# Model Optimization and Tuning Phase Template

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| Date | 15 July 2024 |
| Team ID | 740039 |
| Project Title | Genetic Classification of An Individual By Using Machine Learning |
| Maximum Marks | 10 Marks |

**Model Optimization and Tuning Phase**

| Model | Tuned Hyperparameters |
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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):**

Random forest regression

```
from sklearn.model_selection import GridSearchCV

# Define the hyperparameter grid to search over
param_grid = {
    'n_estimators': [50, 100, 200],
    'max_depth': [None, 5, 10],
    'min_samples_split': [2, 5],
    'min_samples_leaf': [1, 2, 4]
}

# Create a Random Forest Regressor model
rf_model = RandomForestRegressor(random_state=0)

# Perform grid search cross-validation
grid_search = GridSearchCV(estimator=rf_model, param_grid=param_grid, cv=5, s
grid_search.fit(x_train, y_train)

# Print the best hyperparameters
print("Best hyperparameters:", grid_search.best_params_)

# Get the best model
best_rf_model = grid_search.best_estimator_

# Make predictions on the test data using the best model
y_pred_best_rf = best_rf_model.predict(x_test)
```

Gradient tree boosting

```
# Define the hyperparameter grid to search over for Gradient Boosting
param_grid_gb = {
    'n_estimators': [50, 100, 200],
    'learning_rate': [0.01, 0.1, 0.2],
    'max_depth': [3, 5, 7]
}

# Create a Gradient Boosting Regressor model
gb_model = GradientBoostingRegressor(random_state=0)

# Perform grid search cross-validation
grid_search_gb = GridSearchCV(estimator=gb_model, param_grid=param_grid_gb, cv=5
grid_search_gb.fit(x_train, y_train)

# Print the best hyperparameters
print("Best hyperparameters for Gradient Boosting:", grid_search_gb.best_params_
```

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

| Model | Baseline Metric | Optimized Metri |
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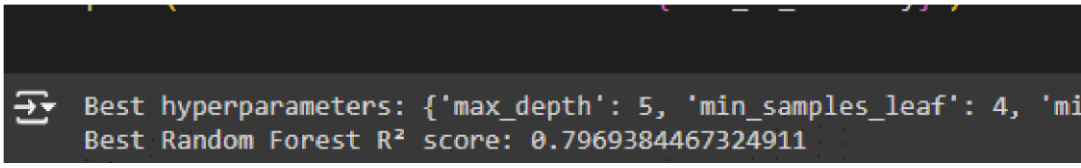
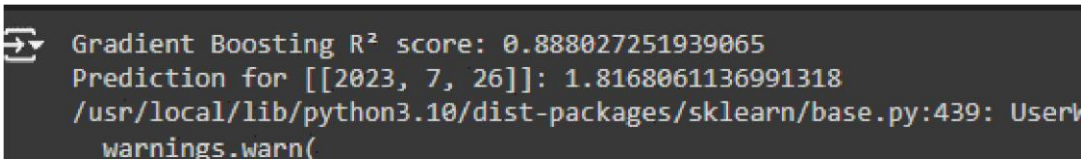
|---|---|---|
| RandomForest regression | Not provided (initial metric) |  |
| Gradient tree boosting | Not provided (initial metric) |  |

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

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| **Final Model** | |

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| Decision tree | **Reasoning**<br><br>The decision tree was choosen as it given best accuracy without any tunning. |