# numerically solved example of binary classification calculating accuracy on a dataset with input features, weight matrix and output

Certainly! Let's walk through a numerical example of binary classification using a simple logistic regression model, including input features, weight matrix, and output.

### Example:

Suppose we have the following dataset with two features (X1 and X2) and a binary target variable (Y):



# Logistic Regression Model:

Assume our logistic regression model is given by:

$$P(Y=1) = \frac{1}{1 + e^{-(\beta_0 + \beta_1 X 1 + \beta_2 X 2)}}$$

We initialize our weight matrix as  $eta_0=-1,\ eta_1=0.5,\ eta_2=1.$ 

## Predictions:

Now, let's calculate the output for each instance in the dataset:

1. For the first row (X1=2, X2=3):

$$Z = -1 + 0.5 \cdot 2 + 1 \cdot 3 = 3.5$$

$$P(Y=1) = \frac{1}{1+e^{-3.5}} \approx 0.97$$

Prediction:  $\hat{Y}=1$  (spam)

2. For the second row (X1=1, X2=4):

$$Z = -1 + 0.5 \cdot 1 + 1 \cdot 4 = 3.5$$

$$P(Y=1)=rac{1}{1+e^{-3.5}}pprox 0.97$$



$$Z = -1 + 0.5 \cdot 1 + 1 \cdot 4 = 3.5$$
  
 $P(Y = 1) = \frac{1}{1 + e^{-3.5}} \approx 0.97$ 

Prediction:  $\hat{Y} = 1$  (spam)

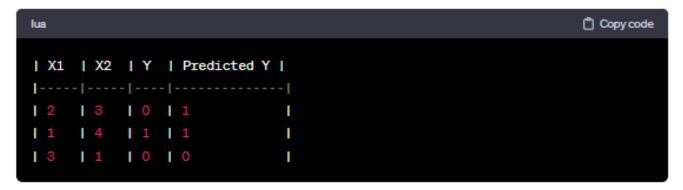
3. For the third row (X1=3, X2=1):

$$Z = -1 + 0.5 \cdot 3 + 1 \cdot 1 = 0.5$$

$$P(Y=1) = \frac{1}{1+e^{-0.5}} \approx 0.62$$

Prediction:  $\hat{Y} = 1$  (not spam)

#### Actual vs. Predicted:



#### **Accuracy Calculation:**

In this example, there are 2 correct predictions out of 3 instances.

$$Accuracy = \frac{Number of Correct Predictions}{Total Number of Instances} = \frac{2}{3} \approx 0.67$$

So, the accuracy of our binary classification ullet del on this dataset is approximately 67%.