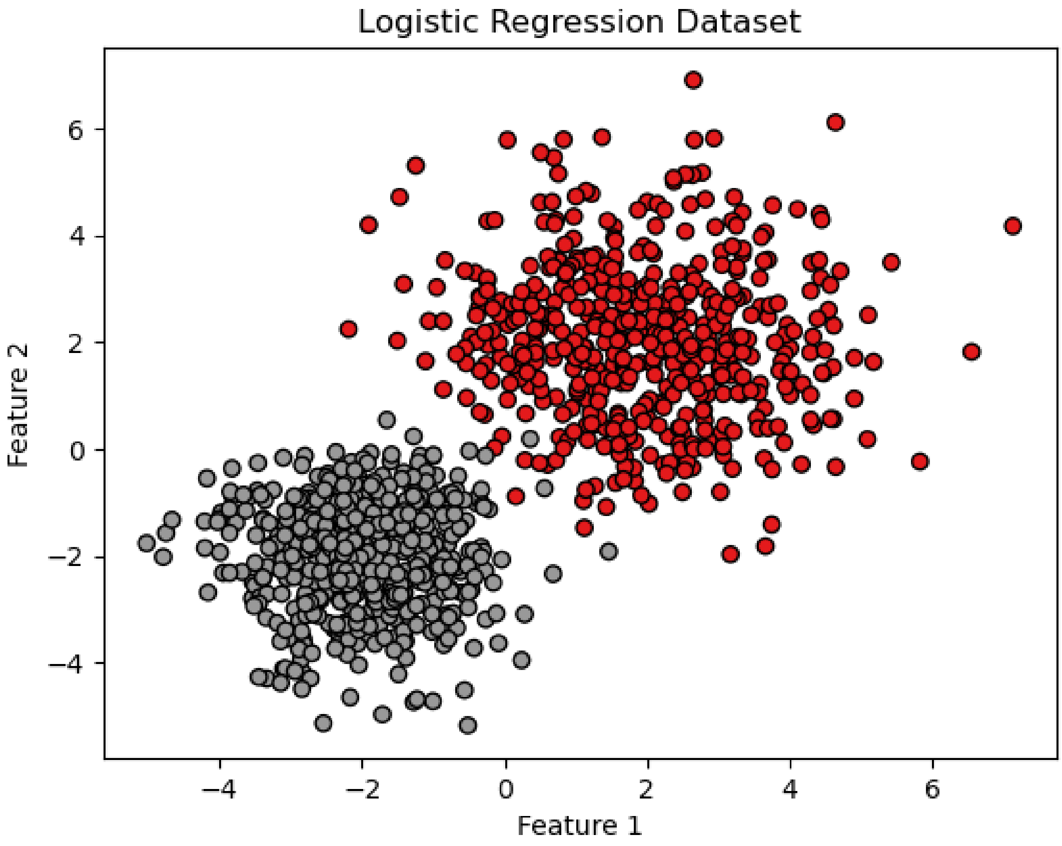
LogisticRegression

2025 年 6 月 22 日

[1]:

```
""" 激活函数为 Sigmoid"""
import numpy as np
import matplotlib.pyplot as plt

"""* 设置随机种子（可复现结果）"""
np.random.seed(36)

""" 生成随机数据"""
mean_1 = [2, 2]
cov_1 = [[2, 0], [0, 2]]
mean_2 = [-2, -2]
cov_2 = [[1, 0], [0, 1]]

""" 生成分类一样本"""
x1 = np.random.multivariate_normal(mean_1, cov_1, 500)
y1 = np.zeros(500)

""" 生成分类二样本"""
x2 = np.random.multivariate_normal(mean_2, cov_2, 500)
y2 = np.ones(500)

""" 合并标签和样本"""
X = np.concatenate((x1, x2), axis=0)
y = np.concatenate((y1, y2))

""" 绘制图"""
plt.scatter(X[:, 0], X[:, 1], c=y, cmap='Set1', edgecolors='k')
plt.xlabel('Feature 1')
plt.ylabel('Feature 2')
plt.title('Logistic Regression Dataset')
plt.show()
```



[2]:

```
""" 自定义激活函数（Sigmoid） """
def sigmoid(x):
    if x.all() > 0:
        return 1.0 / (1.0 + np.exp(-x))
    else:
        return np.exp(-x)/(1.0 + np.exp(-x))

""" 自定义逻辑回归类"""
class LogisticRegression:
    def __init__(self, learning_rate=0.01, max_iter=1000):
        self.learning_rate = learning_rate
        self.max_iter = max_iter
        self.weights = None
        self.bias = None

    def fit(self, X, y):
        num_samples, num_features = X.shape
        """ 把样本的特征数和样本数分离"""

        """ 初始化权重与偏置"""
        self.weights = np.zeros(num_features)
        self.bias = 0

        """ 梯度下降算法"""
        for _ in range(self.max_iter):
            """f(x)=w*x+b"""
            linear_model = np.dot(X, self.weights) + self.bias
            y_pred = sigmoid(linear_model)

            """ 参数更新，使用的交叉熵损失作为参数更新的损失函数（成本函数）"""
            dw = (1 / num_samples) * np.dot(X.T, (y_pred - y))
            db = (1 / num_samples) * np.sum(y_pred - y)

            self.weights -= self.learning_rate * dw
            self.bias -= self.learning_rate * db

    def predict_prob(self, X):
        linear_model = np.dot(X, self.weights) + self.bias
        y_pred = sigmoid(linear_model)
        return y_pred

    def predict(self, X, threshold=0.5):
        y_pred_prob = self.predict_prob(X)
        y_pred = np.zeros_like(y_pred_prob)
        y_pred[y_pred_prob >= threshold] = 1
        return y_pred
```

[3]:

```
""" 创建逻辑回归模型"""
logreg = LogisticRegression()

""" 模型训练"""
logreg.fit(X, y)

""" 预测"""
X_new = np.array([[2.3, 2.3], [-3.0, -4.0]])
y_pred_prob = logreg.predict_prob(X_new)
y_pred = logreg.predict(X_new)

print("预测概率为: ", y_pred_prob)
print("预测类别为: ", y_pred)
```

```
预测概率为:  [0.00483741 0.999628  ]
预测类别为:  [0. 1.]
```

[4]:

```
"""sklearn 库实现"""
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import accuracy_score

""" 划分训练集和测试集"""
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2,␣
 ↪random_state=42)

""" 创建逻辑回归模型"""
logreg = LogisticRegression()

""" 训练模型"""
logreg.fit(X_train, y_train)

""" 预测"""
y_pred = logreg.predict(X_test)
```

```
""" 计算准确率"""
accuracy = accuracy_score(y_test, y_pred)
print("Accuracy:", accuracy)
```

```
Accuracy: 0.995
```