JADAVPUR UNIVERSITY

MACHINE LEARNING LABORATORY

ASSIGNMENT #2 - D) WISCONSIN BREAST CANCER DATASET

NAME - RITIK BAID

DEPARTMENT - INFORMATION TECHNOLOGY

ROLL NO - 001811001035

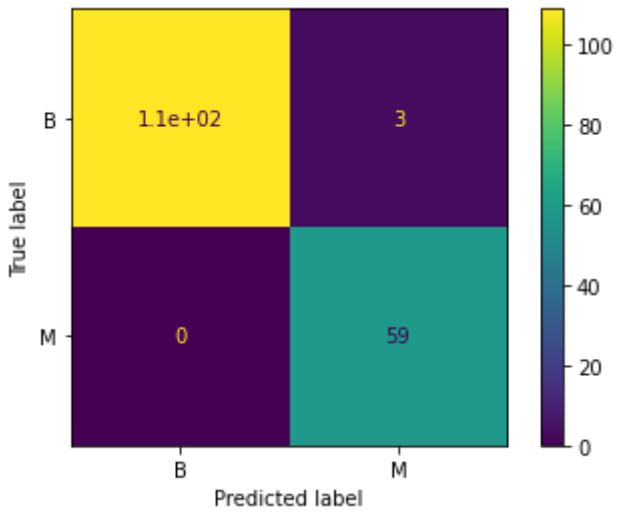
In [ ]:

```
# BREAST CANCER DATASET
# Random Forest Classifier(Without Tuning)[70-30 split]


import pandas as pd
import numpy as np

# Dataset Preparation
df = pd.read_csv("wdbc.data",header=None)

col_name = ['1','Class','3','4','5','6','7','8','9','10','11','12','13','14','15','16','17','18','19'
           ,'20','21','22','23','24','25','26','27','28','29','30','31','32']

df.columns = col_name


X = df.drop(['1','Class'], axis=1)
y = df['Class']

from sklearn.model_selection import train_test_split

X_train, X_test, y_train, y_test = train_test_split(X,y,train_size=0.7,test_size=0.3,random_state=10)


# Feature Scaling
from sklearn.preprocessing import StandardScaler

sc = StandardScaler()
X_train = sc.fit_transform(X_train)
X_test = sc.transform(X_test)

# Classification
from sklearn.ensemble import RandomForestClassifier

classifier = RandomForestClassifier(n_estimators=20, random_state=0)
classifier.fit(X_train,y_train)

y_pred = classifier.predict(X_test)
```

```
from sklearn.metrics import classification_report, confusion_matrix, accuracy_score

print("Confusion Matrix:")
print(confusion_matrix(y_test, y_pred))

print("-------------------------------------------------------")
print("-------------------------------------------------------")


print("Performance Evaluation")
print(classification_report(y_test, y_pred))


print("-------------------------------------------------------")
print("-------------------------------------------------------")

print("Accuracy:")
print(accuracy_score(y_test, y_pred))

import matplotlib.pyplot as plt
from sklearn.metrics import plot_confusion_matrix
plot_confusion_matrix(classifier, X_test, y_test)
plt.show()
```

```
Confusion Matrix:
[[109   3]
 [  0  59]]
-------------------------------------------------------
-------------------------------------------------------
Performance Evaluation
```

```
              precision    recall  f1-score   support

           B       1.00      0.97      0.99       112
           M       0.95      1.00      0.98        59

    accuracy                           0.98       171
   macro avg       0.98      0.99      0.98       171
weighted avg       0.98      0.98      0.98       171

--------------------------------------------------
--------------------------------------------------
Accuracy:
0.9824561403508771
```

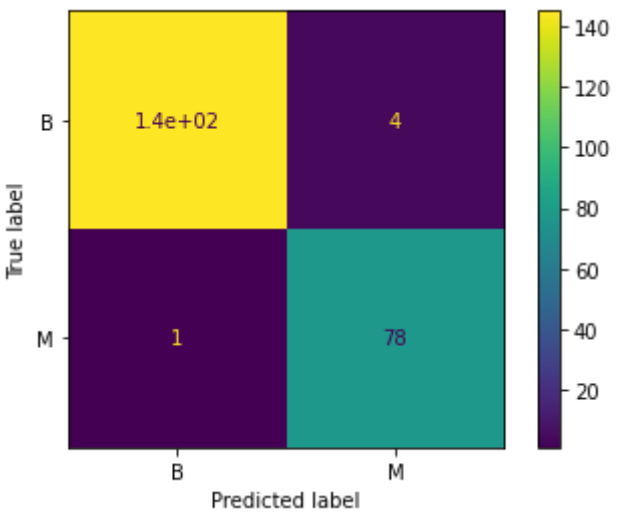


In [ ]:

```python
# BREAST CANCER DATASET
# Random Forest Classifier(Without Tuning)[60-40 split]


import pandas as pd
import numpy as np

# Dataset Preparation
df = pd.read_csv("wdbc.data",header=None)

col_name = ['1','Class','3','4','5','6','7','8','9','10','11','12','13','14','15','16','17','18','19'
           ,'20','21','22','23','24','25','26','27','28','29','30','31','32']

df.columns = col_name


X = df.drop(['1','Class'], axis=1)
y = df['Class']

from sklearn.model_selection import train_test_split

X_train, X_test, y_train, y_test = train_test_split(X,y,train_size=0.6,test_size=0.4,random_state=10)


# Feature Scaling
from sklearn.preprocessing import StandardScaler

sc = StandardScaler()
X_train = sc.fit_transform(X_train)
X_test = sc.transform(X_test)

# Classification
from sklearn.ensemble import RandomForestClassifier

classifier = RandomForestClassifier(n_estimators=20, random_state=0)
classifier.fit(X_train,y_train)

y_pred = classifier.predict(X_test)

from sklearn.metrics import classification_report, confusion_matrix, accuracy_score

print("Confusion Matrix:")
print(confusion_matrix(y_test, y_pred))

print("--------------------------------------------------")
print("--------------------------------------------------")


print("Performance Evaluation")
print(classification_report(y_test, y_pred))


print("--------------------------------------------------")
print("--------------------------------------------------")

print("Accuracy:")
print(accuracy_score(y_test, y_pred))

import matplotlib.pyplot as plt
from sklearn.metrics import plot_confusion_matrix
plot_confusion_matrix(classifier, X_test, y_test)
plt.show()
```

```
Confusion Matrix:
```

```
[[145   4]
 [  1  78]]
--------------------------------------------------
--------------------------------------------------
Performance Evaluation
              precision    recall  f1-score   support

           B       0.99      0.97      0.98       149
           M       0.95      0.99      0.97        79

    accuracy                           0.98       228
   macro avg       0.97      0.98      0.98       228
weighted avg       0.98      0.98      0.98       228

--------------------------------------------------
--------------------------------------------------
Accuracy:
0.9780701754385965
```

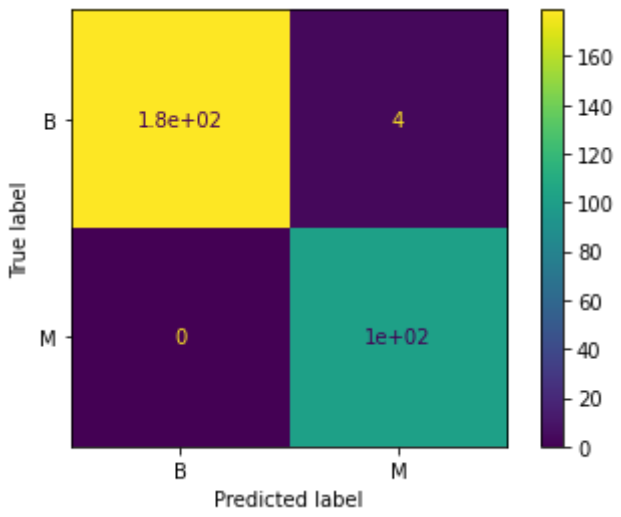


In [ ]:

```
# BREAST CANCER DATASET
# Random Forest Classifier(Without Tuning)[50-50 split]


import pandas as pd
import numpy as np

# Dataset Preparation
df = pd.read_csv("wdbc.data",header=None)

col_name = ['1','Class','3','4','5','6','7','8','9','10','11','12','13','14','15','16','17','18','19'
           ,'20','21','22','23','24','25','26','27','28','29','30','31','32']

df.columns = col_name


X = df.drop(['1','Class'], axis=1)
y = df['Class']

from sklearn.model_selection import train_test_split

X_train, X_test, y_train, y_test = train_test_split(X,y,train_size=0.5,test_size=0.5,random_state=10)


# Feature Scaling
from sklearn.preprocessing import StandardScaler

sc = StandardScaler()
X_train = sc.fit_transform(X_train)
X_test = sc.transform(X_test)

# Classification
from sklearn.ensemble import RandomForestClassifier

classifier = RandomForestClassifier(n_estimators=20, random_state=0)
classifier.fit(X_train,y_train)

y_pred = classifier.predict(X_test)

from sklearn.metrics import classification_report, confusion_matrix, accuracy_score

print("Confusion Matrix:")
print(confusion_matrix(y_test, y_pred))

print("--------------------------------------------------")
print("--------------------------------------------------")


print("Performance Evaluation")
print(classification_report(y_test, y_pred))


print("--------------------------------------------------")
print("--------------------------------------------------")

print("Accuracy:")
print(accuracy_score(y_test, y_pred))

import matplotlib.pyplot as plt
```

```
from sklearn.metrics import plot_confusion_matrix
plot_confusion_matrix(classifier, X_test, y_test)
plt.show()
```

```
Confusion Matrix:
[[179   4]
 [  0 102]]
--------------------------------------------------
--------------------------------------------------
Performance Evaluation
              precision    recall  f1-score   support

           B       1.00      0.98      0.99       183
           M       0.96      1.00      0.98       102

    accuracy                           0.99       285
   macro avg       0.98      0.99      0.98       285
weighted avg       0.99      0.99      0.99       285

--------------------------------------------------
--------------------------------------------------
Accuracy:
0.9859649122807017
```

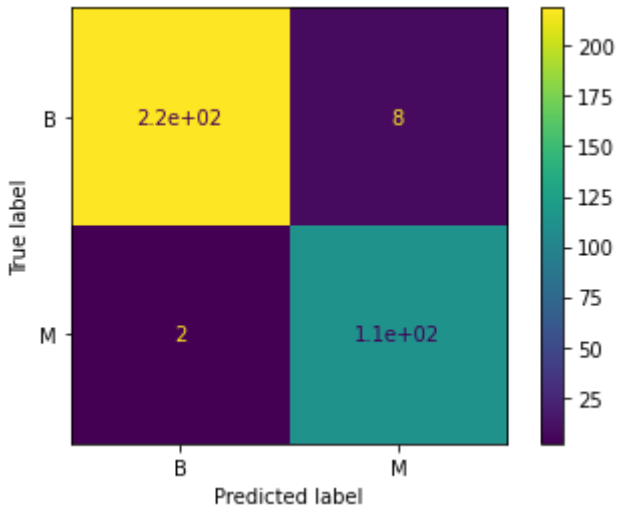


In [ ]:

```
# BREAST CANCER DATASET
# Random Forest Classifier(Without Tuning)[40-60 split]


import pandas as pd
import numpy as np

# Dataset Preparation
df = pd.read_csv("wdbc.data",header=None)

col_name = ['1','Class','3','4','5','6','7','8','9','10','11','12','13','14','15','16','17','18','19'
           ,'20','21','22','23','24','25','26','27','28','29','30','31','32']

df.columns = col_name


X = df.drop(['1','Class'], axis=1)
y = df['Class']

from sklearn.model_selection import train_test_split

X_train, X_test, y_train, y_test = train_test_split(X,y,train_size=0.4,test_size=0.6,random_state=10)


# Feature Scaling
from sklearn.preprocessing import StandardScaler

sc = StandardScaler()
X_train = sc.fit_transform(X_train)
X_test = sc.transform(X_test)

# Classification
from sklearn.ensemble import RandomForestClassifier

classifier = RandomForestClassifier(n_estimators=20, random_state=0)
classifier.fit(X_train,y_train)

y_pred = classifier.predict(X_test)

from sklearn.metrics import classification_report, confusion_matrix, accuracy_score

print("Confusion Matrix:")
print(confusion_matrix(y_test, y_pred))

print("--------------------------------------------------")
print("--------------------------------------------------")


print("Performance Evaluation")
print(classification_report(y_test, y_pred))


print("--------------------------------------------------")
print("--------------------------------------------------")
```

```
print("Accuracy:")
print(accuracy_score(y_test, y_pred))

import matplotlib.pyplot as plt
from sklearn.metrics import plot_confusion_matrix
plot_confusion_matrix(classifier, X_test, y_test)
plt.show()
```

```
Confusion Matrix:
[[219   8]
 [  2 113]]
--------------------------------------------------
--------------------------------------------------
Performance Evaluation
              precision    recall  f1-score   support

           B       0.99      0.96      0.98       227
           M       0.93      0.98      0.96       115

    accuracy                           0.97       342
   macro avg       0.96      0.97      0.97       342
weighted avg       0.97      0.97      0.97       342

--------------------------------------------------
--------------------------------------------------
Accuracy:
0.9707602339181286
```

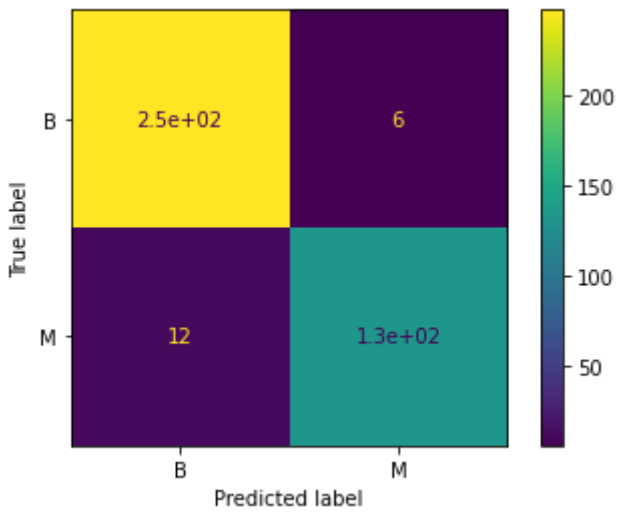


In [ ]:

```
# BREAST CANCER DATASET
# Random Forest Classifier(Without Tuning)[30-70 split]


import pandas as pd
import numpy as np

# Dataset Preparation
df = pd.read_csv("wdbc.data",header=None)

col_name = ['1','Class','3','4','5','6','7','8','9','10','11','12','13','14','15','16','17','18','19'
           ,'20','21','22','23','24','25','26','27','28','29','30','31','32']

df.columns = col_name


X = df.drop(['1','Class'], axis=1)
y = df['Class']

from sklearn.model_selection import train_test_split

X_train, X_test, y_train, y_test = train_test_split(X,y,train_size=0.3,test_size=0.7,random_state=10)


# Feature Scaling
from sklearn.preprocessing import StandardScaler

sc = StandardScaler()
X_train = sc.fit_transform(X_train)
X_test = sc.transform(X_test)

# Classification
from sklearn.ensemble import RandomForestClassifier

classifier = RandomForestClassifier(n_estimators=20, random_state=0)
classifier.fit(X_train,y_train)

y_pred = classifier.predict(X_test)

from sklearn.metrics import classification_report, confusion_matrix, accuracy_score

print("Confusion Matrix:")
print(confusion_matrix(y_test, y_pred))

print("--------------------------------------------------")
print("--------------------------------------------------")


print("Performance Evaluation")
```

```
print(classification_report(y_test, y_pred))


print("-----------------------------------------------------")
print("-----------------------------------------------------")

print("Accuracy:")
print(accuracy_score(y_test, y_pred))

import matplotlib.pyplot as plt
from sklearn.metrics import plot_confusion_matrix
plot_confusion_matrix(classifier, X_test, y_test)
plt.show()
```

```
Confusion Matrix:
[[247   6]
 [ 12 134]]
-----------------------------------------------------
-----------------------------------------------------
Performance Evaluation
              precision    recall  f1-score   support

           B       0.95      0.98      0.96       253
           M       0.96      0.92      0.94       146

    accuracy                           0.95       399
   macro avg       0.96      0.95      0.95       399
weighted avg       0.95      0.95      0.95       399

-----------------------------------------------------
-----------------------------------------------------
Accuracy:
0.9548872180451128
```



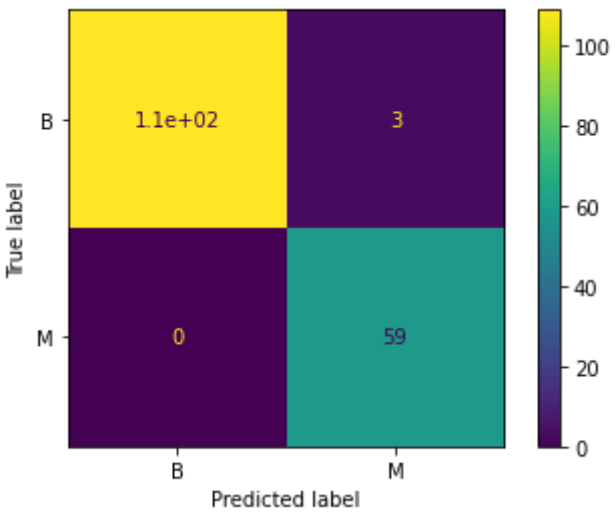
In [ ]:

```
# BREAST CANCER DATASET
# Random Forest Classifier(With Tuning)[70-30 split]


import pandas as pd
import numpy as np

# Dataset Preparation
df = pd.read_csv("wdbc.data",header=None)

col_name = ['1','Class','3','4','5','6','7','8','9','10','11','12','13','14','15','16','17','18','19'
           ,'20','21','22','23','24','25','26','27','28','29','30','31','32']


df.columns = col_name


X = df.drop(['Class'], axis=1)
y = df['Class']

from sklearn.model_selection import train_test_split

X_train, X_test, y_train, y_test = train_test_split(X,y,train_size=0.7,test_size=0.30,random_state=10)


# Feature Scaling
from sklearn.preprocessing import StandardScaler

sc = StandardScaler()
X_train = sc.fit_transform(X_train)
X_test = sc.transform(X_test)

# Classification
from sklearn.ensemble import RandomForestClassifier

classifier = RandomForestClassifier()

################################################################################
# Showing all the parameters

from pprint import pprint
# Look at parameters used by our current forest
print('Parameters currently in use:\n')
pprint(classifier.get_params())
```

```
##########################################################################
# Creating a set of important sample features

from sklearn.model_selection import RandomizedSearchCV
# Number of trees in random forest
n_estimators = [int(x) for x in np.linspace(start = 200, stop = 2000, num = 10)]
# Number of features to consider at every split
max_features = ['auto', 'sqrt']
# Maximum number of levels in tree
max_depth = [int(x) for x in np.linspace(10, 110, num = 11)]
max_depth.append(None)
# Minimum number of samples required to split a node
min_samples_split = [2, 5, 10]
# Minimum number of samples required at each leaf node
min_samples_leaf = [1, 2, 4]
# Method of selecting samples for training each tree
bootstrap = [True, False]
# Create the random grid
random_grid = {'n_estimators': n_estimators,
               'max_features': max_features,
               'max_depth': max_depth,
               'min_samples_split': min_samples_split,
               'min_samples_leaf': min_samples_leaf,
               'bootstrap': bootstrap}
pprint(random_grid)

##########################################################################

# Use the random grid to search for best hyperparameters
# First create the base model to tune
classifier = RandomForestClassifier()
# Random search of parameters, using 3 fold cross validation,
# search across 100 different combinations, and use all available cores
rf_random = RandomizedSearchCV(estimator = classifier, param_distributions = random_grid, n_iter = 100, cv = 3, verbose=2, random_
# Fit the random search model
rf_random.fit(X_train, y_train)

y_pred = rf_random.predict(X_test)

from sklearn.metrics import classification_report, confusion_matrix, accuracy_score

print("Confusion Matrix:")
print(confusion_matrix(y_test, y_pred))

print("-------------------------------------------------------")
print("-------------------------------------------------------")


print("Performance Evaluation")
print(classification_report(y_test, y_pred))


print("-------------------------------------------------------")
print("-------------------------------------------------------")

print("Accuracy:")
print(accuracy_score(y_test, y_pred))

import matplotlib.pyplot as plt
from sklearn.metrics import plot_confusion_matrix
plot_confusion_matrix(rf_random, X_test, y_test)
plt.show()
```

```
Parameters currently in use:

{'bootstrap': True,
 'ccp_alpha': 0.0,
 'class_weight': None,
 'criterion': 'gini',
 'max_depth': None,
 'max_features': 'auto',
 'max_leaf_nodes': None,
 'max_samples': None,
 'min_impurity_decrease': 0.0,
 'min_impurity_split': None,
 'min_samples_leaf': 1,
 'min_samples_split': 2,
 'min_weight_fraction_leaf': 0.0,
 'n_estimators': 100,
 'n_jobs': None,
 'oob_score': False,
 'random_state': None,
 'verbose': 0,
 'warm_start': False}
{'bootstrap': [True, False],
 'max_depth': [10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, None],
 'max_features': ['auto', 'sqrt'],
 'min_samples_leaf': [1, 2, 4],
 'min_samples_split': [2, 5, 10],
 'n_estimators': [200, 400, 600, 800, 1000, 1200, 1400, 1600, 1800, 2000]}
Fitting 3 folds for each of 100 candidates, totalling 300 fits
[Parallel(n_jobs=-1)]: Using backend LokyBackend with 2 concurrent workers.
[Parallel(n_jobs=-1)]: Done  37 tasks      | elapsed:   57.6s
```

```
[Parallel(n_jobs=-1)]: Done 158 tasks      | elapsed:  3.9min
[Parallel(n_jobs=-1)]: Done 300 out of 300 | elapsed:  7.3min finished
Confusion Matrix:
[[109   3]
 [  0  59]]
--------------------------------------------------
--------------------------------------------------
Performance Evaluation
              precision    recall  f1-score   support

           B       1.00      0.97      0.99       112
           M       0.95      1.00      0.98        59

    accuracy                           0.98       171
   macro avg       0.98      0.99      0.98       171
weighted avg       0.98      0.98      0.98       171

--------------------------------------------------
--------------------------------------------------
Accuracy:
0.9824561403508771
```



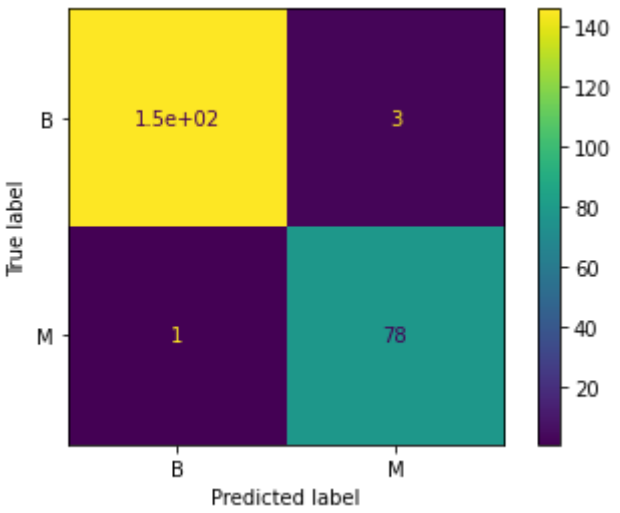
In [ ]:

```
# BREAST CANCER DATASET
# Random Forest Classifier(With Tuning)[60-40 split]


import pandas as pd
import numpy as np

# Dataset Preparation
df = pd.read_csv("wdbc.data",header=None)

col_name = ['1','Class','3','4','5','6','7','8','9','10','11','12','13','14','15','16','17','18','19'
           ,'20','21','22','23','24','25','26','27','28','29','30','31','32']


df.columns = col_name


X = df.drop(['Class'], axis=1)
y = df['Class']

from sklearn.model_selection import train_test_split

X_train, X_test, y_train, y_test = train_test_split(X,y,train_size=0.6,test_size=0.4,random_state=10)


# Feature Scaling
from sklearn.preprocessing import StandardScaler

sc = StandardScaler()
X_train = sc.fit_transform(X_train)
X_test = sc.transform(X_test)

# Classification
from sklearn.ensemble import RandomForestClassifier

classifier = RandomForestClassifier()

###############################################################################
# Showing all the parameters

from pprint import pprint
# Look at parameters used by our current forest
print('Parameters currently in use:\n')
pprint(classifier.get_params())

###############################################################################
# Creating a set of important sample features

from sklearn.model_selection import RandomizedSearchCV
# Number of trees in random forest
n_estimators = [int(x) for x in np.linspace(start = 200, stop = 2000, num = 10)]
# Number of features to consider at every split
max_features = ['auto', 'sqrt']
# Maximum number of levels in tree
max_depth = [int(x) for x in np.linspace(10, 110, num = 11)]
max_depth.append(None)
```

```
# Minimum number of samples required to split a node
min_samples_split = [2, 5, 10]
# Minimum number of samples required at each leaf node
min_samples_leaf = [1, 2, 4]
# Method of selecting samples for training each tree
bootstrap = [True, False]
# Create the random grid
random_grid = {'n_estimators': n_estimators,
               'max_features': max_features,
               'max_depth': max_depth,
               'min_samples_split': min_samples_split,
               'min_samples_leaf': min_samples_leaf,
               'bootstrap': bootstrap}
pprint(random_grid)

################################################################################

# Use the random grid to search for best hyperparameters
# First create the base model to tune
classifier = RandomForestClassifier()
# Random search of parameters, using 3 fold cross validation,
# search across 100 different combinations, and use all available cores
rf_random = RandomizedSearchCV(estimator = classifier, param_distributions = random_grid, n_iter = 100, cv = 3, verbose=2, random_
# Fit the random search model
rf_random.fit(X_train, y_train)

y_pred = rf_random.predict(X_test)

from sklearn.metrics import classification_report, confusion_matrix, accuracy_score

print("Confusion Matrix:")
print(confusion_matrix(y_test, y_pred))

print("--------------------------------------------------")
print("--------------------------------------------------")


print("Performance Evaluation")
print(classification_report(y_test, y_pred))


print("--------------------------------------------------")
print("--------------------------------------------------")

print("Accuracy:")
print(accuracy_score(y_test, y_pred))

import matplotlib.pyplot as plt
from sklearn.metrics import plot_confusion_matrix
plot_confusion_matrix(rf_random, X_test, y_test)
plt.show()
```

```
Parameters currently in use:

{'bootstrap': True,
 'ccp_alpha': 0.0,
 'class_weight': None,
 'criterion': 'gini',
 'max_depth': None,
 'max_features': 'auto',
 'max_leaf_nodes': None,
 'max_samples': None,
 'min_impurity_decrease': 0.0,
 'min_impurity_split': None,
 'min_samples_leaf': 1,
 'min_samples_split': 2,
 'min_weight_fraction_leaf': 0.0,
 'n_estimators': 100,
 'n_jobs': None,
 'oob_score': False,
 'random_state': None,
 'verbose': 0,
 'warm_start': False}
{'bootstrap': [True, False],
 'max_depth': [10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, None],
 'max_features': ['auto', 'sqrt'],
 'min_samples_leaf': [1, 2, 4],
 'min_samples_split': [2, 5, 10],
 'n_estimators': [200, 400, 600, 800, 1000, 1200, 1400, 1600, 1800, 2000]}
Fitting 3 folds for each of 100 candidates, totalling 300 fits
[Parallel(n_jobs=-1)]: Using backend LokyBackend with 2 concurrent workers.
[Parallel(n_jobs=-1)]: Done  37 tasks      | elapsed:   53.9s
[Parallel(n_jobs=-1)]: Done 158 tasks      | elapsed:  3.7min
[Parallel(n_jobs=-1)]: Done 300 out of 300 | elapsed:  7.0min finished
Confusion Matrix:
[[146   3]
 [  1  78]]
--------------------------------------------------
--------------------------------------------------
Performance Evaluation
              precision    recall  f1-score   support

           B       0.99      0.98      0.99       149
           M       0.96      0.99      0.97        79

    accuracy                           0.98       228
```

```
   macro avg       0.98      0.98      0.98       228
weighted avg       0.98      0.98      0.98       228

--------------------------------------------------
--------------------------------------------------
Accuracy:
0.9824561403508771
```

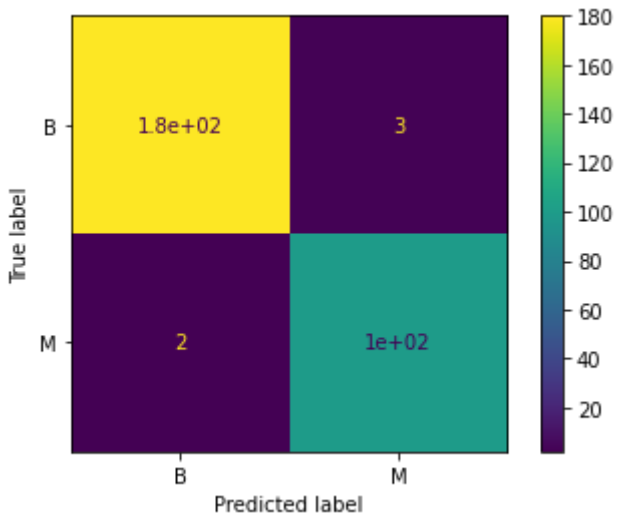


In [ ]:

```python
# BREAST CANCER DATASET
# Random Forest Classifier(With Tuning)[50-50 split]


import pandas as pd
import numpy as np

# Dataset Preparation
df = pd.read_csv("wdbc.data",header=None)

col_name = ['1','Class','3','4','5','6','7','8','9','10','11','12','13','14','15','16','17','18','19'
           ,'20','21','22','23','24','25','26','27','28','29','30','31','32']


df.columns = col_name


X = df.drop(['Class'], axis=1)
y = df['Class']

from sklearn.model_selection import train_test_split

X_train, X_test, y_train, y_test = train_test_split(X,y,train_size=0.5,test_size=0.5,random_state=10)


# Feature Scaling
from sklearn.preprocessing import StandardScaler

sc = StandardScaler()
X_train = sc.fit_transform(X_train)
X_test = sc.transform(X_test)

# Classification
from sklearn.ensemble import RandomForestClassifier

classifier = RandomForestClassifier()

###############################################################################
# Showing all the parameters

from pprint import pprint
# Look at parameters used by our current forest
print('Parameters currently in use:\n')
pprint(classifier.get_params())

###############################################################################
# Creating a set of important sample features

from sklearn.model_selection import RandomizedSearchCV
# Number of trees in random forest
n_estimators = [int(x) for x in np.linspace(start = 200, stop = 2000, num = 10)]
# Number of features to consider at every split
max_features = ['auto', 'sqrt']
# Maximum number of levels in tree
max_depth = [int(x) for x in np.linspace(10, 110, num = 11)]
max_depth.append(None)
# Minimum number of samples required to split a node
min_samples_split = [2, 5, 10]
# Minimum number of samples required at each leaf node
min_samples_leaf = [1, 2, 4]
# Method of selecting samples for training each tree
bootstrap = [True, False]
# Create the random grid
random_grid = {'n_estimators': n_estimators,
               'max_features': max_features,
               'max_depth': max_depth,
               'min_samples_split': min_samples_split,
               'min_samples_leaf': min_samples_leaf,
               'bootstrap': bootstrap}
```

```
pprint(random_grid)

################################################################################

# Use the random grid to search for best hyperparameters
# First create the base model to tune
classifier = RandomForestClassifier()
# Random search of parameters, using 3 fold cross validation,
# search across 100 different combinations, and use all available cores
rf_random = RandomizedSearchCV(estimator = classifier, param_distributions = random_grid, n_iter = 100, cv = 3, verbose=2, random_
# Fit the random search model
rf_random.fit(X_train, y_train)

y_pred = rf_random.predict(X_test)

from sklearn.metrics import classification_report, confusion_matrix, accuracy_score

print("Confusion Matrix:")
print(confusion_matrix(y_test, y_pred))

print("--------------------------------------------------")
print("--------------------------------------------------")


print("Performance Evaluation")
print(classification_report(y_test, y_pred))


print("--------------------------------------------------")
print("--------------------------------------------------")

print("Accuracy:")
print(accuracy_score(y_test, y_pred))

import matplotlib.pyplot as plt
from sklearn.metrics import plot_confusion_matrix
plot_confusion_matrix(rf_random, X_test, y_test)
plt.show()
```

```
Parameters currently in use:

{'bootstrap': True,
 'ccp_alpha': 0.0,
 'class_weight': None,
 'criterion': 'gini',
 'max_depth': None,
 'max_features': 'auto',
 'max_leaf_nodes': None,
 'max_samples': None,
 'min_impurity_decrease': 0.0,
 'min_impurity_split': None,
 'min_samples_leaf': 1,
 'min_samples_split': 2,
 'min_weight_fraction_leaf': 0.0,
 'n_estimators': 100,
 'n_jobs': None,
 'oob_score': False,
 'random_state': None,
 'verbose': 0,
 'warm_start': False}
{'bootstrap': [True, False],
 'max_depth': [10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, None],
 'max_features': ['auto', 'sqrt'],
 'min_samples_leaf': [1, 2, 4],
 'min_samples_split': [2, 5, 10],
 'n_estimators': [200, 400, 600, 800, 1000, 1200, 1400, 1600, 1800, 2000]}
Fitting 3 folds for each of 100 candidates, totalling 300 fits
[Parallel(n_jobs=-1)]: Using backend LokyBackend with 2 concurrent workers.
[Parallel(n_jobs=-1)]: Done  37 tasks      | elapsed:   51.5s
[Parallel(n_jobs=-1)]: Done 158 tasks      | elapsed:  3.5min
[Parallel(n_jobs=-1)]: Done 300 out of 300 | elapsed:  6.7min finished
Confusion Matrix:
[[180   3]
 [  2 100]]
--------------------------------------------------
--------------------------------------------------
Performance Evaluation
              precision    recall  f1-score   support

           B       0.99      0.98      0.99       183
           M       0.97      0.98      0.98       102

    accuracy                           0.98       285
   macro avg       0.98      0.98      0.98       285
weighted avg       0.98      0.98      0.98       285

--------------------------------------------------
--------------------------------------------------
Accuracy:
0.9824561403508771
```

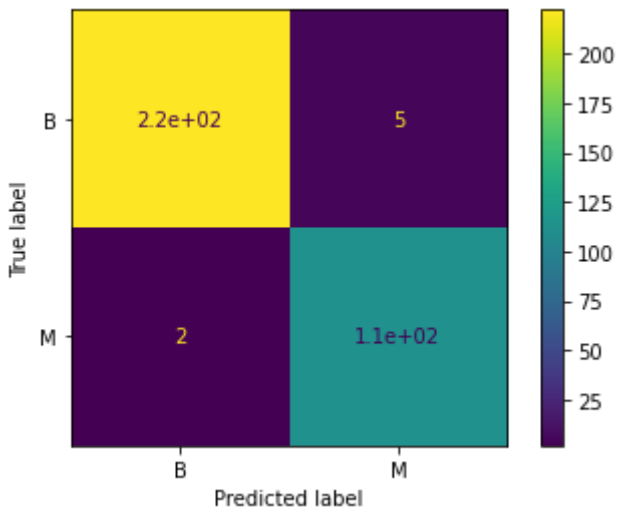


In [ ]:

```
# BREAST CANCER DATASET
# Random Forest Classifier(With Tuning)[40-60 split]


import pandas as pd
import numpy as np

# Dataset Preparation
df = pd.read_csv("wdbc.data",header=None)

col_name = ['1','Class','3','4','5','6','7','8','9','10','11','12','13','14','15','16','17','18','19'
           ,'20','21','22','23','24','25','26','27','28','29','30','31','32']


df.columns = col_name


X = df.drop(['Class'], axis=1)
y = df['Class']

from sklearn.model_selection import train_test_split

X_train, X_test, y_train, y_test = train_test_split(X,y,train_size=0.4,test_size=0.6,random_state=10)


# Feature Scaling
from sklearn.preprocessing import StandardScaler

sc = StandardScaler()
X_train = sc.fit_transform(X_train)
X_test = sc.transform(X_test)

# Classification
from sklearn.ensemble import RandomForestClassifier

classifier = RandomForestClassifier()

###############################################################################
# Showing all the parameters

from pprint import pprint
# Look at parameters used by our current forest
print('Parameters currently in use:\n')
pprint(classifier.get_params())

###############################################################################
# Creating a set of important sample features

from sklearn.model_selection import RandomizedSearchCV
# Number of trees in random forest
n_estimators = [int(x) for x in np.linspace(start = 200, stop = 2000, num = 10)]
# Number of features to consider at every split
max_features = ['auto', 'sqrt']
# Maximum number of levels in tree
max_depth = [int(x) for x in np.linspace(10, 110, num = 11)]
max_depth.append(None)
# Minimum number of samples required to split a node
min_samples_split = [2, 5, 10]
# Minimum number of samples required at each leaf node
min_samples_leaf = [1, 2, 4]
# Method of selecting samples for training each tree
bootstrap = [True, False]
# Create the random grid
random_grid = {'n_estimators': n_estimators,
               'max_features': max_features,
               'max_depth': max_depth,
               'min_samples_split': min_samples_split,
               'min_samples_leaf': min_samples_leaf,
               'bootstrap': bootstrap}
pprint(random_grid)

###############################################################################

# Use the random grid to search for best hyperparameters
# First create the base model to tune
classifier = RandomForestClassifier()
```

```python
# Random search of parameters, using 3 fold cross validation,
# search across 100 different combinations, and use all available cores
rf_random = RandomizedSearchCV(estimator = classifier, param_distributions = random_grid, n_iter = 100, cv = 3, verbose=2, random_
# Fit the random search model
rf_random.fit(X_train, y_train)

y_pred = rf_random.predict(X_test)

from sklearn.metrics import classification_report, confusion_matrix, accuracy_score

print("Confusion Matrix:")
print(confusion_matrix(y_test, y_pred))

print("--------------------------------------------------")
print("--------------------------------------------------")


print("Performance Evaluation")
print(classification_report(y_test, y_pred))


print("--------------------------------------------------")
print("--------------------------------------------------")

print("Accuracy:")
print(accuracy_score(y_test, y_pred))

import matplotlib.pyplot as plt
from sklearn.metrics import plot_confusion_matrix
plot_confusion_matrix(rf_random, X_test, y_test)
plt.show()
```

```
Parameters currently in use:

{'bootstrap': True,
 'ccp_alpha': 0.0,
 'class_weight': None,
 'criterion': 'gini',
 'max_depth': None,
 'max_features': 'auto',
 'max_leaf_nodes': None,
 'max_samples': None,
 'min_impurity_decrease': 0.0,
 'min_impurity_split': None,
 'min_samples_leaf': 1,
 'min_samples_split': 2,
 'min_weight_fraction_leaf': 0.0,
 'n_estimators': 100,
 'n_jobs': None,
 'oob_score': False,
 'random_state': None,
 'verbose': 0,
 'warm_start': False}
{'bootstrap': [True, False],
 'max_depth': [10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, None],
 'max_features': ['auto', 'sqrt'],
 'min_samples_leaf': [1, 2, 4],
 'min_samples_split': [2, 5, 10],
 'n_estimators': [200, 400, 600, 800, 1000, 1200, 1400, 1600, 1800, 2000]}
Fitting 3 folds for each of 100 candidates, totalling 300 fits
[Parallel(n_jobs=-1)]: Using backend LokyBackend with 2 concurrent workers.
[Parallel(n_jobs=-1)]: Done  37 tasks      | elapsed:   48.5s
[Parallel(n_jobs=-1)]: Done 158 tasks      | elapsed:  3.3min
[Parallel(n_jobs=-1)]: Done 300 out of 300 | elapsed:  6.4min finished
Confusion Matrix:
[[222   5]
 [  2 113]]
--------------------------------------------------
--------------------------------------------------
Performance Evaluation
              precision    recall  f1-score   support

           B       0.99      0.98      0.98       227
           M       0.96      0.98      0.97       115

    accuracy                           0.98       342
   macro avg       0.97      0.98      0.98       342
weighted avg       0.98      0.98      0.98       342

--------------------------------------------------
--------------------------------------------------
Accuracy:
0.97953216374269
```

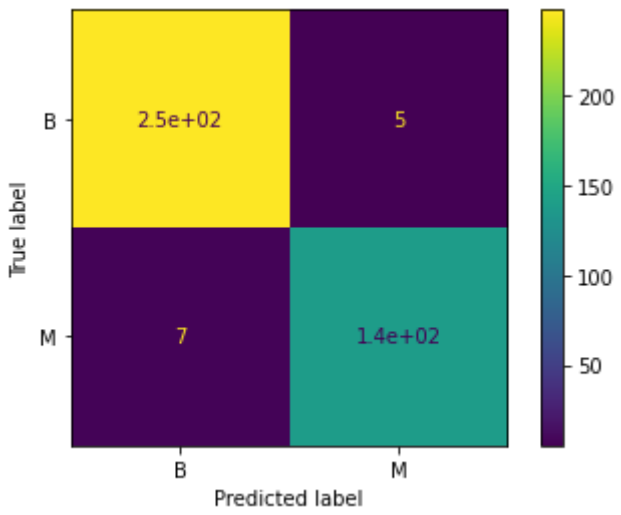


In [ ]:

```
# BREAST CANCER DATASET
# Random Forest Classifier(With Tuning)[30-70 split]


import pandas as pd
import numpy as np

# Dataset Preparation
df = pd.read_csv("wdbc.data",header=None)

col_name = ['1','Class','3','4','5','6','7','8','9','10','11','12','13','14','15','16','17','18','19'
           ,'20','21','22','23','24','25','26','27','28','29','30','31','32']


df.columns = col_name


X = df.drop(['Class'], axis=1)
y = df['Class']

from sklearn.model_selection import train_test_split

X_train, X_test, y_train, y_test = train_test_split(X,y,train_size=0.3,test_size=0.7,random_state=10)


# Feature Scaling
from sklearn.preprocessing import StandardScaler

sc = StandardScaler()
X_train = sc.fit_transform(X_train)
X_test = sc.transform(X_test)

# Classification
from sklearn.ensemble import RandomForestClassifier

classifier = RandomForestClassifier()

################################################################################
# Showing all the parameters

from pprint import pprint
# Look at parameters used by our current forest
print('Parameters currently in use:\n')
pprint(classifier.get_params())

################################################################################
# Creating a set of important sample features

from sklearn.model_selection import RandomizedSearchCV
# Number of trees in random forest
n_estimators = [int(x) for x in np.linspace(start = 200, stop = 2000, num = 10)]
# Number of features to consider at every split
max_features = ['auto', 'sqrt']
# Maximum number of levels in tree
max_depth = [int(x) for x in np.linspace(10, 110, num = 11)]
max_depth.append(None)
# Minimum number of samples required to split a node
min_samples_split = [2, 5, 10]
# Minimum number of samples required at each leaf node
min_samples_leaf = [1, 2, 4]
# Method of selecting samples for training each tree
bootstrap = [True, False]
# Create the random grid
random_grid = {'n_estimators': n_estimators,
               'max_features': max_features,
               'max_depth': max_depth,
               'min_samples_split': min_samples_split,
               'min_samples_leaf': min_samples_leaf,
               'bootstrap': bootstrap}
pprint(random_grid)

################################################################################

# Use the random grid to search for best hyperparameters
# First create the base model to tune
classifier = RandomForestClassifier()
```

```python
# Random search of parameters, using 3 fold cross validation,
# search across 100 different combinations, and use all available cores
rf_random = RandomizedSearchCV(estimator = classifier, param_distributions = random_grid, n_iter = 100, cv = 3, verbose=2, random_
# Fit the random search model
rf_random.fit(X_train, y_train)

y_pred = rf_random.predict(X_test)

from sklearn.metrics import classification_report, confusion_matrix, accuracy_score

print("Confusion Matrix:")
print(confusion_matrix(y_test, y_pred))

print("--------------------------------------------------")
print("--------------------------------------------------")


print("Performance Evaluation")
print(classification_report(y_test, y_pred))


print("--------------------------------------------------")
print("--------------------------------------------------")

print("Accuracy:")
print(accuracy_score(y_test, y_pred))

import matplotlib.pyplot as plt
from sklearn.metrics import plot_confusion_matrix
plot_confusion_matrix(rf_random, X_test, y_test)
plt.show()
```

```
Parameters currently in use:

{'bootstrap': True,
 'ccp_alpha': 0.0,
 'class_weight': None,
 'criterion': 'gini',
 'max_depth': None,
 'max_features': 'auto',
 'max_leaf_nodes': None,
 'max_samples': None,
 'min_impurity_decrease': 0.0,
 'min_impurity_split': None,
 'min_samples_leaf': 1,
 'min_samples_split': 2,
 'min_weight_fraction_leaf': 0.0,
 'n_estimators': 100,
 'n_jobs': None,
 'oob_score': False,
 'random_state': None,
 'verbose': 0,
 'warm_start': False}
{'bootstrap': [True, False],
 'max_depth': [10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, None],
 'max_features': ['auto', 'sqrt'],
 'min_samples_leaf': [1, 2, 4],
 'min_samples_split': [2, 5, 10],
 'n_estimators': [200, 400, 600, 800, 1000, 1200, 1400, 1600, 1800, 2000]}
Fitting 3 folds for each of 100 candidates, totalling 300 fits
[Parallel(n_jobs=-1)]: Using backend LokyBackend with 2 concurrent workers.
[Parallel(n_jobs=-1)]: Done  37 tasks      | elapsed:   46.0s
[Parallel(n_jobs=-1)]: Done 158 tasks      | elapsed:  3.2min
[Parallel(n_jobs=-1)]: Done 300 out of 300 | elapsed:  6.0min finished
Confusion Matrix:
[[248   5]
 [  7 139]]
--------------------------------------------------
--------------------------------------------------
Performance Evaluation
              precision    recall  f1-score   support

           B       0.97      0.98      0.98       253
           M       0.97      0.95      0.96       146

    accuracy                           0.97       399
   macro avg       0.97      0.97      0.97       399
weighted avg       0.97      0.97      0.97       399

--------------------------------------------------
--------------------------------------------------
Accuracy:
0.9699248120300752
```

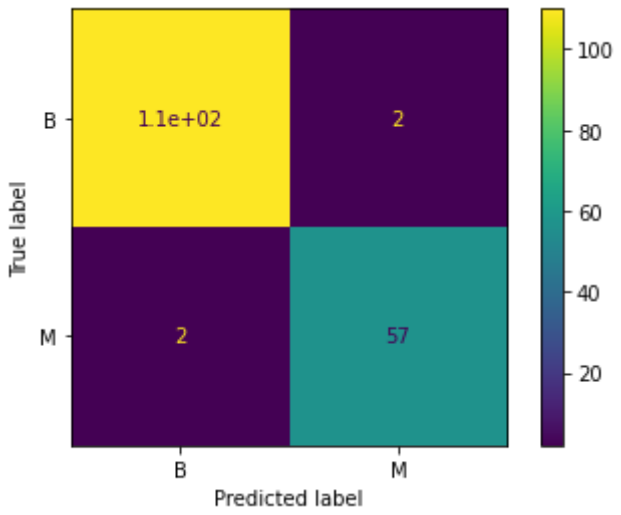


In [ ]:
```
##########################################################################################################################
```

In [ ]:
```
# BREAST CANCER DATASET
# Multi Layer Perceptron(Without Tuning)[70-30 split]


import pandas as pd
import numpy as np

# Dataset Preparation
df = pd.read_csv("wdbc.data",header=None)

col_name = ['1','Class','3','4','5','6','7','8','9','10','11','12','13','14','15','16','17','18','19'
           ,'20','21','22','23','24','25','26','27','28','29','30','31','32']


df.columns = col_name


X = df.drop(['1','Class'], axis=1)
y = df['Class']

from sklearn.model_selection import train_test_split

X_train, X_test, y_train, y_test = train_test_split(X,y,train_size=0.7,test_size=0.30,random_state=10)


# Feature Scaling
from sklearn.preprocessing import StandardScaler

sc = StandardScaler()
X_train = sc.fit_transform(X_train)
X_test = sc.transform(X_test)

# Classification using MLP
from sklearn.neural_network import MLPClassifier

classifier = MLPClassifier()
classifier.fit(X_train,y_train)

y_pred = classifier.predict(X_test)

from sklearn.metrics import classification_report, confusion_matrix, accuracy_score

print("Confusion Matrix:")
print(confusion_matrix(y_test, y_pred))

print("--------------------------------------------------")
print("--------------------------------------------------")


print("Performance Evaluation")
print(classification_report(y_test, y_pred))


print("--------------------------------------------------")
print("--------------------------------------------------")

print("Accuracy:")
print(accuracy_score(y_test, y_pred))

import matplotlib.pyplot as plt
from sklearn.metrics import plot_confusion_matrix
plot_confusion_matrix(classifier, X_test, y_test)
plt.show()
```

```
/usr/local/lib/python3.7/dist-packages/sklearn/neural_network/_multilayer_perceptron.py:571: ConvergenceWarning: Stochastic Optimi
zer: Maximum iterations (200) reached and the optimization hasn't converged yet.
  % self.max_iter, ConvergenceWarning)
Confusion Matrix:
[[110   2]
 [  2  57]]
--------------------------------------------------
--------------------------------------------------
Performance Evaluation
```

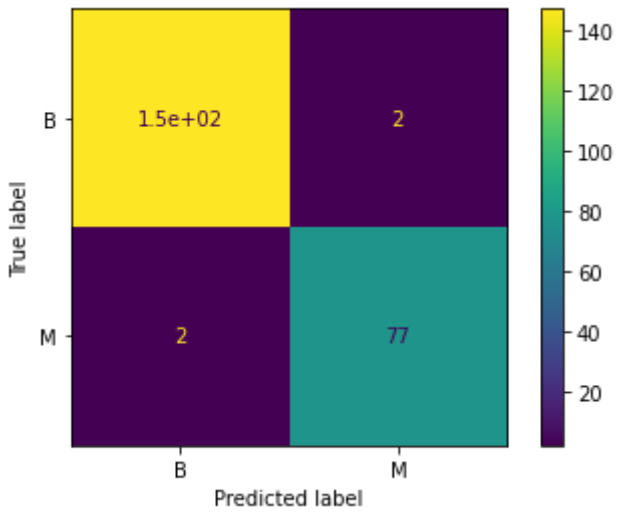
```
              precision    recall  f1-score   support

           B       0.98      0.98      0.98       112
           M       0.97      0.97      0.97        59

    accuracy                           0.98       171
   macro avg       0.97      0.97      0.97       171
weighted avg       0.98      0.98      0.98       171

--------------------------------------------------
--------------------------------------------------
Accuracy:
0.9766081871345029
```



In [ ]:

```python
# BREAST CANCER DATASET
# Multi Layer Perceptron(Without Tuning)[60-40 split]


import pandas as pd
import numpy as np

# Dataset Preparation
df = pd.read_csv("wdbc.data",header=None)

col_name = ['1','Class','3','4','5','6','7','8','9','10','11','12','13','14','15','16','17','18','19'
           ,'20','21','22','23','24','25','26','27','28','29','30','31','32']


df.columns = col_name


X = df.drop(['1','Class'], axis=1)
y = df['Class']

from sklearn.model_selection import train_test_split

X_train, X_test, y_train, y_test = train_test_split(X,y,train_size=0.6,test_size=0.4,random_state=10)


# Feature Scaling
from sklearn.preprocessing import StandardScaler

sc = StandardScaler()
X_train = sc.fit_transform(X_train)
X_test = sc.transform(X_test)

# Classification using MLP
from sklearn.neural_network import MLPClassifier

classifier = MLPClassifier()
classifier.fit(X_train,y_train)

y_pred = classifier.predict(X_test)

from sklearn.metrics import classification_report, confusion_matrix, accuracy_score

print("Confusion Matrix:")
print(confusion_matrix(y_test, y_pred))

print("--------------------------------------------------")
print("--------------------------------------------------")


print("Performance Evaluation")
print(classification_report(y_test, y_pred))


print("--------------------------------------------------")
print("--------------------------------------------------")

print("Accuracy:")
print(accuracy_score(y_test, y_pred))

import matplotlib.pyplot as plt
from sklearn.metrics import plot_confusion_matrix
plot_confusion_matrix(classifier, X_test, y_test)
plt.show()
```

```
/usr/local/lib/python3.7/dist-packages/sklearn/neural_network/_multilayer_perceptron.py:571: ConvergenceWarning: Stochastic Optimi
zer: Maximum iterations (200) reached and the optimization hasn't converged yet.
  % self.max_iter, ConvergenceWarning)
Confusion Matrix:
[[147   2]
 [  2  77]]
--------------------------------------------------
--------------------------------------------------
Performance Evaluation
              precision    recall  f1-score   support

           B       0.99      0.99      0.99       149
           M       0.97      0.97      0.97        79

    accuracy                           0.98       228
   macro avg       0.98      0.98      0.98       228
weighted avg       0.98      0.98      0.98       228

--------------------------------------------------
--------------------------------------------------
Accuracy:
0.9824561403508771
```

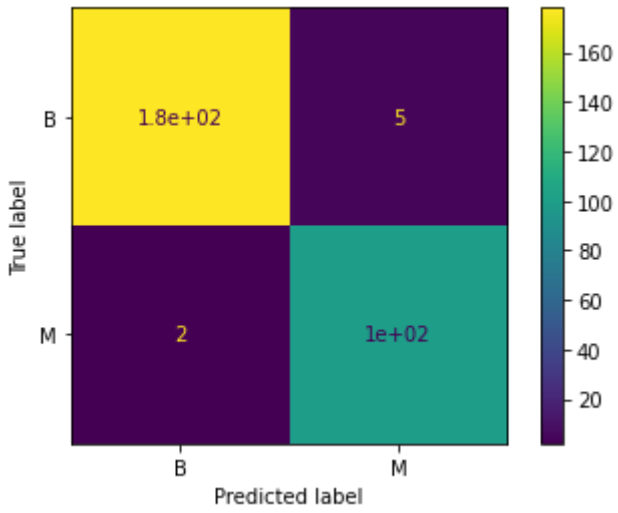


In [ ]:

```
# BREAST CANCER DATASET
# Multi Layer Perceptron(Without Tuning)[50-50 split]


import pandas as pd
import numpy as np

# Dataset Preparation
df = pd.read_csv("wdbc.data",header=None)

col_name = ['1','Class','3','4','5','6','7','8','9','10','11','12','13','14','15','16','17','18','19'
           ,'20','21','22','23','24','25','26','27','28','29','30','31','32']


df.columns = col_name


X = df.drop(['1','Class'], axis=1)
y = df['Class']

from sklearn.model_selection import train_test_split

X_train, X_test, y_train, y_test = train_test_split(X,y,train_size=0.5,test_size=0.5,random_state=10)


# Feature Scaling
from sklearn.preprocessing import StandardScaler

sc = StandardScaler()
X_train = sc.fit_transform(X_train)
X_test = sc.transform(X_test)

# Classification using MLP
from sklearn.neural_network import MLPClassifier

classifier = MLPClassifier()
classifier.fit(X_train,y_train)

y_pred = classifier.predict(X_test)

from sklearn.metrics import classification_report, confusion_matrix, accuracy_score

print("Confusion Matrix:")
print(confusion_matrix(y_test, y_pred))

print("--------------------------------------------------")
print("--------------------------------------------------")


print("Performance Evaluation")
print(classification_report(y_test, y_pred))


print("--------------------------------------------------")
print("--------------------------------------------------")
```

```
print("Accuracy:")
print(accuracy_score(y_test, y_pred))

import matplotlib.pyplot as plt
from sklearn.metrics import plot_confusion_matrix
plot_confusion_matrix(classifier, X_test, y_test)
plt.show()
```

```
/usr/local/lib/python3.7/dist-packages/sklearn/neural_network/_multilayer_perceptron.py:571: ConvergenceWarning: Stochastic Optimi
zer: Maximum iterations (200) reached and the optimization hasn't converged yet.
  % self.max_iter, ConvergenceWarning)
Confusion Matrix:
[[178   5]
 [  2 100]]
--------------------------------------------------
--------------------------------------------------
Performance Evaluation
              precision    recall  f1-score   support

           B       0.99      0.97      0.98       183
           M       0.95      0.98      0.97       102

    accuracy                           0.98       285
   macro avg       0.97      0.98      0.97       285
weighted avg       0.98      0.98      0.98       285

--------------------------------------------------
--------------------------------------------------
Accuracy:
0.9754385964912281
```

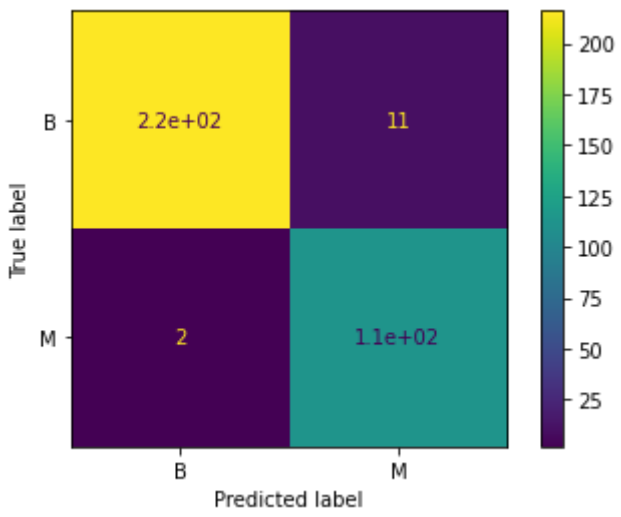


In [ ]:

```
# BREAST CANCER DATASET
# Multi Layer Perceptron(Without Tuning)[40-60 split]


import pandas as pd
import numpy as np

# Dataset Preparation
df = pd.read_csv("wdbc.data",header=None)

col_name = ['1','Class','3','4','5','6','7','8','9','10','11','12','13','14','15','16','17','18','19'
           ,'20','21','22','23','24','25','26','27','28','29','30','31','32']


df.columns = col_name


X = df.drop(['1','Class'], axis=1)
y = df['Class']

from sklearn.model_selection import train_test_split

X_train, X_test, y_train, y_test = train_test_split(X,y,train_size=0.4,test_size=0.6,random_state=10)


# Feature Scaling
from sklearn.preprocessing import StandardScaler

sc = StandardScaler()
X_train = sc.fit_transform(X_train)
X_test = sc.transform(X_test)

# Classification using MLP
from sklearn.neural_network import MLPClassifier

classifier = MLPClassifier()
classifier.fit(X_train,y_train)

y_pred = classifier.predict(X_test)

from sklearn.metrics import classification_report, confusion_matrix, accuracy_score

print("Confusion Matrix:")
print(confusion_matrix(y_test, y_pred))

print("--------------------------------------------------")
```

```
print("-------------------------------------------------")


print("Performance Evaluation")
print(classification_report(y_test, y_pred))


print("-------------------------------------------------")
print("-------------------------------------------------")

print("Accuracy:")
print(accuracy_score(y_test, y_pred))

import matplotlib.pyplot as plt
from sklearn.metrics import plot_confusion_matrix
plot_confusion_matrix(classifier, X_test, y_test)
plt.show()
```

```
/usr/local/lib/python3.7/dist-packages/sklearn/neural_network/_multilayer_perceptron.py:571: ConvergenceWarning: Stochastic Optimi
zer: Maximum iterations (200) reached and the optimization hasn't converged yet.
  % self.max_iter, ConvergenceWarning)
Confusion Matrix:
[[216  11]
 [  2 113]]
-------------------------------------------------
-------------------------------------------------
Performance Evaluation
              precision    recall  f1-score   support

           B       0.99      0.95      0.97       227
           M       0.91      0.98      0.95       115

    accuracy                           0.96       342
   macro avg       0.95      0.97      0.96       342
weighted avg       0.96      0.96      0.96       342

-------------------------------------------------
-------------------------------------------------
Accuracy:
0.9619883040935673
```

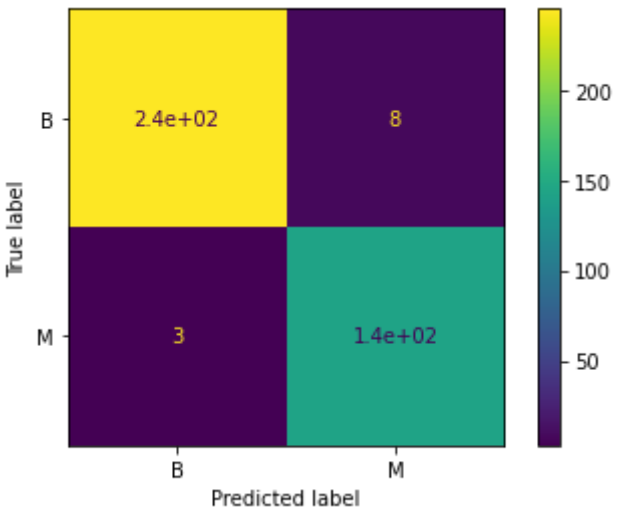


In [ ]:

```
# BREAST CANCER DATASET
# Multi Layer Perceptron(Without Tuning)[30-70 split]


import pandas as pd
import numpy as np

# Dataset Preparation
df = pd.read_csv("wdbc.data",header=None)

col_name = ['1','Class','3','4','5','6','7','8','9','10','11','12','13','14','15','16','17','18','19'
           ,'20','21','22','23','24','25','26','27','28','29','30','31','32']


df.columns = col_name


X = df.drop(['1','Class'], axis=1)
y = df['Class']

from sklearn.model_selection import train_test_split

X_train, X_test, y_train, y_test = train_test_split(X,y,train_size=0.3,test_size=0.7,random_state=10)


# Feature Scaling
from sklearn.preprocessing import StandardScaler

sc = StandardScaler()
X_train = sc.fit_transform(X_train)
X_test = sc.transform(X_test)

# Classification using MLP
from sklearn.neural_network import MLPClassifier

classifier = MLPClassifier()
classifier.fit(X_train,y_train)
```

```
y_pred = classifier.predict(X_test)

from sklearn.metrics import classification_report, confusion_matrix, accuracy_score

print("Confusion Matrix:")
print(confusion_matrix(y_test, y_pred))

print("--------------------------------------------------")
print("--------------------------------------------------")


print("Performance Evaluation")
print(classification_report(y_test, y_pred))


print("--------------------------------------------------")
print("--------------------------------------------------")

print("Accuracy:")
print(accuracy_score(y_test, y_pred))

import matplotlib.pyplot as plt
from sklearn.metrics import plot_confusion_matrix
plot_confusion_matrix(classifier, X_test, y_test)
plt.show()
```

```
/usr/local/lib/python3.7/dist-packages/sklearn/neural_network/_multilayer_perceptron.py:571: ConvergenceWarning: Stochastic Optimi
zer: Maximum iterations (200) reached and the optimization hasn't converged yet.
  % self.max_iter, ConvergenceWarning)
Confusion Matrix:
[[245   8]
 [  3 143]]
--------------------------------------------------
--------------------------------------------------
Performance Evaluation
              precision    recall  f1-score   support

           B       0.99      0.97      0.98       253
           M       0.95      0.98      0.96       146

    accuracy                           0.97       399
   macro avg       0.97      0.97      0.97       399
weighted avg       0.97      0.97      0.97       399

--------------------------------------------------
--------------------------------------------------
Accuracy:
0.9724310776942355
```



In [ ]:

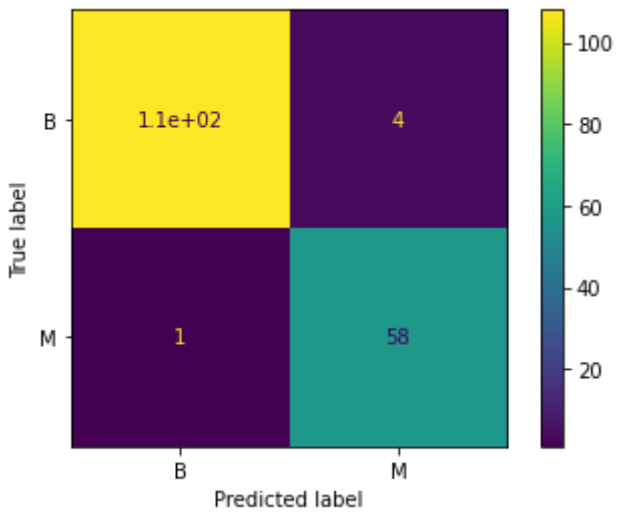
```
# BREAST CANCER DATASET
# Multi Layer Perceptron(With Tuning)[70-30 split]


import pandas as pd
import numpy as np

# Dataset Preparation
df = pd.read_csv("wdbc.data",header=None)

col_name = ['1','Class','3','4','5','6','7','8','9','10','11','12','13','14','15','16','17','18','19'
           ,'20','21','22','23','24','25','26','27','28','29','30','31','32']


df.columns = col_name


X = df.drop(['1','Class'], axis=1)
y = df['Class']

from sklearn.model_selection import train_test_split

X_train, X_test, y_train, y_test = train_test_split(X,y,train_size=0.7,test_size=0.3,random_state=10)


# Feature Scaling
from sklearn.preprocessing import StandardScaler
```

```
sc = StandardScaler()
X_train = sc.fit_transform(X_train)
X_test = sc.transform(X_test)

# Classification
from sklearn.neural_network import MLPClassifier
classifier = MLPClassifier(max_iter=100)

###############################################################################
# Showing all the parameters

from pprint import pprint
# Look at parameters used by our current forest
print('Parameters currently in use:\n')
pprint(classifier.get_params())

###############################################################################
# Creating a set of important sample features

parameter_space = {
    'hidden_layer_sizes': [(50,50,50), (50,100,50), (100,)],
    'activation': ['tanh', 'relu'],
    'solver': ['sgd', 'adam'],
    'alpha': [0.0001, 0.05],
    'learning_rate': ['constant','adaptive'],
}
pprint(parameter_space)

###############################################################################

from sklearn.model_selection import GridSearchCV

# Use the random grid to search for best hyperparameters
# First create the base model to tune
classifier = MLPClassifier(max_iter=100)
# Random search of parameters, using 3 fold cross validation,
# search across 100 different combinations, and use all available cores

rf_random = GridSearchCV(classifier, parameter_space, n_jobs=-1, cv=3)
rf_random.fit(X_train, y_train)

y_pred = rf_random.predict(X_test)

from sklearn.metrics import classification_report, confusion_matrix, accuracy_score

print("Confusion Matrix:")
print(confusion_matrix(y_test, y_pred))

print("-------------------------------------------------------")
print("-------------------------------------------------------")


print("Performance Evaluation")
print(classification_report(y_test, y_pred))


print("-------------------------------------------------------")
print("-------------------------------------------------------")

print("Accuracy:")
print(accuracy_score(y_test, y_pred))


import matplotlib.pyplot as plt
from sklearn.metrics import plot_confusion_matrix
plot_confusion_matrix(rf_random, X_test, y_test)
plt.show()
```

```
Parameters currently in use:

{'activation': 'relu',
 'alpha': 0.0001,
 'batch_size': 'auto',
 'beta_1': 0.9,
 'beta_2': 0.999,
 'early_stopping': False,
 'epsilon': 1e-08,
 'hidden_layer_sizes': (100,),
 'learning_rate': 'constant',
 'learning_rate_init': 0.001,
 'max_fun': 15000,
 'max_iter': 100,
 'momentum': 0.9,
 'n_iter_no_change': 10,
 'nesterovs_momentum': True,
 'power_t': 0.5,
 'random_state': None,
 'shuffle': True,
 'solver': 'adam',
 'tol': 0.0001,
 'validation_fraction': 0.1,
 'verbose': False,
 'warm_start': False}
{'activation': ['tanh', 'relu'],
 'alpha': [0.0001, 0.05],
 'hidden_layer_sizes': [(50, 50, 50), (50, 100, 50), (100,)],
```

```
 'learning_rate': ['constant', 'adaptive'],
 'solver': ['sgd', 'adam']}
```

```
/usr/local/lib/python3.7/dist-packages/sklearn/neural_network/_multilayer_perceptron.py:571: ConvergenceWarning: Stochastic Optimizer: Maximum iterations (100) reached and the optimization hasn't converged yet.
  % self.max_iter, ConvergenceWarning)
Confusion Matrix:
[[108   4]
 [  1  58]]
--------------------------------------------------
--------------------------------------------------
Performance Evaluation
              precision    recall  f1-score   support

           B       0.99      0.96      0.98       112
           M       0.94      0.98      0.96        59

    accuracy                           0.97       171
   macro avg       0.96      0.97      0.97       171
weighted avg       0.97      0.97      0.97       171

--------------------------------------------------
--------------------------------------------------
Accuracy:
0.9707602339181286
```

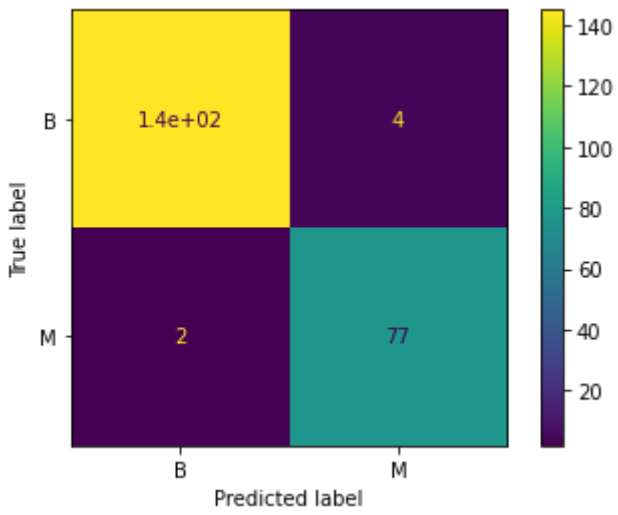


In [ ]:

```
# BREAST CANCER DATASET
# Multi Layer Perceptron(With Tuning)[60-40 split]


import pandas as pd
import numpy as np

# Dataset Preparation
df = pd.read_csv("wdbc.data",header=None)

col_name = ['1','Class','3','4','5','6','7','8','9','10','11','12','13','14','15','16','17','18','19'
           ,'20','21','22','23','24','25','26','27','28','29','30','31','32']


df.columns = col_name


X = df.drop(['1','Class'], axis=1)
y = df['Class']

from sklearn.model_selection import train_test_split

X_train, X_test, y_train, y_test = train_test_split(X,y,train_size=0.6,test_size=0.4,random_state=10)


# Feature Scaling
from sklearn.preprocessing import StandardScaler

sc = StandardScaler()
X_train = sc.fit_transform(X_train)
X_test = sc.transform(X_test)

# Classification
from sklearn.neural_network import MLPClassifier
classifier = MLPClassifier(max_iter=100)

###############################################################################
# Showing all the parameters

from pprint import pprint
# Look at parameters used by our current forest
print('Parameters currently in use:\n')
pprint(classifier.get_params())

###############################################################################
# Creating a set of important sample features

parameter_space = {
    'hidden_layer_sizes': [(50,50,50), (50,100,50), (100,)],
    'activation': ['tanh', 'relu'],
    'solver': ['sgd', 'adam'],
    'alpha': [0.0001, 0.05],
    'learning_rate': ['constant','adaptive'],
```

```
}
pprint(parameter_space)

################################################################################

from sklearn.model_selection import GridSearchCV

# Use the random grid to search for best hyperparameters
# First create the base model to tune
classifier = MLPClassifier(max_iter=100)
# Random search of parameters, using 3 fold cross validation,
# search across 100 different combinations, and use all available cores

rf_random = GridSearchCV(classifier, parameter_space, n_jobs=-1, cv=3)
rf_random.fit(X_train, y_train)

y_pred = rf_random.predict(X_test)

from sklearn.metrics import classification_report, confusion_matrix, accuracy_score

print("Confusion Matrix:")
print(confusion_matrix(y_test, y_pred))

print("-------------------------------------------------------")
print("-------------------------------------------------------")


print("Performance Evaluation")
print(classification_report(y_test, y_pred))


print("-------------------------------------------------------")
print("-------------------------------------------------------")

print("Accuracy:")
print(accuracy_score(y_test, y_pred))


import matplotlib.pyplot as plt
from sklearn.metrics import plot_confusion_matrix
plot_confusion_matrix(rf_random, X_test, y_test)
plt.show()
```

```
Parameters currently in use:

{'activation': 'relu',
 'alpha': 0.0001,
 'batch_size': 'auto',
 'beta_1': 0.9,
 'beta_2': 0.999,
 'early_stopping': False,
 'epsilon': 1e-08,
 'hidden_layer_sizes': (100,),
 'learning_rate': 'constant',
 'learning_rate_init': 0.001,
 'max_fun': 15000,
 'max_iter': 100,
 'momentum': 0.9,
 'n_iter_no_change': 10,
 'nesterovs_momentum': True,
 'power_t': 0.5,
 'random_state': None,
 'shuffle': True,
 'solver': 'adam',
 'tol': 0.0001,
 'validation_fraction': 0.1,
 'verbose': False,
 'warm_start': False}
{'activation': ['tanh', 'relu'],
 'alpha': [0.0001, 0.05],
 'hidden_layer_sizes': [(50, 50, 50), (50, 100, 50), (100,)],
 'learning_rate': ['constant', 'adaptive'],
 'solver': ['sgd', 'adam']}
/usr/local/lib/python3.7/dist-packages/sklearn/neural_network/_multilayer_perceptron.py:571: ConvergenceWarning: Stochastic Optimi
zer: Maximum iterations (100) reached and the optimization hasn't converged yet.
  % self.max_iter, ConvergenceWarning)
Confusion Matrix:
[[145   4]
 [  2  77]]
-------------------------------------------------------
-------------------------------------------------------
Performance Evaluation
              precision    recall  f1-score   support

           B       0.99      0.97      0.98       149
           M       0.95      0.97      0.96        79

    accuracy                           0.97       228
   macro avg       0.97      0.97      0.97       228
weighted avg       0.97      0.97      0.97       228

-------------------------------------------------------
-------------------------------------------------------
Accuracy:
0.9736842105263158
```

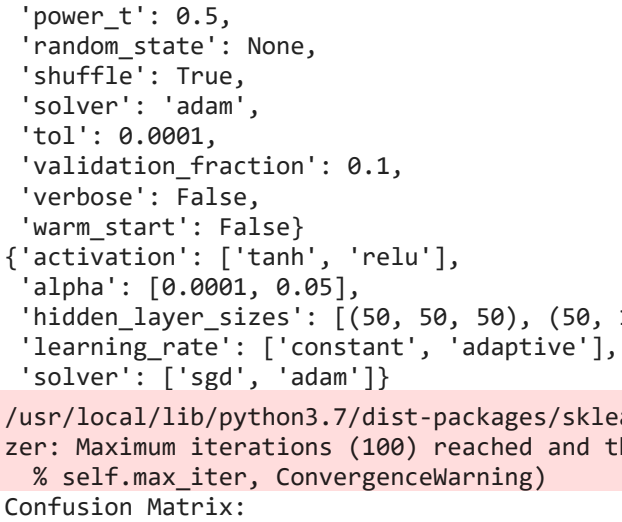


In [ ]:

```
# BREAST CANCER DATASET
# Multi Layer Perceptron(With Tuning)[50-50 split]


import pandas as pd
import numpy as np

# Dataset Preparation
df = pd.read_csv("wdbc.data",header=None)

col_name = ['1','Class','3','4','5','6','7','8','9','10','11','12','13','14','15','16','17','18','19'
           ,'20','21','22','23','24','25','26','27','28','29','30','31','32']


df.columns = col_name


X = df.drop(['1','Class'], axis=1)
y = df['Class']

from sklearn.model_selection import train_test_split

X_train, X_test, y_train, y_test = train_test_split(X,y,train_size=0.5,test_size=0.5,random_state=10)


# Feature Scaling
from sklearn.preprocessing import StandardScaler

sc = StandardScaler()
X_train = sc.fit_transform(X_train)
X_test = sc.transform(X_test)

# Classification
from sklearn.neural_network import MLPClassifier
classifier = MLPClassifier(max_iter=100)

###############################################################################
# Showing all the parameters

from pprint import pprint
# Look at parameters used by our current forest
print('Parameters currently in use:\n')
pprint(classifier.get_params())

###############################################################################
# Creating a set of important sample features


parameter_space = {
    'hidden_layer_sizes': [(50,50,50), (50,100,50), (100,)],
    'activation': ['tanh', 'relu'],
    'solver': ['sgd', 'adam'],
    'alpha': [0.0001, 0.05],
    'learning_rate': ['constant','adaptive'],
}
pprint(parameter_space)

###############################################################################

from sklearn.model_selection import GridSearchCV

# Use the random grid to search for best hyperparameters
# First create the base model to tune
classifier = MLPClassifier(max_iter=100)
# Random search of parameters, using 3 fold cross validation,
# search across 100 different combinations, and use all available cores

rf_random = GridSearchCV(classifier, parameter_space, n_jobs=-1, cv=3)
rf_random.fit(X_train, y_train)

y_pred = rf_random.predict(X_test)

from sklearn.metrics import classification_report, confusion_matrix, accuracy_score

print("Confusion Matrix:")
print(confusion_matrix(y_test, y_pred))
```

```
print("-------------------------------------------------")
print("-------------------------------------------------")


print("Performance Evaluation")
print(classification_report(y_test, y_pred))


print("-------------------------------------------------")
print("-------------------------------------------------")

print("Accuracy:")
print(accuracy_score(y_test, y_pred))


import matplotlib.pyplot as plt
from sklearn.metrics import plot_confusion_matrix
plot_confusion_matrix(rf_random, X_test, y_test)
plt.show()
```

```
Parameters currently in use:

{'activation': 'relu',
 'alpha': 0.0001,
 'batch_size': 'auto',
 'beta_1': 0.9,
 'beta_2': 0.999,
 'early_stopping': False,
 'epsilon': 1e-08,
 'hidden_layer_sizes': (100,),
 'learning_rate': 'constant',
 'learning_rate_init': 0.001,
 'max_fun': 15000,
 'max_iter': 100,
 'momentum': 0.9,
 'n_iter_no_change': 10,
 'nesterovs_momentum': True,
 'power_t': 0.5,
 'random_state': None,
 'shuffle': True,
 'solver': 'adam',
 'tol': 0.0001,
 'validation_fraction': 0.1,
 'verbose': False,
 'warm_start': False}
{'activation': ['tanh', 'relu'],
 'alpha': [0.0001, 0.05],
 'hidden_layer_sizes': [(50, 50, 50), (50, 100, 50), (100,)],
 'learning_rate': ['constant', 'adaptive'],
 'solver': ['sgd', 'adam']}
/usr/local/lib/python3.7/dist-packages/sklearn/neural_network/_multilayer_perceptron.py:571: ConvergenceWarning: Stochastic Optimi
zer: Maximum iterations (100) reached and the optimization hasn't converged yet.
  % self.max_iter, ConvergenceWarning)
Confusion Matrix:
[[177   6]
 [  0 102]]
-------------------------------------------------
-------------------------------------------------
Performance Evaluation
              precision    recall  f1-score   support

           B       1.00      0.97      0.98       183
           M       0.94      1.00      0.97       102

    accuracy                           0.98       285
   macro avg       0.97      0.98      0.98       285
weighted avg       0.98      0.98      0.98       285

-------------------------------------------------
-------------------------------------------------
Accuracy:
0.9789473684210527
```



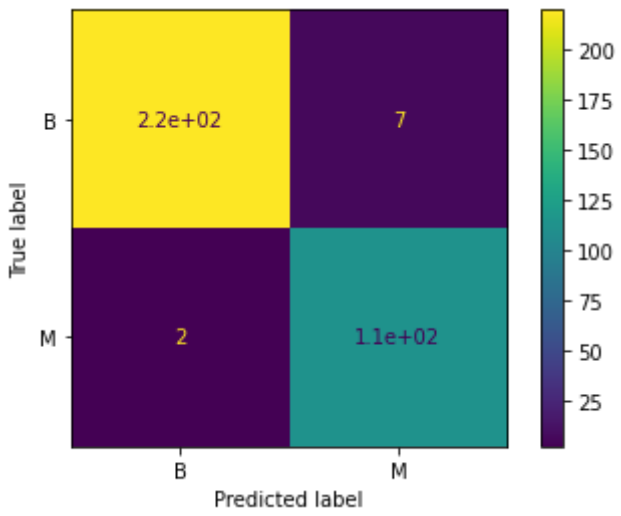
In [ ]:

```
# BREAST CANCER DATASET
# Multi Layer Perceptron(With Tuning)[40-60 split]


import pandas as pd
import numpy as np
```

```
# Dataset Preparation
df = pd.read_csv("wdbc.data",header=None)

col_name = ['1','Class','3','4','5','6','7','8','9','10','11','12','13','14','15','16','17','18','19'
           ,'20','21','22','23','24','25','26','27','28','29','30','31','32']


df.columns = col_name


X = df.drop(['1','Class'], axis=1)
y = df['Class']

from sklearn.model_selection import train_test_split

X_train, X_test, y_train, y_test = train_test_split(X,y,train_size=0.4,test_size=0.6,random_state=10)


# Feature Scaling
from sklearn.preprocessing import StandardScaler

sc = StandardScaler()
X_train = sc.fit_transform(X_train)
X_test = sc.transform(X_test)

# Classification
from sklearn.neural_network import MLPClassifier
classifier = MLPClassifier(max_iter=100)

###############################################################################
# Showing all the parameters

from pprint import pprint
# Look at parameters used by our current forest
print('Parameters currently in use:\n')
pprint(classifier.get_params())

###############################################################################
# Creating a set of important sample features

parameter_space = {
    'hidden_layer_sizes': [(50,50,50), (50,100,50), (100,)],
    'activation': ['tanh', 'relu'],
    'solver': ['sgd', 'adam'],
    'alpha': [0.0001, 0.05],
    'learning_rate': ['constant','adaptive'],
}
pprint(parameter_space)

###############################################################################

from sklearn.model_selection import GridSearchCV

# Use the random grid to search for best hyperparameters
# First create the base model to tune
classifier = MLPClassifier(max_iter=100)
# Random search of parameters, using 3 fold cross validation,
# search across 100 different combinations, and use all available cores

rf_random = GridSearchCV(classifier, parameter_space, n_jobs=-1, cv=3)
rf_random.fit(X_train, y_train)

y_pred = rf_random.predict(X_test)

from sklearn.metrics import classification_report, confusion_matrix, accuracy_score

print("Confusion Matrix:")
print(confusion_matrix(y_test, y_pred))

print("--------------------------------------------------")
print("--------------------------------------------------")


print("Performance Evaluation")
print(classification_report(y_test, y_pred))


print("--------------------------------------------------")
print("--------------------------------------------------")

print("Accuracy:")
print(accuracy_score(y_test, y_pred))


import matplotlib.pyplot as plt
from sklearn.metrics import plot_confusion_matrix
plot_confusion_matrix(rf_random, X_test, y_test)
plt.show()
```

```
Parameters currently in use:

{'activation': 'relu',
 'alpha': 0.0001,
 'batch_size': 'auto',
```

```
 'beta_1': 0.9,
 'beta_2': 0.999,
 'early_stopping': False,
 'epsilon': 1e-08,
 'hidden_layer_sizes': (100,),
 'learning_rate': 'constant',
 'learning_rate_init': 0.001,
 'max_fun': 15000,
 'max_iter': 100,
 'momentum': 0.9,
 'n_iter_no_change': 10,
 'nesterovs_momentum': True,
 'power_t': 0.5,
 'random_state': None,
 'shuffle': True,
 'solver': 'adam',
 'tol': 0.0001,
 'validation_fraction': 0.1,
 'verbose': False,
 'warm_start': False}
{'activation': ['tanh', 'relu'],
 'alpha': [0.0001, 0.05],
 'hidden_layer_sizes': [(50, 50, 50), (50, 100, 50), (100,)],
 'learning_rate': ['constant', 'adaptive'],
 'solver': ['sgd', 'adam']}
/usr/local/lib/python3.7/dist-packages/sklearn/neural_network/_multilayer_perceptron.py:571: ConvergenceWarning: Stochastic Optimi
zer: Maximum iterations (100) reached and the optimization hasn't converged yet.
  % self.max_iter, ConvergenceWarning)
Confusion Matrix:
[[220   7]
 [  2 113]]
--------------------------------------------------
Performance Evaluation
              precision    recall  f1-score   support

           B       0.99      0.97      0.98       227
           M       0.94      0.98      0.96       115

    accuracy                           0.97       342
   macro avg       0.97      0.98      0.97       342
weighted avg       0.97      0.97      0.97       342

--------------------------------------------------
--------------------------------------------------
Accuracy:
0.9736842105263158
```



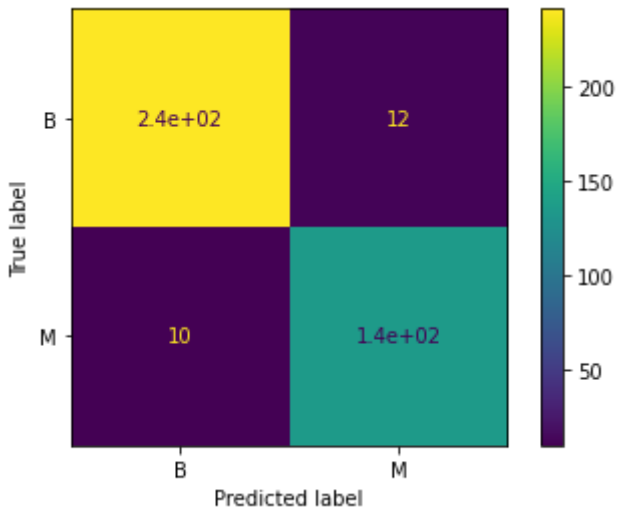
In [ ]:

```python
# BREAST CANCER DATASET
# Multi Layer Perceptron(With Tuning)[30-70 split]


import pandas as pd
import numpy as np

# Dataset Preparation
df = pd.read_csv("wdbc.data",header=None)

col_name = ['1','Class','3','4','5','6','7','8','9','10','11','12','13','14','15','16','17','18','19'
           ,'20','21','22','23','24','25','26','27','28','29','30','31','32']


df.columns = col_name


X = df.drop(['1','Class'], axis=1)
y = df['Class']

from sklearn.model_selection import train_test_split

X_train, X_test, y_train, y_test = train_test_split(X,y,train_size=0.3,test_size=0.7,random_state=10)


# Feature Scaling
from sklearn.preprocessing import StandardScaler

sc = StandardScaler()
X_train = sc.fit_transform(X_train)
X_test = sc.transform(X_test)
```

```
# Classification
from sklearn.neural_network import MLPClassifier
classifier = MLPClassifier(max_iter=100)

###############################################################################
# Showing all the parameters

from pprint import pprint
# Look at parameters used by our current forest
print('Parameters currently in use:\n')
pprint(classifier.get_params())

###############################################################################
# Creating a set of important sample features

parameter_space = {
    'hidden_layer_sizes': [(50,50,50), (50,100,50), (100,)],
    'activation': ['tanh', 'relu'],
    'solver': ['sgd', 'adam'],
    'alpha': [0.0001, 0.05],
    'learning_rate': ['constant','adaptive'],
}
pprint(parameter_space)

###############################################################################

from sklearn.model_selection import GridSearchCV

# Use the random grid to search for best hyperparameters
# First create the base model to tune
classifier = MLPClassifier(max_iter=100)
# Random search of parameters, using 3 fold cross validation,
# search across 100 different combinations, and use all available cores

rf_random = GridSearchCV(classifier, parameter_space, n_jobs=-1, cv=3)
rf_random.fit(X_train, y_train)

y_pred = rf_random.predict(X_test)

from sklearn.metrics import classification_report, confusion_matrix, accuracy_score

print("Confusion Matrix:")
print(confusion_matrix(y_test, y_pred))

print("--------------------------------------------------")
print("--------------------------------------------------")


print("Performance Evaluation")
print(classification_report(y_test, y_pred))


print("--------------------------------------------------")
print("--------------------------------------------------")

print("Accuracy:")
print(accuracy_score(y_test, y_pred))


import matplotlib.pyplot as plt
from sklearn.metrics import plot_confusion_matrix
plot_confusion_matrix(rf_random, X_test, y_test)
plt.show()
```

```
Parameters currently in use:

{'activation': 'relu',
 'alpha': 0.0001,
 'batch_size': 'auto',
 'beta_1': 0.9,
 'beta_2': 0.999,
 'early_stopping': False,
 'epsilon': 1e-08,
 'hidden_layer_sizes': (100,),
 'learning_rate': 'constant',
 'learning_rate_init': 0.001,
 'max_fun': 15000,
 'max_iter': 100,
 'momentum': 0.9,
 'n_iter_no_change': 10,
 'nesterovs_momentum': True,
 'power_t': 0.5,
 'random_state': None,
 'shuffle': True,
 'solver': 'adam',
 'tol': 0.0001,
 'validation_fraction': 0.1,
 'verbose': False,
 'warm_start': False}
{'activation': ['tanh', 'relu'],
 'alpha': [0.0001, 0.05],
 'hidden_layer_sizes': [(50, 50, 50), (50, 100, 50), (100,)],
 'learning_rate': ['constant', 'adaptive'],
 'solver': ['sgd', 'adam']}
```

```
/usr/local/lib/python3.7/dist-packages/sklearn/neural_network/_multilayer_perceptron.py:571: ConvergenceWarning: Stochastic Optimi
zer: Maximum iterations (100) reached and the optimization hasn't converged yet.
  % self.max_iter, ConvergenceWarning)
Confusion Matrix:
[[241  12]
 [ 10 136]]
--------------------------------------------------
--------------------------------------------------
Performance Evaluation
              precision    recall  f1-score   support

           B       0.96      0.95      0.96       253
           M       0.92      0.93      0.93       146

    accuracy                           0.94       399
   macro avg       0.94      0.94      0.94       399
weighted avg       0.95      0.94      0.94       399

--------------------------------------------------
--------------------------------------------------
Accuracy:
0.9448621553884712
```



In [ ]:

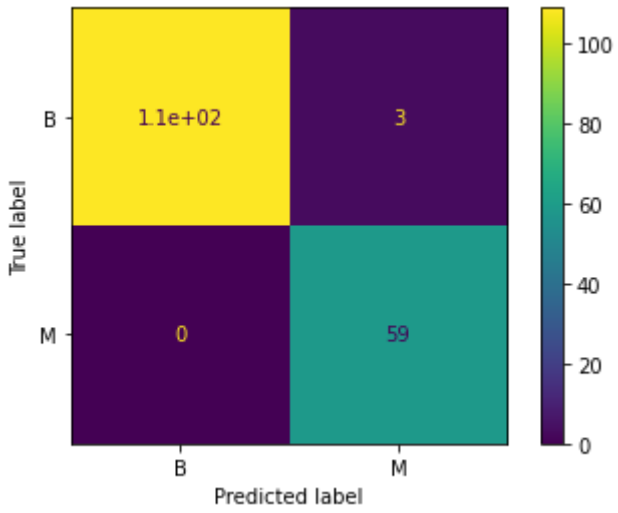
```
##########################################################################################################################
```

In [ ]:

```
# BREAST CANCER DATASET
# SVM(Without Tuning)[70-30 split]


import pandas as pd
import numpy as np

# Dataset Preparation
df = pd.read_csv("wdbc.data",header=None)

col_name = ['1','Class','3','4','5','6','7','8','9','10','11','12','13','14','15','16','17','18','19'
           ,'20','21','22','23','24','25','26','27','28','29','30','31','32']


df.columns = col_name


X = df.drop(['1','Class'], axis=1)
y = df['Class']

from sklearn.model_selection import train_test_split

X_train, X_test, y_train, y_test = train_test_split(X,y,train_size=0.7,test_size=0.3,random_state=10)


# Feature Scaling
from sklearn.preprocessing import StandardScaler

sc = StandardScaler()
X_train = sc.fit_transform(X_train)
X_test = sc.transform(X_test)

# Classification
from sklearn.svm import SVC

classifier = SVC()
classifier.fit(X_train,y_train)

y_pred = classifier.predict(X_test)

from sklearn.metrics import classification_report, confusion_matrix, accuracy_score

print("Confusion Matrix:")
print(confusion_matrix(y_test, y_pred))

print("--------------------------------------------------")
print("--------------------------------------------------")


print("Performance Evaluation")
print(classification_report(y_test, y_pred))
```

```
print("-------------------------------------------------------")
print("-------------------------------------------------------")

print("Accuracy:")
print(accuracy_score(y_test, y_pred))

import matplotlib.pyplot as plt
from sklearn.metrics import plot_confusion_matrix
plot_confusion_matrix(classifier, X_test, y_test)
plt.show()
```

```
Confusion Matrix:
[[109   3]
 [  0  59]]
-------------------------------------------------------
-------------------------------------------------------
Performance Evaluation
              precision    recall  f1-score   support

           B       1.00      0.97      0.99       112
           M       0.95      1.00      0.98        59

    accuracy                           0.98       171
   macro avg       0.98      0.99      0.98       171
weighted avg       0.98      0.98      0.98       171

-------------------------------------------------------
-------------------------------------------------------
Accuracy:
0.9824561403508771
```

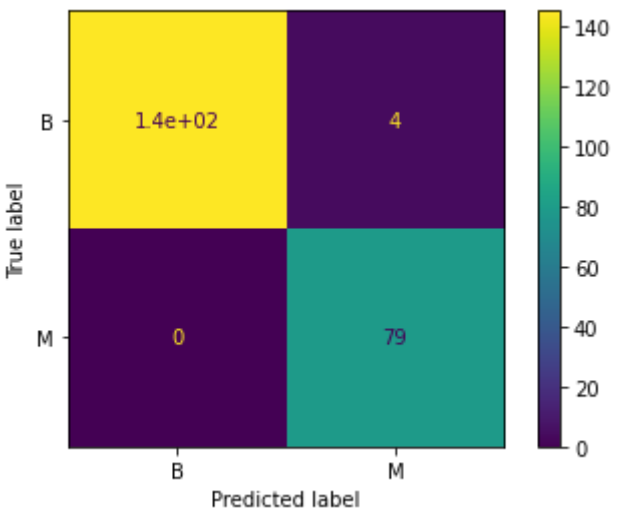


In [ ]:

```
# BREAST CANCER DATASET
# SVM(Without Tuning)[60-40 split]


import pandas as pd
import numpy as np

# Dataset Preparation
df = pd.read_csv("wdbc.data",header=None)

col_name = ['1','Class','3','4','5','6','7','8','9','10','11','12','13','14','15','16','17','18','19'
           ,'20','21','22','23','24','25','26','27','28','29','30','31','32']


df.columns = col_name


X = df.drop(['1','Class'], axis=1)
y = df['Class']

from sklearn.model_selection import train_test_split

X_train, X_test, y_train, y_test = train_test_split(X,y,train_size=0.6,test_size=0.4,random_state=10)


# Feature Scaling
from sklearn.preprocessing import StandardScaler

sc = StandardScaler()
X_train = sc.fit_transform(X_train)
X_test = sc.transform(X_test)

# Classification
from sklearn.svm import SVC

classifier = SVC()
classifier.fit(X_train,y_train)

y_pred = classifier.predict(X_test)

from sklearn.metrics import classification_report, confusion_matrix, accuracy_score

print("Confusion Matrix:")
print(confusion_matrix(y_test, y_pred))

print("-------------------------------------------------------")
```

```
print("-------------------------------------------------")


print("Performance Evaluation")
print(classification_report(y_test, y_pred))


print("-------------------------------------------------")
print("-------------------------------------------------")

print("Accuracy:")
print(accuracy_score(y_test, y_pred))

import matplotlib.pyplot as plt
from sklearn.metrics import plot_confusion_matrix
plot_confusion_matrix(classifier, X_test, y_test)
plt.show()
```

```
Confusion Matrix:
[[145   4]
 [  0  79]]
-------------------------------------------------
-------------------------------------------------
Performance Evaluation
              precision    recall  f1-score   support

           B       1.00      0.97      0.99       149
           M       0.95      1.00      0.98        79

    accuracy                           0.98       228
   macro avg       0.98      0.99      0.98       228
weighted avg       0.98      0.98      0.98       228

-------------------------------------------------
-------------------------------------------------
Accuracy:
0.9824561403508771
```

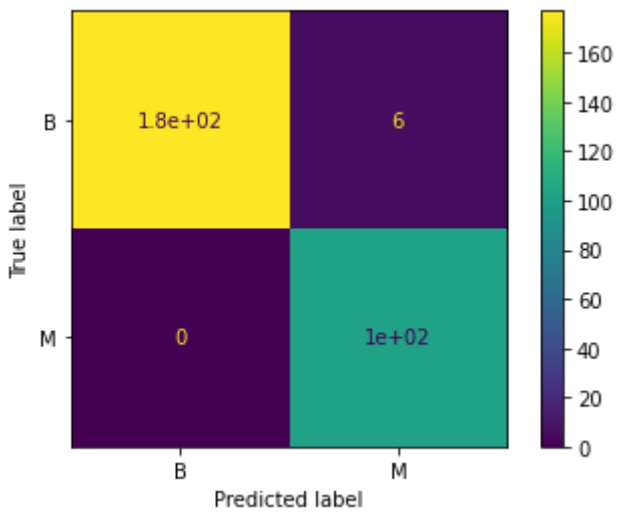


In [ ]:

```
# BREAST CANCER DATASET
# SVM(Without Tuning)[50-50 split]


import pandas as pd
import numpy as np

# Dataset Preparation
df = pd.read_csv("wdbc.data",header=None)
col_name = ['1','Class','3','4','5','6','7','8','9','10','11','12','13','14','15','16','17','18','19'
           ,'20','21','22','23','24','25','26','27','28','29','30','31','32']


df.columns = col_name


X = df.drop(['1','Class'], axis=1)
y = df['Class']

from sklearn.model_selection import train_test_split

X_train, X_test, y_train, y_test = train_test_split(X,y,train_size=0.5,test_size=0.5,random_state=10)


# Feature Scaling
from sklearn.preprocessing import StandardScaler

sc = StandardScaler()
X_train = sc.fit_transform(X_train)
X_test = sc.transform(X_test)

# Classification
from sklearn.svm import SVC

classifier = SVC()
classifier.fit(X_train,y_train)

y_pred = classifier.predict(X_test)
```

```
from sklearn.metrics import classification_report, confusion_matrix, accuracy_score

print("Confusion Matrix:")
print(confusion_matrix(y_test, y_pred))

print("-------------------------------------------------------")
print("-------------------------------------------------------")


print("Performance Evaluation")
print(classification_report(y_test, y_pred))


print("-------------------------------------------------------")
print("-------------------------------------------------------")

print("Accuracy:")
print(accuracy_score(y_test, y_pred))

import matplotlib.pyplot as plt
from sklearn.metrics import plot_confusion_matrix
plot_confusion_matrix(classifier, X_test, y_test)
plt.show()
```

```
Confusion Matrix:
[[177   6]
 [  0 102]]
-------------------------------------------------------
-------------------------------------------------------
Performance Evaluation
              precision    recall  f1-score   support

           B       1.00      0.97      0.98       183
           M       0.94      1.00      0.97       102

    accuracy                           0.98       285
   macro avg       0.97      0.98      0.98       285
weighted avg       0.98      0.98      0.98       285

-------------------------------------------------------
-------------------------------------------------------
Accuracy:
0.9789473684210527
```

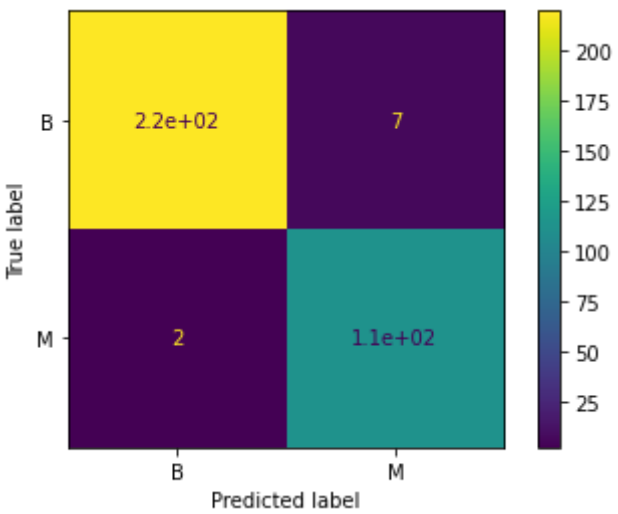


In [ ]:

```
# BREAST CANCER DATASET
# SVM(Without Tuning)[40-60 split]

import pandas as pd
import numpy as np

# Dataset Preparation
df = pd.read_csv("wdbc.data",header=None)

col_name = ['1','Class','3','4','5','6','7','8','9','10','11','12','13','14','15','16','17','18','19'
           ,'20','21','22','23','24','25','26','27','28','29','30','31','32']


df.columns = col_name


X = df.drop(['1','Class'], axis=1)
y = df['Class']

from sklearn.model_selection import train_test_split

X_train, X_test, y_train, y_test = train_test_split(X,y,train_size=0.4,test_size=0.6,random_state=10)


# Feature Scaling
from sklearn.preprocessing import StandardScaler

sc = StandardScaler()
X_train = sc.fit_transform(X_train)
X_test = sc.transform(X_test)

# Classification
from sklearn.svm import SVC
```

```
classifier = SVC()
classifier.fit(X_train,y_train)

y_pred = classifier.predict(X_test)

from sklearn.metrics import classification_report, confusion_matrix, accuracy_score

print("Confusion Matrix:")
print(confusion_matrix(y_test, y_pred))

print("--------------------------------------------------")
print("--------------------------------------------------")


print("Performance Evaluation")
print(classification_report(y_test, y_pred))


print("--------------------------------------------------")
print("--------------------------------------------------")

print("Accuracy:")
print(accuracy_score(y_test, y_pred))

import matplotlib.pyplot as plt
from sklearn.metrics import plot_confusion_matrix
plot_confusion_matrix(classifier, X_test, y_test)
plt.show()
```

```
Confusion Matrix:
[[220   7]
 [  2 113]]
--------------------------------------------------
--------------------------------------------------
Performance Evaluation
              precision    recall  f1-score   support

           B       0.99      0.97      0.98       227
           M       0.94      0.98      0.96       115

    accuracy                           0.97       342
   macro avg       0.97      0.98      0.97       342
weighted avg       0.97      0.97      0.97       342

--------------------------------------------------
--------------------------------------------------
Accuracy:
0.9736842105263158
```



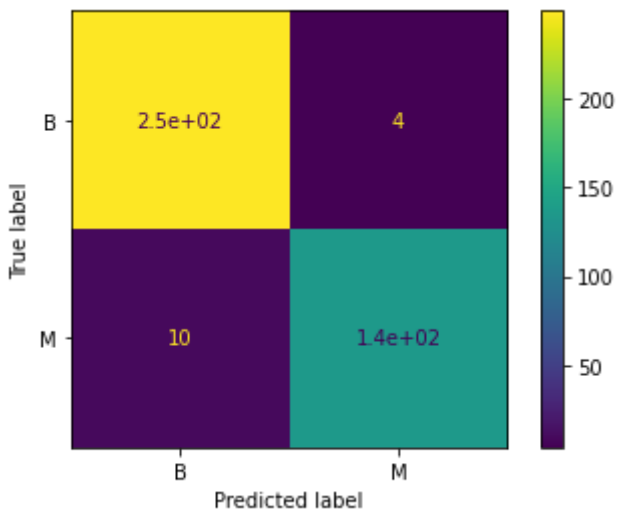
In [ ]:

```
# BREAST CANCER DATASET
# SVM(Without Tuning)[30-70 split]


import pandas as pd
import numpy as np

# Dataset Preparation
df = pd.read_csv("wdbc.data",header=None)

col_name = ['1','Class','3','4','5','6','7','8','9','10','11','12','13','14','15','16','17','18','19'
           ,'20','21','22','23','24','25','26','27','28','29','30','31','32']


df.columns = col_name


X = df.drop(['1','Class'], axis=1)
y = df['Class']

from sklearn.model_selection import train_test_split

X_train, X_test, y_train, y_test = train_test_split(X,y,train_size=0.3,test_size=0.7,random_state=10)


# Feature Scaling
from sklearn.preprocessing import StandardScaler
```

```
sc = StandardScaler()
X_train = sc.fit_transform(X_train)
X_test = sc.transform(X_test)

# Classification
from sklearn.svm import SVC

classifier = SVC()
classifier.fit(X_train,y_train)

y_pred = classifier.predict(X_test)

from sklearn.metrics import classification_report, confusion_matrix, accuracy_score

print("Confusion Matrix:")
print(confusion_matrix(y_test, y_pred))

print("----------------------------------------------------")
print("----------------------------------------------------")


print("Performance Evaluation")
print(classification_report(y_test, y_pred))


print("----------------------------------------------------")
print("----------------------------------------------------")

print("Accuracy:")
print(accuracy_score(y_test, y_pred))
```

```
import matplotlib.pyplot as plt
from sklearn.metrics import plot_confusion_matrix
plot_confusion_matrix(classifier, X_test, y_test)
plt.show()
```

```
Confusion Matrix:
[[249   4]
 [ 10 136]]
----------------------------------------------------
----------------------------------------------------
Performance Evaluation
              precision    recall  f1-score   support

           B       0.96      0.98      0.97       253
           M       0.97      0.93      0.95       146

    accuracy                           0.96       399
   macro avg       0.97      0.96      0.96       399
weighted avg       0.97      0.96      0.96       399

----------------------------------------------------
----------------------------------------------------
Accuracy:
0.9649122807017544
```



In [ ]:

```
# BREAST CANCER DATASET
# SVM(With Tuning)[70-30 split]


import pandas as pd
import numpy as np

# Dataset Preparation
df = pd.read_csv("wdbc.data",header=None)

col_name = ['1','Class','3','4','5','6','7','8','9','10','11','12','13','14','15','16','17','18','19'
           ,'20','21','22','23','24','25','26','27','28','29','30','31','32']


df.columns = col_name


X = df.drop(['1','Class'], axis=1)
y = df['Class']

from sklearn.model_selection import train_test_split
```

```python
X_train, X_test, y_train, y_test = train_test_split(X,y,train_size=0.7,test_size=0.3,random_state=10)


# Feature Scaling
from sklearn.preprocessing import StandardScaler

sc = StandardScaler()
X_train = sc.fit_transform(X_train)
X_test = sc.transform(X_test)


# Classification
from sklearn.svm import SVC

classifier = SVC()

################################################################################
# Showing all the parameters

from pprint import pprint
# Look at parameters used by our current forest
print('Parameters currently in use:\n')
pprint(classifier.get_params())

################################################################################
# Creating a set of important sample features

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

pprint(param_grid)

################################################################################

from sklearn.model_selection import GridSearchCV

# Use the random grid to search for best hyperparameters
# First create the base model to tune
classifier = SVC()
# Random search of parameters, using 3 fold cross validation,
# search across 100 different combinations, and use all available cores

rf_random = GridSearchCV(SVC(), param_grid, refit=True, verbose=2)
rf_random.fit(X_train, y_train)

y_pred = rf_random.predict(X_test)

from sklearn.metrics import classification_report, confusion_matrix, accuracy_score

print("Confusion Matrix:")
print(confusion_matrix(y_test, y_pred))

print("--------------------------------------------------")
print("--------------------------------------------------")


print("Performance Evaluation")
print(classification_report(y_test, y_pred))


print("--------------------------------------------------")
print("--------------------------------------------------")

print("Accuracy:")
print(accuracy_score(y_test, y_pred))



import matplotlib.pyplot as plt
from sklearn.metrics import plot_confusion_matrix
plot_confusion_matrix(rf_random, X_test, y_test)
plt.show()
```

```
Parameters currently in use:

{'C': 1.0,
 'break_ties': False,
 'cache_size': 200,
 'class_weight': None,
 'coef0': 0.0,
 'decision_function_shape': 'ovr',
 'degree': 3,
 'gamma': 'scale',
 'kernel': 'rbf',
 'max_iter': -1,
 'probability': False,
 'random_state': None,
 'shrinking': True,
 'tol': 0.001,
 'verbose': False}
{'C': [0.1, 1, 10, 100],
 'gamma': [1, 0.1, 0.01, 0.001],
 'kernel': ['rbf', 'poly', 'sigmoid']}
Fitting 5 folds for each of 48 candidates, totalling 240 fits
[CV] C=0.1, gamma=1, kernel=rbf .....................................
[CV] ...................... C=0.1, gamma=1, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=1, kernel=rbf .....................................
```

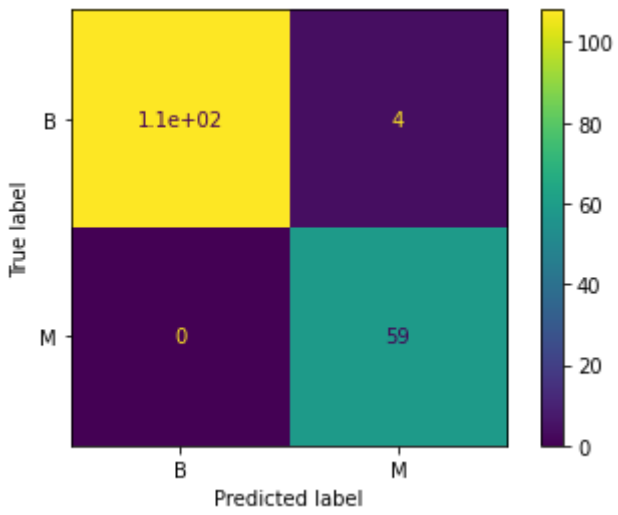
```
[CV] ........................ C=0.1, gamma=1, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=1, kernel=rbf ......................................
[CV] ........................ C=0.1, gamma=1, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=1, kernel=rbf ......................................
[CV] ........................ C=0.1, gamma=1, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=1, kernel=rbf ......................................
[CV] ........................ C=0.1, gamma=1, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=1, kernel=poly .....................................
[CV] ....................... C=0.1, gamma=1, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=1, kernel=poly .....................................
[CV] ....................... C=0.1, gamma=1, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=1, kernel=poly .....................................
[CV] ....................... C=0.1, gamma=1, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=1, kernel=poly .....................................
[CV] ....................... C=0.1, gamma=1, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=1, kernel=poly .....................................
[CV] ....................... C=0.1, gamma=1, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=1, kernel=sigmoid ..................................
[CV] .................... C=0.1, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=1, kernel=sigmoid ..................................
[CV] .................... C=0.1, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=1, kernel=sigmoid ..................................
[CV] .................... C=0.1, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=1, kernel=sigmoid ..................................
[CV] .................... C=0.1, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=1, kernel=sigmoid ..................................
[CV] .................... C=0.1, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=rbf ....................................
[CV] ...................... C=0.1, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=rbf ....................................
[CV] ...................... C=0.1, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=rbf ....................................
[CV] ...................... C=0.1, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=rbf ....................................
[CV] ...................... C=0.1, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=rbf ....................................
[CV] ...................... C=0.1, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=poly ...................................
[CV] ..................... C=0.1, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=poly ...................................
[CV] ..................... C=0.1, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=poly ...................................
[Parallel(n_jobs=1)]: Using backend SequentialBackend with 1 concurrent workers.
[Parallel(n_jobs=1)]: Done   1 out of   1 | elapsed:    0.0s remaining:    0.0s
[CV] ..................... C=0.1, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=poly ...................................
[CV] ..................... C=0.1, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=poly ...................................
[CV] ..................... C=0.1, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=sigmoid ................................
[CV] .................. C=0.1, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=sigmoid ................................
[CV] .................. C=0.1, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=sigmoid ................................
[CV] .................. C=0.1, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=sigmoid ................................
[CV] .................. C=0.1, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=sigmoid ................................
[CV] .................. C=0.1, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=rbf ...................................
[CV] ..................... C=0.1, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=rbf ...................................
[CV] ..................... C=0.1, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=rbf ...................................
[CV] ..................... C=0.1, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=rbf ...................................
[CV] ..................... C=0.1, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=rbf ...................................
[CV] ..................... C=0.1, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=poly ..................................
[CV] .................... C=0.1, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=poly ..................................
[CV] .................... C=0.1, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=poly ..................................
[CV] .................... C=0.1, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=poly ..................................
[CV] .................... C=0.1, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=poly ..................................
[CV] .................... C=0.1, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=sigmoid ...............................
[CV] ................. C=0.1, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=sigmoid ...............................
[CV] ................. C=0.1, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=sigmoid ...............................
[CV] ................. C=0.1, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=sigmoid ...............................
[CV] ................. C=0.1, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=sigmoid ...............................
[CV] ................. C=0.1, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=rbf ..................................
[CV] .................... C=0.1, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=rbf ..................................
[CV] .................... C=0.1, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=rbf ..................................
[CV] .................... C=0.1, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=rbf ..................................
[CV] .................... C=0.1, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=rbf ..................................
[CV] .................... C=0.1, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=poly .................................
```

```
[CV] .................. C=0.1, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=poly .................................
[CV] .................. C=0.1, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=poly .................................
[CV] .................. C=0.1, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=poly .................................
[CV] .................. C=0.1, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=poly .................................
[CV] .................. C=0.1, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=sigmoid ..............................
[CV] ............... C=0.1, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=sigmoid ..............................
[CV] ............... C=0.1, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=sigmoid ..............................
[CV] ............... C=0.1, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=sigmoid ..............................
[CV] ............... C=0.1, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=sigmoid ..............................
[CV] ............... C=0.1, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=1, kernel=rbf ........................................
[CV] ......................... C=1, gamma=1, kernel=rbf, total=   0.0s
[CV] C=1, gamma=1, kernel=rbf ........................................
[CV] ......................... C=1, gamma=1, kernel=rbf, total=   0.0s
[CV] C=1, gamma=1, kernel=rbf ........................................
[CV] ......................... C=1, gamma=1, kernel=rbf, total=   0.0s
[CV] C=1, gamma=1, kernel=rbf ........................................
[CV] ......................... C=1, gamma=1, kernel=rbf, total=   0.0s
[CV] C=1, gamma=1, kernel=rbf ........................................
[CV] ......................... C=1, gamma=1, kernel=rbf, total=   0.0s
[CV] C=1, gamma=1, kernel=poly .......................................
[CV] ........................ C=1, gamma=1, kernel=poly, total=   0.0s
[CV] C=1, gamma=1, kernel=poly .......................................
[CV] ........................ C=1, gamma=1, kernel=poly, total=   0.0s
[CV] C=1, gamma=1, kernel=poly .......................................
[CV] ........................ C=1, gamma=1, kernel=poly, total=   0.0s
[CV] C=1, gamma=1, kernel=poly .......................................
[CV] ........................ C=1, gamma=1, kernel=poly, total=   0.0s
[CV] C=1, gamma=1, kernel=poly .......................................
[CV] ........................ C=1, gamma=1, kernel=poly, total=   0.0s
[CV] C=1, gamma=1, kernel=sigmoid ....................................
[CV] ..................... C=1, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=1, kernel=sigmoid ....................................
[CV] ..................... C=1, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=1, kernel=sigmoid ....................................
[CV] ..................... C=1, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=1, kernel=sigmoid ....................................
[CV] ..................... C=1, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=1, kernel=sigmoid ....................................
[CV] ..................... C=1, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.1, kernel=rbf ......................................
[CV] ....................... C=1, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.1, kernel=rbf ......................................
[CV] ....................... C=1, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.1, kernel=rbf ......................................
[CV] ....................... C=1, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.1, kernel=rbf ......................................
[CV] ....................... C=1, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.1, kernel=rbf ......................................
[CV] ....................... C=1, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.1, kernel=poly .....................................
[CV] ...................... C=1, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.1, kernel=poly .....................................
[CV] ...................... C=1, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.1, kernel=poly .....................................
[CV] ...................... C=1, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.1, kernel=poly .....................................
[CV] ...................... C=1, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.1, kernel=poly .....................................
[CV] ...................... C=1, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.1, kernel=sigmoid ..................................
[CV] ................... C=1, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.1, kernel=sigmoid ..................................
[CV] ................... C=1, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.1, kernel=sigmoid ..................................
[CV] ................... C=1, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.1, kernel=sigmoid ..................................
[CV] ................... C=1, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.1, kernel=sigmoid ..................................
[CV] ................... C=1, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.01, kernel=rbf .....................................
[CV] ...................... C=1, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.01, kernel=rbf .....................................
[CV] ...................... C=1, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.01, kernel=rbf .....................................
[CV] ...................... C=1, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.01, kernel=rbf .....................................
[CV] ...................... C=1, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.01, kernel=rbf .....................................
[CV] ...................... C=1, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.01, kernel=poly ....................................
[CV] ..................... C=1, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.01, kernel=poly ....................................
[CV] ..................... C=1, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.01, kernel=poly ....................................
[CV] ..................... C=1, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.01, kernel=poly ....................................
[CV] ..................... C=1, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.01, kernel=poly ....................................
[CV] ..................... C=1, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.01, kernel=sigmoid .................................
```

```
[CV] .................. C=1, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.01, kernel=sigmoid .................................
[CV] .................. C=1, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.01, kernel=sigmoid .................................
[CV] .................. C=1, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.01, kernel=sigmoid .................................
[CV] .................. C=1, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.01, kernel=sigmoid .................................
[CV] .................. C=1, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.001, kernel=rbf ....................................
[CV] ..................... C=1, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.001, kernel=rbf ....................................
[CV] ..................... C=1, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.001, kernel=rbf ....................................
[CV] ..................... C=1, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.001, kernel=rbf ....................................
[CV] ..................... C=1, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.001, kernel=rbf ....................................
[CV] ..................... C=1, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.001, kernel=poly ...................................
[CV] .................... C=1, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.001, kernel=poly ...................................
[CV] .................... C=1, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.001, kernel=poly ...................................
[CV] .................... C=1, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.001, kernel=poly ...................................
[CV] .................... C=1, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.001, kernel=poly ...................................
[CV] .................... C=1, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.001, kernel=sigmoid ................................
[CV] ................. C=1, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.001, kernel=sigmoid ................................
[CV] ................. C=1, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.001, kernel=sigmoid ................................
[CV] ................. C=1, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.001, kernel=sigmoid ................................
[CV] ................. C=1, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.001, kernel=sigmoid ................................
[CV] ................. C=1, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=1, kernel=rbf .......................................
[CV] ........................ C=10, gamma=1, kernel=rbf, total=   0.0s
[CV] C=10, gamma=1, kernel=rbf .......................................
[CV] ........................ C=10, gamma=1, kernel=rbf, total=   0.0s
[CV] C=10, gamma=1, kernel=rbf .......................................
[CV] ........................ C=10, gamma=1, kernel=rbf, total=   0.0s
[CV] C=10, gamma=1, kernel=rbf .......................................
[CV] ........................ C=10, gamma=1, kernel=rbf, total=   0.0s
[CV] C=10, gamma=1, kernel=rbf .......................................
[CV] ........................ C=10, gamma=1, kernel=rbf, total=   0.0s
[CV] C=10, gamma=1, kernel=poly ......................................
[CV] ....................... C=10, gamma=1, kernel=poly, total=   0.0s
[CV] C=10, gamma=1, kernel=poly ......................................
[CV] ....................... C=10, gamma=1, kernel=poly, total=   0.0s
[CV] C=10, gamma=1, kernel=poly ......................................
[CV] ....................... C=10, gamma=1, kernel=poly, total=   0.0s
[CV] C=10, gamma=1, kernel=poly ......................................
[CV] ....................... C=10, gamma=1, kernel=poly, total=   0.0s
[CV] C=10, gamma=1, kernel=poly ......................................
[CV] ....................... C=10, gamma=1, kernel=poly, total=   0.0s
[CV] C=10, gamma=1, kernel=sigmoid ...................................
[CV] .................... C=10, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=1, kernel=sigmoid ...................................
[CV] .................... C=10, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=1, kernel=sigmoid ...................................
[CV] .................... C=10, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=1, kernel=sigmoid ...................................
[CV] .................... C=10, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=1, kernel=sigmoid ...................................
[CV] .................... C=10, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.1, kernel=rbf .....................................
[CV] ...................... C=10, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.1, kernel=rbf .....................................
[CV] ...................... C=10, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.1, kernel=rbf .....................................
[CV] ...................... C=10, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.1, kernel=rbf .....................................
[CV] ...................... C=10, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.1, kernel=rbf .....................................
[CV] ...................... C=10, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.1, kernel=poly ....................................
[CV] ..................... C=10, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.1, kernel=poly ....................................
[CV] ..................... C=10, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.1, kernel=poly ....................................
[CV] ..................... C=10, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.1, kernel=poly ....................................
[CV] ..................... C=10, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.1, kernel=poly ....................................
[CV] ..................... C=10, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.1, kernel=sigmoid .................................
[CV] .................. C=10, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.1, kernel=sigmoid .................................
[CV] .................. C=10, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.1, kernel=sigmoid .................................
[CV] .................. C=10, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.1, kernel=sigmoid .................................
[CV] .................. C=10, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.1, kernel=sigmoid .................................
[CV] .................. C=10, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.01, kernel=rbf ....................................
```

```
[CV] ..................... C=10, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.01, kernel=rbf ....................................
[CV] ..................... C=10, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.01, kernel=rbf ....................................
[CV] ..................... C=10, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.01, kernel=rbf ....................................
[CV] ..................... C=10, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.01, kernel=rbf ....................................
[CV] ..................... C=10, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.01, kernel=poly ...................................
[CV] .................... C=10, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.01, kernel=poly ...................................
[CV] .................... C=10, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.01, kernel=poly ...................................
[CV] .................... C=10, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.01, kernel=poly ...................................
[CV] .................... C=10, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.01, kernel=poly ...................................
[CV] .................... C=10, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.01, kernel=sigmoid ................................
[CV] ................. C=10, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.01, kernel=sigmoid ................................
[CV] ................. C=10, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.01, kernel=sigmoid ................................
[CV] ................. C=10, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.01, kernel=sigmoid ................................
[CV] ................. C=10, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.01, kernel=sigmoid ................................
[CV] ................. C=10, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.001, kernel=rbf ...................................
[CV] .................... C=10, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.001, kernel=rbf ...................................
[CV] .................... C=10, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.001, kernel=rbf ...................................
[CV] .................... C=10, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.001, kernel=rbf ...................................
[CV] .................... C=10, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.001, kernel=rbf ...................................
[CV] .................... C=10, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.001, kernel=poly ..................................
[CV] ................... C=10, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.001, kernel=poly ..................................
[CV] ................... C=10, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.001, kernel=poly ..................................
[CV] ................... C=10, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.001, kernel=poly ..................................
[CV] ................... C=10, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.001, kernel=poly ..................................
[CV] ................... C=10, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.001, kernel=sigmoid ...............................
[CV] ................ C=10, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.001, kernel=sigmoid ...............................
[CV] ................ C=10, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.001, kernel=sigmoid ...............................
[CV] ................ C=10, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.001, kernel=sigmoid ...............................
[CV] ................ C=10, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.001, kernel=sigmoid ...............................
[CV] ................ C=10, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=1, kernel=rbf ......................................
[CV] ....................... C=100, gamma=1, kernel=rbf, total=   0.0s
[CV] C=100, gamma=1, kernel=rbf ......................................
[CV] ....................... C=100, gamma=1, kernel=rbf, total=   0.0s
[CV] C=100, gamma=1, kernel=rbf ......................................
[CV] ....................... C=100, gamma=1, kernel=rbf, total=   0.0s
[CV] C=100, gamma=1, kernel=rbf ......................................
[CV] ....................... C=100, gamma=1, kernel=rbf, total=   0.0s
[CV] C=100, gamma=1, kernel=rbf ......................................
[CV] ....................... C=100, gamma=1, kernel=rbf, total=   0.0s
[CV] C=100, gamma=1, kernel=poly .....................................
[CV] ...................... C=100, gamma=1, kernel=poly, total=   0.0s
[CV] C=100, gamma=1, kernel=poly .....................................
[CV] ...................... C=100, gamma=1, kernel=poly, total=   0.0s
[CV] C=100, gamma=1, kernel=poly .....................................
[CV] ...................... C=100, gamma=1, kernel=poly, total=   0.0s
[CV] C=100, gamma=1, kernel=poly .....................................
[CV] ...................... C=100, gamma=1, kernel=poly, total=   0.0s
[CV] C=100, gamma=1, kernel=poly .....................................
[CV] ...................... C=100, gamma=1, kernel=poly, total=   0.0s
[CV] C=100, gamma=1, kernel=sigmoid ..................................
[CV] ................... C=100, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=1, kernel=sigmoid ..................................
[CV] ................... C=100, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=1, kernel=sigmoid ..................................
[CV] ................... C=100, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=1, kernel=sigmoid ..................................
[CV] ................... C=100, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=1, kernel=sigmoid ..................................
[CV] ................... C=100, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.1, kernel=rbf ....................................
[CV] ..................... C=100, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.1, kernel=rbf ....................................
[CV] ..................... C=100, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.1, kernel=rbf ....................................
[CV] ..................... C=100, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.1, kernel=rbf ....................................
[CV] ..................... C=100, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.1, kernel=rbf ....................................
[CV] ..................... C=100, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.1, kernel=poly ...................................
```

```
[CV] ................... C=100, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.1, kernel=poly .................................
[CV] ................... C=100, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.1, kernel=poly .................................
[CV] ................... C=100, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.1, kernel=poly .................................
[CV] ................... C=100, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.1, kernel=poly .................................
[CV] ................... C=100, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.1, kernel=sigmoid ..............................
[CV] ................ C=100, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.1, kernel=sigmoid ..............................
[CV] ................ C=100, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.1, kernel=sigmoid ..............................
[CV] ................ C=100, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.1, kernel=sigmoid ..............................
[CV] ................ C=100, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.1, kernel=sigmoid ..............................
[CV] ................ C=100, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.01, kernel=rbf .................................
[CV] ................... C=100, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.01, kernel=rbf .................................
[CV] ................... C=100, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.01, kernel=rbf .................................
[CV] ................... C=100, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.01, kernel=rbf .................................
[CV] ................... C=100, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.01, kernel=rbf .................................
[CV] ................... C=100, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.01, kernel=poly ................................
[CV] .................. C=100, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.01, kernel=poly ................................
[CV] .................. C=100, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.01, kernel=poly ................................
[CV] .................. C=100, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.01, kernel=poly ................................
[CV] .................. C=100, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.01, kernel=poly ................................
[CV] .................. C=100, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.01, kernel=sigmoid .............................
[CV] ............... C=100, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.01, kernel=sigmoid .............................
[CV] ............... C=100, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.01, kernel=sigmoid .............................
[CV] ............... C=100, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.01, kernel=sigmoid .............................
[CV] ............... C=100, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.01, kernel=sigmoid .............................
[CV] ............... C=100, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.001, kernel=rbf ................................
[CV] .................. C=100, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.001, kernel=rbf ................................
[CV] .................. C=100, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.001, kernel=rbf ................................
[CV] .................. C=100, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.001, kernel=rbf ................................
[CV] .................. C=100, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.001, kernel=rbf ................................
[CV] .................. C=100, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.001, kernel=poly ...............................
[CV] ................. C=100, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.001, kernel=poly ...............................
[CV] ................. C=100, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.001, kernel=poly ...............................
[CV] ................. C=100, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.001, kernel=poly ...............................
[CV] ................. C=100, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.001, kernel=poly ...............................
[CV] ................. C=100, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.001, kernel=sigmoid ............................
[CV] .............. C=100, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.001, kernel=sigmoid ............................
[CV] .............. C=100, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.001, kernel=sigmoid ............................
[CV] .............. C=100, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.001, kernel=sigmoid ............................
[CV] .............. C=100, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.001, kernel=sigmoid ............................
[CV] .............. C=100, gamma=0.001, kernel=sigmoid, total=   0.0s
Confusion Matrix:
[[108   4]
 [  0  59]]
--------------------------------------------------
--------------------------------------------------
Performance Evaluation
              precision    recall  f1-score   support

           B       1.00      0.96      0.98       112
           M       0.94      1.00      0.97        59

    accuracy                           0.98       171
   macro avg       0.97      0.98      0.97       171
weighted avg       0.98      0.98      0.98       171

--------------------------------------------------
--------------------------------------------------
Accuracy:
0.9766081871345029
[Parallel(n_jobs=1)]: Done 240 out of 240 | elapsed:    1.7s finished
```



In [ ]:

```
# BREAST CANCER DATASET
# SVM(With Tuning)[60-40 split]


import pandas as pd
import numpy as np

# Dataset Preparation
df = pd.read_csv("wdbc.data",header=None)

col_name = ['1','Class','3','4','5','6','7','8','9','10','11','12','13','14','15','16','17','18','19'
           ,'20','21','22','23','24','25','26','27','28','29','30','31','32']


df.columns = col_name


X = df.drop(['1','Class'], axis=1)
y = df['Class']

from sklearn.model_selection import train_test_split

X_train, X_test, y_train, y_test = train_test_split(X,y,train_size=0.6,test_size=0.4,random_state=10)


# Feature Scaling
from sklearn.preprocessing import StandardScaler

sc = StandardScaler()
X_train = sc.fit_transform(X_train)
X_test = sc.transform(X_test)


# Classification
from sklearn.svm import SVC

classifier = SVC()

################################################################################
# Showing all the parameters

from pprint import pprint
# Look at parameters used by our current forest
print('Parameters currently in use:\n')
pprint(classifier.get_params())

################################################################################
# Creating a set of important sample features

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

pprint(param_grid)

################################################################################

from sklearn.model_selection import GridSearchCV

# Use the random grid to search for best hyperparameters
# First create the base model to tune
classifier = SVC()
# Random search of parameters, using 3 fold cross validation,
# search across 100 different combinations, and use all available cores

rf_random = GridSearchCV(SVC(), param_grid, refit=True, verbose=2)
rf_random.fit(X_train, y_train)

y_pred = rf_random.predict(X_test)

from sklearn.metrics import classification_report, confusion_matrix, accuracy_score

print("Confusion Matrix:")
print(confusion_matrix(y_test, y_pred))

print("--------------------------------------------------")
print("--------------------------------------------------")
```

```python
print("Performance Evaluation")
print(classification_report(y_test, y_pred))


print("--------------------------------------------------")
print("--------------------------------------------------")

print("Accuracy:")
print(accuracy_score(y_test, y_pred))


import matplotlib.pyplot as plt
from sklearn.metrics import plot_confusion_matrix
plot_confusion_matrix(rf_random, X_test, y_test)
plt.show()
```

```
Parameters currently in use:

{'C': 1.0,
 'break_ties': False,
 'cache_size': 200,
 'class_weight': None,
 'coef0': 0.0,
 'decision_function_shape': 'ovr',
 'degree': 3,
 'gamma': 'scale',
 'kernel': 'rbf',
 'max_iter': -1,
 'probability': False,
 'random_state': None,
 'shrinking': True,
 'tol': 0.001,
 'verbose': False}
{'C': [0.1, 1, 10, 100],
 'gamma': [1, 0.1, 0.01, 0.001],
 'kernel': ['rbf', 'poly', 'sigmoid']}
Fitting 5 folds for each of 48 candidates, totalling 240 fits
[CV] C=0.1, gamma=1, kernel=rbf .....................................
[CV] ...................... C=0.1, gamma=1, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=1, kernel=rbf .....................................
[CV] ...................... C=0.1, gamma=1, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=1, kernel=rbf .....................................
[CV] ...................... C=0.1, gamma=1, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=1, kernel=rbf .....................................
[CV] ...................... C=0.1, gamma=1, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=1, kernel=rbf .....................................
[CV] ...................... C=0.1, gamma=1, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=1, kernel=poly ....................................
[CV] ..................... C=0.1, gamma=1, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=1, kernel=poly ....................................
[CV] ..................... C=0.1, gamma=1, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=1, kernel=poly ....................................
[CV] ..................... C=0.1, gamma=1, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=1, kernel=poly ....................................
[CV] ..................... C=0.1, gamma=1, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=1, kernel=poly ....................................
[CV] ..................... C=0.1, gamma=1, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=1, kernel=sigmoid .................................
[CV] .................. C=0.1, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=1, kernel=sigmoid .................................
[CV] .................. C=0.1, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=1, kernel=sigmoid .................................
[CV] .................. C=0.1, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=1, kernel=sigmoid .................................
[CV] .................. C=0.1, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=1, kernel=sigmoid .................................
[CV] .................. C=0.1, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=rbf ...................................
[CV] .................... C=0.1, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=rbf ...................................
[CV] .................... C=0.1, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=rbf ...................................
[CV] .................... C=0.1, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=rbf ...................................
[CV] .................... C=0.1, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=rbf ...................................
[CV] .................... C=0.1, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=poly ..................................
[CV] ................... C=0.1, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=poly ..................................
[CV] ................... C=0.1, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=poly ..................................
[CV] ................... C=0.1, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=poly ..................................
[CV] ................... C=0.1, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=poly ..................................
[CV] ................... C=0.1, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=sigmoid ...............................
[CV] ................ C=0.1, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=sigmoid ...............................
[CV] ................ C=0.1, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=sigmoid ...............................
[CV] ................ C=0.1, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=sigmoid ...............................
[Parallel(n_jobs=1)]: Using backend SequentialBackend with 1 concurrent workers.
[Parallel(n_jobs=1)]: Done   1 out of   1 | elapsed:    0.0s remaining:    0.0s
[CV] ................ C=0.1, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=sigmoid ...............................
```

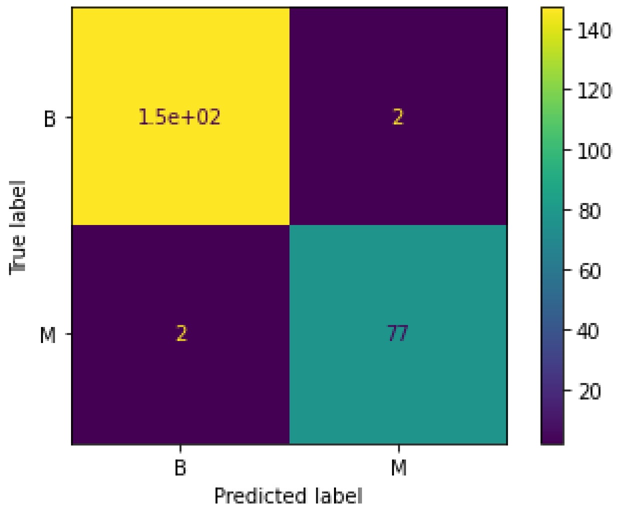
```
[CV] ................. C=0.1, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=rbf ...................................
[CV] .................... C=0.1, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=rbf ...................................
[CV] .................... C=0.1, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=rbf ...................................
[CV] .................... C=0.1, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=rbf ...................................
[CV] .................... C=0.1, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=rbf ...................................
[CV] .................... C=0.1, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=poly ..................................
[CV] ................... C=0.1, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=poly ..................................
[CV] ................... C=0.1, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=poly ..................................
[CV] ................... C=0.1, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=poly ..................................
[CV] ................... C=0.1, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=poly ..................................
[CV] ................... C=0.1, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=sigmoid ...............................
[CV] ................ C=0.1, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=sigmoid ...............................
[CV] ................ C=0.1, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=sigmoid ...............................
[CV] ................ C=0.1, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=sigmoid ...............................
[CV] ................ C=0.1, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=sigmoid ...............................
[CV] ................ C=0.1, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=rbf ..................................
[CV] ................... C=0.1, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=rbf ..................................
[CV] ................... C=0.1, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=rbf ..................................
[CV] ................... C=0.1, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=rbf ..................................
[CV] ................... C=0.1, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=rbf ..................................
[CV] ................... C=0.1, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=poly .................................
[CV] .................. C=0.1, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=poly .................................
[CV] .................. C=0.1, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=poly .................................
[CV] .................. C=0.1, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=poly .................................
[CV] .................. C=0.1, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=poly .................................
[CV] .................. C=0.1, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=sigmoid ..............................
[CV] ............... C=0.1, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=sigmoid ..............................
[CV] ............... C=0.1, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=sigmoid ..............................
[CV] ............... C=0.1, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=sigmoid ..............................
[CV] ............... C=0.1, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=sigmoid ..............................
[CV] ............... C=0.1, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=1, kernel=rbf ........................................
[CV] ......................... C=1, gamma=1, kernel=rbf, total=   0.0s
[CV] C=1, gamma=1, kernel=rbf ........................................
[CV] ......................... C=1, gamma=1, kernel=rbf, total=   0.0s
[CV] C=1, gamma=1, kernel=rbf ........................................
[CV] ......................... C=1, gamma=1, kernel=rbf, total=   0.0s
[CV] C=1, gamma=1, kernel=rbf ........................................
[CV] ......................... C=1, gamma=1, kernel=rbf, total=   0.0s
[CV] C=1, gamma=1, kernel=rbf ........................................
[CV] ......................... C=1, gamma=1, kernel=rbf, total=   0.0s
[CV] C=1, gamma=1, kernel=poly .......................................
[CV] ........................ C=1, gamma=1, kernel=poly, total=   0.0s
[CV] C=1, gamma=1, kernel=poly .......................................
[CV] ........................ C=1, gamma=1, kernel=poly, total=   0.0s
[CV] C=1, gamma=1, kernel=poly .......................................
[CV] ........................ C=1, gamma=1, kernel=poly, total=   0.0s
[CV] C=1, gamma=1, kernel=poly .......................................
[CV] ........................ C=1, gamma=1, kernel=poly, total=   0.0s
[CV] C=1, gamma=1, kernel=poly .......................................
[CV] ........................ C=1, gamma=1, kernel=poly, total=   0.0s
[CV] C=1, gamma=1, kernel=sigmoid ....................................
[CV] ..................... C=1, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=1, kernel=sigmoid ....................................
[CV] ..................... C=1, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=1, kernel=sigmoid ....................................
[CV] ..................... C=1, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=1, kernel=sigmoid ....................................
[CV] ..................... C=1, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=1, kernel=sigmoid ....................................
[CV] ..................... C=1, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.1, kernel=rbf ......................................
[CV] ....................... C=1, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.1, kernel=rbf ......................................
[CV] ....................... C=1, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.1, kernel=rbf ......................................
[CV] ....................... C=1, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.1, kernel=rbf ......................................
[CV] ....................... C=1, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.1, kernel=rbf ......................................
```

```
[CV] ....................... C=1, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.1, kernel=poly .....................................
[CV] ...................... C=1, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.1, kernel=poly .....................................
[CV] ...................... C=1, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.1, kernel=poly .....................................
[CV] ...................... C=1, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.1, kernel=poly .....................................
[CV] ...................... C=1, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.1, kernel=poly .....................................
[CV] ...................... C=1, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.1, kernel=sigmoid ..................................
[CV] ................... C=1, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.1, kernel=sigmoid ..................................
[CV] ................... C=1, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.1, kernel=sigmoid ..................................
[CV] ................... C=1, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.1, kernel=sigmoid ..................................
[CV] ................... C=1, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.1, kernel=sigmoid ..................................
[CV] ................... C=1, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.01, kernel=rbf .....................................
[CV] ...................... C=1, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.01, kernel=rbf .....................................
[CV] ...................... C=1, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.01, kernel=rbf .....................................
[CV] ...................... C=1, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.01, kernel=rbf .....................................
[CV] ...................... C=1, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.01, kernel=rbf .....................................
[CV] ...................... C=1, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.01, kernel=poly ....................................
[CV] ..................... C=1, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.01, kernel=poly ....................................
[CV] ..................... C=1, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.01, kernel=poly ....................................
[CV] ..................... C=1, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.01, kernel=poly ....................................
[CV] ..................... C=1, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.01, kernel=poly ....................................
[CV] ..................... C=1, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.01, kernel=sigmoid .................................
[CV] .................. C=1, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.01, kernel=sigmoid .................................
[CV] .................. C=1, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.01, kernel=sigmoid .................................
[CV] .................. C=1, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.01, kernel=sigmoid .................................
[CV] .................. C=1, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.01, kernel=sigmoid .................................
[CV] .................. C=1, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.001, kernel=rbf ....................................
[CV] ..................... C=1, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.001, kernel=rbf ....................................
[CV] ..................... C=1, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.001, kernel=rbf ....................................
[CV] ..................... C=1, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.001, kernel=rbf ....................................
[CV] ..................... C=1, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.001, kernel=rbf ....................................
[CV] ..................... C=1, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.001, kernel=poly ...................................
[CV] .................... C=1, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.001, kernel=poly ...................................
[CV] .................... C=1, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.001, kernel=poly ...................................
[CV] .................... C=1, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.001, kernel=poly ...................................
[CV] .................... C=1, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.001, kernel=poly ...................................
[CV] .................... C=1, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.001, kernel=sigmoid ................................
[CV] ................. C=1, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.001, kernel=sigmoid ................................
[CV] ................. C=1, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.001, kernel=sigmoid ................................
[CV] ................. C=1, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.001, kernel=sigmoid ................................
[CV] ................. C=1, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.001, kernel=sigmoid ................................
[CV] ................. C=1, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=1, kernel=rbf .......................................
[CV] ........................ C=10, gamma=1, kernel=rbf, total=   0.0s
[CV] C=10, gamma=1, kernel=rbf .......................................
[CV] ........................ C=10, gamma=1, kernel=rbf, total=   0.0s
[CV] C=10, gamma=1, kernel=rbf .......................................
[CV] ........................ C=10, gamma=1, kernel=rbf, total=   0.0s
[CV] C=10, gamma=1, kernel=rbf .......................................
[CV] ........................ C=10, gamma=1, kernel=rbf, total=   0.0s
[CV] C=10, gamma=1, kernel=rbf .......................................
[CV] ........................ C=10, gamma=1, kernel=rbf, total=   0.0s
[CV] C=10, gamma=1, kernel=poly ......................................
[CV] ....................... C=10, gamma=1, kernel=poly, total=   0.0s
[CV] C=10, gamma=1, kernel=poly ......................................
[CV] ....................... C=10, gamma=1, kernel=poly, total=   0.0s
[CV] C=10, gamma=1, kernel=poly ......................................
[CV] ....................... C=10, gamma=1, kernel=poly, total=   0.0s
[CV] C=10, gamma=1, kernel=poly ......................................
[CV] ....................... C=10, gamma=1, kernel=poly, total=   0.0s
[CV] C=10, gamma=1, kernel=poly ......................................
```

```
[CV] ....................... C=10, gamma=1, kernel=poly, total=   0.0s
[CV] C=10, gamma=1, kernel=sigmoid ...................................
[CV] .................... C=10, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=1, kernel=sigmoid ...................................
[CV] .................... C=10, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=1, kernel=sigmoid ...................................
[CV] .................... C=10, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=1, kernel=sigmoid ...................................
[CV] .................... C=10, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=1, kernel=sigmoid ...................................
[CV] .................... C=10, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.1, kernel=rbf .....................................
[CV] ...................... C=10, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.1, kernel=rbf .....................................
[CV] ...................... C=10, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.1, kernel=rbf .....................................
[CV] ...................... C=10, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.1, kernel=rbf .....................................
[CV] ...................... C=10, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.1, kernel=rbf .....................................
[CV] ...................... C=10, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.1, kernel=poly ....................................
[CV] ..................... C=10, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.1, kernel=poly ....................................
[CV] ..................... C=10, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.1, kernel=poly ....................................
[CV] ..................... C=10, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.1, kernel=poly ....................................
[CV] ..................... C=10, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.1, kernel=poly ....................................
[CV] ..................... C=10, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.1, kernel=sigmoid .................................
[CV] .................. C=10, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.1, kernel=sigmoid .................................
[CV] .................. C=10, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.1, kernel=sigmoid .................................
[CV] .................. C=10, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.1, kernel=sigmoid .................................
[CV] .................. C=10, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.1, kernel=sigmoid .................................
[CV] .................. C=10, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.01, kernel=rbf ....................................
[CV] ..................... C=10, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.01, kernel=rbf ....................................
[CV] ..................... C=10, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.01, kernel=rbf ....................................
[CV] ..................... C=10, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.01, kernel=rbf ....................................
[CV] ..................... C=10, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.01, kernel=rbf ....................................
[CV] ..................... C=10, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.01, kernel=poly ...................................
[CV] .................... C=10, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.01, kernel=poly ...................................
[CV] .................... C=10, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.01, kernel=poly ...................................
[CV] .................... C=10, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.01, kernel=poly ...................................
[CV] .................... C=10, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.01, kernel=poly ...................................
[CV] .................... C=10, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.01, kernel=sigmoid ................................
[CV] ................. C=10, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.01, kernel=sigmoid ................................
[CV] ................. C=10, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.01, kernel=sigmoid ................................
[CV] ................. C=10, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.01, kernel=sigmoid ................................
[CV] ................. C=10, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.01, kernel=sigmoid ................................
[CV] ................. C=10, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.001, kernel=rbf ...................................
[CV] .................... C=10, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.001, kernel=rbf ...................................
[CV] .................... C=10, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.001, kernel=rbf ...................................
[CV] .................... C=10, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.001, kernel=rbf ...................................
[CV] .................... C=10, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.001, kernel=rbf ...................................
[CV] .................... C=10, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.001, kernel=poly ..................................
[CV] ................... C=10, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.001, kernel=poly ..................................
[CV] ................... C=10, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.001, kernel=poly ..................................
[CV] ................... C=10, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.001, kernel=poly ..................................
[CV] ................... C=10, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.001, kernel=poly ..................................
[CV] ................... C=10, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.001, kernel=sigmoid ...............................
[CV] ................ C=10, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.001, kernel=sigmoid ...............................
[CV] ................ C=10, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.001, kernel=sigmoid ...............................
[CV] ................ C=10, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.001, kernel=sigmoid ...............................
[CV] ................ C=10, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.001, kernel=sigmoid ...............................
```

```
[CV] ................ C=10, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=1, kernel=rbf ......................................
[CV] ....................... C=100, gamma=1, kernel=rbf, total=   0.0s
[CV] C=100, gamma=1, kernel=rbf ......................................
[CV] ....................... C=100, gamma=1, kernel=rbf, total=   0.0s
[CV] C=100, gamma=1, kernel=rbf ......................................
[CV] ....................... C=100, gamma=1, kernel=rbf, total=   0.0s
[CV] C=100, gamma=1, kernel=rbf ......................................
[CV] ....................... C=100, gamma=1, kernel=rbf, total=   0.0s
[CV] C=100, gamma=1, kernel=rbf ......................................
[CV] ....................... C=100, gamma=1, kernel=rbf, total=   0.0s
[CV] C=100, gamma=1, kernel=poly .....................................
[CV] ...................... C=100, gamma=1, kernel=poly, total=   0.0s
[CV] C=100, gamma=1, kernel=poly .....................................
[CV] ...................... C=100, gamma=1, kernel=poly, total=   0.0s
[CV] C=100, gamma=1, kernel=poly .....................................
[CV] ...................... C=100, gamma=1, kernel=poly, total=   0.0s
[CV] C=100, gamma=1, kernel=poly .....................................
[CV] ...................... C=100, gamma=1, kernel=poly, total=   0.0s
[CV] C=100, gamma=1, kernel=poly .....................................
[CV] ...................... C=100, gamma=1, kernel=poly, total=   0.0s
[CV] C=100, gamma=1, kernel=sigmoid ..................................
[CV] ................... C=100, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=1, kernel=sigmoid ..................................
[CV] ................... C=100, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=1, kernel=sigmoid ..................................
[CV] ................... C=100, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=1, kernel=sigmoid ..................................
[CV] ................... C=100, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=1, kernel=sigmoid ..................................
[CV] ................... C=100, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.1, kernel=rbf ....................................
[CV] ..................... C=100, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.1, kernel=rbf ....................................
[CV] ..................... C=100, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.1, kernel=rbf ....................................
[CV] ..................... C=100, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.1, kernel=rbf ....................................
[CV] ..................... C=100, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.1, kernel=rbf ....................................
[CV] ..................... C=100, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.1, kernel=poly ...................................
[CV] .................... C=100, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.1, kernel=poly ...................................
[CV] .................... C=100, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.1, kernel=poly ...................................
[CV] .................... C=100, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.1, kernel=poly ...................................
[CV] .................... C=100, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.1, kernel=poly ...................................
[CV] .................... C=100, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.1, kernel=sigmoid ................................
[CV] ................. C=100, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.1, kernel=sigmoid ................................
[CV] ................. C=100, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.1, kernel=sigmoid ................................
[CV] ................. C=100, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.1, kernel=sigmoid ................................
[CV] ................. C=100, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.1, kernel=sigmoid ................................
[CV] ................. C=100, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.01, kernel=rbf ...................................
[CV] .................... C=100, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.01, kernel=rbf ...................................
[CV] .................... C=100, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.01, kernel=rbf ...................................
[CV] .................... C=100, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.01, kernel=rbf ...................................
[CV] .................... C=100, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.01, kernel=rbf ...................................
[CV] .................... C=100, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.01, kernel=poly ..................................
[CV] ................... C=100, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.01, kernel=poly ..................................
[CV] ................... C=100, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.01, kernel=poly ..................................
[CV] ................... C=100, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.01, kernel=poly ..................................
[CV] ................... C=100, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.01, kernel=poly ..................................
[CV] ................... C=100, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.01, kernel=sigmoid ...............................
[CV] ................ C=100, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.01, kernel=sigmoid ...............................
[CV] ................ C=100, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.01, kernel=sigmoid ...............................
[CV] ................ C=100, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.01, kernel=sigmoid ...............................
[CV] ................ C=100, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.01, kernel=sigmoid ...............................
[CV] ................ C=100, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.001, kernel=rbf ..................................
[CV] ................... C=100, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.001, kernel=rbf ..................................
[CV] ................... C=100, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.001, kernel=rbf ..................................
[CV] ................... C=100, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.001, kernel=rbf ..................................
[CV] ................... C=100, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.001, kernel=rbf ..................................
```

```
[CV] .................. C=100, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.001, kernel=poly ................................
[CV] ................. C=100, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.001, kernel=poly ................................
[CV] ................. C=100, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.001, kernel=poly ................................
[CV] ................. C=100, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.001, kernel=poly ................................
[CV] ................. C=100, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.001, kernel=poly ................................
[CV] ................. C=100, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.001, kernel=sigmoid .............................
[CV] .............. C=100, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.001, kernel=sigmoid .............................
[CV] .............. C=100, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.001, kernel=sigmoid .............................
[CV] .............. C=100, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.001, kernel=sigmoid .............................
[CV] .............. C=100, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.001, kernel=sigmoid .............................
[CV] .............. C=100, gamma=0.001, kernel=sigmoid, total=   0.0s
Confusion Matrix:
[[147   2]
 [  2  77]]
--------------------------------------------------
--------------------------------------------------
Performance Evaluation
              precision    recall  f1-score   support

           B       0.99      0.99      0.99       149
           M       0.97      0.97      0.97        79

    accuracy                           0.98       228
   macro avg       0.98      0.98      0.98       228
weighted avg       0.98      0.98      0.98       228

--------------------------------------------------
--------------------------------------------------
Accuracy:
0.9824561403508771
[Parallel(n_jobs=1)]: Done 240 out of 240 | elapsed:    1.4s finished
```



In [ ]:

```
# BREAST CANCER DATASET
# SVM(With Tuning)[50-50 split]


import pandas as pd
import numpy as np

# Dataset Preparation
df = pd.read_csv("wdbc.data",header=None)

col_name = ['1','Class','3','4','5','6','7','8','9','10','11','12','13','14','15','16','17','18','19'
           ,'20','21','22','23','24','25','26','27','28','29','30','31','32']


df.columns = col_name


X = df.drop(['1','Class'], axis=1)
y = df['Class']

from sklearn.model_selection import train_test_split

X_train, X_test, y_train, y_test = train_test_split(X,y,train_size=0.5,test_size=0.5,random_state=10)


# Feature Scaling
from sklearn.preprocessing import StandardScaler

sc = StandardScaler()
X_train = sc.fit_transform(X_train)
X_test = sc.transform(X_test)


# Classification
from sklearn.svm import SVC

classifier = SVC()
```

```python
###############################################################################
# Showing all the parameters

from pprint import pprint
# Look at parameters used by our current forest
print('Parameters currently in use:\n')
pprint(classifier.get_params())

###############################################################################
# Creating a set of important sample features

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

pprint(param_grid)

###############################################################################

from sklearn.model_selection import GridSearchCV

# Use the random grid to search for best hyperparameters
# First create the base model to tune
classifier = SVC()
# Random search of parameters, using 3 fold cross validation,
# search across 100 different combinations, and use all available cores

rf_random = GridSearchCV(SVC(), param_grid, refit=True, verbose=2)
rf_random.fit(X_train, y_train)

y_pred = rf_random.predict(X_test)

from sklearn.metrics import classification_report, confusion_matrix, accuracy_score

print("Confusion Matrix:")
print(confusion_matrix(y_test, y_pred))

print("--------------------------------------------------")
print("--------------------------------------------------")


print("Performance Evaluation")
print(classification_report(y_test, y_pred))


print("--------------------------------------------------")
print("--------------------------------------------------")

print("Accuracy:")
print(accuracy_score(y_test, y_pred))


import matplotlib.pyplot as plt
from sklearn.metrics import plot_confusion_matrix
plot_confusion_matrix(rf_random, X_test, y_test)
plt.show()
```

```
Parameters currently in use:

{'C': 1.0,
 'break_ties': False,
 'cache_size': 200,
 'class_weight': None,
 'coef0': 0.0,
 'decision_function_shape': 'ovr',
 'degree': 3,
 'gamma': 'scale',
 'kernel': 'rbf',
 'max_iter': -1,
 'probability': False,
 'random_state': None,
 'shrinking': True,
 'tol': 0.001,
 'verbose': False}
{'C': [0.1, 1, 10, 100],
 'gamma': [1, 0.1, 0.01, 0.001],
 'kernel': ['rbf', 'poly', 'sigmoid']}
Fitting 5 folds for each of 48 candidates, totalling 240 fits
[CV] C=0.1, gamma=1, kernel=rbf .....................................
[CV] ...................... C=0.1, gamma=1, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=1, kernel=rbf .....................................
[CV] ...................... C=0.1, gamma=1, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=1, kernel=rbf .....................................
[CV] ...................... C=0.1, gamma=1, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=1, kernel=rbf .....................................
[CV] ...................... C=0.1, gamma=1, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=1, kernel=rbf .....................................
[CV] ...................... C=0.1, gamma=1, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=1, kernel=poly ....................................
[CV] ..................... C=0.1, gamma=1, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=1, kernel=poly ....................................
[CV] ..................... C=0.1, gamma=1, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=1, kernel=poly ....................................
[CV] ..................... C=0.1, gamma=1, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=1, kernel=poly ....................................
[CV] ..................... C=0.1, gamma=1, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=1, kernel=poly ....................................
```

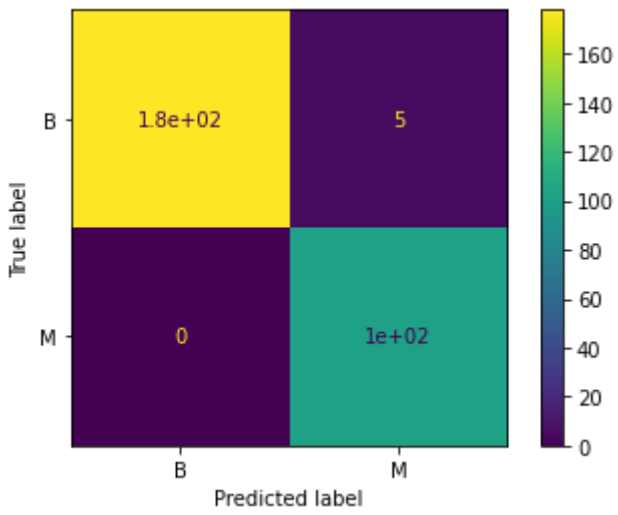
```
[CV] ...................... C=0.1, gamma=1, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=1, kernel=sigmoid ..................................
[CV] ................... C=0.1, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=1, kernel=sigmoid ..................................
[CV] ................... C=0.1, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=1, kernel=sigmoid ..................................
[CV] ................... C=0.1, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=1, kernel=sigmoid ..................................
[CV] ................... C=0.1, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=1, kernel=sigmoid ..................................
[CV] ................... C=0.1, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=rbf ....................................
[CV] ..................... C=0.1, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=rbf ....................................
[CV] ..................... C=0.1, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=rbf ....................................
[CV] ..................... C=0.1, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=rbf ....................................
[CV] ..................... C=0.1, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=rbf ....................................
[CV] ..................... C=0.1, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=poly ...................................
[CV] .................... C=0.1, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=poly ...................................
[CV] .................... C=0.1, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=poly ...................................
[CV] .................... C=0.1, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=poly ...................................
[CV] .................... C=0.1, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=poly ...................................
[CV] .................... C=0.1, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=sigmoid ................................
[CV] ................. C=0.1, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=sigmoid ................................
[CV] ................. C=0.1, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=sigmoid ................................
[CV] ................. C=0.1, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=sigmoid ................................
[CV] ................. C=0.1, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=sigmoid ................................
[CV] ................. C=0.1, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=rbf ...................................
[CV] .................... C=0.1, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=rbf ...................................
[CV] .................... C=0.1, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=rbf ...................................
[CV] .................... C=0.1, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=rbf ...................................
[CV] .................... C=0.1, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=rbf ...................................
[Parallel(n_jobs=1)]: Using backend SequentialBackend with 1 concurrent workers.
[Parallel(n_jobs=1)]: Done   1 out of   1 | elapsed:    0.0s remaining:    0.0s
[CV] .................... C=0.1, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=poly ..................................
[CV] ................... C=0.1, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=poly ..................................
[CV] ................... C=0.1, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=poly ..................................
[CV] ................... C=0.1, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=poly ..................................
[CV] ................... C=0.1, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=poly ..................................
[CV] ................... C=0.1, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=sigmoid ...............................
[CV] ................ C=0.1, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=sigmoid ...............................
[CV] ................ C=0.1, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=sigmoid ...............................
[CV] ................ C=0.1, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=sigmoid ...............................
[CV] ................ C=0.1, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=sigmoid ...............................
[CV] ................ C=0.1, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=rbf ..................................
[CV] ................... C=0.1, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=rbf ..................................
[CV] ................... C=0.1, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=rbf ..................................
[CV] ................... C=0.1, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=rbf ..................................
[CV] ................... C=0.1, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=rbf ..................................
[CV] ................... C=0.1, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=poly .................................
[CV] .................. C=0.1, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=poly .................................
[CV] .................. C=0.1, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=poly .................................
[CV] .................. C=0.1, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=poly .................................
[CV] .................. C=0.1, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=poly .................................
[CV] .................. C=0.1, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=sigmoid ..............................
[CV] ............... C=0.1, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=sigmoid ..............................
[CV] ............... C=0.1, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=sigmoid ..............................
[CV] ............... C=0.1, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=sigmoid ..............................
```

```
[CV] ............... C=0.1, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=sigmoid ..............................
[CV] ............... C=0.1, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=1, kernel=rbf ........................................
[CV] ......................... C=1, gamma=1, kernel=rbf, total=   0.0s
[CV] C=1, gamma=1, kernel=rbf ........................................
[CV] ......................... C=1, gamma=1, kernel=rbf, total=   0.0s
[CV] C=1, gamma=1, kernel=rbf ........................................
[CV] ......................... C=1, gamma=1, kernel=rbf, total=   0.0s
[CV] C=1, gamma=1, kernel=rbf ........................................
[CV] ......................... C=1, gamma=1, kernel=rbf, total=   0.0s
[CV] C=1, gamma=1, kernel=rbf ........................................
[CV] ......................... C=1, gamma=1, kernel=rbf, total=   0.0s
[CV] C=1, gamma=1, kernel=poly .......................................
[CV] ........................ C=1, gamma=1, kernel=poly, total=   0.0s
[CV] C=1, gamma=1, kernel=poly .......................................
[CV] ........................ C=1, gamma=1, kernel=poly, total=   0.0s
[CV] C=1, gamma=1, kernel=poly .......................................
[CV] ........................ C=1, gamma=1, kernel=poly, total=   0.0s
[CV] C=1, gamma=1, kernel=poly .......................................
[CV] ........................ C=1, gamma=1, kernel=poly, total=   0.0s
[CV] C=1, gamma=1, kernel=poly .......................................
[CV] ........................ C=1, gamma=1, kernel=poly, total=   0.0s
[CV] C=1, gamma=1, kernel=sigmoid ....................................
[CV] ..................... C=1, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=1, kernel=sigmoid ....................................
[CV] ..................... C=1, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=1, kernel=sigmoid ....................................
[CV] ..................... C=1, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=1, kernel=sigmoid ....................................
[CV] ..................... C=1, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=1, kernel=sigmoid ....................................
[CV] ..................... C=1, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.1, kernel=rbf ......................................
[CV] ....................... C=1, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.1, kernel=rbf ......................................
[CV] ....................... C=1, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.1, kernel=rbf ......................................
[CV] ....................... C=1, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.1, kernel=rbf ......................................
[CV] ....................... C=1, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.1, kernel=rbf ......................................
[CV] ....................... C=1, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.1, kernel=poly .....................................
[CV] ...................... C=1, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.1, kernel=poly .....................................
[CV] ...................... C=1, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.1, kernel=poly .....................................
[CV] ...................... C=1, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.1, kernel=poly .....................................
[CV] ...................... C=1, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.1, kernel=poly .....................................
[CV] ...................... C=1, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.1, kernel=sigmoid ..................................
[CV] ................... C=1, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.1, kernel=sigmoid ..................................
[CV] ................... C=1, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.1, kernel=sigmoid ..................................
[CV] ................... C=1, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.1, kernel=sigmoid ..................................
[CV] ................... C=1, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.1, kernel=sigmoid ..................................
[CV] ................... C=1, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.01, kernel=rbf .....................................
[CV] ...................... C=1, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.01, kernel=rbf .....................................
[CV] ...................... C=1, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.01, kernel=rbf .....................................
[CV] ...................... C=1, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.01, kernel=rbf .....................................
[CV] ...................... C=1, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.01, kernel=rbf .....................................
[CV] ...................... C=1, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.01, kernel=poly ....................................
[CV] ..................... C=1, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.01, kernel=poly ....................................
[CV] ..................... C=1, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.01, kernel=poly ....................................
[CV] ..................... C=1, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.01, kernel=poly ....................................
[CV] ..................... C=1, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.01, kernel=poly ....................................
[CV] ..................... C=1, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.01, kernel=sigmoid .................................
[CV] .................. C=1, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.01, kernel=sigmoid .................................
[CV] .................. C=1, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.01, kernel=sigmoid .................................
[CV] .................. C=1, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.01, kernel=sigmoid .................................
[CV] .................. C=1, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.01, kernel=sigmoid .................................
[CV] .................. C=1, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.001, kernel=rbf ....................................
[CV] ..................... C=1, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.001, kernel=rbf ....................................
[CV] ..................... C=1, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.001, kernel=rbf ....................................
[CV] ..................... C=1, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.001, kernel=rbf ....................................
```

```
[CV] ..................... C=1, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.001, kernel=rbf ....................................
[CV] ..................... C=1, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.001, kernel=poly ...................................
[CV] .................... C=1, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.001, kernel=poly ...................................
[CV] .................... C=1, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.001, kernel=poly ...................................
[CV] .................... C=1, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.001, kernel=poly ...................................
[CV] .................... C=1, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.001, kernel=poly ...................................
[CV] .................... C=1, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.001, kernel=sigmoid ................................
[CV] ................. C=1, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.001, kernel=sigmoid ................................
[CV] ................. C=1, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.001, kernel=sigmoid ................................
[CV] ................. C=1, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.001, kernel=sigmoid ................................
[CV] ................. C=1, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.001, kernel=sigmoid ................................
[CV] ................. C=1, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=1, kernel=rbf .......................................
[CV] ........................ C=10, gamma=1, kernel=rbf, total=   0.0s
[CV] C=10, gamma=1, kernel=rbf .......................................
[CV] ........................ C=10, gamma=1, kernel=rbf, total=   0.0s
[CV] C=10, gamma=1, kernel=rbf .......................................
[CV] ........................ C=10, gamma=1, kernel=rbf, total=   0.0s
[CV] C=10, gamma=1, kernel=rbf .......................................
[CV] ........................ C=10, gamma=1, kernel=rbf, total=   0.0s
[CV] C=10, gamma=1, kernel=rbf .......................................
[CV] ........................ C=10, gamma=1, kernel=rbf, total=   0.0s
[CV] C=10, gamma=1, kernel=poly ......................................
[CV] ....................... C=10, gamma=1, kernel=poly, total=   0.0s
[CV] C=10, gamma=1, kernel=poly ......................................
[CV] ....................... C=10, gamma=1, kernel=poly, total=   0.0s
[CV] C=10, gamma=1, kernel=poly ......................................
[CV] ....................... C=10, gamma=1, kernel=poly, total=   0.0s
[CV] C=10, gamma=1, kernel=poly ......................................
[CV] ....................... C=10, gamma=1, kernel=poly, total=   0.0s
[CV] C=10, gamma=1, kernel=poly ......................................
[CV] ....................... C=10, gamma=1, kernel=poly, total=   0.0s
[CV] C=10, gamma=1, kernel=sigmoid ...................................
[CV] .................... C=10, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=1, kernel=sigmoid ...................................
[CV] .................... C=10, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=1, kernel=sigmoid ...................................
[CV] .................... C=10, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=1, kernel=sigmoid ...................................
[CV] .................... C=10, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=1, kernel=sigmoid ...................................
[CV] .................... C=10, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.1, kernel=rbf .....................................
[CV] ...................... C=10, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.1, kernel=rbf .....................................
[CV] ...................... C=10, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.1, kernel=rbf .....................................
[CV] ...................... C=10, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.1, kernel=rbf .....................................
[CV] ...................... C=10, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.1, kernel=rbf .....................................
[CV] ...................... C=10, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.1, kernel=poly ....................................
[CV] ..................... C=10, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.1, kernel=poly ....................................
[CV] ..................... C=10, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.1, kernel=poly ....................................
[CV] ..................... C=10, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.1, kernel=poly ....................................
[CV] ..................... C=10, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.1, kernel=poly ....................................
[CV] ..................... C=10, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.1, kernel=sigmoid .................................
[CV] .................. C=10, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.1, kernel=sigmoid .................................
[CV] .................. C=10, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.1, kernel=sigmoid .................................
[CV] .................. C=10, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.1, kernel=sigmoid .................................
[CV] .................. C=10, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.1, kernel=sigmoid .................................
[CV] .................. C=10, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.01, kernel=rbf ....................................
[CV] ..................... C=10, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.01, kernel=rbf ....................................
[CV] ..................... C=10, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.01, kernel=rbf ....................................
[CV] ..................... C=10, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.01, kernel=rbf ....................................
[CV] ..................... C=10, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.01, kernel=rbf ....................................
[CV] ..................... C=10, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.01, kernel=poly ...................................
[CV] .................... C=10, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.01, kernel=poly ...................................
[CV] .................... C=10, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.01, kernel=poly ...................................
[CV] .................... C=10, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.01, kernel=poly ...................................
```

```
[CV] ..................... C=10, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.01, kernel=poly ...................................
[CV] ..................... C=10, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.01, kernel=sigmoid ................................
[CV] .................. C=10, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.01, kernel=sigmoid ................................
[CV] .................. C=10, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.01, kernel=sigmoid ................................
[CV] .................. C=10, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.01, kernel=sigmoid ................................
[CV] .................. C=10, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.01, kernel=sigmoid ................................
[CV] .................. C=10, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.001, kernel=rbf ...................................
[CV] ..................... C=10, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.001, kernel=rbf ...................................
[CV] ..................... C=10, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.001, kernel=rbf ...................................
[CV] ..................... C=10, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.001, kernel=rbf ...................................
[CV] ..................... C=10, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.001, kernel=rbf ...................................
[CV] ..................... C=10, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.001, kernel=poly ..................................
[CV] .................... C=10, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.001, kernel=poly ..................................
[CV] .................... C=10, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.001, kernel=poly ..................................
[CV] .................... C=10, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.001, kernel=poly ..................................
[CV] .................... C=10, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.001, kernel=poly ..................................
[CV] .................... C=10, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.001, kernel=sigmoid ...............................
[CV] ................. C=10, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.001, kernel=sigmoid ...............................
[CV] ................. C=10, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.001, kernel=sigmoid ...............................
[CV] ................. C=10, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.001, kernel=sigmoid ...............................
[CV] ................. C=10, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.001, kernel=sigmoid ...............................
[CV] ................. C=10, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=1, kernel=rbf ......................................
[CV] ........................ C=100, gamma=1, kernel=rbf, total=   0.0s
[CV] C=100, gamma=1, kernel=rbf ......................................
[CV] ........................ C=100, gamma=1, kernel=rbf, total=   0.0s
[CV] C=100, gamma=1, kernel=rbf ......................................
[CV] ........................ C=100, gamma=1, kernel=rbf, total=   0.0s
[CV] C=100, gamma=1, kernel=rbf ......................................
[CV] ........................ C=100, gamma=1, kernel=rbf, total=   0.0s
[CV] C=100, gamma=1, kernel=rbf ......................................
[CV] ........................ C=100, gamma=1, kernel=rbf, total=   0.0s
[CV] C=100, gamma=1, kernel=poly .....................................
[CV] ....................... C=100, gamma=1, kernel=poly, total=   0.0s
[CV] C=100, gamma=1, kernel=poly .....................................
[CV] ....................... C=100, gamma=1, kernel=poly, total=   0.0s
[CV] C=100, gamma=1, kernel=poly .....................................
[CV] ....................... C=100, gamma=1, kernel=poly, total=   0.0s
[CV] C=100, gamma=1, kernel=poly .....................................
[CV] ....................... C=100, gamma=1, kernel=poly, total=   0.0s
[CV] C=100, gamma=1, kernel=poly .....................................
[CV] ....................... C=100, gamma=1, kernel=poly, total=   0.0s
[CV] C=100, gamma=1, kernel=sigmoid ..................................
[CV] .................... C=100, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=1, kernel=sigmoid ..................................
[CV] .................... C=100, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=1, kernel=sigmoid ..................................
[CV] .................... C=100, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=1, kernel=sigmoid ..................................
[CV] .................... C=100, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=1, kernel=sigmoid ..................................
[CV] .................... C=100, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.1, kernel=rbf ....................................
[CV] ...................... C=100, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.1, kernel=rbf ....................................
[CV] ...................... C=100, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.1, kernel=rbf ....................................
[CV] ...................... C=100, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.1, kernel=rbf ....................................
[CV] ...................... C=100, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.1, kernel=rbf ....................................
[CV] ...................... C=100, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.1, kernel=poly ...................................
[CV] ..................... C=100, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.1, kernel=poly ...................................
[CV] ..................... C=100, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.1, kernel=poly ...................................
[CV] ..................... C=100, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.1, kernel=poly ...................................
[CV] ..................... C=100, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.1, kernel=poly ...................................
[CV] ..................... C=100, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.1, kernel=sigmoid ................................
[CV] .................. C=100, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.1, kernel=sigmoid ................................
[CV] .................. C=100, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.1, kernel=sigmoid ................................
[CV] .................. C=100, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.1, kernel=sigmoid ................................
```

```
[CV] ................ C=100, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.1, kernel=sigmoid ................................
[CV] ................ C=100, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.01, kernel=rbf ...................................
[CV] ................... C=100, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.01, kernel=rbf ...................................
[CV] ................... C=100, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.01, kernel=rbf ...................................
[CV] ................... C=100, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.01, kernel=rbf ...................................
[CV] ................... C=100, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.01, kernel=rbf ...................................
[CV] ................... C=100, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.01, kernel=poly ..................................
[CV] .................. C=100, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.01, kernel=poly ..................................
[CV] .................. C=100, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.01, kernel=poly ..................................
[CV] .................. C=100, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.01, kernel=poly ..................................
[CV] .................. C=100, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.01, kernel=poly ..................................
[CV] .................. C=100, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.01, kernel=sigmoid ...............................
[CV] ............... C=100, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.01, kernel=sigmoid ...............................
[CV] ............... C=100, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.01, kernel=sigmoid ...............................
[CV] ............... C=100, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.01, kernel=sigmoid ...............................
[CV] ............... C=100, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.01, kernel=sigmoid ...............................
[CV] ............... C=100, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.001, kernel=rbf ..................................
[CV] .................. C=100, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.001, kernel=rbf ..................................
[CV] .................. C=100, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.001, kernel=rbf ..................................
[CV] .................. C=100, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.001, kernel=rbf ..................................
[CV] .................. C=100, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.001, kernel=rbf ..................................
[CV] .................. C=100, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.001, kernel=poly .................................
[CV] ................. C=100, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.001, kernel=poly .................................
[CV] ................. C=100, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.001, kernel=poly .................................
[CV] ................. C=100, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.001, kernel=poly .................................
[CV] ................. C=100, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.001, kernel=poly .................................
[CV] ................. C=100, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.001, kernel=sigmoid ..............................
[CV] .............. C=100, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.001, kernel=sigmoid ..............................
[CV] .............. C=100, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.001, kernel=sigmoid ..............................
[CV] .............. C=100, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.001, kernel=sigmoid ..............................
[CV] .............. C=100, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.001, kernel=sigmoid ..............................
[CV] .............. C=100, gamma=0.001, kernel=sigmoid, total=   0.0s
Confusion Matrix:
[[178   5]
 [  0 102]]
--------------------------------------------------
--------------------------------------------------
Performance Evaluation
[Parallel(n_jobs=1)]: Done 240 out of 240 | elapsed:    1.2s finished
              precision    recall  f1-score   support

           B       1.00      0.97      0.99       183
           M       0.95      1.00      0.98       102

    accuracy                           0.98       285
   macro avg       0.98      0.99      0.98       285
weighted avg       0.98      0.98      0.98       285

--------------------------------------------------
--------------------------------------------------
Accuracy:
0.9824561403508771
```



In [ ]:

```
# BREAST CANCER DATASET
# SVM(With Tuning)[40-60 split]


import pandas as pd
import numpy as np

# Dataset Preparation
df = pd.read_csv("wdbc.data",header=None)

col_name = ['1','Class','3','4','5','6','7','8','9','10','11','12','13','14','15','16','17','18','19'
           ,'20','21','22','23','24','25','26','27','28','29','30','31','32']


df.columns = col_name


X = df.drop(['1','Class'], axis=1)
y = df['Class']

from sklearn.model_selection import train_test_split

X_train, X_test, y_train, y_test = train_test_split(X,y,train_size=0.4,test_size=0.6,random_state=10)


# Feature Scaling
from sklearn.preprocessing import StandardScaler

sc = StandardScaler()
X_train = sc.fit_transform(X_train)
X_test = sc.transform(X_test)


# Classification
from sklearn.svm import SVC

classifier = SVC()

################################################################################
# Showing all the parameters

from pprint import pprint
# Look at parameters used by our current forest
print('Parameters currently in use:\n')
pprint(classifier.get_params())

################################################################################
# Creating a set of important sample features

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

pprint(param_grid)

################################################################################

from sklearn.model_selection import GridSearchCV

# Use the random grid to search for best hyperparameters
# First create the base model to tune
classifier = SVC()
# Random search of parameters, using 3 fold cross validation,
# search across 100 different combinations, and use all available cores

rf_random = GridSearchCV(SVC(), param_grid, refit=True, verbose=2)
rf_random.fit(X_train, y_train)

y_pred = rf_random.predict(X_test)

from sklearn.metrics import classification_report, confusion_matrix, accuracy_score

print("Confusion Matrix:")
print(confusion_matrix(y_test, y_pred))

print("-------------------------------------------------------")
print("-------------------------------------------------------")
```

```python
print("Performance Evaluation")
print(classification_report(y_test, y_pred))


print("--------------------------------------------------")
print("--------------------------------------------------")

print("Accuracy:")
print(accuracy_score(y_test, y_pred))


import matplotlib.pyplot as plt
from sklearn.metrics import plot_confusion_matrix
plot_confusion_matrix(rf_random, X_test, y_test)
plt.show()
```

```
Parameters currently in use:

{'C': 1.0,
 'break_ties': False,
 'cache_size': 200,
 'class_weight': None,
 'coef0': 0.0,
 'decision_function_shape': 'ovr',
 'degree': 3,
 'gamma': 'scale',
 'kernel': 'rbf',
 'max_iter': -1,
 'probability': False,
 'random_state': None,
 'shrinking': True,
 'tol': 0.001,
 'verbose': False}
{'C': [0.1, 1, 10, 100],
 'gamma': [1, 0.1, 0.01, 0.001],
 'kernel': ['rbf', 'poly', 'sigmoid']}
Fitting 5 folds for each of 48 candidates, totalling 240 fits
[CV] C=0.1, gamma=1, kernel=rbf ....................................
[CV] ....................... C=0.1, gamma=1, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=1, kernel=rbf ....................................
[CV] ....................... C=0.1, gamma=1, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=1, kernel=rbf ....................................
[CV] ....................... C=0.1, gamma=1, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=1, kernel=rbf ....................................
[CV] ....................... C=0.1, gamma=1, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=1, kernel=rbf ....................................
[CV] ....................... C=0.1, gamma=1, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=1, kernel=poly ...................................
[CV] ...................... C=0.1, gamma=1, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=1, kernel=poly ...................................
[CV] ...................... C=0.1, gamma=1, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=1, kernel=poly ...................................
[CV] ...................... C=0.1, gamma=1, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=1, kernel=poly ...................................
[CV] ...................... C=0.1, gamma=1, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=1, kernel=poly ...................................
[CV] ...................... C=0.1, gamma=1, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=1, kernel=sigmoid ................................
[CV] ................... C=0.1, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=1, kernel=sigmoid ................................
[CV] ................... C=0.1, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=1, kernel=sigmoid ................................
[CV] ................... C=0.1, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=1, kernel=sigmoid ................................
[CV] ................... C=0.1, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=1, kernel=sigmoid ................................
[CV] ................... C=0.1, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=rbf ..................................
[CV] ..................... C=0.1, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=rbf ..................................
[CV] ..................... C=0.1, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=rbf ..................................
[CV] ..................... C=0.1, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=rbf ..................................
[CV] ..................... C=0.1, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=rbf ..................................
[CV] ..................... C=0.1, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=poly .................................
[CV] .................... C=0.1, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=poly .................................
[CV] .................... C=0.1, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=poly .................................
[CV] .................... C=0.1, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=poly .................................
[CV] .................... C=0.1, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=poly .................................
[CV] .................... C=0.1, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=sigmoid ..............................
[CV] ................. C=0.1, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=sigmoid ..............................
[CV] ................. C=0.1, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=sigmoid ..............................
[CV] ................. C=0.1, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=sigmoid ..............................
[CV] ................. C=0.1, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=sigmoid ..............................
[CV] ................. C=0.1, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=rbf .................................
```

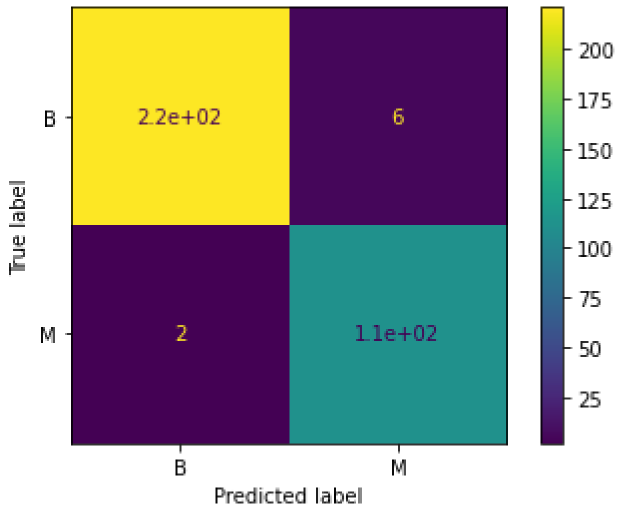
```
[CV] .................... C=0.1, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=rbf ...................................
[CV] .................... C=0.1, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=rbf ...................................
[CV] .................... C=0.1, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=rbf ...................................
[CV] .................... C=0.1, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=rbf ...................................
[CV] .................... C=0.1, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=poly ..................................
[CV] ................... C=0.1, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=poly ..................................
[CV] ................... C=0.1, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=poly ..................................
[CV] ................... C=0.1, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=poly ..................................
[CV] ................... C=0.1, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=poly ..................................
[CV] ................... C=0.1, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=sigmoid ...............................
[CV] ................ C=0.1, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=sigmoid ...............................
[CV] ................ C=0.1, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=sigmoid ...............................
[CV] ................ C=0.1, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=sigmoid ...............................
[Parallel(n_jobs=1)]: Using backend SequentialBackend with 1 concurrent workers.
[Parallel(n_jobs=1)]: Done   1 out of   1 | elapsed:    0.0s remaining:    0.0s
[CV] ................ C=0.1, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=sigmoid ...............................
[CV] ................ C=0.1, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=rbf ..................................
[CV] ................... C=0.1, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=rbf ..................................
[CV] ................... C=0.1, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=rbf ..................................
[CV] ................... C=0.1, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=rbf ..................................
[CV] ................... C=0.1, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=rbf ..................................
[CV] ................... C=0.1, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=poly .................................
[CV] .................. C=0.1, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=poly .................................
[CV] .................. C=0.1, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=poly .................................
[CV] .................. C=0.1, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=poly .................................
[CV] .................. C=0.1, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=poly .................................
[CV] .................. C=0.1, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=sigmoid ..............................
[CV] ............... C=0.1, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=sigmoid ..............................
[CV] ............... C=0.1, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=sigmoid ..............................
[CV] ............... C=0.1, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=sigmoid ..............................
[CV] ............... C=0.1, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=sigmoid ..............................
[CV] ............... C=0.1, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=1, kernel=rbf ........................................
[CV] ......................... C=1, gamma=1, kernel=rbf, total=   0.0s
[CV] C=1, gamma=1, kernel=rbf ........................................
[CV] ......................... C=1, gamma=1, kernel=rbf, total=   0.0s
[CV] C=1, gamma=1, kernel=rbf ........................................
[CV] ......................... C=1, gamma=1, kernel=rbf, total=   0.0s
[CV] C=1, gamma=1, kernel=rbf ........................................
[CV] ......................... C=1, gamma=1, kernel=rbf, total=   0.0s
[CV] C=1, gamma=1, kernel=rbf ........................................
[CV] ......................... C=1, gamma=1, kernel=rbf, total=   0.0s
[CV] C=1, gamma=1, kernel=poly .......................................
[CV] ........................ C=1, gamma=1, kernel=poly, total=   0.0s
[CV] C=1, gamma=1, kernel=poly .......................................
[CV] ........................ C=1, gamma=1, kernel=poly, total=   0.0s
[CV] C=1, gamma=1, kernel=poly .......................................
[CV] ........................ C=1, gamma=1, kernel=poly, total=   0.0s
[CV] C=1, gamma=1, kernel=poly .......................................
[CV] ........................ C=1, gamma=1, kernel=poly, total=   0.0s
[CV] C=1, gamma=1, kernel=poly .......................................
[CV] ........................ C=1, gamma=1, kernel=poly, total=   0.0s
[CV] C=1, gamma=1, kernel=sigmoid ....................................
[CV] ..................... C=1, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=1, kernel=sigmoid ....................................
[CV] ..................... C=1, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=1, kernel=sigmoid ....................................
[CV] ..................... C=1, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=1, kernel=sigmoid ....................................
[CV] ..................... C=1, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=1, kernel=sigmoid ....................................
[CV] ..................... C=1, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.1, kernel=rbf ......................................
[CV] ....................... C=1, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.1, kernel=rbf ......................................
[CV] ....................... C=1, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.1, kernel=rbf ......................................
[CV] ....................... C=1, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.1, kernel=rbf ......................................
[CV] ....................... C=1, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.1, kernel=rbf ......................................
```

```
[CV] ....................... C=1, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.1, kernel=poly .....................................
[CV] ...................... C=1, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.1, kernel=poly .....................................
[CV] ...................... C=1, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.1, kernel=poly .....................................
[CV] ...................... C=1, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.1, kernel=poly .....................................
[CV] ...................... C=1, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.1, kernel=poly .....................................
[CV] ...................... C=1, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.1, kernel=sigmoid ..................................
[CV] ................... C=1, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.1, kernel=sigmoid ..................................
[CV] ................... C=1, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.1, kernel=sigmoid ..................................
[CV] ................... C=1, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.1, kernel=sigmoid ..................................
[CV] ................... C=1, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.1, kernel=sigmoid ..................................
[CV] ................... C=1, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.01, kernel=rbf .....................................
[CV] ...................... C=1, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.01, kernel=rbf .....................................
[CV] ...................... C=1, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.01, kernel=rbf .....................................
[CV] ...................... C=1, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.01, kernel=rbf .....................................
[CV] ...................... C=1, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.01, kernel=rbf .....................................
[CV] ...................... C=1, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.01, kernel=poly ....................................
[CV] ..................... C=1, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.01, kernel=poly ....................................
[CV] ..................... C=1, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.01, kernel=poly ....................................
[CV] ..................... C=1, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.01, kernel=poly ....................................
[CV] ..................... C=1, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.01, kernel=poly ....................................
[CV] ..................... C=1, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.01, kernel=sigmoid .................................
[CV] .................. C=1, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.01, kernel=sigmoid .................................
[CV] .................. C=1, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.01, kernel=sigmoid .................................
[CV] .................. C=1, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.01, kernel=sigmoid .................................
[CV] .................. C=1, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.01, kernel=sigmoid .................................
[CV] .................. C=1, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.001, kernel=rbf ....................................
[CV] ..................... C=1, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.001, kernel=rbf ....................................
[CV] ..................... C=1, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.001, kernel=rbf ....................................
[CV] ..................... C=1, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.001, kernel=rbf ....................................
[CV] ..................... C=1, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.001, kernel=rbf ....................................
[CV] ..................... C=1, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.001, kernel=poly ...................................
[CV] .................... C=1, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.001, kernel=poly ...................................
[CV] .................... C=1, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.001, kernel=poly ...................................
[CV] .................... C=1, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.001, kernel=poly ...................................
[CV] .................... C=1, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.001, kernel=poly ...................................
[CV] .................... C=1, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.001, kernel=sigmoid ................................
[CV] ................. C=1, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.001, kernel=sigmoid ................................
[CV] ................. C=1, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.001, kernel=sigmoid ................................
[CV] ................. C=1, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.001, kernel=sigmoid ................................
[CV] ................. C=1, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.001, kernel=sigmoid ................................
[CV] ................. C=1, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=1, kernel=rbf .......................................
[CV] ........................ C=10, gamma=1, kernel=rbf, total=   0.0s
[CV] C=10, gamma=1, kernel=rbf .......................................
[CV] ........................ C=10, gamma=1, kernel=rbf, total=   0.0s
[CV] C=10, gamma=1, kernel=rbf .......................................
[CV] ........................ C=10, gamma=1, kernel=rbf, total=   0.0s
[CV] C=10, gamma=1, kernel=rbf .......................................
[CV] ........................ C=10, gamma=1, kernel=rbf, total=   0.0s
[CV] C=10, gamma=1, kernel=rbf .......................................
[CV] ........................ C=10, gamma=1, kernel=rbf, total=   0.0s
[CV] C=10, gamma=1, kernel=poly ......................................
[CV] ....................... C=10, gamma=1, kernel=poly, total=   0.0s
[CV] C=10, gamma=1, kernel=poly ......................................
[CV] ....................... C=10, gamma=1, kernel=poly, total=   0.0s
[CV] C=10, gamma=1, kernel=poly ......................................
[CV] ....................... C=10, gamma=1, kernel=poly, total=   0.0s
[CV] C=10, gamma=1, kernel=poly ......................................
[CV] ....................... C=10, gamma=1, kernel=poly, total=   0.0s
[CV] C=10, gamma=1, kernel=poly ......................................
```

```
[CV] ....................... C=10, gamma=1, kernel=poly, total=   0.0s
[CV] C=10, gamma=1, kernel=sigmoid ...................................
[CV] .................... C=10, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=1, kernel=sigmoid ...................................
[CV] .................... C=10, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=1, kernel=sigmoid ...................................
[CV] .................... C=10, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=1, kernel=sigmoid ...................................
[CV] .................... C=10, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=1, kernel=sigmoid ...................................
[CV] .................... C=10, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.1, kernel=rbf .....................................
[CV] ...................... C=10, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.1, kernel=rbf .....................................
[CV] ...................... C=10, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.1, kernel=rbf .....................................
[CV] ...................... C=10, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.1, kernel=rbf .....................................
[CV] ...................... C=10, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.1, kernel=rbf .....................................
[CV] ...................... C=10, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.1, kernel=poly ....................................
[CV] ..................... C=10, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.1, kernel=poly ....................................
[CV] ..................... C=10, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.1, kernel=poly ....................................
[CV] ..................... C=10, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.1, kernel=poly ....................................
[CV] ..................... C=10, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.1, kernel=poly ....................................
[CV] ..................... C=10, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.1, kernel=sigmoid .................................
[CV] .................. C=10, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.1, kernel=sigmoid .................................
[CV] .................. C=10, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.1, kernel=sigmoid .................................
[CV] .................. C=10, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.1, kernel=sigmoid .................................
[CV] .................. C=10, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.1, kernel=sigmoid .................................
[CV] .................. C=10, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.01, kernel=rbf ....................................
[CV] ..................... C=10, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.01, kernel=rbf ....................................
[CV] ..................... C=10, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.01, kernel=rbf ....................................
[CV] ..................... C=10, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.01, kernel=rbf ....................................
[CV] ..................... C=10, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.01, kernel=rbf ....................................
[CV] ..................... C=10, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.01, kernel=poly ...................................
[CV] .................... C=10, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.01, kernel=poly ...................................
[CV] .................... C=10, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.01, kernel=poly ...................................
[CV] .................... C=10, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.01, kernel=poly ...................................
[CV] .................... C=10, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.01, kernel=poly ...................................
[CV] .................... C=10, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.01, kernel=sigmoid ................................
[CV] ................. C=10, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.01, kernel=sigmoid ................................
[CV] ................. C=10, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.01, kernel=sigmoid ................................
[CV] ................. C=10, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.01, kernel=sigmoid ................................
[CV] ................. C=10, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.01, kernel=sigmoid ................................
[CV] ................. C=10, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.001, kernel=rbf ...................................
[CV] .................... C=10, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.001, kernel=rbf ...................................
[CV] .................... C=10, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.001, kernel=rbf ...................................
[CV] .................... C=10, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.001, kernel=rbf ...................................
[CV] .................... C=10, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.001, kernel=rbf ...................................
[CV] .................... C=10, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.001, kernel=poly ..................................
[CV] ................... C=10, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.001, kernel=poly ..................................
[CV] ................... C=10, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.001, kernel=poly ..................................
[CV] ................... C=10, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.001, kernel=poly ..................................
[CV] ................... C=10, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.001, kernel=poly ..................................
[CV] ................... C=10, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.001, kernel=sigmoid ...............................
[CV] ................ C=10, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.001, kernel=sigmoid ...............................
[CV] ................ C=10, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.001, kernel=sigmoid ...............................
[CV] ................ C=10, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.001, kernel=sigmoid ...............................
[CV] ................ C=10, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.001, kernel=sigmoid ...............................
```

```
[CV] ................ C=10, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=1, kernel=rbf ......................................
[CV] ....................... C=100, gamma=1, kernel=rbf, total=   0.0s
[CV] C=100, gamma=1, kernel=rbf ......................................
[CV] ....................... C=100, gamma=1, kernel=rbf, total=   0.0s
[CV] C=100, gamma=1, kernel=rbf ......................................
[CV] ....................... C=100, gamma=1, kernel=rbf, total=   0.0s
[CV] C=100, gamma=1, kernel=rbf ......................................
[CV] ....................... C=100, gamma=1, kernel=rbf, total=   0.0s
[CV] C=100, gamma=1, kernel=rbf ......................................
[CV] ....................... C=100, gamma=1, kernel=rbf, total=   0.0s
[CV] C=100, gamma=1, kernel=poly .....................................
[CV] ...................... C=100, gamma=1, kernel=poly, total=   0.0s
[CV] C=100, gamma=1, kernel=poly .....................................
[CV] ...................... C=100, gamma=1, kernel=poly, total=   0.0s
[CV] C=100, gamma=1, kernel=poly .....................................
[CV] ...................... C=100, gamma=1, kernel=poly, total=   0.0s
[CV] C=100, gamma=1, kernel=poly .....................................
[CV] ...................... C=100, gamma=1, kernel=poly, total=   0.0s
[CV] C=100, gamma=1, kernel=poly .....................................
[CV] ...................... C=100, gamma=1, kernel=poly, total=   0.0s
[CV] C=100, gamma=1, kernel=sigmoid ..................................
[CV] ................... C=100, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=1, kernel=sigmoid ..................................
[CV] ................... C=100, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=1, kernel=sigmoid ..................................
[CV] ................... C=100, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=1, kernel=sigmoid ..................................
[CV] ................... C=100, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=1, kernel=sigmoid ..................................
[CV] ................... C=100, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.1, kernel=rbf ....................................
[CV] ..................... C=100, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.1, kernel=rbf ....................................
[CV] ..................... C=100, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.1, kernel=rbf ....................................
[CV] ..................... C=100, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.1, kernel=rbf ....................................
[CV] ..................... C=100, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.1, kernel=rbf ....................................
[CV] ..................... C=100, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.1, kernel=poly ...................................
[CV] .................... C=100, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.1, kernel=poly ...................................
[CV] .................... C=100, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.1, kernel=poly ...................................
[CV] .................... C=100, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.1, kernel=poly ...................................
[CV] .................... C=100, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.1, kernel=poly ...................................
[CV] .................... C=100, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.1, kernel=sigmoid ................................
[CV] ................. C=100, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.1, kernel=sigmoid ................................
[CV] ................. C=100, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.1, kernel=sigmoid ................................
[CV] ................. C=100, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.1, kernel=sigmoid ................................
[CV] ................. C=100, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.1, kernel=sigmoid ................................
[CV] ................. C=100, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.01, kernel=rbf ...................................
[CV] .................... C=100, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.01, kernel=rbf ...................................
[CV] .................... C=100, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.01, kernel=rbf ...................................
[CV] .................... C=100, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.01, kernel=rbf ...................................
[CV] .................... C=100, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.01, kernel=rbf ...................................
[CV] .................... C=100, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.01, kernel=poly ..................................
[CV] ................... C=100, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.01, kernel=poly ..................................
[CV] ................... C=100, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.01, kernel=poly ..................................
[CV] ................... C=100, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.01, kernel=poly ..................................
[CV] ................... C=100, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.01, kernel=poly ..................................
[CV] ................... C=100, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.01, kernel=sigmoid ...............................
[CV] ................ C=100, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.01, kernel=sigmoid ...............................
[CV] ................ C=100, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.01, kernel=sigmoid ...............................
[CV] ................ C=100, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.01, kernel=sigmoid ...............................
[CV] ................ C=100, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.01, kernel=sigmoid ...............................
[CV] ................ C=100, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.001, kernel=rbf ..................................
[CV] ................... C=100, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.001, kernel=rbf ..................................
[CV] ................... C=100, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.001, kernel=rbf ..................................
[CV] ................... C=100, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.001, kernel=rbf ..................................
[CV] ................... C=100, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.001, kernel=rbf ..................................
```

```
[CV] .................. C=100, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.001, kernel=poly ................................
[CV] ................. C=100, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.001, kernel=poly ................................
[CV] ................. C=100, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.001, kernel=poly ................................
[CV] ................. C=100, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.001, kernel=poly ................................
[CV] ................. C=100, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.001, kernel=poly ................................
[CV] ................. C=100, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.001, kernel=sigmoid .............................
[CV] .............. C=100, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.001, kernel=sigmoid .............................
[CV] .............. C=100, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.001, kernel=sigmoid .............................
[CV] .............. C=100, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.001, kernel=sigmoid .............................
[CV] .............. C=100, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.001, kernel=sigmoid .............................
[CV] .............. C=100, gamma=0.001, kernel=sigmoid, total=   0.0s
Confusion Matrix:
[[221   6]
 [  2 113]]
--------------------------------------------------
--------------------------------------------------
Performance Evaluation
              precision    recall  f1-score   support

           B       0.99      0.97      0.98       227
           M       0.95      0.98      0.97       115

    accuracy                           0.98       342
   macro avg       0.97      0.98      0.97       342
weighted avg       0.98      0.98      0.98       342

--------------------------------------------------
--------------------------------------------------
Accuracy:
0.9766081871345029
[Parallel(n_jobs=1)]: Done 240 out of 240 | elapsed:    1.0s finished
```



In [ ]:

```
# BREAST CANCER DATASET
# SVM(With Tuning)[30-70 split]


import pandas as pd
import numpy as np

# Dataset Preparation
df = pd.read_csv("wdbc.data",header=None)

col_name = ['1','Class','3','4','5','6','7','8','9','10','11','12','13','14','15','16','17','18','19'
           ,'20','21','22','23','24','25','26','27','28','29','30','31','32']


df.columns = col_name


X = df.drop(['1','Class'], axis=1)
y = df['Class']

from sklearn.model_selection import train_test_split

X_train, X_test, y_train, y_test = train_test_split(X,y,train_size=0.3,test_size=0.7,random_state=10)


# Feature Scaling
from sklearn.preprocessing import StandardScaler

sc = StandardScaler()
X_train = sc.fit_transform(X_train)
X_test = sc.transform(X_test)


# Classification
from sklearn.svm import SVC

classifier = SVC()
```

```python
###############################################################################
# Showing all the parameters

from pprint import pprint
# Look at parameters used by our current forest
print('Parameters currently in use:\n')
pprint(classifier.get_params())

###############################################################################
# Creating a set of important sample features

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

pprint(param_grid)

###############################################################################

from sklearn.model_selection import GridSearchCV

# Use the random grid to search for best hyperparameters
# First create the base model to tune
classifier = SVC()
# Random search of parameters, using 3 fold cross validation,
# search across 100 different combinations, and use all available cores

rf_random = GridSearchCV(SVC(), param_grid, refit=True, verbose=2)
rf_random.fit(X_train, y_train)

y_pred = rf_random.predict(X_test)

from sklearn.metrics import classification_report, confusion_matrix, accuracy_score

print("Confusion Matrix:")
print(confusion_matrix(y_test, y_pred))

print("----------------------------------------------------")
print("----------------------------------------------------")


print("Performance Evaluation")
print(classification_report(y_test, y_pred))


print("----------------------------------------------------")
print("----------------------------------------------------")

print("Accuracy:")
print(accuracy_score(y_test, y_pred))


import matplotlib.pyplot as plt
from sklearn.metrics import plot_confusion_matrix
plot_confusion_matrix(rf_random, X_test, y_test)
plt.show()
```

```
Parameters currently in use:

{'C': 1.0,
 'break_ties': False,
 'cache_size': 200,
 'class_weight': None,
 'coef0': 0.0,
 'decision_function_shape': 'ovr',
 'degree': 3,
 'gamma': 'scale',
 'kernel': 'rbf',
 'max_iter': -1,
 'probability': False,
 'random_state': None,
 'shrinking': True,
 'tol': 0.001,
 'verbose': False}
{'C': [0.1, 1, 10, 100],
 'gamma': [1, 0.1, 0.01, 0.001],
 'kernel': ['rbf', 'poly', 'sigmoid']}
Fitting 5 folds for each of 48 candidates, totalling 240 fits
[CV] C=0.1, gamma=1, kernel=rbf .......................................
[CV] ....................... C=0.1, gamma=1, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=1, kernel=rbf .......................................
[CV] ....................... C=0.1, gamma=1, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=1, kernel=rbf .......................................
[CV] ....................... C=0.1, gamma=1, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=1, kernel=rbf .......................................
[CV] ....................... C=0.1, gamma=1, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=1, kernel=rbf .......................................
[CV] ....................... C=0.1, gamma=1, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=1, kernel=poly ......................................
[CV] ...................... C=0.1, gamma=1, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=1, kernel=poly ......................................
[CV] ...................... C=0.1, gamma=1, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=1, kernel=poly ......................................
[CV] ...................... C=0.1, gamma=1, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=1, kernel=poly ......................................
[CV] ...................... C=0.1, gamma=1, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=1, kernel=poly ......................................
```

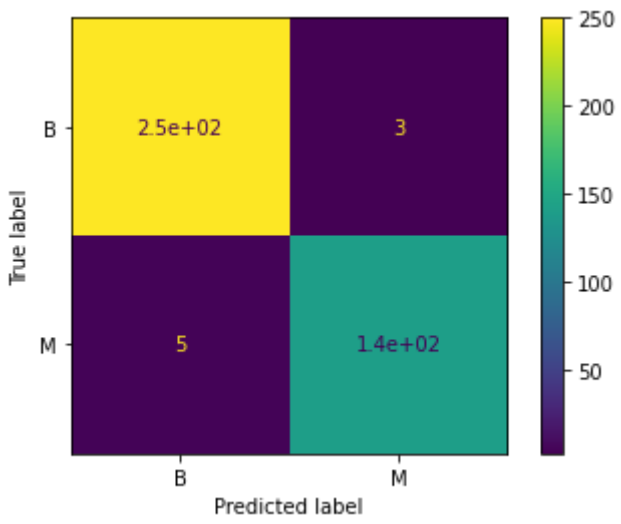
```
[CV] ...................... C=0.1, gamma=1, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=1, kernel=sigmoid ..................................
[CV] ................... C=0.1, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=1, kernel=sigmoid ..................................
[CV] ................... C=0.1, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=1, kernel=sigmoid ..................................
[CV] ................... C=0.1, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=1, kernel=sigmoid ..................................
[CV] ................... C=0.1, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=1, kernel=sigmoid ..................................
[CV] ................... C=0.1, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=rbf ....................................
[CV] ..................... C=0.1, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=rbf ....................................
[CV] ..................... C=0.1, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=rbf ....................................
[CV] ..................... C=0.1, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=rbf ....................................
[CV] ..................... C=0.1, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=rbf ....................................
[CV] ..................... C=0.1, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=poly ...................................
[CV] .................... C=0.1, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=poly ...................................
[CV] .................... C=0.1, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=poly ...................................
[CV] .................... C=0.1, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=poly ...................................
[CV] .................... C=0.1, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=poly ...................................
[CV] .................... C=0.1, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=sigmoid ................................
[CV] ................. C=0.1, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=sigmoid ................................
[CV] ................. C=0.1, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=sigmoid ................................
[CV] ................. C=0.1, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=sigmoid ................................
[CV] ................. C=0.1, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=sigmoid ................................
[CV] ................. C=0.1, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=rbf ...................................
[CV] .................... C=0.1, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=rbf ...................................
[CV] .................... C=0.1, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=rbf ...................................
[CV] .................... C=0.1, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=rbf ...................................
[CV] .................... C=0.1, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=rbf ...................................
[CV] .................... C=0.1, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=poly ..................................
[CV] ................... C=0.1, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=poly ..................................
[CV] ................... C=0.1, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=poly ..................................
[CV] ................... C=0.1, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=poly ..................................
[CV] ................... C=0.1, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=poly ..................................
[CV] ................... C=0.1, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=sigmoid ...............................
[CV] ................ C=0.1, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=sigmoid ...............................
[CV] ................ C=0.1, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=sigmoid ...............................
[CV] ................ C=0.1, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=sigmoid ...............................
[CV] ................ C=0.1, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=sigmoid ...............................
[CV] ................ C=0.1, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=rbf ..................................
[CV] ................... C=0.1, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=rbf ..................................
[CV] ................... C=0.1, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=rbf ..................................
[CV] ................... C=0.1, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=rbf ..................................
[CV] ................... C=0.1, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=rbf ..................................
[CV] ................... C=0.1, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=poly .................................
[CV] .................. C=0.1, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=poly .................................
[CV] .................. C=0.1, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=poly .................................
[CV] .................. C=0.1, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=poly .................................
[CV] .................. C=0.1, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=poly .................................
[Parallel(n_jobs=1)]: Using backend SequentialBackend with 1 concurrent workers.
[Parallel(n_jobs=1)]: Done   1 out of   1 | elapsed:    0.0s remaining:    0.0s
[CV] .................. C=0.1, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=sigmoid ..............................
[CV] ............... C=0.1, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=sigmoid ..............................
[CV] ............... C=0.1, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=sigmoid ..............................
[CV] ............... C=0.1, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=sigmoid ..............................
```

```
[CV] ............... C=0.1, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=sigmoid ..............................
[CV] ............... C=0.1, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=1, kernel=rbf ........................................
[CV] ......................... C=1, gamma=1, kernel=rbf, total=   0.0s
[CV] C=1, gamma=1, kernel=rbf ........................................
[CV] ......................... C=1, gamma=1, kernel=rbf, total=   0.0s
[CV] C=1, gamma=1, kernel=rbf ........................................
[CV] ......................... C=1, gamma=1, kernel=rbf, total=   0.0s
[CV] C=1, gamma=1, kernel=rbf ........................................
[CV] ......................... C=1, gamma=1, kernel=rbf, total=   0.0s
[CV] C=1, gamma=1, kernel=rbf ........................................
[CV] ......................... C=1, gamma=1, kernel=rbf, total=   0.0s
[CV] C=1, gamma=1, kernel=poly .......................................
[CV] ........................ C=1, gamma=1, kernel=poly, total=   0.0s
[CV] C=1, gamma=1, kernel=poly .......................................
[CV] ........................ C=1, gamma=1, kernel=poly, total=   0.0s
[CV] C=1, gamma=1, kernel=poly .......................................
[CV] ........................ C=1, gamma=1, kernel=poly, total=   0.0s
[CV] C=1, gamma=1, kernel=poly .......................................
[CV] ........................ C=1, gamma=1, kernel=poly, total=   0.0s
[CV] C=1, gamma=1, kernel=poly .......................................
[CV] ........................ C=1, gamma=1, kernel=poly, total=   0.0s
[CV] C=1, gamma=1, kernel=sigmoid ....................................
[CV] ..................... C=1, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=1, kernel=sigmoid ....................................
[CV] ..................... C=1, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=1, kernel=sigmoid ....................................
[CV] ..................... C=1, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=1, kernel=sigmoid ....................................
[CV] ..................... C=1, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=1, kernel=sigmoid ....................................
[CV] ..................... C=1, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.1, kernel=rbf ......................................
[CV] ....................... C=1, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.1, kernel=rbf ......................................
[CV] ....................... C=1, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.1, kernel=rbf ......................................
[CV] ....................... C=1, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.1, kernel=rbf ......................................
[CV] ....................... C=1, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.1, kernel=rbf ......................................
[CV] ....................... C=1, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.1, kernel=poly .....................................
[CV] ...................... C=1, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.1, kernel=poly .....................................
[CV] ...................... C=1, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.1, kernel=poly .....................................
[CV] ...................... C=1, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.1, kernel=poly .....................................
[CV] ...................... C=1, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.1, kernel=poly .....................................
[CV] ...................... C=1, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.1, kernel=sigmoid ..................................
[CV] ................... C=1, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.1, kernel=sigmoid ..................................
[CV] ................... C=1, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.1, kernel=sigmoid ..................................
[CV] ................... C=1, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.1, kernel=sigmoid ..................................
[CV] ................... C=1, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.1, kernel=sigmoid ..................................
[CV] ................... C=1, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.01, kernel=rbf .....................................
[CV] ...................... C=1, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.01, kernel=rbf .....................................
[CV] ...................... C=1, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.01, kernel=rbf .....................................
[CV] ...................... C=1, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.01, kernel=rbf .....................................
[CV] ...................... C=1, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.01, kernel=rbf .....................................
[CV] ...................... C=1, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.01, kernel=poly ....................................
[CV] ..................... C=1, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.01, kernel=poly ....................................
[CV] ..................... C=1, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.01, kernel=poly ....................................
[CV] ..................... C=1, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.01, kernel=poly ....................................
[CV] ..................... C=1, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.01, kernel=poly ....................................
[CV] ..................... C=1, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.01, kernel=sigmoid .................................
[CV] .................. C=1, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.01, kernel=sigmoid .................................
[CV] .................. C=1, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.01, kernel=sigmoid .................................
[CV] .................. C=1, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.01, kernel=sigmoid .................................
[CV] .................. C=1, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.01, kernel=sigmoid .................................
[CV] .................. C=1, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.001, kernel=rbf ....................................
[CV] ..................... C=1, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.001, kernel=rbf ....................................
[CV] ..................... C=1, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.001, kernel=rbf ....................................
[CV] ..................... C=1, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.001, kernel=rbf ....................................
```

```
[CV] ..................... C=1, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.001, kernel=rbf ....................................
[CV] ..................... C=1, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.001, kernel=poly ...................................
[CV] .................... C=1, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.001, kernel=poly ...................................
[CV] .................... C=1, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.001, kernel=poly ...................................
[CV] .................... C=1, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.001, kernel=poly ...................................
[CV] .................... C=1, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.001, kernel=poly ...................................
[CV] .................... C=1, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.001, kernel=sigmoid ................................
[CV] ................. C=1, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.001, kernel=sigmoid ................................
[CV] ................. C=1, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.001, kernel=sigmoid ................................
[CV] ................. C=1, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.001, kernel=sigmoid ................................
[CV] ................. C=1, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.001, kernel=sigmoid ................................
[CV] ................. C=1, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=1, kernel=rbf .......................................
[CV] ........................ C=10, gamma=1, kernel=rbf, total=   0.0s
[CV] C=10, gamma=1, kernel=rbf .......................................
[CV] ........................ C=10, gamma=1, kernel=rbf, total=   0.0s
[CV] C=10, gamma=1, kernel=rbf .......................................
[CV] ........................ C=10, gamma=1, kernel=rbf, total=   0.0s
[CV] C=10, gamma=1, kernel=rbf .......................................
[CV] ........................ C=10, gamma=1, kernel=rbf, total=   0.0s
[CV] C=10, gamma=1, kernel=rbf .......................................
[CV] ........................ C=10, gamma=1, kernel=rbf, total=   0.0s
[CV] C=10, gamma=1, kernel=poly ......................................
[CV] ....................... C=10, gamma=1, kernel=poly, total=   0.0s
[CV] C=10, gamma=1, kernel=poly ......................................
[CV] ....................... C=10, gamma=1, kernel=poly, total=   0.0s
[CV] C=10, gamma=1, kernel=poly ......................................
[CV] ....................... C=10, gamma=1, kernel=poly, total=   0.0s
[CV] C=10, gamma=1, kernel=poly ......................................
[CV] ....................... C=10, gamma=1, kernel=poly, total=   0.0s
[CV] C=10, gamma=1, kernel=poly ......................................
[CV] ....................... C=10, gamma=1, kernel=poly, total=   0.0s
[CV] C=10, gamma=1, kernel=sigmoid ...................................
[CV] .................... C=10, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=1, kernel=sigmoid ...................................
[CV] .................... C=10, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=1, kernel=sigmoid ...................................
[CV] .................... C=10, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=1, kernel=sigmoid ...................................
[CV] .................... C=10, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=1, kernel=sigmoid ...................................
[CV] .................... C=10, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.1, kernel=rbf .....................................
[CV] ...................... C=10, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.1, kernel=rbf .....................................
[CV] ...................... C=10, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.1, kernel=rbf .....................................
[CV] ...................... C=10, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.1, kernel=rbf .....................................
[CV] ...................... C=10, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.1, kernel=rbf .....................................
[CV] ...................... C=10, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.1, kernel=poly ....................................
[CV] ..................... C=10, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.1, kernel=poly ....................................
[CV] ..................... C=10, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.1, kernel=poly ....................................
[CV] ..................... C=10, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.1, kernel=poly ....................................
[CV] ..................... C=10, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.1, kernel=poly ....................................
[CV] ..................... C=10, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.1, kernel=sigmoid .................................
[CV] .................. C=10, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.1, kernel=sigmoid .................................
[CV] .................. C=10, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.1, kernel=sigmoid .................................
[CV] .................. C=10, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.1, kernel=sigmoid .................................
[CV] .................. C=10, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.1, kernel=sigmoid .................................
[CV] .................. C=10, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.01, kernel=rbf ....................................
[CV] ..................... C=10, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.01, kernel=rbf ....................................
[CV] ..................... C=10, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.01, kernel=rbf ....................................
[CV] ..................... C=10, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.01, kernel=rbf ....................................
[CV] ..................... C=10, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.01, kernel=rbf ....................................
[CV] ..................... C=10, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.01, kernel=poly ...................................
[CV] .................... C=10, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.01, kernel=poly ...................................
[CV] .................... C=10, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.01, kernel=poly ...................................
[CV] .................... C=10, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.01, kernel=poly ...................................
```

```
[CV] .................... C=10, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.01, kernel=poly ...................................
[CV] .................... C=10, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.01, kernel=sigmoid ................................
[CV] ................. C=10, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.01, kernel=sigmoid ................................
[CV] ................. C=10, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.01, kernel=sigmoid ................................
[CV] ................. C=10, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.01, kernel=sigmoid ................................
[CV] ................. C=10, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.01, kernel=sigmoid ................................
[CV] ................. C=10, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.001, kernel=rbf ...................................
[CV] .................... C=10, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.001, kernel=rbf ...................................
[CV] .................... C=10, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.001, kernel=rbf ...................................
[CV] .................... C=10, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.001, kernel=rbf ...................................
[CV] .................... C=10, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.001, kernel=rbf ...................................
[CV] .................... C=10, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.001, kernel=poly ..................................
[CV] ................... C=10, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.001, kernel=poly ..................................
[CV] ................... C=10, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.001, kernel=poly ..................................
[CV] ................... C=10, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.001, kernel=poly ..................................
[CV] ................... C=10, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.001, kernel=poly ..................................
[CV] ................... C=10, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.001, kernel=sigmoid ...............................
[CV] ................ C=10, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.001, kernel=sigmoid ...............................
[CV] ................ C=10, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.001, kernel=sigmoid ...............................
[CV] ................ C=10, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.001, kernel=sigmoid ...............................
[CV] ................ C=10, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.001, kernel=sigmoid ...............................
[CV] ................ C=10, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=1, kernel=rbf ......................................
[CV] ....................... C=100, gamma=1, kernel=rbf, total=   0.0s
[CV] C=100, gamma=1, kernel=rbf ......................................
[CV] ....................... C=100, gamma=1, kernel=rbf, total=   0.0s
[CV] C=100, gamma=1, kernel=rbf ......................................
[CV] ....................... C=100, gamma=1, kernel=rbf, total=   0.0s
[CV] C=100, gamma=1, kernel=rbf ......................................
[CV] ....................... C=100, gamma=1, kernel=rbf, total=   0.0s
[CV] C=100, gamma=1, kernel=rbf ......................................
[CV] ....................... C=100, gamma=1, kernel=rbf, total=   0.0s
[CV] C=100, gamma=1, kernel=poly .....................................
[CV] ...................... C=100, gamma=1, kernel=poly, total=   0.0s
[CV] C=100, gamma=1, kernel=poly .....................................
[CV] ...................... C=100, gamma=1, kernel=poly, total=   0.0s
[CV] C=100, gamma=1, kernel=poly .....................................
[CV] ...................... C=100, gamma=1, kernel=poly, total=   0.0s
[CV] C=100, gamma=1, kernel=poly .....................................
[CV] ...................... C=100, gamma=1, kernel=poly, total=   0.0s
[CV] C=100, gamma=1, kernel=poly .....................................
[CV] ...................... C=100, gamma=1, kernel=poly, total=   0.0s
[CV] C=100, gamma=1, kernel=sigmoid ..................................
[CV] ................... C=100, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=1, kernel=sigmoid ..................................
[CV] ................... C=100, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=1, kernel=sigmoid ..................................
[CV] ................... C=100, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=1, kernel=sigmoid ..................................
[CV] ................... C=100, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=1, kernel=sigmoid ..................................
[CV] ................... C=100, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.1, kernel=rbf ....................................
[CV] ..................... C=100, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.1, kernel=rbf ....................................
[CV] ..................... C=100, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.1, kernel=rbf ....................................
[CV] ..................... C=100, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.1, kernel=rbf ....................................
[CV] ..................... C=100, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.1, kernel=rbf ....................................
[CV] ..................... C=100, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.1, kernel=poly ...................................
[CV] .................... C=100, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.1, kernel=poly ...................................
[CV] .................... C=100, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.1, kernel=poly ...................................
[CV] .................... C=100, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.1, kernel=poly ...................................
[CV] .................... C=100, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.1, kernel=poly ...................................
[CV] .................... C=100, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.1, kernel=sigmoid ................................
[CV] ................. C=100, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.1, kernel=sigmoid ................................
[CV] ................. C=100, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.1, kernel=sigmoid ................................
[CV] ................. C=100, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.1, kernel=sigmoid ................................
```

```
[CV] ................ C=100, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.1, kernel=sigmoid ...............................
[CV] ................ C=100, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.01, kernel=rbf ..................................
[CV] ................... C=100, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.01, kernel=rbf ..................................
[CV] ................... C=100, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.01, kernel=rbf ..................................
[CV] ................... C=100, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.01, kernel=rbf ..................................
[CV] ................... C=100, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.01, kernel=rbf ..................................
[CV] ................... C=100, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.01, kernel=poly .................................
[CV] .................. C=100, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.01, kernel=poly .................................
[CV] .................. C=100, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.01, kernel=poly .................................
[CV] .................. C=100, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.01, kernel=poly .................................
[CV] .................. C=100, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.01, kernel=poly .................................
[CV] .................. C=100, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.01, kernel=sigmoid ..............................
[CV] ............... C=100, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.01, kernel=sigmoid ..............................
[CV] ............... C=100, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.01, kernel=sigmoid ..............................
[CV] ............... C=100, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.01, kernel=sigmoid ..............................
[CV] ............... C=100, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.01, kernel=sigmoid ..............................
[CV] ............... C=100, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.001, kernel=rbf .................................
[CV] .................. C=100, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.001, kernel=rbf .................................
[CV] .................. C=100, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.001, kernel=rbf .................................
[CV] .................. C=100, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.001, kernel=rbf .................................
[CV] .................. C=100, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.001, kernel=rbf .................................
[CV] .................. C=100, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.001, kernel=poly ................................
[CV] ................. C=100, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.001, kernel=poly ................................
[CV] ................. C=100, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.001, kernel=poly ................................
[CV] ................. C=100, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.001, kernel=poly ................................
[CV] ................. C=100, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.001, kernel=poly ................................
[CV] ................. C=100, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.001, kernel=sigmoid .............................
[CV] .............. C=100, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.001, kernel=sigmoid .............................
[CV] .............. C=100, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.001, kernel=sigmoid .............................
[CV] .............. C=100, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.001, kernel=sigmoid .............................
[CV] .............. C=100, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.001, kernel=sigmoid .............................
[CV] .............. C=100, gamma=0.001, kernel=sigmoid, total=   0.0s
Confusion Matrix:
[[250   3]
 [  5 141]]
-------------------------------------------------
-------------------------------------------------
Performance Evaluation
              precision    recall  f1-score   support

           B       0.98      0.99      0.98       253
           M       0.98      0.97      0.97       146

    accuracy                           0.98       399
   macro avg       0.98      0.98      0.98       399
weighted avg       0.98      0.98      0.98       399

-------------------------------------------------
-------------------------------------------------
Accuracy:
0.9799498746867168
[Parallel(n_jobs=1)]: Done 240 out of 240 | elapsed:    0.8s finished
```



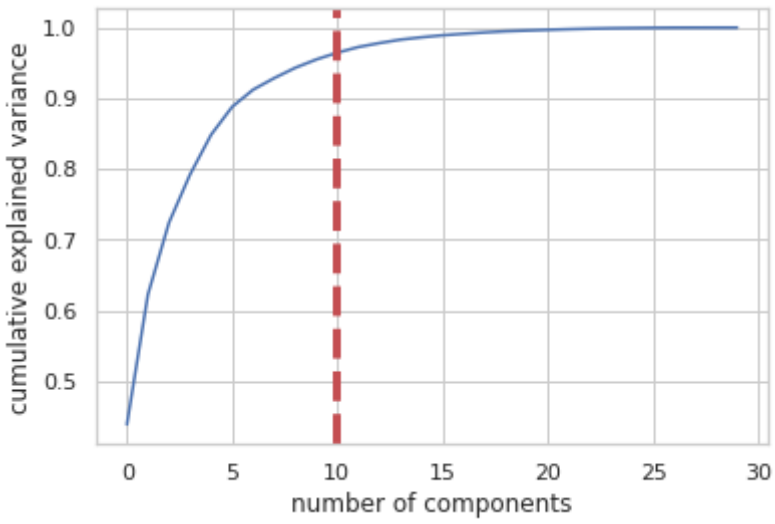
In [ ]:

```
##########################################################################################################
```

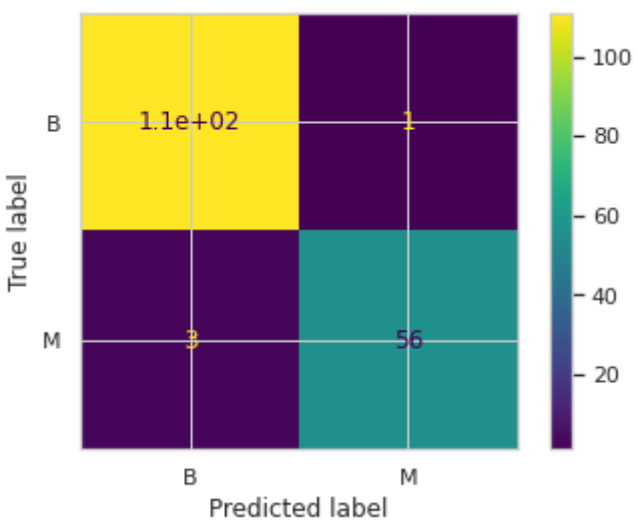
In [ ]:

```
# BREAST CANCER DATASET
# Random Forest Classifier(Without Tuning)[70-30 split]


import pandas as pd
import numpy as np

# Dataset Preparation
df = pd.read_csv("wdbc.data",header=None)

col_name = ['1','Class','3','4','5','6','7','8','9','10','11','12','13','14','15','16','17','18','19'
           ,'20','21','22','23','24','25','26','27','28','29','30','31','32']

df.columns = col_name


X = df.drop(['1','Class'], axis=1)
y = df['Class']

from sklearn.model_selection import train_test_split

X_train, X_test, y_train, y_test = train_test_split(X,y,train_size=0.7,test_size=0.3,random_state=10)


# Feature Scaling
from sklearn.preprocessing import StandardScaler

sc = StandardScaler()
X_train = sc.fit_transform(X_train)
X_test = sc.transform(X_test)


# Finding the important parameters that contribute to most of the variance in the data.

import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.decomposition import PCA

pca_test = PCA(n_components=30)
pca_test.fit(X_train)
sns.set(style='whitegrid')
plt.plot(np.cumsum(pca_test.explained_variance_ratio_))
plt.xlabel('number of components')
plt.ylabel('cumulative explained variance')
plt.axvline(linewidth=4, color='r', linestyle = '--', x=10, ymin=0, ymax=1)
display(plt.show())

# So we can see that we have 10 important parameters

pca = PCA(n_components=10)
pca.fit(X_train)
X_train = pca.transform(X_train)
X_test = pca.transform(X_test)

# Classification
from sklearn.ensemble import RandomForestClassifier

classifier = RandomForestClassifier(n_estimators=20, random_state=0)
classifier.fit(X_train,y_train)

y_pred = classifier.predict(X_test)

from sklearn.metrics import classification_report, confusion_matrix, accuracy_score

print("Confusion Matrix:")
print(confusion_matrix(y_test, y_pred))

print("--------------------------------------------------")
print("--------------------------------------------------")


print("Performance Evaluation")
```

```
print(classification_report(y_test, y_pred))


print("-----------------------------------------------------")
print("-----------------------------------------------------")

print("Accuracy:")
print(accuracy_score(y_test, y_pred))

import matplotlib.pyplot as plt
from sklearn.metrics import plot_confusion_matrix
plot_confusion_matrix(classifier, X_test, y_test)
plt.show()
```




```
None
Confusion Matrix:
[[111   1]
 [  3  56]]
-----------------------------------------------------
-----------------------------------------------------
Performance Evaluation
              precision    recall  f1-score   support

           B       0.97      0.99      0.98       112
           M       0.98      0.95      0.97        59

    accuracy                           0.98       171
   macro avg       0.98      0.97      0.97       171
weighted avg       0.98      0.98      0.98       171

-----------------------------------------------------
-----------------------------------------------------
Accuracy:
0.9766081871345029
```

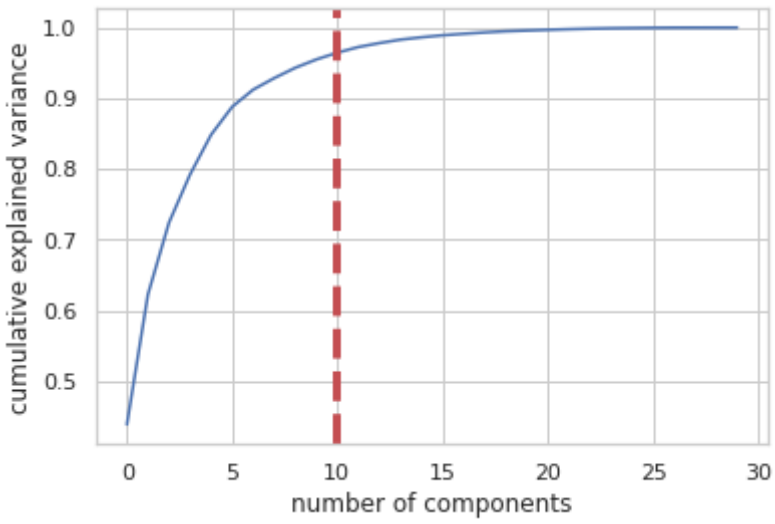


In [ ]:

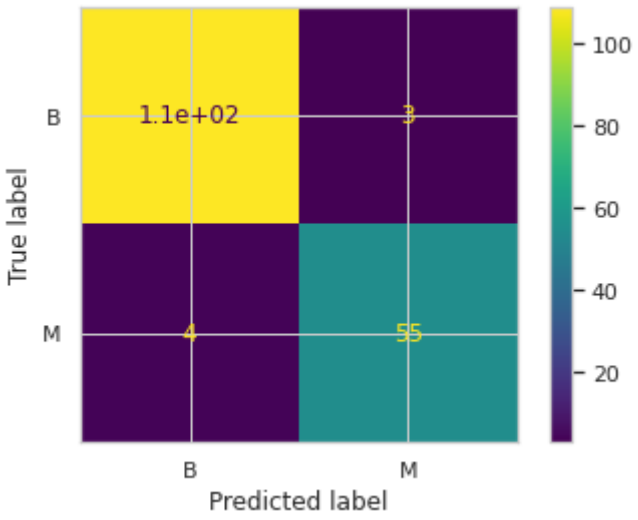
```
# BREAST CANCER DATASET
# Random Forest Classifier(With Tuning)[70-30 split]


import pandas as pd
import numpy as np

# Dataset Preparation
df = pd.read_csv("wdbc.data",header=None)

col_name = ['1','Class','3','4','5','6','7','8','9','10','11','12','13','14','15','16','17','18','19'
           ,'20','21','22','23','24','25','26','27','28','29','30','31','32']


df.columns = col_name


X = df.drop(['1','Class'], axis=1)
y = df['Class']

from sklearn.model_selection import train_test_split

X_train, X_test, y_train, y_test = train_test_split(X,y,train_size=0.7,test_size=0.30,random_state=10)


# Feature Scaling
```

```
from sklearn.preprocessing import StandardScaler

sc = StandardScaler()
X_train = sc.fit_transform(X_train)
X_test = sc.transform(X_test)


# Finding the important parameters that contribute to most of the variance in the data.

import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.decomposition import PCA

pca_test = PCA(n_components=30)
pca_test.fit(X_train)
sns.set(style='whitegrid')
plt.plot(np.cumsum(pca_test.explained_variance_ratio_))
plt.xlabel('number of components')
plt.ylabel('cumulative explained variance')
plt.axvline(linewidth=4, color='r', linestyle = '--', x=10, ymin=0, ymax=1)
display(plt.show())

# So we can see that we have 10 important parameters

pca = PCA(n_components=10)
pca.fit(X_train)
X_train = pca.transform(X_train)
X_test = pca.transform(X_test)


# Classification
from sklearn.ensemble import RandomForestClassifier

classifier = RandomForestClassifier()

###############################################################################
# Showing all the parameters

from pprint import pprint
# Look at parameters used by our current forest
print('Parameters currently in use:\n')
pprint(classifier.get_params())

###############################################################################
# Creating a set of important sample features

from sklearn.model_selection import RandomizedSearchCV
# Number of trees in random forest
n_estimators = [int(x) for x in np.linspace(start = 200, stop = 2000, num = 10)]
# Number of features to consider at every split
max_features = ['auto', 'sqrt']
# Maximum number of levels in tree
max_depth = [int(x) for x in np.linspace(10, 110, num = 11)]
max_depth.append(None)
# Minimum number of samples required to split a node
min_samples_split = [2, 5, 10]
# Minimum number of samples required at each leaf node
min_samples_leaf = [1, 2, 4]
# Method of selecting samples for training each tree
bootstrap = [True, False]
# Create the random grid
random_grid = {'n_estimators': n_estimators,
               'max_features': max_features,
               'max_depth': max_depth,
               'min_samples_split': min_samples_split,
               'min_samples_leaf': min_samples_leaf,
               'bootstrap': bootstrap}
pprint(random_grid)

###############################################################################

# Use the random grid to search for best hyperparameters
# First create the base model to tune
classifier = RandomForestClassifier()
# Random search of parameters, using 3 fold cross validation,
# search across 100 different combinations, and use all available cores
rf_random = RandomizedSearchCV(estimator = classifier, param_distributions = random_grid, n_iter = 100, cv = 3, verbose=2, random_
# Fit the random search model
rf_random.fit(X_train, y_train)

y_pred = rf_random.predict(X_test)

from sklearn.metrics import classification_report, confusion_matrix, accuracy_score

print("Confusion Matrix:")
print(confusion_matrix(y_test, y_pred))

print("-------------------------------------------------------")
print("-------------------------------------------------------")


print("Performance Evaluation")
print(classification_report(y_test, y_pred))
```

```
print("-------------------------------------------------------")
print("-------------------------------------------------------")

print("Accuracy:")
print(accuracy_score(y_test, y_pred))

import matplotlib.pyplot as plt
from sklearn.metrics import plot_confusion_matrix
plot_confusion_matrix(rf_random, X_test, y_test)
plt.show()
```



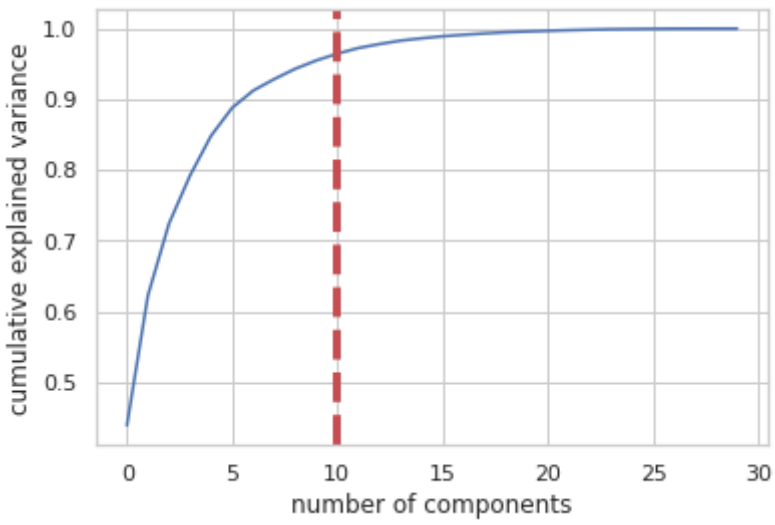

```
None
Parameters currently in use:

{'bootstrap': True,
 'ccp_alpha': 0.0,
 'class_weight': None,
 'criterion': 'gini',
 'max_depth': None,
 'max_features': 'auto',
 'max_leaf_nodes': None,
 'max_samples': None,
 'min_impurity_decrease': 0.0,
 'min_impurity_split': None,
 'min_samples_leaf': 1,
 'min_samples_split': 2,
 'min_weight_fraction_leaf': 0.0,
 'n_estimators': 100,
 'n_jobs': None,
 'oob_score': False,
 'random_state': None,
 'verbose': 0,
 'warm_start': False}
{'bootstrap': [True, False],
 'max_depth': [10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, None],
 'max_features': ['auto', 'sqrt'],
 'min_samples_leaf': [1, 2, 4],
 'min_samples_split': [2, 5, 10],
 'n_estimators': [200, 400, 600, 800, 1000, 1200, 1400, 1600, 1800, 2000]}
Fitting 3 folds for each of 100 candidates, totalling 300 fits
[Parallel(n_jobs=-1)]: Using backend LokyBackend with 2 concurrent workers.
[Parallel(n_jobs=-1)]: Done  37 tasks      | elapsed:   55.6s
[Parallel(n_jobs=-1)]: Done 158 tasks      | elapsed:  3.7min
[Parallel(n_jobs=-1)]: Done 300 out of 300 | elapsed:  7.1min finished
Confusion Matrix:
[[109   3]
 [  4  55]]
--------------------------------------------------
--------------------------------------------------
Performance Evaluation
              precision    recall  f1-score   support

           B       0.96      0.97      0.97       112
           M       0.95      0.93      0.94        59

    accuracy                           0.96       171
   macro avg       0.96      0.95      0.95       171
weighted avg       0.96      0.96      0.96       171

--------------------------------------------------
--------------------------------------------------
Accuracy:
0.9590643274853801
```



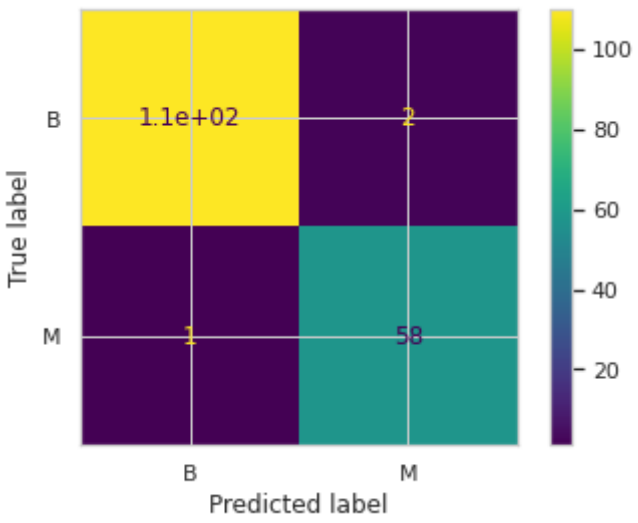
In [ ]:

```
# BREAST CANCER DATASET
# Multi Layer Perceptron(Without Tuning)[70-30 split]


import pandas as pd
import numpy as np

# Dataset Preparation
df = pd.read_csv("wdbc.data",header=None)

col_name = ['1','Class','3','4','5','6','7','8','9','10','11','12','13','14','15','16','17','18','19'
           ,'20','21','22','23','24','25','26','27','28','29','30','31','32']


df.columns = col_name


X = df.drop(['1','Class'], axis=1)
y = df['Class']

from sklearn.model_selection import train_test_split

X_train, X_test, y_train, y_test = train_test_split(X,y,train_size=0.7,test_size=0.30,random_state=10)


# Feature Scaling
from sklearn.preprocessing import StandardScaler

sc = StandardScaler()
X_train = sc.fit_transform(X_train)
X_test = sc.transform(X_test)


# Finding the important parameters that contribute to most of the variance in the data.

import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.decomposition import PCA

pca_test = PCA(n_components=30)
pca_test.fit(X_train)
sns.set(style='whitegrid')
plt.plot(np.cumsum(pca_test.explained_variance_ratio_))
plt.xlabel('number of components')
plt.ylabel('cumulative explained variance')
plt.axvline(linewidth=4, color='r', linestyle = '--', x=10, ymin=0, ymax=1)
display(plt.show())

# So we can see that we have 10 important parameters

pca = PCA(n_components=10)
pca.fit(X_train)
X_train = pca.transform(X_train)
X_test = pca.transform(X_test)


# Classification using MLP
from sklearn.neural_network import MLPClassifier

classifier = MLPClassifier()
classifier.fit(X_train,y_train)

y_pred = classifier.predict(X_test)

from sklearn.metrics import classification_report, confusion_matrix, accuracy_score

print("Confusion Matrix:")
print(confusion_matrix(y_test, y_pred))

print("-------------------------------------------------------")
print("-------------------------------------------------------")


print("Performance Evaluation")
print(classification_report(y_test, y_pred))
```

```
print("-----------------------------------------------------")
print("-----------------------------------------------------")

print("Accuracy:")
print(accuracy_score(y_test, y_pred))

import matplotlib.pyplot as plt
from sklearn.metrics import plot_confusion_matrix
plot_confusion_matrix(classifier, X_test, y_test)
plt.show()
```




```
None
/usr/local/lib/python3.7/dist-packages/sklearn/neural_network/_multilayer_perceptron.py:571: ConvergenceWarning: Stochastic Optimizer: Maximum iterations (200) reached and the optimization hasn't converged yet.
  % self.max_iter, ConvergenceWarning)
Confusion Matrix:
[[110   2]
 [  1  58]]
-----------------------------------------------------
-----------------------------------------------------
Performance Evaluation
              precision    recall  f1-score   support

           B       0.99      0.98      0.99       112
           M       0.97      0.98      0.97        59

    accuracy                           0.98       171
   macro avg       0.98      0.98      0.98       171
weighted avg       0.98      0.98      0.98       171

-----------------------------------------------------
-----------------------------------------------------
Accuracy:
0.9824561403508771
```



In [ ]:

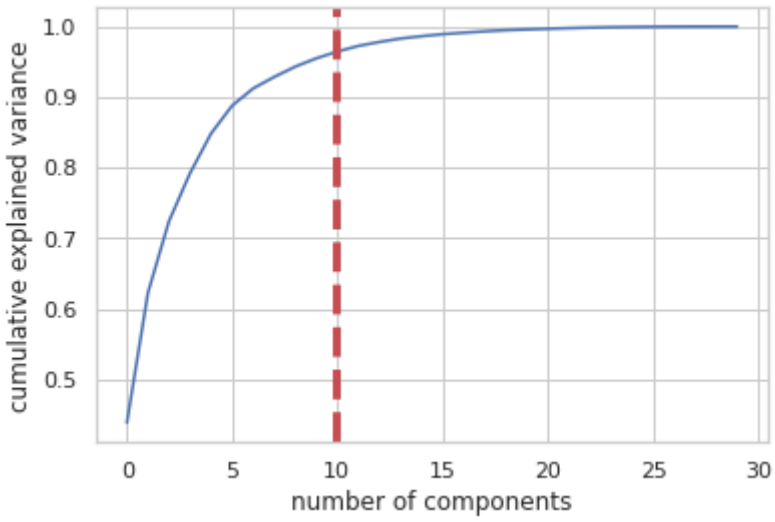
```
# BREAST CANCER DATASET
# Multi Layer Perceptron(With Tuning)[70-30 split]


import pandas as pd
import numpy as np

# Dataset Preparation
df = pd.read_csv("wdbc.data",header=None)

col_name = ['1','Class','3','4','5','6','7','8','9','10','11','12','13','14','15','16','17','18','19'
           ,'20','21','22','23','24','25','26','27','28','29','30','31','32']


df.columns = col_name


X = df.drop(['1','Class'], axis=1)
y = df['Class']

from sklearn.model_selection import train_test_split

X_train, X_test, y_train, y_test = train_test_split(X,y,train_size=0.7,test_size=0.3,random_state=10)
```

```
# Feature Scaling
from sklearn.preprocessing import StandardScaler

sc = StandardScaler()
X_train = sc.fit_transform(X_train)
X_test = sc.transform(X_test)


# Finding the important parameters that contribute to most of the variance in the data.

import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.decomposition import PCA

pca_test = PCA(n_components=30)
pca_test.fit(X_train)
sns.set(style='whitegrid')
plt.plot(np.cumsum(pca_test.explained_variance_ratio_))
plt.xlabel('number of components')
plt.ylabel('cumulative explained variance')
plt.axvline(linewidth=4, color='r', linestyle = '--', x=10, ymin=0, ymax=1)
display(plt.show())

# So we can see that we have 10 important parameters

pca = PCA(n_components=10)
pca.fit(X_train)
X_train = pca.transform(X_train)
X_test = pca.transform(X_test)
```

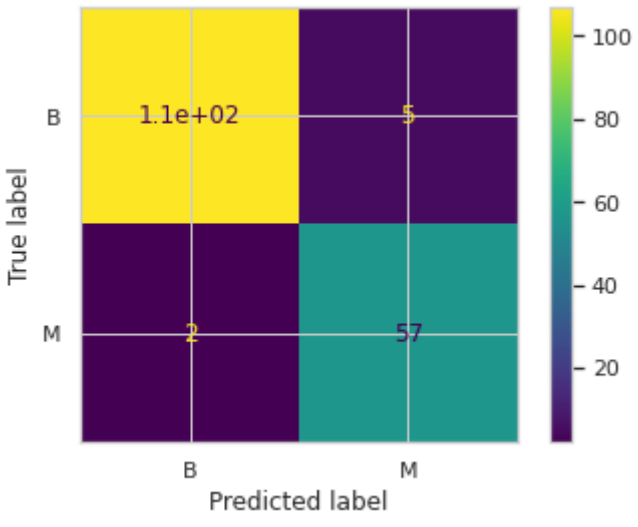
```
# Classification
from sklearn.neural_network import MLPClassifier
classifier = MLPClassifier(max_iter=100)

###############################################################################
# Showing all the parameters

from pprint import pprint
# Look at parameters used by our current forest
print('Parameters currently in use:\n')
pprint(classifier.get_params())

###############################################################################
# Creating a set of important sample features

parameter_space = {
    'hidden_layer_sizes': [(50,50,50), (50,100,50), (100,)],
    'activation': ['tanh', 'relu'],
    'solver': ['sgd', 'adam'],
    'alpha': [0.0001, 0.05],
    'learning_rate': ['constant','adaptive'],
}
pprint(parameter_space)

###############################################################################

from sklearn.model_selection import GridSearchCV

# Use the random grid to search for best hyperparameters
# First create the base model to tune
classifier = MLPClassifier(max_iter=100)
```

```
# Random search of parameters, using 3 fold cross validation,
# search across 100 different combinations, and use all available cores

rf_random = GridSearchCV(classifier, parameter_space, n_jobs=-1, cv=3)
rf_random.fit(X_train, y_train)

y_pred = rf_random.predict(X_test)

from sklearn.metrics import classification_report, confusion_matrix, accuracy_score

print("Confusion Matrix:")
print(confusion_matrix(y_test, y_pred))

print("--------------------------------------------------")
print("--------------------------------------------------")


print("Performance Evaluation")
print(classification_report(y_test, y_pred))


print("--------------------------------------------------")
print("--------------------------------------------------")

print("Accuracy:")
print(accuracy_score(y_test, y_pred))


import matplotlib.pyplot as plt
from sklearn.metrics import plot_confusion_matrix
```

```
plot_confusion_matrix(rf_random, X_test, y_test)
plt.show()
```



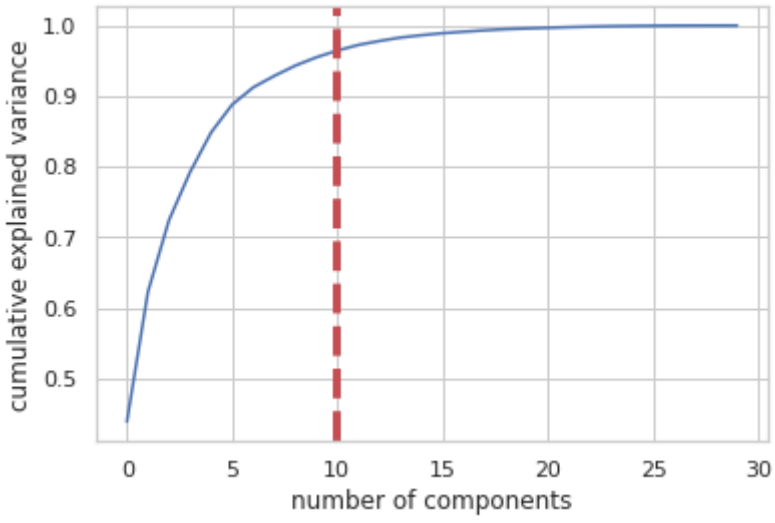

```
None
Parameters currently in use:

{'activation': 'relu',
 'alpha': 0.0001,
 'batch_size': 'auto',
 'beta_1': 0.9,
 'beta_2': 0.999,
 'early_stopping': False,
 'epsilon': 1e-08,
 'hidden_layer_sizes': (100,),
 'learning_rate': 'constant',
 'learning_rate_init': 0.001,
 'max_fun': 15000,
 'max_iter': 100,
 'momentum': 0.9,
 'n_iter_no_change': 10,
 'nesterovs_momentum': True,
 'power_t': 0.5,
 'random_state': None,
 'shuffle': True,
 'solver': 'adam',
 'tol': 0.0001,
 'validation_fraction': 0.1,
 'verbose': False,
 'warm_start': False}
{'activation': ['tanh', 'relu'],
 'alpha': [0.0001, 0.05],
 'hidden_layer_sizes': [(50, 50, 50), (50, 100, 50), (100,)],
 'learning_rate': ['constant', 'adaptive'],
 'solver': ['sgd', 'adam']}
/usr/local/lib/python3.7/dist-packages/sklearn/neural_network/_multilayer_perceptron.py:571: ConvergenceWarning: Stochastic Optimi
zer: Maximum iterations (100) reached and the optimization hasn't converged yet.
  % self.max_iter, ConvergenceWarning)
Confusion Matrix:
[[107   5]
 [  2  57]]
--------------------------------------------------
--------------------------------------------------
Performance Evaluation
              precision    recall  f1-score   support

           B       0.98      0.96      0.97       112
           M       0.92      0.97      0.94        59

    accuracy                           0.96       171
   macro avg       0.95      0.96      0.96       171
weighted avg       0.96      0.96      0.96       171

--------------------------------------------------
--------------------------------------------------
Accuracy:
0.9590643274853801
```



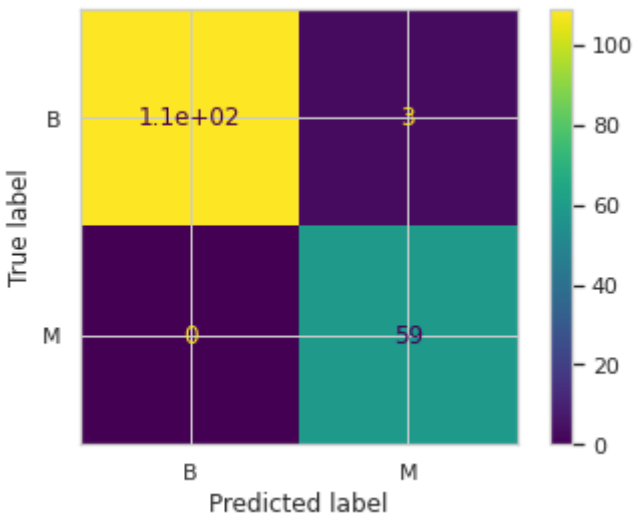
In [ ]:

```
# BREAST CANCER DATASET
# SVM(Without Tuning)[70-30 split]


import pandas as pd
```

```
import numpy as np

# Dataset Preparation
df = pd.read_csv("wdbc.data",header=None)

col_name = ['1','Class','3','4','5','6','7','8','9','10','11','12','13','14','15','16','17','18','19'
           ,'20','21','22','23','24','25','26','27','28','29','30','31','32']


df.columns = col_name


X = df.drop(['1','Class'], axis=1)
y = df['Class']

from sklearn.model_selection import train_test_split

X_train, X_test, y_train, y_test = train_test_split(X,y,train_size=0.7,test_size=0.3,random_state=10)


# Feature Scaling
from sklearn.preprocessing import StandardScaler

sc = StandardScaler()
X_train = sc.fit_transform(X_train)
X_test = sc.transform(X_test)


# Finding the important parameters that contribute to most of the variance in the data.

import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.decomposition import PCA

pca_test = PCA(n_components=30)
pca_test.fit(X_train)
sns.set(style='whitegrid')
plt.plot(np.cumsum(pca_test.explained_variance_ratio_))
plt.xlabel('number of components')
plt.ylabel('cumulative explained variance')
plt.axvline(linewidth=4, color='r', linestyle = '--', x=10, ymin=0, ymax=1)
display(plt.show())

# So we can see that we have 10 important parameters

pca = PCA(n_components=10)
pca.fit(X_train)
X_train = pca.transform(X_train)
X_test = pca.transform(X_test)


# Classification
from sklearn.svm import SVC

classifier = SVC()
classifier.fit(X_train,y_train)

y_pred = classifier.predict(X_test)

from sklearn.metrics import classification_report, confusion_matrix, accuracy_score

print("Confusion Matrix:")
print(confusion_matrix(y_test, y_pred))

print("-------------------------------------------------------")
print("-------------------------------------------------------")


print("Performance Evaluation")
print(classification_report(y_test, y_pred))


print("-------------------------------------------------------")
print("-------------------------------------------------------")

print("Accuracy:")
print(accuracy_score(y_test, y_pred))

import matplotlib.pyplot as plt
from sklearn.metrics import plot_confusion_matrix
plot_confusion_matrix(classifier, X_test, y_test)
plt.show()
```



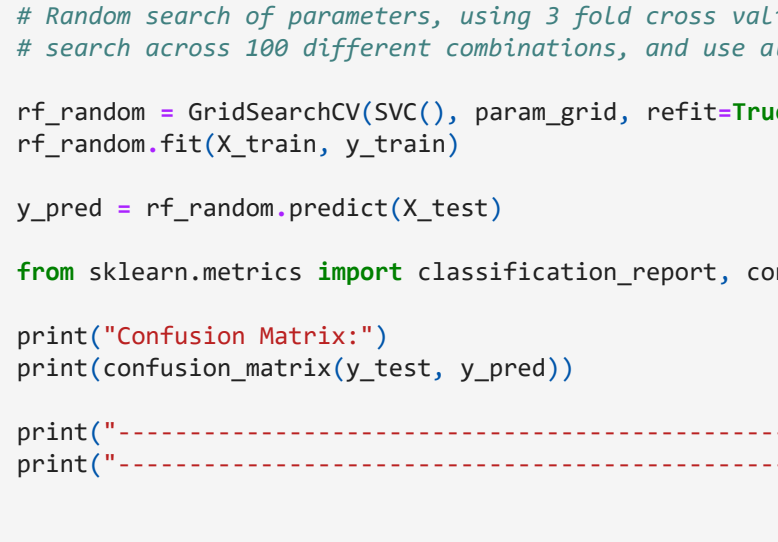

```
None
Confusion Matrix:
[[109   3]
 [  0  59]]
--------------------------------------------------
--------------------------------------------------
Performance Evaluation
              precision    recall  f1-score   support

           B       1.00      0.97      0.99       112
           M       0.95      1.00      0.98        59

    accuracy                           0.98       171
   macro avg       0.98      0.99      0.98       171
weighted avg       0.98      0.98      0.98       171

--------------------------------------------------
--------------------------------------------------
Accuracy:
0.9824561403508771
```



In [ ]:

```python
# BREAST CANCER DATASET
# SVM(With Tuning)[70-30 split]


import pandas as pd
import numpy as np

# Dataset Preparation
df = pd.read_csv("wdbc.data",header=None)

col_name = ['1','Class','3','4','5','6','7','8','9','10','11','12','13','14','15','16','17','18','19'
           ,'20','21','22','23','24','25','26','27','28','29','30','31','32']


df.columns = col_name


X = df.drop(['1','Class'], axis=1)
y = df['Class']

from sklearn.model_selection import train_test_split

X_train, X_test, y_train, y_test = train_test_split(X,y,train_size=0.7,test_size=0.3,random_state=10)


# Feature Scaling
from sklearn.preprocessing import StandardScaler

sc = StandardScaler()
X_train = sc.fit_transform(X_train)
X_test = sc.transform(X_test)


# Finding the important parameters that contribute to most of the variance in the data.

import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.decomposition import PCA

pca_test = PCA(n_components=30)
```

```
pca_test.fit(X_train)
sns.set(style='whitegrid')
plt.plot(np.cumsum(pca_test.explained_variance_ratio_))
plt.xlabel('number of components')
plt.ylabel('cumulative explained variance')
plt.axvline(linewidth=4, color='r', linestyle = '--', x=10, ymin=0, ymax=1)
display(plt.show())

# So we can see that we have 10 important parameters

pca = PCA(n_components=10)
pca.fit(X_train)
X_train = pca.transform(X_train)
X_test = pca.transform(X_test)


# Classification
from sklearn.svm import SVC

classifier = SVC()

##############################################################################
# Showing all the parameters

from pprint import pprint
# Look at parameters used by our current forest
print('Parameters currently in use:\n')
pprint(classifier.get_params())

##############################################################################
# Creating a set of important sample features

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

pprint(param_grid)

##############################################################################

from sklearn.model_selection import GridSearchCV

# Use the random grid to search for best hyperparameters
# First create the base model to tune
classifier = SVC()
# Random search of parameters, using 3 fold cross validation,
# search across 100 different combinations, and use all available cores

rf_random = GridSearchCV(SVC(), param_grid, refit=True, verbose=2)
rf_random.fit(X_train, y_train)

y_pred = rf_random.predict(X_test)

from sklearn.metrics import classification_report, confusion_matrix, accuracy_score

print("Confusion Matrix:")
print(confusion_matrix(y_test, y_pred))

print("----------------------------------------------------")
print("----------------------------------------------------")


print("Performance Evaluation")
print(classification_report(y_test, y_pred))


print("----------------------------------------------------")
print("----------------------------------------------------")

print("Accuracy:")
print(accuracy_score(y_test, y_pred))


import matplotlib.pyplot as plt
from sklearn.metrics import plot_confusion_matrix
plot_confusion_matrix(rf_random, X_test, y_test)
plt.show()
```



None

```
Parameters currently in use:

{'C': 1.0,
 'break_ties': False,
 'cache_size': 200,
 'class_weight': None,
 'coef0': 0.0,
 'decision_function_shape': 'ovr',
 'degree': 3,
 'gamma': 'scale',
 'kernel': 'rbf',
 'max_iter': -1,
 'probability': False,
 'random_state': None,
 'shrinking': True,
 'tol': 0.001,
 'verbose': False}
{'C': [0.1, 1, 10, 100],
 'gamma': [1, 0.1, 0.01, 0.001],
 'kernel': ['rbf', 'poly', 'sigmoid']}
Fitting 5 folds for each of 48 candidates, totalling 240 fits
[CV] C=0.1, gamma=1, kernel=rbf .....................................
[CV] ...................... C=0.1, gamma=1, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=1, kernel=rbf .....................................
[CV] ...................... C=0.1, gamma=1, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=1, kernel=rbf .....................................
[CV] ...................... C=0.1, gamma=1, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=1, kernel=rbf .....................................
[CV] ...................... C=0.1, gamma=1, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=1, kernel=rbf .....................................
[CV] ...................... C=0.1, gamma=1, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=1, kernel=poly ....................................
[CV] ..................... C=0.1, gamma=1, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=1, kernel=poly ....................................
[CV] ..................... C=0.1, gamma=1, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=1, kernel=poly ....................................
[CV] ..................... C=0.1, gamma=1, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=1, kernel=poly ....................................
[CV] ..................... C=0.1, gamma=1, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=1, kernel=poly ....................................
[CV] ..................... C=0.1, gamma=1, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=1, kernel=sigmoid .................................
[CV] .................. C=0.1, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=1, kernel=sigmoid .................................
[CV] .................. C=0.1, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=1, kernel=sigmoid .................................
[CV] .................. C=0.1, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=1, kernel=sigmoid .................................
[CV] .................. C=0.1, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=1, kernel=sigmoid .................................
[CV] .................. C=0.1, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=rbf ...................................
[CV] .................... C=0.1, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=rbf ...................................
[CV] .................... C=0.1, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=rbf ...................................
[CV] .................... C=0.1, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=rbf ...................................
[CV] .................... C=0.1, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=rbf ...................................
[CV] .................... C=0.1, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=poly ..................................
[CV] ................... C=0.1, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=poly ..................................
[CV] ................... C=0.1, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=poly ..................................
[CV] ................... C=0.1, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=poly ..................................
[CV] ................... C=0.1, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=poly ..................................
[CV] ................... C=0.1, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=sigmoid ...............................
[CV] ................ C=0.1, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=sigmoid ...............................
[Parallel(n_jobs=1)]: Using backend SequentialBackend with 1 concurrent workers.
[Parallel(n_jobs=1)]: Done   1 out of   1 | elapsed:    0.0s remaining:    0.0s
[CV] ................ C=0.1, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=sigmoid ...............................
[CV] ................ C=0.1, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=sigmoid ...............................
[CV] ................ C=0.1, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.1, kernel=sigmoid ...............................
[CV] ................ C=0.1, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=rbf ..................................
[CV] ................... C=0.1, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=rbf ..................................
[CV] ................... C=0.1, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=rbf ..................................
[CV] ................... C=0.1, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=rbf ..................................
[CV] ................... C=0.1, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=rbf ..................................
[CV] ................... C=0.1, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=poly .................................
[CV] .................. C=0.1, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=poly .................................
[CV] .................. C=0.1, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=poly .................................
[CV] .................. C=0.1, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=poly .................................
```

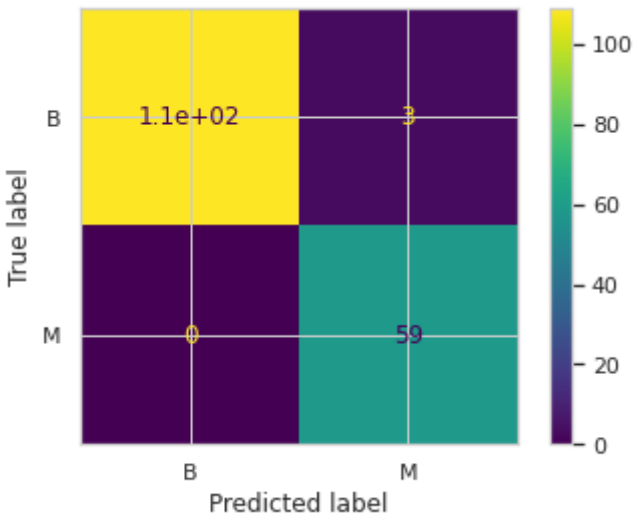
```
[CV] .................. C=0.1, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=poly ................................
[CV] .................. C=0.1, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=sigmoid .............................
[CV] ............... C=0.1, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=sigmoid .............................
[CV] ............... C=0.1, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=sigmoid .............................
[CV] ............... C=0.1, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=sigmoid .............................
[CV] ............... C=0.1, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.01, kernel=sigmoid .............................
[CV] ............... C=0.1, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=rbf ................................
[CV] .................. C=0.1, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=rbf ................................
[CV] .................. C=0.1, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=rbf ................................
[CV] .................. C=0.1, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=rbf ................................
[CV] .................. C=0.1, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=rbf ................................
[CV] .................. C=0.1, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=poly ...............................
[CV] ................. C=0.1, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=poly ...............................
[CV] ................. C=0.1, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=poly ...............................
[CV] ................. C=0.1, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=poly ...............................
[CV] ................. C=0.1, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=poly ...............................
[CV] ................. C=0.1, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=sigmoid ............................
[CV] .............. C=0.1, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=sigmoid ............................
[CV] .............. C=0.1, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=sigmoid ............................
[CV] .............. C=0.1, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=sigmoid ............................
[CV] .............. C=0.1, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=0.1, gamma=0.001, kernel=sigmoid ............................
[CV] .............. C=0.1, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=1, kernel=rbf ......................................
[CV] ........................ C=1, gamma=1, kernel=rbf, total=   0.0s
[CV] C=1, gamma=1, kernel=rbf ......................................
[CV] ........................ C=1, gamma=1, kernel=rbf, total=   0.0s
[CV] C=1, gamma=1, kernel=rbf ......................................
[CV] ........................ C=1, gamma=1, kernel=rbf, total=   0.0s
[CV] C=1, gamma=1, kernel=rbf ......................................
[CV] ........................ C=1, gamma=1, kernel=rbf, total=   0.0s
[CV] C=1, gamma=1, kernel=rbf ......................................
[CV] ........................ C=1, gamma=1, kernel=rbf, total=   0.0s
[CV] C=1, gamma=1, kernel=poly .....................................
[CV] ....................... C=1, gamma=1, kernel=poly, total=   0.0s
[CV] C=1, gamma=1, kernel=poly .....................................
[CV] ....................... C=1, gamma=1, kernel=poly, total=   0.0s
[CV] C=1, gamma=1, kernel=poly .....................................
[CV] ....................... C=1, gamma=1, kernel=poly, total=   0.0s
[CV] C=1, gamma=1, kernel=poly .....................................
[CV] ....................... C=1, gamma=1, kernel=poly, total=   0.0s
[CV] C=1, gamma=1, kernel=poly .....................................
[CV] ....................... C=1, gamma=1, kernel=poly, total=   0.0s
[CV] C=1, gamma=1, kernel=sigmoid ..................................
[CV] .................... C=1, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=1, kernel=sigmoid ..................................
[CV] .................... C=1, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=1, kernel=sigmoid ..................................
[CV] .................... C=1, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=1, kernel=sigmoid ..................................
[CV] .................... C=1, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=1, kernel=sigmoid ..................................
[CV] .................... C=1, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.1, kernel=rbf ....................................
[CV] ...................... C=1, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.1, kernel=rbf ....................................
[CV] ...................... C=1, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.1, kernel=rbf ....................................
[CV] ...................... C=1, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.1, kernel=rbf ....................................
[CV] ...................... C=1, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.1, kernel=rbf ....................................
[CV] ...................... C=1, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.1, kernel=poly ...................................
[CV] ..................... C=1, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.1, kernel=poly ...................................
[CV] ..................... C=1, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.1, kernel=poly ...................................
[CV] ..................... C=1, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.1, kernel=poly ...................................
[CV] ..................... C=1, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.1, kernel=poly ...................................
[CV] ..................... C=1, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.1, kernel=sigmoid ................................
[CV] .................. C=1, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.1, kernel=sigmoid ................................
[CV] .................. C=1, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.1, kernel=sigmoid ................................
[CV] .................. C=1, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.1, kernel=sigmoid ................................
```

```
[CV] ................... C=1, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.1, kernel=sigmoid ..................................
[CV] ................... C=1, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.01, kernel=rbf .....................................
[CV] ...................... C=1, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.01, kernel=rbf .....................................
[CV] ...................... C=1, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.01, kernel=rbf .....................................
[CV] ...................... C=1, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.01, kernel=rbf .....................................
[CV] ...................... C=1, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.01, kernel=rbf .....................................
[CV] ...................... C=1, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.01, kernel=poly ....................................
[CV] ..................... C=1, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.01, kernel=poly ....................................
[CV] ..................... C=1, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.01, kernel=poly ....................................
[CV] ..................... C=1, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.01, kernel=poly ....................................
[CV] ..................... C=1, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.01, kernel=poly ....................................
[CV] ..................... C=1, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.01, kernel=sigmoid .................................
[CV] .................. C=1, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.01, kernel=sigmoid .................................
[CV] .................. C=1, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.01, kernel=sigmoid .................................
[CV] .................. C=1, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.01, kernel=sigmoid .................................
[CV] .................. C=1, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.01, kernel=sigmoid .................................
[CV] .................. C=1, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.001, kernel=rbf ....................................
[CV] ..................... C=1, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.001, kernel=rbf ....................................
[CV] ..................... C=1, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.001, kernel=rbf ....................................
[CV] ..................... C=1, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.001, kernel=rbf ....................................
[CV] ..................... C=1, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.001, kernel=rbf ....................................
[CV] ..................... C=1, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=1, gamma=0.001, kernel=poly ...................................
[CV] .................... C=1, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.001, kernel=poly ...................................
[CV] .................... C=1, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.001, kernel=poly ...................................
[CV] .................... C=1, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.001, kernel=poly ...................................
[CV] .................... C=1, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.001, kernel=poly ...................................
[CV] .................... C=1, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=1, gamma=0.001, kernel=sigmoid ................................
[CV] ................. C=1, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.001, kernel=sigmoid ................................
[CV] ................. C=1, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.001, kernel=sigmoid ................................
[CV] ................. C=1, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.001, kernel=sigmoid ................................
[CV] ................. C=1, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=1, gamma=0.001, kernel=sigmoid ................................
[CV] ................. C=1, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=1, kernel=rbf .......................................
[CV] ........................ C=10, gamma=1, kernel=rbf, total=   0.0s
[CV] C=10, gamma=1, kernel=rbf .......................................
[CV] ........................ C=10, gamma=1, kernel=rbf, total=   0.0s
[CV] C=10, gamma=1, kernel=rbf .......................................
[CV] ........................ C=10, gamma=1, kernel=rbf, total=   0.0s
[CV] C=10, gamma=1, kernel=rbf .......................................
[CV] ........................ C=10, gamma=1, kernel=rbf, total=   0.0s
[CV] C=10, gamma=1, kernel=rbf .......................................
[CV] ........................ C=10, gamma=1, kernel=rbf, total=   0.0s
[CV] C=10, gamma=1, kernel=poly ......................................
[CV] ....................... C=10, gamma=1, kernel=poly, total=   0.0s
[CV] C=10, gamma=1, kernel=poly ......................................
[CV] ....................... C=10, gamma=1, kernel=poly, total=   0.0s
[CV] C=10, gamma=1, kernel=poly ......................................
[CV] ....................... C=10, gamma=1, kernel=poly, total=   0.0s
[CV] C=10, gamma=1, kernel=poly ......................................
[CV] ....................... C=10, gamma=1, kernel=poly, total=   0.0s
[CV] C=10, gamma=1, kernel=poly ......................................
[CV] ....................... C=10, gamma=1, kernel=poly, total=   0.0s
[CV] C=10, gamma=1, kernel=sigmoid ...................................
[CV] .................... C=10, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=1, kernel=sigmoid ...................................
[CV] .................... C=10, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=1, kernel=sigmoid ...................................
[CV] .................... C=10, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=1, kernel=sigmoid ...................................
[CV] .................... C=10, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=1, kernel=sigmoid ...................................
[CV] .................... C=10, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.1, kernel=rbf .....................................
[CV] ...................... C=10, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.1, kernel=rbf .....................................
[CV] ...................... C=10, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.1, kernel=rbf .....................................
[CV] ...................... C=10, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.1, kernel=rbf .....................................
```

```
[CV] ...................... C=10, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.1, kernel=rbf .....................................
[CV] ...................... C=10, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.1, kernel=poly ....................................
[CV] ..................... C=10, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.1, kernel=poly ....................................
[CV] ..................... C=10, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.1, kernel=poly ....................................
[CV] ..................... C=10, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.1, kernel=poly ....................................
[CV] ..................... C=10, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.1, kernel=poly ....................................
[CV] ..................... C=10, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.1, kernel=sigmoid .................................
[CV] .................. C=10, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.1, kernel=sigmoid .................................
[CV] .................. C=10, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.1, kernel=sigmoid .................................
[CV] .................. C=10, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.1, kernel=sigmoid .................................
[CV] .................. C=10, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.1, kernel=sigmoid .................................
[CV] .................. C=10, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.01, kernel=rbf ....................................
[CV] ..................... C=10, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.01, kernel=rbf ....................................
[CV] ..................... C=10, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.01, kernel=rbf ....................................
[CV] ..................... C=10, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.01, kernel=rbf ....................................
[CV] ..................... C=10, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.01, kernel=rbf ....................................
[CV] ..................... C=10, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.01, kernel=poly ...................................
[CV] .................... C=10, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.01, kernel=poly ...................................
[CV] .................... C=10, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.01, kernel=poly ...................................
[CV] .................... C=10, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.01, kernel=poly ...................................
[CV] .................... C=10, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.01, kernel=poly ...................................
[CV] .................... C=10, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.01, kernel=sigmoid ................................
[CV] ................. C=10, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.01, kernel=sigmoid ................................
[CV] ................. C=10, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.01, kernel=sigmoid ................................
[CV] ................. C=10, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.01, kernel=sigmoid ................................
[CV] ................. C=10, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.01, kernel=sigmoid ................................
[CV] ................. C=10, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.001, kernel=rbf ...................................
[CV] .................... C=10, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.001, kernel=rbf ...................................
[CV] .................... C=10, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.001, kernel=rbf ...................................
[CV] .................... C=10, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.001, kernel=rbf ...................................
[CV] .................... C=10, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.001, kernel=rbf ...................................
[CV] .................... C=10, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=10, gamma=0.001, kernel=poly ..................................
[CV] ................... C=10, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.001, kernel=poly ..................................
[CV] ................... C=10, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.001, kernel=poly ..................................
[CV] ................... C=10, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.001, kernel=poly ..................................
[CV] ................... C=10, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.001, kernel=poly ..................................
[CV] ................... C=10, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=10, gamma=0.001, kernel=sigmoid ...............................
[CV] ................ C=10, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.001, kernel=sigmoid ...............................
[CV] ................ C=10, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.001, kernel=sigmoid ...............................
[CV] ................ C=10, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.001, kernel=sigmoid ...............................
[CV] ................ C=10, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=10, gamma=0.001, kernel=sigmoid ...............................
[CV] ................ C=10, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=1, kernel=rbf ......................................
[CV] ....................... C=100, gamma=1, kernel=rbf, total=   0.0s
[CV] C=100, gamma=1, kernel=rbf ......................................
[CV] ....................... C=100, gamma=1, kernel=rbf, total=   0.0s
[CV] C=100, gamma=1, kernel=rbf ......................................
[CV] ....................... C=100, gamma=1, kernel=rbf, total=   0.0s
[CV] C=100, gamma=1, kernel=rbf ......................................
[CV] ....................... C=100, gamma=1, kernel=rbf, total=   0.0s
[CV] C=100, gamma=1, kernel=rbf ......................................
[CV] ....................... C=100, gamma=1, kernel=rbf, total=   0.0s
[CV] C=100, gamma=1, kernel=poly .....................................
[CV] ...................... C=100, gamma=1, kernel=poly, total=   0.0s
[CV] C=100, gamma=1, kernel=poly .....................................
[CV] ...................... C=100, gamma=1, kernel=poly, total=   0.0s
[CV] C=100, gamma=1, kernel=poly .....................................
[CV] ...................... C=100, gamma=1, kernel=poly, total=   0.0s
[CV] C=100, gamma=1, kernel=poly .....................................
```

```
[CV] ...................... C=100, gamma=1, kernel=poly, total=   0.0s
[CV] C=100, gamma=1, kernel=poly .....................................
[CV] ...................... C=100, gamma=1, kernel=poly, total=   0.0s
[CV] C=100, gamma=1, kernel=sigmoid ..................................
[CV] ................... C=100, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=1, kernel=sigmoid ..................................
[CV] ................... C=100, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=1, kernel=sigmoid ..................................
[CV] ................... C=100, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=1, kernel=sigmoid ..................................
[CV] ................... C=100, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=1, kernel=sigmoid ..................................
[CV] ................... C=100, gamma=1, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.1, kernel=rbf ....................................
[CV] ..................... C=100, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.1, kernel=rbf ....................................
[CV] ..................... C=100, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.1, kernel=rbf ....................................
[CV] ..................... C=100, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.1, kernel=rbf ....................................
[CV] ..................... C=100, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.1, kernel=rbf ....................................
[CV] ..................... C=100, gamma=0.1, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.1, kernel=poly ...................................
[CV] .................... C=100, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.1, kernel=poly ...................................
[CV] .................... C=100, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.1, kernel=poly ...................................
[CV] .................... C=100, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.1, kernel=poly ...................................
[CV] .................... C=100, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.1, kernel=poly ...................................
[CV] .................... C=100, gamma=0.1, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.1, kernel=sigmoid ................................
[CV] ................. C=100, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.1, kernel=sigmoid ................................
[CV] ................. C=100, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.1, kernel=sigmoid ................................
[CV] ................. C=100, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.1, kernel=sigmoid ................................
[CV] ................. C=100, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.1, kernel=sigmoid ................................
[CV] ................. C=100, gamma=0.1, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.01, kernel=rbf ...................................
[CV] .................... C=100, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.01, kernel=rbf ...................................
[CV] .................... C=100, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.01, kernel=rbf ...................................
[CV] .................... C=100, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.01, kernel=rbf ...................................
[CV] .................... C=100, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.01, kernel=rbf ...................................
[CV] .................... C=100, gamma=0.01, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.01, kernel=poly ..................................
[CV] ................... C=100, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.01, kernel=poly ..................................
[CV] ................... C=100, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.01, kernel=poly ..................................
[CV] ................... C=100, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.01, kernel=poly ..................................
[CV] ................... C=100, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.01, kernel=poly ..................................
[CV] ................... C=100, gamma=0.01, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.01, kernel=sigmoid ...............................
[CV] ................ C=100, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.01, kernel=sigmoid ...............................
[CV] ................ C=100, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.01, kernel=sigmoid ...............................
[CV] ................ C=100, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.01, kernel=sigmoid ...............................
[CV] ................ C=100, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.01, kernel=sigmoid ...............................
[CV] ................ C=100, gamma=0.01, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.001, kernel=rbf ..................................
[CV] ................... C=100, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.001, kernel=rbf ..................................
[CV] ................... C=100, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.001, kernel=rbf ..................................
[CV] ................... C=100, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.001, kernel=rbf ..................................
[CV] ................... C=100, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.001, kernel=rbf ..................................
[CV] ................... C=100, gamma=0.001, kernel=rbf, total=   0.0s
[CV] C=100, gamma=0.001, kernel=poly .................................
[CV] .................. C=100, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.001, kernel=poly .................................
[CV] .................. C=100, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.001, kernel=poly .................................
[CV] .................. C=100, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.001, kernel=poly .................................
[CV] .................. C=100, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.001, kernel=poly .................................
[CV] .................. C=100, gamma=0.001, kernel=poly, total=   0.0s
[CV] C=100, gamma=0.001, kernel=sigmoid ..............................
[CV] ............... C=100, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.001, kernel=sigmoid ..............................
[CV] ............... C=100, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.001, kernel=sigmoid ..............................
[CV] ............... C=100, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.001, kernel=sigmoid ..............................
```

```
[CV] ............... C=100, gamma=0.001, kernel=sigmoid, total=   0.0s
[CV] C=100, gamma=0.001, kernel=sigmoid .............................
[CV] ............... C=100, gamma=0.001, kernel=sigmoid, total=   0.0s
Confusion Matrix:
[[109   3]
 [  0  59]]
--------------------------------------------------
--------------------------------------------------
Performance Evaluation
              precision    recall  f1-score   support

           B       1.00      0.97      0.99       112
           M       0.95      1.00      0.98        59

    accuracy                           0.98       171
   macro avg       0.98      0.99      0.98       171
weighted avg       0.98      0.98      0.98       171

--------------------------------------------------
--------------------------------------------------
Accuracy:
0.9824561403508771
[Parallel(n_jobs=1)]: Done 240 out of 240 | elapsed:    1.4s finished
```



In [ ]: