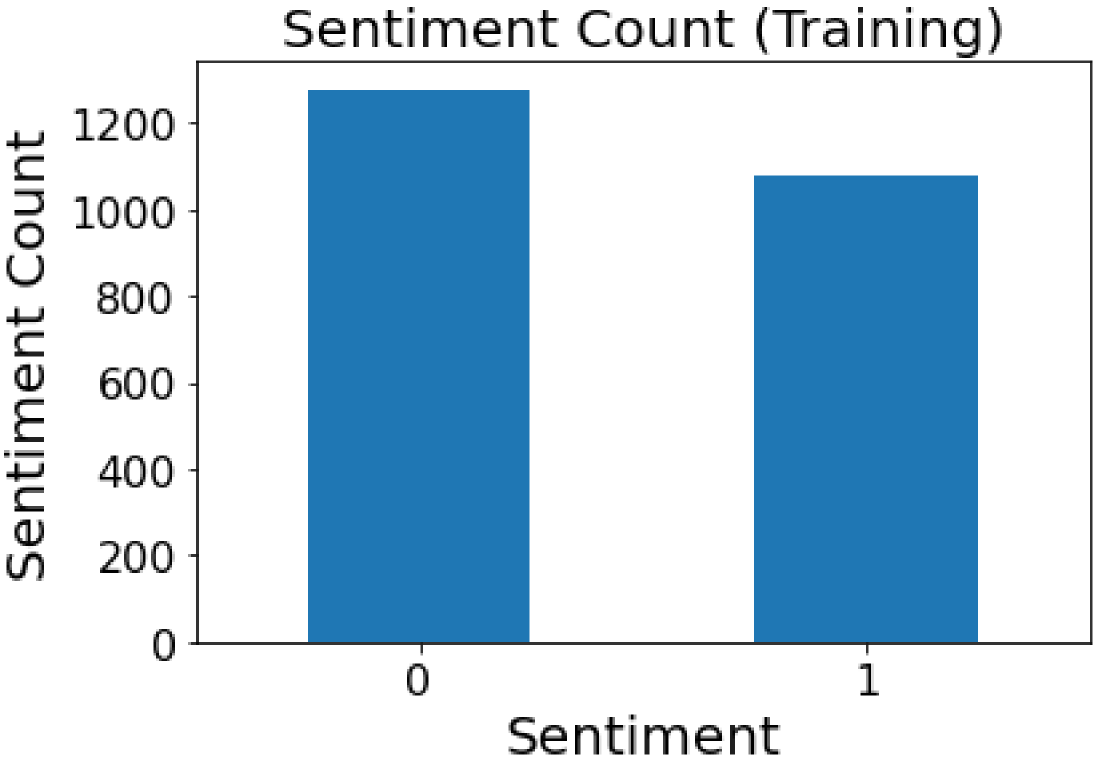
```
#data split into training and testing datastet

test_percentage = .2
train_df, test_df = train_test_split(data, test_size=test_percentage,␣
 ↪random_state=42)

labels = train_df['sentiment']
test_labels = test_df['sentiment']

print("\n### Split Complete ###\n")
```

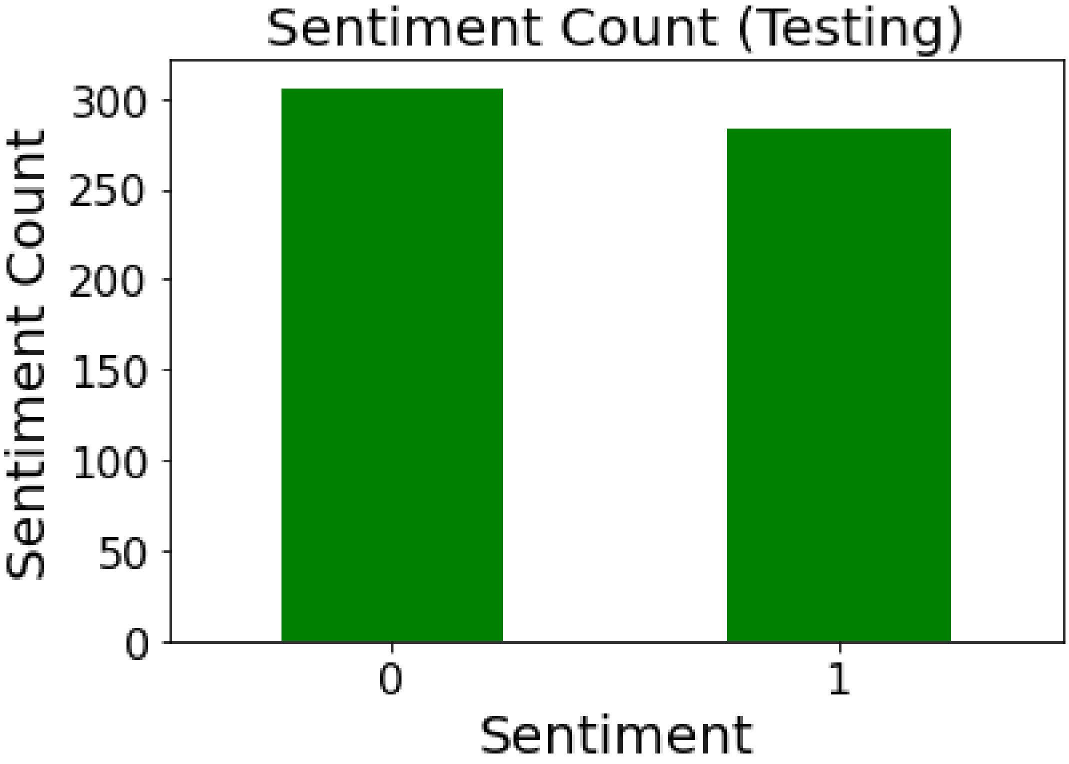
```
### Split Complete ###
```

[5]:

```python
# Print counts of each class
print("- Counting Splits -")
print("Training Samples:", len(train_df))
print("Testing Samples:", len(test_df))

# Graph counts of each class, for both training and testing

count_train_classes = pd.value_counts(train_df['sentiment'])
count_train_classes.plot(kind='bar', fontsize=16)
plt.title("Sentiment Count (Training)", fontsize=20)
plt.xticks(rotation='horizontal')
plt.xlabel("Sentiment", fontsize=20)
plt.ylabel("Sentiment Count", fontsize=20)

plt.show()

count_test_classes = pd.value_counts(test_df['sentiment'])
count_test_classes.plot(kind='bar', fontsize=16, colormap='ocean')
plt.title("Sentiment Count (Testing)", fontsize=20)
plt.xticks(rotation='horizontal')
plt.xlabel("Sentiment", fontsize=20)
plt.ylabel("Sentiment Count", fontsize=20)

plt.show()
```

```
- Counting Splits -
Training Samples: 2359
Testing Samples: 590
```


Sentiment Count (Training)
Sentiment Count
1200
1000
800
600
400
200
0
0
1
Sentiment


Sentiment Count (Testing)
Sentiment Count
300
250
200
150
100
50
0
0
1
Sentiment

[6]:

```
# Vectorizer the training inputs -- Takes about 30 seconds to complete
#   There are two types of vectors:
#     1. Count vectorizer
#     2. Term Frequency-Inverse Document Frequency (TF-IDF)
from nltk.tokenize import word_tokenize


print("- Training Count Vectorizer -")
cVec = CountVectorizer()
count_X = cVec.fit_transform(train_df['tweet_text'])

print("- Training TF-IDF Vectorizer -")
tVec = TfidfVectorizer()
tfidf_X = tVec.fit_transform(train_df['tweet_text'])


print("\n### Vectorizing Complete ###\n")
```

```
- Training Count Vectorizer -
- Training TF-IDF Vectorizer -

### Vectorizing Complete ###
```

[7]:

```
# Vectorize the testing inputs
#   Use 'transform' instead of 'fit_transform' because we've already trained␣
 ↪our vectorizers

print("- Count Vectorizer -")
test_count_X = cVec.transform(test_df['tweet_text'])

print("- TFIDF Vectorizer -")
test_tfidf_X = tVec.transform(test_df['tweet_text'])


print("\n### Vectorizing Complete ###\n")
```

```
- Count Vectorizer -
- TFIDF Vectorizer -

### Vectorizing Complete ###
```

[8]:

```
def generate_report(cmatrix, score, creport):
  """Generates and displays graphical reports
  Keyword arguments:
    cmatrix - Confusion matrix generated by the model
    score --- Score generated by the model
    creport - Classification Report generated by the model

  :Returns -- N/A
  """

  # Transform cmatrix because Sklearn has pred as columns and actual as rows.
  cmatrix = cmatrix.T

  # Generate confusion matrix heatmap
  plt.figure(figsize=(5,5))
  sns.heatmap(cmatrix,
              annot=True,
              fmt="d",
              linewidths=.5,
              square = True,
              cmap = 'Blues',
              annot_kws={"size": 16},
              xticklabels=['negative', 'positive'],
              yticklabels=['negative', 'positive'])

  plt.xticks(rotation='horizontal', fontsize=16)
  plt.yticks(rotation='horizontal', fontsize=16)
  plt.xlabel('Actual Label', size=20);
  plt.ylabel('Predicted Label', size=20);

  title = 'Accuracy Score: {0:.4f}'.format(score)
  plt.title(title, size = 20);

  # Display classification report and confusion matrix
  print(creport)
  plt.show()


print("\n### Report Generator Defined ###\n")
```

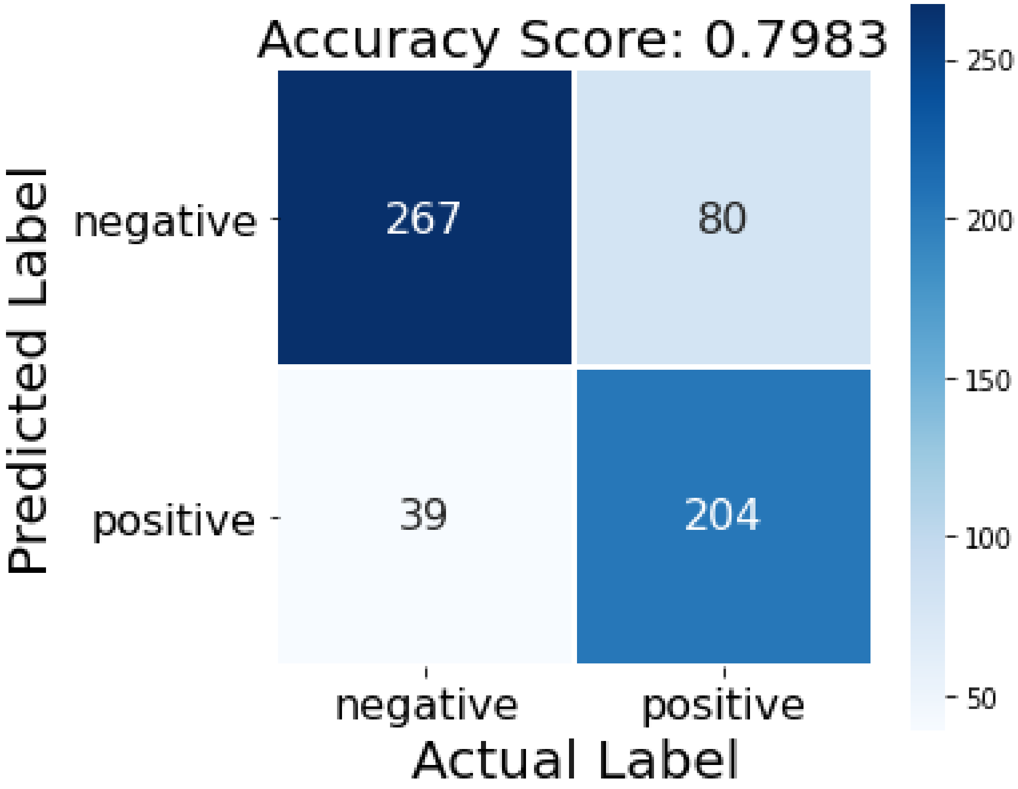
```
### Report Generator Defined ###
```

[9]:

```
# Multinomial Naive Bayesian with TF-IDF

# Train the model
mnb_tfidf = MultinomialNB()
mnb_tfidf.fit(tfidf_X, labels)
```

```
# Test the mode (score, predictions, confusion matrix, classification report)
score_mnb_tfidf = mnb_tfidf.score(test_tfidf_X, test_labels)
predictions_mnb_tfidf = mnb_tfidf.predict(test_tfidf_X)
cmatrix_mnb_tfidf = confusion_matrix(test_labels, predictions_mnb_tfidf)
creport_mnb_tfidf = classification_report(test_labels, predictions_mnb_tfidf)

print("\n### Model Built ###\n")
generate_report(cmatrix_mnb_tfidf, score_mnb_tfidf, creport_mnb_tfidf)
```

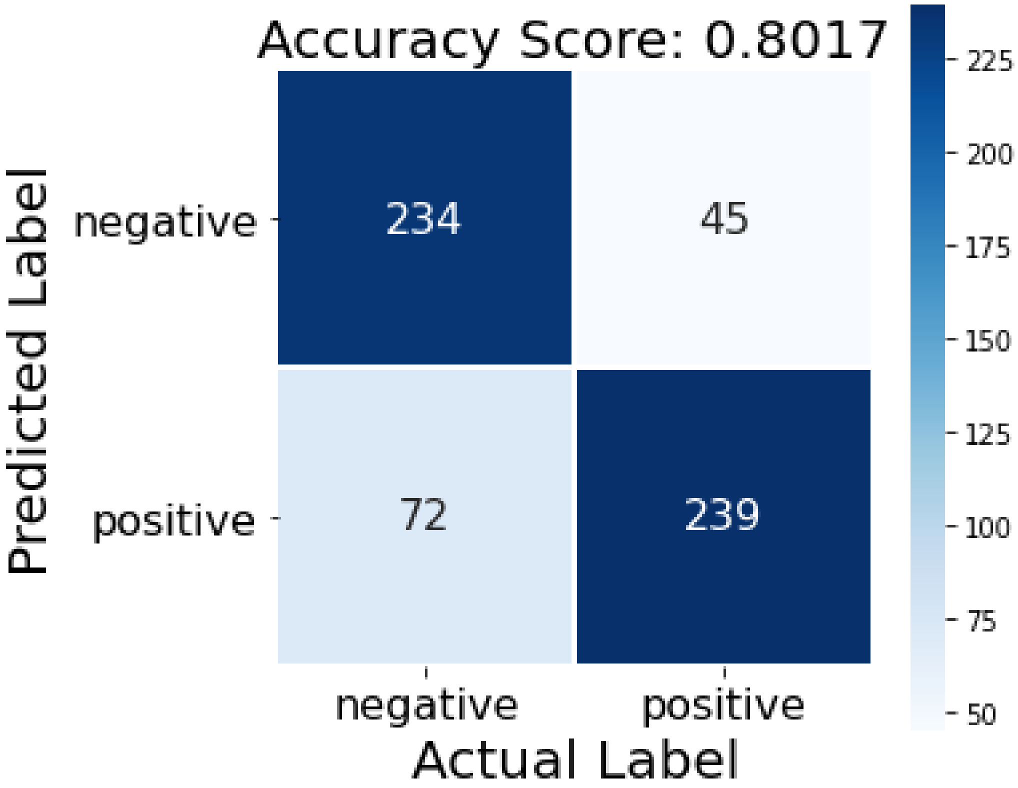
```
### Model Built ###

              precision    recall  f1-score   support

           0       0.77      0.87      0.82       306
           1       0.84      0.72      0.77       284

    accuracy                           0.80       590
   macro avg       0.80      0.80      0.80       590
weighted avg       0.80      0.80      0.80       590
```



[10]:

```python
# Multinomial Naive Bayesian with Count Vectorizer

# Train the model
mnb_count = MultinomialNB()
mnb_count.fit(count_X, labels)


# Test the mode (score, predictions, confusion matrix, classification report)
score_mnb_count = mnb_count.score(test_count_X, test_labels)
predictions_mnb_count = mnb_count.predict(test_count_X)
cmatrix_mnb_count = confusion_matrix(test_labels, predictions_mnb_count)
creport_mnb_count = classification_report(test_labels, predictions_mnb_count)

print("\n### Model Built ###\n")
generate_report(cmatrix_mnb_count, score_mnb_count, creport_mnb_count)
```

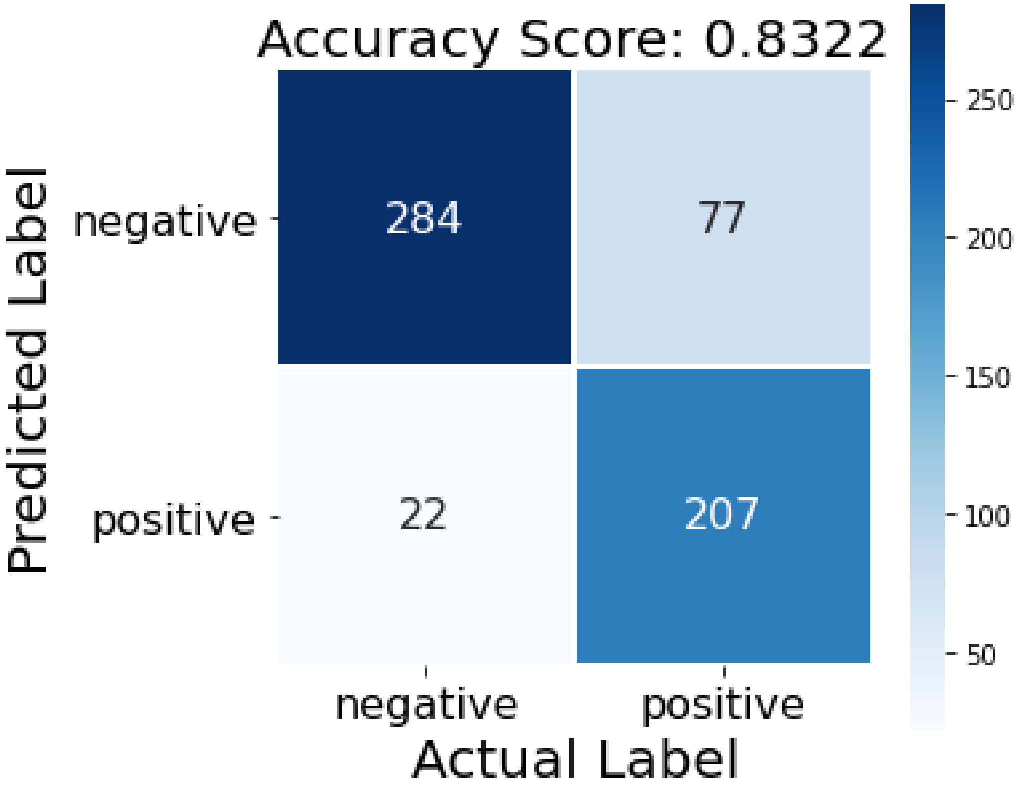
```
### Model Built ###

              precision    recall  f1-score   support

           0       0.84      0.76      0.80       306
           1       0.77      0.84      0.80       284

    accuracy                           0.80       590
   macro avg       0.80      0.80      0.80       590
weighted avg       0.80      0.80      0.80       590
```



[11]:

```
# Logistic Regression with TF-IDF

# Train the model
lgs_tfidf = LogisticRegression(solver='lbfgs')
lgs_tfidf.fit(tfidf_X, labels)


# Test the mode (score, predictions, confusion matrix, classification report)
score_lgs_tfidf = lgs_tfidf.score(test_tfidf_X, test_labels)
predictions_lgs_tfidf = lgs_tfidf.predict(test_tfidf_X)
cmatrix_lgs_tfidf = confusion_matrix(test_labels, predictions_lgs_tfidf)
creport_lgs_tfidf = classification_report(test_labels, predictions_lgs_tfidf)

print("\n### Model Built ###\n")
generate_report(cmatrix_lgs_tfidf, score_lgs_tfidf, creport_lgs_tfidf)
```

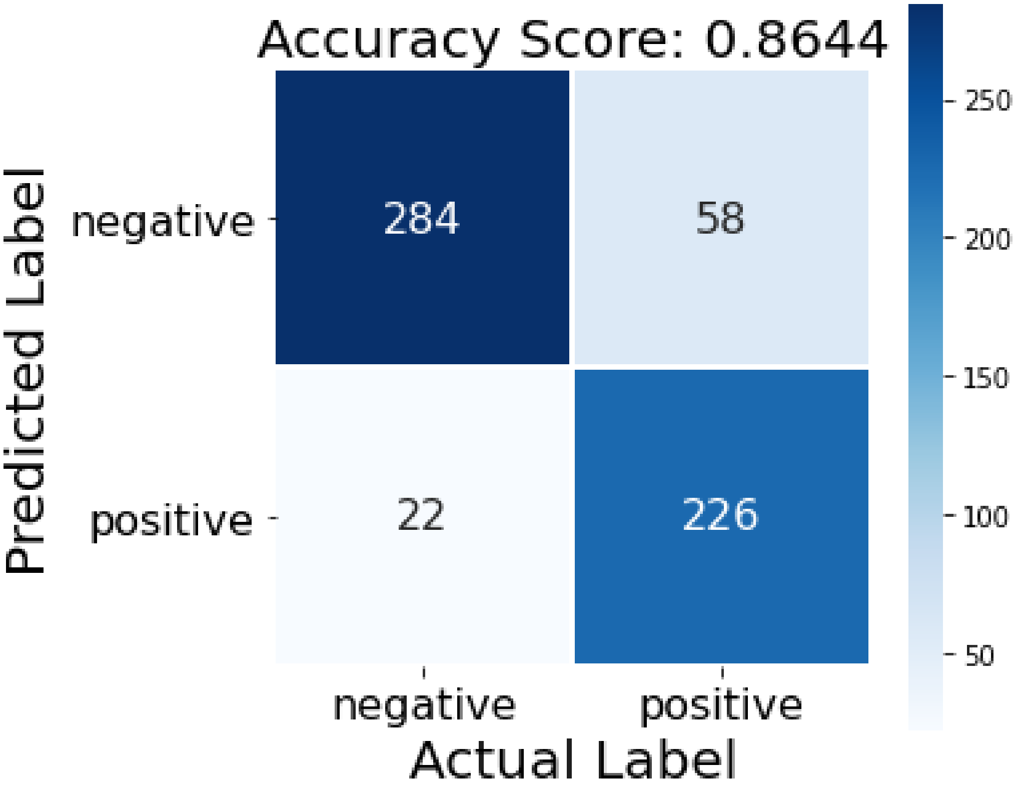
```
### Model Built ###

              precision    recall  f1-score   support

           0       0.79      0.93      0.85       306
           1       0.90      0.73      0.81       284

    accuracy                           0.83       590
   macro avg       0.85      0.83      0.83       590
weighted avg       0.84      0.83      0.83       590
```



[12]:

```
# Logistic Regression with Count Vectorizer

# Train the model
lgs_count = LogisticRegression(solver='lbfgs')
lgs_count.fit(count_X, labels)


# Test the mode (score, predictions, confusion matrix, classification report)
score_lgs_count = lgs_count.score(test_count_X, test_labels)
predictions_lgs_count = lgs_count.predict(test_count_X)
cmatrix_lgs_count = confusion_matrix(test_labels, predictions_lgs_count)
creport_lgs_count = classification_report(test_labels, predictions_lgs_count)

print("\n### Model Built ###\n")
generate_report(cmatrix_lgs_count, score_lgs_count, creport_lgs_count)
```

```
### Model Built ###

              precision    recall  f1-score   support

           0       0.83      0.93      0.88       306
           1       0.91      0.80      0.85       284

    accuracy                           0.86       590
   macro avg       0.87      0.86      0.86       590
weighted avg       0.87      0.86      0.86       590
```


Accuracy Score: 0.8644
Predicted Label
negative
positive
negative
positive
Actual Label