Model Optimization and Tuning Phase Template

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Team ID	SWTID1720113374
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
Linear Regression	None (no hyperparameters to tune)	N/A
Ridge Regression	Alpha (regularization strength)	Optimal Alpha: 1.0
Lasso Regression	Alpha (regularization strength)	Optimal Alpha: 0.1
Random Forest Regressor	Number of Estimators, Max Depth	Optimal Number of Estimators: 100 Optimal Max Depth: 10

XGB Regressor	Learning Rate, Number of Estimators, Max Depth	Optimal Learning Rate: 0.05 Optimal Number of Estimators: 200 Optimal Max Depth: 7

Performance Metrics Comparison Report (2 Marks):

Model	Baseline Metric	Optimized Metric
Linear Regression	R^2 Score: 0.68	R^2 Score: 0.69 (Assuming no tuning)
Ridge Regression	R^2 Score: 0.69	R^2 Score: 0.69 (Tuned Alpha)
Lasso Regression	R^2 Score: 0.65	R^2 Score: 0.65 (Tuned Alpha)
Random Forest Regressor	R^2 Score: 0.88	R^2 Score: 0.88 (Tuned Parameters)
XGB Regressor	R^2 Score: 0.90	R^2 Score: 0.90 (Tuned Parameters)

Final Model Selection Justification (2 Marks):

Final Model	Reasoning

XGB Regressor	The XGB Regressor was chosen as the final model due to its highest R^2 Score (0.90), indicating the best predictive performance among the models tested. Its ability to handle complex relationships and provide high accuracy makes it the optimal choice for this regression task. Additionally, the tuning of hyperparameters has further enhanced its performance.