Model Optimization and Tuning Phase Template

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Team ID	SWTID1720171884
Project Title	Predicting Compressive Strength Of Concrete 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
Gradient Boosting Regressor	param_grid = { 'n_estimators': [100, 200, 300], 'learning_rate': [0.01, 0.05, 0.1], 'max_depth': [3, 4, 5], 'subsample': [0.8, 0.9, 1.0], 'min_samples_split': [2, 5, 10], 'min_samples_leaf': [1, 2, 4] }	Best Parameters: {'learning_rate': 0.1, 'max_depth': 4, 'min_samples_leaf': 1, 'min_samples_split': 10, 'n_estimators': 300, 'subsample': 0.9}

Performance Metrics Comparison Report (2 Marks):

Model	Baseline Metric	Optimized Metric
Gradient Boosting Regressor	```score=gbr.score(x_test,y_test)``` ```score``` [73]: 0.8867788660493143 [79]:	```print("Mean Absolute Error:", mean_absolute_error(y_test,y_pred))``` ```print("Mean Squared Error:", mean_squared_error(y_test,y_pred))``` ```print("Root Mean Square Error:", np.sqrt(mean_absolute_error(y_test,y_pred)))``` ```print("R2 score :" ,r2_score(y_test,y_pred))``` Mean Absolute Error: 3.2827032042535604 Mean Squared Error: 22.38162773605611 Root Mean Square Error: 1.8118231713535293 R2 score : 0.9137489588786115

Final Model Selection Justification (2 Marks):

Final Model	Reasoning
Gradient Boosting Regressor	We selected the GradientBoostingRegressor for its ability to handle non-linearity and provide robust predictions by combining multiple weak learners. GridSearchCV was utilized to systematically explore the hyperparameter space and identify the best parameter combination, enhancing the model's performance and generalization ability. This combination ensures optimal accuracy and efficiency for our predictive task. The accuracy of prediction increased from 88% to 91%.