Model Optimization and Tuning Phase Report

Date	24 July 2025
ProjectName	Machine Learning Approach for Employee Performance Prediction
Maximum 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.

Model	Tuned Hyperparameter	Optimal Values

Linear Regression	-	`r2 = r2_score(Y_test, Y_pred)`
		`r2 #Evaluation of the optimal value (0.290`
		`0.29075725756610216`

Random Forest	`2. Random Forest Model`
	`from sklearn.ensemble import RandomForestRegressor`
	`Rf = RandomForestRegressor(n_estimators=100, random_state=42)`
	`Rf_model = Rf.fit(X_train, Y_train)`
	`Y_pred = Rf_model.predict(X_test)`
	`Y_pred`
		`r2 = r2_score(Y_test, Y_pred)`
		`r2 #Evaluation of optimal values (0.470)`
		`0.4707626410260015`

XGBoost	`#Define hyperparameters`
	`param_grid = {`
	`objective='reg:squarederror',`
	`n_estimators=250,`
	`max_depth=3,`
	`learning_rate=0.1,`
	`random_state=40`
	`}`
		`r2 = r2_score(Y_test, Y_pred)`
		`r2 #Evaluation of optimal values (0.521)`
		`0.5217457607580249`

Performance Metrics Comparison Report (2 Marks):

Model	Optimized Metric
Linear Regression	MAE : 0.105 MSE : 0.020 R2 Score : 0.290
Random Forest	MAE : 0.079 MSE : 0.015 R2 Score : 0.470
XGBoost	MAE : 0.078 MSE : 0.014 R2 Score : 0.521

Final Model Selection Justification (2 Marks):

Final Model	Resoning
XGBoost	The XGBoost model was selected for its superior performance, exhibiting high R2 Score 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.