**Model Optimization and Tuning Phase**

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| Project Title | Predictive Modeling for Fleet Fuel Management 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 :

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| **Model** | **Tuned Hyperparameters** | **Optimal Values** |
| Model-1  Random Forest Regressor | n\_estimators, criterion, max\_depth, min\_samples\_split, min\_samples\_leaf, max\_features, max\_leaf\_nodes, bootstrap, oob\_score, random\_state, max\_samples | (100 to 500), squared error, (none,10,20,30),( 2,5,10) ,(1,2,4), auto, none, True, false, 42, none |
| Model-2  Decision tree | max\_depth, min\_samples\_split, min\_samples\_leaf, max\_features, criterion, max\_leaf\_nodes | (None.10.20.30),(2,10,20), (1,5,10), (auto,sqrt), (mse,mae), (none.10 to 30) |
| Model-3  Hist Gradient Boosting regressor | Max\_iter, learning rate, max\_depth, max\_bins, min\_samples\_leaf | (100,200,300), ( 0.01, 0.1, 0.2), (3,4,5,6), (10,20,30),  (1,2,4) |
| Model-4  Supprt Vector regressor | C, epsilon, kernel, degree, gamma, random\_state | (0.1,1,10,100,1000), (0.1,0.2,0.5,1.0), (linear,poly,rgf), (scale,auto,0.001,0.01,0.1),(none,random) |

### Performance Metrics Comparison Report:

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| **Model** | **Baseline Metric** | **Optimized Metric** |
| Model 1 | Baseline value | Optimized value |
| Model 2 | Baseline value | Optimized value |

### Final Model Selection Justification :

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| **Final Model** | **Reasoning** |
| Model 1 – Random forest regressor | It achieved the highest r2 score, mean squared error etc among the evaluated models, indicating better predictive accuracy. |