```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.model_selection import train_test_split
from sklearn.svm import SVC
from sklearn.metrics import confusion_matrix
from sklearn.metrics import accuracy_score
from sklearn.metrics import classification_report

df=pd.read_csv('/content/Salary_Data.csv')
df
```

```
{"summary":"{\n  \"name\": \"df\",\n  \"rows\": 30,\n  \"fields\": [\n
{\n      \"column\": \"YearsExperience\",\n      \"properties\": {\n
\"dtype\": \"number\",\n        \"std\": 2.8378881576627184,\n
\"min\": 1.1,\n        \"max\": 10.5,\n        \"num_unique_values\":
28,\n        \"samples\": [\n          3.9,\n          9.6,\n
3.7\n        ],\n        \"semantic_type\": \"\",\n
\"description\": \"\"\n      }\n    },\n    {\n      \"column\":
\"Salary\",\n      \"properties\": {\n        \"dtype\": \"number\",\n
\"std\": 27414.4297845823,\n        \"min\": 37731.0,\n
\"max\": 122391.0,\n        \"num_unique_values\": 30,\n
\"samples\": [\n          112635.0,\n          67938.0,\n
113812.0\n        ],\n        \"semantic_type\": \"\",\n
\"description\": \"\"\n      }\n    }\n  ]\
n}","type":"dataframe","variable_name":"df"}
```

```
df.head()
```

```
{"summary":"{\n  \"name\": \"df\",\n  \"rows\": 30,\n  \"fields\": [\n
{\n      \"column\": \"YearsExperience\",\n      \"properties\": {\n
\"dtype\": \"number\",\n        \"std\": 2.8378881576627184,\n
\"min\": 1.1,\n        \"max\": 10.5,\n        \"num_unique_values\":
28,\n        \"samples\": [\n          3.9,\n          9.6,\n
3.7\n        ],\n        \"semantic_type\": \"\",\n
\"description\": \"\"\n      }\n    },\n    {\n      \"column\":
\"Salary\",\n      \"properties\": {\n        \"dtype\": \"number\",\n
\"std\": 27414.4297845823,\n        \"min\": 37731.0,\n
\"max\": 122391.0,\n        \"num_unique_values\": 30,\n
\"samples\": [\n          112635.0,\n          67938.0,\n
113812.0\n        ],\n        \"semantic_type\": \"\",\n
\"description\": \"\"\n      }\n    }\n  ]\
n}","type":"dataframe","variable_name":"df"}
```

```
df.tail()
```

```
{"summary":"{\n  \"name\": \"df\",\n  \"rows\": 5,\n  \"fields\": [\n
{\n      \"column\": \"YearsExperience\",\n      \"properties\": {\n
\"dtype\": \"number\",\n        \"std\": 0.6140032573203502,\n
\"min\": 9.0,\n        \"max\": 10.5,\n        \"num_unique_values\":
```

```
5,\n        \"samples\": [\n          9.5,\n          10.5,\n
9.6\n        ],\n        \"semantic_type\": \"\",\n
\"description\": \"\"\n      }\n    },\n    {\n      \"column\":
\"Salary\",\n      \"properties\": {\n        \"dtype\": \"number\",\n
\"std\": 7001.097321134738,\n        \"min\": 105582.0,\n
\"max\": 122391.0,\n        \"num_unique_values\": 5,\n
\"samples\": [\n          116969.0,\n          121872.0,\n
112635.0\n        ],\n        \"semantic_type\": \"\",\n
\"description\": \"\"\n      }\n    }\n  ]\n}","type":"dataframe"}
```


```
df.info()
```

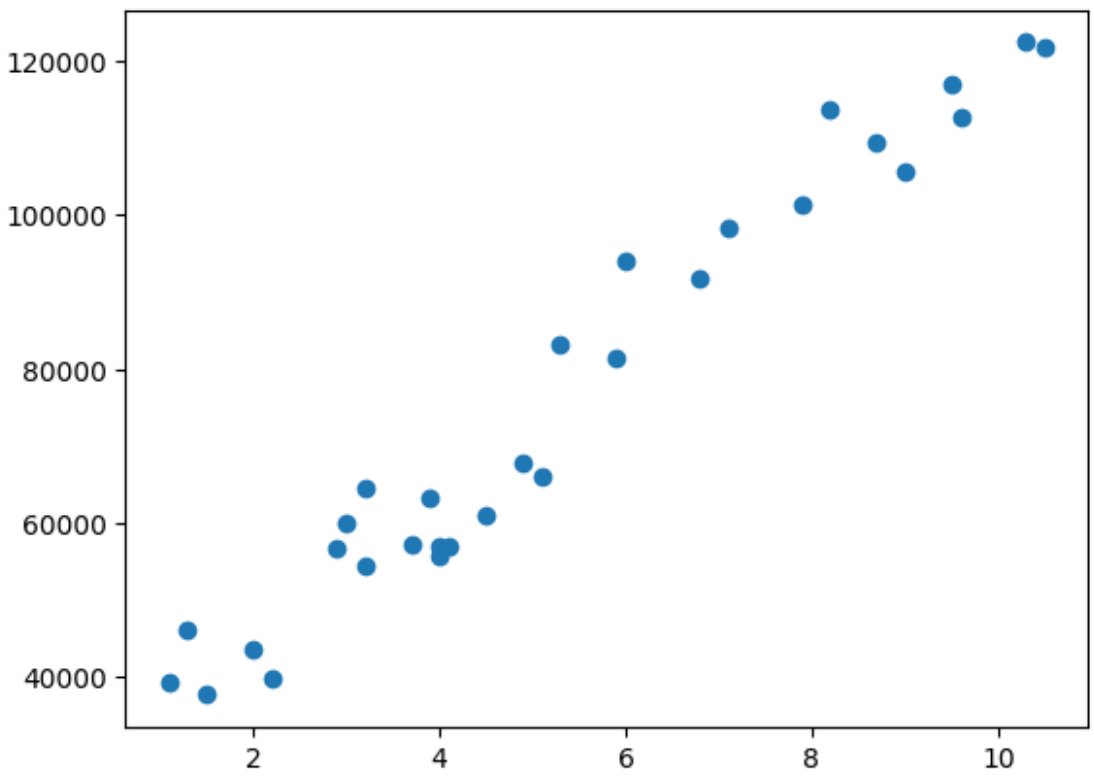
```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 30 entries, 0 to 29
Data columns (total 2 columns):
 #   Column           Non-Null Count  Dtype
---  ------           --------------  -----
 0   YearsExperience  30 non-null     float64
 1   Salary           30 non-null     float64
dtypes: float64(2)
memory usage: 608.0 bytes
```

```
df.isnull().sum()
```

```
YearsExperience    0
Salary             0
dtype: int64
```

```
plt.scatter(df['YearsExperience'],df['Salary'])
```

```
<matplotlib.collections.PathCollection at 0x7c56aca69db0>
```




```
X=df['YearsExperience']
y=df['Salary']
X
```

```
0      1.1
1      1.3
2      1.5
3      2.0
4      2.2
5      2.9
6      3.0
7      3.2
8      3.2
9      3.7
10     3.9
11     4.0
12     4.0
13     4.1
14     4.5
15     4.9
16     5.1
17     5.3
18     5.9
19     6.0
20     6.8
```

```
21     7.1
22     7.9
23     8.2
24     8.7
25     9.0
26     9.5
27     9.6
28    10.3
29    10.5
Name: YearsExperience, dtype: float64
```

```
y
```

```
0      39343.0
1      46205.0
2      37731.0
3      43525.0
4      39891.0
5      56642.0
6      60150.0
7      54445.0
8      64445.0
9      57189.0
10     63218.0
11     55794.0
12     56957.0
13     57081.0
14     61111.0
15     67938.0
16     66029.0
17     83088.0
18     81363.0
19     93940.0
20     91738.0
21     98273.0
22    101302.0
23    113812.0
24    109431.0
25    105582.0
26    116969.0
27    112635.0
28    122391.0
29    121872.0
Name: Salary, dtype: float64
```

```
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,rando
m_state=0)
```

```
X_train.shape
```

```
(24,)
```

```
X_test.shape
```

```
(6,)
```

```
y_train.shape
```

```
(24,)
```

```
y_test.shape
```

```
(6,)
```

```
from sklearn.svm import SVC
import numpy as np
model = SVC(kernel='linear')
model.fit(X_train.values.reshape(-1, 1), y_train.values)
```

```
SVC(kernel='linear')
```

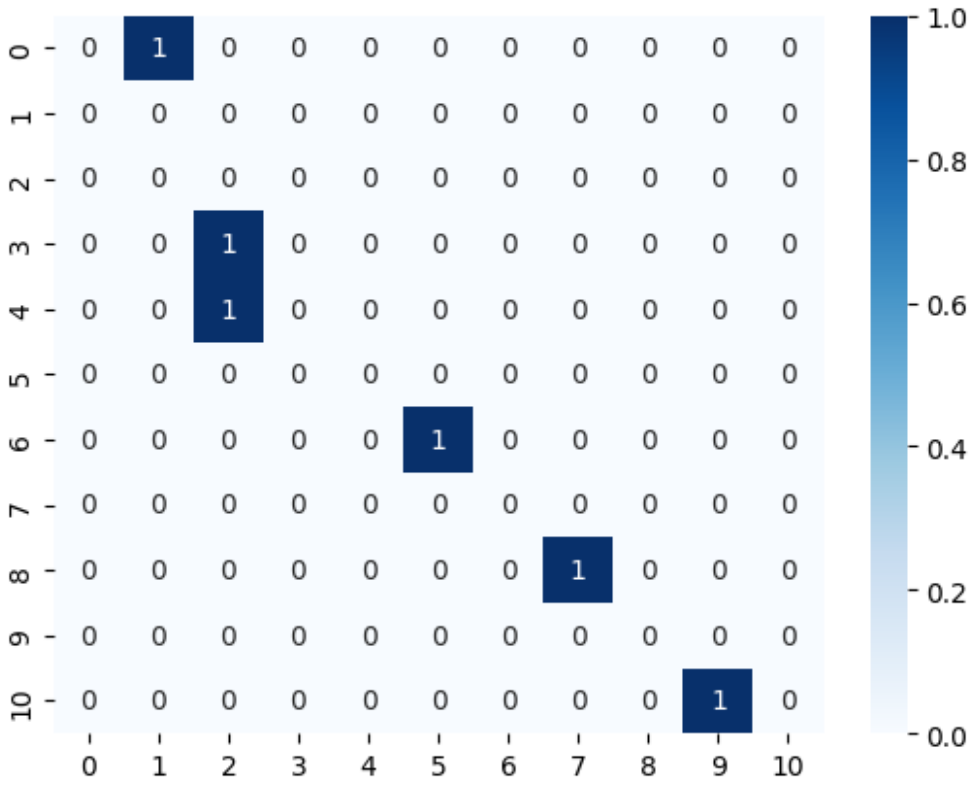
```
y_pred = model.predict(X_test.values.reshape(-1, 1))
```

```
from sklearn.metrics import accuracy_score
accuracy=accuracy_score(y_test,y_pred)
print(f'Accuracy: {accuracy:.2f}')
```

```
Accuracy: 0.00
```

```
cm=confusion_matrix(y_test,y_pred)
sns.heatmap(cm,annot=True,cmap='Blues')
print(cm)
```

```
[[0 1 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 0 0 0 0 0 0 0 0]
 [0 0 1 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 0 0 0 0 0]
 [0 0 0 0 0 0 0 0 0 0 0]
 [0 0 0 0 0 0 0 1 0 0 0]
 [0 0 0 0 0 0 0 0 0 0 0]
 [0 0 0 0 0 0 0 0 0 1 0]]
```




```
from sklearn.metrics import classification_report
print(classification_report(y_test,y_pred))
```

```
              precision    recall  f1-score   support

     37731.0       0.00      0.00      0.00       1.0
     46205.0       0.00      0.00      0.00       0.0
     56957.0       0.00      0.00      0.00       0.0
     57081.0       0.00      0.00      0.00       1.0
     63218.0       0.00      0.00      0.00       1.0
    105582.0       0.00      0.00      0.00       0.0
    109431.0       0.00      0.00      0.00       1.0
    112635.0       0.00      0.00      0.00       0.0
    116969.0       0.00      0.00      0.00       1.0
    121872.0       0.00      0.00      0.00       0.0
    122391.0       0.00      0.00      0.00       1.0

    accuracy                           0.00       6.0
   macro avg       0.00      0.00      0.00       6.0
weighted avg       0.00      0.00      0.00       6.0


/usr/local/lib/python3.10/dist-packages/sklearn/metrics/
_classification.py:1531: UndefinedMetricWarning: Precision is ill-
defined and being set to 0.0 in labels with no predicted samples. Use
`zero_division` parameter to control this behavior.
```

```
  _warn_prf(average, modifier, f"{metric.capitalize()} is",
len(result))
/usr/local/lib/python3.10/dist-packages/sklearn/metrics/_classificatio
n.py:1531: UndefinedMetricWarning: Recall is ill-defined and being set
to 0.0 in labels with no true samples. Use `zero_division` parameter
to control this behavior.
  _warn_prf(average, modifier, f"{metric.capitalize()} is",
len(result))
/usr/local/lib/python3.10/dist-packages/sklearn/metrics/_classificatio
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len(result))
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len(result))
/usr/local/lib/python3.10/dist-packages/sklearn/metrics/_classificatio
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to 0.0 in labels with no true samples. Use `zero_division` parameter
to control this behavior.
  _warn_prf(average, modifier, f"{metric.capitalize()} is",
len(result))
```

```
from sklearn.svm import SVC
tuned_model = SVC(kernel='rbf', C=10, gamma=0.1)
tuned_model.fit(X_train.values.reshape(-1, 1), y_train.values)
```

```
SVC(C=10, gamma=0.1)
```

```
from sklearn.metrics import classification_report
y_pred_tuned = tuned_model.predict(X_test.values.reshape(-1, 1))
print('\nSVM with Manually Tuned Parameters')
print(classification_report(y_test, y_pred_tuned))
```

```

SVM with Manually Tuned Parameters
              precision    recall  f1-score   support

     37731.0       0.00      0.00      0.00       1.0
     46205.0       0.00      0.00      0.00       0.0
```

```
     56957.0       0.00      0.00      0.00       0.0
     57081.0       0.00      0.00      0.00       1.0
     63218.0       0.00      0.00      0.00       1.0
    105582.0       0.00      0.00      0.00       0.0
    109431.0       0.00      0.00      0.00       1.0
    112635.0       0.00      0.00      0.00       0.0
    116969.0       0.00      0.00      0.00       1.0
    121872.0       0.00      0.00      0.00       0.0
    122391.0       0.00      0.00      0.00       1.0

    accuracy                           0.00       6.0
   macro avg       0.00      0.00      0.00       6.0
weighted avg       0.00      0.00      0.00       6.0


/usr/local/lib/python3.10/dist-packages/sklearn/metrics/
_classification.py:1531: UndefinedMetricWarning: Precision is ill-
defined and being set to 0.0 in labels with no predicted samples. Use
`zero_division` parameter to control this behavior.
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/usr/local/lib/python3.10/dist-packages/sklearn/metrics/_classificatio
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/usr/local/lib/python3.10/dist-packages/sklearn/metrics/_classificatio
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len(result))
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len(result))
/usr/local/lib/python3.10/dist-packages/sklearn/metrics/_classificatio
n.py:1531: UndefinedMetricWarning: Recall is ill-defined and being set
to 0.0 in labels with no true samples. Use `zero_division` parameter
to control this behavior.
```

```
  _warn_prf(average, modifier, f"{metric.capitalize()} is",
len(result))
```

```
from sklearn.svm import SVC
import numpy as np
model = SVC(kernel='rbf')
model.fit(X_train.values.reshape(-1, 1), y_train.values)
```

```
SVC()
```

```
y_pred = model.predict(X_test.values.reshape(-1, 1))
```

```
param_grid={'C':[0.1,1,10,100],
'gamma':[1,0.1,0.01,0.001],
'kernel':['linear','rbf']}
```

```
from sklearn.model_selection import LeaveOneOut, GridSearchCV
from sklearn.svm import SVC
print(y_train.value_counts())
loo = LeaveOneOut()
grid_search = GridSearchCV(SVC(), param_grid, refit=True, verbose=2,
cv=loo)
grid_search.fit(X_train.values.reshape(-1, 1), y_train.values)
print("\nBest Parameters found by Grid Search:")
print(grid_search.best_params_)
```

```
Salary
112635.0    1
55794.0     1
67938.0     1
98273.0     1
39343.0     1
43525.0     1
105582.0    1
54445.0     1
57189.0     1
93940.0     1
81363.0     1
39891.0     1
60150.0     1
121872.0    1
46205.0     1
91738.0     1
113812.0    1
61111.0     1
64445.0     1
66029.0     1
56642.0     1
101302.0    1
83088.0     1
56957.0     1
```

```
Name: count, dtype: int64
Fitting 24 folds for each of 32 candidates, totalling 768 fits
[CV] END ......................C=0.1, gamma=1, kernel=linear; total
time=   0.0s
[CV] END ......................C=0.1, gamma=1, kernel=linear; total
time=   0.0s
[CV] END ......................C=0.1, gamma=1, kernel=linear; total
time=   0.0s
[CV] END ......................C=0.1, gamma=1, kernel=linear; total
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time=   0.0s
[CV] END ......................C=0.1, gamma=1, kernel=linear; total
```

```
time=   0.0s
[CV] END .........................C=0.1, gamma=1, kernel=rbf; total
time=   0.0s
[CV] END .........................C=0.1, gamma=1, kernel=rbf; total
time=   0.0s
[CV] END .........................C=0.1, gamma=1, kernel=rbf; total
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[CV] END .........................C=0.1, gamma=1, kernel=rbf; total
time=   0.0s
[CV] END .........................C=0.1, gamma=1, kernel=rbf; total
time=   0.0s
```

```
[CV] END ....................C=0.1, gamma=0.1, kernel=linear; total
time=   0.0s
[CV] END ....................C=0.1, gamma=0.1, kernel=linear; total
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[CV] END ....................C=0.1, gamma=0.1, kernel=linear; total
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[CV] END ....................C=0.1, gamma=0.1, kernel=linear; total
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[CV] END ....................C=0.1, gamma=0.1, kernel=linear; total
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[CV] END ....................C=0.1, gamma=0.1, kernel=linear; total
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[CV] END ....................C=0.1, gamma=0.1, kernel=linear; total
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[CV] END ....................C=0.1, gamma=0.1, kernel=linear; total
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[CV] END ....................C=0.1, gamma=0.1, kernel=linear; total
time=   0.0s
[CV] END ....................C=0.1, gamma=0.1, kernel=linear; total
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[CV] END ....................C=0.1, gamma=0.1, kernel=linear; total
time=   0.0s
[CV] END ....................C=0.1, gamma=0.1, kernel=linear; total
time=   0.0s
[CV] END .......................C=0.1, gamma=0.1, kernel=rbf; total
```

```
time=   0.0s
[CV] END .......................C=0.1, gamma=0.1, kernel=rbf; total
time=   0.0s
[CV] END .......................C=0.1, gamma=0.1, kernel=rbf; total
time=   0.0s
[CV] END .......................C=0.1, gamma=0.1, kernel=rbf; total
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[CV] END .......................C=0.1, gamma=0.1, kernel=rbf; total
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[CV] END .......................C=0.1, gamma=0.1, kernel=rbf; total
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Best Parameters found by Grid Search:
{'C': 0.1, 'gamma': 1, 'kernel': 'linear'}
```

```
accuracy=accuracy_score(y_test,y_pred)
print("\n Accuracy with Best Hyperparameter:accuracy")
print(accuracy)
```

```
 Accuracy with Best Hyperparameter:accuracy
0.0
```

```
from sklearn.metrics import classification_report
y_pred_grid = grid_search.predict(X_test.values.reshape(-1, 1))
print('\nSVM with Manually Tuned Parameters')
print(classification_report(y_test.values, y_pred_grid))
```

```
SVM with Manually Tuned Parameters
              precision    recall  f1-score   support

     37731.0       0.00      0.00      0.00       1.0
     46205.0       0.00      0.00      0.00       0.0
     56957.0       0.00      0.00      0.00       0.0
     57081.0       0.00      0.00      0.00       1.0
     63218.0       0.00      0.00      0.00       1.0
    105582.0       0.00      0.00      0.00       0.0
    109431.0       0.00      0.00      0.00       1.0
    112635.0       0.00      0.00      0.00       0.0
    116969.0       0.00      0.00      0.00       1.0
    121872.0       0.00      0.00      0.00       0.0
    122391.0       0.00      0.00      0.00       1.0

    accuracy                           0.00       6.0
```

```
   macro avg       0.00      0.00      0.00       6.0
weighted avg       0.00      0.00      0.00       6.0


/usr/local/lib/python3.10/dist-packages/sklearn/metrics/
_classification.py:1531: UndefinedMetricWarning: Precision is ill-
defined and being set to 0.0 in labels with no predicted samples. Use
`zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, f"{metric.capitalize()} is",
len(result))
/usr/local/lib/python3.10/dist-packages/sklearn/metrics/_classificatio
n.py:1531: UndefinedMetricWarning: Recall is ill-defined and being set
to 0.0 in labels with no true samples. Use `zero_division` parameter
to control this behavior.
  _warn_prf(average, modifier, f"{metric.capitalize()} is",
len(result))
/usr/local/lib/python3.10/dist-packages/sklearn/metrics/_classificatio
n.py:1531: UndefinedMetricWarning: Precision is ill-defined and being
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  _warn_prf(average, modifier, f"{metric.capitalize()} is",
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/usr/local/lib/python3.10/dist-packages/sklearn/metrics/_classificatio
n.py:1531: UndefinedMetricWarning: Recall is ill-defined and being set
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  _warn_prf(average, modifier, f"{metric.capitalize()} is",
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/usr/local/lib/python3.10/dist-packages/sklearn/metrics/_classificatio
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/usr/local/lib/python3.10/dist-packages/sklearn/metrics/_classificatio
n.py:1531: UndefinedMetricWarning: Recall is ill-defined and being set
to 0.0 in labels with no true samples. Use `zero_division` parameter
to control this behavior.
  _warn_prf(average, modifier, f"{metric.capitalize()} is",
len(result))
```
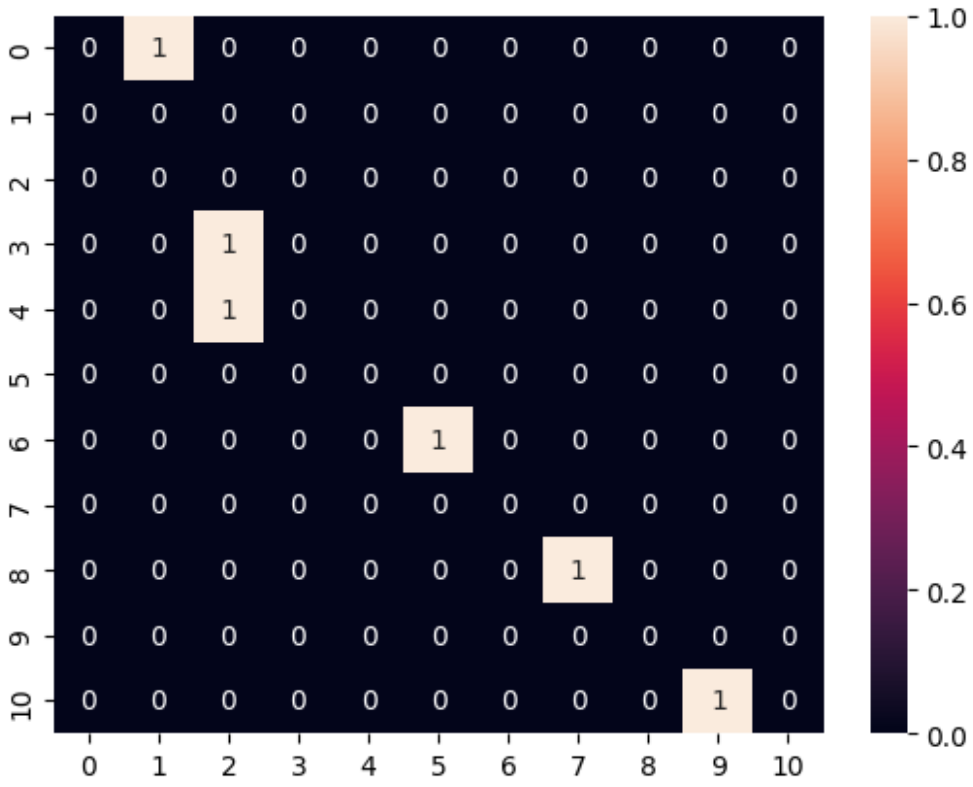
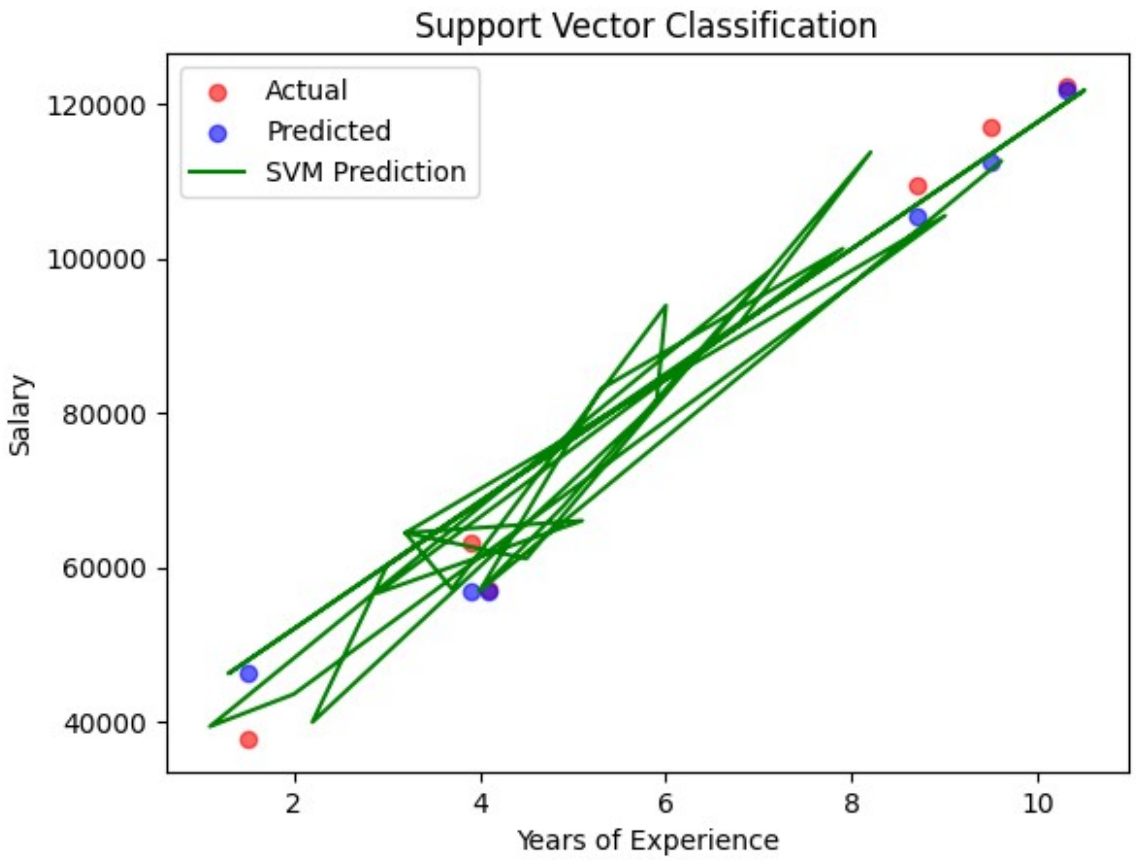

```
cm=confusion_matrix(y_test,y_pred)
sns.heatmap(cm,annot=True)
plt.show()
```




```
from sklearn.metrics import mean_squared_error
mse=mean_squared_error(y_test,y_pred)
print("Mean Squared Error:",mse)
```

```
Mean Squared Error: 24148648.5
```

```
import matplotlib.pyplot as plt
y_pred = grid_search.predict(X_test.values.reshape(-1, 1))
plt.scatter(X_test, y_test, color='red', label='Actual', alpha=0.6)
plt.scatter(X_test, y_pred, color='blue', label='Predicted',
alpha=0.6)
plt.plot(X_train.values, grid_search.predict(X_train.values.reshape(-
1, 1)), color='green', label='SVM Prediction')
plt.xlabel('Years of Experience')
plt.ylabel('Salary')
plt.title('Support Vector Classification')
plt.legend()
plt.show()
```




```
df=pd.read_csv('/content/Iris.csv')
df
```


```
{"summary":"{\n  \"name\": \"df\",\n  \"rows\": 150,\n  \"fields\": [\
n    {\n      \"column\": \"Id\",\n      \"properties\": {\n
\"dtype\": \"number\",\n        \"std\": 43,\n        \"min\": 1,\n
\"max\": 150,\n        \"num_unique_values\": 150,\n
\"samples\": [\n          74,\n          19,\n          119\
n        ],\n        \"semantic_type\": \"\",\n
\"description\": \"\"\n      }\n    },\n    {\n      \"column\":
\"SepalLengthCm\",\n      \"properties\": {\n        \"dtype\":
\"number\",\n        \"std\": 0.8280661279778629,\n        \"min\":
4.3,\n        \"max\": 7.9,\n        \"num_unique_values\": 35,\n
\"samples\": [\n          6.2,\n          4.5,\n          5.6\n
],\n        \"semantic_type\": \"\",\n        \"description\": \"\"\n
}\n    },\n    {\n      \"column\": \"SepalWidthCm\",\n
\"properties\": {\n        \"dtype\": \"number\",\n        \"std\":
0.4335943113621737,\n        \"min\": 2.0,\n        \"max\": 4.4,\n
\"num_unique_values\": 23,\n        \"samples\": [\n          2.3,\n
4.0,\n          3.5\n        ],\n        \"semantic_type\": \"\",\n
\"description\": \"\"\n      }\n    },\n    {\n      \"column\":
\"PetalLengthCm\",\n      \"properties\": {\n        \"dtype\":
\"number\",\n        \"std\": 1.7644204199522617,\n        \"min\":
```

```
1.0,\n        \"max\": 6.9,\n        \"num_unique_values\": 43,\n
\"samples\": [\n          6.7,\n          3.8,\n          3.7\n
],\n        \"semantic_type\": \"\",\n        \"description\": \"\"\n
}\n    },\n    {\n      \"column\": \"PetalWidthCm\",\n
\"properties\": {\n        \"dtype\": \"number\",\n        \"std\":
0.7631607417008414,\n        \"min\": 0.1,\n        \"max\": 2.5,\n
\"num_unique_values\": 22,\n        \"samples\": [\n          0.2,\n
1.2,\n          1.3\n        ],\n        \"semantic_type\": \"\",\n
\"description\": \"\"\n      }\n    },\n    {\n      \"column\":
\"Species\",\n      \"properties\": {\n        \"dtype\":
\"category\",\n        \"num_unique_values\": 3,\n        \"samples\":
[\n          \"Iris-setosa\",\n          \"Iris-versicolor\",\n
\"Iris-virginica\"\n        ],\n        \"semantic_type\": \"\",\n
\"description\": \"\"\n      }\n    }\n  ]\
n}","type":"dataframe","variable_name":"df"}
```


```
df.head()
```


```
{"summary":"{\n  \"name\": \"df\",\n  \"rows\": 150,\n  \"fields\": [\
n    {\n      \"column\": \"Id\",\n      \"properties\": {\n
\"dtype\": \"number\",\n        \"std\": 43,\n        \"min\": 1,\n
\"max\": 150,\n        \"num_unique_values\": 150,\n
\"samples\": [\n          74,\n          19,\n          119\
n        ],\n        \"semantic_type\": \"\",\n
\"description\": \"\"\n      }\n    },\n    {\n      \"column\":
\"SepalLengthCm\",\n      \"properties\": {\n        \"dtype\":
\"number\",\n        \"std\": 0.8280661279778629,\n        \"min\":
4.3,\n        \"max\": 7.9,\n        \"num_unique_values\": 35,\n
\"samples\": [\n          6.2,\n          4.5,\n          5.6\n
],\n        \"semantic_type\": \"\",\n        \"description\": \"\"\n
}\n    },\n    {\n      \"column\": \"SepalWidthCm\",\n
\"properties\": {\n        \"dtype\": \"number\",\n        \"std\":
0.4335943113621737,\n        \"min\": 2.0,\n        \"max\": 4.4,\n
\"num_unique_values\": 23,\n        \"samples\": [\n          2.3,\n
4.0,\n          3.5\n        ],\n        \"semantic_type\": \"\",\n
\"description\": \"\"\n      }\n    },\n    {\n      \"column\":
\"PetalLengthCm\",\n      \"properties\": {\n        \"dtype\":
\"number\",\n        \"std\": 1.7644204199522617,\n        \"min\":
1.0,\n        \"max\": 6.9,\n        \"num_unique_values\": 43,\n
\"samples\": [\n          6.7,\n          3.8,\n          3.7\n
],\n        \"semantic_type\": \"\",\n        \"description\": \"\"\n
}\n    },\n    {\n      \"column\": \"PetalWidthCm\",\n
\"properties\": {\n        \"dtype\": \"number\",\n        \"std\":
0.7631607417008414,\n        \"min\": 0.1,\n        \"max\": 2.5,\n
\"num_unique_values\": 22,\n        \"samples\": [\n          0.2,\n
1.2,\n          1.3\n        ],\n        \"semantic_type\": \"\",\n
\"description\": \"\"\n      }\n    },\n    {\n      \"column\":
\"Species\",\n      \"properties\": {\n        \"dtype\":
\"category\",\n        \"num_unique_values\": 3,\n        \"samples\":
[\n          \"Iris-setosa\",\n          \"Iris-versicolor\",\n
```

\"Iris-virginica\"\n   ],\n   \"semantic_type\": \"\",\n
\"description\": \"\"\n   }\n   }\n]\
n}","type":"dataframe","variable_name":"df"}

```
df.tail()
```

{"summary":"{\n \"name\": \"df\",\n \"rows\": 5,\n \"fields\": [\n
{\n   \"column\": \"Id\",\n   \"properties\": {\n
\"dtype\": \"number\",\n   \"std\": 1,\n   \"min\": 146,\n
\"max\": 150,\n   \"num_unique_values\": 5,\n   \"samples\":
[\n   147,\n   150,\n   148\n   ],\n
\"semantic_type\": \"\",\n   \"description\": \"\"\n   }\
n   },\n   {\n   \"column\": \"SepalLengthCm\",\n
\"properties\": {\n   \"dtype\": \"number\",\n   \"std\":
0.30331501776206193,\n   \"min\": 5.9,\n   \"max\": 6.7,\n
\"num_unique_values\": 5,\n   \"samples\": [\n   6.3,\n
5.9,\n   6.5\n   ],\n   \"semantic_type\": \"\",\n
\"description\": \"\"\n   }\n   },\n   {\n   \"column\":
\"SepalWidthCm\",\n   \"properties\": {\n   \"dtype\":
\"number\",\n   \"std\": 0.31937438845342625,\n   \"min\":
2.5,\n   \"max\": 3.4,\n   \"num_unique_values\": 3,\n
\"samples\": [\n   3.0,\n   2.5,\n   3.4\n
],\n   \"semantic_type\": \"\",\n   \"description\": \"\"\n
}\n   },\n   {\n   \"column\": \"PetalLengthCm\",\n
\"properties\": {\n   \"dtype\": \"number\",\n   \"std\":
0.14832396974191348,\n   \"min\": 5.0,\n   \"max\": 5.4,\n
\"num_unique_values\": 4,\n   \"samples\": [\n   5.0,\n
5.1,\n   5.2\n   ],\n   \"semantic_type\": \"\",\n
\"description\": \"\"\n   }\n   },\n   {\n   \"column\":
\"PetalWidthCm\",\n   \"properties\": {\n   \"dtype\":
\"number\",\n   \"std\": 0.23021728866442667,\n   \"min\":
1.8,\n   \"max\": 2.3,\n   \"num_unique_values\": 4,\n
\"samples\": [\n   1.9,\n   1.8,\n   2.3\n
],\n   \"semantic_type\": \"\",\n   \"description\": \"\"\n
}\n   },\n   {\n   \"column\": \"Species\",\n
\"properties\": {\n   \"dtype\": \"category\",\n
\"num_unique_values\": 1,\n   \"samples\": [\n   \"Iris-
virginica\"\n   ],\n   \"semantic_type\": \"\",\n
\"description\": \"\"\n   }\n   }\n]\n}","type":"dataframe"}

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 150 entries, 0 to 149
Data columns (total 6 columns):
 #   Column         Non-Null Count  Dtype
---  ------         --------------  -----
 0   Id             150 non-null    int64
 1   SepalLengthCm  150 non-null    float64
 2   SepalWidthCm   150 non-null    float64
```

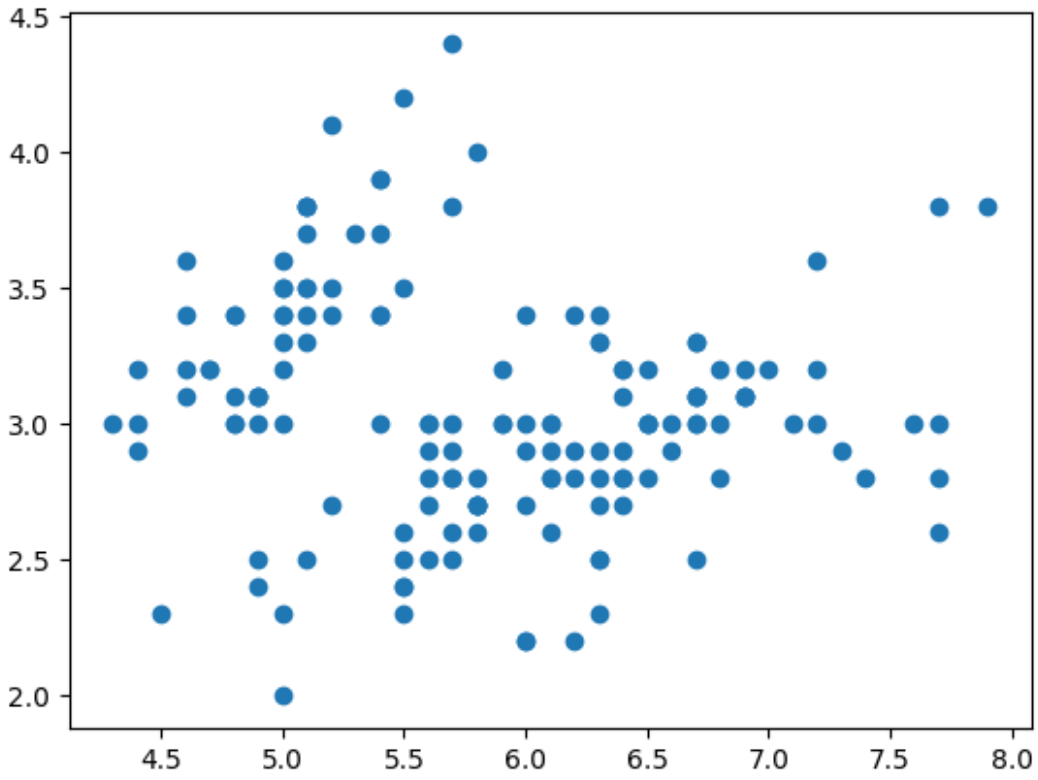
```
 3   PetalLengthCm  150 non-null    float64
 4   PetalWidthCm   150 non-null    float64
 5   Species        150 non-null    object
dtypes: float64(4), int64(1), object(1)
memory usage: 7.2+ KB
```

```
df.isnull().sum()
```

```
Id               0
SepalLengthCm    0
SepalWidthCm     0
PetalLengthCm    0
PetalWidthCm     0
Species          0
dtype: int64
```

```
plt.scatter(df['SepalLengthCm'],df['SepalWidthCm'])
```

```
<matplotlib.collections.PathCollection at 0x7c56aa4ad000>
```




```
X=df[['SepalLengthCm','SepalWidthCm']]
y=df['Species']
X
```

{"summary":"{\n \"name\": \"X\",\n \"rows\": 150,\n \"fields\": [\n{\n   \"column\": \"SepalLengthCm\",\n   \"properties\": {\n\"dtype\": \"number\",\n   \"std\": 0.8280661279778629,\n\"min\": 4.3,\n   \"max\": 7.9,\n   \"num_unique_values\": 35,\n   \"samples\": [\n   6.2,\n   4.5,\n5.6\n   ],\n   \"semantic_type\": \"\",\n\"description\": \"\"\n   }\n   },\n   {\n   \"column\": \"SepalWidthCm\",\n   \"properties\": {\n   \"dtype\": \"number\",\n   \"std\": 0.4335943113621737,\n   \"min\": 2.0,\n   \"max\": 4.4,\n   \"num_unique_values\": 23,\n\"samples\": [\n   2.3,\n   4.0,\n   3.5\n],\n   \"semantic_type\": \"\",\n   \"description\": \"\"\n}\n   }\n]\n}","type":"dataframe","variable_name":"X"}

```
y
```

```
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: Species, Length: 150, dtype: object
```

```
X_train,X_test,y_train,y_test=train_test_split(X,y,test_size=0.2,rando
m_state=0)
```

```
X_train.shape
```

```
(120, 2)
```

```
X_test.shape
```

```
(30, 2)
```

```
y_train.shape
```

```
(120,)
```

```
y_test.shape
```

```
(30,)
```

```
model = SVC(kernel='linear')
model.fit(X_train, y_train)
```

```
SVC(kernel='linear')
```

```
y_pred=model.predict(X_test)

from sklearn.metrics import accuracy_score
accuracy=accuracy_score(y_test,y_pred)
print(f'Accuracy: {accuracy:.2f}')
```

```
Accuracy: 0.73
```

```
from sklearn.metrics import classification_report
print(classification_report(y_test,y_pred))
```

```
                  precision    recall  f1-score   support

    Iris-setosa       1.00      1.00      1.00        11
Iris-versicolor       0.73      0.62      0.67        13
 Iris-virginica       0.38      0.50      0.43         6

       accuracy                           0.73        30
      macro avg       0.70      0.71      0.70        30
   weighted avg       0.76      0.73      0.74        30
```

```
from sklearn.svm import SVC
model=SVC(kernel='rbf')
model.fit(X_train,y_train)
```

```
SVC()
```

```
tuned_model=SVC(kernel='rbf',C=10,gamma=0.1)
tuned_model.fit(X_train,y_train)
```

```
SVC(C=10, gamma=0.1)
```

```
y_pred_tuned=tuned_model.predict(X_test)
print('\n SVM with Manually Tuned Parameters')
print(classification_report(y_test,y_pred_tuned))
```

```
 SVM with Manually Tuned Parameters
                  precision    recall  f1-score   support

    Iris-setosa       1.00      1.00      1.00        11
Iris-versicolor       0.73      0.62      0.67        13
 Iris-virginica       0.38      0.50      0.43         6

       accuracy                           0.73        30
      macro avg       0.70      0.71      0.70        30
   weighted avg       0.76      0.73      0.74        30
```

```
param_grid={'C':[0.1,1,10,100],
'gamma':[1,0.1,0.01,0.001],
'kernel':['linear','rbf']}

from sklearn.model_selection import GridSearchCV
grid_Search=GridSearchCV(SVC(),param_grid,refit=True,verbose=2,cv=5)
grid_Search.fit(X_train,y_train)
```

```
Fitting 5 folds for each of 32 candidates, totalling 160 fits
[CV] END .....................C=0.1, gamma=1, kernel=linear; total
time=   0.0s
[CV] END .....................C=0.1, gamma=1, kernel=linear; total
time=   0.0s
[CV] END .....................C=0.1, gamma=1, kernel=linear; total
time=   0.0s
[CV] END .....................C=0.1, gamma=1, kernel=linear; total
time=   0.0s
[CV] END .....................C=0.1, gamma=1, kernel=linear; total
time=   0.0s
[CV] END ......................C=0.1, gamma=1, kernel=rbf; total
time=   0.0s
[CV] END ......................C=0.1, gamma=1, kernel=rbf; total
time=   0.0s
[CV] END ......................C=0.1, gamma=1, kernel=rbf; total
time=   0.0s
[CV] END ......................C=0.1, gamma=1, kernel=rbf; total
time=   0.0s
[CV] END ......................C=0.1, gamma=1, kernel=rbf; total
time=   0.0s
[CV] END ....................C=0.1, gamma=0.1, kernel=linear; total
time=   0.0s
[CV] END ....................C=0.1, gamma=0.1, kernel=linear; total
time=   0.0s
[CV] END ....................C=0.1, gamma=0.1, kernel=linear; total
time=   0.0s
[CV] END ....................C=0.1, gamma=0.1, kernel=linear; total
time=   0.0s
[CV] END ....................C=0.1, gamma=0.1, kernel=linear; total
time=   0.0s
[CV] END .....................C=0.1, gamma=0.1, kernel=rbf; total
time=   0.0s
[CV] END .....................C=0.1, gamma=0.1, kernel=rbf; total
time=   0.0s
[CV] END .....................C=0.1, gamma=0.1, kernel=rbf; total
time=   0.0s
[CV] END .....................C=0.1, gamma=0.1, kernel=rbf; total
time=   0.0s
[CV] END .....................C=0.1, gamma=0.1, kernel=rbf; total
time=   0.0s
[CV] END ...................C=0.1, gamma=0.01, kernel=linear; total
```

```
time=   0.0s
[CV] END ..................C=0.1, gamma=0.01, kernel=linear; total
time=   0.0s
[CV] END ..................C=0.1, gamma=0.01, kernel=linear; total
time=   0.0s
[CV] END ..................C=0.1, gamma=0.01, kernel=linear; total
time=   0.0s
[CV] END ..................C=0.1, gamma=0.01, kernel=linear; total
time=   0.0s
[CV] END ......................C=0.1, gamma=0.01, kernel=rbf; total
time=   0.0s
[CV] END ......................C=0.1, gamma=0.01, kernel=rbf; total
time=   0.0s
[CV] END ......................C=0.1, gamma=0.01, kernel=rbf; total
time=   0.0s
[CV] END ......................C=0.1, gamma=0.01, kernel=rbf; total
time=   0.0s
[CV] END ......................C=0.1, gamma=0.01, kernel=rbf; total
time=   0.0s
[CV] END .................C=0.1, gamma=0.001, kernel=linear; total
time=   0.0s
[CV] END .................C=0.1, gamma=0.001, kernel=linear; total
time=   0.0s
[CV] END .................C=0.1, gamma=0.001, kernel=linear; total
time=   0.0s
[CV] END .................C=0.1, gamma=0.001, kernel=linear; total
time=   0.0s
[CV] END .................C=0.1, gamma=0.001, kernel=linear; total
time=   0.0s
[CV] END .....................C=0.1, gamma=0.001, kernel=rbf; total
time=   0.0s
[CV] END .....................C=0.1, gamma=0.001, kernel=rbf; total
time=   0.0s
[CV] END .....................C=0.1, gamma=0.001, kernel=rbf; total
time=   0.0s
[CV] END .....................C=0.1, gamma=0.001, kernel=rbf; total
time=   0.0s
[CV] END ........................C=1, gamma=1, kernel=linear; total
time=   0.0s
[CV] END ........................C=1, gamma=1, kernel=linear; total
time=   0.0s
[CV] END ........................C=1, gamma=1, kernel=linear; total
time=   0.0s
[CV] END ........................C=1, gamma=1, kernel=linear; total
time=   0.0s
[CV] END ........................C=1, gamma=1, kernel=linear; total
time=   0.0s
```

```
[CV] END ..........................C=1, gamma=1, kernel=rbf; total
time=   0.0s
[CV] END ..........................C=1, gamma=1, kernel=rbf; total
time=   0.0s
[CV] END ..........................C=1, gamma=1, kernel=rbf; total
time=   0.0s
[CV] END ..........................C=1, gamma=1, kernel=rbf; total
time=   0.0s
[CV] END ..........................C=1, gamma=1, kernel=rbf; total
time=   0.0s
[CV] END ......................C=1, gamma=0.1, kernel=linear; total
time=   0.0s
[CV] END ......................C=1, gamma=0.1, kernel=linear; total
time=   0.0s
[CV] END ......................C=1, gamma=0.1, kernel=linear; total
time=   0.0s
[CV] END ......................C=1, gamma=0.1, kernel=linear; total
time=   0.0s
[CV] END ......................C=1, gamma=0.1, kernel=linear; total
time=   0.0s
[CV] END ..........................C=1, gamma=0.1, kernel=rbf; total
time=   0.0s
[CV] END ..........................C=1, gamma=0.1, kernel=rbf; total
time=   0.0s
[CV] END ..........................C=1, gamma=0.1, kernel=rbf; total
time=   0.0s
[CV] END ..........................C=1, gamma=0.1, kernel=rbf; total
time=   0.0s
[CV] END ..........................C=1, gamma=0.1, kernel=rbf; total
time=   0.0s
[CV] END ......................C=1, gamma=0.01, kernel=linear; total
time=   0.0s
[CV] END ......................C=1, gamma=0.01, kernel=linear; total
time=   0.0s
[CV] END ......................C=1, gamma=0.01, kernel=linear; total
time=   0.0s
[CV] END ......................C=1, gamma=0.01, kernel=linear; total
time=   0.0s
[CV] END ......................C=1, gamma=0.01, kernel=linear; total
time=   0.0s
[CV] END ..........................C=1, gamma=0.01, kernel=rbf; total
time=   0.0s
[CV] END ..........................C=1, gamma=0.01, kernel=rbf; total
time=   0.0s
[CV] END ..........................C=1, gamma=0.01, kernel=rbf; total
time=   0.0s
[CV] END ..........................C=1, gamma=0.01, kernel=rbf; total
time=   0.0s
[CV] END ..........................C=1, gamma=0.01, kernel=rbf; total
```

```
time=   0.0s
[CV] END .....................C=1, gamma=0.001, kernel=linear; total
time=   0.0s
[CV] END .....................C=1, gamma=0.001, kernel=linear; total
time=   0.0s
[CV] END .....................C=1, gamma=0.001, kernel=linear; total
time=   0.0s
[CV] END .....................C=1, gamma=0.001, kernel=linear; total
time=   0.0s
[CV] END .....................C=1, gamma=0.001, kernel=linear; total
time=   0.0s
[CV] END ........................C=1, gamma=0.001, kernel=rbf; total
time=   0.0s
[CV] END ........................C=1, gamma=0.001, kernel=rbf; total
time=   0.0s
[CV] END ........................C=1, gamma=0.001, kernel=rbf; total
time=   0.0s
[CV] END ........................C=1, gamma=0.001, kernel=rbf; total
time=   0.0s
[CV] END ........................C=1, gamma=0.001, kernel=rbf; total
time=   0.0s
[CV] END ........................C=10, gamma=1, kernel=linear; total
time=   0.0s
[CV] END ........................C=10, gamma=1, kernel=linear; total
time=   0.0s
[CV] END ........................C=10, gamma=1, kernel=linear; total
time=   0.0s
[CV] END ........................C=10, gamma=1, kernel=linear; total
time=   0.0s
[CV] END ........................C=10, gamma=1, kernel=linear; total
time=   0.0s
[CV] END ...........................C=10, gamma=1, kernel=rbf; total
time=   0.0s
[CV] END ...........................C=10, gamma=1, kernel=rbf; total
time=   0.0s
[CV] END ...........................C=10, gamma=1, kernel=rbf; total
time=   0.0s
[CV] END ...........................C=10, gamma=1, kernel=rbf; total
time=   0.1s
[CV] END ...........................C=10, gamma=1, kernel=rbf; total
time=   0.0s
[CV] END .....................C=10, gamma=0.1, kernel=linear; total
time=   0.0s
[CV] END .....................C=10, gamma=0.1, kernel=linear; total
time=   0.0s
[CV] END .....................C=10, gamma=0.1, kernel=linear; total
time=   0.0s
[CV] END .....................C=10, gamma=0.1, kernel=linear; total
time=   0.0s
```

```
[CV] END .....................C=10, gamma=0.1, kernel=linear; total
time=   0.0s
[CV] END ........................C=10, gamma=0.1, kernel=rbf; total
time=   0.0s
[CV] END ........................C=10, gamma=0.1, kernel=rbf; total
time=   0.0s
[CV] END ........................C=10, gamma=0.1, kernel=rbf; total
time=   0.0s
[CV] END ........................C=10, gamma=0.1, kernel=rbf; total
time=   0.0s
[CV] END ........................C=10, gamma=0.1, kernel=rbf; total
time=   0.0s
[CV] END .....................C=10, gamma=0.01, kernel=linear; total
time=   0.0s
[CV] END .....................C=10, gamma=0.01, kernel=linear; total
time=   0.0s
[CV] END .....................C=10, gamma=0.01, kernel=linear; total
time=   0.0s
[CV] END .....................C=10, gamma=0.01, kernel=linear; total
time=   0.0s
[CV] END .....................C=10, gamma=0.01, kernel=linear; total
time=   0.0s
[CV] END ........................C=10, gamma=0.01, kernel=rbf; total
time=   0.0s
[CV] END ........................C=10, gamma=0.01, kernel=rbf; total
time=   0.0s
[CV] END ........................C=10, gamma=0.01, kernel=rbf; total
time=   0.0s
[CV] END ........................C=10, gamma=0.01, kernel=rbf; total
time=   0.0s
[CV] END ........................C=10, gamma=0.01, kernel=rbf; total
time=   0.0s
[CV] END ....................C=10, gamma=0.001, kernel=linear; total
time=   0.0s
[CV] END ....................C=10, gamma=0.001, kernel=linear; total
time=   0.0s
[CV] END ....................C=10, gamma=0.001, kernel=linear; total
time=   0.0s
[CV] END ....................C=10, gamma=0.001, kernel=linear; total
time=   0.0s
[CV] END ....................C=10, gamma=0.001, kernel=linear; total
time=   0.0s
[CV] END ........................C=10, gamma=0.001, kernel=rbf; total
time=   0.0s
[CV] END ........................C=10, gamma=0.001, kernel=rbf; total
time=   0.0s
[CV] END ........................C=10, gamma=0.001, kernel=rbf; total
time=   0.0s
[CV] END ........................C=10, gamma=0.001, kernel=rbf; total
```

```
time=   0.0s
[CV] END .....................C=10, gamma=0.001, kernel=rbf; total
time=   0.0s
[CV] END .....................C=100, gamma=1, kernel=linear; total
time=   0.0s
[CV] END .....................C=100, gamma=1, kernel=linear; total
time=   0.0s
[CV] END .....................C=100, gamma=1, kernel=linear; total
time=   0.0s
[CV] END .....................C=100, gamma=1, kernel=linear; total
time=   0.0s
[CV] END .....................C=100, gamma=1, kernel=linear; total
time=   0.0s
[CV] END .....................C=100, gamma=1, kernel=rbf; total
time=   0.0s
[CV] END .....................C=100, gamma=1, kernel=rbf; total
time=   0.0s
[CV] END .....................C=100, gamma=1, kernel=rbf; total
time=   0.0s
[CV] END .....................C=100, gamma=1, kernel=rbf; total
time=   0.0s
[CV] END .....................C=100, gamma=1, kernel=rbf; total
time=   0.0s
[CV] END ...................C=100, gamma=0.1, kernel=linear; total
time=   0.0s
[CV] END ...................C=100, gamma=0.1, kernel=linear; total
time=   0.0s
[CV] END ...................C=100, gamma=0.1, kernel=linear; total
time=   0.0s
[CV] END ...................C=100, gamma=0.1, kernel=linear; total
time=   0.0s
[CV] END ...................C=100, gamma=0.1, kernel=linear; total
time=   0.0s
[CV] END ....................C=100, gamma=0.1, kernel=rbf; total
time=   0.0s
[CV] END ....................C=100, gamma=0.1, kernel=rbf; total
time=   0.0s
[CV] END ....................C=100, gamma=0.1, kernel=rbf; total
time=   0.0s
[CV] END ....................C=100, gamma=0.1, kernel=rbf; total
time=   0.0s
[CV] END ....................C=100, gamma=0.1, kernel=rbf; total
time=   0.0s
[CV] END ..................C=100, gamma=0.01, kernel=linear; total
time=   0.0s
[CV] END ..................C=100, gamma=0.01, kernel=linear; total
time=   0.0s
[CV] END ..................C=100, gamma=0.01, kernel=linear; total
time=   0.0s
```

```
[CV] END ..................C=100, gamma=0.01, kernel=linear; total
time=   0.0s
[CV] END ..................C=100, gamma=0.01, kernel=linear; total
time=   0.0s
[CV] END ..................C=100, gamma=0.01, kernel=rbf; total
time=   0.0s
[CV] END ..................C=100, gamma=0.01, kernel=rbf; total
time=   0.0s
[CV] END ..................C=100, gamma=0.01, kernel=rbf; total
time=   0.0s
[CV] END ..................C=100, gamma=0.01, kernel=rbf; total
time=   0.0s
[CV] END ..................C=100, gamma=0.01, kernel=rbf; total
time=   0.0s
[CV] END .................C=100, gamma=0.001, kernel=linear; total
time=   0.0s
[CV] END .................C=100, gamma=0.001, kernel=linear; total
time=   0.0s
[CV] END .................C=100, gamma=0.001, kernel=linear; total
time=   0.0s
[CV] END .................C=100, gamma=0.001, kernel=linear; total
time=   0.0s
[CV] END .................C=100, gamma=0.001, kernel=linear; total
time=   0.0s
[CV] END ..................C=100, gamma=0.001, kernel=rbf; total
time=   0.0s
[CV] END ..................C=100, gamma=0.001, kernel=rbf; total
time=   0.0s
[CV] END ..................C=100, gamma=0.001, kernel=rbf; total
time=   0.0s
[CV] END ..................C=100, gamma=0.001, kernel=rbf; total
time=   0.0s
[CV] END ..................C=100, gamma=0.001, kernel=rbf; total
time=   0.0s
```

```
GridSearchCV(cv=5, estimator=SVC(),
             param_grid={'C': [0.1, 1, 10, 100], 'gamma': [1, 0.1,
0.01, 0.001],
                         'kernel': ['linear', 'rbf']},
             verbose=2)
```

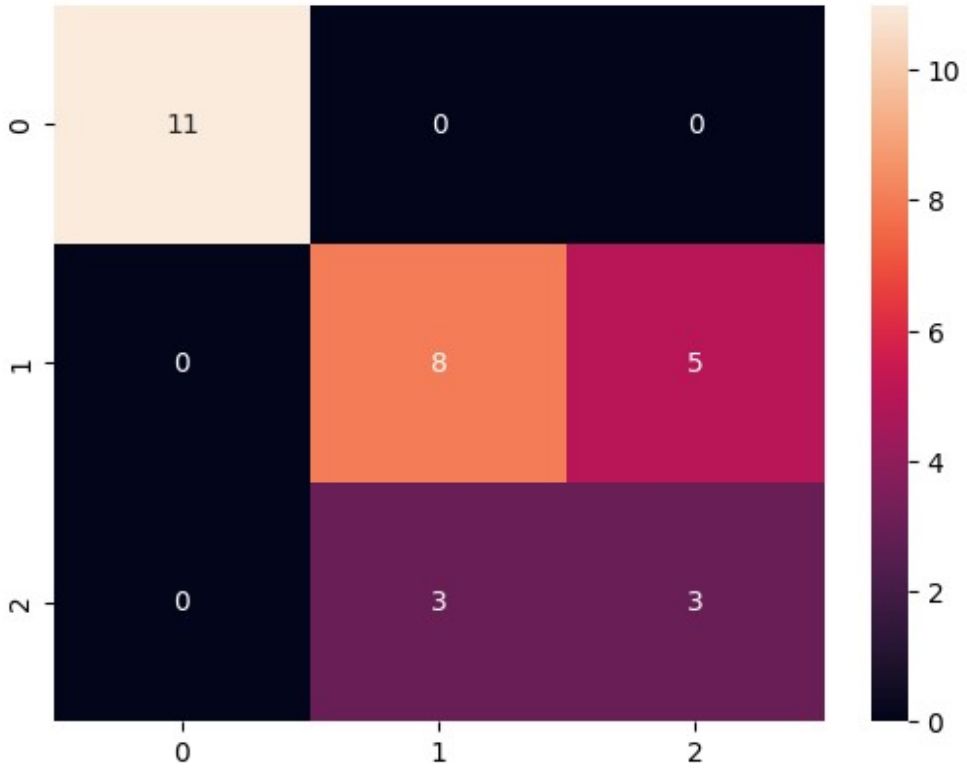
```
accuracy=accuracy_score(y_test,y_pred)
print("\n Accuracy with Best Hyperparameter:accuracy")
print(accuracy)
```

```
 Accuracy with Best Hyperparameter:accuracy
0.7333333333333333
```

```
y_pred_grid=grid_Search.predict(X_test)
print('\nSVM with Manually Tuned Parameters')
print(classification_report(y_test, y_pred_grid))
```

```
SVM with Manually Tuned Parameters
                 precision    recall  f1-score   support

    Iris-setosa       1.00      1.00      1.00        11
Iris-versicolor       0.73      0.62      0.67        13
 Iris-virginica       0.38      0.50      0.43         6

       accuracy                           0.73        30
      macro avg       0.70      0.71      0.70        30
   weighted avg       0.76      0.73      0.74        30
```

```
cm=confusion_matrix(y_test,y_pred)
sns.heatmap(cm,annot=True)
plt.show()
```




```
plt.scatter(X_test.iloc[:,0], y_test, color='red', label='Actual')
plt.scatter(X_test.iloc[:,0], y_pred, color='blue', label='Predicted')
plt.plot(X_train, model.predict(X_train), color='green', label='SVM
Prediction')
```

```
plt.xlabel('Sepal Length')
plt.ylabel('Petal Width')
plt.title('Support Vector Classification')
plt.legend()
plt.show()
```