Model Optimization and Tuning Phase Template

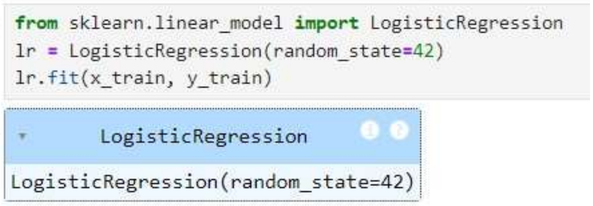
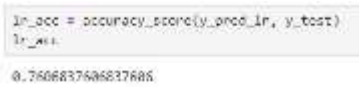
Date	13 july 2024
Team ID	739952
Project Title	Prediction and Analysis of Liver Patient Data Using Machine Learning
Maximum Marks	10 Marks

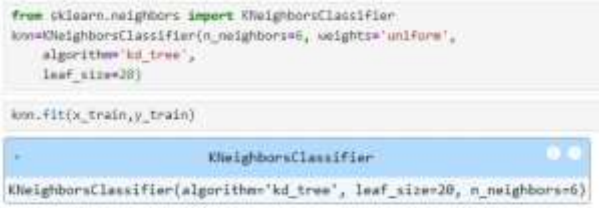
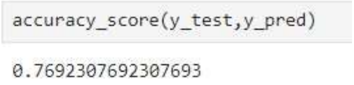
Model Optimization and Tuning Phase

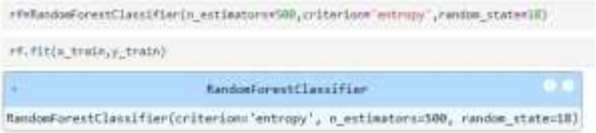
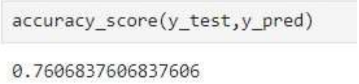
The Model Optimization and Tuning Phase involves refining machine learning models for peak performance. It includes optimized model code, fine-tuning hyperparameters, comparing performance metrics, and justifying the final model selection for enhanced predictive accuracy and efficiency.

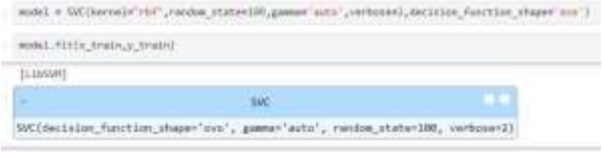
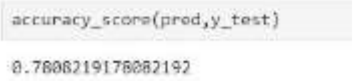
Hyperparameter Tuning Documentation (6 Marks):

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`

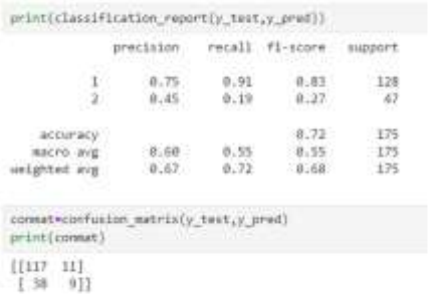
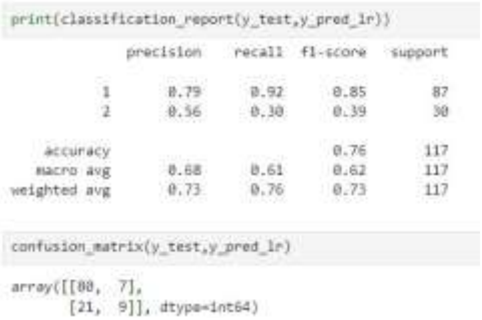
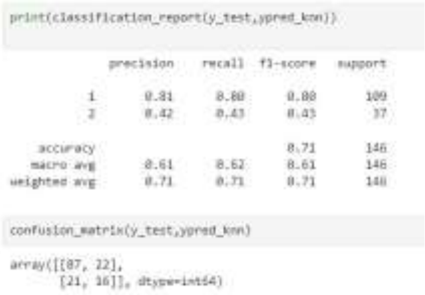
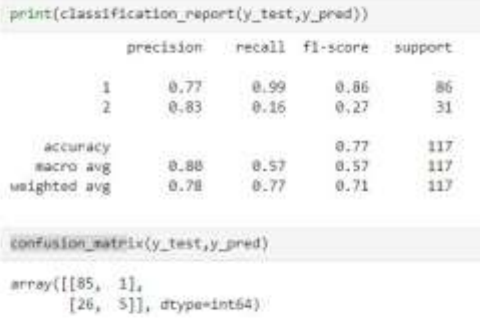
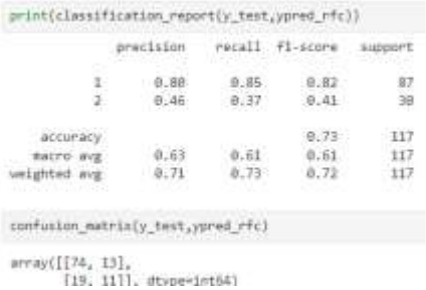
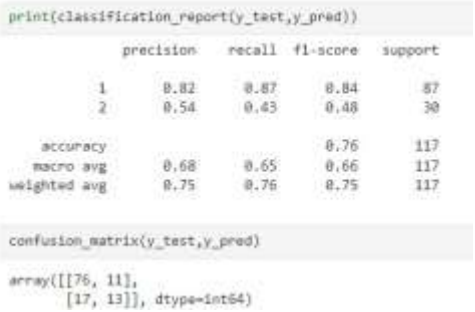
K neighbors
Classifier
	 `from sklearn.neighbors import KNeighborsClassifier`
	`knn=KNeighborsClassifier(n_neighbors=6, weights='uniform',`
	`    algorithm='kd_tree',`
	`    leaf_size=20)`
	`knn.fit(x_train,y_train)`
	`KNeighborsClassifier`
	`KNeighborsClassifier(algorithm='kd_tree', leaf_size=20, n_neighbors=6)`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

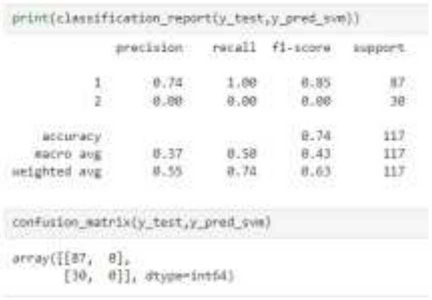
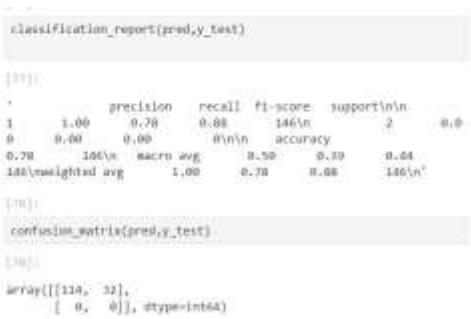
RandomForest
Classifier
	 `rf=RandomForestClassifier(n_estimators=500,criterion='entropy',random_state=18)`
	`rf.fit(x_train,y_train)`
	`RandomForestClassifier`
	`RandomForestClassifier(criterion='entropy', n_estimators=500, random_state=18)`
		 `accuracy_score(y_test,y_pred)`
		`0.7606837606837606`

SVC	 `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)`
		 `accuracy_score(pred,y_test)`
		`0.7808219178082192`

Performance Metrics Comparison Report (2 Marks):

Model	Baseline Metric	Optimized Metric

Logistic Regression	 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]]	 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)
K neighbors Classifier	 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)	 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)
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	SVC is selected as for its Effective in High-Dimensional Spaces, Robust to Overfitting handle both linear and non-linear classification problems by employing kernel functions, making it a versatile and powerful tool for a wide range of applications