Assignment N0. 6

Aim : Data Analytics III

1. Implement Simple Naïve Bayes classification algorithm using Python/R on iris.csv dataset.
2. Compute Confusion matrix to find TP, FP, TN, FN, Accuracy, Error rate, Precision, Recall on the given dataset.

Code :

In [6]:
```
1 import pandas as pd
2 import matplotlib.pyplot as plt
```

In [11]:
```
1 data = pd.read_csv("https://raw.githubusercontent.com/plotly/datasets/master/iris-data.csv")
2 data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 150 entries, 0 to 149
Data columns (total 5 columns):
 #   Column        Non-Null Count  Dtype  
---  ------        --------------  -----  
 0   sepal length  150 non-null    float64
 1   sepal width   150 non-null    float64
 2   petal length  150 non-null    float64
 3   petal width   150 non-null    float64
 4   class         150 non-null    object 
dtypes: float64(4), object(1)
memory usage: 6.0+ KB
```

In [12]:
```
1 data.shape
```

Out[12]: (150, 5)

In [13]:
```
1 data.head()
```

Out[13]:

	sepal length	sepal width	petal length	petal width	class
0	5.1	3.5	1.4	0.2	Iris-setosa
1	4.9	3.0	1.4	0.2	Iris-setosa
2	4.7	3.2	1.3	0.2	Iris-setosa
3	4.6	3.1	1.5	0.2	Iris-setosa
4	5.0	3.6	1.4	0.2	Iris-setosa

In [14]:
```
1 data.tail()
```

Out[14]:

	sepal length	sepal width	petal length	petal width	class
145	6.7	3.0	5.2	2.3	Iris-virginica
146	6.3	2.5	5.0	1.9	Iris-virginica
147	6.5	3.0	5.2	2.0	Iris-virginica
148	6.2	3.4	5.4	2.3	Iris-virginica
149	5.9	3.0	5.1	1.8	Iris-virginica

In [15]:
```
1 data.describe()
```

Out[15]:

	sepal length	sepal width	petal length	petal width
count	150.000000	150.000000	150.000000	150.000000
mean	5.843333	3.054000	3.758667	1.198667
std	0.828066	0.433594	1.764420	0.763161
min	4.300000	2.000000	1.000000	0.100000
25%	5.100000	2.800000	1.600000	0.300000
50%	5.800000	3.000000	4.350000	1.300000
75%	6.400000	3.300000	5.100000	1.800000
max	7.900000	4.400000	6.900000	2.500000

In [16]:
```
1 data.isnull().sum()
```

Out[16]:
```
sepal length    0
sepal width     0
petal length    0
petal width     0
class           0
dtype: int64
```

In [17]:
```
1 X = data.drop(['class'], axis=1)
2 y = data.drop(['sepal length',  'sepal width',  'petal length',  'petal width'], axis=1)
3 print(X)
4 print(y)
5 print(X.shape)
6 print(y.shape)
```

```
     sepal length  sepal width  petal length  petal width
0             5.1          3.5           1.4          0.2
1             4.9          3.0           1.4          0.2
2             4.7          3.2           1.3          0.2
3             4.6          3.1           1.5          0.2
4             5.0          3.6           1.4          0.2
..            ...          ...           ...          ...
145           6.7          3.0           5.2          2.3
146           6.3          2.5           5.0          1.9
147           6.5          3.0           5.2          2.0
148           6.2          3.4           5.4          2.3
149           5.9          3.0           5.1          1.8

[150 rows x 4 columns]
              class
0       Iris-setosa
1       Iris-setosa
2       Iris-setosa
3       Iris-setosa
4       Iris-setosa
..              ...
145  Iris-virginica
146  Iris-virginica
147  Iris-virginica
148  Iris-virginica
149  Iris-virginica

[150 rows x 1 columns]
(150, 4)
(150, 1)
```

In [18]:
```
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, shuffle=True)
print(X_train.shape)
print(X_test.shape)
print(y_train.shape)
print(y_test.shape)
```

```
(120, 4)
(30, 4)
(120, 1)
(30, 1)
```

In [19]:
```
from sklearn.naive_bayes import GaussianNB
model = GaussianNB()
model.fit(X_train, y_train)
```

```
C:\Users\Welcome\anaconda3\Lib\site-packages\sklearn\utils\validation.py:1143: DataConversionWarni
ng: A column-vector y was passed when a 1d array was expected. Please change the shape of y to (n_
samples, ), for example using ravel().
  y = column_or_1d(y, warn=True)
```

Out[19]:

▾ GaussianNB

GaussianNB()

In [20]:
```
y_pred = model.predict(X_test)
model.score(X_test,y_test)
```

Out[20]: 0.9333333333333333

In [21]:
```
y_pred
```

Out[21]:
```
array(['Iris-setosa', 'Iris-virginica', 'Iris-versicolor',
       'Iris-virginica', 'Iris-virginica', 'Iris-setosa',
       'Iris-versicolor', 'Iris-versicolor', 'Iris-setosa',
       'Iris-versicolor', 'Iris-virginica', 'Iris-setosa',
       'Iris-virginica', 'Iris-virginica', 'Iris-virginica',
       'Iris-versicolor', 'Iris-virginica', 'Iris-setosa',
       'Iris-versicolor', 'Iris-virginica', 'Iris-versicolor',
       'Iris-virginica', 'Iris-setosa', 'Iris-setosa', 'Iris-virginica',
       'Iris-virginica', 'Iris-virginica', 'Iris-virginica',
       'Iris-virginica', 'Iris-virginica'], dtype='<U15')
```

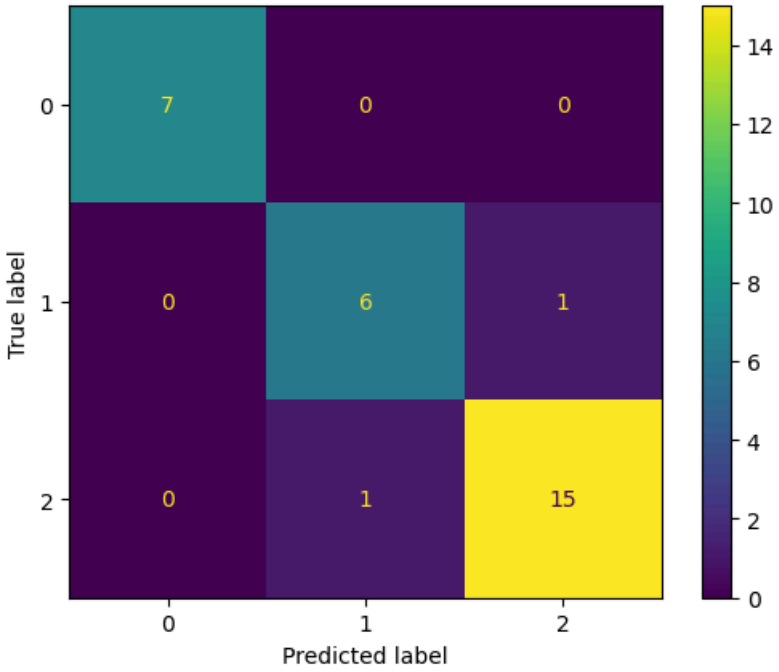
In [23]:
```
from sklearn.metrics import accuracy_score, confusion_matrix, ConfusionMatrixDisplay
print(accuracy_score(y_test, y_pred))
```

```
0.9333333333333333
```

In [24]:
```
cm = confusion_matrix(y_test, y_pred)
disp = ConfusionMatrixDisplay(confusion_matrix = cm)
print("Confusion matrix:")
print(cm)
```

```
Confusion matrix:
[[ 7  0  0]
 [ 0  6  1]
 [ 0  1 15]]
```

In [25]:
```
disp.plot()
plt.show()
```



In [26]:
```
def get_confusion_matrix_values(y_true, y_pred):
    cm = confusion_matrix(y_true, y_pred)
    return(cm[0][0], cm[0][1], cm[1][0], cm[1][1])

TP, FP, FN, TN = get_confusion_matrix_values(y_test, y_pred)
print("TP: ", TP)
print("FP: ", FP)
print("FN: ", FN)
print("TN: ", TN)
```

```
TP:  7
FP:  0
FN:  0
TN:  6
```

In [27]:
```
print("The Accuracy is ", (TP+TN)/(TP+TN+FP+FN))
print("The precision is ", TP/(TP+FP))
print("The recall is ", TP/(TP+FN))
```

```
The Accuracy is  1.0
The precision is  1.0
The recall is  1.0
```

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