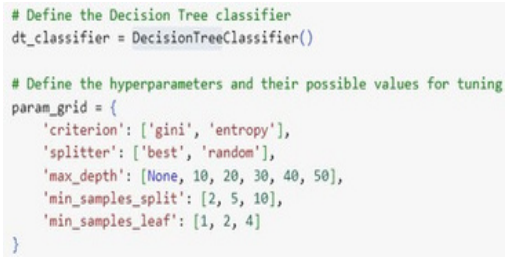
Model Optimization and Tuning Phase Report

Date	27 January 2025
Team ID	SWUID20240011509
Project Title	Restaurant Recommendation System
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	TunedHyperparameters	Optimal Values
Decision Tree		
Random Forest		

KNN	`knn_classifier = KNeighborsClassifier()`
	
	`# Define the hyperparameters and their possible values for tuning`
	`param_grid = {`
	`'n_neighbors': [3, 5, 7, 9],`
	`'weights': ['uniform', 'distance'],`
	`'p': [1, 2]`
	`}`
		`# Evaluate the performance of the tuned model`
		`accuracy = accuracy_score(y_test, y_pred)`
		`print(f'Optimal Hyperparameters: {best_params}')`
		`print(f'Accuracy on Test Set: {accuracy}')`
		
		`Optimal Hyperparameters: {'n_neighbors': 9, 'p': 1, 'weights': 'distance'}`
		`Accuracy on Test Set: 0.7218934911242604`

Gradient Boosting	`# Define the Gradient Boosting classifier`
	`gb_classifier = GradientBoostingClassifier()`
	
	`# Define the hyperparameters and their possible values for tuning`
	`param_grid = {`
	`'n_estimators': [50, 100, 200],`
	`'learning_rate': [0.01, 0.1, 0.2],`
	`'max_depth': [3, 4, 5],`
	`'min_samples_split': [2, 5, 10],`
	`'min_samples_leaf': [1, 2, 4],`
	`'subsample': [0.8, 1.0]`
	`}`
		`# Evaluate the performance of the tuned model`
		`accuracy = accuracy_score(y_test, y_pred)`
		`print(f'Optimal Hyperparameters: {best_params}')`
		`print(f'Accuracy on Test Set: {accuracy}')`
		
		`Optimal Hyperparameters: {'learning_rate': 0.1, 'max_depth': 5, 'min_samples_leaf': 2, 'min_samples_split': 5, 'n_estimators': 100, 'subsample': 0.8}`
		`Accuracy on Test Set: 0.7928994082840237`

Final Model Selection Justification (2 Marks):

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