

## Model Optimization and Tuning Phase Report

Date	15 March 2024
Team ID	739882
Project Title	Income Activities 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.

Model	Tuned Hyperparameters	Optimal Values
Random Forest	<pre>from sklearn.model_selection import train_test_split x_train, x_test, y_train, y_test = train_test_split(x, y, test_size=0.2)  print(x_train.shape) print(x_test.shape) print(y_train.shape) print(y_test.shape)</pre> <pre>(275, 6) (69, 6) (275,) (69,)</pre>	<pre>[ ] rf_model.predict([[0,213,18,2009.0,20.118277,27]]) ⇒ array([5.8])  [ ] rf_model.predict([[31,54,18,2011.0,7.022699,31]]) ⇒ array([5.44])</pre>

### Hyperparameter Tuning Documentation (6 Marks):

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

Model	Optimized Metric

Random Forest	<pre>In [65]: random_forest_regressor.predict([[0,213,58,18,2089.8,29.118277,27]]) Out[65]: array([7.88])  In [66]: random_forest_regressor.predict([[11,54,58,18,2011.8,7.822699,31]]) Out[66]: array([18.])  In [67]: random_forest_regressor.predict([[11,246,58,21,2011.8,2.537681,31]]) Out[67]: array([18.])  In [68]: random_forest_regressor.predict([[11,246,58,27,2011.8,2.877772,31]]) Out[68]: array([18.])</pre>
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### Final Model Selection Justification (2 Marks):

Final Model	Reasoning
Gradient Boosting	The Gradient Boosting model was selected for its superior performance, exhibiting high accuracy during hyperparameter tuning. Its ability to handle complex relationships, minimize overfitting, and optimize predictive accuracy aligns with project objectives, justifying its selection as the final model.