**Model Optimization and Tuning Phase Template**

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| Date | 2 AUGUST 2025 |
| Team ID | LTVIP2025TMID45496 |
| Project Title | Revolutionising Liver Care-Predicting Liver Cirrhosis using Advanced 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):**

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| **Model** | **Tuned Hyperparameters** | **Optimal Values** |
| Random Forest | 'n\_estimators': [100, 200, 300],  'max\_features': ['auto', 'sqrt', 'log2'],  'max\_depth': [10, 20, 30, None],  'min\_samples\_split': [2, 5, 10],  'min\_samples\_leaf': [1, 2, 4],  'bootstrap': [True, False]  } | Best parameters: {'bootstrap': False, 'max\_depth': 20, 'max\_fea tures': 'sqrt', 'min\_samples\_leaf' : 1, 'min\_samples\_split': 10, 'n\_e stimators': 200} |
| KNN | param\_grid = { | Best parameters: {'bootstrap': False, 'max\_depth': 20, 'max\_fea tures': 'sqrt', 'min\_samples\_leaf' |

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| **Model** | **Baseline Metric** | **Optimized Metric** |
| Random Forest | Accuracy: 0.8666666666666667 | Accuracy: 0.887719298245614 |

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|  | 'n\_estimators': [100, 200, 300],  'max\_features': ['auto', 'sqrt', 'log2'],  'max\_depth': [10, 20, 30, None],  'min\_samples\_split': [2, 5, 10],  'min\_samples\_leaf': [1, 2, 4],  'bootstrap': [True, False]  } | : 1, 'min\_samples\_split': 10, 'n\_e stimators': 200} |
| xgboost | aram\_grid = {  'max\_depth': [3, 5, 7],  'learning\_rate': [0.01, 0.1, 0.2],  'n\_estimators': [100, 200, 300],  'subsample': [0.8, 0.9, 1.0],  'colsample\_bytree': [0.8, 0.9, 1.0]  } | Best parameters: {'colsample\_b ytree': 0.8, 'learning\_rate': 0.01, 'max\_depth': 5, 'n\_estimators':  200, 'subsample': 0.8} |

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

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| KNN | Baseline KNN Accuracy: 0.89473684  21052632 | Baseline KNN Accuracy: 0.884736842105  2632 |

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

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| **Final Model** | **Reasoning** |
| KNN | I have choosen KNN model because it shows higher accuracy and prediction needs to be accurate incase of medical field |