Model Optimization and Tuning Phase Template

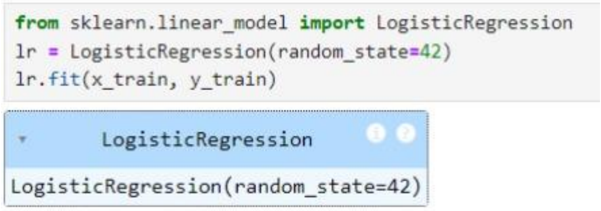
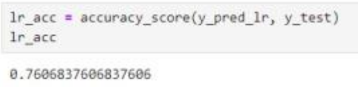
Date	09 July 2024
Team ID	SWTID1720023141
Project Title	Prediction and Analysis of Liver Patient Data Using Machine Learning
Maximum Marks	10 Marks

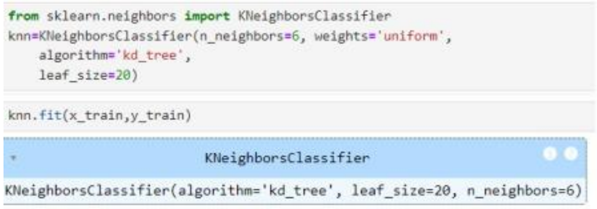
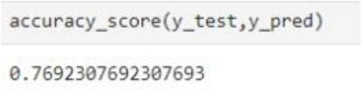
Model Optimization and Tuning Phase

The Model Optimization and Tuning Phase involves refining machine learning models for peak performance. It includes optimized model code, fine-tuning hyper parameters, comparing performance metrics, and justifying the final model selection for enhanced predictive accuracy and efficiency.

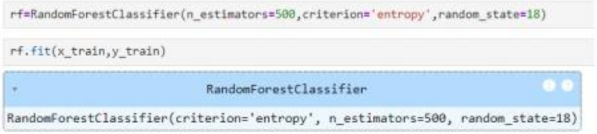
Hyperparameter Tuning Documentation (6 Marks):

Model	Tuned Hyperparameters	Optimal Values

Logistic
Regression
	
	`from sklearn.linear_model import LogisticRegression`
	`lr = LogisticRegression(random_state=42)`
	`lr.fit(x_train, y_train)`
	`LogisticRegression`
	`LogisticRegression(random_state=42)`
		
		`lr_acc = accuracy_score(y_pred_lr, y_test)`
		`lr_acc`
		`0.7606837606837606`

K neighbors
Classifier
	
	`from sklearn.neighbors import KNeighborsClassifier`
	`knn=KNeighborsClassifier(n_neighbors=6, weights='uniform',`
	`    algorithm='kd_tree',`
	`    leaf_size=20)`
	`knn.fit(x_train,y_train)`
	`KNeighborsClassifier`
	`KNeighborsClassifier(algorithm='kd_tree', leaf_size=20, n_neighbors=6)`
		
		`accuracy_score(y_test,y_pred)`
		`0.7692307692307693`

<table>
<tr>
<td>RandomForest
Classifier</td>
<td>

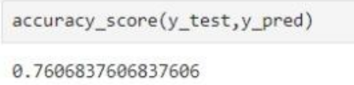


```
rf=RandomForestClassifier(n_estimators=500,criterion='entropy',random_state=18)
```

```
rf.fit(x_train,y_train)
```

```
RandomForestClassifier
RandomForestClassifier(criterion='entropy', n_estimators=500, random_state=18)
```

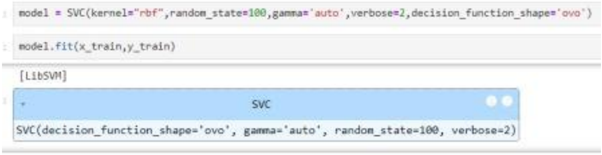
</td>
<td>



```
accuracy_score(y_test,y_pred)
```

```
0.7606837606837606
```

</td>
</tr>
<tr>
<td>SVC</td>
<td>

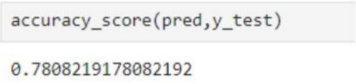


```
model = SVC(kernel="rbf",random_state=100,gamma='auto',verbose=2,decision_function_shape='ovo')
```

```
model.fit(x_train,y_train)
```

```
[LibSVM]
SVC
SVC(decision_function_shape='ovo', gamma='auto', random_state=100, verbose=2)
```

</td>
<td>



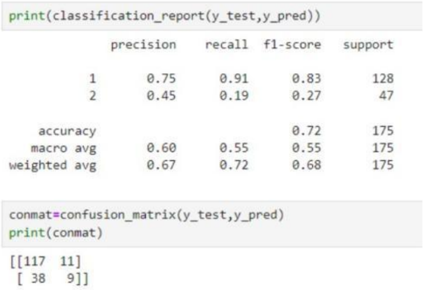
```
accuracy_score(pred,y_test)
```

```
0.7808219178082192
```

</td>
</tr>
</table>

Performance Metrics Comparison Report (2 Marks):

<table>
<tr>
<th>Model</th>
<th>Baseline Metric</th>
<th>Optimized Metric</th>
</tr>
<tr>
<td>Logistic
Regression</td>
<td>



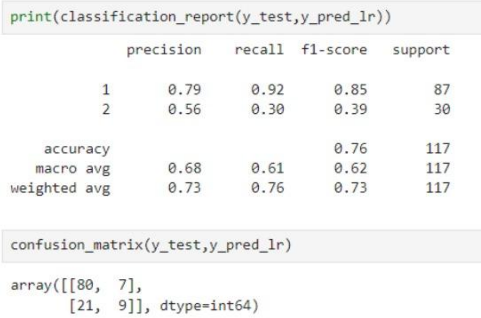
```
print(classification_report(y_test,y_pred))
```

```
              precision    recall  f1-score   support

           1       0.75      0.91      0.83       128
           2       0.45      0.19      0.27        47

    accuracy                           0.72       175
   macro avg       0.60      0.55      0.55       175
weighted avg       0.67      0.72      0.68       175
```

```
conmat=confusion_matrix(y_test,y_pred)
print(conmat)
```

```
[[117  11]
 [ 38   9]]
```

</td>
<td>



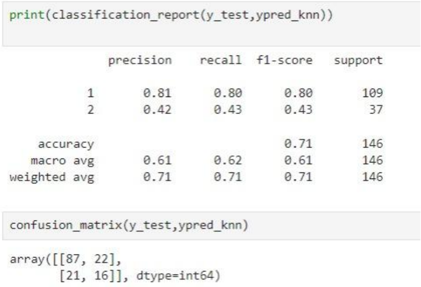
```
print(classification_report(y_test,y_pred_lr))
```

```
              precision    recall  f1-score   support

           1       0.79      0.92      0.85        87
           2       0.56      0.30      0.39        30

    accuracy                           0.76       117
   macro avg       0.68      0.61      0.62       117
weighted avg       0.73      0.76      0.73       117
```

```
confusion_matrix(y_test,y_pred_lr)
```

```
array([[80,  7],
       [21,  9]], dtype=int64)
```

</td>
</tr>
<tr>
<td>K neighbors
Classifier</td>
<td>



```
print(classification_report(y_test,ypred_knn))
```

```
              precision    recall  f1-score   support

           1       0.81      0.80      0.80       109
           2       0.42      0.43      0.43        37

    accuracy                           0.71       146
   macro avg       0.61      0.62      0.61       146
weighted avg       0.71      0.71      0.71       146
```

```
confusion_matrix(y_test,ypred_knn)
```

```
array([[87, 22],
       [21, 16]], dtype=int64)
```

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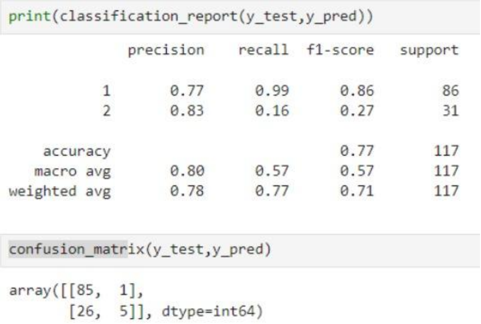


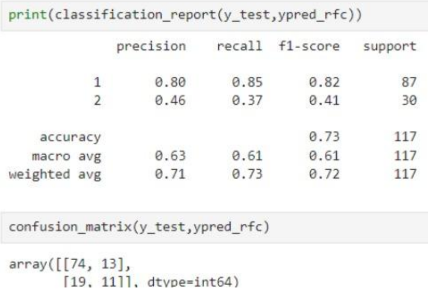
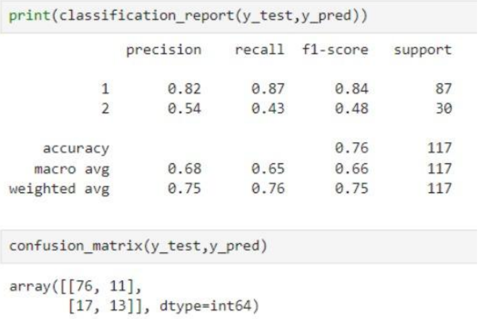
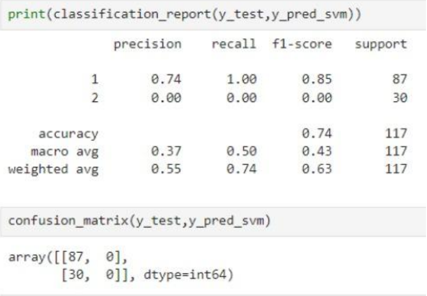
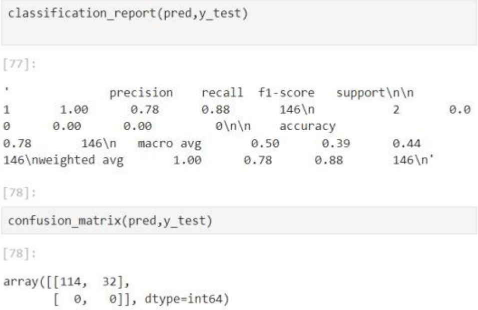
```
print(classification_report(y_test,y_pred))
```

```
              precision    recall  f1-score   support

           1       0.77      0.99      0.86        86
           2       0.83      0.16      0.27        31

    accuracy                           0.77       117
   macro avg       0.80      0.57      0.57       117
weighted avg       0.78      0.77      0.71       117
```

```
confusion_matrix(y_test,y_pred)
```

```
array([[85,  1],
       [26,  5]], dtype=int64)
```

</td>
</tr>
</table>

RandomForest Classifier	 print(classification_report(y_test,ypred_rfc)) precision recall f1-score support 1 0.80 0.85 0.82 87 2 0.46 0.37 0.41 30 accuracy 0.73 117 macro avg 0.63 0.61 0.61 117 weighted avg 0.71 0.73 0.72 117 confusion_matrix(y_test,ypred_rfc) array([[74, 13], [19, 11]], dtype=int64)	 print(classification_report(y_test,y_pred)) precision recall f1-score support 1 0.82 0.87 0.84 87 2 0.54 0.43 0.48 30 accuracy 0.76 117 macro avg 0.68 0.65 0.66 117 weighted avg 0.75 0.76 0.75 117 confusion_matrix(y_test,y_pred) array([[76, 11], [17, 13]], dtype=int64)
SVC	 print(classification_report(y_test,y_pred_svm)) precision recall f1-score support 1 0.74 1.00 0.85 87 2 0.00 0.00 0.00 30 accuracy 0.74 117 macro avg 0.37 0.50 0.43 117 weighted avg 0.55 0.74 0.63 117 confusion_matrix(y_test,y_pred_svm) array([[87, 0], [30, 0]], dtype=int64)	 classification_report(pred,y_test) [77]: ' precision recall f1-score support\n\n 1 1.00 0.78 0.88 146\n 2 0.0 0 0.00 0.00 0\n\n accuracy 0.78 146\n macro avg 0.50 0.39 0.44 146\nweighted avg 1.00 0.78 0.88 146\n' [78]: confusion_matrix(pred,y_test) [78]: array([[114, 32], [0, 0]], dtype=int64)

Final Model Selection Justification (2 Marks):

Final Model	Reasoning
SVC	Support Vector Classifier (SVC) is selected for its effectiveness in high-dimensional spaces and robustness to overfitting. It handles both linear and non-linear classification problems by employing kernel functions, making it a versatile and powerful tool suitable for a wide range of applications.