Report

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I. Linear Regression:

A. Code explanation:

a. Functions:

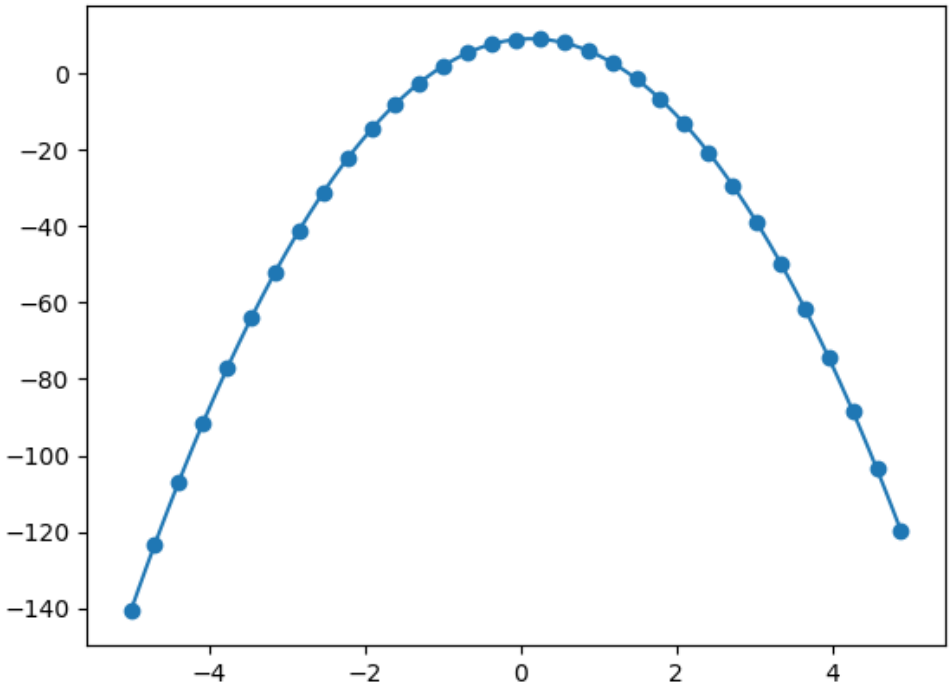
1. inverse(A) : 計算矩陣 A 的反矩陣，使用 Gaussian elimination
2. transpose(A): 計算矩陣 A 的轉置矩陣
3. dot(A, B): 計算 A, B 的內積

b. Workflow:

1. 讀入 data
2. $X = \begin{bmatrix} 1 & {x_0}^2 \cdots & {x_0}^{32} \\ \vdots & \ddots & \vdots \\ 1 & {x_{32}}^2 \cdots & {x_{32}}^{32} \end{bmatrix}$, $y = \begin{bmatrix} y_0 \\ y_1 \\ \vdots \\ y_{31} \\ y_{32} \end{bmatrix}$

   計算 $w = (X^TX)^{-1}X^Ty$
3. 從 32 最高次方開始，依序去除，找出 error 最小的方程式
4. 畫圖並印出方程式及 error

B. Result:




```
Fitting Line:  -5.708286019710432X^2+1.4305785155761899X^1+8.999616611732536
Total Error:  0.459647918501763
```

II. Logistic Regression:

A. Code explanation:

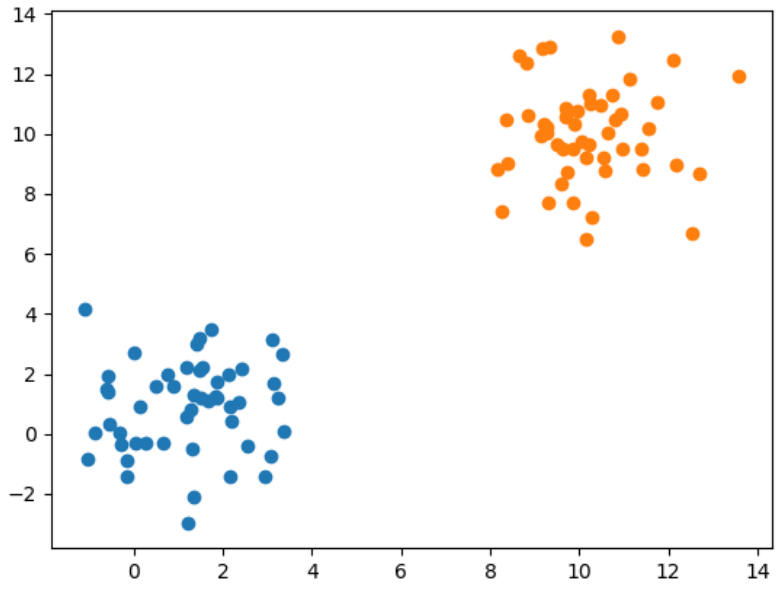
a. Function:

1. normalize(x): 把 X 的數值標準化到[-1,1]
2. dot(w, x): w, x 內積
3. sigmoid(x): 計算$\frac{1}{1+e^{-x}}$
4. M_of_x(w, x): 計算 $M_w(X_i)$
5. Cost(X,y,w,m): 計算 cross entropy
6. Cost_Derivation(X,y,w,j,m,alpha): Cost 的導數
7. Gradient(X,y,w,m,alpha): gradient descent，回傳新的 w
8. Logistic Regression(X,y,alpha,w,times):主要函式呼叫 Gradient 並更新 w
9. Calculate(data0,data1):包含對資料的前處理，並呼叫 Logistic Regression

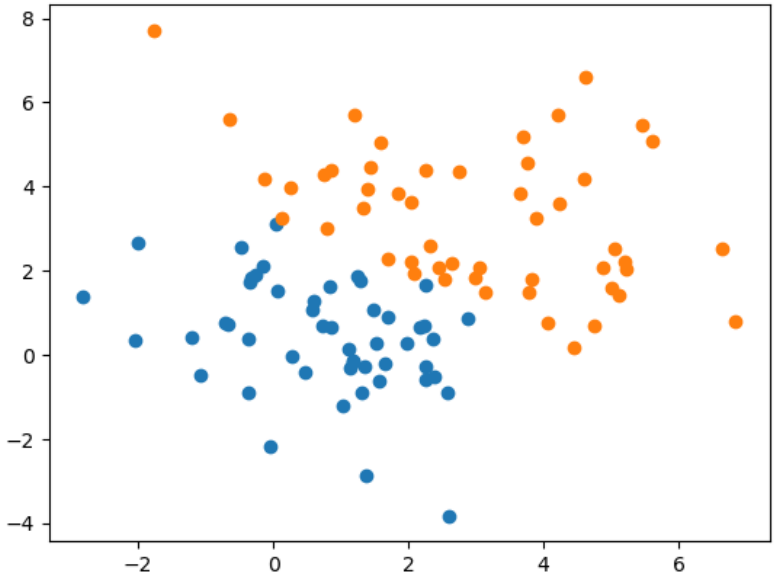
b. Workflow:

1. 把 data 讀入，並標準化到[-1,1]，標準化後的 X_norm 加上 bias 即每一列代表[x,y,1]
2. 初始 w=[0,0,0]
3. 計算 logistic regression，更新 w 共 10000 次
4. 把 data 分成兩群:w 所對應的方程式以上及以下
5. 畫圖並印出 Confusion Matrix

B. Result:



```
w:  [6.602966567223772, 5.607428246452326, 0.26949491977413431]
Confusion Matrix:
                  Is Cluster 1  Is Cluster 2
Predixt Cluster 1            50             0
Predict Cluster 2             0            50
Precision:  1.0
Recall:  1.0
```




```
w:  [3.19417850134753, 5.321473968500361, -0.059045346916071751]
Confusion Matrix:
                  Is Cluster 1  Is Cluster 2
Predixt Cluster 1            41             9
Predict Cluster 2             9            41
Precision:  0.82
Recall:  0.82
```