import numpy as np  
import pandas as pd  
import matplotlib.pyplot as plt  
  
  
data = pd.read\_csv('E:\\机器学习\\机器学习作业\_数据/regress\_data1.csv')  
X = data['人口'].values.reshape(-1, 1)  
y = data['收益'].values.reshape(-1, 1)  
  
  
m, n = X.shape  
X = np.hstack([np.ones((m, 1)), X])  
  
  
theta = np.zeros((n + 1, 1))  
  
  
learning\_rate = 0.01  
iterations = 1000  
lambda\_param = 0.1  
  
  
for i in range(iterations):  
  
 y\_pred = np.dot(X, theta)  
  
  
 error = y\_pred - y  
  
 *# 计算梯度，加入L2正则项* regularization = lambda\_param \* theta  
 regularization[0] = 0  
 gradient = (1 / m) \* np.dot(X.T, error) + regularization  
  
  
 theta -= learning\_rate \* gradient  
  
  
theta\_final = theta  
  
  
plt.scatter(X[:, 1], y, color='blue', label='Data Points')  
plt.plot(X[:, 1], np.dot(X, theta\_final), color='red', label='Linear Regression Line with L2 Regularization')  
plt.xlabel('Population')  
plt.ylabel('Income')  
plt.legend()  
plt.show()