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


from bs4 import BeautifulSoup
import re
from nltk.corpus import stopwords
nltk.download('stopwords')
from sklearn import svm
from sklearn.model_selection import train_test_split
from sklearn.feature_extraction.text import CountVectorizer
from sklearn.metrics import accuracy_score, confusion_matrix, recall_score, precision_score, f1_score
```

```
[nltk_data] Downloading package stopwords to /root/nltk_data...
[nltk_data]   Unzipping corpora/stopwords.zip.
```

```
df = pd.read_csv("wiki_movie_plots_deduped.csv")


df.tail()
```

	Release Year	Title	Origin/Ethnicity	Director	Cast	Genre	Wiki Page
34881	2014	The Water Diviner	Turkish	Director: Russell Crowe\r\nCast: Russell Crowe...	unknown	https://en.wikipedia.org/wiki/The_Water_Diviner	
34882	2017	Çalgı Çengi İkimiz	Turkish	Selçuk Aydemir	Ahmet Kural, Murat Cemcir	comedy	https://en.wikipedia.org/wiki/%C3%87alg%C4%B1_...
34883	2017	Olanlar Oldu	Turkish	Hakan Algül	Ata Demirer, Tuvana Türkay, Ülkü Duru	comedy	https://en.wikipedia.org/wiki/Olanlar_Oldu
					YouTubers Shanna		

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 34886 entries, 0 to 34885
Data columns (total 8 columns):
 #   Column            Non-Null Count  Dtype 
---  ------            --------------  ----- 
 0   Release Year      34886 non-null  int64 
 1   Title             34886 non-null  object
 2   Origin/Ethnicity  34886 non-null  object
 3   Director          34886 non-null  object
 4   Cast              33464 non-null  object
 5   Genre             34886 non-null  object
 6   Wiki Page         34886 non-null  object
 7   Plot              34886 non-null  object
dtypes: int64(1), object(7)
memory usage: 2.1+ MB
```

```
df['Genre']=df['Genre'].replace('unknown',np.nan)
df=df.dropna(axis=0, subset=['Genre'])
print(df.tail())
```

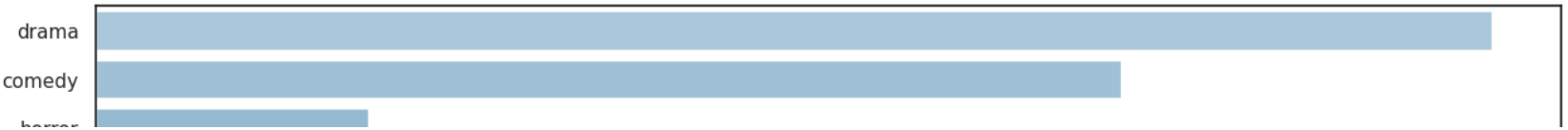
```
       Release Year               Title Origin/Ethnicity         Director  \
34877          2013     Particle (film)          Turkish    Erdem Tepegöz
34882          2017  Çalgı Çengi İkimiz          Turkish   Selçuk Aydemir
34883          2017        Olanlar Oldu          Turkish      Hakan Algül
34884          2017    Non-Transferable          Turkish  Brendan Bradley
34885          2017  İstanbul Kırmızısı          Turkish   Ferzan Özpetek

                                                Cast            Genre  \
34877  Jale Arıkan, Rüçhan Caliskur, Özay Fecht, Remz...       drama film
34882                          Ahmet Kural, Murat Cemcir           comedy
34883              Ata Demirer, Tuvana Türkay, Ülkü Duru           comedy
34884  YouTubers Shanna Malcolm, Shira Lazar, Sara Fl...  romantic comedy
34885  Halit Ergenç, Tuba Büyüküstün, Mehmet Günsür, ...         romantic

                                            Wiki Page  \
34877      https://en.wikipedia.org/wiki/Particle_(film)
34882  https://en.wikipedia.org/wiki/%C3%87alg%C4%B1_...
34883         https://en.wikipedia.org/wiki/Olanlar_Oldu
34884  https://en.wikipedia.org/wiki/Non-Transferable...
34885  https://en.wikipedia.org/wiki/%C4%B0stanbul_K%...

                                                    Plot
34877  Zeynep lost her job at weaving factory, and he...
34882  Two musicians, Salih and Gürkan, described the...
34883  Zafer, a sailor living with his mother Döndü i...
34884  The film centres around a young woman named Am...
34885  The writer Orhan Şahin returns to İstanbul aft...
```

```
print(df.shape)
print(len(df))
a=df['Genre'].value_counts()[:20]
b=a.keys().tolist()
print(b)
df=df[df.Genre.isin(b)]
df=df.reset_index(drop=True)
```

```
(28803, 8)
28803
['drama', 'comedy', 'horror', 'action', 'thriller', 'romance', 'western', 'crime', 'adventure', 'musical', 'crime drama', 'romantic com
```

```
sns.set(style="white")
genre_to_count=pd.DataFrame({'Genre':a.index, 'Count':a.values})
plt.figure(figsize=(15,10))
sns.barplot(y="Genre", x="Count", data=genre_to_count,palette="Blues_d")
```

```
<Axes: xlabel='Count', ylabel='Genre'>
```




```
def plotToWords(raw_plot):
    letters_only = re.sub("[^a-zA-Z]", " ", raw_plot)
    lower_case = letters_only.lower()
    words = lower_case.split()
    stops = set(stopwords.words("english"))
    meaningful_words = [w for w in words if not w in stops]
    return (" ".join(meaningful_words))
```

```
def preprocess(dataframe):
    clean_train_reviews = []
    for i in range(0,len(dataframe)):
        clean_train_reviews.append(plotToWords(dataframe.iloc[i]['Plot']))
    dataframe['Plot']=clean_train_reviews
    return dataframe
```


```
df=preprocess(df)
print(df["Plot"][:10])
```

```
0    film opens two bandits breaking railroad teleg...
1    film family move suburbs hoping quiet life thi...
2    heading baseball game nearby ballpark sports f...
3    plot black woman going dentist toothache given...
4    beautiful summer day father mother take daught...
5    thug accosts girl leaves workplace man rescues...
6    young couple decides elope caught midst romant...
7    white girl florence lawrence rejects proposal ...
8    prints first american film adaptation christma...
9    film opens town mexican border poker game goin...
Name: Plot, dtype: object
```

```
from sklearn.feature_extraction.text import TfidfVectorizer
tfidf = TfidfVectorizer(sublinear_tf=True, min_df=5, norm='l2', encoding='latin-1', ngram_range=(1, 2), max_features=4000)
```

```
features = tfidf.fit_transform(df.Plot).toarray()
labels = df.Genre
features.shape
```

```
     (20132, 4000)
```

```
from sklearn.model_selection import train_test_split
from sklearn.feature_extraction.text import CountVectorizer
from sklearn.feature_extraction.text import TfidfTransformer
from sklearn.naive_bayes import MultinomialNB
X_train, X_test, y_train, y_test = train_test_split(df['Plot'], df['Genre'], random_state = 0)
count_vect = CountVectorizer()
X_train_counts = count_vect.fit_transform(X_train)
tfidf_transformer = TfidfTransformer()
X_train_tfidf = tfidf_transformer.fit_transform(X_train_counts)
clf = MultinomialNB().fit(X_train_tfidf, y_train)
```

```
print(clf.predict(count_vect.transform(["In an interview with CBC Radio, UniversitÃ© de MontrÃ©al History Professor Dominique St. Arnaud tell
```

```
     ['drama']
```

```
from sklearn.linear_model import LogisticRegression
from sklearn.ensemble import RandomForestClassifier
from sklearn.svm import LinearSVC
from sklearn.model_selection import cross_val_score
```

```
models = [
    LinearSVC(),
    MultinomialNB(),
    LogisticRegression(random_state=0),
]
CV = 5
cv_df = pd.DataFrame(index=range(CV * len(models)))
entries = []
for model in models:
    model_name = model.__class__.__name__
```

```
    accuracies = cross_val_score(model, features, labels, scoring='accuracy', cv=CV)
    for fold_idx, accuracy in enumerate(accuracies):
        entries.append((model_name, fold_idx, accuracy))
cv_df = pd.DataFrame(entries, columns=['model_name', 'fold_idx', 'accuracy'])
import seaborn as sns
sns.boxplot(x='model_name', y='accuracy', data=cv_df)
sns.stripplot(x='model_name', y='accuracy', data=cv_df,
              size=8, jitter=True, edgecolor="gray", linewidth=2)
```

```
/usr/local/lib/python3.10/dist-packages/sklearn/linear_model/_logistic.py:458: ConvergenceWarning: lbfgs failed to converge
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(
/usr/local/lib/python3.10/dist-packages/sklearn/linear_model/_logistic.py:458: ConvergenceWarning: lbfgs failed to converge
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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(
```
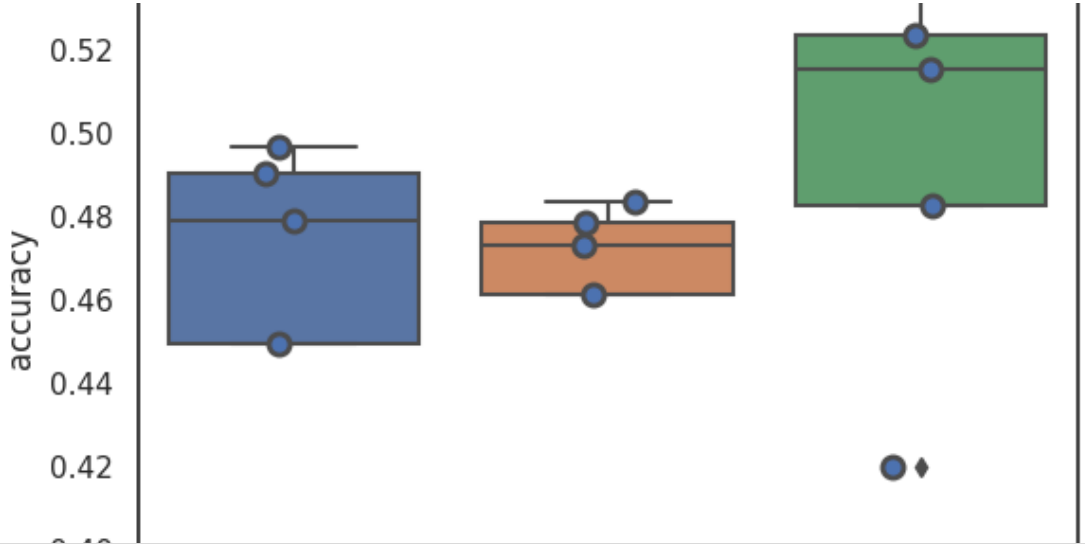

```
plt.show()
```

```
cv_df.groupby('model_name').accuracy.mean()
```

```
model_name
LinearSVC             0.459963
LogisticRegression    0.495677
MultinomialNB         0.456386
Name: accuracy, dtype: float64
```

```
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(
<Axes: xlabel='model_name', ylabel='accuracy'>
```


0.52
0.50
0.48
0.46
0.44
0.42
accuracy