Example on the cost function calculation of Logistic Regression.

Let's consider a simple example with 3 training examples:

X	Y
1	1
2	0
3	1

Assume the model parameters are $\theta=0.5$, and the sigmoid function is used for predictions.

c or b=0

Step 1: Compute Predictions

For each training example, compute $h_\theta(x)$:

1. For $X=1$:

   $h\theta(1)=1/[1+e-(0.5x1)]=1/(1+e\text{^}-0.5)\approx0.622$
2. For $X=2$:
   $h\theta(2)=1/[1+e\text{^}-(0.5x2)=1/(1+e\text{^}-1)\approx0.731$
3. For $X=3$:
   $h\theta(3)=1/[1+e\text{^}-(0.5x3)=1/(1+e\text{^}-1.5)\approx0.817$

Step 2: Compute Cost for Each Example

Using the cost function formula:

1. For $X=1$, $Y=1$:

   $Cost1=-y\log(h\theta(X))=-1\cdot\log(0.622)\approx0.474$

   For $x=2$, $y=0$:
   $Cost2=-(1-y)\log(1-h\theta(x))=-1\cdot\log(1-0.731)\approx1.309$
2. For $x=3$, $y=1$:
   $Cost3=-y\log(h\theta(x))=-1\cdot\log(0.817)\approx0.202$

Step 3: Compute Total Cost

Sum the costs and average them:

$J(\theta)=1/3(Cost1+Cost2+Cost3)$

$J(\theta)=1/3(0.474+1.309+0.202)\approx1.985/3\approx0.662$

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5. Interpretation

The cost function $J(\theta)$ measures the average error of the model's predictions. In this example, the cost is approximately **0.662**. The goal of training the logistic regression model is to minimize this cost by adjusting the parameters θ.