NLP Assignment 1 - 22070126093

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1 NLP Assignment 1 - *IMDB Dataset of 50K Movie Reviews*

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IMDB dataset having 50K movie reviews for natural language processing or Text analytics. This is a dataset for binary sentiment classification containing substantially more data than previous benchmark datasets. We provide a set of 25,000 highly polar movie reviews for training and 25,000 for testing. So, predict the number of positive and negative reviews using either classification or deep learning algorithms.

Import necessary libraries

[4]:
```
# Import libraries
import pandas as pd
import numpy as np
from sklearn.model_selection import train_test_split
from sklearn.feature_extraction.text import CountVectorizer, TfidfVectorizer
from sklearn.linear_model import LogisticRegression
from sklearn.svm import SVC
from sklearn.ensemble import RandomForestClassifier
from sklearn.metrics import classification_report, confusion_matrix
import seaborn as sns
import matplotlib.pyplot as plt
import nltk
from nltk.corpus import stopwords
import re
import spacy

# Load dataset
df = pd.read_csv('/content/IMDB Dataset.csv')
```

Preprocessing the text

[5]:
```
# Preprocessing
nltk.download('stopwords')
stop_words = set(stopwords.words('english'))
nlp = spacy.load('en_core_web_sm')
```

```
def preprocess_text(text):
    # Removing URLs
    text = re.sub(r'http\S+|www\S+|https\S+', '', text, flags=re.MULTILINE)
    # Removing symbols and numbers
    text = re.sub(r'\W', ' ', text)
    text = re.sub(r'\d', '', text)
    # Tokenization and Lemmatization
    doc = nlp(text)
    tokens = [token.lemma_ for token in doc if token.text.lower() not in␣
 ↪stop_words and token.is_alpha]
    return ' '.join(tokens)

df['review'] = df['review'].apply(preprocess_text)
```

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

Dataset Splitting

[6]:
```
X_train, X_test, y_train, y_test = train_test_split(df['review'],␣
 ↪df['sentiment'], test_size=0.2, random_state=42)
```

Vectorization using Count Vectorizer and TFIDF Vectorizer

[7]:
```
# Vectorization
count_vectorizer = CountVectorizer()
tfidf_vectorizer = TfidfVectorizer()

X_train_count = count_vectorizer.fit_transform(X_train)
X_test_count = count_vectorizer.transform(X_test)

X_train_tfidf = tfidf_vectorizer.fit_transform(X_train)
X_test_tfidf = tfidf_vectorizer.transform(X_test)
```

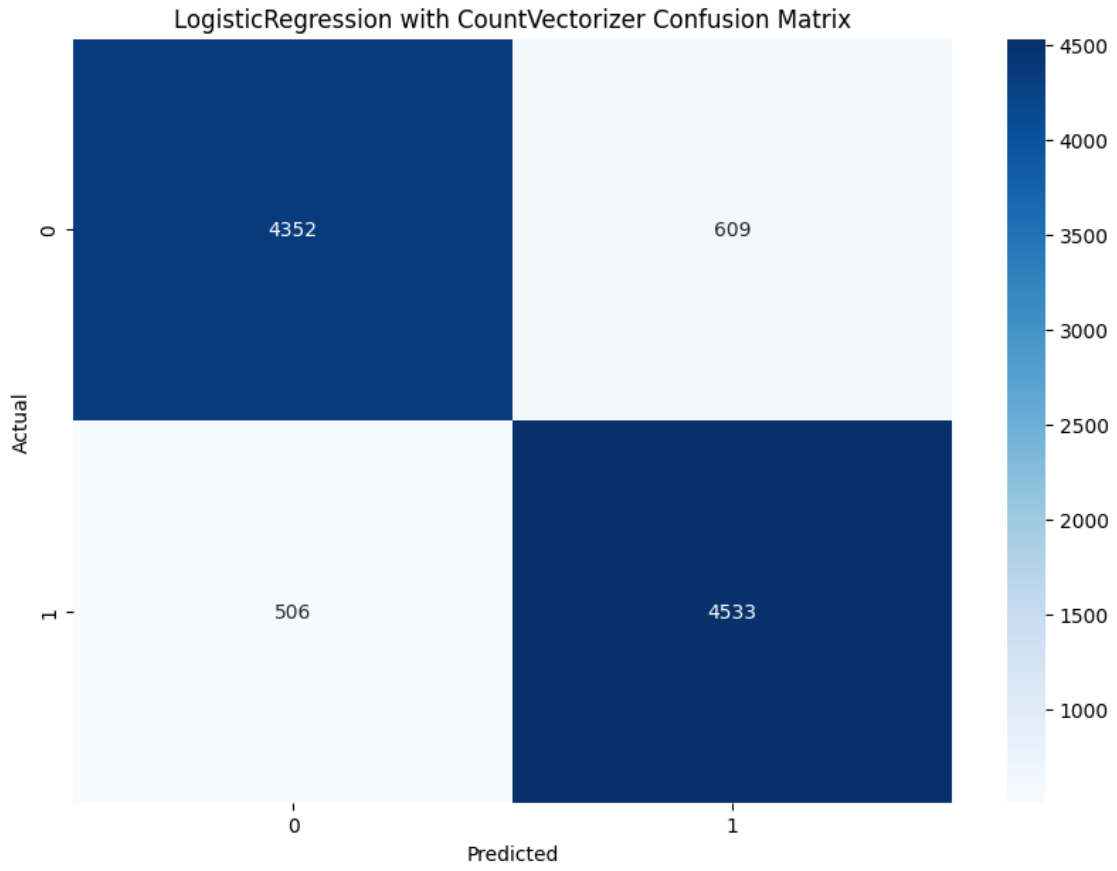
Train Machine Learning Models Train Logistic Regression, SVC and Random Forest models using both CountVectorizer and TF-IDFVectorizer features

Evaluate the models using classification report and confusion matrix

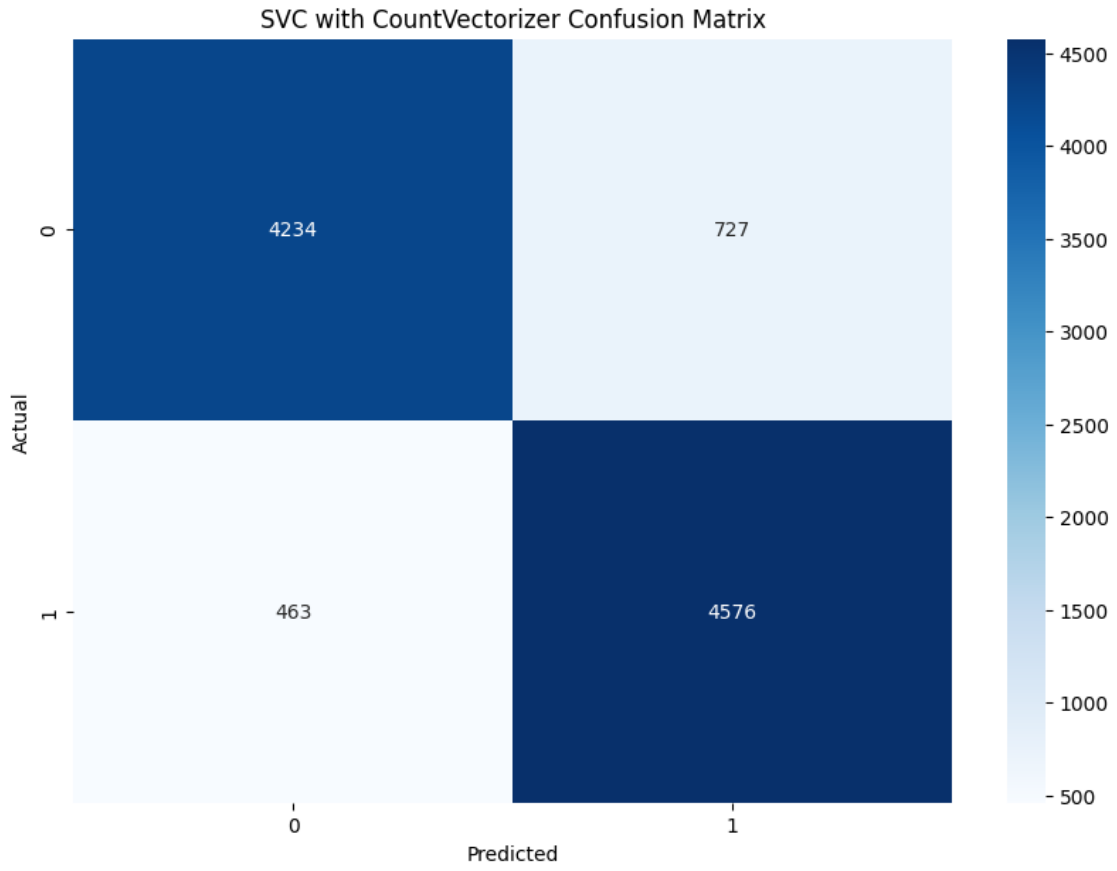
[8]:
```
# Models
models = {
    'Logistic Regression': LogisticRegression(),
    'SVC': SVC(),
    'Random Forest': RandomForestClassifier()
}

# Function to train and evaluate models
def evaluate_model(model, X_train, X_test, y_train, y_test, vectorizer_name):
    model.fit(X_train, y_train)
```

```
    y_pred = model.predict(X_test)

    print(f"--- {model.__class__.__name__} with {vectorizer_name} ---")
    print(classification_report(y_test, y_pred))

    cm = confusion_matrix(y_test, y_pred)
    plt.figure(figsize=(10, 7))
    sns.heatmap(cm, annot=True, fmt='d', cmap='Blues')
    plt.title(f'{model.__class__.__name__} with {vectorizer_name} Confusion␣
 ↪Matrix')
    plt.xlabel('Predicted')
    plt.ylabel('Actual')
    plt.show()

# Evaluate all models with CountVectorizer
for model_name, model in models.items():
    evaluate_model(model, X_train_count, X_test_count, y_train, y_test,␣
 ↪'CountVectorizer')

# Evaluate all models with TFIDFVectorizer
for model_name, model in models.items():
    evaluate_model(model, X_train_tfidf, X_test_tfidf, y_train, y_test,␣
 ↪'TFIDFVectorizer')
```

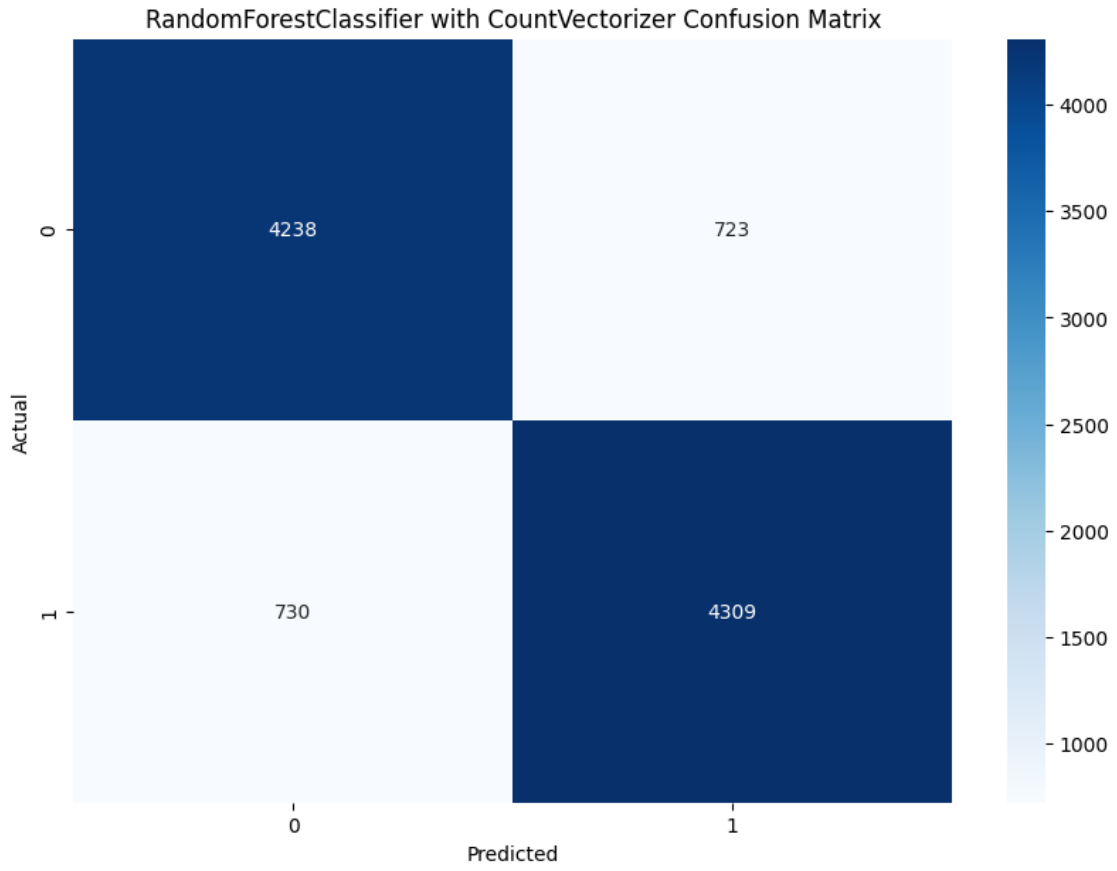
```
/usr/local/lib/python3.10/dist-packages/sklearn/linear_model/_logistic.py:460:
ConvergenceWarning: lbfgs failed to converge (status=1):
STOP: TOTAL NO. of ITERATIONS REACHED LIMIT.

Increase the number of iterations (max_iter) or scale the data as shown in:
    https://scikit-learn.org/stable/modules/preprocessing.html
Please also refer to the documentation for alternative solver options:
    https://scikit-learn.org/stable/modules/linear_model.html#logistic-
regression
  n_iter_i = _check_optimize_result(
--- LogisticRegression with CountVectorizer ---
              precision    recall  f1-score   support

    negative       0.90      0.88      0.89      4961
    positive       0.88      0.90      0.89      5039

    accuracy                           0.89     10000
   macro avg       0.89      0.89      0.89     10000
weighted avg       0.89      0.89      0.89     10000
```



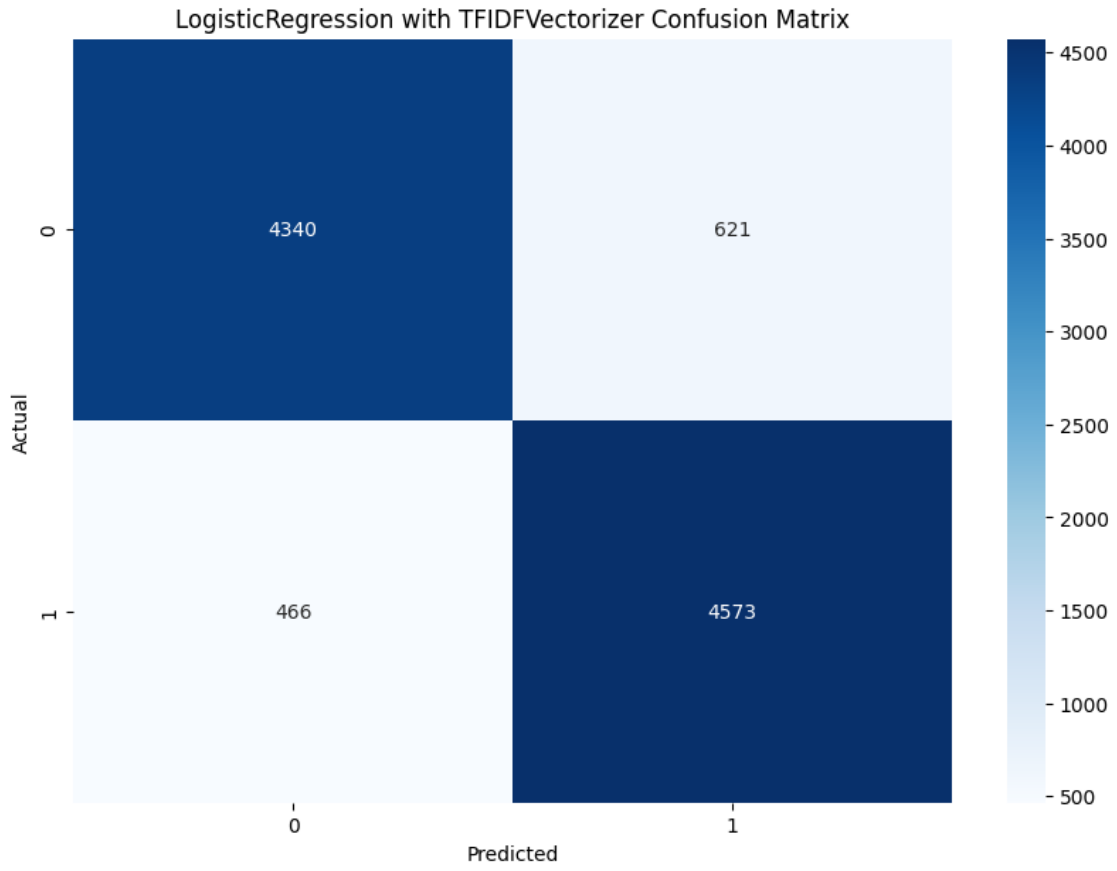

```
--- SVC with CountVectorizer ---
              precision    recall  f1-score   support

    negative       0.90      0.85      0.88      4961
    positive       0.86      0.91      0.88      5039

    accuracy                           0.88     10000
   macro avg       0.88      0.88      0.88     10000
weighted avg       0.88      0.88      0.88     10000
```



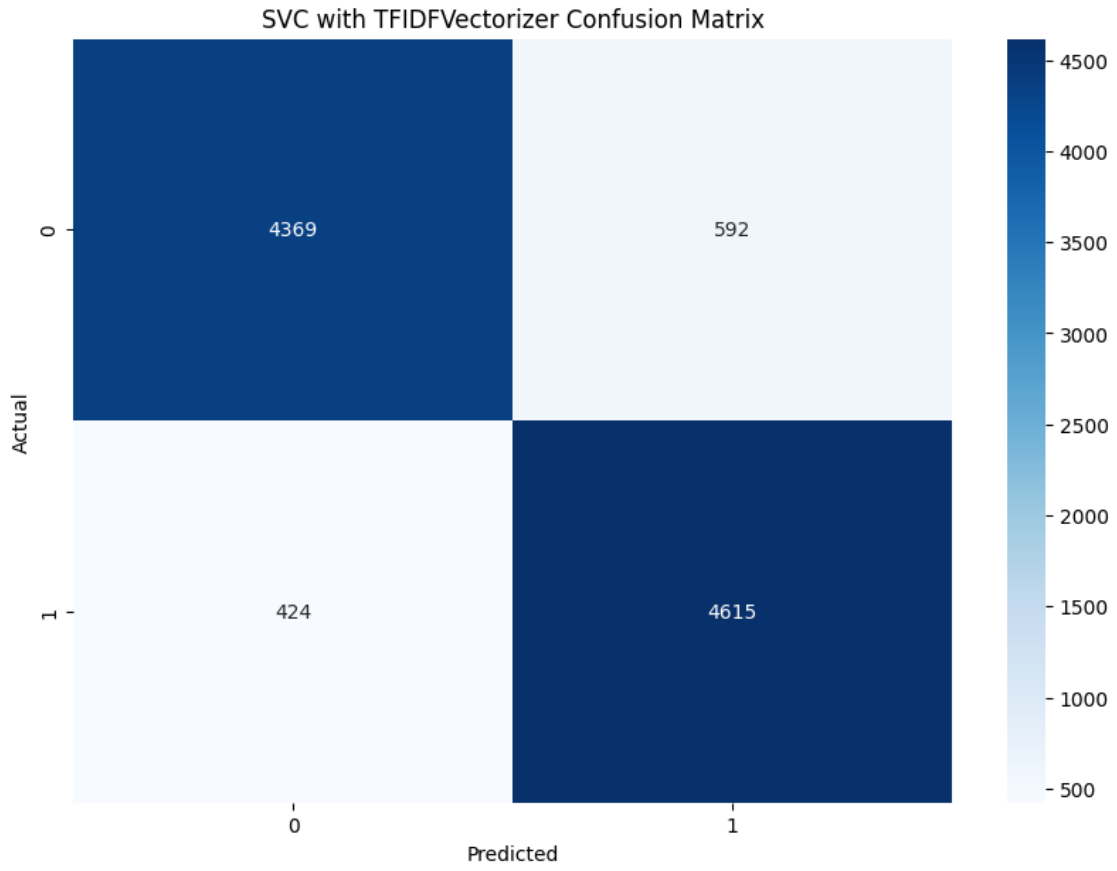

```
--- RandomForestClassifier with CountVectorizer ---
              precision    recall  f1-score   support

    negative       0.85      0.85      0.85      4961
    positive       0.86      0.86      0.86      5039

    accuracy                           0.85     10000
   macro avg       0.85      0.85      0.85     10000
weighted avg       0.85      0.85      0.85     10000
```



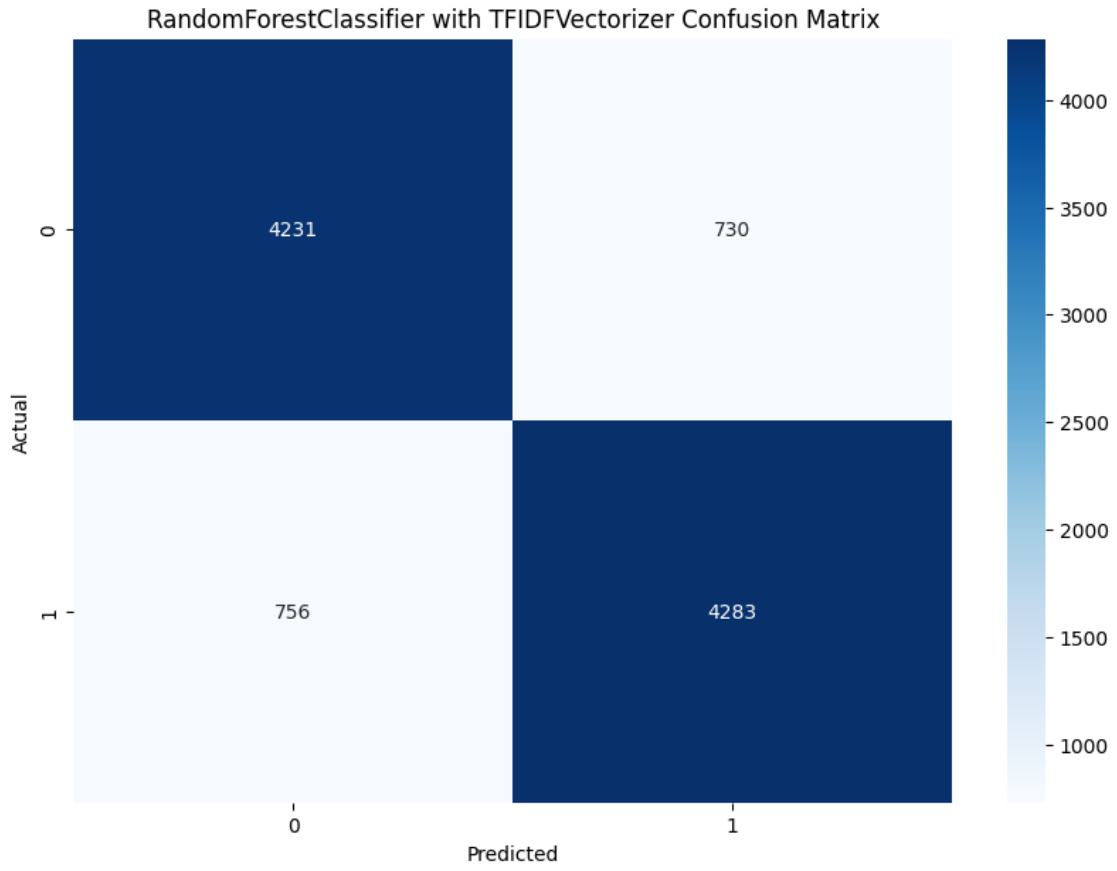

```
--- LogisticRegression with TFIDFVectorizer ---
              precision    recall  f1-score   support

    negative       0.90      0.87      0.89      4961
    positive       0.88      0.91      0.89      5039

    accuracy                           0.89     10000
   macro avg       0.89      0.89      0.89     10000
weighted avg       0.89      0.89      0.89     10000
```




```
--- SVC with TFIDFVectorizer ---
              precision    recall  f1-score   support

    negative       0.91      0.88      0.90      4961
    positive       0.89      0.92      0.90      5039

    accuracy                           0.90     10000
   macro avg       0.90      0.90      0.90     10000
weighted avg       0.90      0.90      0.90     10000
```




```
--- RandomForestClassifier with TFIDFVectorizer ---
              precision    recall  f1-score   support

    negative       0.85      0.85      0.85      4961
    positive       0.85      0.85      0.85      5039

    accuracy                           0.85     10000
   macro avg       0.85      0.85      0.85     10000
weighted avg       0.85      0.85      0.85     10000
```



[11]:
```
from google.colab import drive
drive.mount('/content/drive')
```

```
Mounted at /content/drive
```

[13]:
```
# Convert notebook to PDF
!apt-get install texlive texlive-xetex texlive-latex-extra pandoc
!pip install pypandoc
!jupyter nbconvert --to PDF "/content/drive/MyDrive/Colab Notebooks/NLP␣
↪Assignment 1 - 22070126093.ipynb"
```

```
Reading package lists… Done
Building dependency tree… Done
Reading state information… Done
pandoc is already the newest version (2.9.2.1-3ubuntu2).
texlive is already the newest version (2021.20220204-1).
texlive-latex-extra is already the newest version (2021.20220204-1).
texlive-xetex is already the newest version (2021.20220204-1).
0 upgraded, 0 newly installed, 0 to remove and 49 not upgraded.
Requirement already satisfied: pypandoc in /usr/local/lib/python3.10/dist-
```

```
packages (1.13)
[NbConvertApp] Converting notebook /content/drive/MyDrive/Colab Notebooks/NLP
Assignment 1 - 22070126093.ipynb to PDF
[NbConvertApp] Support files will be in NLP Assignment 1 - 22070126093_files/
[NbConvertApp] Making directory ./NLP Assignment 1 - 22070126093_files
[NbConvertApp] Making directory ./NLP Assignment 1 - 22070126093_files
[NbConvertApp] Making directory ./NLP Assignment 1 - 22070126093_files
[NbConvertApp] Making directory ./NLP Assignment 1 - 22070126093_files
[NbConvertApp] Making directory ./NLP Assignment 1 - 22070126093_files
[NbConvertApp] Making directory ./NLP Assignment 1 - 22070126093_files
[NbConvertApp] Writing 60584 bytes to notebook.tex
[NbConvertApp] Building PDF
[NbConvertApp] Running xelatex 3 times: ['xelatex', 'notebook.tex', '-quiet']
[NbConvertApp] Running bibtex 1 time: ['bibtex', 'notebook']
[NbConvertApp] WARNING | bibtex had problems, most likely because there were no
citations
[NbConvertApp] PDF successfully created
[NbConvertApp] Writing 195950 bytes to /content/drive/MyDrive/Colab
Notebooks/NLP Assignment 1 - 22070126093.pdf
```

[ ]: