

Logistic Regression

<https://github.com/sangjianshun/Master-School/blob/master/logisticRegression.py>

业务背景

身高	体重
170	60



是否正常
1

身高	体重
180	50



是否正常
0

Logistic Regression

● 前向计算流程

身高	体重
170	60



是否正常
1

抽象

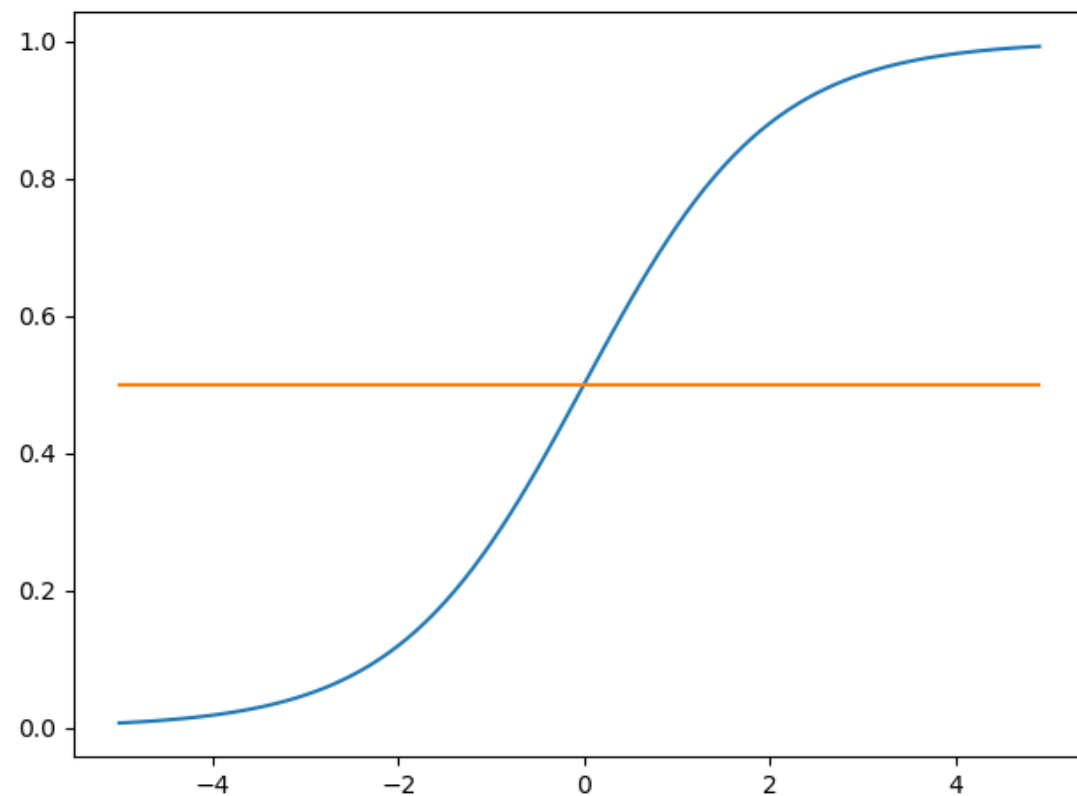
x_1	x_2
170	60



\hat{y}
1

$$z = 170w_1 + 60w_2 + b$$

$$y = \sigma(z) = \frac{1}{1 + e^{-z}}$$



Logistic Regression

反向更新参数

$$z = w_1 x_1 + w_2 x_2 + b$$

$$y = \sigma(z) = \frac{1}{1 + e^{-z}}$$

损失函数：Cross Entropy

$$\hat{y} = 1 \longleftrightarrow \begin{array}{|c|c|} \hline 0 & 1 \\ \hline \end{array} \longleftrightarrow \begin{array}{|c|c|} \hline 1-\hat{y} & \hat{y} \\ \hline \end{array}$$

$$y = 0.6 \longleftrightarrow \begin{array}{|c|c|} \hline 0.4 & 0.6 \\ \hline \end{array} \longleftrightarrow \begin{array}{|c|c|} \hline 1-y & y \\ \hline \end{array}$$

$$L(w_1, w_2) = -\hat{y} \lg(y) - (1-\hat{y}) \lg(1-y)$$

$$\frac{\partial L(w_1, w_2)}{\partial w_1} = \frac{\partial L(w_1, w_2)}{\partial y} \frac{\partial y}{\partial z} \frac{\partial z}{\partial w_1}$$

$$\frac{\partial L(w_1, w_2)}{\partial y} = -\frac{\hat{y}}{y} + \frac{1-\hat{y}}{1-y}$$

$$\frac{\partial y}{\partial z} = y(1-y)$$

$$\frac{\partial L}{\partial w_1} = (y - \hat{y}) x_1$$

$$w_1 = w_1 - \eta \frac{\partial L}{\partial w_1}$$

```
for i in range(epoch):
    for j in range(len(x)):
        fx = LR(x, w, b)
        w = w - eta * (fx - y[j]) * x[j]
        b = b - eta * (fx - y[j])
```