**Model Optimization and Tuning Phase Template**

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| Date | 15 JULY 2024 |
| Team ID | 739672 |
| Project Title | Car Performance Predicion |
| Maximum Marks | 10 Marks |

**Model Optimization and Tuning Phase**

The Model Optimization and Tuning Phase involves refining the predictive model for car performance by adjusting hyperparameters, selecting optimal algorithms, and applying techniques such as cross-validation. This phase ensures the model achieves high accuracy and generalizes well to new data by minimizing errors and avoiding overfitting, leading to improved predictive performance.

**Hyperparameter Tuning Documentation (6 Marks):**

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| **Model**  **Linear Regression** | **Tuned Hyperparameters** | **Optimal Values** |
|  | Regularization Parameter | 0.01 |
| **Decision Tree**  **Random Forest** | Maximum Depth  Minimum Samples Split | 10  5 |
|  | Number of Trees  Maximum Features | 100  'sqrt' |

**Performance Metrics Comparison Report (2 Marks):**

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| **Model 2**  **Mean Absolute Error (MAE)**  **Root Mean Squared Error (RMSE)**  **R-squared (R²)**  **Prediction Accuracy** | **Baseline value**  **0.35**  **0.45**  **0.72**  **78%** | **Optimized value**  **028**  **0.32**  **0.85**  **88%** |

**Final Model Selection Justification (2 Marks):**

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| --- | --- |
| **FINAL MODEL** | **Reasoning** |
| **Random Forest Regressor**  **Gradient Boosting Regressor**  **Support Vector Regressor** | Robust to overfitting, handles both numerical and categorical data well, and provides feature importance insights.  High accuracy through iterative improvement, effective in capturing complex relationships, and handles mixed data types.  Effective for high-dimensional spaces, versatile kernel functions to capture non-linear relationships, and robust to outliers. |