

Model Optimization and Tuning Phase Template

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| Date | 18 July 2024 |
| Team ID | XXXXXX |
| Project Title | Predicting The Energy Output Of Wind Turbine Based On Weather Condition |
| 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 |
|-------------------------|--|---|
| Random Forest Regressor | <pre>forest_model = RandomForestRegressor(random_state=42) param_grid = { 'n_estimators': [250, 500], 'max_depth': [5, 10, 20], 'max_leaf_nodes': [100, 250, 500], 'min_samples_split': [2, 5, 10], 'min_samples_leaf': [1, 2, 4] }</pre> | <pre>print(best_params1) print(best_score1) ✓ 0.0s {'max_depth': 20, 'max_leaf_nodes': 100, 'min_samples_leaf': 1, 'min_samples_split': 5, 'n_estimators': 250} 158.29183229566257</pre> |
| Ridge Regression | <pre>ridge_model = Ridge() param_grid = { 'alpha': [0.1, 1, 10, 100, 1000] }</pre> | <pre>print(best_params2) print(best_score2) ✓ 0.0s {'alpha': 0.1} 183.64233430967437</pre> |

Performance Metrics Comparison Report (2 Marks):

| Model | Performance of Model |
|----------------------------|---|
| Random Forest Regressor | <pre> y_preds3 = forest_hp_model.predict(X_test) print(mean_absolute_error(y_test,y_preds3)) ✓ 0.1s 162.75284234812003 print(r2_score(y_test,y_preds3)) ✓ 0.0s 0.9053597798760116 </pre> |
| Ridge Regression | <pre> y_preds3 = linear_hp_model.predict(X_test) print(mean_absolute_error(y_test,y_preds3)) ✓ 0.0s 188.71220851181147 print(r2_score(y_test,y_preds3)) ✓ 0.0s 0.8997954279505012 </pre> |

Final Model Selection Justification (2 Marks):

| Final Model | Reasoning |
|-------------------------|---|
| Random Forest Regressor | The Random Forest Regressor was selected for its robust performance in handling complex relationships and minimizing overfitting. With its ensemble approach, it effectively reduces variance and provides valuable insights into feature importance. During hyperparameter tuning, it demonstrated high accuracy, aligning well with the project's objectives and justifying its selection as the final model. |