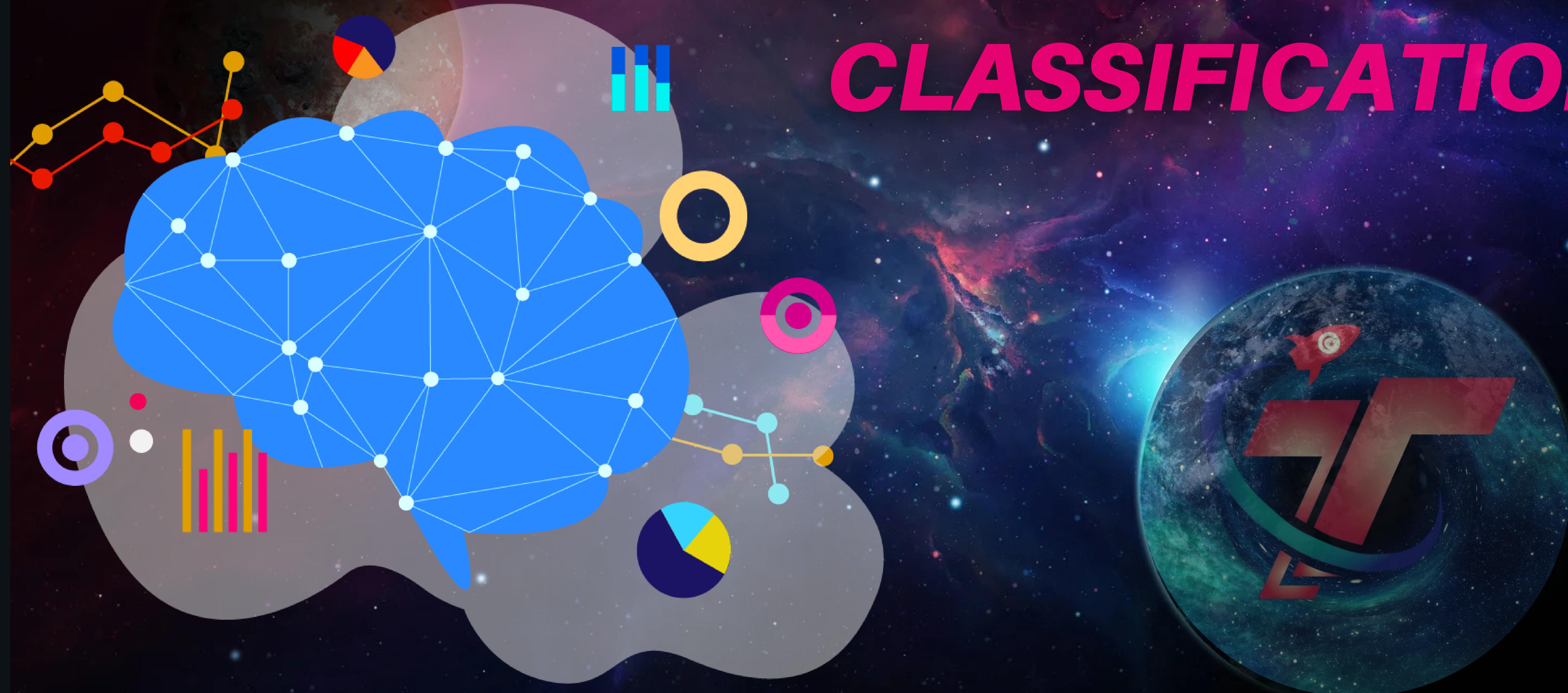


CLASSIFICATION



classification

Classification Algorithms

- Logistic Regression.
- K-Nearest Neighbours (KNN).
- Support Vector Machine (SVM).
- Decision Tree.
- Naïve Bayes.

etc ...

Logistic Regression

Binary classification example : Fraud or Not Fraud?

We suppose we have a dataset that contains these features :

- Amount of the transaction money.
- Used card.
- Email.
- Signature.

We want to train an algorithm that determines if the transaction is fraudulent or not.

Logistic Regression

Questions

- How do we create a function that returns a value between 0 and 1, where 0=> "Not Fraud" and 1=>"Fraud"?
- How do we calculate how far is our algorithm from giving the right answer?

Answer

- Non-linear functions like Sigmoid function.
- We calculate the cost function.

Note

Vectorized Expression of a linear function

$$f(x_0, x_1, \dots, x_n) = \theta_0 * x_0 + \theta_1 * x_1 + \dots + \theta_n * x_n$$

is the same as

$$f(X) = \Theta * X$$

where : $\Theta =$

$$\begin{pmatrix} \theta_0 \\ \vdots \\ \theta_n \end{pmatrix}$$

$\theta_0 = 1$

and $X =$

$$\begin{pmatrix} x_0 & x_1 & \dots & x_n \end{pmatrix}$$

b (bias)

Logistic Regression

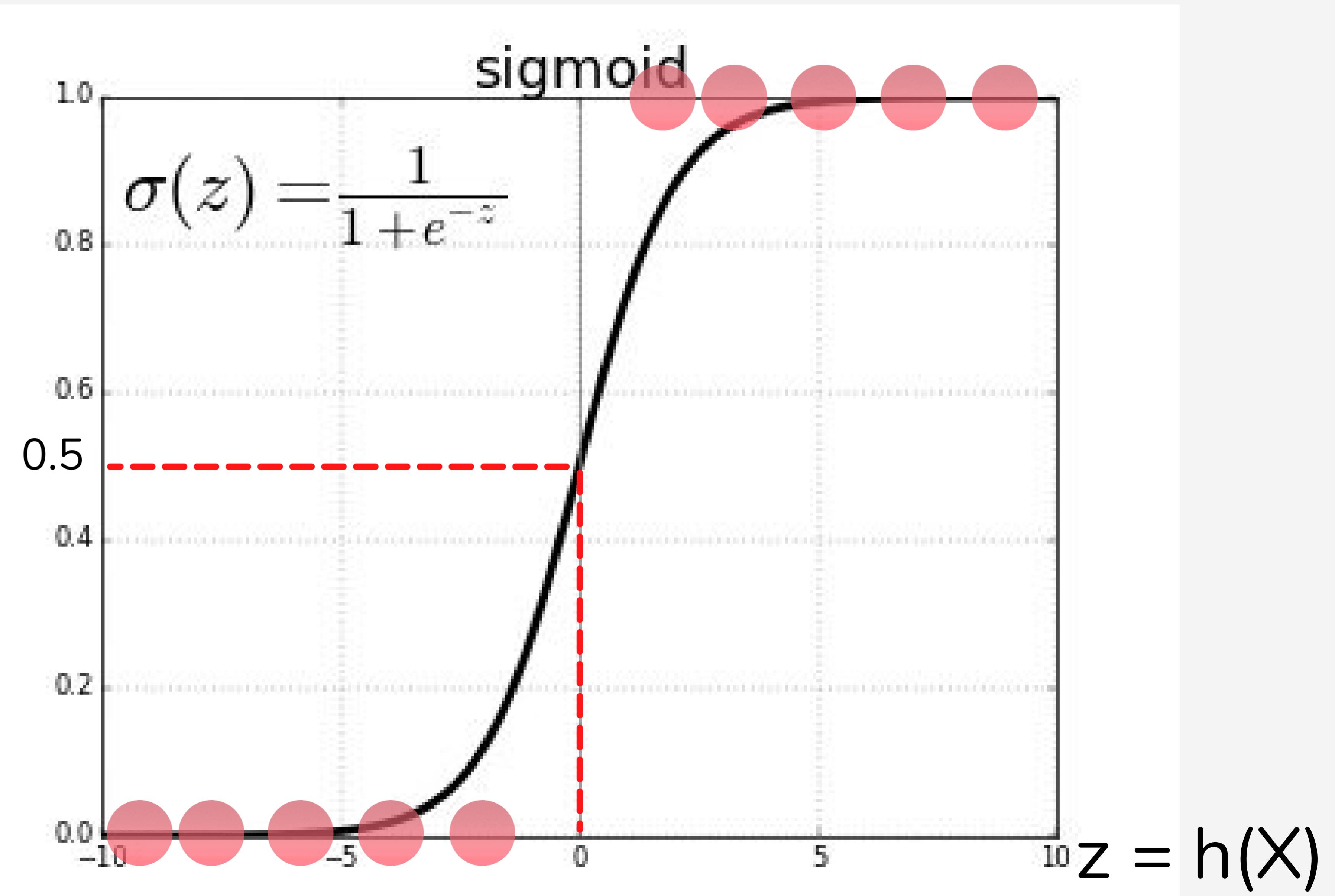
Sigmoid function

$$z = h(X) = \Theta \cdot X$$

X : vector of features.

Θ : vector of coefficients.

Goal : Find the right
Theta that makes
 $\sigma(z)$ fit our data.

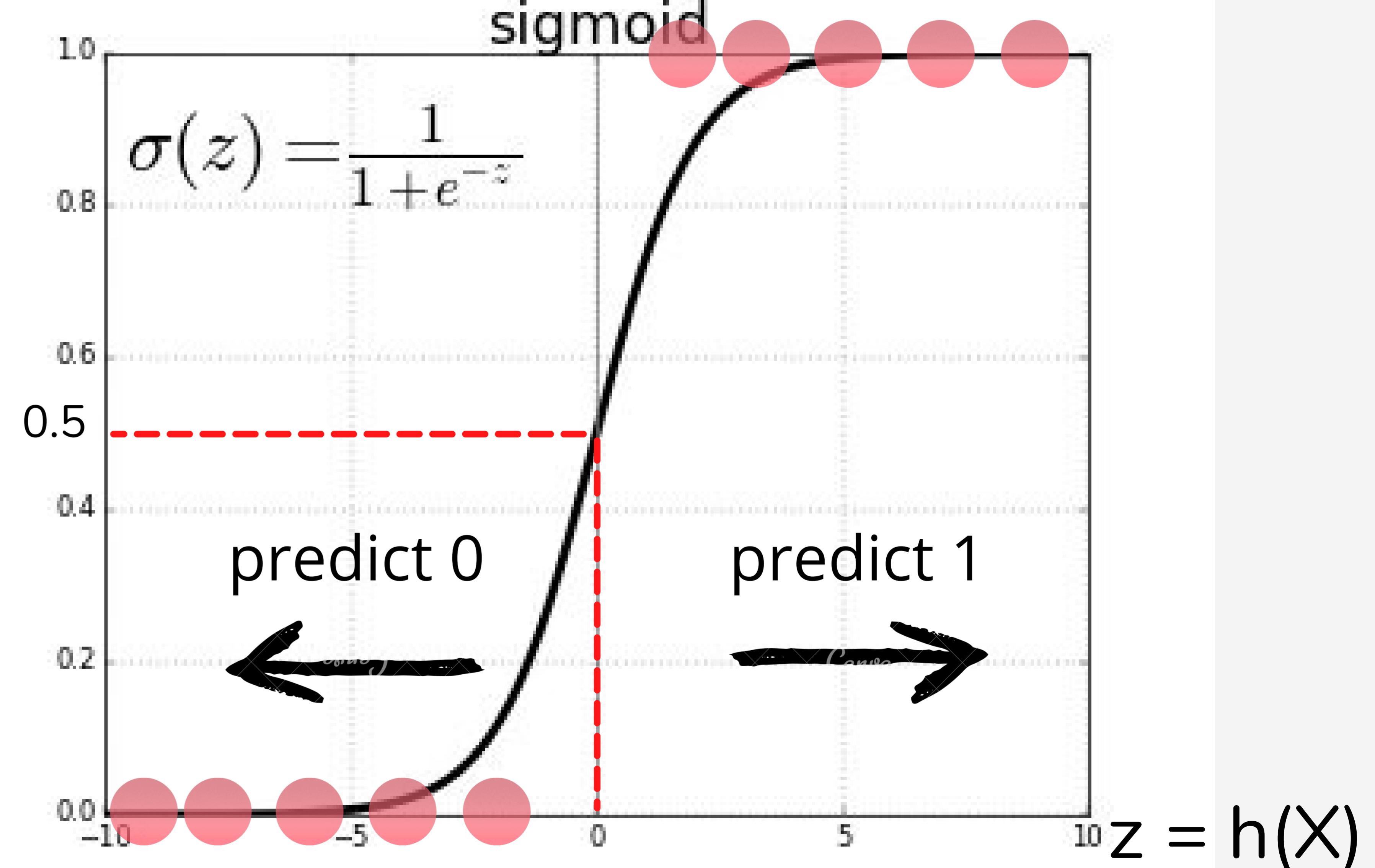


Logistic Regression

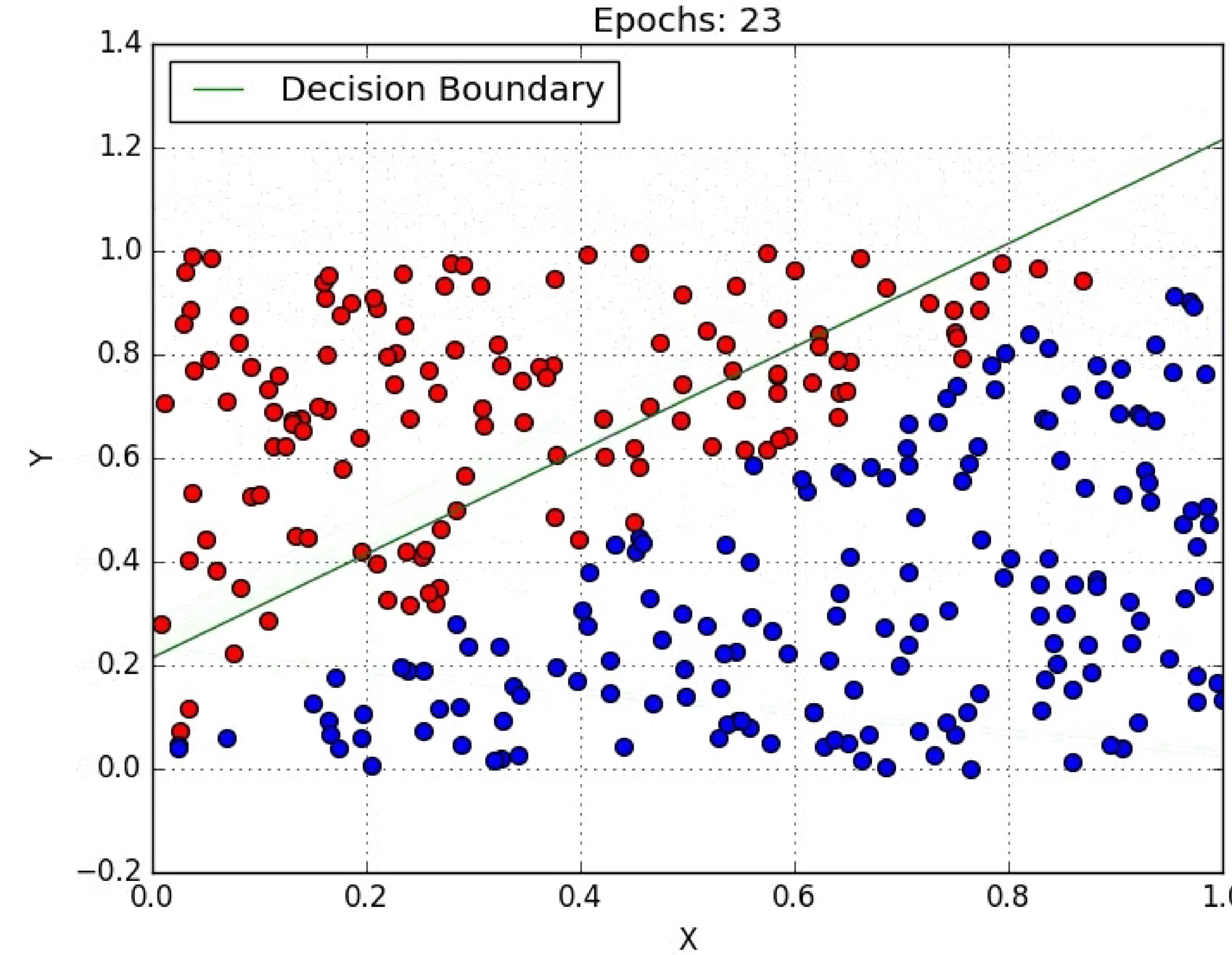
if $\sigma(z) \geq 0.5$:
we predict 1

if $\sigma(z) < 0.5$:
we predict 0

Note : we can choose
the threshold value
(default 0.5).



Logistic Regression

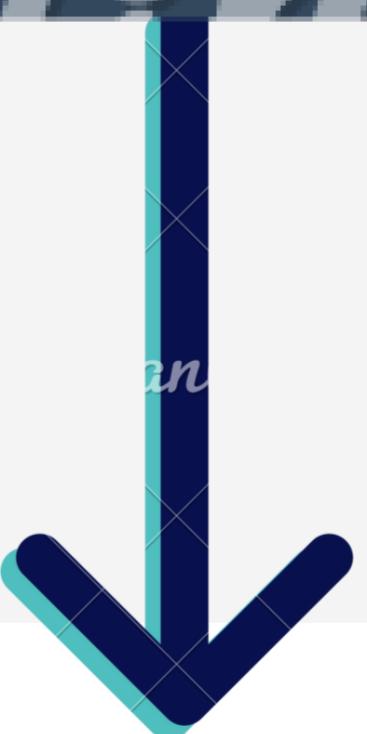


Logistic Regression

Cost function for the binary classification problem :

$$J(\theta) = -\frac{1}{m} \sum \left[y^{(i)} \log(h\theta(x(i))) + (1 - y^{(i)}) \log(1 - h\theta(x(i))) \right]$$

× × Lec 10: Logistic Regression × ×

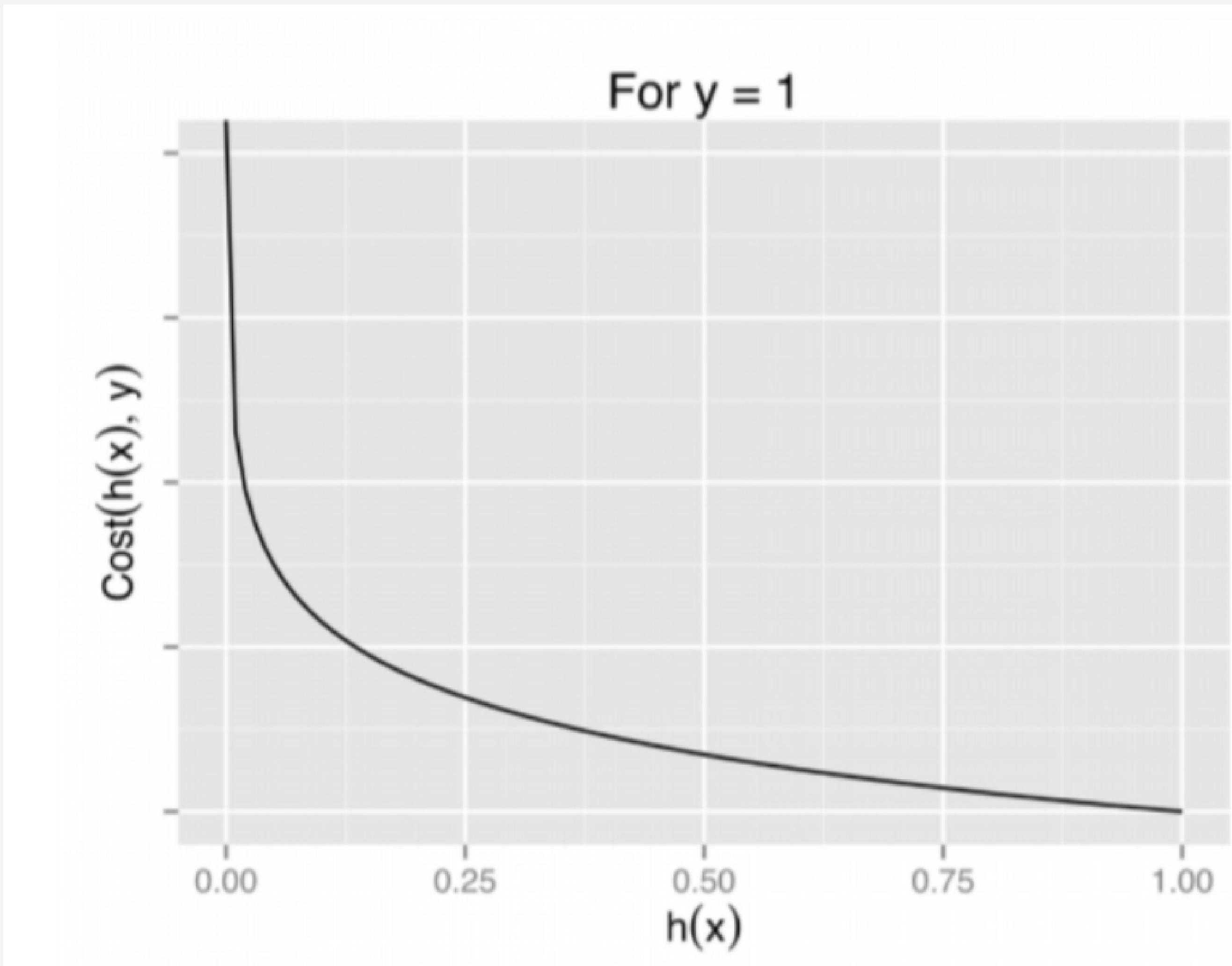


$$J(\theta) = \frac{1}{m} \sum_{i=1}^m \text{Cost}(h_\theta(x^{(i)}), y^{(i)})$$

$$J(\theta) = -\frac{1}{m} \sum \left[y^{(i)} \log(h\theta(x(i))) + (1 - y^{(i)}) \log(1 - h\theta(x(i))) \right]$$

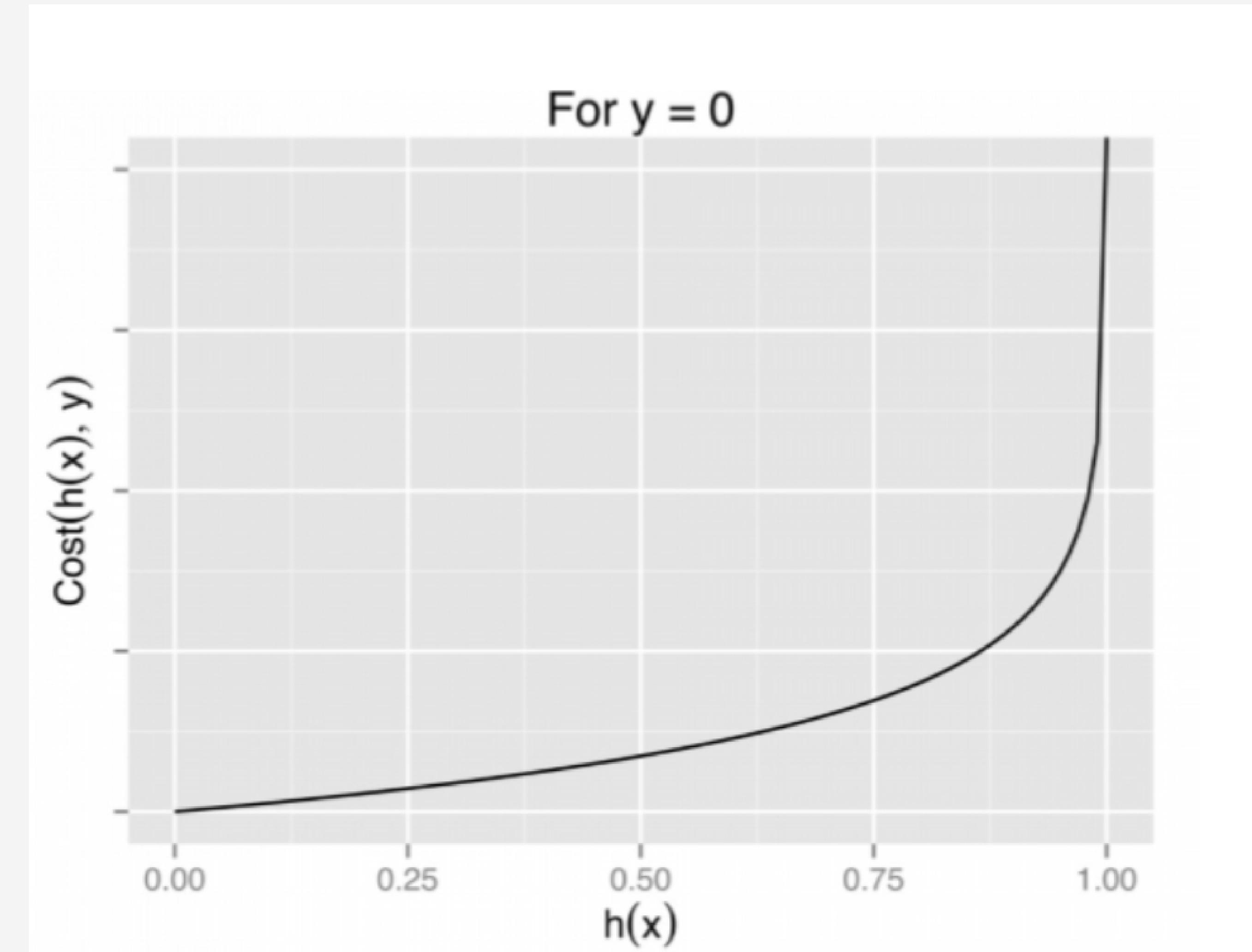
Fraud ($y_i = 1$)

$$\text{Cost}(h_\theta(x), y) = -\log(h_\theta(x))$$



Not Fraud ($y_i = 0$)

$$\text{Cost}(h_\theta(x), y) = -\log(1 - h_\theta(x))$$





A large, bold, black sans-serif font text "Let's practice!" is centered in the middle of the slide. The text is partially obscured by three overlapping circles in a light teal color. One circle is at the bottom center, one is at the top center, and one is on the left side. The circles overlap each other and the text, creating a layered effect.

Let's practice !