predictive model using classificatier

```
In [1]: # Get the stemmed data using the same process as in week3.
         # Load packages first
         import numpy as np
         import pandas as pd
         from bs4 import BeautifulSoup
         import re
         import string
         import nltk
         # Load the data frame
         df = pd.read_csv('labeledTrainData.tsv', delimiter='\t')
         test_df = pd.read_csv('testData.tsv', delimiter='\t')
         df.head()
                id sentiment
Out[1]:
                                                                 review
         0 5814 8
                               With all this stuff going down at the moment w...
         1 2381 9
                               \The Classic War of the Worlds\" by Timothy Hi...
         2 7759 3
                                 The film starts with a manager (Nicholas Bell)...
         3 3630 4
                               It must be assumed that those who praised this...
         4 9495 8
                           1 Superbly trashy and wondrously unpretentious 8...
In [2]: # Clean up. it is known that there is no empty row and no duplicate
         # drop ID column
         df.drop(columns = ['id'])
         from nltk.corpus import stopwords
         from nltk.tokenize import word_tokenize
         from nltk.stem.porter import PorterStemmer
         stopwords = nltk.corpus.stopwords.words("english")
         ps = PorterStemmer()
         def clean(review):
             # Remove data from webpages
```

```
clean html = BeautifulSoup(review).get text()
             # Remove symbols
             clean_non_letters = re.sub("[^a-zA-Z]", " ", clean_html)
             # Lower case words
             cleaned lowercase = clean non letters.lower()
             words = cleaned_lowercase.split()
             # Remove stopwords, stemlize and consider just stem word
             cleaned words = [ps.stem(w) for w in words if w not in stopwords]
             return " ".join(cleaned_words)
         df["cleaned review"] = df["review"].apply(clean)
         C:\Users\Daisy\AppData\Local\Temp\ipykernel 9260\1396983158.py:13: MarkupResemblesLocatorWarning: The input looks more
         like a filename than markup. You may want to open this file and pass the filehandle into Beautiful Soup.
           clean html = BeautifulSoup(review).get text()
         df.head(3)
In [3]:
Out[3]:
                id sentiment
                                                               review
                                                                                                cleaned review
         0 5814 8
                           1 With all this stuff going down at the moment w... stuff go moment mj start listen music watch od...
                                                                         classic war world timothi hine entertain film ...
         1 2381 9
                           1 \The Classic War of the Worlds\" by Timothy Hi...
         2 7759 3
                                The film starts with a manager (Nicholas Bell)...
                                                                       film start manag nichola bell give welcom inve...
In [4]: # tokenize the string
         #from tensorflow.keras.preprocessing.text import Tokenizer
         def tokenize(text):
             word = word tokenize(text)
             return word
         df['token'] =df['cleaned_review'].apply(tokenize)
        #! pip install tensorflow
```

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Collecting tensorflow
  Downloading tensorflow-2.16.1-cp311-cp311-win_amd64.whl.metadata (3.5 kB)
Collecting tensorflow-intel==2.16.1 (from tensorflow)
  Downloading tensorflow intel-2.16.1-cp311-cp311-win amd64.whl.metadata (5.0 kB)
Collecting absl-py>=1.0.0 (from tensorflow-intel==2.16.1->tensorflow)
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Collecting protobuf!=4.21.0,!=4.21.1,!=4.21.2,!=4.21.3,!=4.21.4,!=4.21.5,<5.0.0dev,>=3.20.3 (from tensorflow-intel==2.1
6.1->tensorflow)
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Collecting keras>=3.0.0 (from tensorflow-intel==2.16.1->tensorflow)
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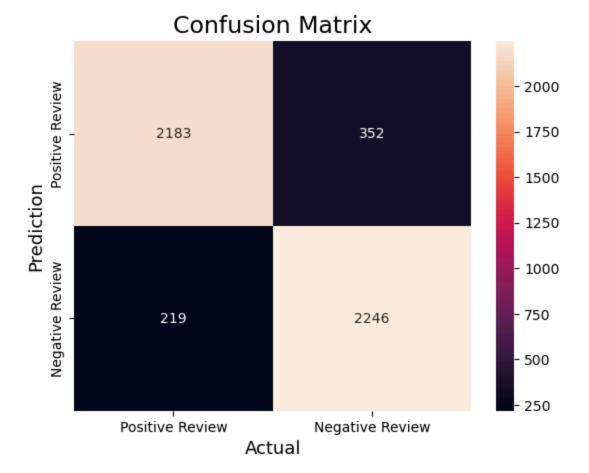
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       [notice] A new release of pip is available: 23.3.2 -> 24.0
       [notice] To update, run: C:\Users\Daisy\AppData\Local\Programs\Python\Python311\python.exe -m pip install --upgrade pip
In [5]: df['token'].head()
            [stuff, go, moment, mj, start, listen, music, ...
Out[5]:
            [classic, war, world, timothi, hine, entertain...
       2
            [film, start, manag, nichola, bell, give, welc...
            [must, assum, prais, film, greatest, film, ope...
            [superbl, trashi, wondrous, unpretenti, exploi...
       Name: token, dtype: object
In [6]: # Split this into a training and test set.
       from sklearn.model selection import train test split
        input = df['cleaned review']
       labels = np.array(df['sentiment'])
        x_train, x_test, y_train, y_test = train_test_split(input, labels, test_size=0.2)
        print(x train.shape, y train.shape, x test.shape, y test.shape)
       (20000,) (20000,) (5000,) (5000,)
In [8]: # Fit and apply the tf-idf vectorization to the training set.
       from sklearn.feature_extraction.text import TfidfVectorizer
        vectorization = TfidfVectorizer()
       xv train = vectorization.fit transform(x train)
```

```
# Apply but DO NOT FIT the tf-idf vectorization to the test set
In [9]:
         # Why do not fit: because in reality, we know nothing about test set, so not allowed to assume (or fit) anything on test
         xv test = vectorization.transform(x test)
In [10]: # Train a logistic regression using the training data.
         from sklearn.linear model import LogisticRegression
         #from sklearn.svm import SVC
         #from sklearn.ensemble import RandomForestClassifier
         model = LogisticRegression()
         # fit the model
         model.fit(xv train,y train)
         #Predicting the test set results based on the model
         y pred = model.predict(xv test)
In [12]: # Find the model accuracy on test set.
         from sklearn.metrics import accuracy score
         accuracy = accuracy_score(y_test,y_pred)
         print('Accuracy of LR model is ', accuracy)
         Accuracy of LR model is 0.8858
In [16]: # Create a confusion matrix for the test set predictions.
         from sklearn.metrics import confusion matrix
         cm = confusion matrix(y test,y pred)
         #visualize the confusion matrix
         import seaborn as sns
         import matplotlib.pyplot as plt
         sns.heatmap(cm,
                     annot=True,
                     fmt='g',
                     xticklabels=['Positive Review','Negative Review'],
                     yticklabels=['Positive Review','Negative Review'])
         plt.ylabel('Prediction',fontsize=13)
         plt.xlabel('Actual', fontsize=13)
         plt.title('Confusion Matrix',fontsize=17)
         plt.show()
```



In [17]: # Get the precision, recall, and F1-score for the test set predictions.
from sklearn.metrics import classification_report
print(classification_report(y_test, y_pred))

	precision	recall	f1-score	support
0	0.91	0.86	0.88	2535
1	0.86	0.91	0.89	2465
2661112614			0.89	5000
accuracy macro avg	0.89	0.89	0.89	5000
weighted avg	0.89	0.89	0.89	5000

In [35]: # Create a ROC curve for the test set.
from sklearn.metrics import roc_curve

```
from sklearn.metrics import roc_auc_score

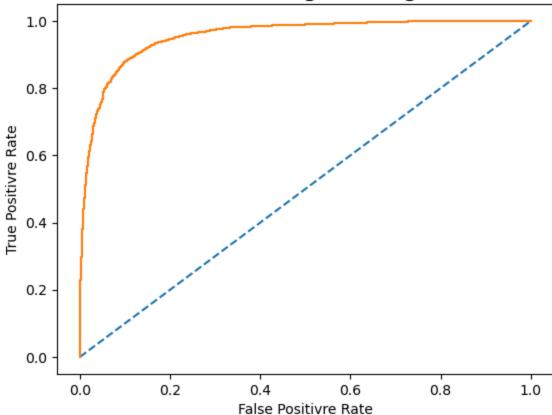
y_pred_prob = model.predict_proba(xv_test)[:,1]
#y_pred_prob[0]
fpr, tpr, thresholds = roc_curve(y_test, y_pred_prob)

print('AUC value is:',roc_auc_score(y_test, y_pred_prob))

plt.plot([0,1], [0,1], '--')
plt.plot(fpr, tpr)
plt.xlabel('False Positivre Rate')
plt.ylabel('True Positivre Rate')
plt.title('ROC curve for logistic Regression',fontsize=17)
plt.show()
```

AUC value is: 0.9549164436229503





```
# Pick another classification model you learned about this week and repeat above steps
In [34]:
         # Try to use support vector Machine model
         from sklearn.svm import SVC
         svm_model = SVC(kernel='linear')
         #Fitting training set to the model
          svm_model.fit(xv_train,y_train)
         #Predicting the test set results based on the model
         svm_y_pred = svm_model.predict(xv_test)
         #Calculate the accuracy score of this model
          score = accuracy_score(y_test,svm_y_pred)
         print('Accuracy of SVM model is ', score)
         Accuracy of SVM model is 0.8858
In [36]: # create confusion matrix for the SVM model
         svm cm = confusion matrix(y test,svm y pred)
         #visualize the confusion matrix
         import seaborn as sns
         import matplotlib.pyplot as plt
          sns.heatmap(svm cm,
                      annot=True,
                     fmt='g',
                      xticklabels=['Positive Review','Negative Review'],
```

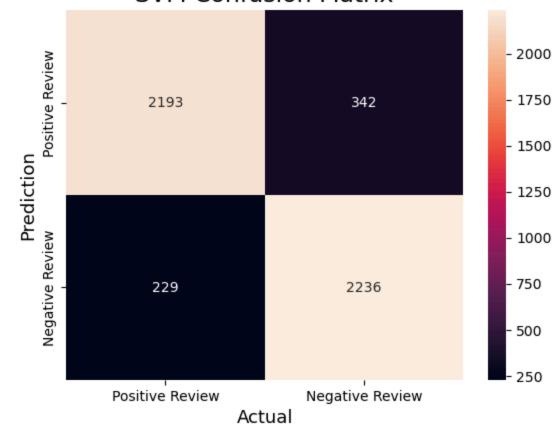
yticklabels=['Positive Review','Negative Review'])

plt.ylabel('Prediction',fontsize=13)
plt.xlabel('Actual',fontsize=13)

plt.title('SVM Confusion Matrix',fontsize=17)

plt.show()





In [37]: # Get the precision, recall, and F1-score for the test set predictions.
print(classification_report(y_test, svm_y_pred))

support	f1-score	recall	precision	
2535	0.88	0.87	0.91	0
2465	0.89	0.91	0.87	1
5000	0.89			accuracy
5000	0.89	0.89	0.89	macro avg
5000	0.89	0.89	0.89	weighted avg

```
In [39]: # Create a ROC curve for the test set.
svm_y_pred_prob = model.predict_proba(xv_test)[:,1]
```

```
svm_fpr, svm_tpr, svm_thresholds = roc_curve(y_test, svm_y_pred_prob)

plt.plot([0,1], [0,1], '--')
plt.plot(fpr, tpr)
plt.xlabel('False Positivre Rate')
plt.ylabel('True Positivre Rate')
plt.title('ROC curve for SVM Regression',fontsize=17)
plt.show()
```



