21522351_Tuan3_Cau5

April 11, 2024

[ ]:
```
%matplotlib inline
import matplotlib.pyplot as plt
import numpy as np
import pandas as pd
import seaborn as sns

from sklearn.model_selection import train_test_split
from sklearn import tree
from sklearn.naive_bayes import GaussianNB
from sklearn import metrics
```

[ ]:
```
df = pd.read_csv("Data/heart.csv")
```

[ ]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 303 entries, 0 to 302
Data columns (total 14 columns):
 #   Column    Non-Null Count  Dtype  
---  ------    --------------  -----  
 0   age       303 non-null    int64  
 1   sex       303 non-null    int64  
 2   cp        303 non-null    int64  
 3   trestbps  303 non-null    int64  
 4   chol      303 non-null    int64  
 5   fbs       303 non-null    int64  
 6   restecg   303 non-null    int64  
 7   thalach   303 non-null    int64  
 8   exang     303 non-null    int64  
 9   oldpeak   303 non-null    float64
 10  slope     303 non-null    int64  
 11  ca        303 non-null    int64  
 12  thal      303 non-null    int64  
 13  target    303 non-null    int64  
dtypes: float64(1), int64(13)
memory usage: 33.3 KB
```

[ ]:
```
total = df.isnull().sum().sort_values(ascending=False)
percent_1=df.isnull().sum()/df.isnull().count()*100
missing_data = pd.concat([total,percent_1],axis=1,keys=['Total','%'])
missing_data.head(5)
```

[ ]:
```
          Total    %
age           0  0.0
sex           0  0.0
cp            0  0.0
trestbps      0  0.0
chol          0  0.0
```

Không có dữ liệu trống Đổi tên cột

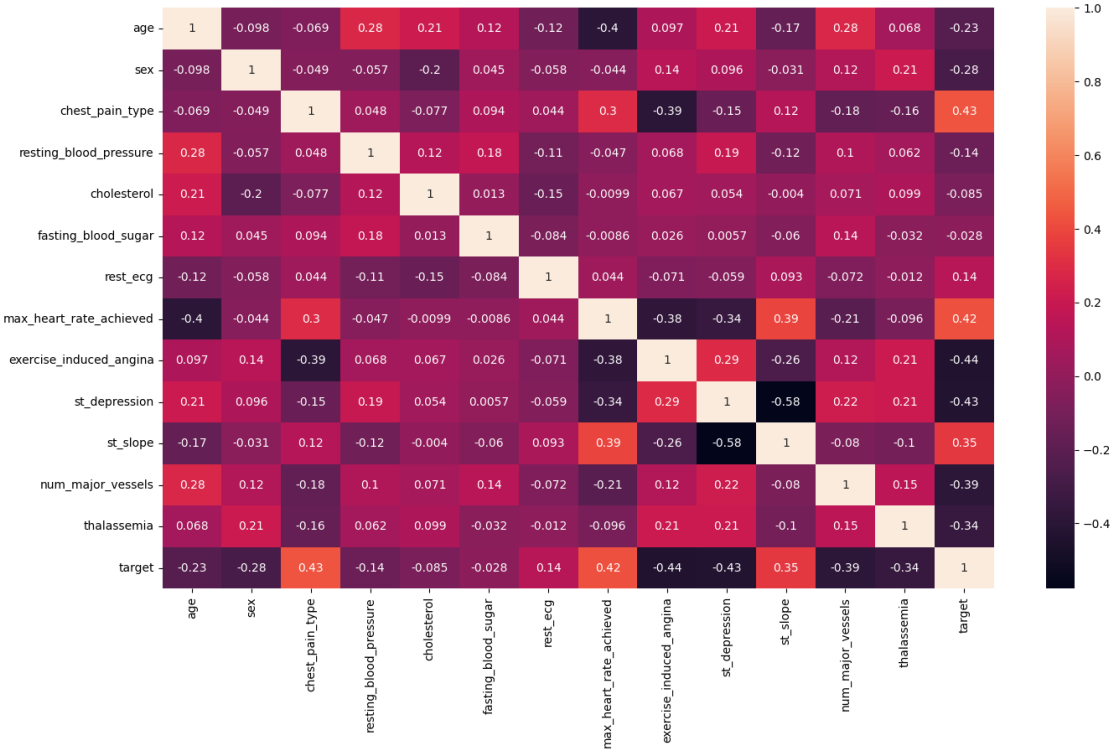
[ ]:
```
df.columns =␣
↪['age','sex','chest_pain_type','resting_blood_pressure','cholesterol','fasting_blood_sugar'
```

[ ]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 303 entries, 0 to 302
Data columns (total 14 columns):
 #   Column                   Non-Null Count  Dtype
---  ------                   --------------  -----
 0   age                      303 non-null    int64
 1   sex                      303 non-null    int64
 2   chest_pain_type          303 non-null    int64
 3   resting_blood_pressure   303 non-null    int64
 4   cholesterol              303 non-null    int64
 5   fasting_blood_sugar      303 non-null    int64
 6   rest_ecg                 303 non-null    int64
 7   max_heart_rate_achieved  303 non-null    int64
 8   exercise_induced_angina  303 non-null    int64
 9   st_depression            303 non-null    float64
 10  st_slope                 303 non-null    int64
 11  num_major_vessels        303 non-null    int64
 12  thalassemia              303 non-null    int64
 13  target                   303 non-null    int64
dtypes: float64(1), int64(13)
memory usage: 33.3 KB
```

[ ]:
```
plt.figure(figsize=(16,9))
sns.heatmap(df.corr(method='pearson'),annot=True)
```

[ ]:
```
<Axes: >
```



[ ]:
```
feature = df.drop('target',axis=1)
label = df['target']
```

[ ]:
```
feature.select_dtypes(exclude=['int64']).columns
```

[ ]:
```
Index(['st_depression'], dtype='object')
```

[ ]:
```
feature_onehot = pd.get_dummies(feature,columns=feature.
  ↪select_dtypes(exclude=['int64']).columns)
feature_onehot
```

[ ]:

	age	sex	chest_pain_type	resting_blood_pressure	cholesterol	\
0	63	1	3	145	233	
1	37	1	2	130	250	
2	41	0	1	130	204	
3	56	1	1	120	236	
4	57	0	0	120	354	
..	…	…	…	…	…	
298	57	0	0	140	241	
299	45	1	3	110	264	
300	68	1	0	144	193	
301	57	1	0	130	131	
302	57	0	1	130	236	

```
     fasting_blood_sugar  rest_ecg  max_heart_rate_achieved  \
0                      1         0                      150
1                      0         1                      187
2                      0         0                      172
3                      0         1                      178
4                      0         1                      163
..                   …       …                        …
298                    0         1                      123
299                    0         1                      132
300                    1         1                      141
301                    0         1                      115
302                    0         0                      174

     exercise_induced_angina  st_slope  …  st_depression_3.2  \
0                          0         0  …              False
1                          0         0  …              False
2                          0         2  …              False
3                          0         2  …              False
4                          1         2  …              False
..                       …       …  …                …
298                        1         1  …              False
299                        0         1  …              False
300                        0         1  …              False
301                        1         1  …              False
302                        0         1  …              False

     st_depression_3.4  st_depression_3.5  st_depression_3.6  \
0                False              False              False
1                False               True              False
2                False              False              False
3                False              False              False
4                False              False              False
..                 …                  …                …
298              False              False              False
299              False              False              False
300               True              False              False
301              False              False              False
302              False              False              False

     st_depression_3.8  st_depression_4.0  st_depression_4.2  \
0                False              False              False
1                False              False              False
2                False              False              False
3                False              False              False
4                False              False              False
..                 …                  …                …
```

```
298              False              False              False
299              False              False              False
300              False              False              False
301              False              False              False
302              False              False              False

     st_depression_4.4  st_depression_5.6  st_depression_6.2
0                False              False              False
1                False              False              False
2                False              False              False
3                False              False              False
4                False              False              False
..                 …                  …                  …
298              False              False              False
299              False              False              False
300              False              False              False
301              False              False              False
302              False              False              False

[303 rows x 52 columns]
```

[ ]:
```
#câu 6
x_train, x_test, y_train, y_test = train_test_split(feature, label, test_size=0.
↪3, random_state=42)
```

[ ]:
```
clf = tree.DecisionTreeClassifier(criterion="entropy",random_state=0)
clf.fit(x_train,y_train)
```

[ ]:
```
DecisionTreeClassifier(criterion='entropy', random_state=0)
```

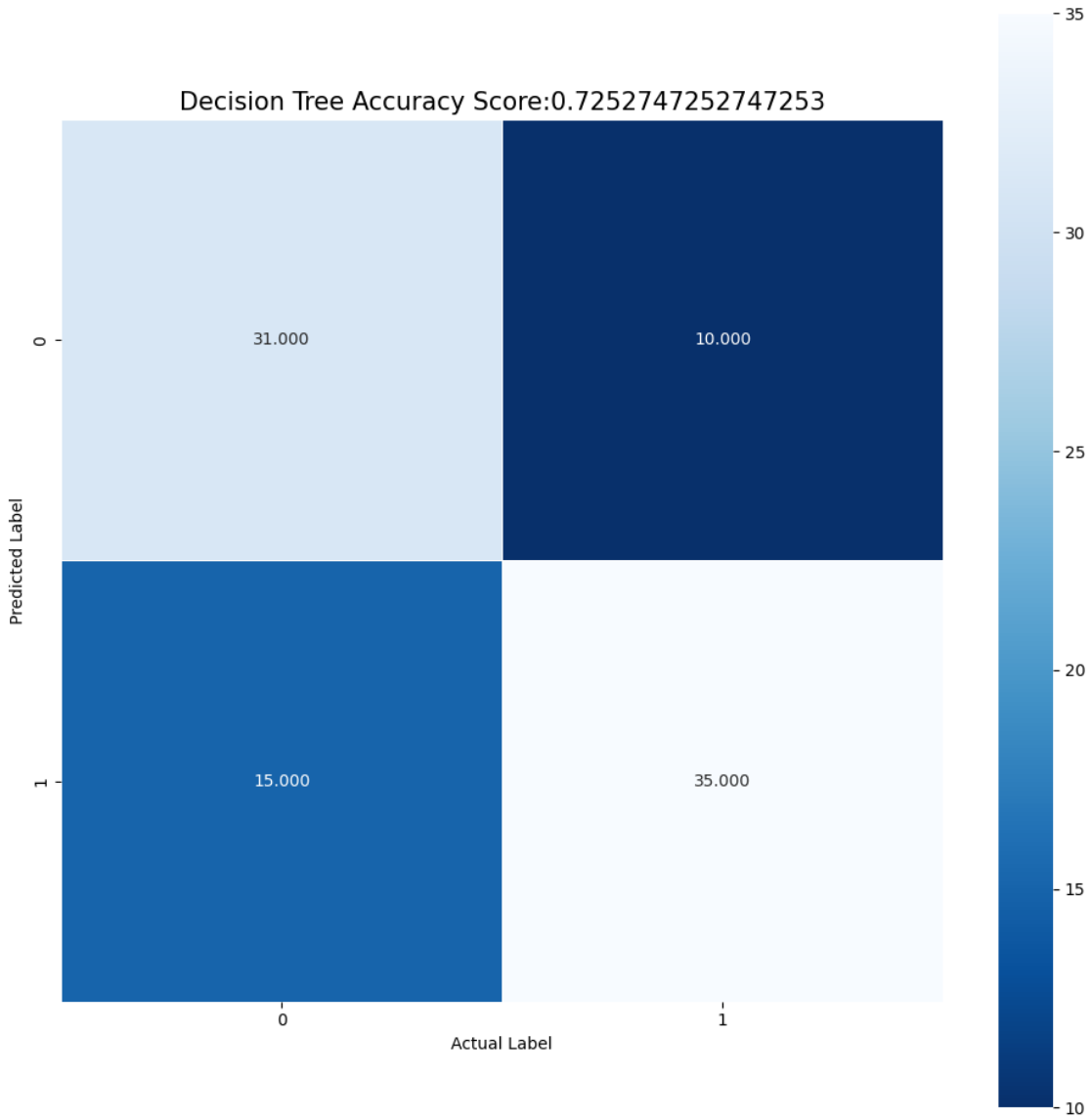
[ ]:
```
tree_pred = clf.predict(x_test)

tree_score = metrics.accuracy_score(y_test,tree_pred)
print("Accruracy:",tree_score)
print("Report:",metrics.classification_report(y_test,tree_pred))
```

```
Accruracy: 0.7252747252747253
Report:               precision    recall  f1-score   support

           0       0.67      0.76      0.71        41
           1       0.78      0.70      0.74        50

    accuracy                           0.73        91
   macro avg       0.73      0.73      0.72        91
weighted avg       0.73      0.73      0.73        91
```

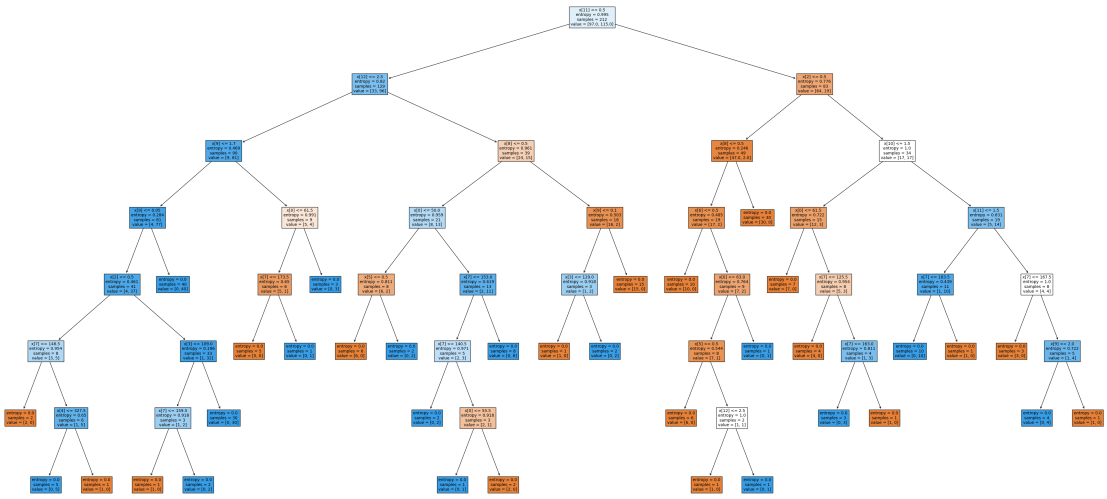
[ ]:
```
tree_cm = metrics.confusion_matrix(y_test,tree_pred)
```

[ ]:
```
plt.figure(figsize=(12,12))
sns.heatmap(tree_cm,annot=True, fmt=".3f",linewidth=.
 ↪5,square=True,cmap='Blues_r')
plt.xlabel('Actual Label')
plt.ylabel('Predicted Label')
title ='Decision Tree Accuracy Score:{0}'.format(tree_score)
plt.title(title,size=15)
```

[ ]:
```
Text(0.5, 1.0, 'Decision Tree Accuracy Score:0.7252747252747253')
```



[ ]:
```
fig, ax = plt.subplots(figsize=(50,24))
tree.plot_tree(clf,filled=True,fontsize=10)
plt.savefig('decision_tree',dpi=100)
plt.show()
```



[ ]:
```
#câu 8
clf = tree.DecisionTreeClassifier(criterion="gini",random_state=0)
clf.fit(x_train,y_train)
```

[ ]:
```
DecisionTreeClassifier(random_state=0)
```

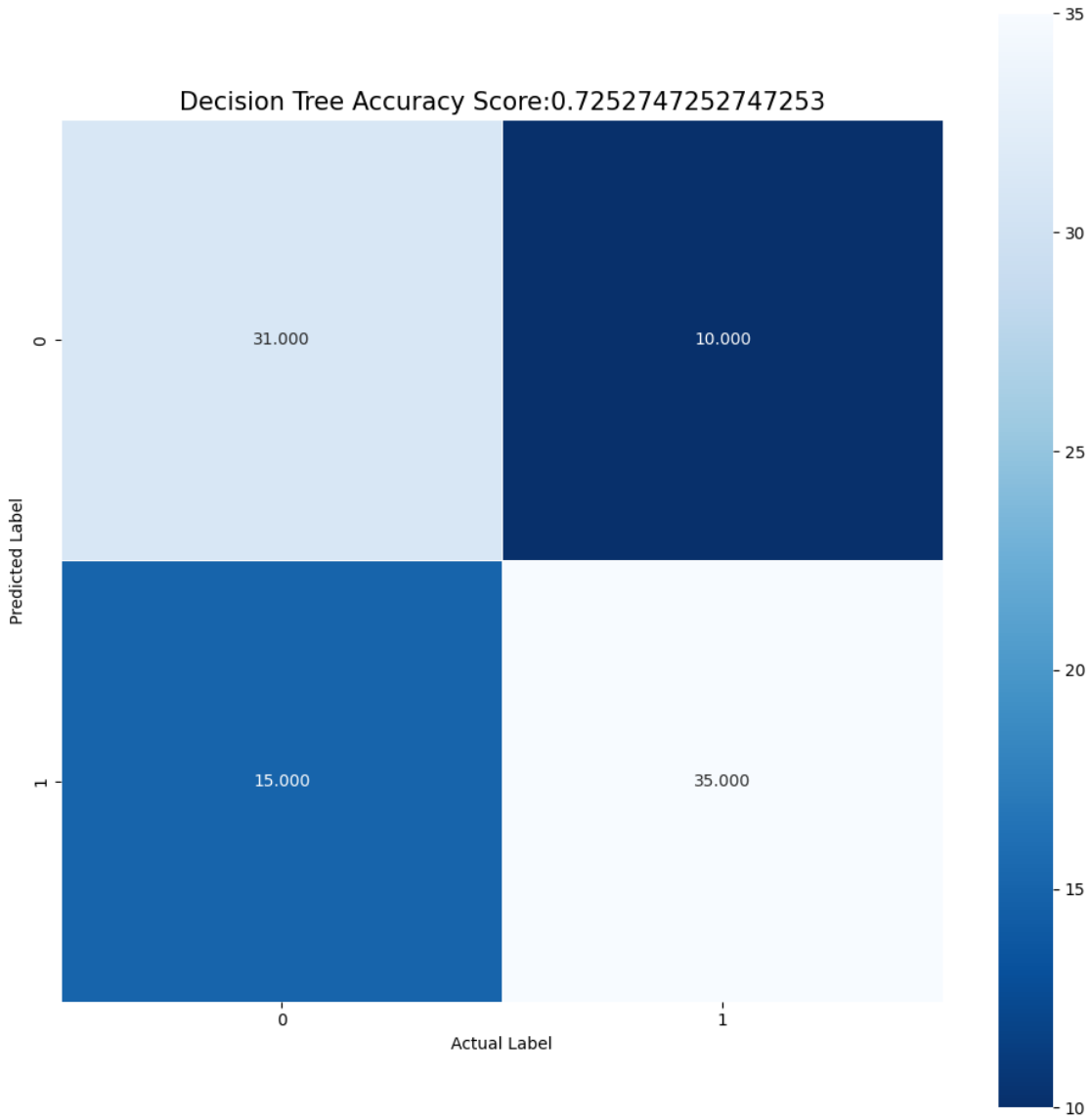
[ ]:
```
tree_pred = clf.predict(x_test)
tree_score = metrics.accuracy_score(y_test,tree_pred)
print("Accruracy:",tree_score)
print("Report:",metrics.classification_report(y_test,tree_pred))
```

```
Accruracy: 0.7252747252747253
Report:               precision    recall  f1-score   support

           0       0.67      0.76      0.71        41
           1       0.78      0.70      0.74        50

    accuracy                           0.73        91
   macro avg       0.73      0.73      0.72        91
weighted avg       0.73      0.73      0.73        91
```

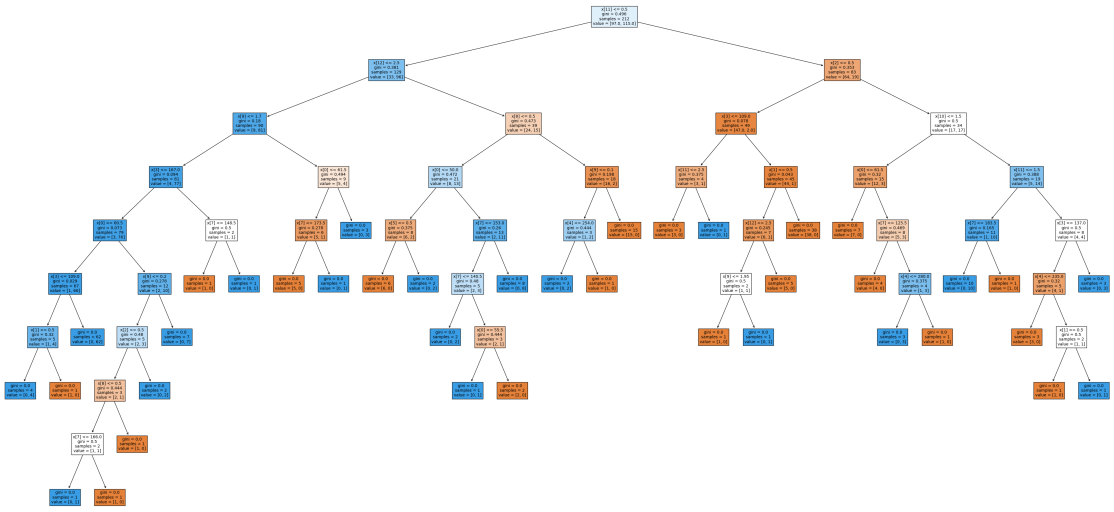
[ ]:
```
tree_cm = metrics.confusion_matrix(y_test,tree_pred)
```

[ ]:
```
plt.figure(figsize=(12,12))
sns.heatmap(tree_cm,annot=True, fmt=".3f",linewidth=.
 ↪5,square=True,cmap='Blues_r')
plt.xlabel('Actual Label')
plt.ylabel('Predicted Label')
title ='Decision Tree Accuracy Score:{0}'.format(tree_score)
plt.title(title,size=15)
```

[ ]:
```
Text(0.5, 1.0, 'Decision Tree Accuracy Score:0.7252747252747253')
```



[ ]:
```
fig, ax = plt.subplots(figsize=(50,24))
tree.plot_tree(clf,filled=True,fontsize=10)
plt.savefig('decision_tree',dpi=100)
plt.show()
```



[ ]:
```
#câu 9
gnb = GaussianNB()
bayes_pred = gnb.fit(x_train, y_train).predict(x_test)
```

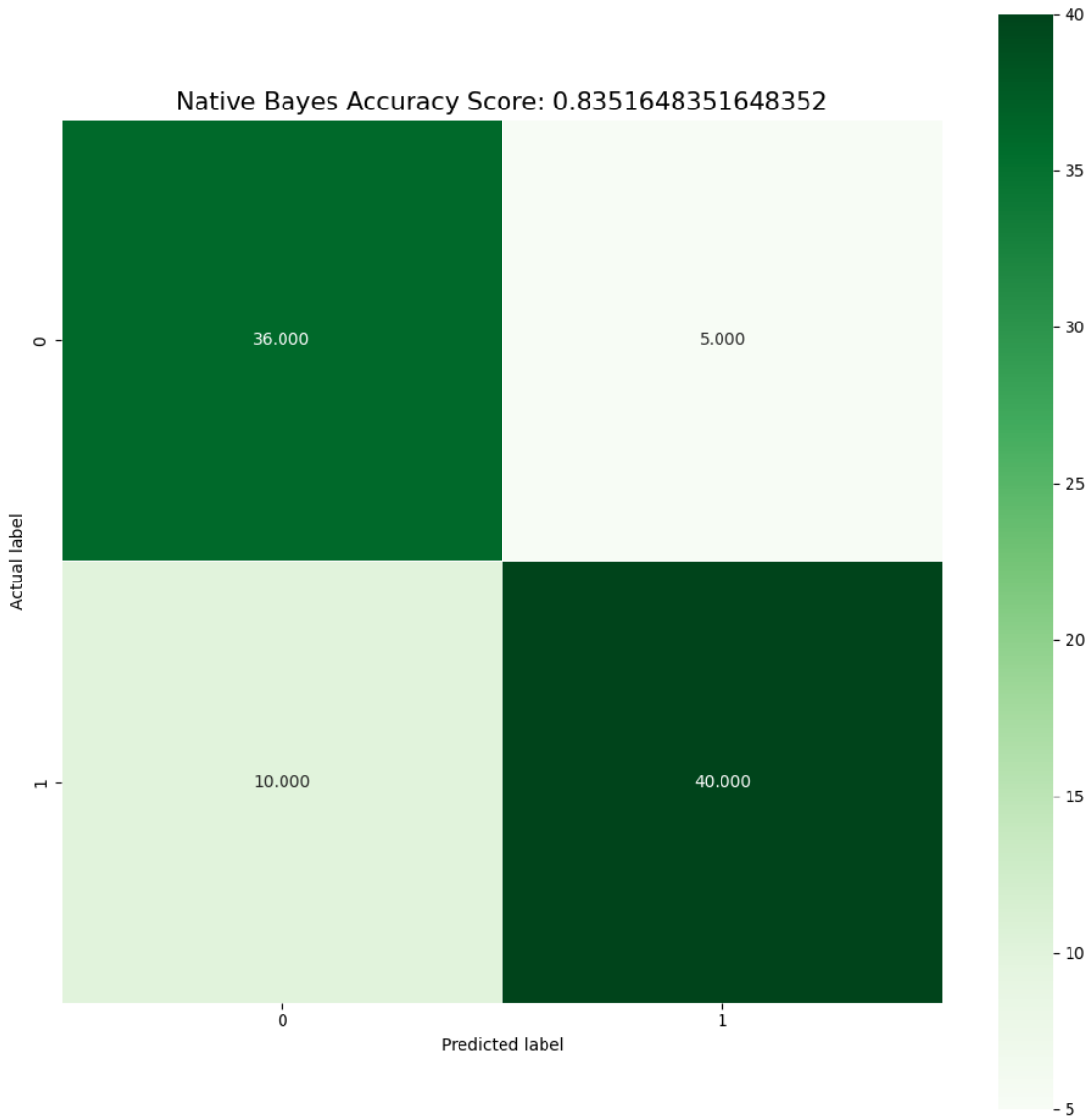
[ ]:
```
bayes_score = metrics.accuracy_score(y_test, bayes_pred)
print("Accuracy: ",bayes_score)
print("Report: ", metrics.classification_report(y_test, bayes_pred))
```

```
Accuracy:  0.8351648351648352
Report:                precision    recall  f1-score   support

           0       0.78      0.88      0.83        41
           1       0.89      0.80      0.84        50

    accuracy                           0.84        91
   macro avg       0.84      0.84      0.83        91
weighted avg       0.84      0.84      0.84        91
```

[ ]:
```
bayes_cm = metrics.confusion_matrix(y_test, bayes_pred)
plt.figure(figsize=(12,12))
sns.heatmap(bayes_cm,annot=True, fmt=".3f",linewidth=.
 ↪5,square=True,cmap='Greens')
plt.ylabel('Actual label')
```

```
plt.xlabel('Predicted label')
title = 'Native Bayes Accuracy Score: {0}'.format(bayes_score)
plt.title(title, size=15)
```

[ ]: Text(0.5, 1.0, 'Native Bayes Accuracy Score: 0.8351648351648352')



[ ]:
```
#Câu 10: So sánh kết quả các mô hình
# Độ chính xác của các thuật toán
# Thuật toán cây ID3: 72.53%
# Thuật toán CART: 72.53%
# Thuật toán cây Naive Bayes: 83.52%
# => thuật toán Naive Bayes cho độ chính xác tốt nhất
```