Model Optimization and Tuning Phase Report

Date	15 July 2024
Team ID	739884
Project Title SmartLender -	Automotive Kickstart
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	—	`pred=lr.predict(x_test)`
		`pred`
		
		`array([1, 1, 1, ..., 3, 1, 1])`
		
		`lg_ac=accuracy_score(y_test,pred)`
		`lg_f1 = f1_score(y_test, pred, average='weighted')  # Options: 'micro', 'macro', 'weighted'`
		`lg_r2=r2_score(y_test,pred)`
		`print(lg_ac)`
		`print(lg_f1)`
		`print(lg_r2)`
		
		`0.8042576462898987`
		`0.7560252728477291`
		`0.5704852951733073`

RandomForest	—	`kpred=knn.predict(x_test)`
		`kpred`
		
		`array([1, 3, 1, ..., 3, 3, 1])`
		
		`knn_ac=accuracy_score(y_test,kpred)`
		`knn_f1 = f1_score(y_test, kpred, average='weighted')  # Options: 'micro', 'macro', 'weighted'`
		`knn_r2=r2_score(y_test,kpred)`
		`print(knn_ac)`
		`print(knn_f1)`
		`print(knn_r2)`
		
		`0.827373250990383`
		`0.7963496160215812`
		`0.6793182337664017`

KNN	—	`rpred=rf.predict(x_test)`
		`rpred`
		
		`array([1, 1, 1, ..., 3, 3, 1])`
		
		`rf_ac=accuracy_score(y_test,rpred)`
		`rf_f1 = f1_score(y_test, rpred, average='weighted')  # Options: 'micro', 'macro', 'weighted'`
		`rf_r2=r2_score(y_test,rpred)`
		`print(rf_ac)`
		`print(rf_f1)`
		`print(rf_r2)`
		
		`0.8595590294914034`
		`0.8253275461008338`
		`0.7824806763876369`

SVM	—	`spred=rf.predict(x_test)`
		`spred`
		
		`array([1, 1, 1, ..., 3, 3, 1])`
		
		`svm_ac=accuracy_score(y_test,spred)`
		`svm_f1 = f1_score(y_test, spred, average='weighted')  # Options: 'micro', 'macro', 'weighted'`
		`svm_r2=r2_score(y_test,rpred)`
		`print(svm_ac)`
		`print(svm_f1)`
		`print(svm_r2)`
		
		`0.8595590294914034`
		`0.8253275461008338`
		`0.7824806763876369`

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Performance Metrics Comparison Report (2 Marks):

Model	Optimised Metric

Logistic regression	`print('\n\n\n', classification_report(y_test,pred))`
	
	`              precision    recall  f1-score   support`
	
	`           0       0.00      0.00      0.00      7766`
	`           1       0.75      0.95      0.84     39471`
	`           2       1.00      0.01      0.02       552`
	`           3       0.91      0.84      0.87     26831`
	`           4       0.00      0.00      0.00       351`
	
	`    accuracy                           0.80     74971`
	`   macro avg       0.53      0.36      0.35     74971`
	`weighted avg       0.73      0.80      0.76     74971`

Random Forest	`print('\n\n\n', classification_report(y_test,kpred))` precision recall f1-score support 0 0.22 0.07 0.11 7766 1 0.81 0.91 0.86 39471 2 0.12 0.01 0.01 552 3 0.92 0.95 0.93 26831 4 0.00 0.00 0.00 351 accuracy 0.83 74971 macro avg 0.41 0.39 0.38 74971 weighted avg 0.78 0.83 0.80 74971
KNN	`print('\n\n\n', classification_report(y_test,rpred))` precision recall f1-score support 0 0.28 0.07 0.12 7766 1 0.83 0.94 0.88 39471 2 0.26 0.03 0.06 552 3 0.95 0.99 0.97 26831 4 0.10 0.01 0.03 351 accuracy 0.86 74971 macro avg 0.49 0.41 0.41 74971 weighted avg 0.81 0.86 0.83 74971
SVM	`print('\n\n\n', classification_report(y_test,spred))` ggle output scrolling precision recall f1-score support 0 0.28 0.07 0.12 7766 1 0.83 0.94 0.88 39471 2 0.26 0.03 0.06 552 3 0.95 0.99 0.97 26831 4 0.10 0.01 0.03 351 accuracy 0.86 74971 macro avg 0.49 0.41 0.41 74971 weighted avg 0.81 0.86 0.83 74971

Final Model Selection Justification (2 Marks):

Final Model	Reasoning
RandomForest	The RandomForest model was selected for its superior performance, exhibiting high accuracy during the predict and texting.Its ability to handle complex relationships, minimize overfitting, and optimize predictive accuracy aligns with project objectives, justifying its selection as the final model.