In [1]:

```
import numpy as np
import pandas as pd

import matplotlib.pyplot as plt
import seaborn as sns

from sklearn import datasets
from sklearn import svm
from sklearn.model_selection import train_test_split


from sklearn.metrics import confusion_matrix, classification_report
```

In [2]:

```
#pd.set_option('display.max_columns', None)
#pd.set_option('display.max_rows', None)
```

In [3]:

```
data = pd.read_csv('emotions_2.csv')
data
```

Out[3]:

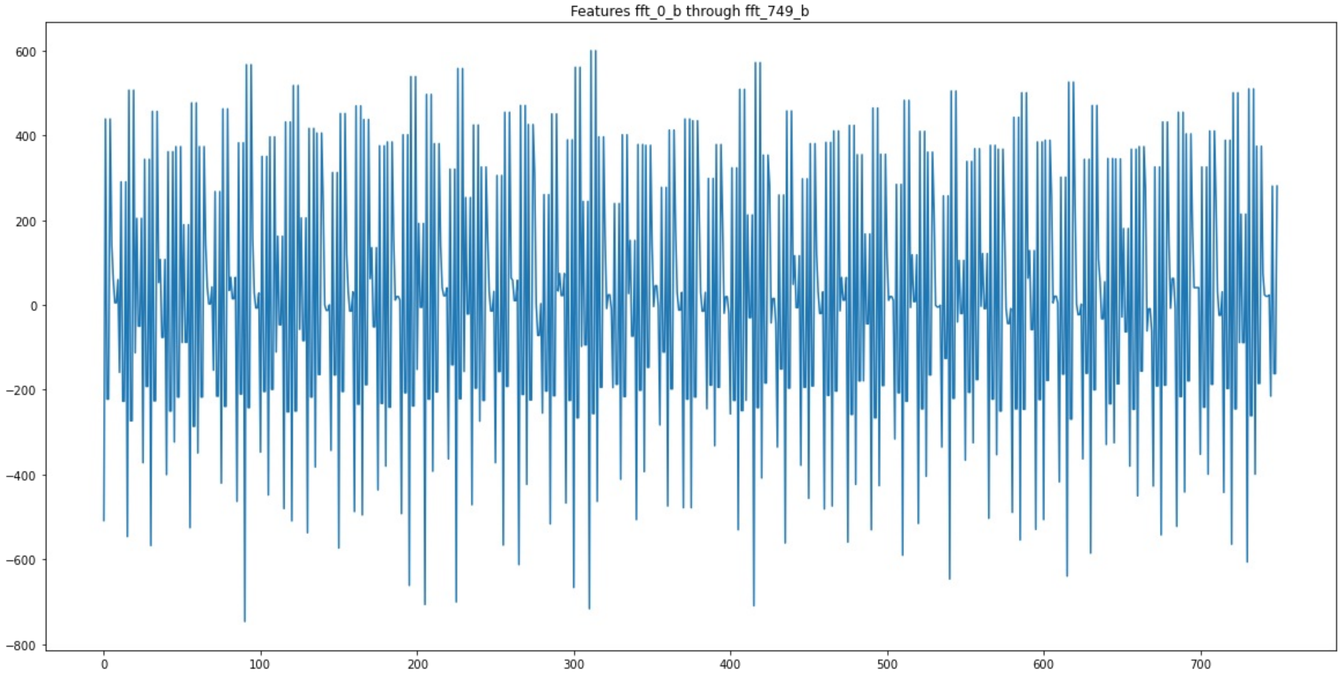
	# mean_0_a	mean_1_a	mean_2_a	mean_3_a	mean_4_a	mean_d_0_a	mean_d_1_a	mean_d_2_a	mean_d_3_a	mean_d_4_a	...	fft_741_
0	4.62	30.3	-356.0	15.60	26.3	1.0700	0.411	-15.70	2.060	3.150	...	23.5
1	28.80	33.1	32.0	25.80	22.8	6.5500	1.680	2.88	3.830	-4.820	...	-23.3
2	8.90	29.4	-416.0	16.70	23.7	79.9000	3.360	90.20	89.900	2.030	...	462.0
3	14.90	31.6	-143.0	19.80	24.3	-0.5840	-0.284	8.82	2.300	-1.970	...	299.0
4	28.30	31.3	45.2	27.30	24.5	34.8000	-5.790	3.06	41.400	5.520	...	12.0
...	...	...	...	...	...	...	...	...	...	...	...	.
194	27.90	29.9	31.2	27.40	25.8	-1.6100	0.134	1.18	-0.413	-0.181	...	-5.9
195	31.40	32.5	32.3	29.60	25.3	2.4700	0.521	6.20	2.370	4.670	...	-1.1
196	2.75	10.6	22.9	-5.72	24.5	-0.0941	1.530	2.84	1.440	-1.730	...	-13.6
197	26.70	30.0	31.1	25.70	22.9	-2.5700	-3.070	-4.37	-2.430	-5.160	...	-31.3
198	9.24	31.1	17.1	8.54	24.0	2.8000	4.100	9.11	2.810	-0.536	...	-10.4

199 rows × 2549 columns

In [4]:

```
sample = data.loc[0, 'fft_0_b':'fft_749_b']

plt.figure(figsize=(20, 10))
plt.plot(range(len(sample)), sample)
plt.title("Features fft_0_b through fft_749_b")
plt.show()
```



In [5]:

```
df=data.replace(['NEGATIVE','POSITIVE','NEUTRAL'],[-1,1,0])
df
```

Out[5]:

	# mean_0_a	mean_1_a	mean_2_a	mean_3_a	mean_4_a	mean_d_0_a	mean_d_1_a	mean_d_2_a	mean_d_3_a	mean_d_4_a	...	fft_741_
0	4.62	30.3	-356.0	15.60	26.3	1.0700	0.411	-15.70	2.060	3.150	...	23.5
1	28.80	33.1	32.0	25.80	22.8	6.5500	1.680	2.88	3.830	-4.820	...	-23.3
2	8.90	29.4	-416.0	16.70	23.7	79.9000	3.360	90.20	89.900	2.030	...	462.0
3	14.90	31.6	-143.0	19.80	24.3	-0.5840	-0.284	8.82	2.300	-1.970	...	299.0
4	28.30	31.3	45.2	27.30	24.5	34.8000	-5.790	3.06	41.400	5.520	...	12.0
...	...	...	...	...	...	...	...	...	...	...	...	.
194	27.90	29.9	31.2	27.40	25.8	-1.6100	0.134	1.18	-0.413	-0.181	...	-5.9
195	31.40	32.5	32.3	29.60	25.3	2.4700	0.521	6.20	2.370	4.670	...	-1.1
196	2.75	10.6	22.9	-5.72	24.5	-0.0941	1.530	2.84	1.440	-1.730	...	-13.6
197	26.70	30.0	31.1	25.70	22.9	-2.5700	-3.070	-4.37	-2.430	-5.160	...	-31.3
198	9.24	31.1	17.1	8.54	24.0	2.8000	4.100	9.11	2.810	-0.536	...	-10.4

199 rows × 2549 columns

In [6]:

```
X=df[['mean_1_a','stddev_1_a','covmat_1_a','eigen_1_a','logm_1_a','entropy1_a','correlate_1_a']]
X.head()
```

Out[6]:

	mean_1_a	stddev_1_a	covmat_1_a	eigen_1_a	logm_1_a	entropy1_a	correlate_1_a
0	30.3	7.80	-4310.0	44200.0	8.37	4.98	20600.0
1	33.1	3.55	-45.9	1160.0	-2.90	5.00	4190.0
2	29.4	4.12	-1800.0	74600.0	5.77	5.00	423000.0
3	31.6	2.99	-848.0	45800.0	5.71	5.01	114000.0
4	31.3	6.99	-74.4	7320.0	-1.99	4.99	9420.0

In [7]:

```
y=df['label']
y.head()
```

Out[7]:

```
0   -1
1    0
2    1
3    1
4    0
Name: label, dtype: int64
```

In [8]:

```
#X = np.array(X).reshape(-1, 2)
#y = np.array(y).reshape(-1, 1)
```

In [9]:

```
y
```

Out[9]:

```
0     -1
1      0
2      1
3      1
4      0
      ..
194    0
195    0
196    1
197    0
198    1
Name: label, Length: 199, dtype: int64
```

In [10]:

```
y = np.array(y).ravel()
```

In [11]:

```
y
```

Out[11]:

```
array([-1,  0,  1,  1,  0,  0,  1, -1,  0, -1,  1, -1,  0, -1,  0, -1,  1,
        0, -1, -1, -1,  0, -1, -1,  1,  0, -1,  0,  1,  1,  1,  0,  0,  1,
        0,  0,  1, -1,  1,  0,  0,  0,  1,  0, -1,  1, -1,  1, -1,  1,  1,
       -1,  1,  0,  1, -1,  0, -1,  1,  0, -1,  0,  1, -1,  0,  1,  0, -1,
        0,  1,  1,  1,  0, -1,  0,  0,  1,  1, -1,  1,  0,  1,  0,  1,  0,
        0,  0,  1,  0,  0,  1, -1, -1,  1,  0, -1,  1, -1, -1,  0, -1, -1,
       -1, -1, -1,  1, -1,  0,  1,  1,  1,  0, -1,  0,  0,  1,  0,  1,  1,
        1,  1,  1,  0,  0,  0,  1,  0, -1, -1,  0, -1,  1,  0, -1,  0, -1,
        1,  1,  0, -1,  1, -1,  1,  0,  1,  1,  1,  1,  1,  0, -1, -1, -1,
        0,  1,  1,  0,  1,  1,  0, -1, -1, -1,  0, -1,  0,  0,  0, -1, -1,
        0,  0, -1,  1,  0,  0, -1,  0, -1, -1,  1, -1,  0, -1,  1,  0,  1,
       -1, -1, -1,  0, -1, -1, -1,  0,  0,  1,  0,  1], dtype=int64)
```

In [12]:

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

In [13]:

```
len(X_train)
```

```
Out[13]: 159
```

```
In [14]: len(X_test)
```

```
Out[14]: 40
```

Support vector machine (SVM)

```
In [15]: from sklearn.svm import SVC
         svm = SVC(kernel='linear', C=1, random_state=0)
```

```
In [16]: svm.fit(X_train, y_train)
```

```
Out[16]: SVC(C=1, kernel='linear', random_state=0)
```

```
In [17]: score_svm= svm.score(X_test, y_test)
```

```
In [18]: score_svm = svm.score(X_test, y_test)
         print('Test accuracy: {:.2f}%'.format(score_svm * 100))
```

```
Test accuracy: 80.00%
```

```
In [19]: y_pred_svm = svm.predict(X_test)
```

```
In [20]: conf_mat_svm = confusion_matrix(y_test, y_pred_svm)
         print('Confusion matrix:')
         conf_mat_svm
```

```
         Confusion matrix:
Out[20]: array([[15,  0,  0],
                [ 0, 10,  1],
                [ 4,  3,  7]], dtype=int64)
```

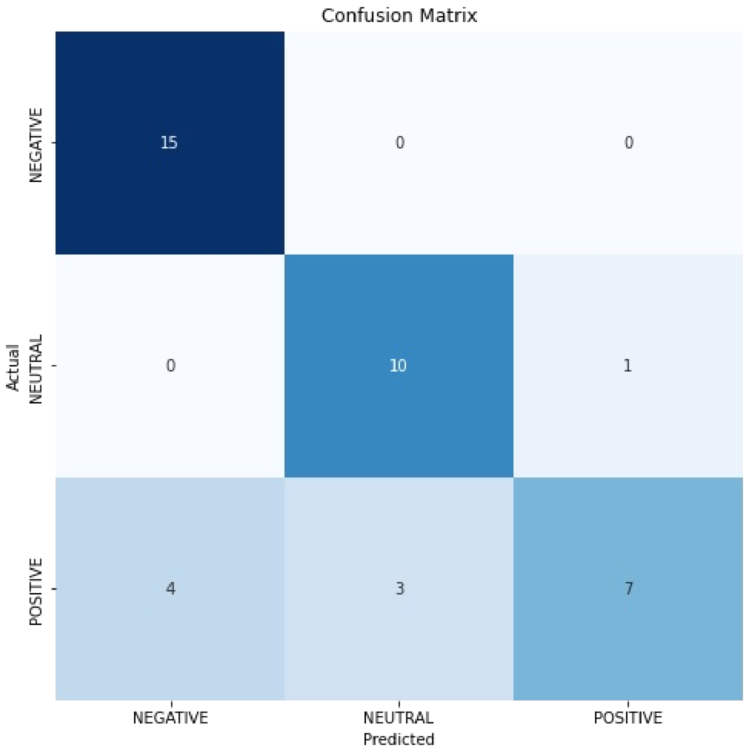
```
In [21]: label_mapping = {'NEGATIVE': -1, 'NEUTRAL': 0, 'POSITIVE': 1}
```

```
In [22]: clr_svm = classification_report(y_test, y_pred_svm, target_names=label_mapping.keys())
```

```
In [23]: plt.figure(figsize=(8, 8))
         sns.heatmap(conf_mat_svm, annot=True, vmin=0, fmt='g', cbar=False, cmap='Blues')

         plt.xticks(np.arange(3) + 0.5, label_mapping.keys())
         plt.yticks(np.arange(3) + 0.5, label_mapping.keys())
         plt.xlabel("Predicted")
         plt.ylabel("Actual")
         plt.title("Confusion Matrix")
         plt.show()

         print("Classification Report:\n----------------------\n", clr_svm)
```



```
Classification Report:
----------------------
              precision    recall  f1-score   support

    NEGATIVE       0.79      1.00      0.88        15
     NEUTRAL       0.77      0.91      0.83        11
    POSITIVE       0.88      0.50      0.64        14

    accuracy                           0.80        40
   macro avg       0.81      0.80      0.78        40
weighted avg       0.81      0.80      0.78        40
```

In [24]:

```
test_data = pd.read_excel('test_values_3.xlsx',sheet_name='Sheet2')
test_data.head()
```

Out[24]:

	mean_1_a	stddev_1_a	covmat_1_a	eigen_1_a	logm_1_a	entropy1_a	correlate_1_a
0	30.3	7.80	-4310.0	44200	8.37	4.98	20600
1	33.1	3.55	-45.9	1160	-2.90	5.00	4190
2	29.4	4.12	-1800.0	74600	5.77	5.00	423000
3	31.6	2.99	-848.0	45800	5.71	5.01	114000
4	31.3	6.99	-74.4	7320	-1.99	4.99	9420

In [25]:

```
feature1=test_data['mean_1_a']
feature2=test_data['stddev_1_a']
feature3=test_data['covmat_1_a']
feature4=test_data['eigen_1_a']
feature5=test_data['logm_1_a']
feature6=test_data['entropy1_a']
feature7=test_data['correlate_1_a']
```

In [26]:

```
for t1,t2,t3,t4,t5,t6,t7 in zip(feature1,feature2,feature3,feature4,feature5,feature6,feature7):

    input_test_data = (t1,t2,t3,t4,t5,t6,t7)
    input_data_array = np.asarray(input_test_data)
    input_data_array_reshape=input_data_array.reshape(1,-1)

    prediction=svm.predict(input_data_array_reshape)

    if prediction==0:
        emotion_result="neutral"
    elif prediction==1:
        emotion_result="happy"
    elif prediction==-1:
        emotion_result="sad"
    print("Test data ",input_test_data,"\nThe emotion is ",emotion_result)
    print()
```

```
Test data  (30.3, 7.8, -4310.0, 44200, 8.37, 4.98, 20600)
The emotion is  sad

Test data  (33.1, 3.55, -45.9, 1160, -2.9, 5.0, 4190)
The emotion is  neutral

Test data  (29.4, 4.12, -1800.0, 74600, 5.77, 5.0, 423000)
The emotion is  sad

Test data  (31.6, 2.99, -848.0, 45800, 5.71, 5.01, 114000)
The emotion is  sad

Test data  (31.3, 6.99, -74.4, 7320, -1.99, 4.99, 9420)
The emotion is  happy

Test data  (30.9, 3.59, -27.4, 1730, -10.7, 5.0, 2660)
The emotion is  neutral

Test data  (21.0, 3.55, 18.4, 2260, 1.68, 5.0, 3030)
The emotion is  happy

Test data  (27.8, 5.22, -674.0, 31100, 5.2, 4.99, 149000)
The emotion is  happy

Test data  (29.7, 4.73, -1.73, 1720, 1.6, 5.0, 4770)
The emotion is  neutral

Test data  (29.2, 3.93, -4120.0, 33900, 8.73, 5.0, 121000)
The emotion is  sad

Test data  (28.4, 4.07, -22.0, 841, -3.98, 5.0, 884)
The emotion is  neutral

Test data  (30.4, 4.02, -1070.0, 18800, 6.01, 5.0, -4080)
The emotion is  happy

Test data  (32.7, 3.07, 8.5, 851, 1.89, 5.01, 6030)
The emotion is  neutral

Test data  (31.7, 6.44, 121.0, 38600, 7.22, 4.99, 50000)
The emotion is  sad

Test data  (31.8, 3.12, -9.32, 891, 3.35, 5.01, 3650)
The emotion is  neutral

Test data  (23.8, 5.13, -1670.0, 45500, 1.98, 4.99, 104000)
The emotion is  sad

Test data  (34.9, 4.6, -120.0, 1760, 3.6, 5.0, 6540)
The emotion is  neutral

Test data  (30.8, 2.71, 23.5, 945, 1.97, 5.01, 5000)
The emotion is  neutral

Test data  (21.9, 4.16, -27000.0, 190000, 9.73, 4.99, 970000)
The emotion is  sad

Test data  (27.6, 7.98, -5460.0, 43000, 9.28, 4.97, 269000)
The emotion is  sad
```

```
C:\Users\RAHUL M\anaconda3\lib\site-packages\sklearn\base.py:450: UserWarning: X does not have valid feature na
mes, but SVC was fitted with feature names
  warnings.warn(
C:\Users\RAHUL M\anaconda3\lib\site-packages\sklearn\base.py:450: UserWarning: X does not have valid feature na
mes, but SVC was fitted with feature names
  warnings.warn(
C:\Users\RAHUL M\anaconda3\lib\site-packages\sklearn\base.py:450: UserWarning: X does not have valid feature na
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  warnings.warn(
C:\Users\RAHUL M\anaconda3\lib\site-packages\sklearn\base.py:450: UserWarning: X does not have valid feature na
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  warnings.warn(
C:\Users\RAHUL M\anaconda3\lib\site-packages\sklearn\base.py:450: UserWarning: X does not have valid feature na
mes, but SVC was fitted with feature names
  warnings.warn(
C:\Users\RAHUL M\anaconda3\lib\site-packages\sklearn\base.py:450: UserWarning: X does not have valid feature na
mes, but SVC was fitted with feature names
  warnings.warn(
C:\Users\RAHUL M\anaconda3\lib\site-packages\sklearn\base.py:450: UserWarning: X does not have valid feature na
mes, but SVC was fitted with feature names
  warnings.warn(
C:\Users\RAHUL M\anaconda3\lib\site-packages\sklearn\base.py:450: UserWarning: X does not have valid feature na
mes, but SVC was fitted with feature names
  warnings.warn(
C:\Users\RAHUL M\anaconda3\lib\site-packages\sklearn\base.py:450: UserWarning: X does not have valid feature na
mes, but SVC was fitted with feature names
  warnings.warn(
C:\Users\RAHUL M\anaconda3\lib\site-packages\sklearn\base.py:450: UserWarning: X does not have valid feature na
mes, but SVC was fitted with feature names
  warnings.warn(
C:\Users\RAHUL M\anaconda3\lib\site-packages\sklearn\base.py:450: UserWarning: X does not have valid feature na
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  warnings.warn(
C:\Users\RAHUL M\anaconda3\lib\site-packages\sklearn\base.py:450: UserWarning: X does not have valid feature na
mes, but SVC was fitted with feature names
  warnings.warn(
C:\Users\RAHUL M\anaconda3\lib\site-packages\sklearn\base.py:450: UserWarning: X does not have valid feature na
mes, but SVC was fitted with feature names
  warnings.warn(
C:\Users\RAHUL M\anaconda3\lib\site-packages\sklearn\base.py:450: UserWarning: X does not have valid feature na
mes, but SVC was fitted with feature names
  warnings.warn(
C:\Users\RAHUL M\anaconda3\lib\site-packages\sklearn\base.py:450: UserWarning: X does not have valid feature na
mes, but SVC was fitted with feature names
  warnings.warn(
C:\Users\RAHUL M\anaconda3\lib\site-packages\sklearn\base.py:450: UserWarning: X does not have valid feature na
mes, but SVC was fitted with feature names
  warnings.warn(
C:\Users\RAHUL M\anaconda3\lib\site-packages\sklearn\base.py:450: UserWarning: X does not have valid feature na
mes, but SVC was fitted with feature names
  warnings.warn(
C:\Users\RAHUL M\anaconda3\lib\site-packages\sklearn\base.py:450: UserWarning: X does not have valid feature na
mes, but SVC was fitted with feature names
  warnings.warn(
C:\Users\RAHUL M\anaconda3\lib\site-packages\sklearn\base.py:450: UserWarning: X does not have valid feature na
mes, but SVC was fitted with feature names
  warnings.warn(
```

k-nearest neighbour(knn)

In [27]:

```
from sklearn.neighbors import KNeighborsClassifierhhhhhhhhhhhhhhhhhhhhhhhhhhhhhhhhhhhhh
```

In [28]:

```
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size = 0.2, random_state=42)
knn = KNeighborsClassifier(n_neighbors=7)
```

In [29]:

```
knn.fit(X_train, y_train)
```

Out[29]:

```
KNeighborsClassifier(n_neighbors=7)
```

In [30]:

```
score_knn = knn.score(X_test, y_test)
```

In [31]:

```
score_knn = knn.score(X_test, y_test)
print('Test accuracy: {:.2f}%'.format(score_knn * 100))
```

```
Test accuracy: 67.50%
```

In [32]:

```
y_pred_knn=knn.predict(X_test)
```

In [33]:

```
conf_mat_knn = confusion_matrix(y_test, y_pred_knn)
print('Confusion matrix:')
conf_mat_knn
```

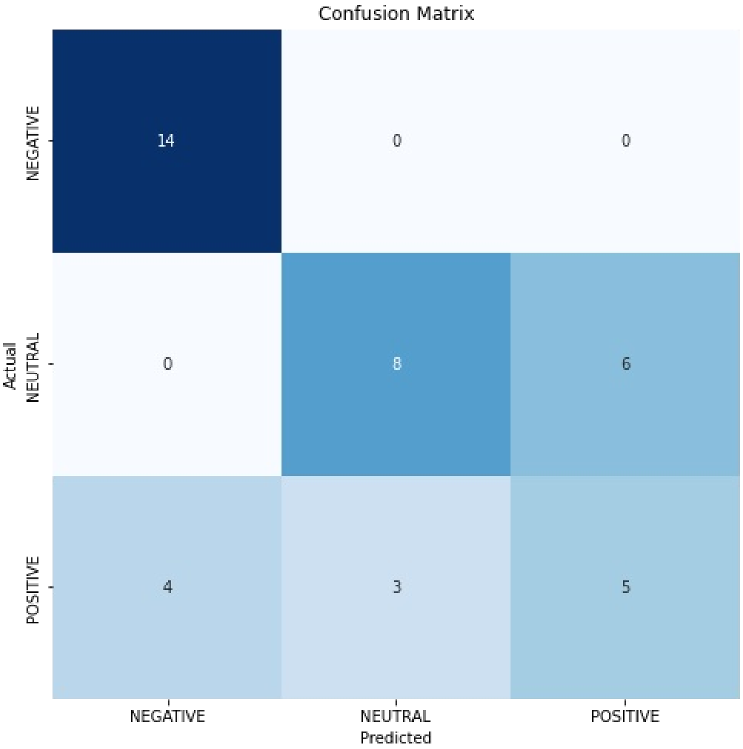
```
Out[33]: Confusion matrix:
         array([[14,  0,  0],
                [ 0,  8,  6],
                [ 4,  3,  5]], dtype=int64)
```

```
In [34]: clr_knn = classification_report(y_test, y_pred_knn, target_names=label_mapping.keys())
```

```
In [35]: plt.figure(figsize=(8, 8))
         sns.heatmap(conf_mat_knn, annot=True, vmin=0, fmt='g', cbar=False, cmap='Blues')

         plt.xticks(np.arange(3) + 0.5, label_mapping.keys())
         plt.yticks(np.arange(3) + 0.5, label_mapping.keys())
         plt.xlabel("Predicted")
         plt.ylabel("Actual")
         plt.title("Confusion Matrix")
         plt.show()

         print("Classification Report:\n----------------------\n", clr_knn)
```



```
Classification Report:
----------------------
               precision    recall  f1-score   support

    NEGATIVE       0.78      1.00      0.88        14
     NEUTRAL       0.73      0.57      0.64        14
    POSITIVE       0.45      0.42      0.43        12

    accuracy                           0.68        40
   macro avg       0.65      0.66      0.65        40
weighted avg       0.66      0.68      0.66        40
```

```
In [36]: for t1,t2,t3,t4,t5,t6,t7 in zip(feature1,feature2,feature3,feature4,feature5,feature6,feature7):

             input_test_data = (t1,t2,t3,t4,t5,t6,t7)
             input_data_array = np.asarray(input_test_data)
             input_data_array_reshape=input_data_array.reshape(1,-1)

             prediction=svm.predict(input_data_array_reshape)

             if prediction==0:
                 emotion_result="neutral"
             elif prediction==1:
                 emotion_result="happy"
             elif prediction==-1:
                 emotion_result="sad"
             print("Test data ",input_test_data,"\nThe emotion is ",emotion_result)
             print()
```

```
Test data  (30.3, 7.8, -4310.0, 44200, 8.37, 4.98, 20600)
The emotion is  sad

Test data  (33.1, 3.55, -45.9, 1160, -2.9, 5.0, 4190)
The emotion is  neutral

Test data  (29.4, 4.12, -1800.0, 74600, 5.77, 5.0, 423000)
The emotion is  sad

Test data  (31.6, 2.99, -848.0, 45800, 5.71, 5.01, 114000)
The emotion is  sad

Test data  (31.3, 6.99, -74.4, 7320, -1.99, 4.99, 9420)
The emotion is  happy

Test data  (30.9, 3.59, -27.4, 1730, -10.7, 5.0, 2660)
The emotion is  neutral

Test data  (21.0, 3.55, 18.4, 2260, 1.68, 5.0, 3030)
The emotion is  happy

Test data  (27.8, 5.22, -674.0, 31100, 5.2, 4.99, 149000)
The emotion is  happy

Test data  (29.7, 4.73, -1.73, 1720, 1.6, 5.0, 4770)
The emotion is  neutral

Test data  (29.2, 3.93, -4120.0, 33900, 8.73, 5.0, 121000)
The emotion is  sad

Test data  (28.4, 4.07, -22.0, 841, -3.98, 5.0, 884)
The emotion is  neutral

Test data  (30.4, 4.02, -1070.0, 18800, 6.01, 5.0, -4080)
The emotion is  happy

Test data  (32.7, 3.07, 8.5, 851, 1.89, 5.01, 6030)
The emotion is  neutral

Test data  (31.7, 6.44, 121.0, 38600, 7.22, 4.99, 50000)
The emotion is  sad

Test data  (31.8, 3.12, -9.32, 891, 3.35, 5.01, 3650)
The emotion is  neutral

Test data  (23.8, 5.13, -1670.0, 45500, 1.98, 4.99, 104000)
The emotion is  sad

Test data  (34.9, 4.6, -120.0, 1760, 3.6, 5.0, 6540)
The emotion is  neutral

Test data  (30.8, 2.71, 23.5, 945, 1.97, 5.01, 5000)
The emotion is  neutral

Test data  (21.9, 4.16, -27000.0, 190000, 9.73, 4.99, 970000)
The emotion is  sad

Test data  (27.6, 7.98, -5460.0, 43000, 9.28, 4.97, 269000)
The emotion is  sad
```

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```

#Decision Tree Classifier

In [37]:

```
from sklearn.tree import DecisionTreeClassifier
from sklearn.metrics import accuracy_score
```

In [38]:

```
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.3, random_state=42)
```

In [39]:

```
clf_dt = DecisionTreeClassifier(random_state=42)
clf_dt.fit(X_train, y_train)
```

Out[39]:

```
DecisionTreeClassifier(random_state=42)
```

In [40]:

```
y_pred_dt = clf_dt.predict(X_test)


accuracy = accuracy_score(y_test, y_pred_dt)
print("Accuracy: {:.2f}%".format(accuracy * 100))
```

```
Accuracy: 80.00%
```

In [41]:

```
conf_mat_dt = confusion_matrix(y_test, y_pred_dt)
print('Confusion matrix:')
conf_mat_dt
```

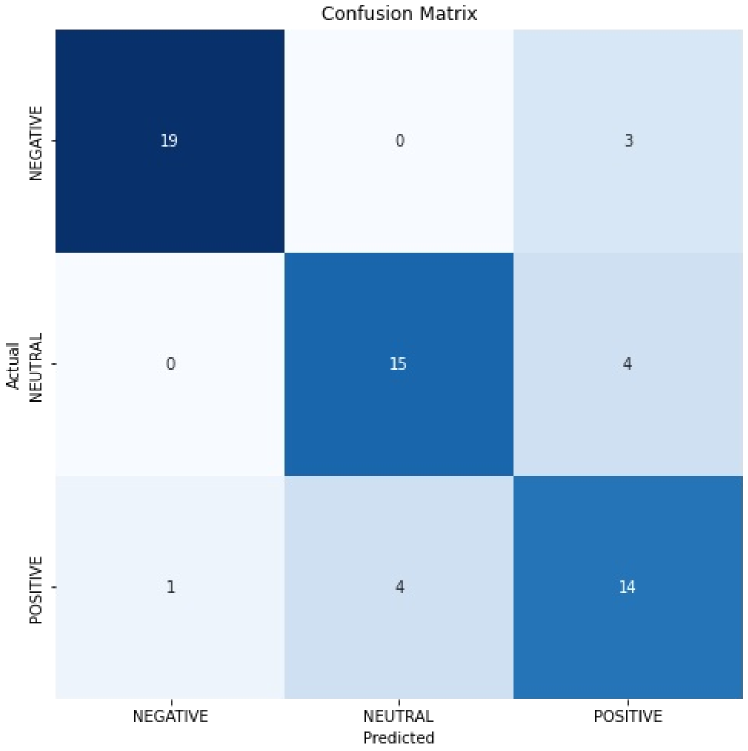
```
Out[41]: Confusion matrix:
         array([[19,  0,  3],
                [ 0, 15,  4],
                [ 1,  4, 14]], dtype=int64)
```

```
In [42]: clr_dt = classification_report(y_test, y_pred_dt, target_names=label_mapping.keys())
```

```
In [43]: plt.figure(figsize=(8, 8))
         sns.heatmap(conf_mat_dt, annot=True, vmin=0, fmt='g', cbar=False, cmap='Blues')

         plt.xticks(np.arange(3) + 0.5, label_mapping.keys())
         plt.yticks(np.arange(3) + 0.5, label_mapping.keys())
         plt.xlabel("Predicted")
         plt.ylabel("Actual")
         plt.title("Confusion Matrix")
         plt.show()

         print("Classification Report:\n----------------------\n", clr_dt)
```



```
Classification Report:
----------------------
               precision    recall  f1-score   support

    NEGATIVE       0.95      0.86      0.90        22
     NEUTRAL       0.79      0.79      0.79        19
    POSITIVE       0.67      0.74      0.70        19

    accuracy                           0.80        60
   macro avg       0.80      0.80      0.80        60
weighted avg       0.81      0.80      0.80        60
```

```
In [44]: for t1,t2,t3,t4,t5,t6,t7 in zip(feature1,feature2,feature3,feature4,feature5,feature6,feature7):

             input_test_data = (t1,t2,t3,t4,t5,t6,t7)
             input_data_array = np.asarray(input_test_data)
             input_data_array_reshape=input_data_array.reshape(1,-1)

             prediction=clf_dt.predict(input_data_array_reshape)

             if prediction==0:
                 emotion_result="neutral"
             elif prediction==1:
                 emotion_result="happy"
             elif prediction==-1:
                 emotion_result="sad"
             print("Test data ",input_test_data,"\nThe emotion is ",emotion_result)
             print()
```

```
Test data  (30.3, 7.8, -4310.0, 44200, 8.37, 4.98, 20600)
The emotion is  sad

Test data  (33.1, 3.55, -45.9, 1160, -2.9, 5.0, 4190)
The emotion is  neutral

Test data  (29.4, 4.12, -1800.0, 74600, 5.77, 5.0, 423000)
The emotion is  happy

Test data  (31.6, 2.99, -848.0, 45800, 5.71, 5.01, 114000)
The emotion is  happy

Test data  (31.3, 6.99, -74.4, 7320, -1.99, 4.99, 9420)
The emotion is  neutral

Test data  (30.9, 3.59, -27.4, 1730, -10.7, 5.0, 2660)
The emotion is  neutral

Test data  (21.0, 3.55, 18.4, 2260, 1.68, 5.0, 3030)
The emotion is  happy

Test data  (27.8, 5.22, -674.0, 31100, 5.2, 4.99, 149000)
The emotion is  sad

Test data  (29.7, 4.73, -1.73, 1720, 1.6, 5.0, 4770)
The emotion is  neutral

Test data  (29.2, 3.93, -4120.0, 33900, 8.73, 5.0, 121000)
The emotion is  sad

Test data  (28.4, 4.07, -22.0, 841, -3.98, 5.0, 884)
The emotion is  happy

Test data  (30.4, 4.02, -1070.0, 18800, 6.01, 5.0, -4080)
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The emotion is  neutral

Test data  (30.8, 2.71, 23.5, 945, 1.97, 5.01, 5000)
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  warnings.warn(
```

Random forest classification

In [45]:

```
from sklearn.ensemble import RandomForestClassifier
```

In [46]:

```
rfc = RandomForestClassifier(n_estimators=100)
```

In [47]:

```
rfc.fit(X_train, y_train)
```

Out[47]:

```
RandomForestClassifier()
```

In [48]:

```
y_pred_rfc = rfc.predict(X_test)
```

In [49]:

```
accuracy = accuracy_score(y_test, y_pred_rfc)
print("Accuracy: {:.2f}%".format(accuracy * 100))
```

```
Accuracy: 81.67%
```

In [50]:

```
conf_mat_rfc = confusion_matrix(y_test, y_pred_rfc)
print('Confusion matrix:')
conf_mat_rfc
```

```
Confusion matrix:
```

```
Out[50]: array([[19,  0,  3],
                [ 0, 17,  2],

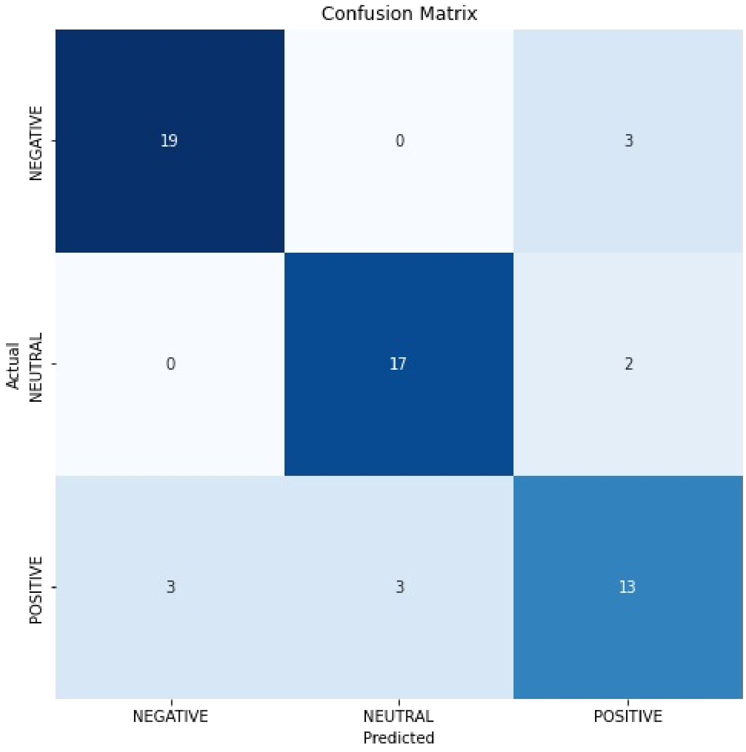
                [ 3,  3, 13]], dtype=int64)
```

```
In [51]: clr_rfc = classification_report(y_test, y_pred_rfc, target_names=label_mapping.keys())
```

```
In [52]: plt.figure(figsize=(8, 8))
         sns.heatmap(conf_mat_rfc, annot=True, vmin=0, fmt='g', cbar=False, cmap='Blues')

         plt.xticks(np.arange(3) + 0.5, label_mapping.keys())
         plt.yticks(np.arange(3) + 0.5, label_mapping.keys())
         plt.xlabel("Predicted")
         plt.ylabel("Actual")
         plt.title("Confusion Matrix")
         plt.show()

         print("Classification Report:\n----------------------\n", clr_rfc)
```



```
Classification Report:
----------------------
               precision    recall  f1-score   support

    NEGATIVE       0.86      0.86      0.86        22
     NEUTRAL       0.85      0.89      0.87        19
    POSITIVE       0.72      0.68      0.70        19

    accuracy                           0.82        60
   macro avg       0.81      0.81      0.81        60
weighted avg       0.81      0.82      0.82        60
```

```
In [53]: for t1,t2,t3,t4,t5,t6,t7 in zip(feature1,feature2,feature3,feature4,feature5,feature6,feature7):

             input_test_data = (t1,t2,t3,t4,t5,t6,t7)
             input_data_array = np.asarray(input_test_data)
             input_data_array_reshape=input_data_array.reshape(1,-1)

             prediction=rfc.predict(input_data_array_reshape)

             if prediction==0:
                 emotion_result="neutral"
             elif prediction==1:
                 emotion_result="happy"
             elif prediction==-1:
                 emotion_result="sad"
             print("Test data ",input_test_data,"\nThe emotion is ",emotion_result)
             print()
```

```
Test data  (30.3, 7.8, -4310.0, 44200, 8.37, 4.98, 20600)
The emotion is  sad

Test data  (33.1, 3.55, -45.9, 1160, -2.9, 5.0, 4190)
The emotion is  neutral

Test data  (29.4, 4.12, -1800.0, 74600, 5.77, 5.0, 423000)
The emotion is  happy

Test data  (31.6, 2.99, -848.0, 45800, 5.71, 5.01, 114000)
The emotion is  happy

Test data  (31.3, 6.99, -74.4, 7320, -1.99, 4.99, 9420)
The emotion is  neutral

Test data  (30.9, 3.59, -27.4, 1730, -10.7, 5.0, 2660)
The emotion is  happy

Test data  (21.0, 3.55, 18.4, 2260, 1.68, 5.0, 3030)
The emotion is  happy

Test data  (27.8, 5.22, -674.0, 31100, 5.2, 4.99, 149000)
The emotion is  sad

Test data  (29.7, 4.73, -1.73, 1720, 1.6, 5.0, 4770)
The emotion is  neutral

Test data  (29.2, 3.93, -4120.0, 33900, 8.73, 5.0, 121000)
The emotion is  happy

Test data  (28.4, 4.07, -22.0, 841, -3.98, 5.0, 884)
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The emotion is  neutral

Test data  (31.7, 6.44, 121.0, 38600, 7.22, 4.99, 50000)
The emotion is  sad

Test data  (31.8, 3.12, -9.32, 891, 3.35, 5.01, 3650)
The emotion is  neutral

Test data  (23.8, 5.13, -1670.0, 45500, 1.98, 4.99, 104000)
The emotion is  sad

Test data  (34.9, 4.6, -120.0, 1760, 3.6, 5.0, 6540)
The emotion is  neutral

Test data  (30.8, 2.71, 23.5, 945, 1.97, 5.01, 5000)
The emotion is  neutral

Test data  (21.9, 4.16, -27000.0, 190000, 9.73, 4.99, 970000)
The emotion is  sad

Test data  (27.6, 7.98, -5460.0, 43000, 9.28, 4.97, 269000)
The emotion is  sad
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