21522351_Tuan3_Cau4

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/winequality-red.csv')
```

[ ]:

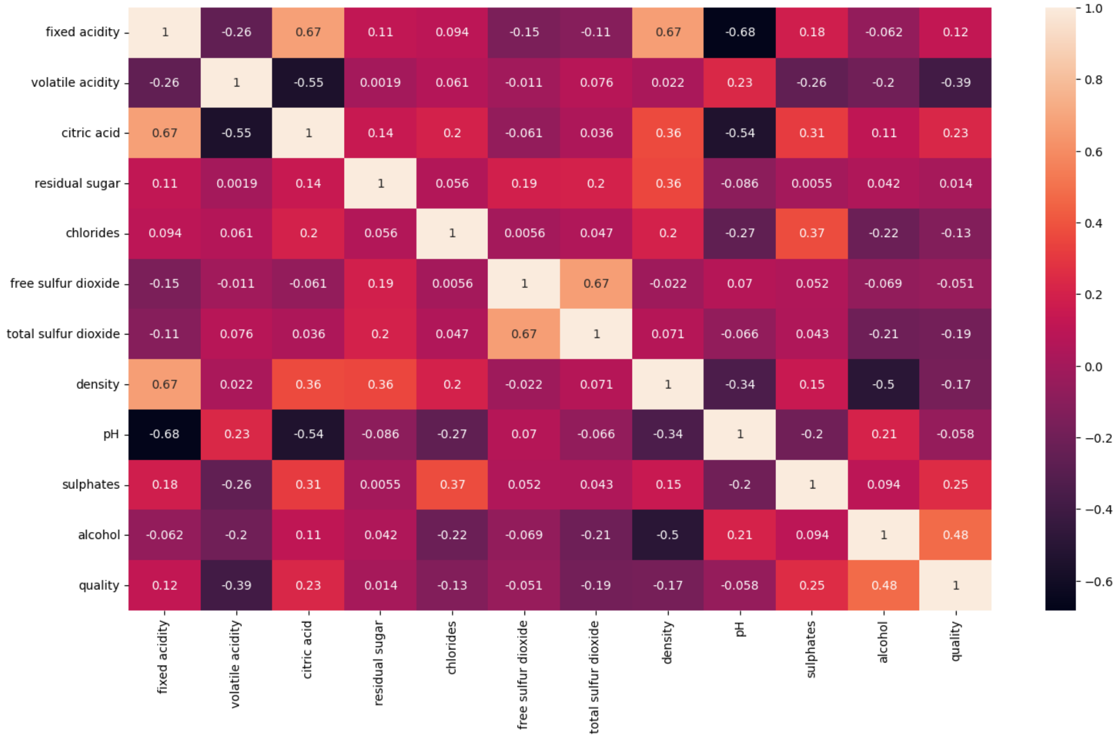
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1599 entries, 0 to 1598
Data columns (total 12 columns):
 #   Column                Non-Null Count  Dtype
---  ------                --------------  -----
 0   fixed acidity         1599 non-null   float64
 1   volatile acidity      1599 non-null   float64
 2   citric acid           1599 non-null   float64
 3   residual sugar        1599 non-null   float64
 4   chlorides             1599 non-null   float64
 5   free sulfur dioxide   1599 non-null   float64
 6   total sulfur dioxide  1599 non-null   float64
 7   density               1599 non-null   float64
 8   pH                    1599 non-null   float64
 9   sulphates             1599 non-null   float64
 10  alcohol               1599 non-null   float64
 11  quality               1599 non-null   int64
dtypes: float64(11), int64(1)
memory usage: 150.0 KB
```

[ ]:

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

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



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

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

```
[ ]: Index(['fixed acidity', 'volatile acidity', 'citric acid', 'residual sugar',
            'chlorides', 'free sulfur dioxide', 'total sulfur dioxide', 'density',
            'pH', 'sulphates', 'alcohol'],
           dtype='object')
```

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

```
[ ]:       fixed acidity_4.6  fixed acidity_4.7  fixed acidity_4.9  \
     0                 False              False              False
     1                 False              False              False
     2                 False              False              False
     3                 False              False              False
     4                 False              False              False
     …                   …                 …                 …
```

```
1594              False              False              False
1595              False              False              False
1596              False              False              False
1597              False              False              False
1598              False              False              False

      fixed acidity_5.0  fixed acidity_5.1  fixed acidity_5.2  \
0                 False              False              False
1                 False              False              False
2                 False              False              False
3                 False              False              False
4                 False              False              False
…                 …                …                …
1594              False              False              False
1595              False              False              False
1596              False              False              False
1597              False              False              False
1598              False              False              False

      fixed acidity_5.3  fixed acidity_5.4  fixed acidity_5.5  \
0                 False              False              False
1                 False              False              False
2                 False              False              False
3                 False              False              False
4                 False              False              False
…                 …                …                …
1594              False              False              False
1595              False              False              False
1596              False              False              False
1597              False              False              False
1598              False              False              False

      fixed acidity_5.6  …  alcohol_13.0  alcohol_13.1  alcohol_13.2  \
0                 False  …         False         False         False
1                 False  …         False         False         False
2                 False  …         False         False         False
3                 False  …         False         False         False
4                 False  …         False         False         False
…                 …  …           …           …           …
1594              False  …         False         False         False
1595              False  …         False         False         False
1596              False  …         False         False         False
1597              False  …         False         False         False
1598              False  …         False         False         False

      alcohol_13.3  alcohol_13.4  alcohol_13.5  alcohol_13.566666666666698  \
0            False         False         False                       False
```

```
1             False         False         False                             False
2             False         False         False                             False
3             False         False         False                             False
4             False         False         False                             False
…             …           …           …                         …
1594          False         False         False                             False
1595          False         False         False                             False
1596          False         False         False                             False
1597          False         False         False                             False
1598          False         False         False                             False

      alcohol_13.6  alcohol_14.0  alcohol_14.9
0             False         False         False
1             False         False         False
2             False         False         False
3             False         False         False
4             False         False         False
…             …           …           …
1594          False         False         False
1595          False         False         False
1596          False         False         False
1597          False         False         False
1598          False         False         False

[1599 rows x 1453 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)
```

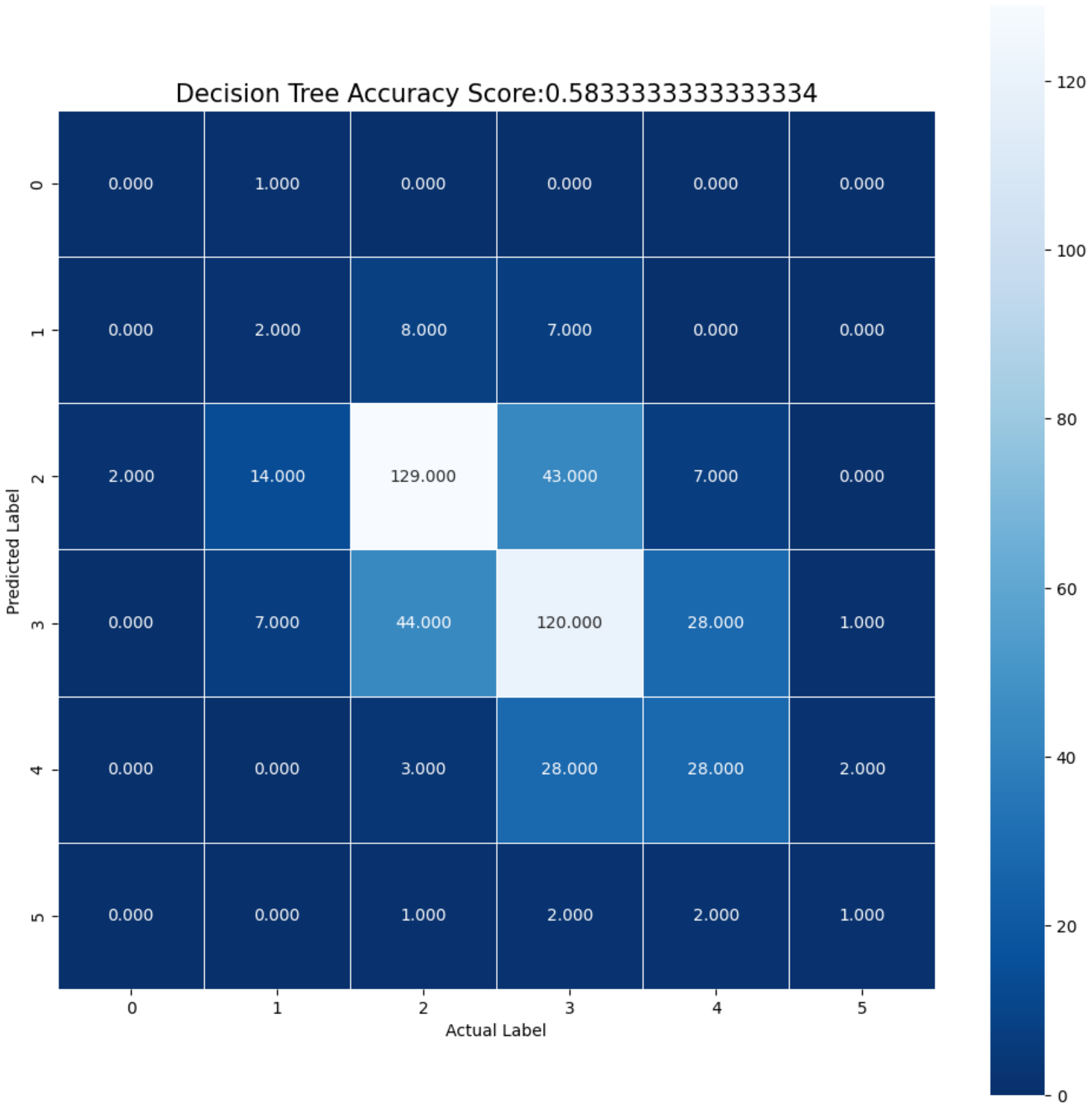
```
[ ]: tree_pred = clf.predict(x_test)

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

```
Accrurancy: 0.5833333333333334
Report:               precision    recall  f1-score   support

           3       0.00      0.00      0.00         1
           4       0.08      0.12      0.10        17
           5       0.70      0.66      0.68       195
           6       0.60      0.60      0.60       200
           7       0.43      0.46      0.44        61
           8       0.25      0.17      0.20         6

    accuracy                           0.58       480
   macro avg       0.34      0.33      0.34       480
weighted avg       0.59      0.58      0.59       480
```

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

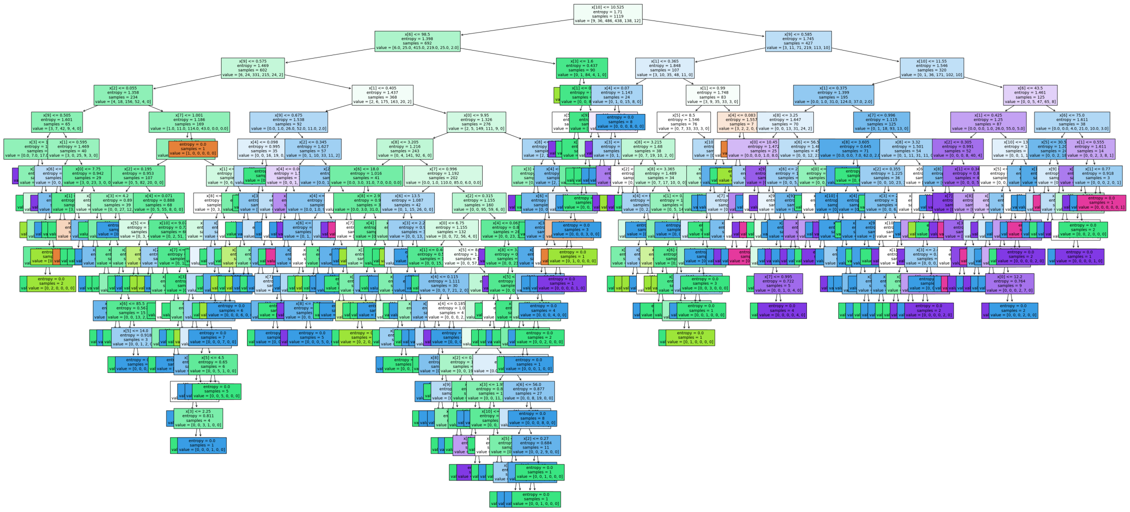
[ ]:
```
plt.figure(figsize=(12,12))
sns.heatmap(tree_cm,annot=True, fmt=".3f",linewidth=.
 ↪5,square=True,cmap='Blues_r')
plt.xlabel('Actual Label')
plt.ylabel('Predicted Label')
title ='Decision Tree Accuracy Score:{0}'.format(tree_score)
plt.title(title,size=15)
```

[ ]:
```
Text(0.5, 1.0, 'Decision Tree Accuracy Score:0.5833333333333334')
```



[ ]:

```
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))
```

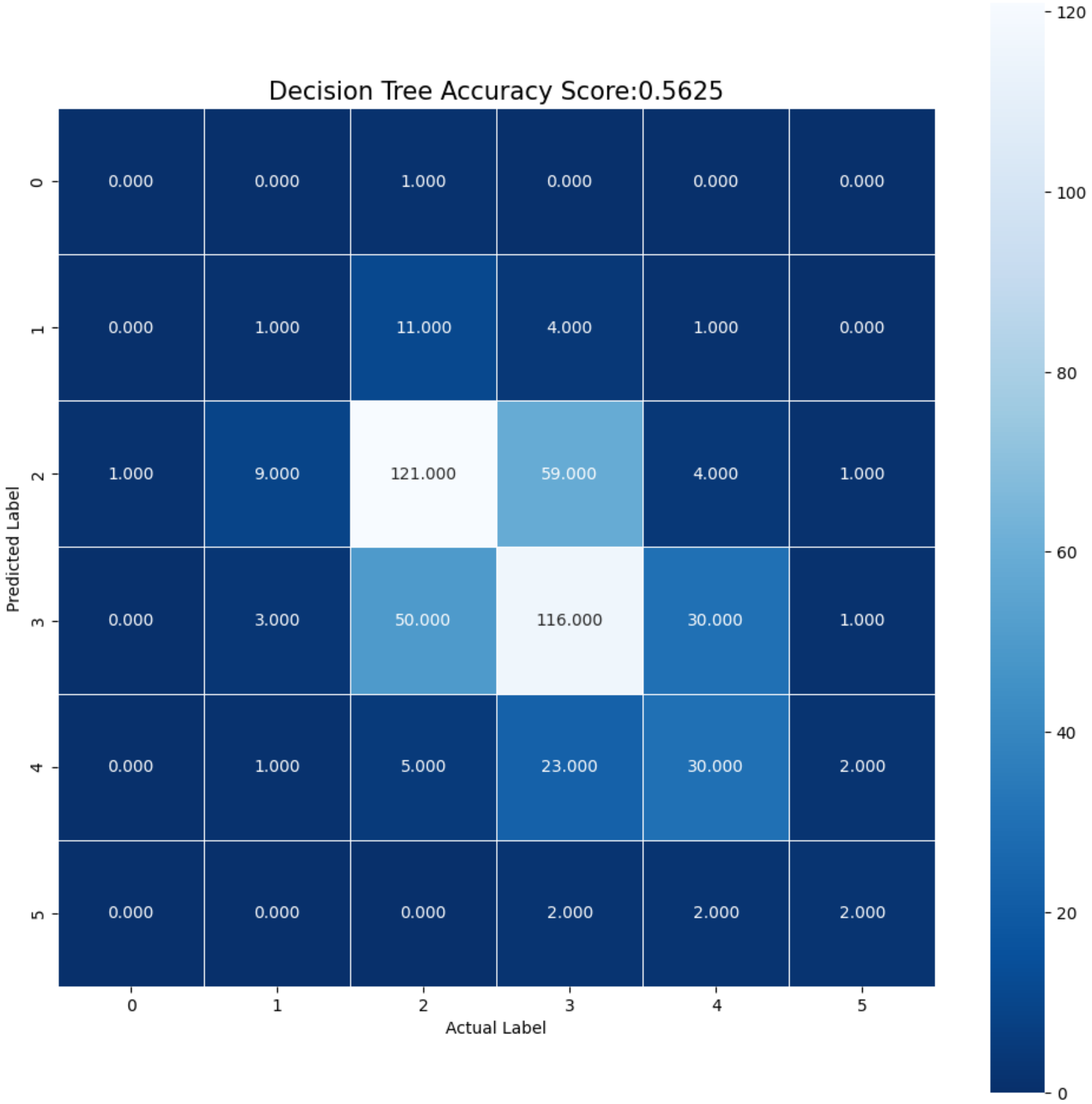
```
Accruracy: 0.5625
Report:               precision    recall  f1-score   support

           3       0.00      0.00      0.00         1
           4       0.07      0.06      0.06        17
           5       0.64      0.62      0.63       195
           6       0.57      0.58      0.57       200
           7       0.45      0.49      0.47        61
           8       0.33      0.33      0.33         6

    accuracy                           0.56       480
   macro avg       0.34      0.35      0.35       480
weighted avg       0.56      0.56      0.56       480
```

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

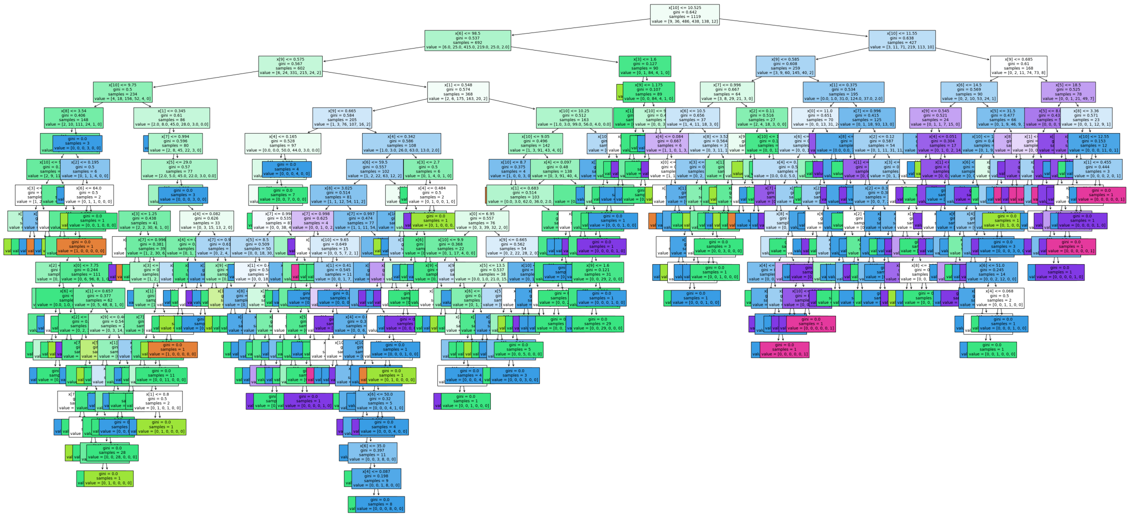
```
[ ]: plt.figure(figsize=(12,12))
```

```
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:0.5625')
```



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



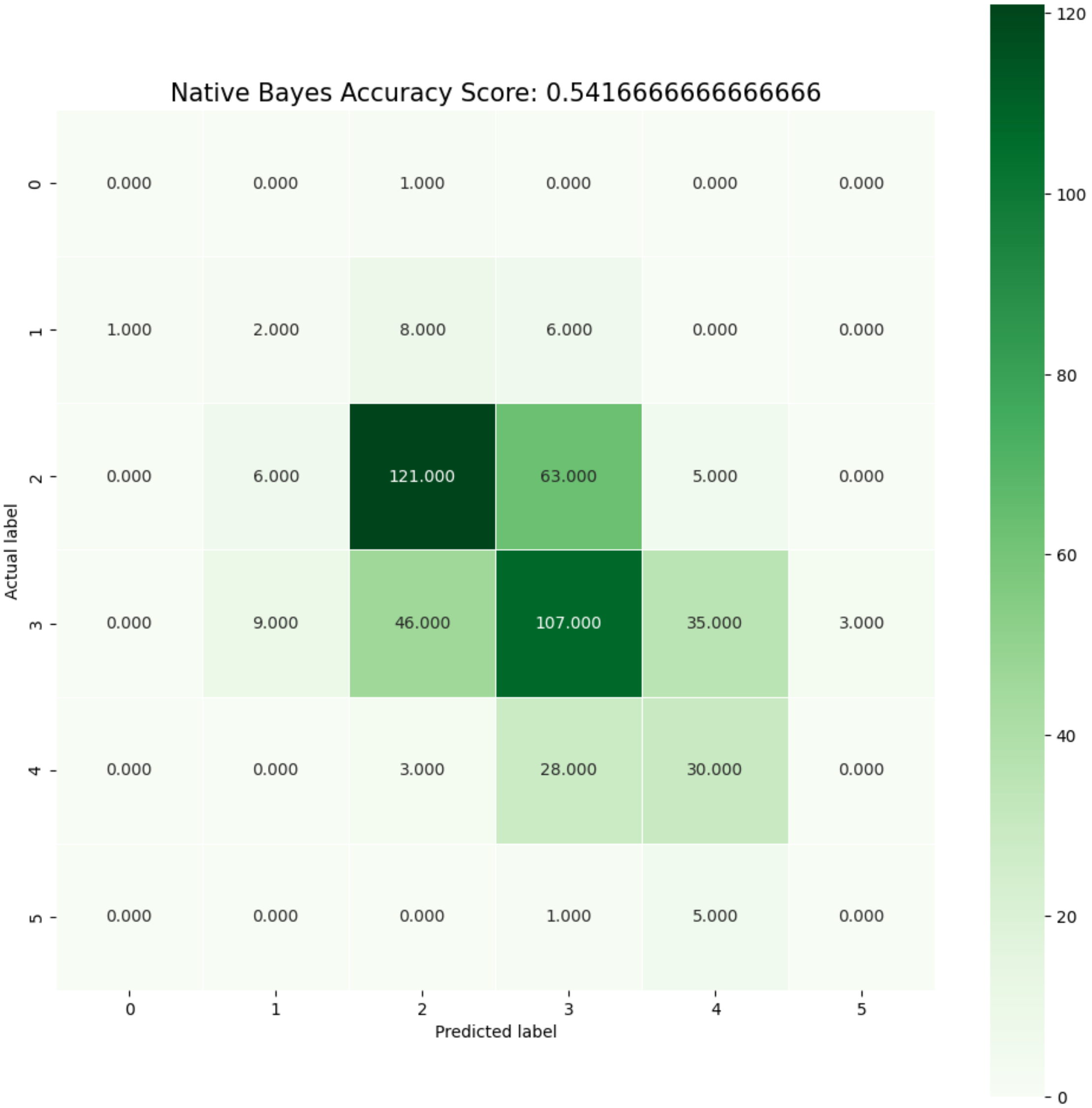
```
[ ]: #câu 9
     gnb = GaussianNB()
     bayes_pred = gnb.fit(x_train, y_train).predict(x_test)
```

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

```
Accuracy:  0.5416666666666666
Report:                precision    recall  f1-score   support

           3       0.00      0.00      0.00         1
           4       0.12      0.12      0.12        17
           5       0.68      0.62      0.65       195
           6       0.52      0.54      0.53       200
           7       0.40      0.49      0.44        61
           8       0.00      0.00      0.00         6

    accuracy                           0.54       480
   macro avg       0.29      0.29      0.29       480
weighted avg       0.55      0.54      0.54       480
```

```
[ ]: 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: 0.5416666666666666')
```



```
[ ]: #Câu 10: So sánh kết quả các mô hình
     # Độ chính xác của các thuật toán
     # Thuật toán cây ID3: 58.34%
     # Thuật toán CART: 56.25%
     # Thuật toán cây Naive Bayes: 54.167%
     # => thuật toán ID3 cho độ chính xác tốt nhất
```