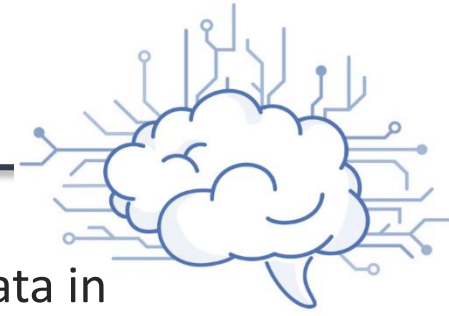


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2. Basics of Neural Networks
3. The Activation Function
4. How do Neural Networks learn ?

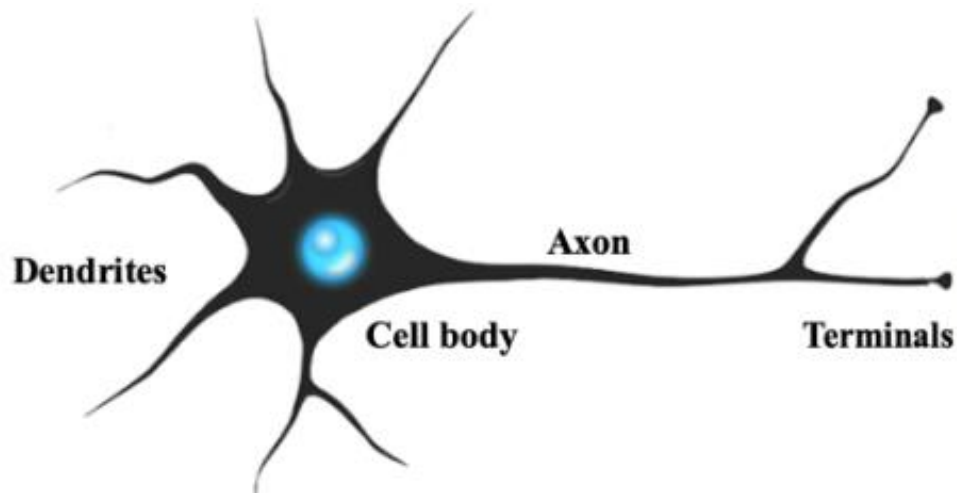


What is Neural Networks ?

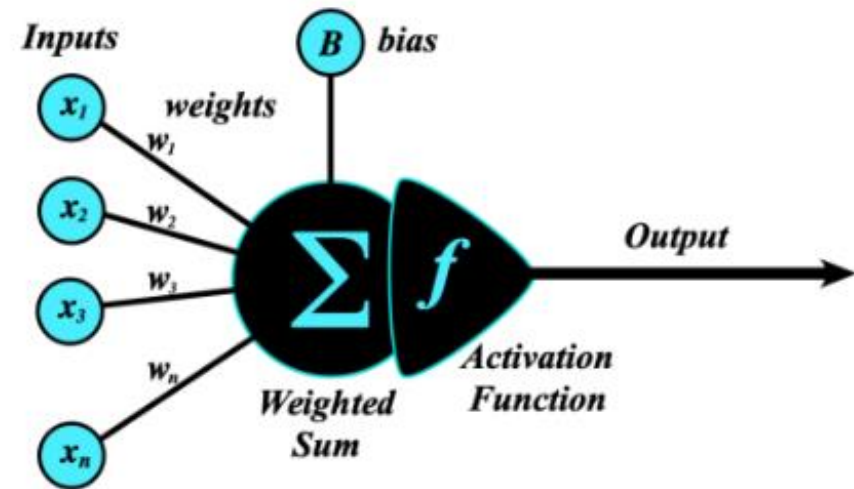


A **neural network** is a method in artificial intelligence that teaches computers to process data in a way that is inspired by the human brain.

It uses interconnected nodes or neurons in a layered structure that resembles the human brain.

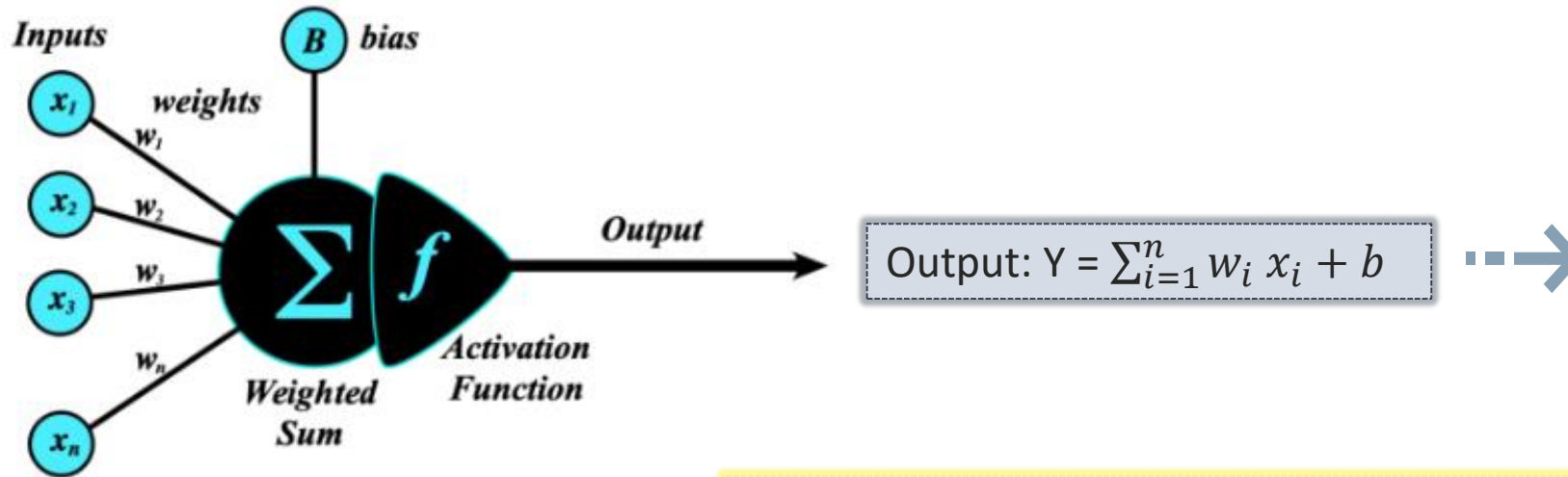
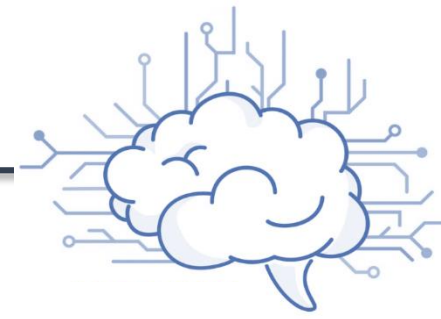


Biological neuron



Artificial neuron (Perceptron)

Basics of Neural Networks :



Later, we will notice that the resulting value will be passed to a function called **Activation Function**

Each sample has 4 features (area, bedrooms, balcony, age)

➤ Features of input examples:

We have 6 samples representing house price dataset

area	bedrooms	balcony	age	price
1200	2	0	2	500000
2300	3	2	5	620000
2500	4	2	1	122500
3650	5	3	3	6000000
1800	3	1	5	2122000
3000	3	1	4	120000

The price of the house is the output

Basics of Neural Networks :



The number of neurons in the input layer = the number of features

➤ Dimensions of arrays (shape of array):

1D array (Vector)

7	2	9	10
---	---	---	----

shape: (4,)

2D array

axis 0 ↓

5.2	3.0	4.5
9.1	0.1	0.3

shape: (2, 3)

3D array

1	2	3	4
4	7	7	4
2	9	7	5
1	3	7	2
9	6	0	0
		9	8

shape: (4, 3, 2)

Rule For Matrix Multiplication

$$\begin{array}{ccccc} A & . & B & = & AB \\ m \times n & & n \times p & & m \times p \\ \downarrow & & \downarrow & & \downarrow \\ & \text{Equal} & & & \text{Dimensions of } AB \end{array}$$

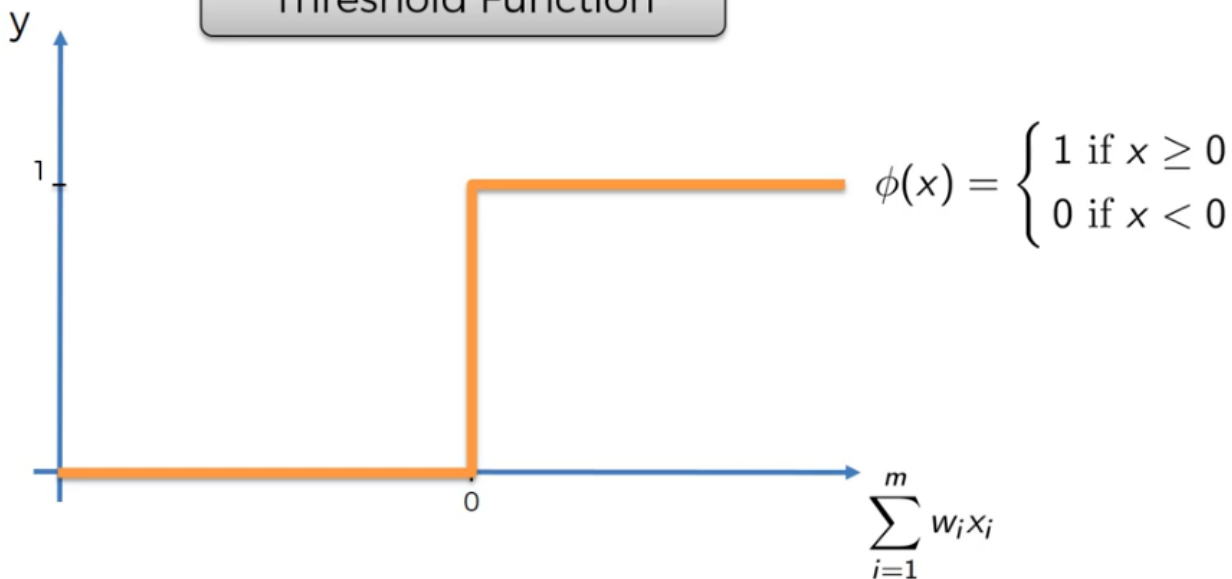
The Activation Function :



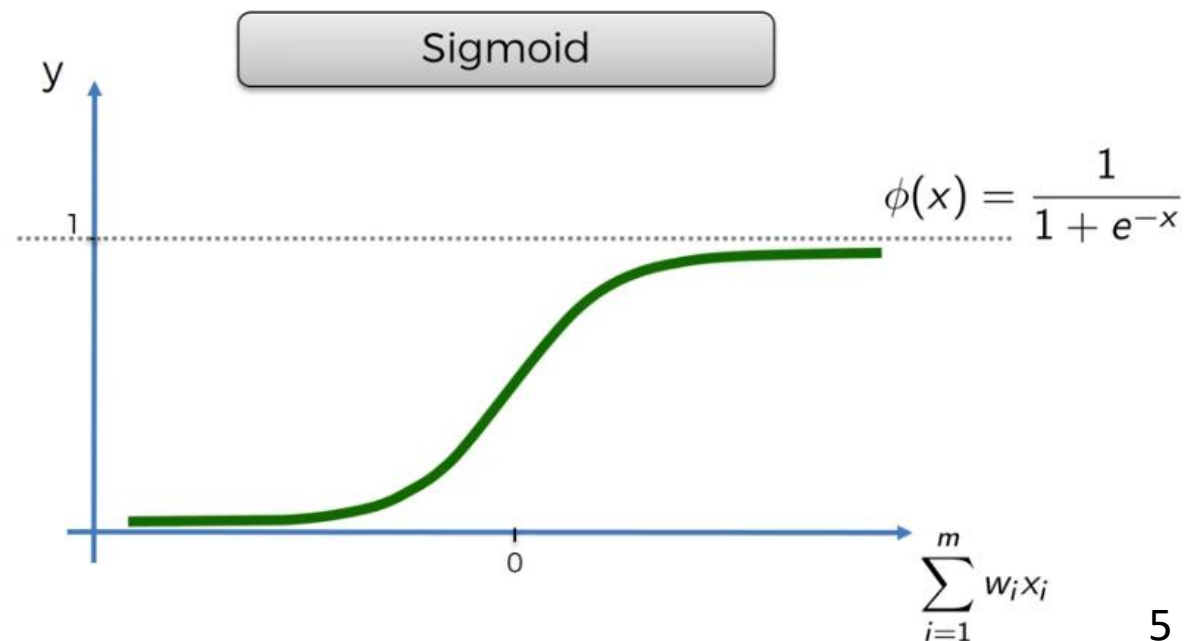
Activation Function is a mathematical function that introduces non-linearity to the output of a neuron.

It is applied to the output of each neuron in a neural network layer, transforming the input into a more useful and meaningful representation. **This allows the neural network to model complex relationships between inputs and outputs.**

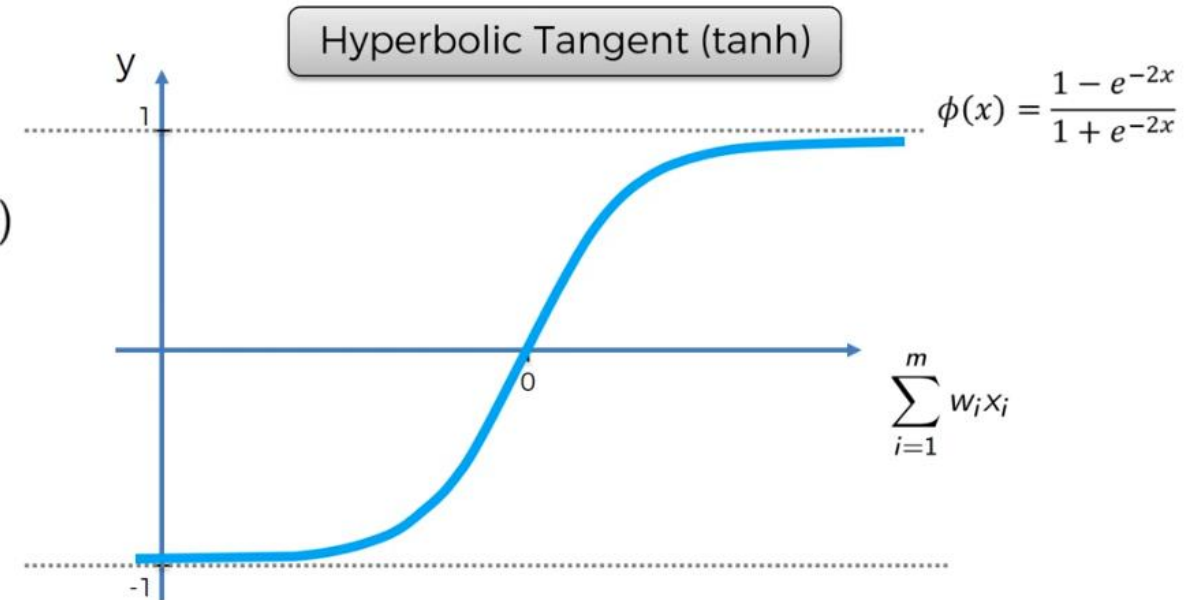
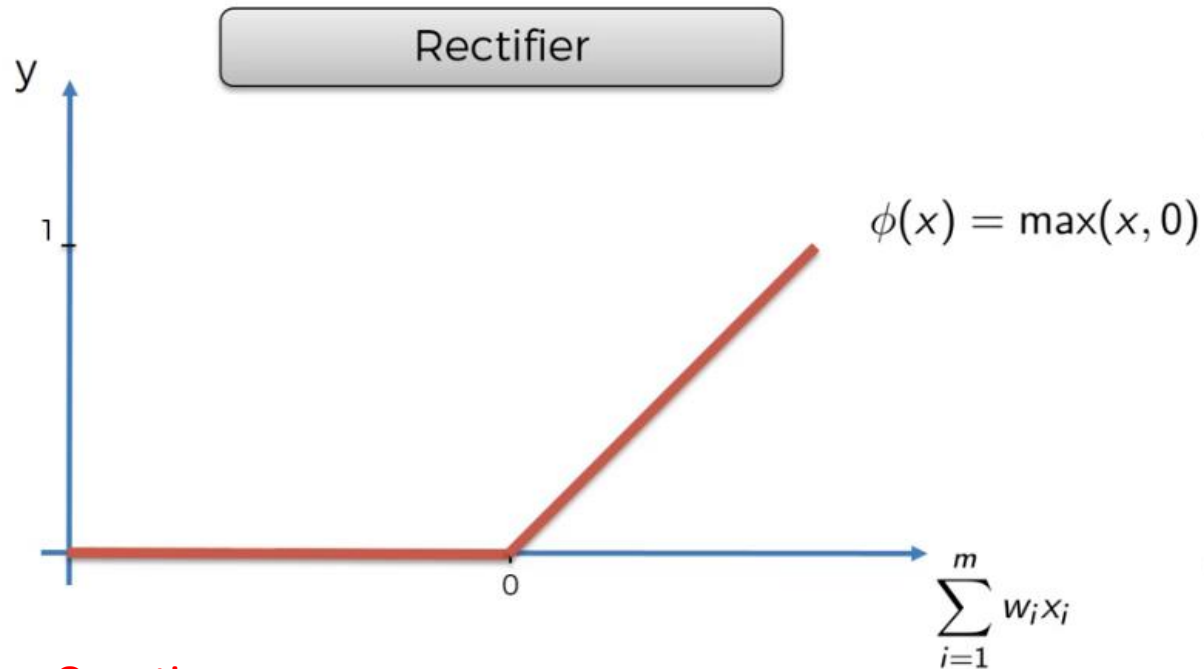
Threshold Function



Sigmoid



The Activation Function :



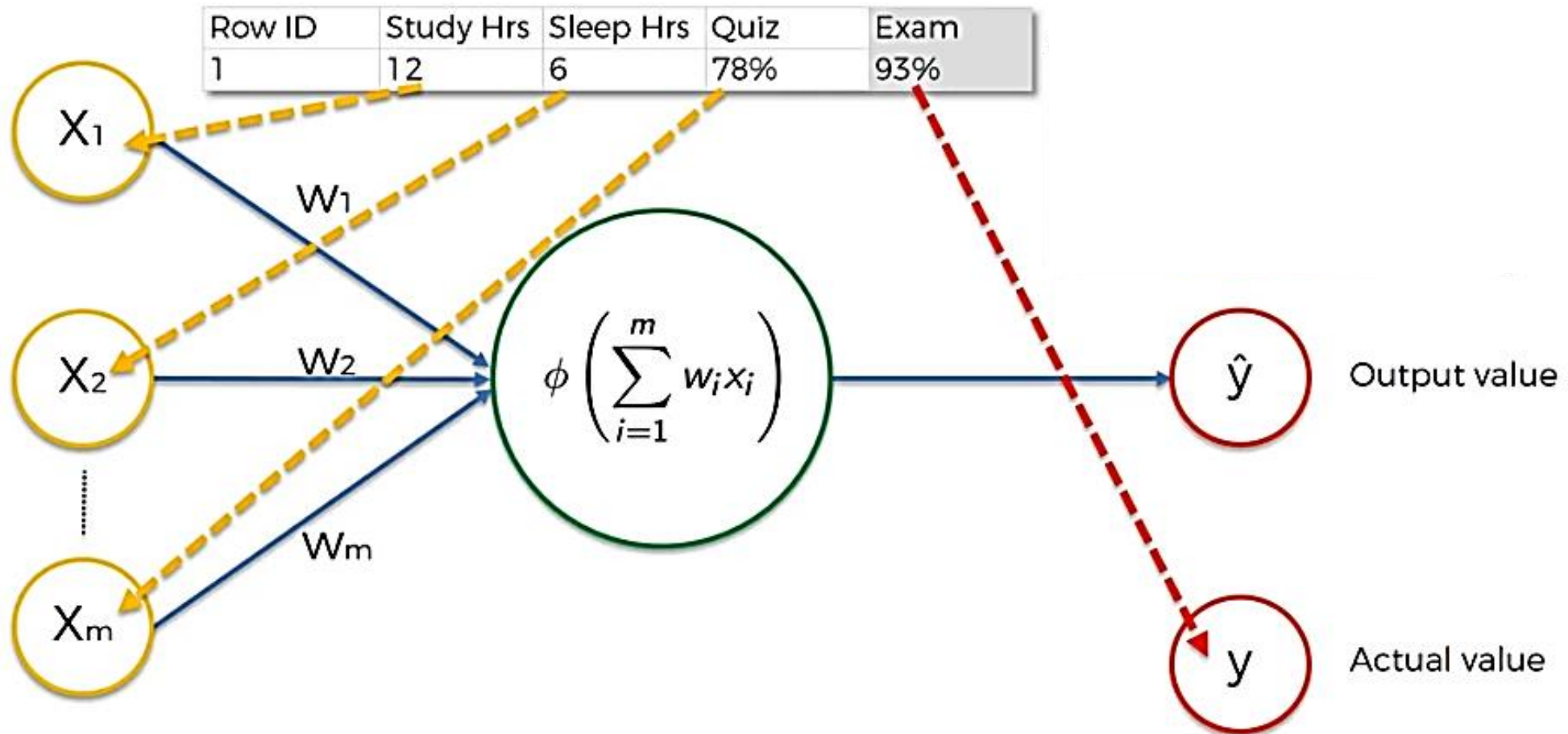
Question :

Assuming that the output is binary ($y = 0$ or $y = 1$), what is the suitable activation function ?

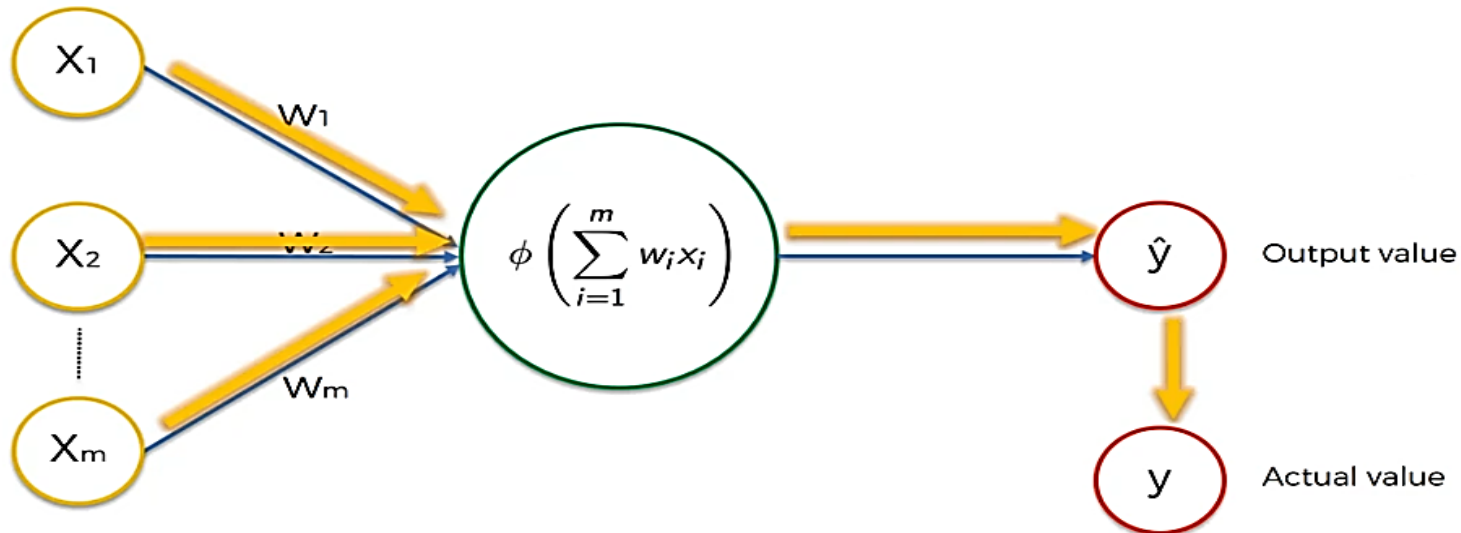
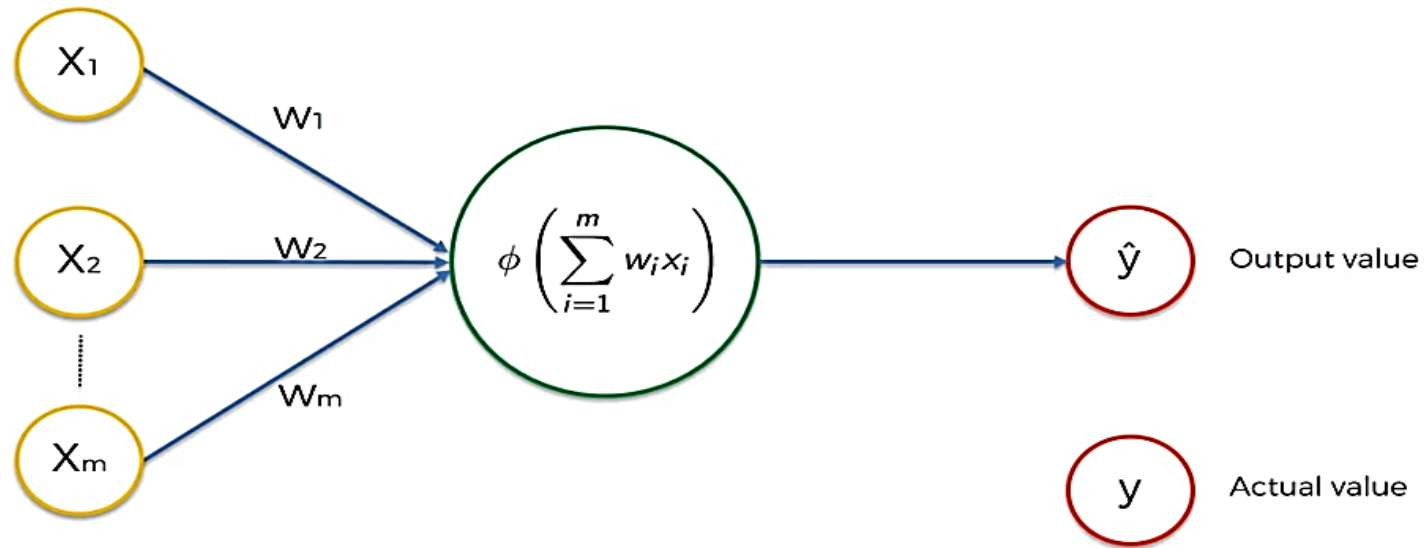
If threshold activation function: $y = \phi \left(\sum_{i=1}^m w_i x_i \right)$

If sigmoid activation function: $\mathbb{P}(y = 1) = \phi \left(\sum_{i=1}^m w_i x_i \right)$

How do Neural Networks learn ?

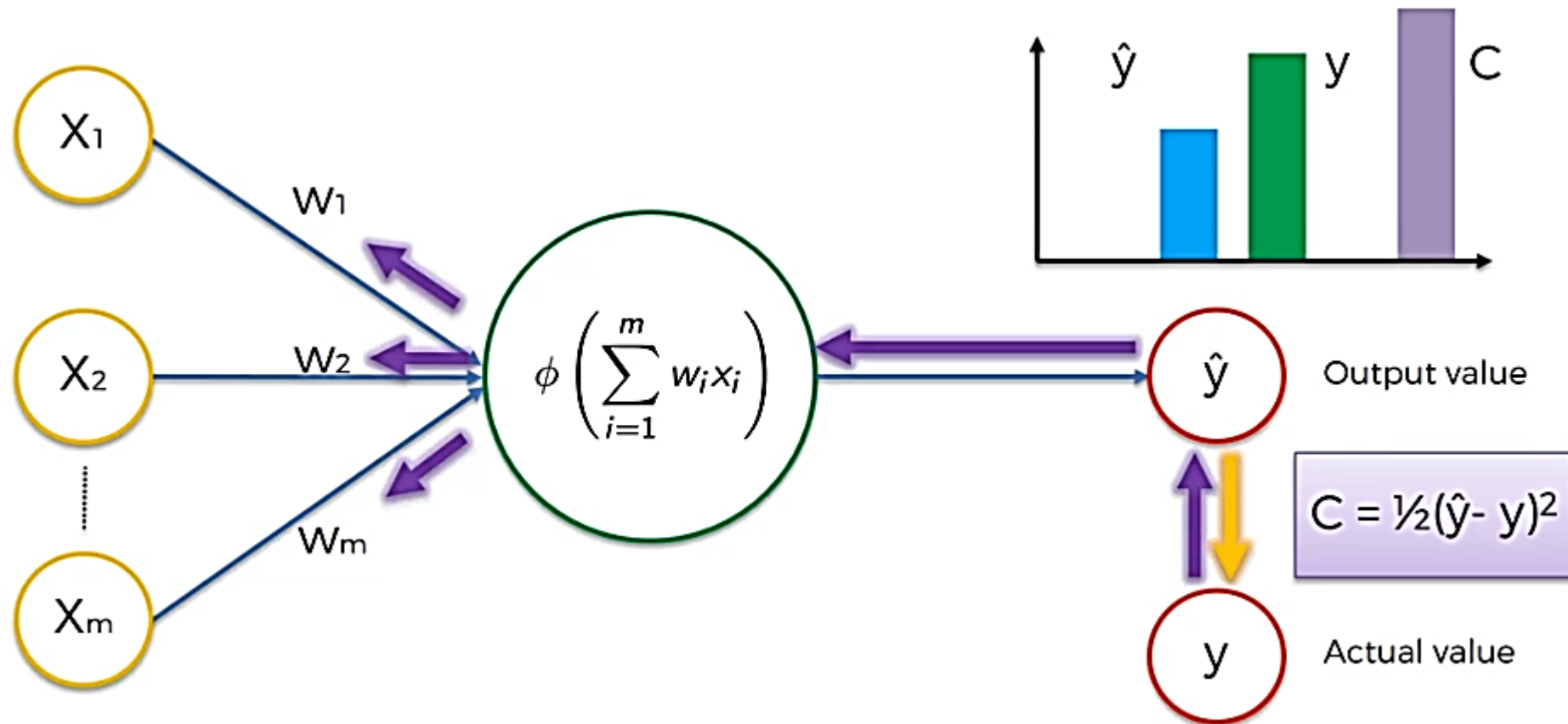


How do Neural Networks learn ?

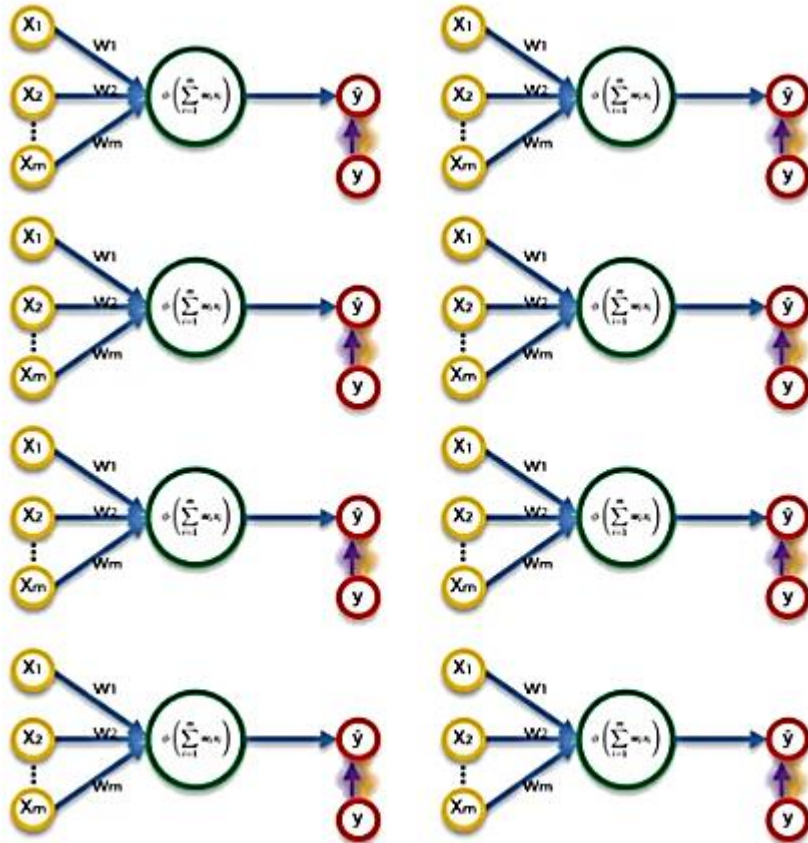


$$C = \frac{1}{2}(\hat{y} - y)^2$$

How do Neural Networks learn ?



How do Neural Networks learn ?

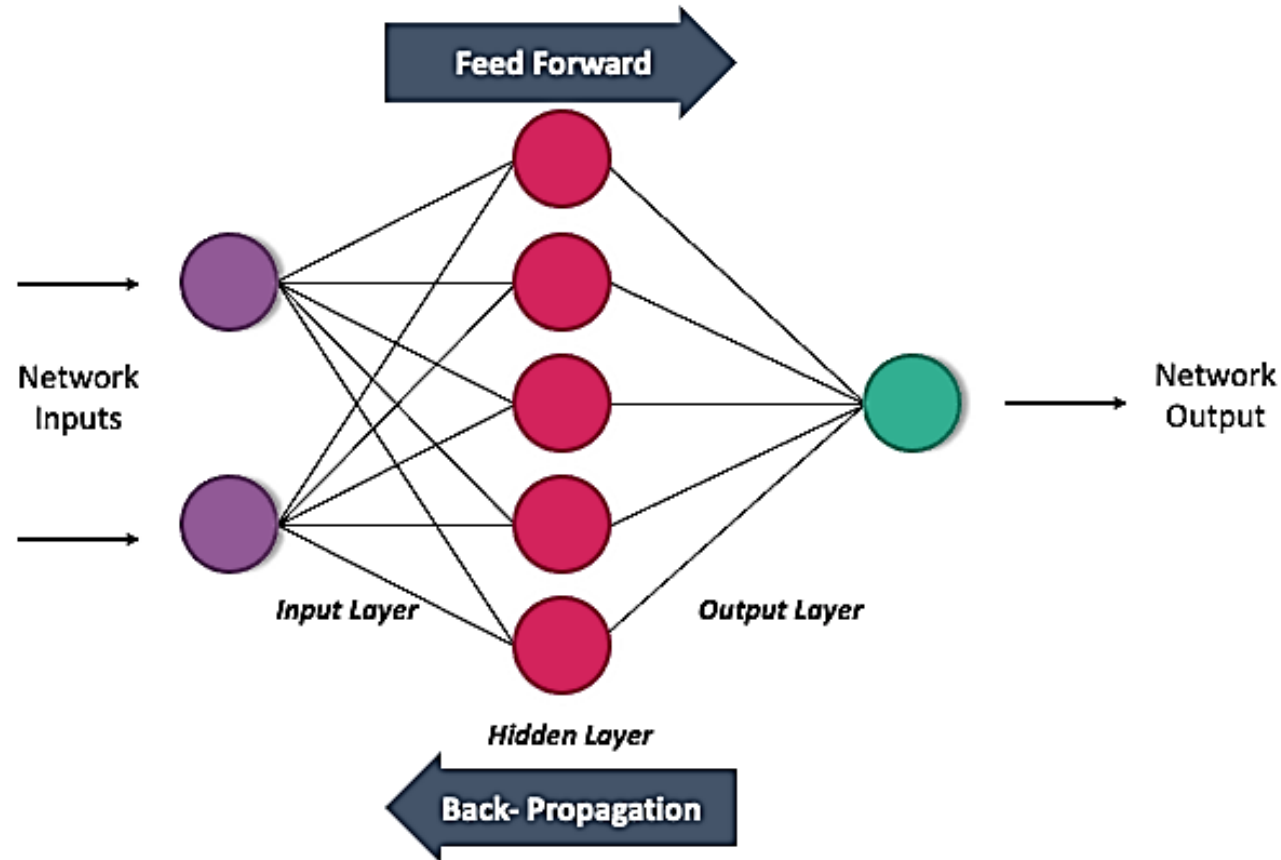


Row ID	Study Hrs	Sleep Hrs	Quiz	Exam
1	12	6	78%	93%
2	22	6.5	24%	68%
3	115	4	100%	95%
4	31	9	67%	75%
5	0	10	58%	51%
6	5	8	78%	60%
7	92	6	82%	89%
8	57	8	91%	97%

$$C = \sum \frac{1}{2}(\hat{y} - y)^2$$



How do Neural Networks learn ?



Any question?

