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

```
pip install seaborn
```

```
Requirement already satisfied: seaborn in c:\users\91978\anaconda3\lib\site-packages (0.13.2)
Requirement already satisfied: numpy!=1.24.0,>=1.20 in c:\users\91978\anaconda3\lib\site-packages (from seaborn) (1.26.4)
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Requirement already satisfied: tzdata>=2022.7 in c:\users\91978\anaconda3\lib\site-packages (from pandas>=1.2->seaborn) (202
Requirement already satisfied: six>=1.5 in c:\users\91978\anaconda3\lib\site-packages (from python-dateutil>=2.7->matplotlib
Note: you may need to restart the kernel to use updated packages.
```
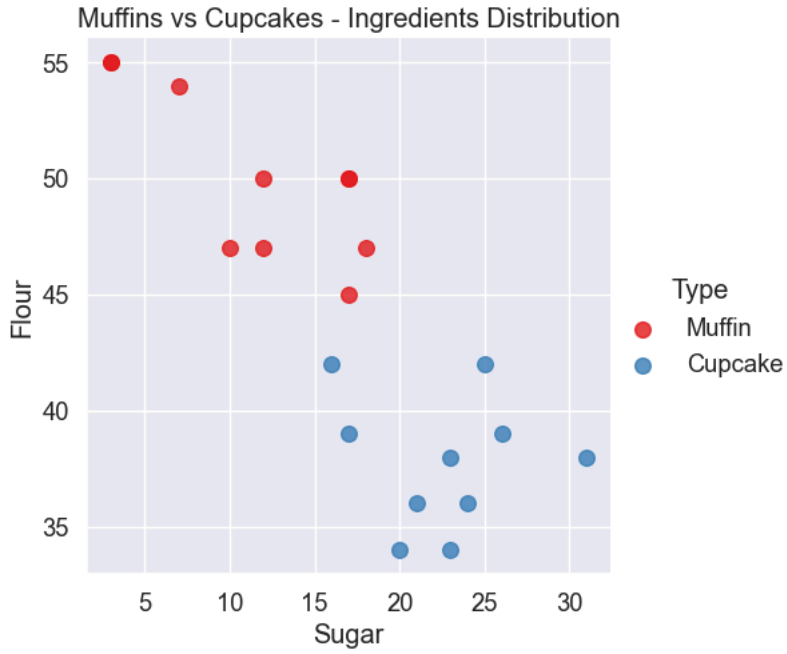

```
# Visualization settings
sns.set(font_scale=1.2)
# Load the dataset
recipes = pd.read_csv('cupcakes.csv')
recipes.head()
```

	Type	Flour	Milk	Sugar	Butter	Egg	Baking Powder	Vanilla	Salt
0	Muffin	55	28	3	7	5	2	0	0
1	Muffin	47	24	12	6	9	1	0	0
2	Muffin	47	23	18	6	4	1	0	0
3	Muffin	45	11	17	17	8	1	0	0
4	Muffin	50	25	12	6	5	2	1	0

```
recipes.shape
```

```
(20, 9)
```

```
# Plot the data
sns.lmplot(x='Sugar', y='Flour', data=recipes, hue='Type',
 palette='Set1', fit_reg=False, scatter_kws={"s": 70})
plt.title("Muffins vs Cupcakes - Ingredients Distribution")
plt.show()
```




```
# Prepare the data
X = recipes[['Sugar', 'Flour']]
y = recipes['Type']
```

```
# Train the SVM model
model = svm.SVC(kernel='linear')
model.fit(X, y)
```

SVC

▶ Parameters

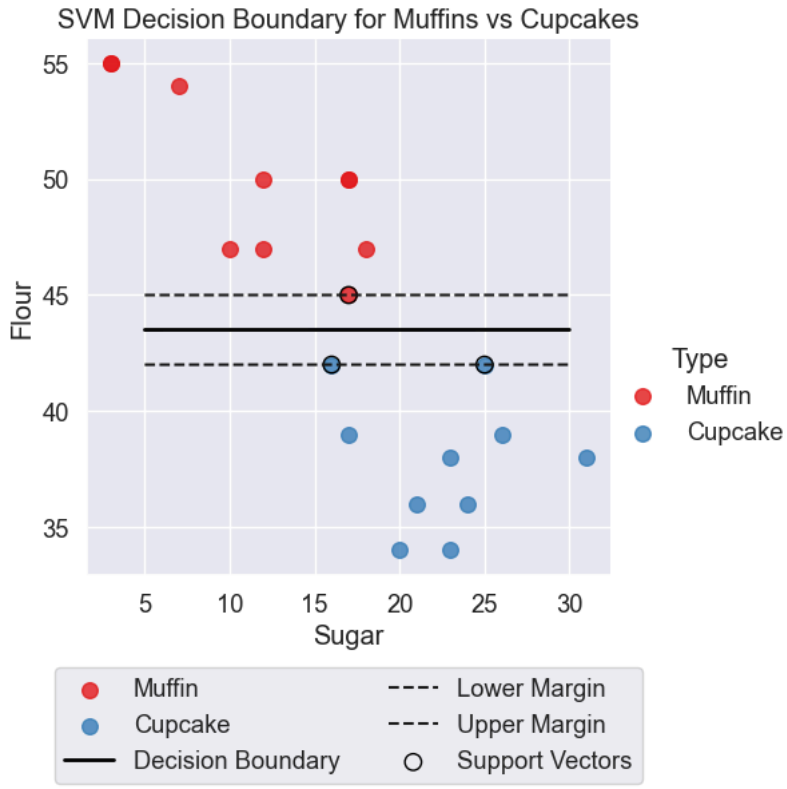
```
# Get model coefficients w0 * x + w1 * y + b = 0
w0 = model.coef_[0][0]
w1 = model.coef_[0][1]
b = model.intercept_[0]
```

```
# Calculate slope and intercept for the main decision boundary y=-(w0/w1)x - b/w1
a = -w0 / w1
xx = np.linspace(5, 30) # Range for x-axis
yy = a * xx - (b / w1) # Decision boundary line
```

```
# Calculate upper and lower margin lines using support vectors
b_down = model.support_vectors_[0]
yy_down = a * xx + (b_down[1] - a * b_down[0])
b_up = model.support_vectors_[-1]
yy_up = a * xx + (b_up[1] - a * b_up[0])
```

```
# Plot the data and the SVM boundaries
sns.lmplot(x='Sugar', y='Flour', data=recipes, hue='Type',
           palette='Set1', fit_reg=False, scatter_kws={"s": 70})

# Plot the decision boundary and margins
plt.plot(xx, yy, linewidth=2, color='black', label='Decision Boundary')
plt.plot(xx, yy_down, 'k--', label='Lower Margin')
plt.plot(xx, yy_up, 'k--', label='Upper Margin')

# Highlight the support vectors
plt.scatter(model.support_vectors_[:, 0],
            model.support_vectors_[:, 1],
            s=80, facecolors='none', edgecolors='black', label='Support Vectors')

# Final plot formatting
plt.title("SVM Decision Boundary for Muffins vs Cupcakes")
plt.xlabel("Sugar")
plt.ylabel("Flour")
```

```
# Legend at the bottom
plt.legend(loc='upper center', bbox_to_anchor=(0.5, -0.15), ncol=2)

plt.show()
```



Start coding or generate with AI.