Project Development Phase

Model Performance Test

Date	20th November,2023
Team ID	Team-592284
Project Name	Market Segmentation analysis using ML
Maximum Marks	10 Marks

Model Performance Testing:

1. **Metrices** **Regression Model:**

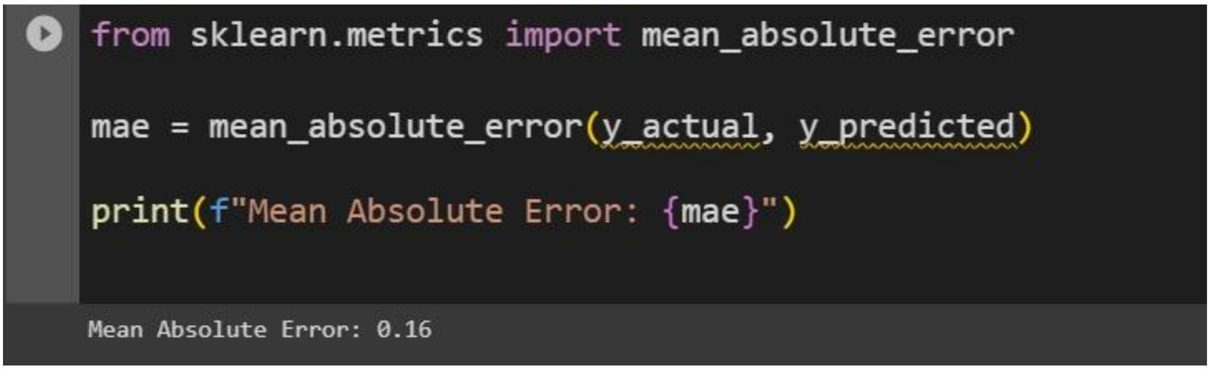
   MA E - , MSE - , RMSE - , R2 score -

   Classification Model:

   Confusion Matrix - , Accuray Score- & Classification Report

Screenshots: Regression Model

MAE:



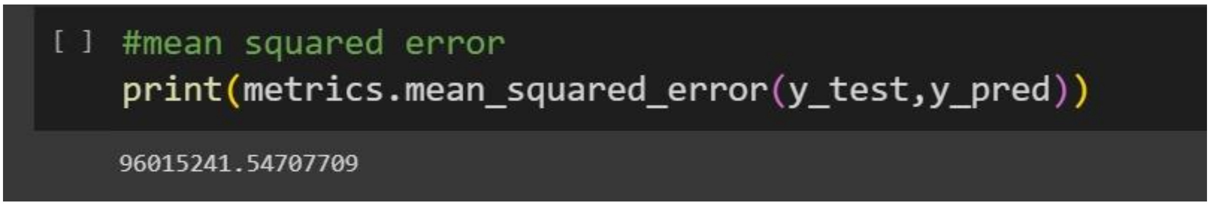
```
from sklearn.metrics import mean_absolute_error

mae = mean_absolute_error(y_actual, y_predicted)

print(f"Mean Absolute Error: {mae}")
```

```
Mean Absolute Error: 0.16
```

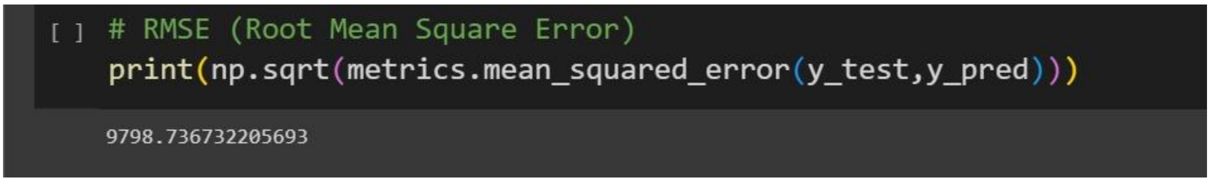
MSE:



```
[ ]  #mean squared error
     print(metrics.mean_squared_error(y_test,y_pred))
```

```
96015241.54707709
```

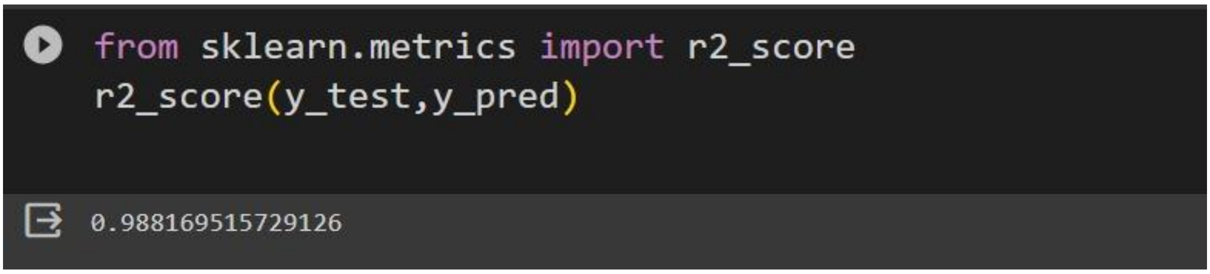
RMSE:



```
[ ]  # RMSE (Root Mean Square Error)
     print(np.sqrt(metrics.mean_squared_error(y_test,y_pred)))
```

```
9798.736732205693
```

R2 Score:

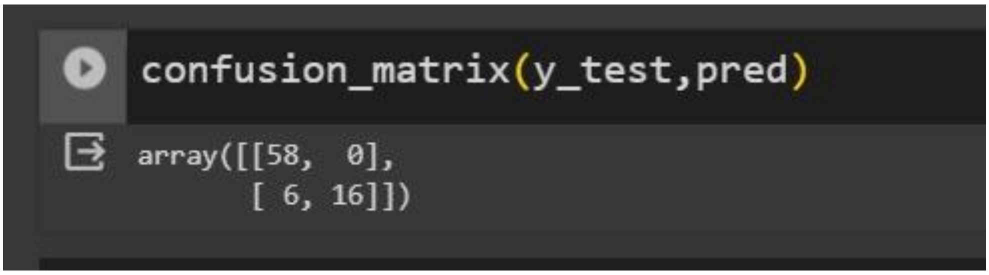


```
from sklearn.metrics import r2_score
r2_score(y_test,y_pred)
```

```
0.988169515729126
```

Classification Model:

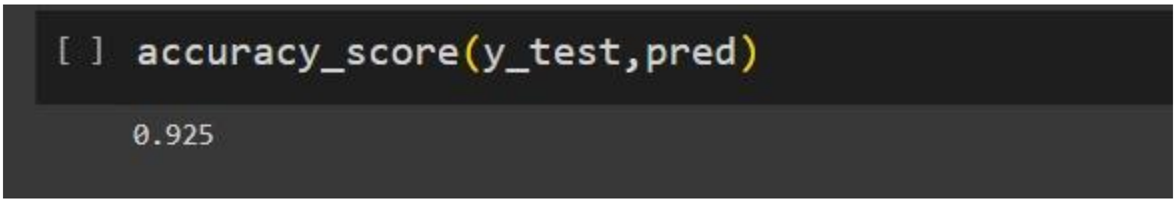
Confusion Matrix:



```
confusion_matrix(y_test,pred)
```

```
array([[58,  0],
       [ 6, 16]])
```

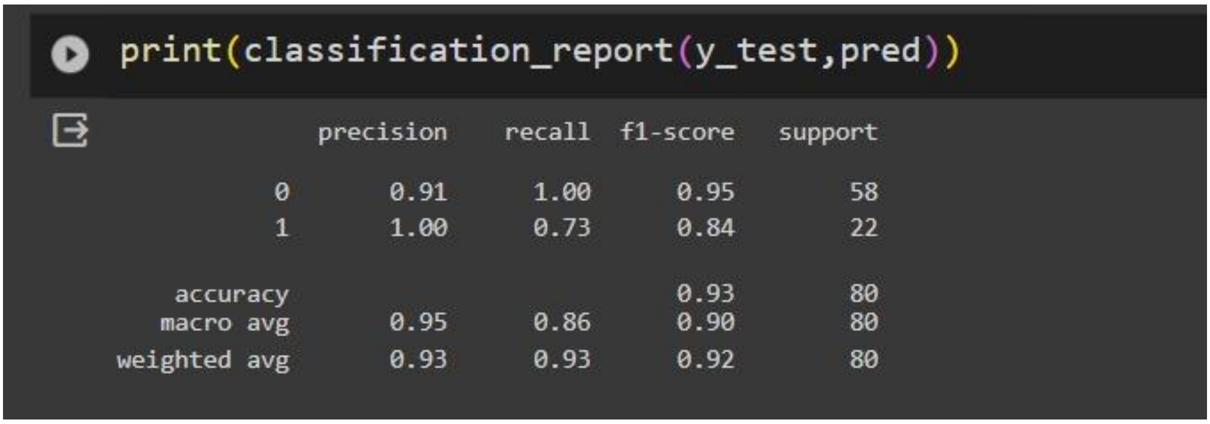
Accuracy Score:



```
[ ] accuracy_score(y_test,pred)
```

```
0.925
```

Classification Report:



```
print(classification_report(y_test,pred))
```

```
              precision    recall  f1-score   support

           0       0.91      1.00      0.95        58
           1       1.00      0.73      0.84        22

    accuracy                           0.93        80
   macro avg       0.95      0.86      0.90        80
weighted avg       0.93      0.93      0.92        80
```

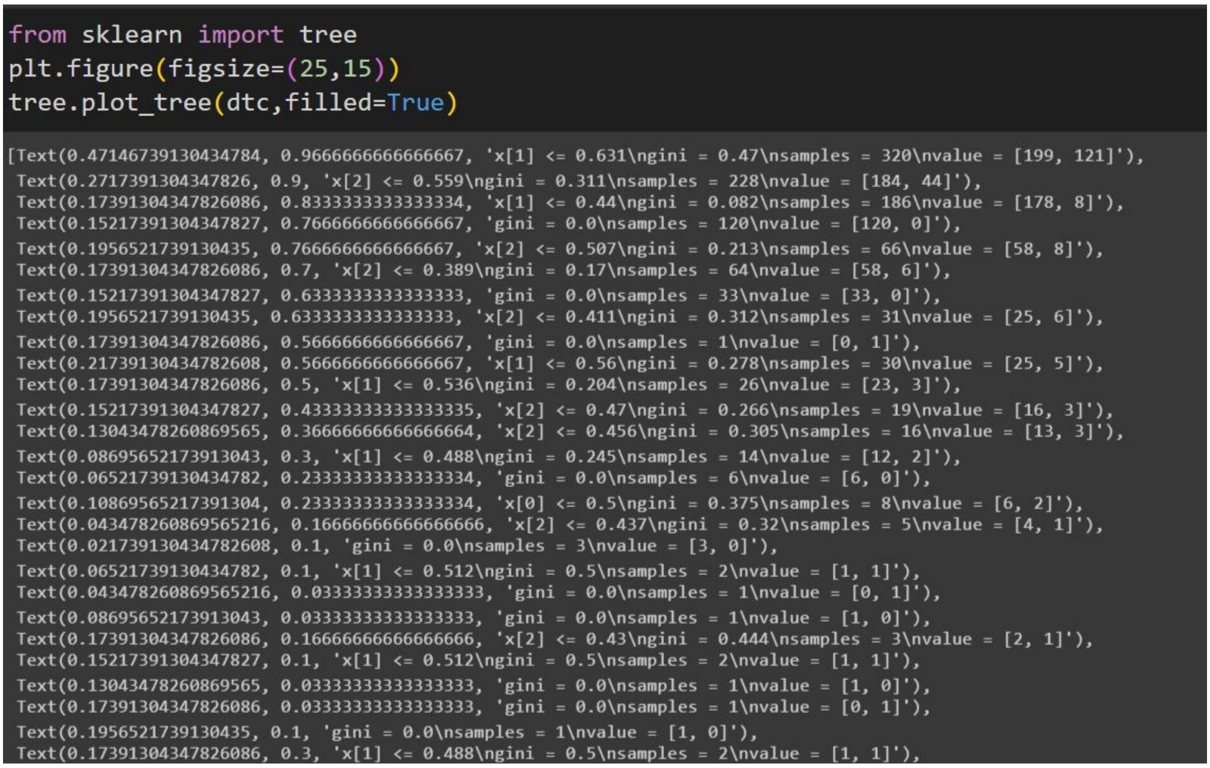
2. Tune the Model   Hyperparameter Tuning -

Validation Method –

Screenshots:

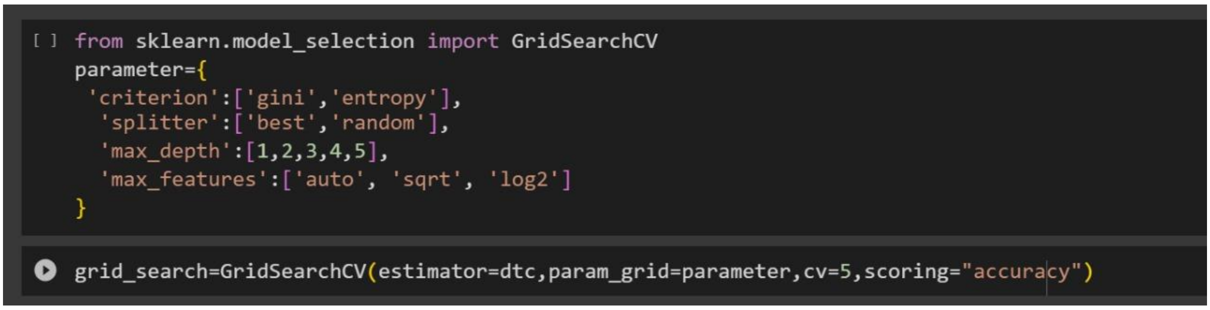
Hyperparameter Tuning -

Validation Method



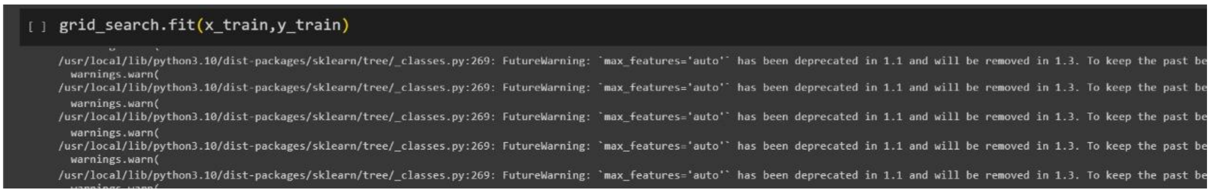
```
from sklearn import tree
plt.figure(figsize=(25,15))
tree.plot_tree(dtc,filled=True)
```

```
[Text(0.47146739130434784, 0.9666666666666667, 'x[1] <= 0.631\ngini = 0.47\nsamples = 320\nvalue = [199, 121]'),
 Text(0.2717391304347826, 0.9, 'x[2] <= 0.559\ngini = 0.311\nsamples = 228\nvalue = [184, 44]'),
 Text(0.17391304347826086, 0.8333333333333334, 'x[1] <= 0.44\ngini = 0.082\nsamples = 186\nvalue = [178, 8]'),
 Text(0.15217391304347827, 0.7666666666666667, 'gini = 0.0\nsamples = 120\nvalue = [120, 0]'),
 Text(0.1956521739130435, 0.7666666666666667, 'x[2] <= 0.507\ngini = 0.213\nsamples = 66\nvalue = [58, 8]'),
 Text(0.17391304347826086, 0.7, 'x[2] <= 0.389\ngini = 0.17\nsamples = 64\nvalue = [58, 6]'),
 Text(0.15217391304347827, 0.6333333333333333, 'gini = 0.0\nsamples = 33\nvalue = [33, 0]'),
 Text(0.1956521739130435, 0.6333333333333333, 'x[2] <= 0.411\ngini = 0.312\nsamples = 31\nvalue = [25, 6]'),
 Text(0.17391304347826086, 0.5666666666666667, 'gini = 0.0\nsamples = 1\nvalue = [0, 1]'),
 Text(0.21739130434782608, 0.5666666666666667, 'x[1] <= 0.56\ngini = 0.278\nsamples = 30\nvalue = [25, 5]'),
 Text(0.17391304347826086, 0.5, 'x[1] <= 0.536\ngini = 0.204\nsamples = 26\nvalue = [23, 3]'),
 Text(0.15217391304347827, 0.43333333333333335, 'x[2] <= 0.47\ngini = 0.266\nsamples = 19\nvalue = [16, 3]'),
 Text(0.13043478260869565, 0.36666666666666664, 'x[2] <= 0.456\ngini = 0.305\nsamples = 16\nvalue = [13, 3]'),
 Text(0.08695652173913043, 0.3, 'x[1] <= 0.488\ngini = 0.245\nsamples = 14\nvalue = [12, 2]'),
 Text(0.06521739130434782, 0.23333333333333334, 'gini = 0.0\nsamples = 6\nvalue = [6, 0]'),
 Text(0.10869565217391304, 0.23333333333333334, 'x[0] <= 0.5\ngini = 0.375\nsamples = 8\nvalue = [6, 2]'),
 Text(0.043478260869565216, 0.16666666666666666, 'x[2] <= 0.437\ngini = 0.32\nsamples = 5\nvalue = [4, 1]'),
 Text(0.021739130434782608, 0.1, 'gini = 0.0\nsamples = 3\nvalue = [3, 0]'),
 Text(0.06521739130434782, 0.1, 'x[1] <= 0.512\ngini = 0.5\nsamples = 2\nvalue = [1, 1]'),
 Text(0.043478260869565216, 0.03333333333333333, 'gini = 0.0\nsamples = 1\nvalue = [0, 1]'),
 Text(0.08695652173913043, 0.03333333333333333, 'gini = 0.0\nsamples = 1\nvalue = [1, 0]'),
 Text(0.17391304347826086, 0.16666666666666666, 'x[2] <= 0.43\ngini = 0.444\nsamples = 3\nvalue = [2, 1]'),
 Text(0.15217391304347827, 0.1, 'x[1] <= 0.512\ngini = 0.5\nsamples = 2\nvalue = [1, 1]'),
 Text(0.13043478260869565, 0.03333333333333333, 'gini = 0.0\nsamples = 1\nvalue = [1, 0]'),
 Text(0.17391304347826086, 0.03333333333333333, 'gini = 0.0\nsamples = 1\nvalue = [0, 1]'),
 Text(0.1956521739130435, 0.1, 'gini = 0.0\nsamples = 1\nvalue = [1, 0]'),
 Text(0.17391304347826086, 0.3, 'x[1] <= 0.488\ngini = 0.5\nsamples = 2\nvalue = [1, 1]'),
```



```
[ ] from sklearn.model_selection import GridSearchCV
    parameter={
     'criterion':['gini','entropy'],
      'splitter':['best','random'],
      'max_depth':[1,2,3,4,5],
      'max_features':['auto', 'sqrt', 'log2']
    }
```

```
grid_search=GridSearchCV(estimator=dtc,param_grid=parameter,cv=5,scoring="accuracy")
```



```
[ ] grid_search.fit(x_train,y_train)
```

```
/usr/local/lib/python3.10/dist-packages/sklearn/tree/_classes.py:269: FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be removed in 1.3. To keep the past be
  warnings.warn(
/usr/local/lib/python3.10/dist-packages/sklearn/tree/_classes.py:269: FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be removed in 1.3. To keep the past be
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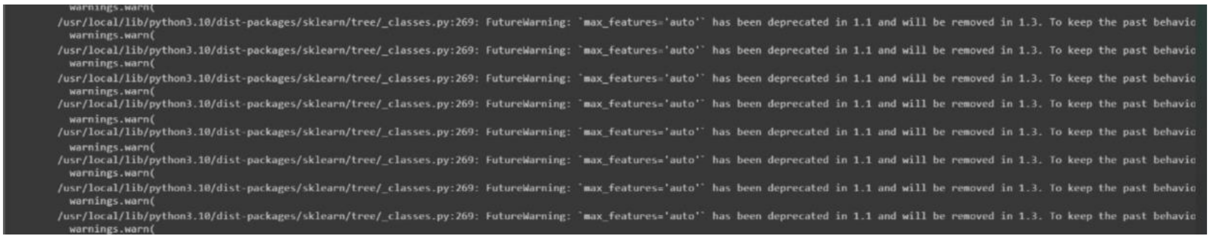

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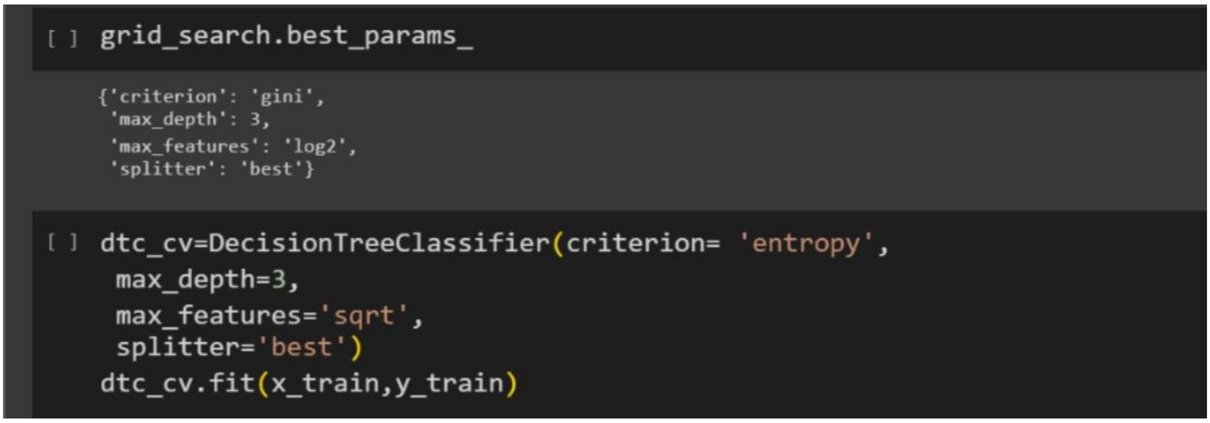
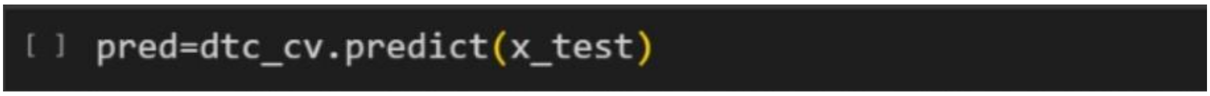


```
[ ] grid_search.best_params_

    {'criterion': 'gini',
     'max_depth': 3,
     'max_features': 'log2',
     'splitter': 'best'}

[ ] dtc_cv=DecisionTreeClassifier(criterion= 'entropy',
     max_depth=3,
     max_features='sqrt',
     splitter='best')
    dtc_cv.fit(x_train,y_train)
```



```
[ ] pred=dtc_cv.predict(x_test)
```