

UE22CS35A: Machine Learning

Orange Level Problem Statement

Submitted by:

Siri N Shetty

PES2UG22CS556

Section J

Fine Tuned Model Parameters

```
# Fine-tune hyperparameters
param_dist = {
    'hidden_layer_sizes': [(50,50,50), (50,100,50), (100,)],
    'activation': ['tanh', 'relu'],
    'solver': ['sgd', 'adam'],
    'alpha': [0.0001, 0.05],
    'learning_rate': ['constant', 'adaptive'],
}
```

```
Best parameters: {'solver': 'adam', 'learning_rate': 'constant', 'hidden_layer_sizes': (100,), 'alpha': 0.05, 'activation': 'relu'}
```

Analytics of Metrics in different Models:

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

     0       0.80      0.90      0.85        31
     1       0.88      0.80      0.83        44
     2       0.68      0.76      0.71        33
     3       0.81      0.64      0.72        45
     4       0.88      0.97      0.92        31
     5       0.85      0.96      0.90        52
     6       0.72      0.57      0.64        37
     7       0.76      0.83      0.79        35

 accuracy          0.80
 macro avg          0.80
 weighted avg       0.80
```

```
Confusion Matrix:
[[28  1  1  0  0  0  0  1]
 [ 0 35  1  2  1  2  3  0]
 [ 2  0 25  1  0  1  0  4]
 [ 4  0  4 29  0  0  5  3]
 [ 0  0  1  0 30  0  0  0]
 [ 0  2  0  0  0 50  0  0]
 [ 0  1  3  3  3  5 21  1]
 [ 1  1  2  1  0  1  0 29]]
```

Performing K-Fold Cross-Validation...

Cross-validation scores: [0.78455285 0.77642276 0.74390244 0.79591837 0.79183673]

Mean CV score: 0.7785266301642608

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```
Training SVM...
Training KNN...

SVM Performance:
              precision    recall  f1-score   support

     0       0.72      0.58      0.64        31
     1       0.56      0.75      0.64        44
     2       0.45      0.55      0.49        33
     3       0.79      0.60      0.68        45
     4       0.74      0.74      0.74        31
     5       0.60      0.65      0.62        52
     6       0.54      0.35      0.43        37
     7       0.63      0.69      0.66        35

 accuracy          0.62
 macro avg          0.63
 weighted avg       0.63
```

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KNN Performance:				
	precision	recall	f1-score	support
0	0.54	0.65	0.59	31
1	0.78	0.64	0.70	44
2	0.49	0.67	0.56	33
3	0.68	0.38	0.49	45
4	0.63	0.61	0.62	31
5	0.60	0.88	0.71	52
6	0.74	0.46	0.57	37
7	0.66	0.66	0.66	35
accuracy			0.62	308
macro avg	0.64	0.62	0.61	308
weighted avg	0.65	0.62	0.62	308

K-Fold Variations

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```
print(confusion_matrix(y_test_encoded, y_pred))

# K-Fold Cross-Validation
print("\nPerforming K-Fold Cross-Validation...")
cv_scores = cross_val_score(best_mlp, X_train_scaled, y_train_encoded, cv=5, n_jobs=-1)
print(f"Cross-validation scores: {cv_scores}")
print(f"Mean CV score: {np.mean(cv_scores)}")

# Comparative study with SVM and KNN
print("\nTraining SVM...")
svm = SVC()
svm.fit(X_train_scaled, y_train_encoded)

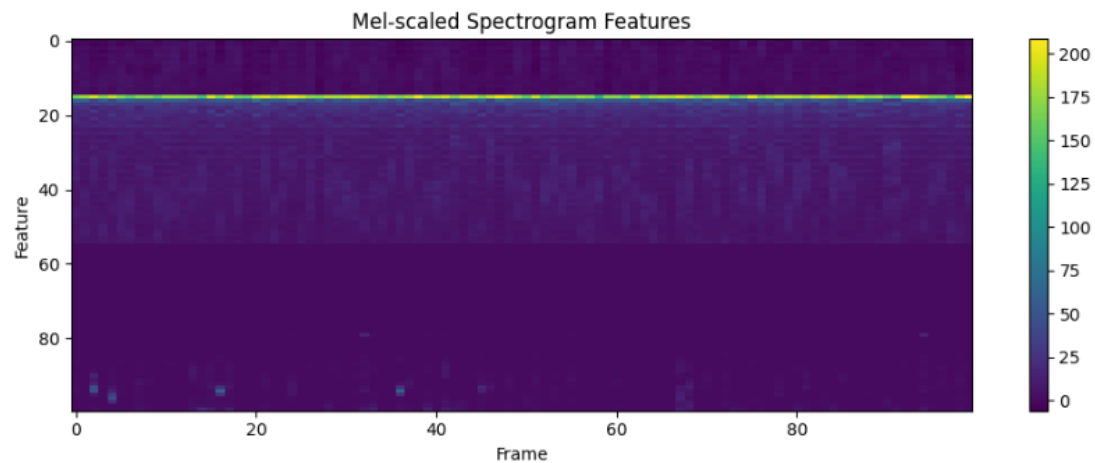
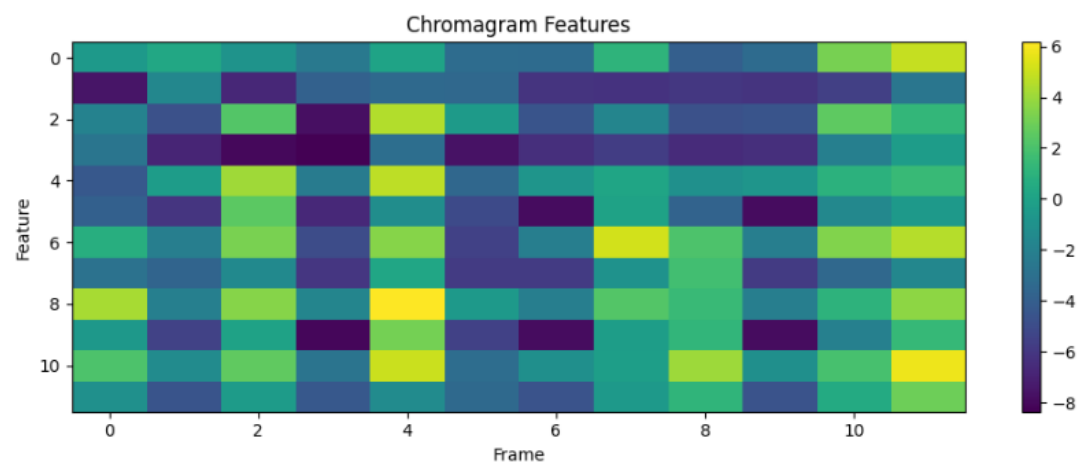
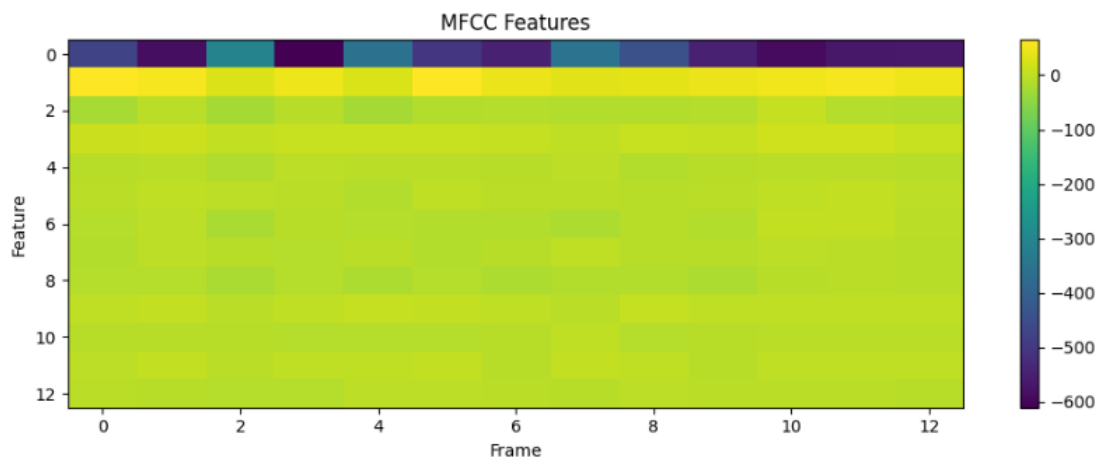
print("Training KNN...")
knn = KNeighborsClassifier()
knn.fit(X_train_scaled, y_train_encoded)

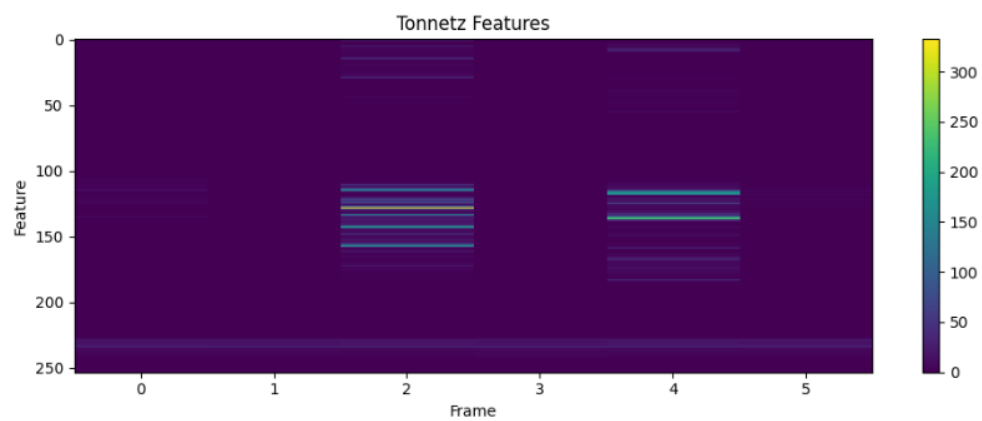
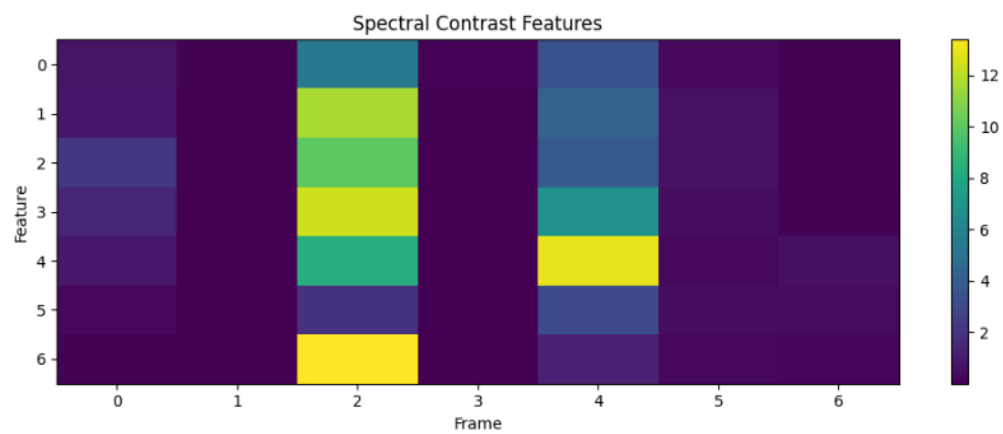
svm_pred = svm.predict(X_test_scaled)
knn_pred = knn.predict(X_test_scaled)

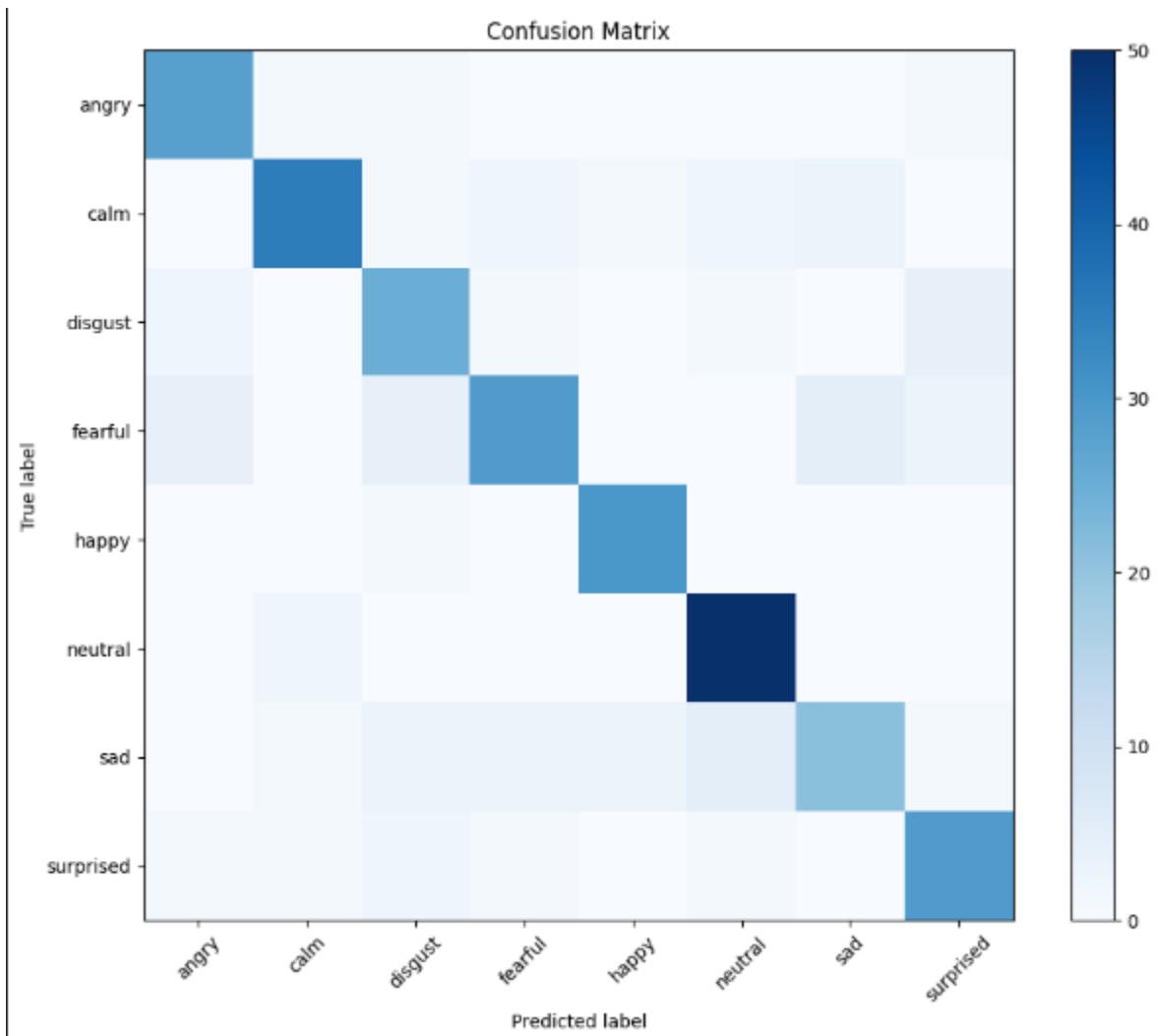
print("\nSVM Performance:")
print(classification_report(y_test_encoded, svm_pred))

print("\nKNN Performance:")
print(classification_report(y_test_encoded, knn_pred))
```

Comparative Study







Model Comparison

