**Model Optimization and Tuning Phase Template**

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| Date | 7th July 2024 |
| Team ID | 739719 |
| Project Title | Garment Workers Productivity Predictions |
| Maximum Marks | 10 Marks |

**Model Optimization and Tuning Phase**

Optimized models using GridSearchCV, selecting XGBoost Regressor for its superior performance. Trained and validated the final model on the full dataset, ensuring accurate productivity predictions.

### Hyperparameter Tuning Documentation (6 Marks):

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| **Model** | **Tuned Hyperparameters** | **Optimal Values** |
| Model 1  Linear Regression | **Hyperparameters:**  **fit\_intercept:** Whether to calculate the intercept for this model (True or False).  **Normalize**:Whether to normalize the input variables(True or False) | fit\_intercept=True, normalize=False |
| Model 2  Random Forest | **Hyperparameters:**  **n\_estimators:**The number of trees in the forest.  **max\_depth:**The maximum depth of the tree.  **min\_samples\_split:**The minimum number of samples rerquired to split an internal node. | n\_estimators=200, max\_depth=20,  min\_samples\_split=5 |
| Model 3 XGBoost Regressor | * **n\_estimators:** The number of boosting rounds.   - **max\_depth:** The maximum depth of a tree.  - **learning\_rate:** Step size shrinkage used in update to prevent overfitting. | n\_estimators=300, max\_depth=6,  learning\_rate=0.1, subsample=0.8,  colsample\_bytree=0.8 |

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

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| **Model** | **Baseline Metric** | **Optimized Metric** |
| Model 1  XGBoost | **Baseline Metric:** The initial performance metric value for XGBoost before optimization is  0.015 | Optimized Metric: The performance metric value for XGBoost after hyperparameter tuning and optimization is 0.123 |
| Model 2  Gradient Boost | **Baseline Metric:** The initial performance metric value for Gradient Boost before optimization is 0.012 | **Optimized Metric:** The performance metric value for Gradient Boost after hyperparameter tuning and optimization is 0.116 |

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

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| **Final Model** | **Reasoning** |
| Model 1  XGBoost Regressor | The XGBoost Regressor was chosen as the final optimized model because it consistently delivered superior performance metrics during the evaluation phase. Its advanced capabilities in handling complex and high-dimensional data, along with its built-in regularization mechanisms, made it the best candidate for accurately predicting garment workers' productivity. |