# Model Optimization and Tuning Phase Template

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| Date | 15 March 2024 |
| Team ID | LTVIP2024TMID25012 |
| Project Title | Predictive Modeling for H1B Visa Approval 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 |
|---|---|---|
| **Random Forest** | n_estimators, max_depth, min_samples_split | 150, 15, 2 |
| **Support Vector Machine (SVM)** | C, kernel, gamma | 0.5, 'linear', 'scale' |
| **Logistic Regression** | solver, C, max_iter | 'liblinear', 0.5, 200 |

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

| Model | Baseline Metric | Optimized Metric |
|---|---|---|
| **Random Forest** | Accuracy: 93.49% | Accuracy: 94.20% |

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| **Support Vector Machine (SVM)** | F1 Score: 0.75 | F1 Score: 0.80 |
| **Logistic Regression** | Accuracy: 88.00% | Accuracy: 89.50% |

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

| Final Model | Reasoning |
|---|---|
| Model 1 : Random Forest | The Random Forest model was selected as the final optimized model due to its superior performance in terms of accuracy and robustness across various metrics. It effectively handles overfitting and performs well with the high dimensionality of the feature space. Its ensemble approach allows it to generalize better than other models, particularly in diverse datasets like the H1B visa approval dataset. |