

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns

from sklearn.model_selection import train_test_split, GridSearchCV
from sklearn.feature_extraction.text import TfidfVectorizer
from sklearn.svm import LinearSVC
from sklearn.metrics import accuracy_score, classification_report
from sklearn.ensemble import RandomForestClassifier

import joblib
```

```
from google.colab import files
```

```
files.upload()
```

Show hidden output

```
df = pd.read_csv("movie_review_sentiment_analysis.csv")
df.head()
```

	review	sentiment
0	One of the other reviewers has mentioned that ...	positive
1	A wonderful little production. The...	positive
2	I thought this was a wonderful way to spend ti...	positive
3	Basically there's a family where a little boy ...	negative
4	Petter Mattei's "Love in the Time of Money" is...	positive

```
df.shape
```

```
(50000, 2)
```

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 50000 entries, 0 to 49999
Data columns (total 2 columns):
 #   Column      Non-Null Count  Dtype  
 ---  --          --          --    
 0   review      50000 non-null   object 
 1   sentiment   50000 non-null   object 
dtypes: object(2)
memory usage: 781.4+ KB
```

```
df.isnull().sum()
```

```
          0
review    0
sentiment 0
dtype: int64
```

```
df['sentiment'] = df['sentiment'].map({'positive': 1,'negative': 0})
```

```
df['sentiment']
```

```
sentiment
0      1
1      1
2      1
3      0
4      1
...
49995    1
49996    0
49997    0
49998    0
49999    0
50000 rows × 1 columns
```

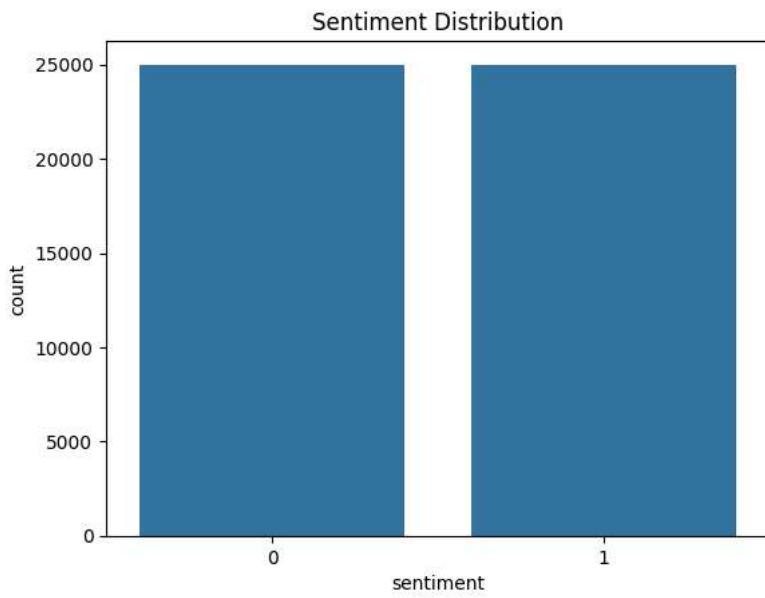
dtype: int64

```
df.dtypes
```

	0
review	object
sentiment	int64

dtype: object

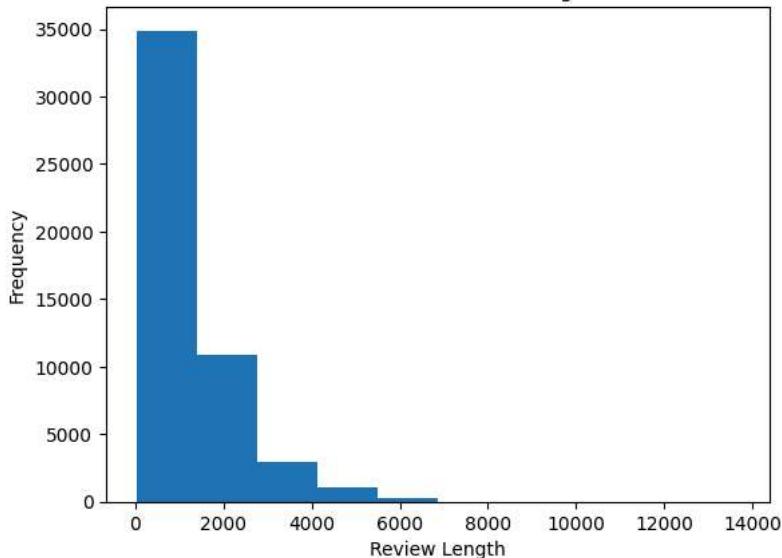
```
sns.countplot(x='sentiment', data=df)
plt.title("Sentiment Distribution")
plt.show()
```



```
df['review_length'] = df['review'].apply(len)
```

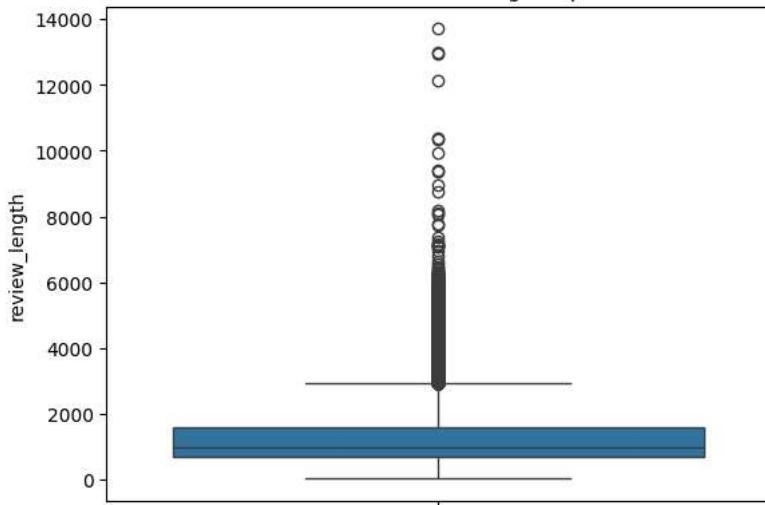
```
plt.hist(df['review_length'])
plt.xlabel("Review Length")
plt.ylabel("Frequency")
plt.title("Distribution of Review Lengths")
plt.show()
```

Distribution of Review Lengths



```
sns.boxplot(df['review_length'])
plt.title("Outlier Detection using Boxplot")
plt.show()
```

Outlier Detection using Boxplot



```
X = df['review']
y = df['sentiment']
```

```
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)
```

```
tfidf = TfidfVectorizer(
    stop_words='english',
    max_features=5000,
    ngram_range=(1,3),
    min_df=2,
    max_df=0.9
)

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

```
svm = LinearSVC(max_iter=10000)

# Filter out NaN values from y_train and corresponding X_train_tfidf
nan_mask = y_train.isna()
```

```
X_train_tfidf_cleaned = X_train_tfidf[~nan_mask.values]
y_train_cleaned = y_train[~nan_mask]

svm.fit(X_train_tfidf_cleaned, y_train_cleaned)
```

▼ LinearSVC ⓘ ⓘ
LinearSVC(max_iter=10000)

```
y_pred = svm.predict(X_test_tfidf)
```

```
print("Accuracy:", accuracy_score(y_test, y_pred))
print(classification_report(y_test, y_pred))
```

	precision	recall	f1-score	support
0	0.89	0.87	0.88	4961
1	0.88	0.89	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

```
param_grid = {
    'C': [0.01, 0.1, 1, 10, 100],
    'max_iter': [1000, 5000, 10000]
}
```

```
grid = GridSearchCV(
    LinearSVC(dual=False),
    param_grid,
    cv=5,
    scoring='f1',
    n_jobs=-1
)
```

```
grid.fit(X_train_tfidf, y_train)
```

```
print("Best parameters:", grid.best_params_)
print("Best F1 score:", grid.best_score_)
```

```
Best parameters: {'C': 0.1, 'max_iter': 1000}
Best F1 score: 0.8875202519598998
```

```
best_svm = grid.best_estimator_
best_svm.fit(X_train_tfidf, y_train)
```

▼ LinearSVC ⓘ ⓘ
LinearSVC(C=0.1, dual=False)

```
best_pred = best_svm.predict(X_test_tfidf)
```

```
print("Optimized Accuracy:", accuracy_score(y_test, best_pred))
print(classification_report(y_test, best_pred))
```

	precision	recall	f1-score	support
0	0.90	0.87	0.89	4961
1	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

```
rf = RandomForestClassifier(n_estimators=100, random_state=42)
rf.fit(X_train_tfidf, y_train)
```

```
rf_pred = rf.predict(X_test_tfidf)
```

```
print("Random Forest Accuracy:". accuracy score(v test. rf pred))  
Random Forest Accuracy: 0.8523
```

```
manual_review = ["Not worth the price"]  
  
manual_tfidf = tfidf.transform(manual_review)  
  
prediction = svm.predict(manual_tfidf)  
  
label_map = {0: "Negative", 1: "Positive"}  
print("Predicted sentiment:", label_map[prediction[0]])
```

```
Predicted sentiment: Positive
```

```
joblib.dump(best_svm, "svm_text_classifier.pkl")  
['svm_text_classifier.pkl']
```

```
joblib.dump(tfidf, "tfidf_vectorizer.pkl")  
['tfidf_vectorizer.pkl']
```

```
from google.colab import files  
  
files.download('svm_text_classifier.pkl')  
  
files.download('tfidf_vectorizer.pkl')  
  
!ls  
  
movie_review_sentiment_analysis.csv  svm_text_classifier.pkl  
sample_data          tfidf_vectorizer.pkl
```

```
!zip models.zip svm_text_classifier.pkl tfidf_vectorizer.pkl
```

```
adding: svm_text_classifier.pkl (deflated 6%)  
adding: tfidf_vectorizer.pkl (deflated 68%)
```

```
!ls  
  
models.zip           svm_text_classifier.pkl  
movie_review_sentiment_analysis.csv  tfidf_vectorizer.pkl  
sample_data
```

```
from google.colab import files  
files.download('models.zip')
```

```
manual_review = ["Waste of money"]  
  
manual_tfidf = tfidf.transform(manual_review)  
  
prediction = svm.predict(manual_tfidf)  
  
label_map = {0: "Negative", 1: "Positive"}  
print("Predicted sentiment:", label_map[prediction[0]])
```

```
Predicted sentiment: Negative
```