**Model Optimization and Tuning Phase Template**

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| Date | 22 June 2024 |
| Team ID | 740185 |
| Project Title | Loan Sanction Amount Prediction Data With Ml |
| 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):

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| **Model** | **Tuned Hyperparameters** | **Optimal Values** |
| KNN | n\_neighbors | 5 |
| SVC | C, kernel | C: 1.0, kernel: 'rbf' |
| Decision Tree | max\_depth, min\_samples\_split | max\_depth: 10, min\_samples\_split: 2 |
| Random Forest | n\_estimators, max\_features | n\_estimators: 100, max\_features: 'sqrt' |

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

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| **Model** | **Optimized Metric** |
| KNN |  **Optimized Metric:** R² score = 0.75   **Description:** KNN showed moderate performance, capturing local data patterns well but not as robust as other models. |
| SVC | **Optimized Metric:** R² score = 0.78  **Description:** SVC provided good accuracy with its non-linear decision boundaries, making it suitable for complex datasets. |
| Random Forest |  **Optimized Metric:** R² score = 0.85   **Description:** Random Forest excelled in handling complex relationships and reducing overfitting through its ensemble approach, providing the highest accuracy. |

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

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| **Final Model** | **Reasoning** |
| Random Forest | The Random Forest model was chosen based on its demonstrated high accuracy and robustness in handling complex relationships within the dataset. Its ensemble nature reduces overfitting and provides reliable predictions by averaging multiple decision trees. This aligns with the task's need for accurate and consistent performance across different scenarios, ensuring reliable loan sanction amount predictions with high predictive power. |