Week 5.2 Assignment

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You will build a model with the movie reviews dataset that you worked with in Week 3: Bag of Words Meets Bags of Popcorn.

In [ ]:
```
#IMPORTS
import pandas as pd
import re
import nltk
from nltk.corpus import stopwords
from nltk.tokenize import word_tokenize
import sklearn
from sklearn.model_selection import train_test_split
from sklearn.metrics import accuracy_score
from sklearn.linear_model import LogisticRegression
from sklearn.feature_extraction.text import CountVectorizer
from sklearn.feature_extraction.text import TfidfVectorizer
from sklearn.metrics import confusion_matrix
from sklearn.metrics import precision_score, recall_score, f1_score
from sklearn.metrics import roc_curve, roc_auc_score
from sklearn.ensemble import RandomForestClassifier
import seaborn as sns
import matplotlib.pyplot as plt
```

Get the stemmed data using the same process you did in Week 3.

In [ ]:
```
df = pd.read_csv('./DATA/labeledTrainData.tsv/labeledTrainData.tsv', sep="\t")
df.head()
```

Out[ ]:

	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...

In [ ]:
```
df_reviews_preprocessed = pd.DataFrame(df[['sentiment','review']])
df_reviews_preprocessed.head()
```

Out[ ]:

	sentiment	review
0	1	With all this stuff going down at the moment w...
1	1	\The Classic War of the Worlds\" by Timothy Hi...
2	0	The film starts with a manager (Nicholas Bell)...
3	0	It must be assumed that those who praised this...
4	1	Superbly trashy and wondrously unpretentious 8...

In [ ]:
```
def clean_text(text):
    """
    Remove punctuations and special characters, makes lower case
    Args: text
    Output: text
    """
    text=text.lower() #makes text lowercase
    text=re.sub('\\d|\\W+|_',' ',text) #removes extra white space
    text=re.sub('[^a-zA-Z0-9]'," ", text) #removes any non-alphanumeric characters

    return text
```

In [ ]:
```
def tokenize_and_remove_stop_words(txt):

    from nltk.corpus import stopwords

    stop_words = stopwords.words('english')

    txt_token = word_tokenize(txt)
    txt_no_stopwords = [word for word in txt_token if word not in stop_words]

    return txt_no_stopwords

def stem_text(word_list):
    from nltk.stem.porter import PorterStemmer
    porter = PorterStemmer()
    return [porter.stem(word) for word in word_list]
#create new columns in the data frame for each preprocessing step
#apply text cleaning function
df_reviews_preprocessed['review_clean'] = df_reviews_preprocessed['review'].apply(clea
df_reviews_preprocessed['review_tokenized'] = df_reviews_preprocessed['review_clean'].
df_reviews_preprocessed['review_stemmed'] = df_reviews_preprocessed['review_tokenized'
df_reviews_preprocessed['review_final'] = df_reviews_preprocessed['review_stemmed'].ap
print(df_reviews_preprocessed.shape)
df_reviews_preprocessed.head()
```

```
(25000, 6)
```

Out[ ]:

	sentiment	review	review_clean	review_tokenized	review_stemmed	review_final
0	1	With all this stuff going down at the moment w...	with all this stuff going down at the moment w...	[stuff, going, moment, mj, started, listening,...	[stuff, go, moment, mj, start, listen, music, ...	stuff go moment mj start listen music watch od...
1	1	\The Classic War of the Worlds\" by Timothy Hi...	the classic war of the worlds by timothy hine...	[classic, war, worlds, timothy, hines, enterta...	[classic, war, world, timothi, hine, entertain...	classic war world timothi hine entertain film ...
2	0	The film starts with a manager (Nicholas Bell)...	the film starts with a manager nicholas bell g...	[film, starts, manager, nicholas, bell, giving...	[film, start, manag, nichola, bell, give, welc...	film start manag nichola bell give welcom inve...
3	0	It must be assumed that those who praised this...	it must be assumed that those who praised this...	[must, assumed, praised, film, greatest, filme...	[must, assum, prais, film, greatest, film, ope...	must assum prais film greatest film opera ever...
4	1	Superbly trashy and wondrously unpretentious 8...	superbly trashy and wondrously unpretentious ...	[superbly, trashy, wondrously, unpretentious, ...	[superbl, trashi, wondrous, unpretenti, exploi...	superbl trashi wondrous unpretenti exploit hoo...

Split this into a training and test set.

In [ ]:
```
x = df_reviews_preprocessed['review_final']
y = df_reviews_preprocessed['sentiment']
# Create training & test datasets
x_train, x_test, y_train, y_test = train_test_split(x, y, test_size = 0.2)
```

Fit and apply the tf-idf vectorization to the training set.

In [ ]:
```
tfidf = TfidfVectorizer()
tfidf_matrix_train = tfidf.fit_transform(x_train)

#  validate shape
tfidf_matrix_train.shape
```

Out[ ]:
```
(20000, 45205)
```

Apply but DO NOT FIT the tf-idf vectorization to the test set (Why?).

In [ ]:
```
tfidf_matrix_test = tfidf.transform(x_test)

# Check the shape to validate
tfidf_matrix_test.shape
```

Out[ ]:
```
(5000, 45205)
```

Fitting the tf-idf vectorization in the test set would cause a leak from our test

set to our model. We want to avoid this.

Train a logistic regression using the training data.

In [ ]:
```
logistic_regression = LogisticRegression(random_state=0)

# Train model and make predictions
y_test_pred = logistic_regression.fit(tfidf_matrix_train, y_train).predict(tfidf_matri
y_test_pred
```

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

Find the model accuracy on test set.

In [ ]:
```
print("Accuracy Rate: ", accuracy_score(y_test, y_test_pred))
```

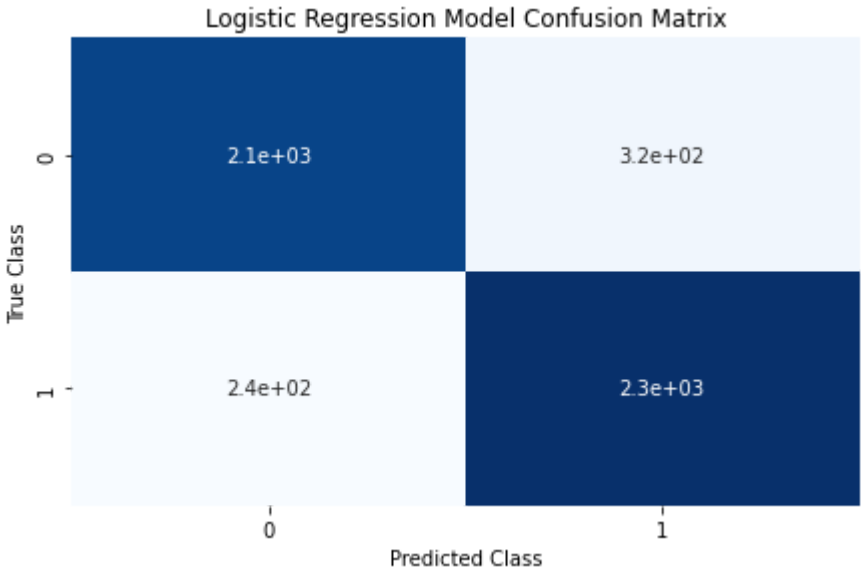
```
Accuracy Rate:  0.8886
```

Create a confusion matrix for the test set predictions.

In [ ]:
```
matrix = confusion_matrix(y_test, y_test_pred)

# Create pandas dataframe
df = pd.DataFrame(matrix)

# Create heatmap
sns.heatmap(df, annot=True, cbar=None, cmap="Blues")
plt.title("Logistic Regression Model Confusion Matrix"), plt.tight_layout()
plt.ylabel("True Class"), plt.xlabel("Predicted Class")
plt.show()
```



Get the precision, recall, and F1-score for the test set predictions.

In [ ]:
```
# Calculate Precision
p = "{:.0%}".format(precision_score(y_test, y_test_pred))

# Calculate Recall
r = "{:.0%}".format(recall_score(y_test, y_test_pred))
```

```
# Calculate F1-score
f1 = "{:.0%}".format(f1_score(y_test, y_test_pred))

# Print results
print("Precision:",p)
print("Recall:",r)
print("F1-score:",f1)
```

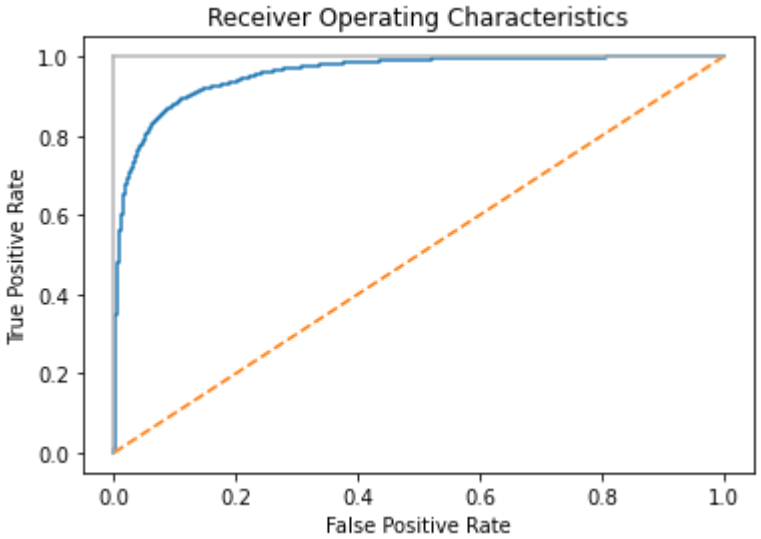
```
Precision: 88%
Recall: 91%
F1-score: 89%
```

Create a ROC curve for the test set.

In [ ]:
```
# Get predicted probabilities
target_probabilities = logistic_regression.predict_proba(tfidf_matrix_test)[:,1]

# Create true and false positive rates
false_positive_rate, true_positive_rate, threshold = roc_curve(y_test, target_probabil

# Plot ROC curve
plt.title("Receiver Operating Characteristics")
plt.plot(false_positive_rate, true_positive_rate)
plt.plot([0, 1], ls="--")
plt.plot([0, 0], [1, 0], c=".7"), plt.plot([1, 1] , c=".7")
plt.ylabel("True Positive Rate")
plt.xlabel("False Positive Rate")
plt.show()
```



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

In [ ]:
```
# Create random forest classifier object
randomforest = RandomForestClassifier(random_state=0, n_jobs=-1)

# Train model & predict
rf_model_pred = randomforest.fit(tfidf_matrix_train, y_train).predict(tfidf_matrix_tes
```

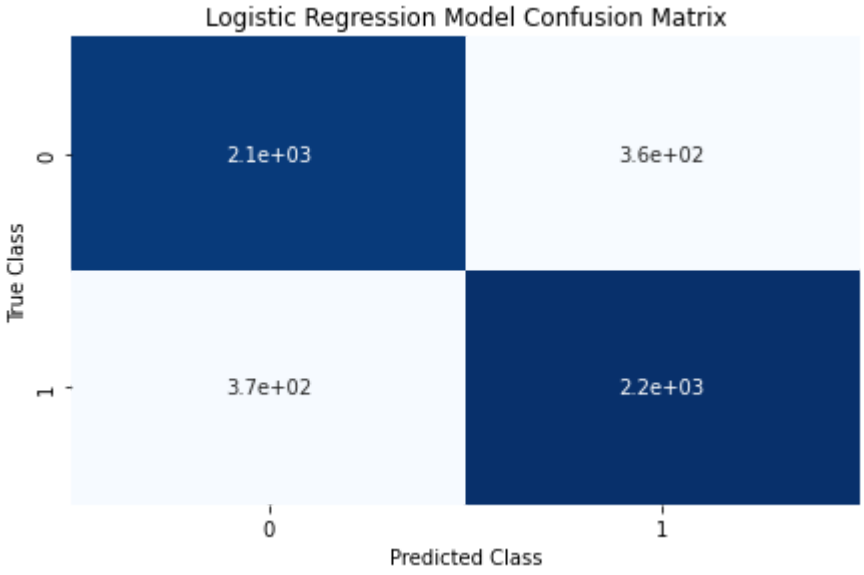
In [ ]:
```
# Calculate accuracy
accuracy_score(y_test, rf_model_pred)
```

Out[ ]:
```
0.8528
```

In [ ]:
```
# Create confusion matrix
matrix_rf = confusion_matrix(y_test, rf_model_pred)

# Create pandas dataframe
df_rf = pd.DataFrame(matrix_rf)

# Create heatmap
sns.heatmap(df_rf, annot=True, cbar=None, cmap="Blues")
plt.title("Logistic Regression Model Confusion Matrix"), plt.tight_layout()
plt.ylabel("True Class"), plt.xlabel("Predicted Class")
plt.show()
```



In [ ]:
```
# Calculate Precision
p_rf = "{:.0%}".format(precision_score(y_test, rf_model_pred))

# Calculate Recall
r_rf = "{:.0%}".format(recall_score(y_test, rf_model_pred))

# Calculate F1-score
f1_rf = "{:.0%}".format(f1_score(y_test, rf_model_pred))

# Print results
print("Precision:",p_rf)
print("Recall:",r_rf)
print("F1-score:",f1_rf)
```

```
Precision: 86%
Recall: 85%
F1-score: 86%
```

In [ ]:
```
# Get predicted probabilities
target_probabilities_rf = randomforest.predict_proba(tfidf_matrix_test)[:,1]

# Create true and false positive rates
false_positive_rate_rf, true_positive_rate_rf, threshold_rf = roc_curve(y_test, target

# Plot ROC curve
plt.title("Receiver Operating Characterisitcs")
```

```
plt.plot(false_positive_rate_rf, true_positive_rate_rf)
plt.plot([0, 1], ls="--")
plt.plot([0, 0], [1, 0], c=".7"), plt.plot([1, 1] , c=".7")
plt.ylabel("True Positive Rate")
plt.xlabel("False Positive Rate")
plt.show()
```