SVM

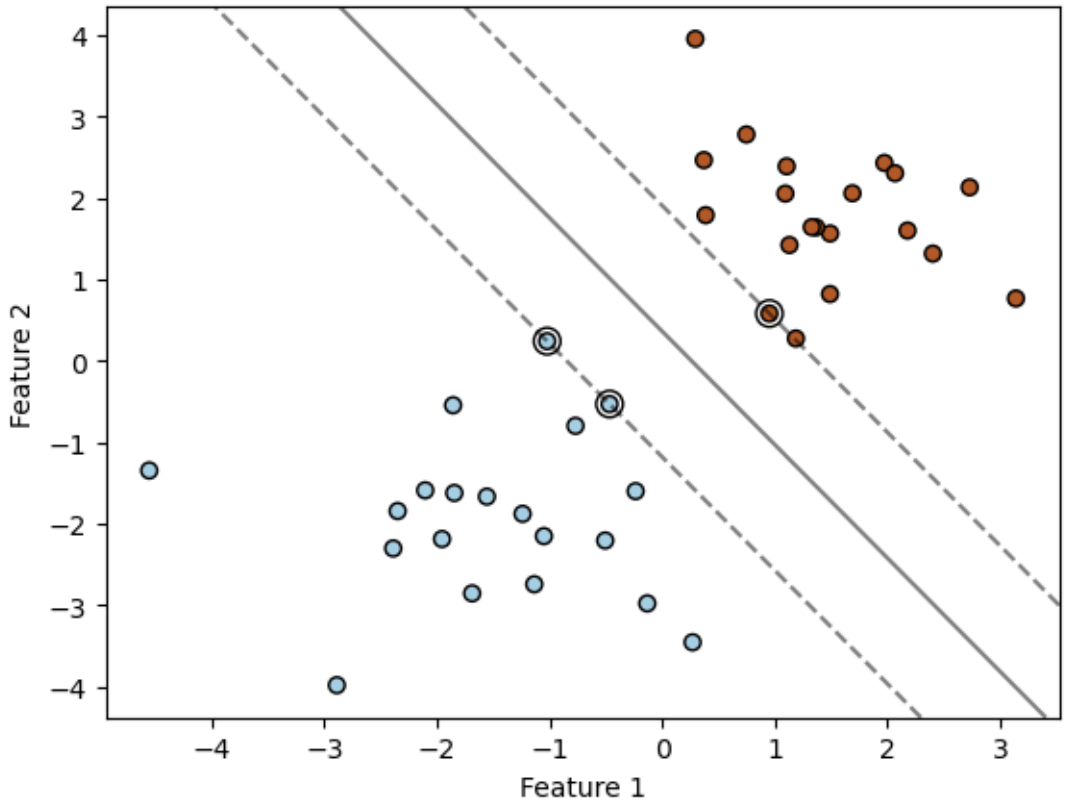
February 23, 2025

[1]:
```
# Importing necessary libraries
from sklearn import datasets
from sklearn.model_selection import train_test_split
from sklearn.svm import SVC
from sklearn.metrics import accuracy_score

# Load dataset (for example, the Iris dataset)
iris = datasets.load_iris()
X = iris.data
y = iris.target

# Split data into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2,␣
↪random_state=42)

# Initialize SVM classifier
svm_classifier = SVC(kernel='linear')  # You can choose different kernels:␣
↪linear, poly, rbf, sigmoid, etc.

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

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

# Calculate accuracy
accuracy = accuracy_score(y_test, y_pred)
print("Accuracy:", accuracy)
```

```
Accuracy: 1.0
```

[2]:
```
#binary
# Importing necessary libraries
import numpy as np
import matplotlib.pyplot as plt
from sklearn import svm

# Generating synthetic data for binary classification
```

```
np.random.seed(0)
X = np.r_[np.random.randn(20, 2) - [2, 2], np.random.randn(20, 2) + [2, 2]]  #␣
 ↪Features
y = [-1] * 20 + [1] * 20  # Labels

# Training the SVM model
clf = svm.SVC(kernel='linear')  # Linear kernel
clf.fit(X, y)

# Plotting the decision function
plt.scatter(X[:, 0], X[:, 1], c=y, cmap=plt.cm.Paired, edgecolors='k')
plt.xlabel('Feature 1')
plt.ylabel('Feature 2')

# Plotting the decision boundary
ax = plt.gca()
xlim = ax.get_xlim()
ylim = ax.get_ylim()

# Create grid to evaluate model
xx = np.linspace(xlim[0], xlim[1], 30)
yy = np.linspace(ylim[0], ylim[1], 30)
YY, XX = np.meshgrid(yy, xx)
xy = np.vstack([XX.ravel(), YY.ravel()]).T
Z = clf.decision_function(xy).reshape(XX.shape)

# Plot decision boundary and margins
ax.contour(XX, YY, Z, colors='k', levels=[-1, 0, 1], alpha=0.5,␣
 ↪linestyles=['--', '-', '--'])
ax.scatter(clf.support_vectors_[:, 0], clf.support_vectors_[:, 1], s=100,␣
 ↪linewidth=1, facecolors='none', edgecolors='k')
plt.show()
```



[5]:
```
#digits
# Importing necessary libraries
from sklearn import datasets
from sklearn.model_selection import train_test_split
from sklearn.svm import SVC
from sklearn.metrics import accuracy_score, classification_report

# Load the digits dataset
digits = datasets.load_digits()

# Split data into features (X) and target labels (y)
X = digits.data
y = digits.target

# Split data into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2,␣
↪random_state=42)

# Initialize SVM classifier
svm_classifier = SVC(kernel='rbf', gamma='scale')  # Using radial basis function␣
↪(RBF) kernel
```

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

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

# Calculate accuracy
accuracy = accuracy_score(y_test, y_pred)
print("Accuracy:", accuracy)

# Display classification report
print("Classification Report:")
print(classification_report(y_test, y_pred))
```

```
Accuracy: 0.9861111111111112
Classification Report:
              precision    recall  f1-score   support

           0       1.00      1.00      1.00        33
           1       1.00      1.00      1.00        28
           2       1.00      1.00      1.00        33
           3       1.00      1.00      1.00        34
           4       1.00      1.00      1.00        46
           5       0.98      0.98      0.98        47
           6       0.97      1.00      0.99        35
           7       0.97      0.97      0.97        34
           8       1.00      0.97      0.98        30
           9       0.95      0.95      0.95        40

    accuracy                           0.99       360
   macro avg       0.99      0.99      0.99       360
weighted avg       0.99      0.99      0.99       360
```

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