In [1]:
```
import warnings
warnings.filterwarnings("ignore")

import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
```

In [2]:
```
path = "https://archive.ics.uci.edu/ml/machine-learning-databases/iris/iris.data"
colname = ["Sepal Length", "Sepal Width", "Petal Length", "Petal Width", "Class"]
df = pd.read_csv(path, header=None, names=colname)
df.head()
```

Out[2]:

	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 [3]:
```
df.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 [4]:
```
df.describe()
```

Out[4]:

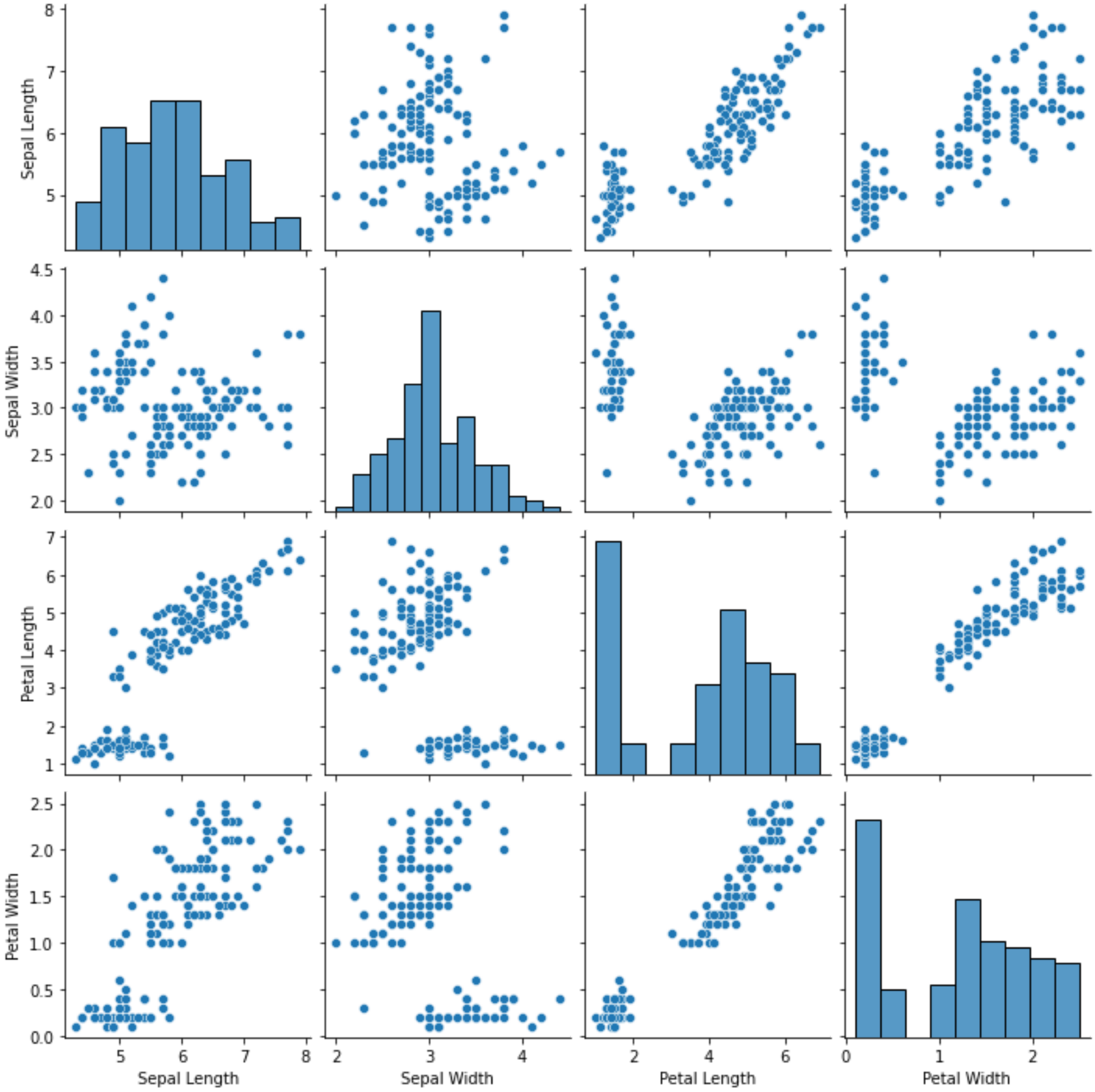
	Sepal Length	Sepal Width	Petal Length	Petal Width
count	150.000000	150.000000	150.000000	150.000000
mean	5.843333	3.054000	3.758667	1.198667
std	0.828066	0.433594	1.764420	0.763161
min	4.300000	2.000000	1.000000	0.100000
25%	5.100000	2.800000	1.600000	0.300000
50%	5.800000	3.000000	4.350000	1.300000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

In [5]:

```
sns.pairplot(df)
```

Out[5]:

```
<seaborn.axisgrid.PairGrid at 0x12773d265e0>
```

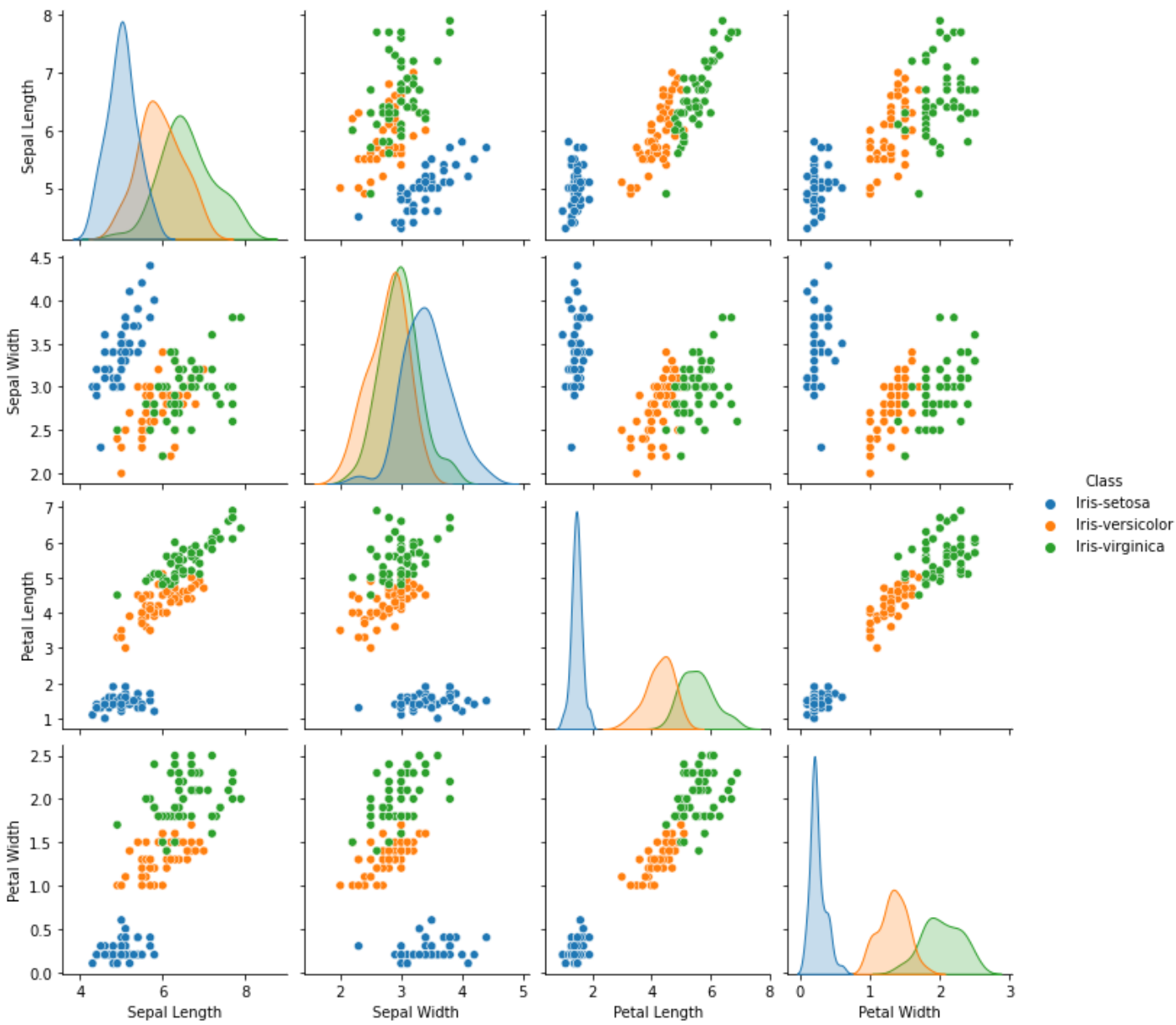


In [6]:

```
sns.pairplot(data=df, hue="Class")
```

Out[6]:

```
<seaborn.axisgrid.PairGrid at 0x12773d38eb0>
```



In [7]:
```
df.Class
```

Out[7]:
```
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
Name: Class, Length: 150, dtype: object
```

In [8]:
```
df.groupby("Class").size()
```

Out[8]:
```
Class
Iris-setosa        50
Iris-versicolor    50
Iris-virginica     50
dtype: int64
```

In [9]:
```
x = df.iloc[:, :-1]
```

```
y = df.iloc[:, -1]
```

In [11]:
```
from sklearn.preprocessing import LabelEncoder
le = LabelEncoder()
y = le.fit_transform(y)
```

In [12]:
```
y
```

Out[12]:
```
array([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
       1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
       1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 2, 2, 2, 2, 2, 2, 2, 2, 2,
       2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2,
       2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2], dtype=int64)
```

In [13]:
```
from sklearn.model_selection import train_test_split
xtrain, xtest, ytrain, ytest = train_test_split(x,y, test_size=0.3,
                                                random_state=1)
```

In [14]:
```
from sklearn.svm import SVC
svm = SVC()
svm.fit(xtrain, ytrain)
ypred = svm.predict(xtest)
```

In [15]:
```
from sklearn.metrics import classification_report
print(classification_report(ytest, ypred))
```

```
              precision    recall  f1-score   support

           0       1.00      1.00      1.00        14
           1       1.00      0.94      0.97        18
           2       0.93      1.00      0.96        13

    accuracy                           0.98        45
   macro avg       0.98      0.98      0.98        45
weighted avg       0.98      0.98      0.98        45
```

In [16]:
```
train = svm.score(xtrain, ytrain)
test = svm.score(xtest, ytest)

print(f"Training Accuracy : {train}\nTesting Accuracy : {test}")
```

```
Training Accuracy : 0.9619047619047619
Testing Accuracy : 0.9777777777777777
```

In [19]:
```
from sklearn.pipeline import Pipeline
from sklearn.preprocessing import StandardScaler
from sklearn.svm import SVC
```

In [20]:
```
pipe = Pipeline(
    steps=[
        ("scaler", StandardScaler()),
        ("svm", SVC())
    ]
)
```

In [21]:
```
pipe.fit(xtrain, ytrain)
ypred = pipe.predict(xtest)
```

In [22]:
```
from sklearn.metrics import classification_report
print(classification_report(ytest, ypred))
```

```
              precision    recall  f1-score   support

           0       1.00      1.00      1.00        14
           1       0.94      0.94      0.94        18
           2       0.92      0.92      0.92        13

    accuracy                           0.96        45
   macro avg       0.96      0.96      0.96        45
weighted avg       0.96      0.96      0.96        45
```

In [23]:
```
train = pipe.score(xtrain, ytrain)
test = pipe.score(xtest, ytest)

print(f"Training Accuracy : {train}\nTesting Accuracy : {test}")
```

```
Training Accuracy : 0.9809523809523809
Testing Accuracy : 0.9555555555555556
```

In [25]:
```
from sklearn.model_selection import GridSearchCV
```

In [26]:
```
parameter = {
    "C": [0.1, 1, 10],
    "gamma": [0.1, 0.01, 0.001],
    "kernel": ["rbf"]
}
```

In [28]:
```
grid = GridSearchCV(SVC(), parameter, verbose=3)
grid.fit(xtrain, ytrain)
```

```
Fitting 5 folds for each of 9 candidates, totalling 45 fits
[CV 1/5] END ......C=0.1, gamma=0.1, kernel=rbf;, score=0.905 total time=   0.0s
[CV 2/5] END ......C=0.1, gamma=0.1, kernel=rbf;, score=0.952 total time=   0.0s
[CV 3/5] END ......C=0.1, gamma=0.1, kernel=rbf;, score=0.905 total time=   0.0s
[CV 4/5] END ......C=0.1, gamma=0.1, kernel=rbf;, score=0.857 total time=   0.0s
[CV 5/5] END ......C=0.1, gamma=0.1, kernel=rbf;, score=0.810 total time=   0.0s
[CV 1/5] END .....C=0.1, gamma=0.01, kernel=rbf;, score=0.714 total time=   0.0s
[CV 2/5] END .....C=0.1, gamma=0.01, kernel=rbf;, score=0.714 total time=   0.0s
[CV 3/5] END .....C=0.1, gamma=0.01, kernel=rbf;, score=0.714 total time=   0.0s
[CV 4/5] END .....C=0.1, gamma=0.01, kernel=rbf;, score=0.667 total time=   0.0s
[CV 5/5] END .....C=0.1, gamma=0.01, kernel=rbf;, score=0.667 total time=   0.0s
[CV 1/5] END ....C=0.1, gamma=0.001, kernel=rbf;, score=0.714 total time=   0.0s
[CV 2/5] END ....C=0.1, gamma=0.001, kernel=rbf;, score=0.714 total time=   0.0s
[CV 3/5] END ....C=0.1, gamma=0.001, kernel=rbf;, score=0.333 total time=   0.0s
[CV 4/5] END ....C=0.1, gamma=0.001, kernel=rbf;, score=0.333 total time=   0.0s
[CV 5/5] END ....C=0.1, gamma=0.001, kernel=rbf;, score=0.333 total time=   0.0s
[CV 1/5] END ........C=1, gamma=0.1, kernel=rbf;, score=1.000 total time=   0.0s
[CV 2/5] END ........C=1, gamma=0.1, kernel=rbf;, score=0.952 total time=   0.0s
[CV 3/5] END ........C=1, gamma=0.1, kernel=rbf;, score=1.000 total time=   0.0s
[CV 4/5] END ........C=1, gamma=0.1, kernel=rbf;, score=0.905 total time=   0.0s
[CV 5/5] END ........C=1, gamma=0.1, kernel=rbf;, score=0.952 total time=   0.0s
[CV 1/5] END .......C=1, gamma=0.01, kernel=rbf;, score=0.952 total time=   0.0s
```

```
[CV 2/5] END .......C=1, gamma=0.01, kernel=rbf;, score=0.952 total time=   0.0s
[CV 3/5] END .......C=1, gamma=0.01, kernel=rbf;, score=0.905 total time=   0.0s
[CV 4/5] END .......C=1, gamma=0.01, kernel=rbf;, score=0.905 total time=   0.0s
[CV 5/5] END .......C=1, gamma=0.01, kernel=rbf;, score=0.857 total time=   0.0s
[CV 1/5] END ......C=1, gamma=0.001, kernel=rbf;, score=0.714 total time=   0.0s
[CV 2/5] END ......C=1, gamma=0.001, kernel=rbf;, score=0.714 total time=   0.0s
[CV 3/5] END ......C=1, gamma=0.001, kernel=rbf;, score=0.714 total time=   0.0s
[CV 4/5] END ......C=1, gamma=0.001, kernel=rbf;, score=0.667 total time=   0.0s
[CV 5/5] END ......C=1, gamma=0.001, kernel=rbf;, score=0.667 total time=   0.0s
[CV 1/5] END .......C=10, gamma=0.1, kernel=rbf;, score=1.000 total time=   0.0s
[CV 2/5] END .......C=10, gamma=0.1, kernel=rbf;, score=0.952 total time=   0.0s
[CV 3/5] END .......C=10, gamma=0.1, kernel=rbf;, score=1.000 total time=   0.0s
[CV 4/5] END .......C=10, gamma=0.1, kernel=rbf;, score=0.952 total time=   0.0s
[CV 5/5] END .......C=10, gamma=0.1, kernel=rbf;, score=0.952 total time=   0.0s
[CV 1/5] END ......C=10, gamma=0.01, kernel=rbf;, score=1.000 total time=   0.0s
[CV 2/5] END ......C=10, gamma=0.01, kernel=rbf;, score=0.952 total time=   0.0s
[CV 3/5] END ......C=10, gamma=0.01, kernel=rbf;, score=1.000 total time=   0.0s
[CV 4/5] END ......C=10, gamma=0.01, kernel=rbf;, score=0.952 total time=   0.0s
[CV 5/5] END ......C=10, gamma=0.01, kernel=rbf;, score=0.952 total time=   0.0s
[CV 1/5] END .....C=10, gamma=0.001, kernel=rbf;, score=0.952 total time=   0.0s
[CV 2/5] END .....C=10, gamma=0.001, kernel=rbf;, score=0.952 total time=   0.0s
[CV 3/5] END .....C=10, gamma=0.001, kernel=rbf;, score=0.905 total time=   0.0s
[CV 4/5] END .....C=10, gamma=0.001, kernel=rbf;, score=0.905 total time=   0.0s
[CV 5/5] END .....C=10, gamma=0.001, kernel=rbf;, score=0.857 total time=   0.0s
```

Out[28]:
```
GridSearchCV(estimator=SVC(),
             param_grid={'C': [0.1, 1, 10], 'gamma': [0.1, 0.01, 0.001],
                         'kernel': ['rbf']},
             verbose=3)
```

In [29]:
```
grid.best_params_
```

Out[29]:
```
{'C': 10, 'gamma': 0.1, 'kernel': 'rbf'}
```

In [30]:
```
grid.best_score_
```

Out[30]:
```
0.9714285714285715
```

In [31]:
```
grid.best_estimator_
```

Out[31]:
```
SVC(C=10, gamma=0.1)
```

In [ ]:
```
svm=SVC(C=10,gamma=0.1)
svm.fit(xtrain, ytrain)
ypred = svm.predict(xtest)
```

In [32]:
```
svm = grid.best_estimator_
svm.fit(xtrain, ytrain)
ypred = svm.predict(xtest)
```

In [33]:
```
from sklearn.metrics import classification_report
print(classification_report(ytest, ypred))
```

```
              precision    recall  f1-score   support

           0       1.00      1.00      1.00        14
           1       1.00      1.00      1.00        18
           2       1.00      1.00      1.00        13
```

```
    accuracy                           1.00        45
   macro avg       1.00      1.00      1.00        45
weighted avg       1.00      1.00      1.00        45
```

In [34]:

```
train = svm.score(xtrain, ytrain)
test = svm.score(xtest, ytest)

print(f"Training Accuracy : {train}\nTesting Accuracy : {test}")
```

```
Training Accuracy : 0.9809523809523809
Testing Accuracy : 1.0
```

In [ ]: