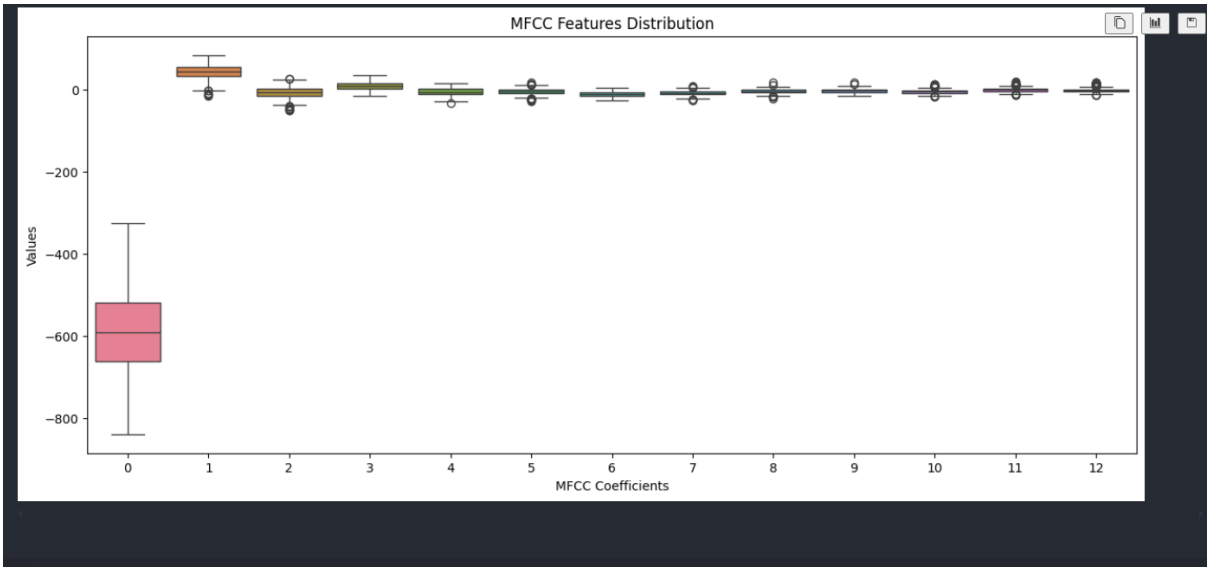
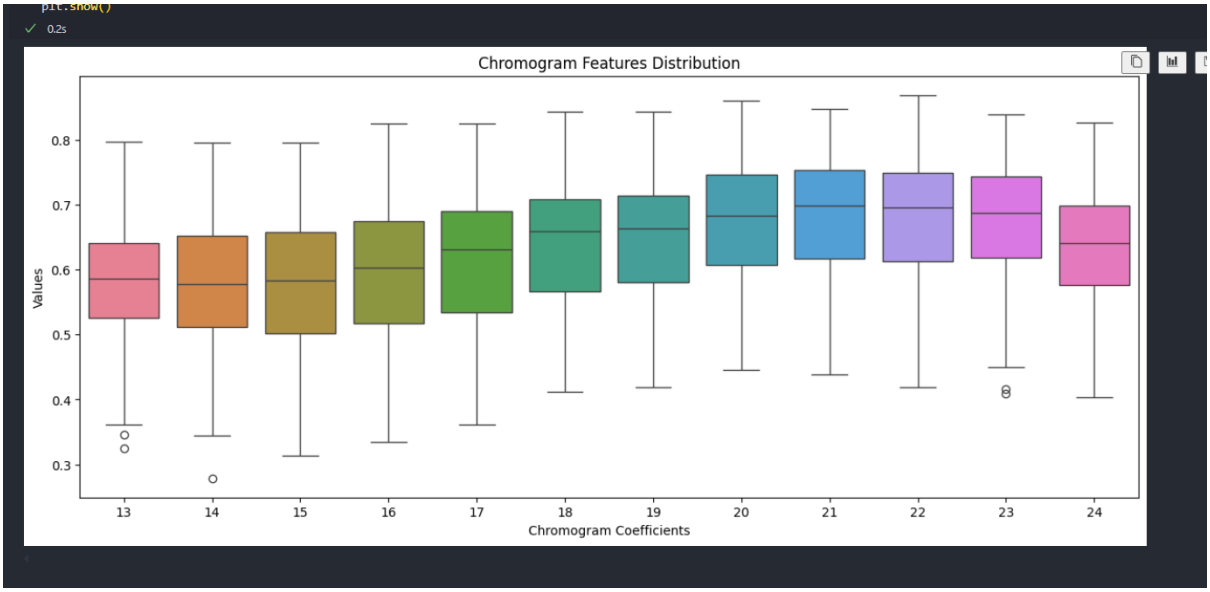
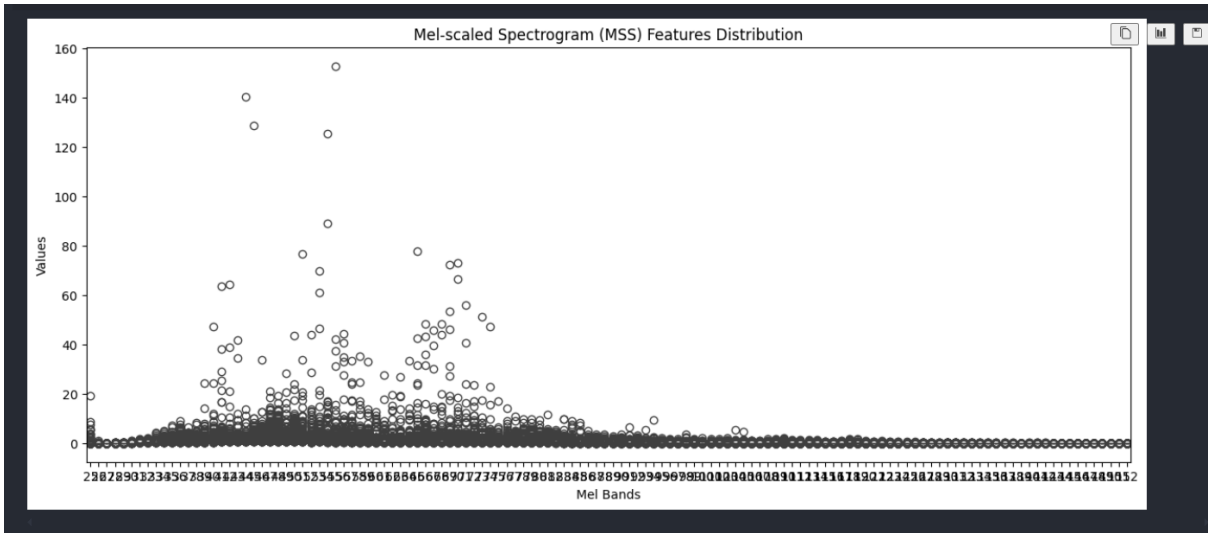
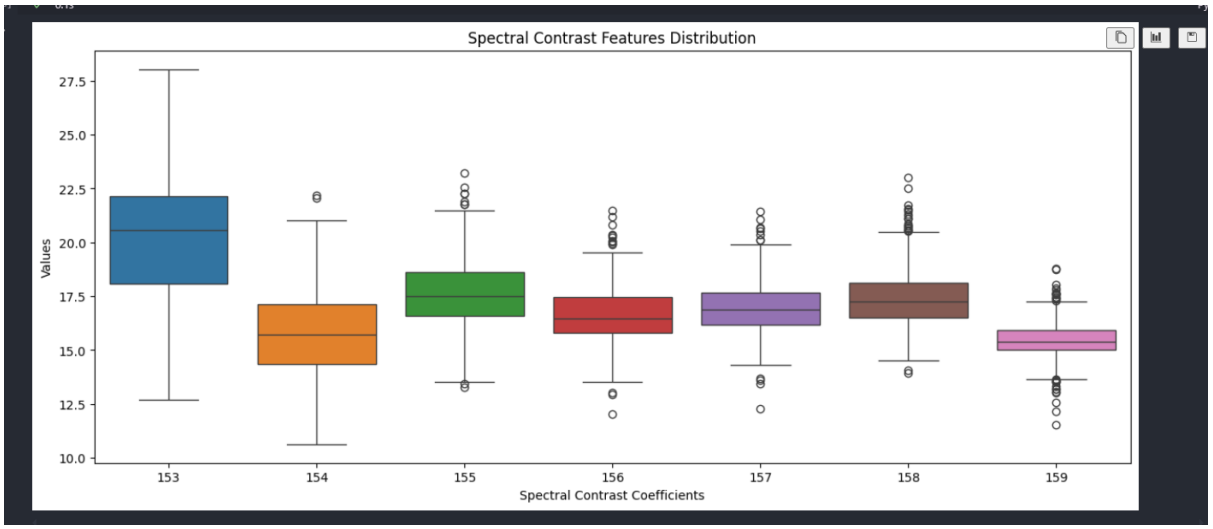
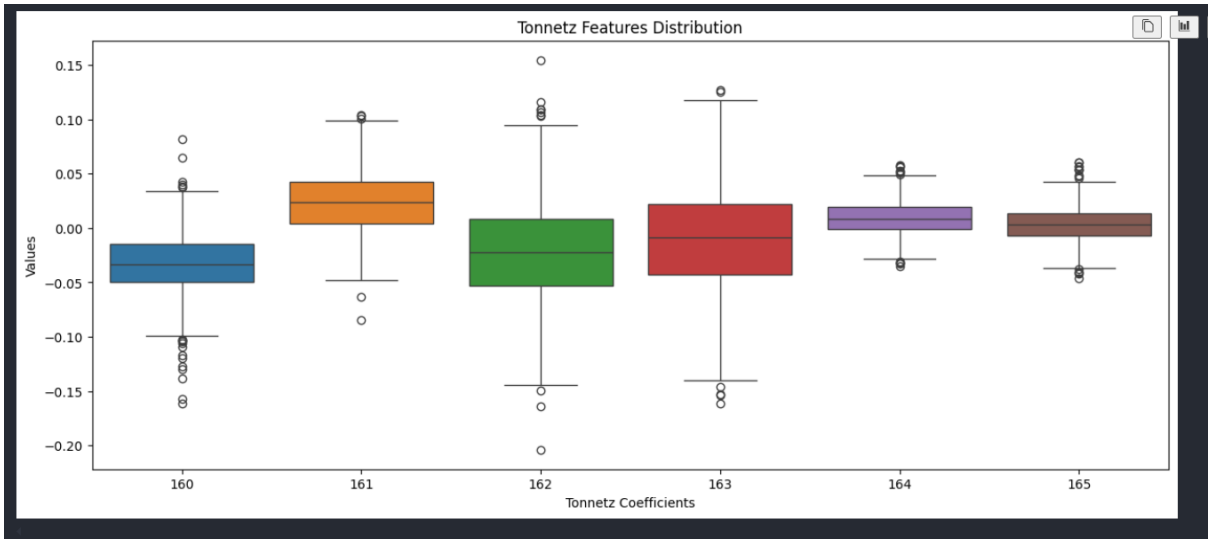
```
Shape of X_train: (614, 166)
Shape of X_test: (154, 166)
Shape of y_train: (614,)
Shape of y_test: (154,)
```






Mel-scaled Spectrogram (MSS) Features Distribution
Values
Mel Bands


Spectral Contrast Features Distribution
Values
153
154
155
156
157
158
159
Spectral Contrast Coefficients


Tonnetz Features Distribution
Values
160
161
162
163
164
165
Tonnetz Coefficients

```
Shape of X_scaled: (768, 166)
Shape of y_encoded: (768,)
```

```
Test Accuracy: 0.5194805194805194
Detailed Classification Report:
              precision    recall  f1-score   support

           1       0.62      0.79      0.70        19
           2       0.64      0.84      0.73        19
           3       0.20      0.11      0.14        19
           4       0.57      0.40      0.47        20
           5       0.67      0.53      0.59        19
           6       0.45      0.53      0.49        19
           7       0.45      0.45      0.45        20
           8       0.42      0.53      0.47        19

    accuracy                           0.52       154
   macro avg       0.50      0.52      0.50       154
weighted avg       0.50      0.52      0.50       154
```

```
Fitting 5 folds for each of 30 candidates, totalling 150 fits
Optimal parameters found:  {'activation': 'relu', 'hidden_layer_sizes': (512,), 'learning_rate_init': 0.003242918568673425, 'max_iter': 900, 'solver': 'adam'}
Best cross-validated score:  0.5013496307613955
```

```
C:\Users\Janvii RV\AppData\Roaming\Python\Python312\site-packages\sklearn\neural_network\_multilayer_perceptron.py:690: ConvergenceW
  warnings.warn(
Accuracy of Simple Model:  0.5
Accuracy of Improved Model:  0.5194805194805194
```

```
Performance Metrics for Basic Model:
Weighted Precision:  0.5092336191649692
Weighted Recall:  0.5
Weighted F1 Score:  0.497226425535249
Confusion Matrix:
 [[12  0  2  2  1  2  0  0]
 [ 4 13  0  1  0  1  0  0]
 [ 2  0  6  1  1  2  2  5]
 [ 2  4  0  7  0  6  0  1]
 [ 1  0  3  1  9  1  1  3]
 [ 1  1  2  1  0 10  3  1]
 [ 1  0  2  3  1  2  8  3]
 [ 0  1  0  3  1  1  1 12]]
Detailed Classification Report:
              precision    recall  f1-score   support

           0       0.52      0.63      0.57        19
           1       0.68      0.68      0.68        19
           2       0.40      0.32      0.35        19
           3       0.37      0.35      0.36        20
           4       0.69      0.47      0.56        19
           5       0.40      0.53      0.45        19
           6       0.53      0.40      0.46        20
           7       0.48      0.63      0.55        19
...
    accuracy                           0.52       154
   macro avg       0.54      0.52      0.52       154
weighted avg       0.54      0.52      0.52       154

Output is truncated. View as a scrollable element or open in a text editor. Adjust cell output settings...
```

```
Fitting 5 folds for each of 50 candidates, totalling 250 fits
Optimal Parameters:  {'activation': 'relu', 'hidden_layer_sizes': (256, 128), 'learning_rate_init': 0.003578215833585241, 'max_iter': 300, 'solver': 'adam'}
Best Cross-Validation Score:  0.48317630082335966
```

```
Cross-Validation Results:  [0.51948052 0.45454545 0.47402597 0.49673203 0.54901961]
Average Accuracy:  0.4987607164077753
Accuracy Standard Deviation:  0.03324508641625003
```

```
Support Vector Machine Model
Accuracy: 0.4091
Classification Report:
              precision    recall  f1-score   support

           1       0.38      0.53      0.44        19
           2       0.47      0.42      0.44        19
           3       0.33      0.37      0.35        19
           4       0.32      0.40      0.36        20
           5       0.50      0.42      0.46        19
           6       0.39      0.37      0.38        19
           7       0.45      0.25      0.32        20
           8       0.50      0.53      0.51        19

    accuracy                           0.41       154
   macro avg       0.42      0.41      0.41       154
weighted avg       0.42      0.41      0.41       154


K-Nearest Neighbors Model
Accuracy: 0.3571
Classification Report:
              precision    recall  f1-score   support

           1       0.33      0.95      0.49        19
...
    accuracy                           0.52       154
   macro avg       0.54      0.52      0.52       154
weighted avg       0.54      0.52      0.52       154
```

Output is truncated. View as a scrollable element or open in a text editor. Adjust cell output settings...