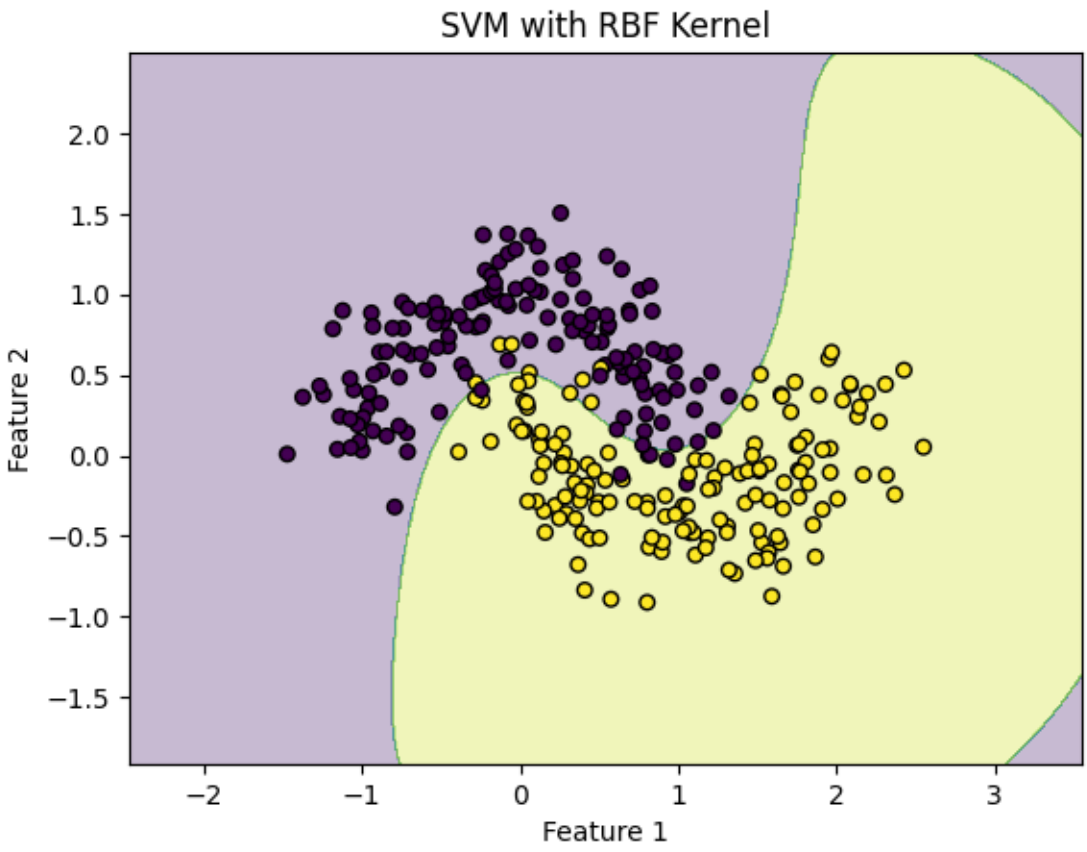
exp6-support-vector-machines

```python
# Import necessary libraries
import numpy as np
import matplotlib.pyplot as plt
from sklearn.datasets import make_moons
from sklearn.model_selection import train_test_split
from sklearn.svm import SVC
from sklearn.metrics import classification_report, confusion_matrix

# Generate a non-linearly separable dataset (moons dataset)
X, y = make_moons(n_samples=300, noise=0.2, random_state=42)

# Split the dataset into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.3,␣
 ↪random_state=42)

# Initialize the SVM classifier with an RBF kernel
svm_classifier = SVC(kernel='rbf', C=1, gamma='scale')

# Train the SVM classifier
svm_classifier.fit(X_train, y_train)

# Predict the labels for the test set
y_pred = svm_classifier.predict(X_test)

# Evaluate the classifier
print("Confusion Matrix:")
print(confusion_matrix(y_test, y_pred))
print("\nClassification Report:")
print(classification_report(y_test, y_pred))

# Plot the decision boundary
def plot_decision_boundary(clf, X, y):
    # Create a grid to plot the decision boundary
    x_min, x_max = X[:, 0].min() - 1, X[:, 0].max() + 1
    y_min, y_max = X[:, 1].min() - 1, X[:, 1].max() + 1
```

```
    xx, yy = np.meshgrid(np.arange(x_min, x_max, 0.01),
                         np.arange(y_min, y_max, 0.01))

    # Predict the classification for each grid point
    Z = clf.predict(np.c_[xx.ravel(), yy.ravel()])
    Z = Z.reshape(xx.shape)

    # Plot the decision boundary
    plt.contourf(xx, yy, Z, alpha=0.3)
    plt.scatter(X[:, 0], X[:, 1], c=y, s=30, edgecolor='k')
    plt.title("SVM with RBF Kernel")
    plt.xlabel("Feature 1")
    plt.ylabel("Feature 2")
    plt.show()

# Visualize the decision boundary
plot_decision_boundary(svm_classifier, X, y)
```

```
Confusion Matrix:
[[37  1]
 [ 2 50]]

Classification Report:
              precision    recall  f1-score   support

           0       0.95      0.97      0.96        38
           1       0.98      0.96      0.97        52

    accuracy                           0.97        90
   macro avg       0.96      0.97      0.97        90
weighted avg       0.97      0.97      0.97        90
```


SVM with RBF Kernel
Feature 2
Feature 1
2.0
1.5
1.0
0.5
0.0
−0.5
−1.0
−1.5
−2
−1
0
1
2
3