Model	Tuned Hyperparameters	Optimal Values
Linear regression		```python lr = LinearRegression() lr.fit(train_X,train_y) print('Attempting to fit Linear Regressor') Attempting to fit Linear Regressor```
Random Forest		```python from sklearn.ensemble import RandomForestRegressor rf = RandomForestRegressor() rf.fit(train_X,train_y) print('Attempting to fit Random Forest Regressor') Attempting to fit Random Forest Regressor```

**Model Optimization and Tuning Phase
Report**

Date	20 June 2024
Team ID	740038
Project Title	Customer Acquisition Cost Estimation Using ML
Maximum Marks	10 Marks

Model Optimization and Tuning Phase

In the model optimization and tuning phase for customer acquisition cost estimation using machine learning, split the data, select key hyperparameters (e.g., `estimators`, `max_depth`), and use `Randomized SearchCV` or `GridSearchCV` to identify optimal values. Evaluate performance using metrics like Mean Absolute Error (MAE) or Mean Squared Error (MSE).

Hyperparameter Tuning Documentation (6 Marks):

Performance Metrics Comparison Report (2 Marks):

Model	Optimized Metric
Random Forest	
Linear Regressor	

```python
y_pred_val_rf = rf.predict(val_X)
print('MAE on Validation set :',metrics.mean_absolute_error(val_y, y_pred_val_rf))
print("\n")
print('MSE on Validation set :',metrics.mean_squared_error(val_y, y_pred_val_rf))
print("\n")
print('RMSE on Validation set :',np.sqrt(metrics.mean_absolute_error(val_y, y_pred_val_rf)))
print("\n")
print('R2 Score on Validation set :',metrics.r2_score(val_y, y_pred_val_rf))
print("\n")
```

```
MAE on Validation set : 0.0925440344201496


MSE on Validation set : 1.7262364914711157


RMSE on Validation set : 0.3042105100422232


R2 Score on Validation set : 0.9980566391348797
```

```
y_pred_val_lr = lr.predict(val_X)
print('MAE on Validation set :',metrics.mean_absolute_error(val_y, y_pred_val_lr))
print("\n")
print('MSE on Validation set :',metrics.mean_squared_error(val_y, y_pred_val_lr))
print("\n")
print('RMSE on Validation set :',np.sqrt(metrics.mean_absolute_error(val_y, y_pred_val_lr)))
print("\n")
print('R2 Score on Validation set :',metrics.r2_score(val_y, y_pred_val_lr))
print("\n")
```

```
MAE on Validation set : 25.212882223695512


MSE on Validation set : 862.7559482129169


RMSE on Validation set : 5.0212430954590825


R2 Score on Validation set : 0.028727434398146512
```

Final Model Selection Justification (2 Marks):

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