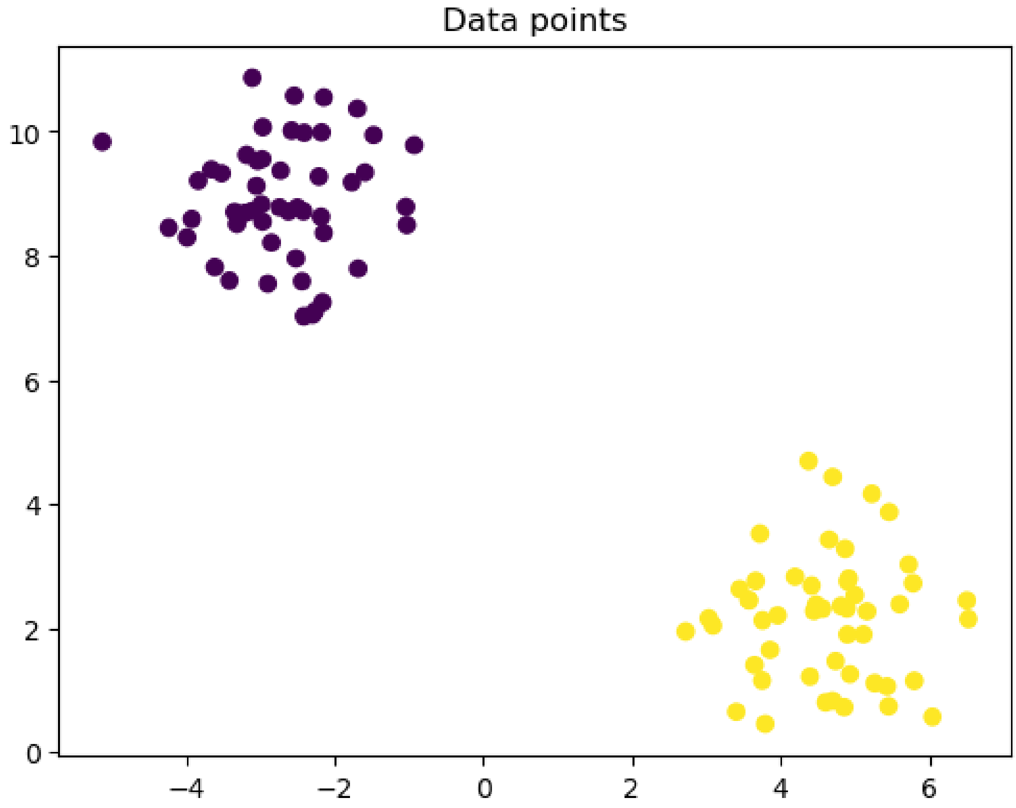
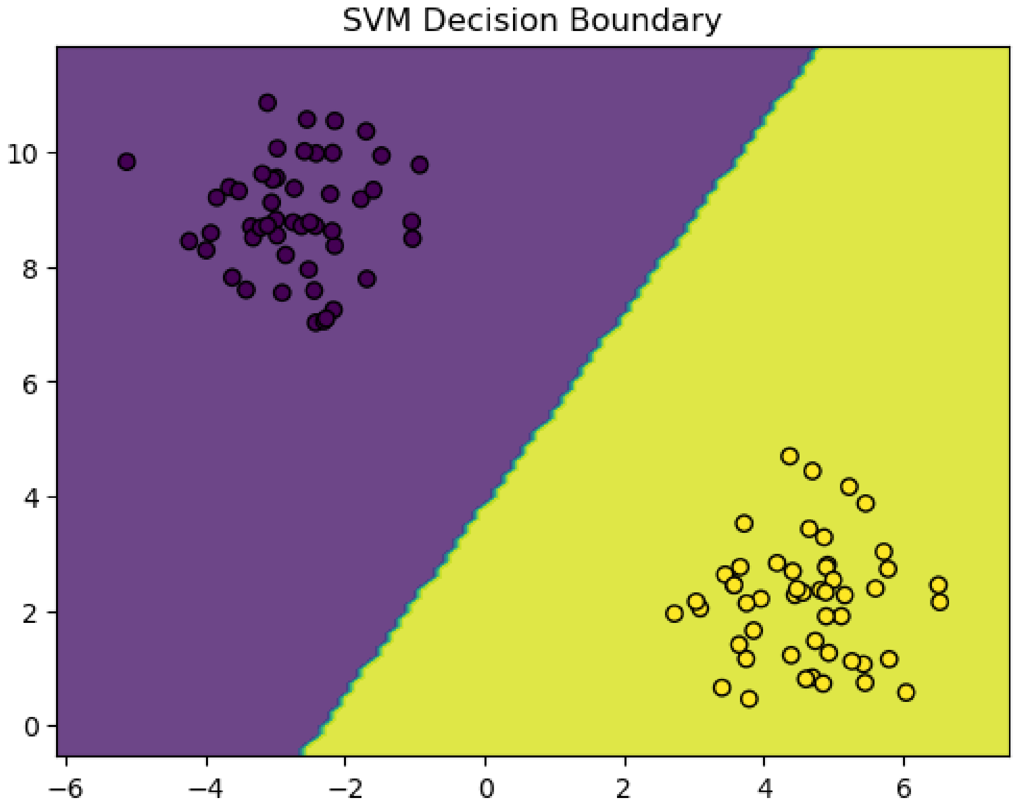
lab 12 svm

October 30, 2024

[1]:

```
import numpy as np
import matplotlib.pyplot as plt
from sklearn.datasets import make_blobs

class SVM:
    def __init__(self, learning_rate=0.01, lambda_param=0.01, n_iters=1000):
        self.learning_rate = learning_rate
        self.lambda_param = lambda_param
        self.n_iters = n_iters
        self.w = None
        self.b = None

    def fit(self, X, y):
        n_samples, n_features = X.shape
        self.w = np.zeros(n_features)
        self.b = 0

        # Convert labels to -1 and 1
        y_ = np.where(y <= 0, -1, 1)

        for _ in range(self.n_iters):
            for idx, x_i in enumerate(X):
                condition = y_[idx] * (np.dot(x_i, self.w) - self.b) >= 1
                if condition:
                    self.w -= self.learning_rate * (2 * self.lambda_param *␣
 ↪self.w)
                else:
                    self.w -= self.learning_rate * (2 * self.lambda_param *␣
 ↪self.w - np.dot(x_i, y_[idx]))
                    self.b -= self.learning_rate * y_[idx]

    def predict(self, X):
        linear_output = np.dot(X, self.w) - self.b
        return np.sign(linear_output)

def plot_decision_boundary(svm, X, y):
    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.linspace(x_min, x_max, 100),
                         np.linspace(y_min, y_max, 100))
    Z = svm.predict(np.c_[xx.ravel(), yy.ravel()])
    Z = Z.reshape(xx.shape)

    plt.contourf(xx, yy, Z, alpha=0.8)
    plt.scatter(X[:, 0], X[:, 1], c=y, edgecolors='k')
    plt.title("SVM Decision Boundary")
    plt.show()

# Generate synthetic data
X, y = make_blobs(n_samples=100, centers=2, random_state=42)
y = np.where(y == 0, -1, 1)  # Convert labels to -1 and 1

# Visualize the data
plt.scatter(X[:, 0], X[:, 1], c=y, cmap='viridis')
plt.title("Data points")
plt.show()

# Train the SVM
svm = SVM()
svm.fit(X, y)

# Make predictions and visualize the results
predictions = svm.predict(X)
plot_decision_boundary(svm, X, y)
```


Data points
10
8
6
4
2
0
−4
−2
0
2
4
6


SVM Decision Boundary
10
8
6
4
2
0
−6
−4
−2
0
2
4
6