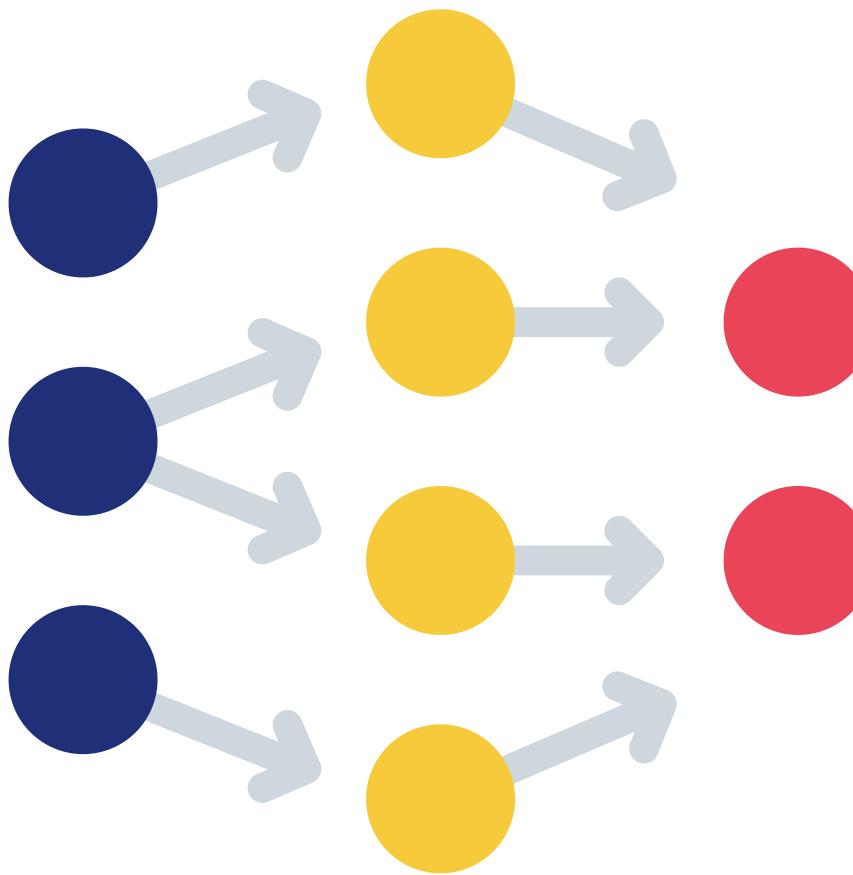
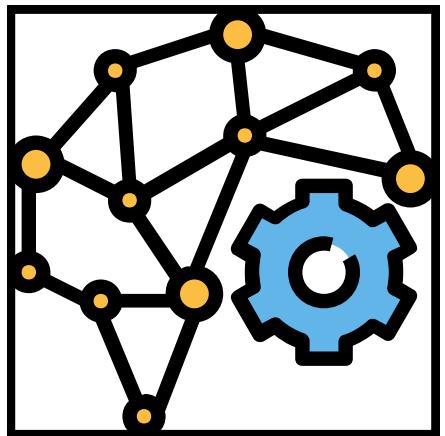


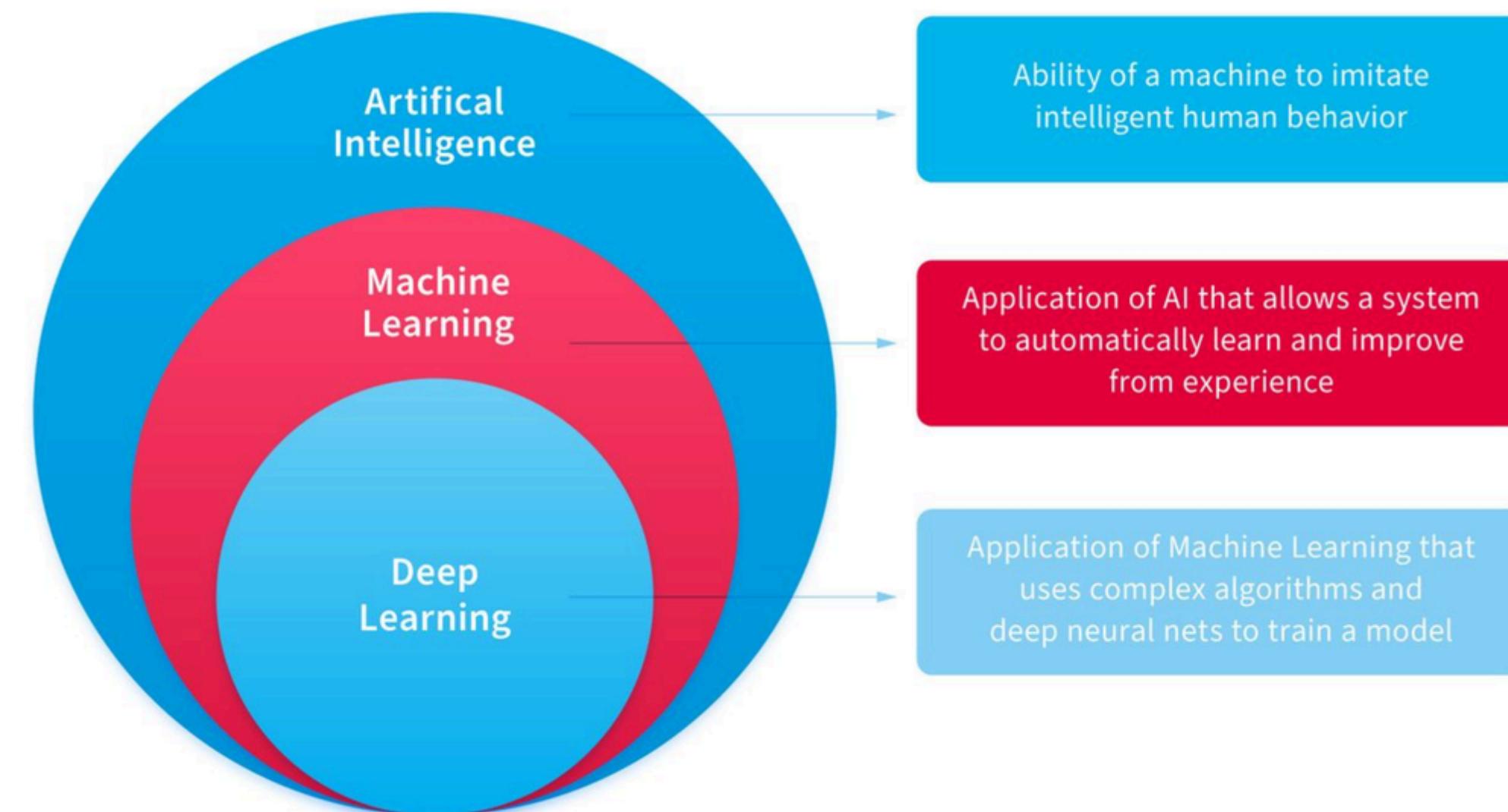
What is Deep Learning?



Meet Deep Learning



- **Deep Learning** is a branch of machine learning that uses complex algorithm and deep neural networks to train a model.



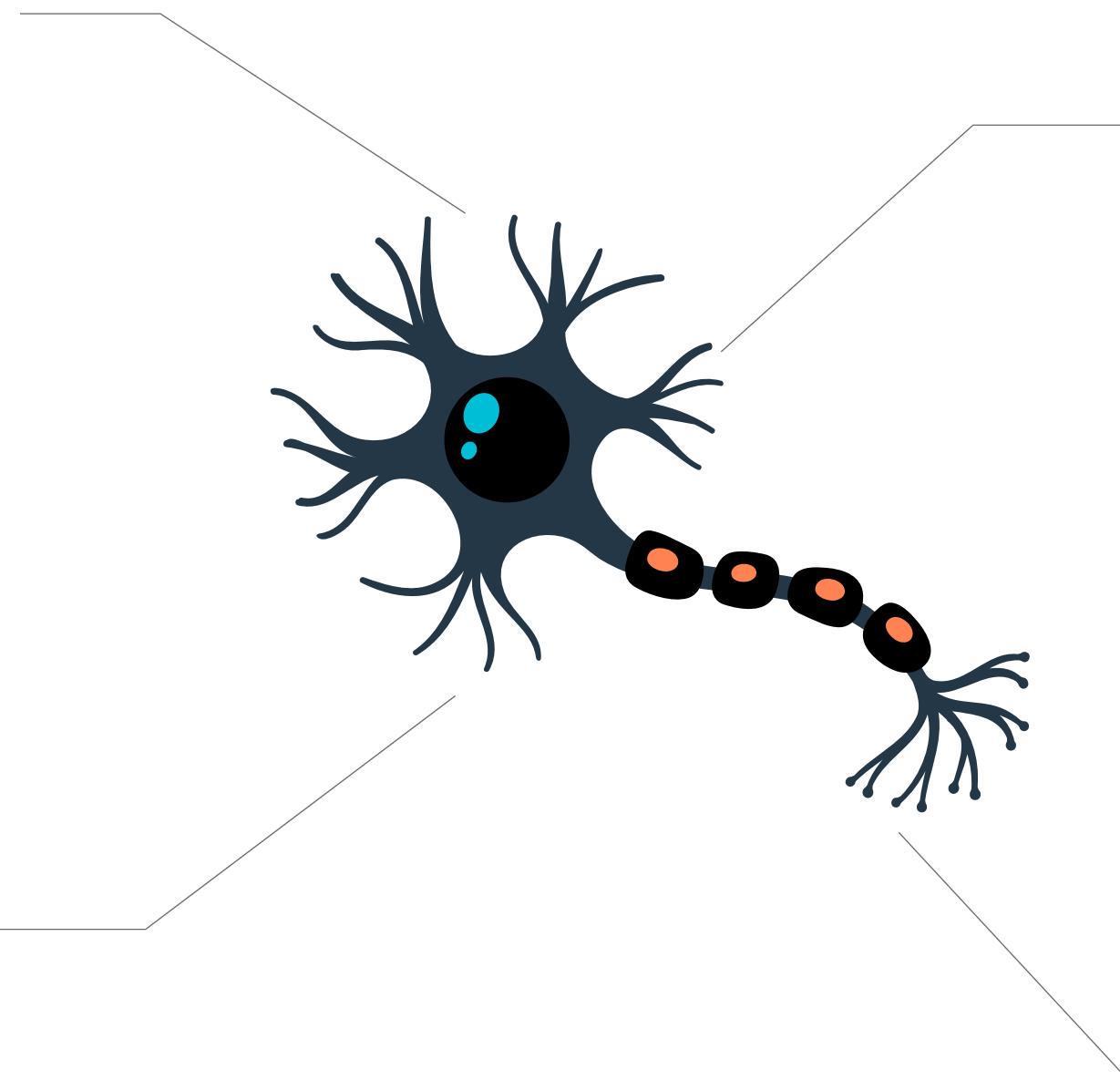
WHAT IS NEURON

The brain has over **100 billion** neurons communicating through electrical and chemical signals.

Neurons communicate with each other and help us see, think, and generate ideas.

Human brain learns by creating connections among these neurons.

ANNs are information processing models inspired by the human brain.



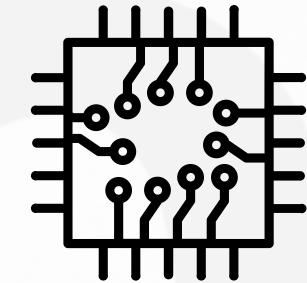
WHY DEEP LEARNING NOW?

In general, three technical forces are driving advances in machine learning:



I. Big Data

- Larger Datasets
- Easier Collection
- Storage



II. Hardware

- Graphics Processing Units (GPUs)
- Massively Parallelizable



III. Software

- Improved Techniques
- New Models
- Toolboxes

Types of Deep Learning

SUPERVISED

Artificial Neural Networks

Convolutional Neural Networks

Recurrent Neural works

UNSUPERVISED

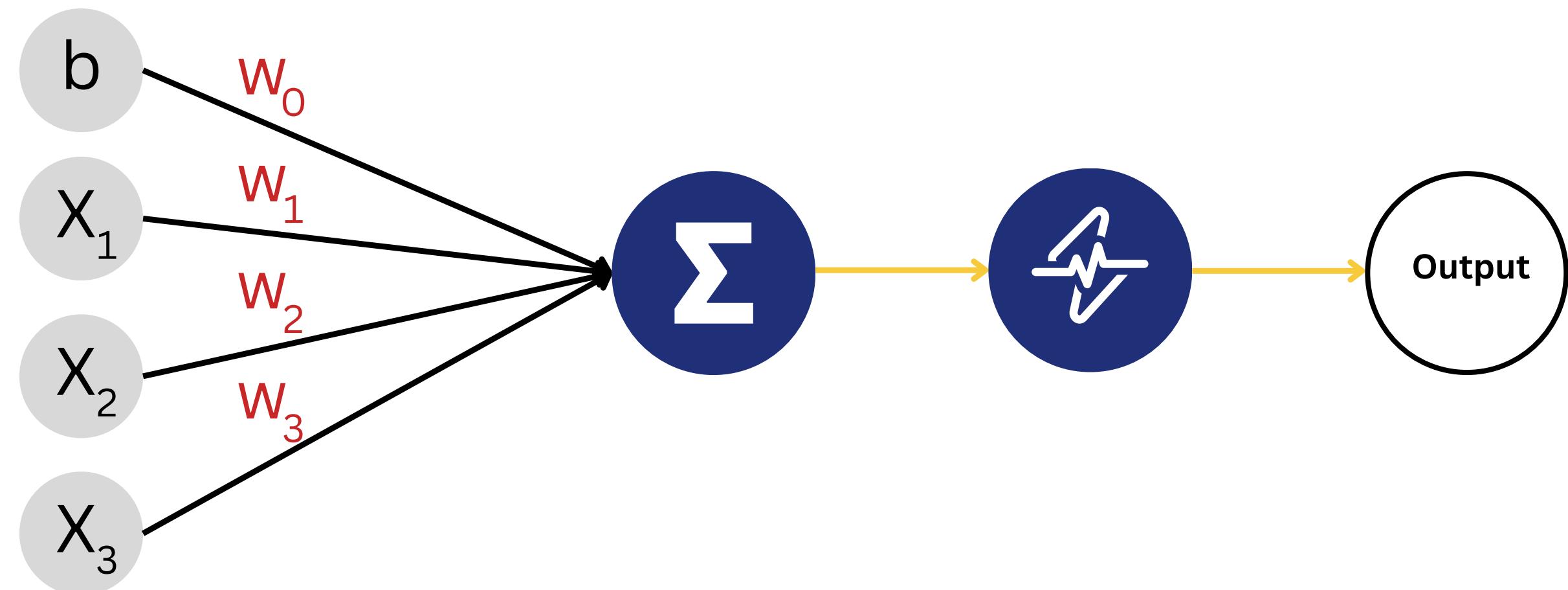
Self-Organizing Maps

Deep Boltzmann Machines

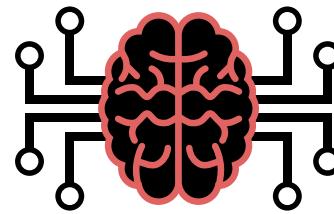
AutoEncoders

The Perceptron

$$\hat{y} = g \left(\sum_{i=1}^m x_i y_i \right)$$



The PERCEPTRON



In this section, we'll learn about the **perceptron**, which is the first step in our journey to understand **deep learning**. A basic understanding of **neurons** is a necessary feature in deep learning.

TOPICS WE'LL COVER:

INPUT LAYER

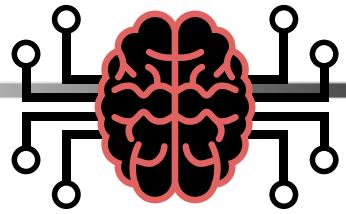
HIDDEN LAYER

WEIGHT

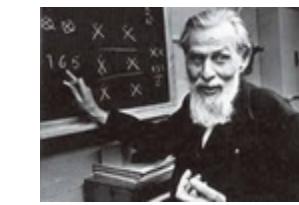
ACTIVATION
FUNCTION

GOALS FOR THIS SECTION:

- Understand the Perceptron
- Understand the input layer
- Gain knowledge about the hidden layer
- Explore the concept of weights
- Learn about activation functions



THE PERCEPTRON



Warren Sturgis
McCulloch



INPUT LAYER

HIDDEN LAYER

WIEGHT

ACTIVATION
FUNCTION

INPUT LAYER

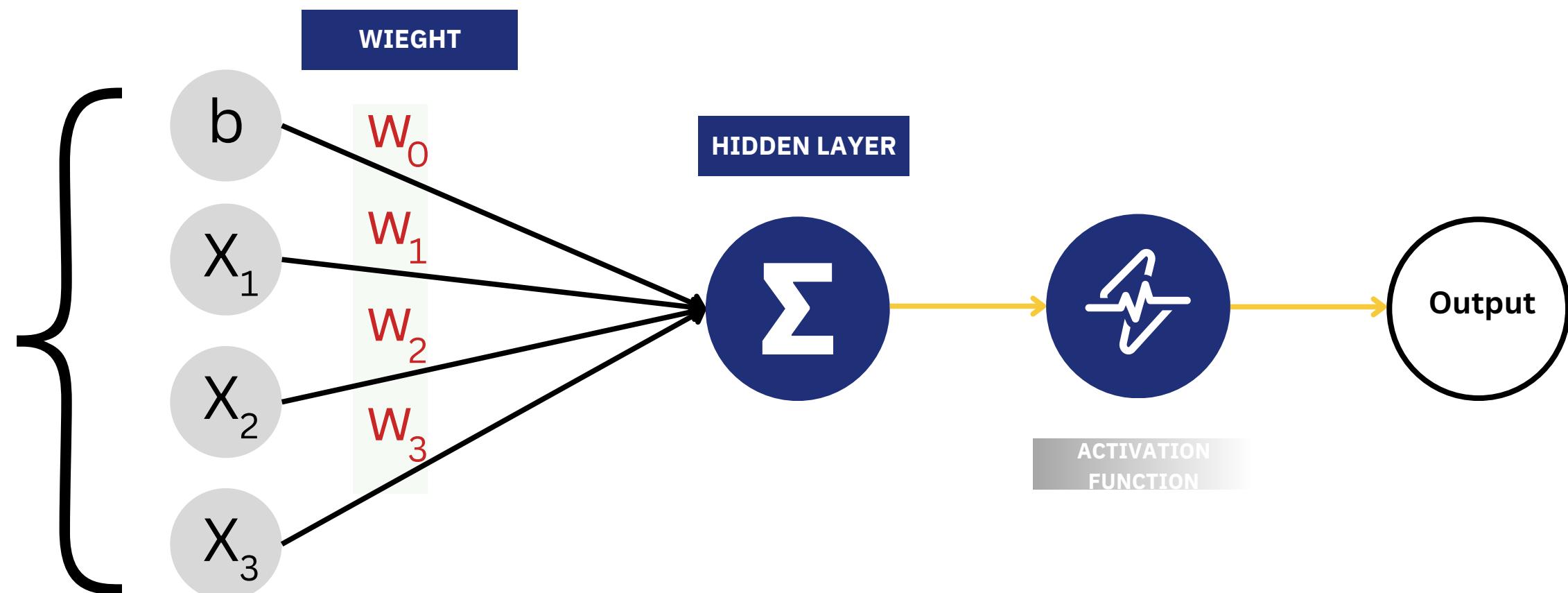
WIEGHT

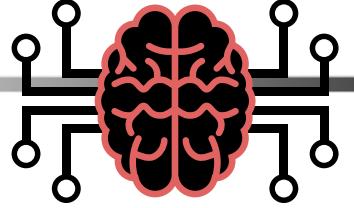
HIDDEN LAYER

Σ

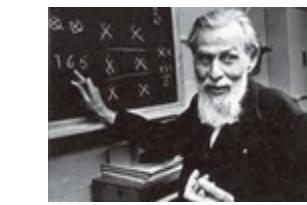
ACTIVATION
FUNCTION

Output





THE PERCEPTRON



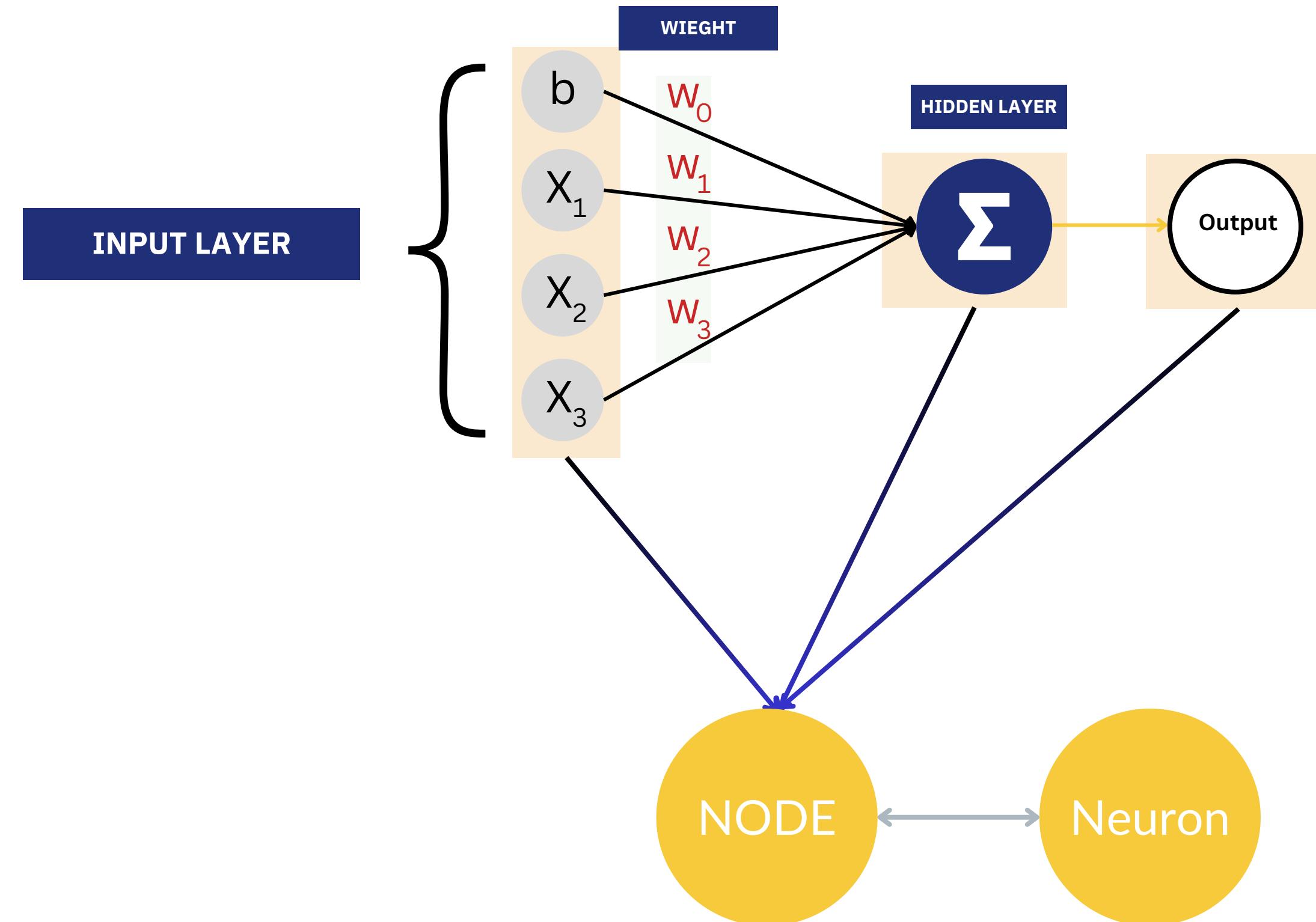
Warren Sturgis
McCulloch

INPUT LAYER

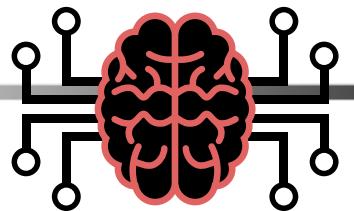
HIDDEN LAYER

WIEGHT

ACTIVATION
FUNCTION



THE INPUT LAYER



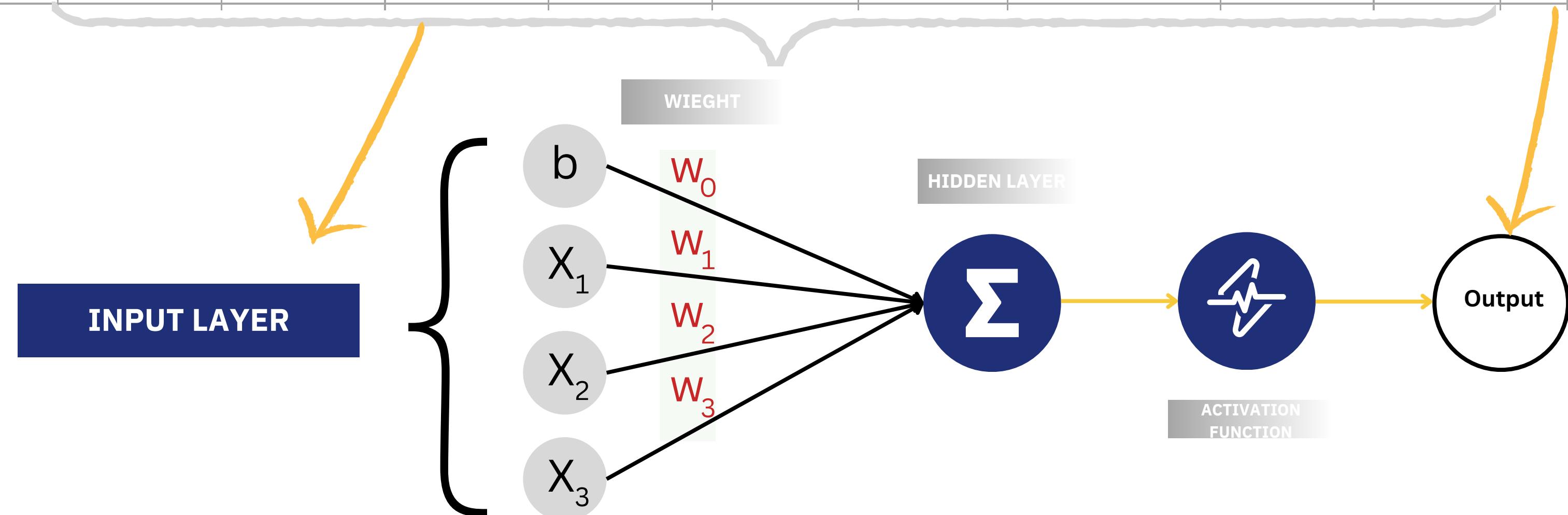
INPUT LAYER

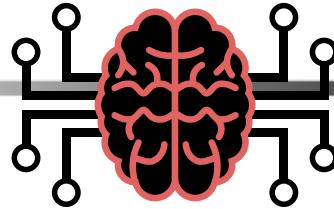
HIDDEN LAYER

WEIGHT

**ACTIVATION
FUNCTION**

Churn	DeviceProtection	TechSupport	StreamingTV	StreamingMovies	Contract	PaperlessBilling	PaymentMethod	MonthlyCharges	TotalCharges	SUNRISE INSTITUTE	Churn
No	No	No	No	No	Month-to-month	Yes	Electronic check	29.85	29.85	No	No
Yes	No	No	No	No	One year	No	Mailed check	56.95	1889.5	No	No
No	No	No	No	No	Month-to-month	Yes	Mailed check	53.85	108.15	Yes	Yes
Yes	Yes	No	No	No	One year	No	Bank transfer (automatic)	42.3	1840.75	No	No
No	No	No	No	No	Month-to-month	Yes	Electronic check	70.7	151.65	Yes	Yes
Yes	No	Yes	Yes	Yes	Month-to-month	Yes	Electronic check	99.65	820.5	Yes	Yes
No	No	Yes	No	No	Month-to-month	Yes	Credit card (automatic)	89.1	1949.4	No	No
No	No	No	No	No	Month-to-month	No	Mailed check	29.75	301.9	No	No





Example Input Layer

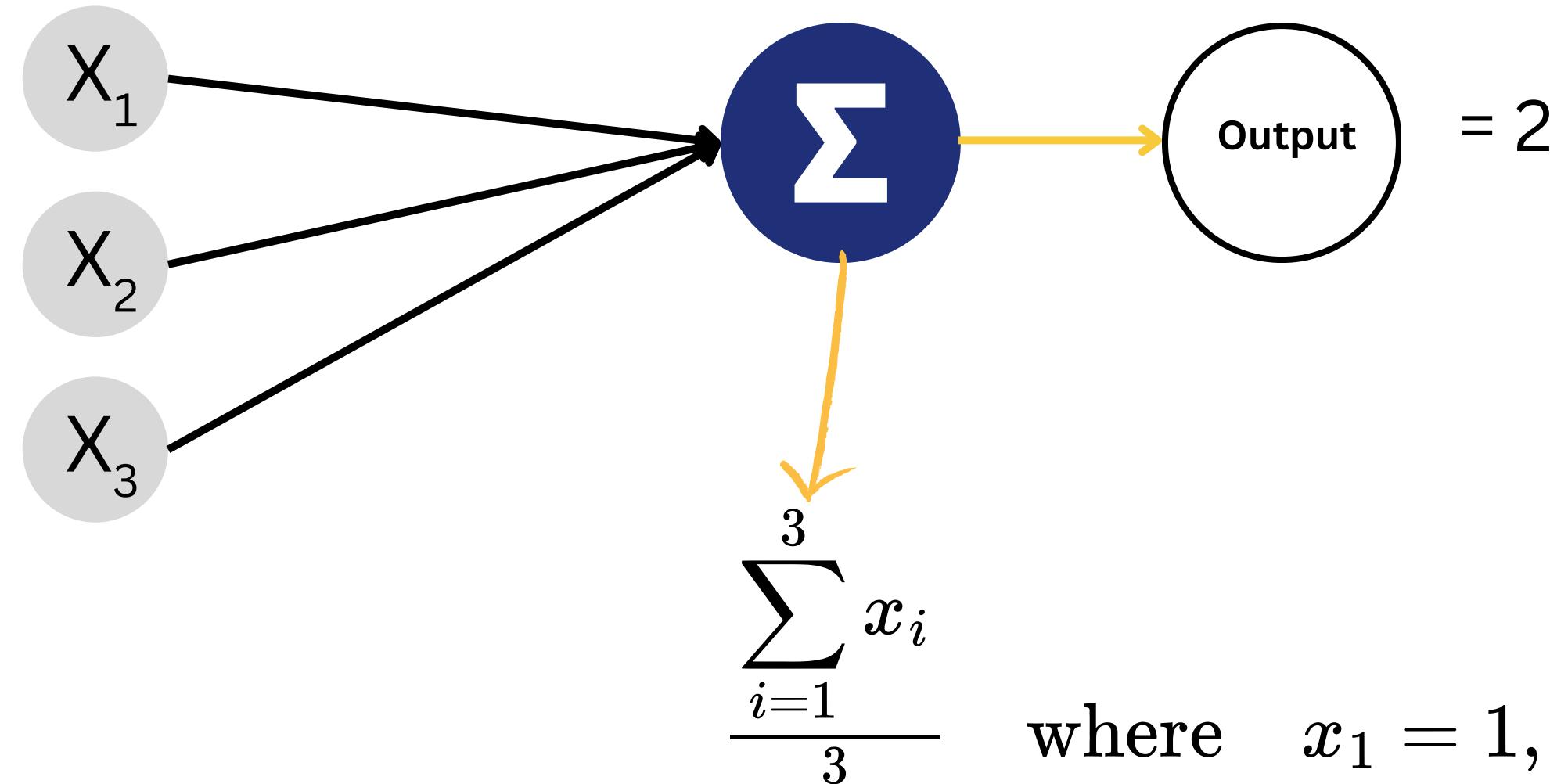
If we have: $x_1 = 1$ $x_2 = 2$ $x_3 = 3$

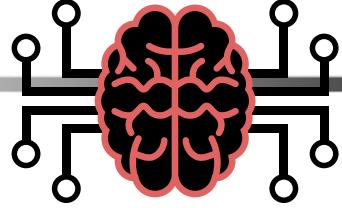
INPUT LAYER

HIDDEN LAYER

WEIGHT

**ACTIVATION
FUNCTION**





Example Input Layer

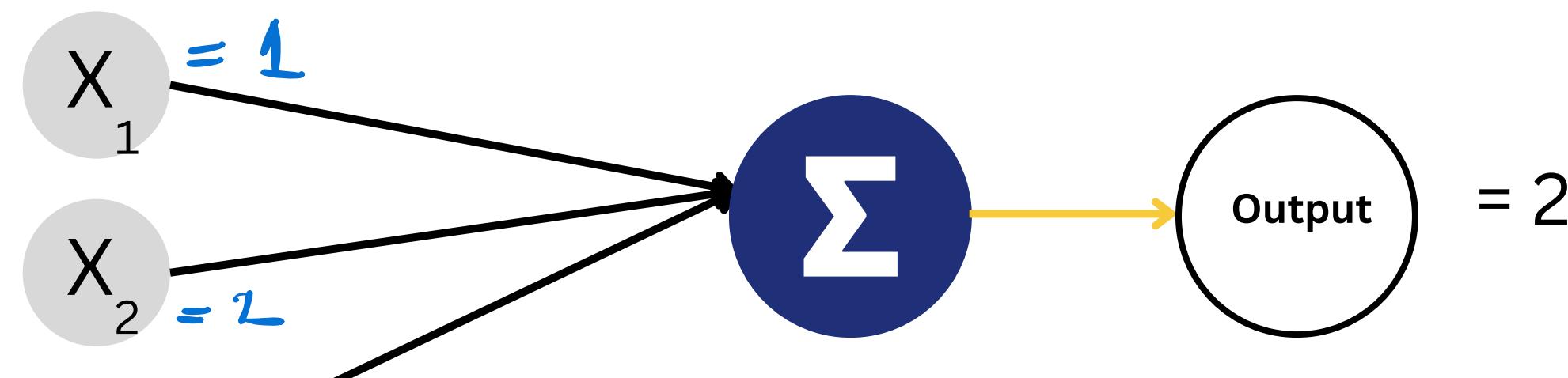
If we have: $x_1 = 1$ $x_2 = 2$ $x_3 = 3$

INPUT LAYER

HIDDEN LAYER

WEIGHT

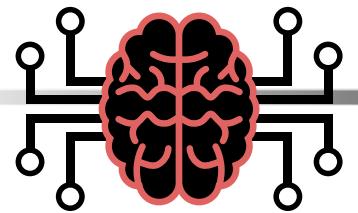
ACTIVATION
FUNCTION



An average
machine

$$\frac{\sum_{i=1}^3 x_i}{3} \quad \text{where } x_1 = 1, x_2 = 2, x_3 = 3$$

THE HIDDEN LAYER



INPUT LAYER

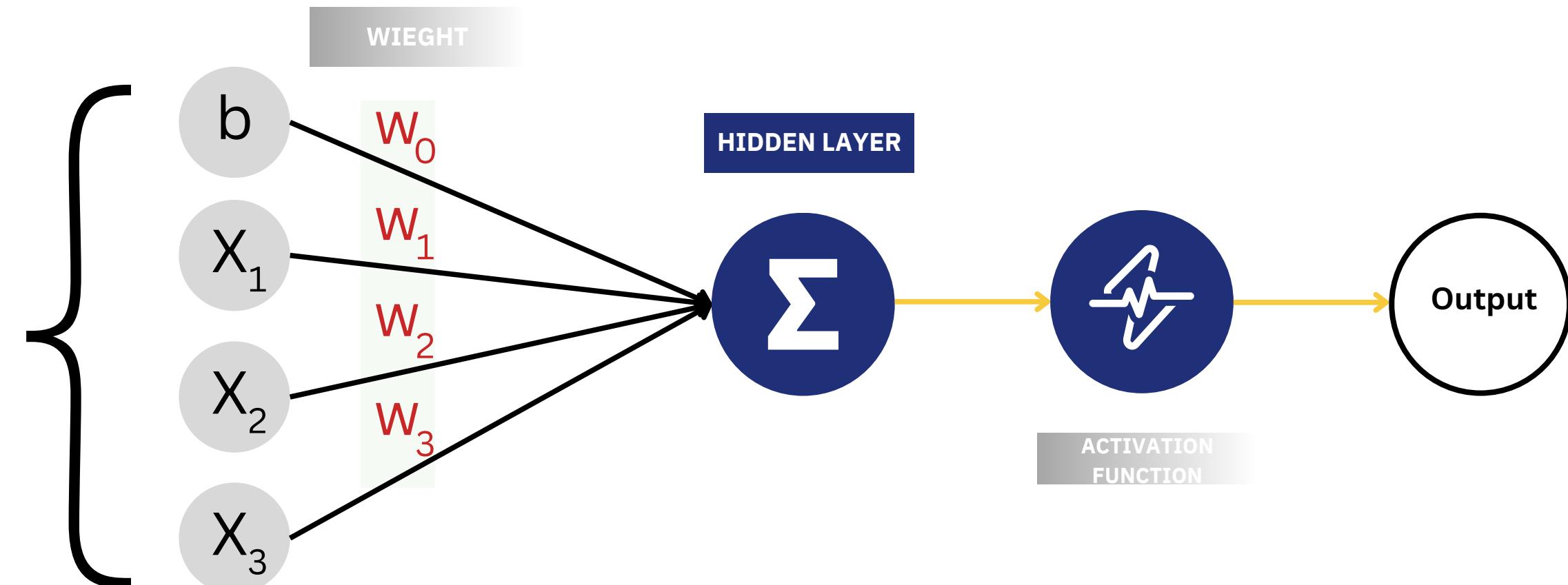
Hidden layer is an intermediate layer of neurons between the **input layer** (where the data is received) and the **output layer** (where the result is produced).

HIDDEN LAYER

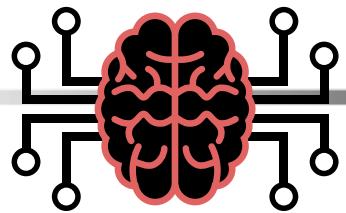
WIEGHT

INPUT LAYER

ACTIVATION
FUNCTION



Example Hidden Layer



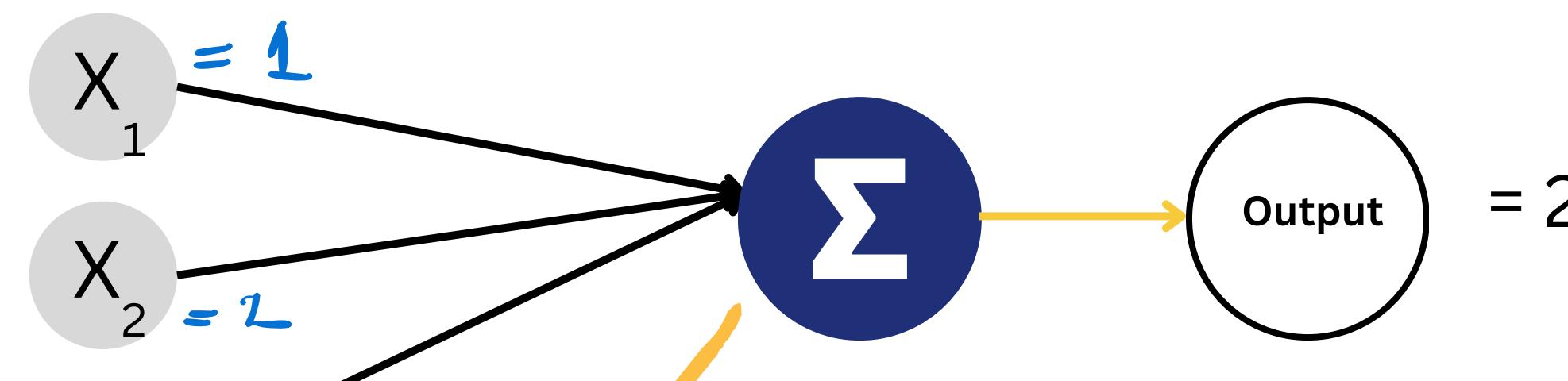
If we have: $x_1 = 1$ $x_2 = 2$ $x_3 = 3$

INPUT LAYER

HIDDEN LAYER

WEIGHT

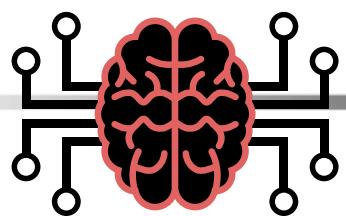
ACTIVATION
FUNCTION



$$\sum_{i=1}^3 x_i$$

where $x_1 = 1, x_2 = 2, x_3 = 3$

THE WIEGHT



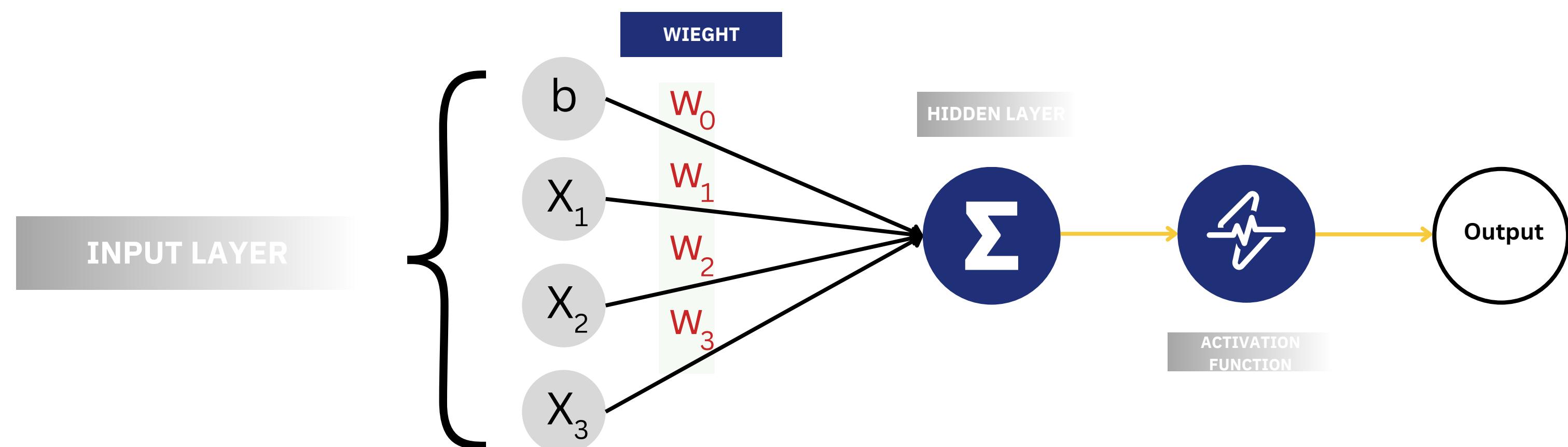
In **machine learning**, the **perceptron** (or **McCulloch–Pitts neuron**) is an algorithm for **supervised learning** of **binary classifiers**.

INPUT LAYER

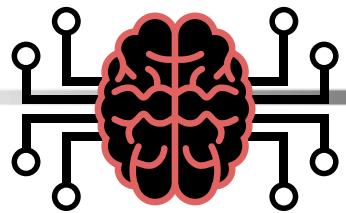
HIDDEN LAYER

WIEGHT

ACTIVATION
FUNCTION



Example WIEGHT



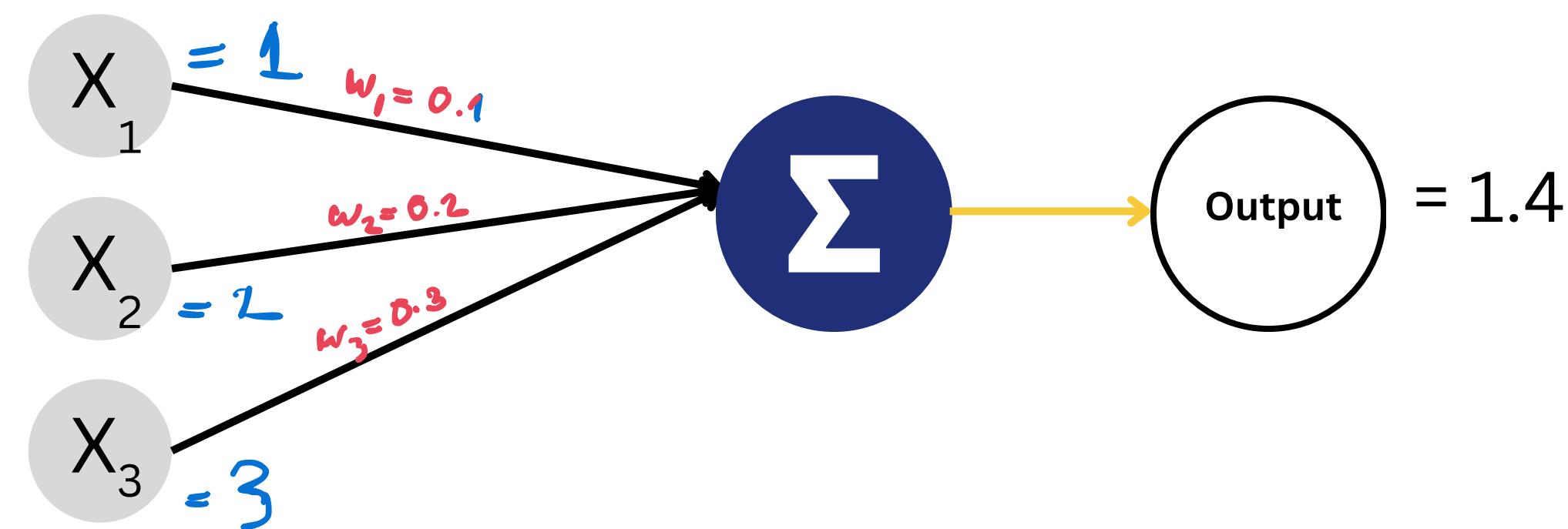
If we have: $x_1 = 1, x_2 = 2, x_3 = 3$
 $w_1 = 0.1, w_2 = 0.2, w_3 = 0.3$

INPUT LAYER

HIDDEN LAYER

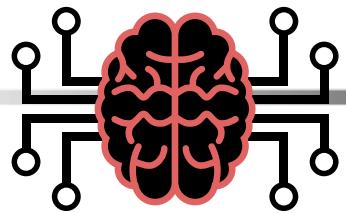
WIEGHT

ACTIVATION
FUNCTION



$$z = \sum_{i=1}^3 w_i x_i = (0.1 \cdot 1) + (0.2 \cdot 2) + (0.3 \cdot 3)$$

THE ACTIVATION FUNCTION



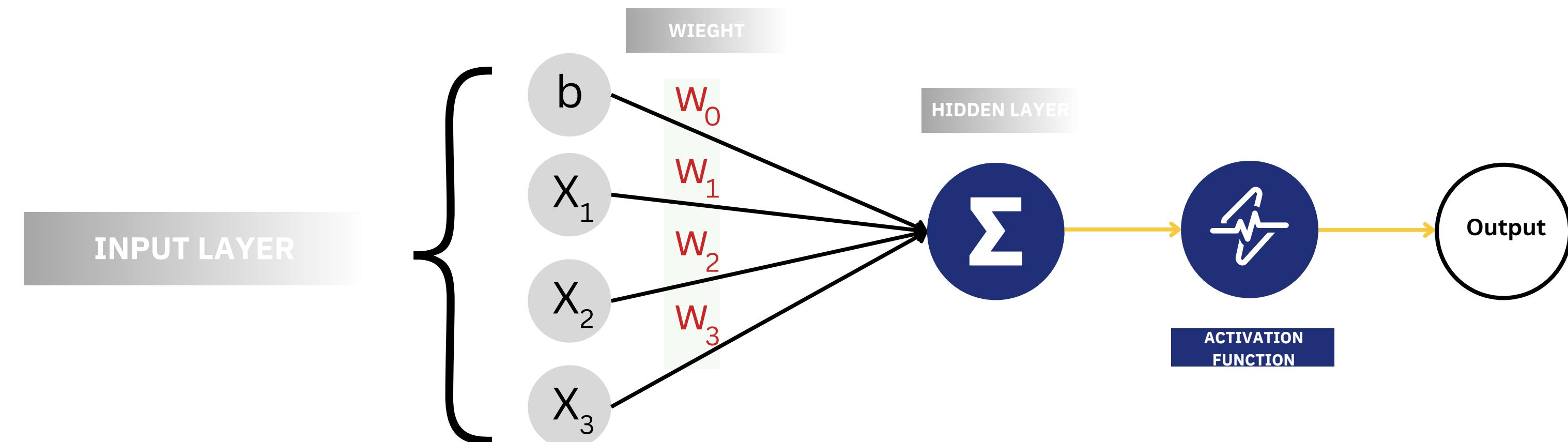
INPUT LAYER

HIDDEN LAYER

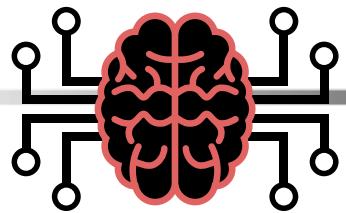
WIEGHT

ACTIVATION
FUNCTION

The **activation function** of a node in an artificial neural network is a function that calculates the output of the node based on its individual inputs and their weights.



Example WIEGHT



If we have: $x_1 = 1, x_2 = 2, x_3 = 3$

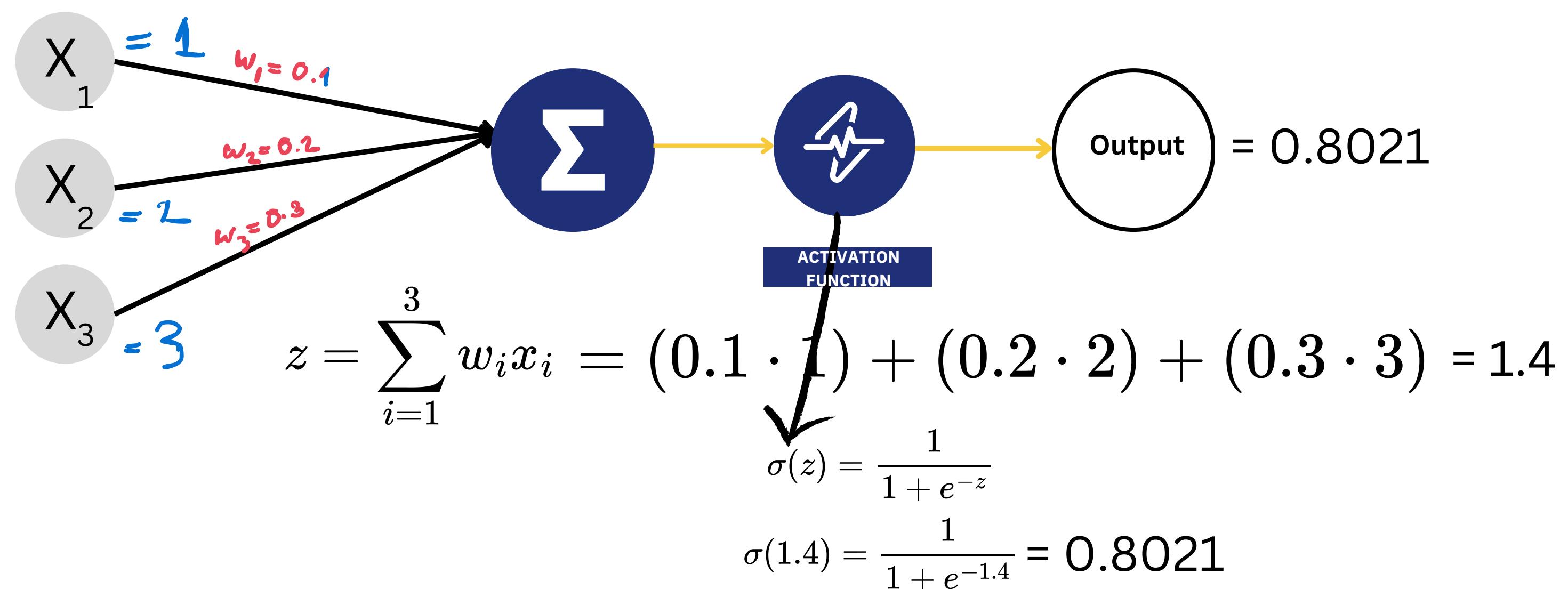
$w_1 = 0.1, w_2 = 0.2, w_3 = 0.3$

INPUT LAYER

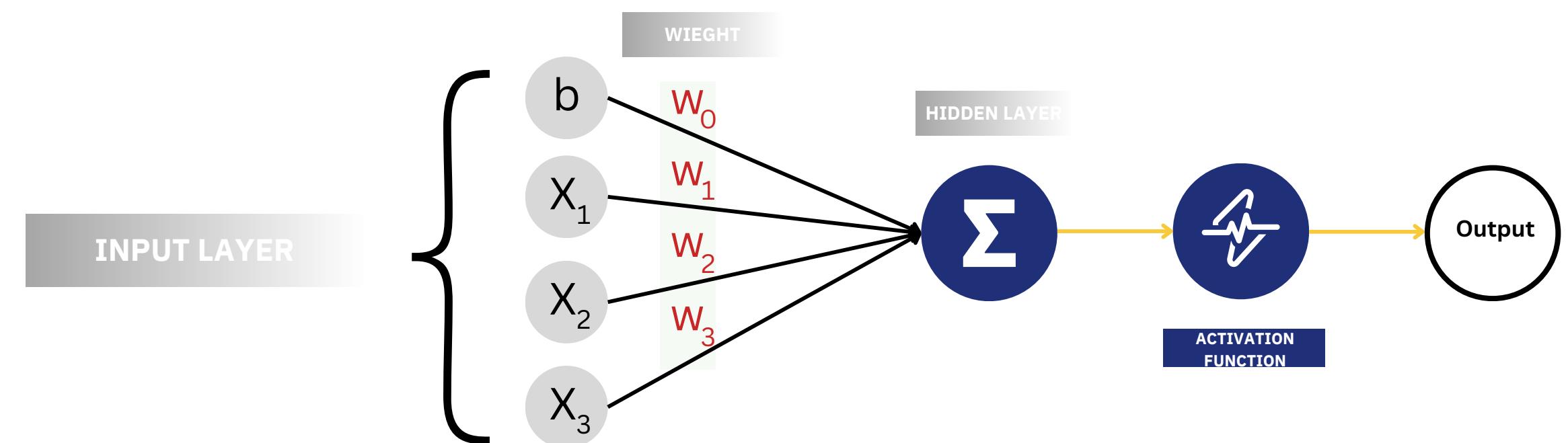
HIDDEN LAYER

WIEGHT

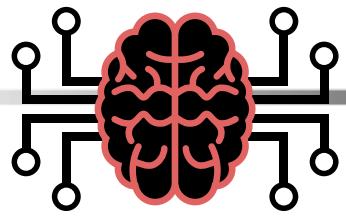
ACTIVATION
FUNCTION



The Activation Function



COMMON ACTIVATION FUNCTION

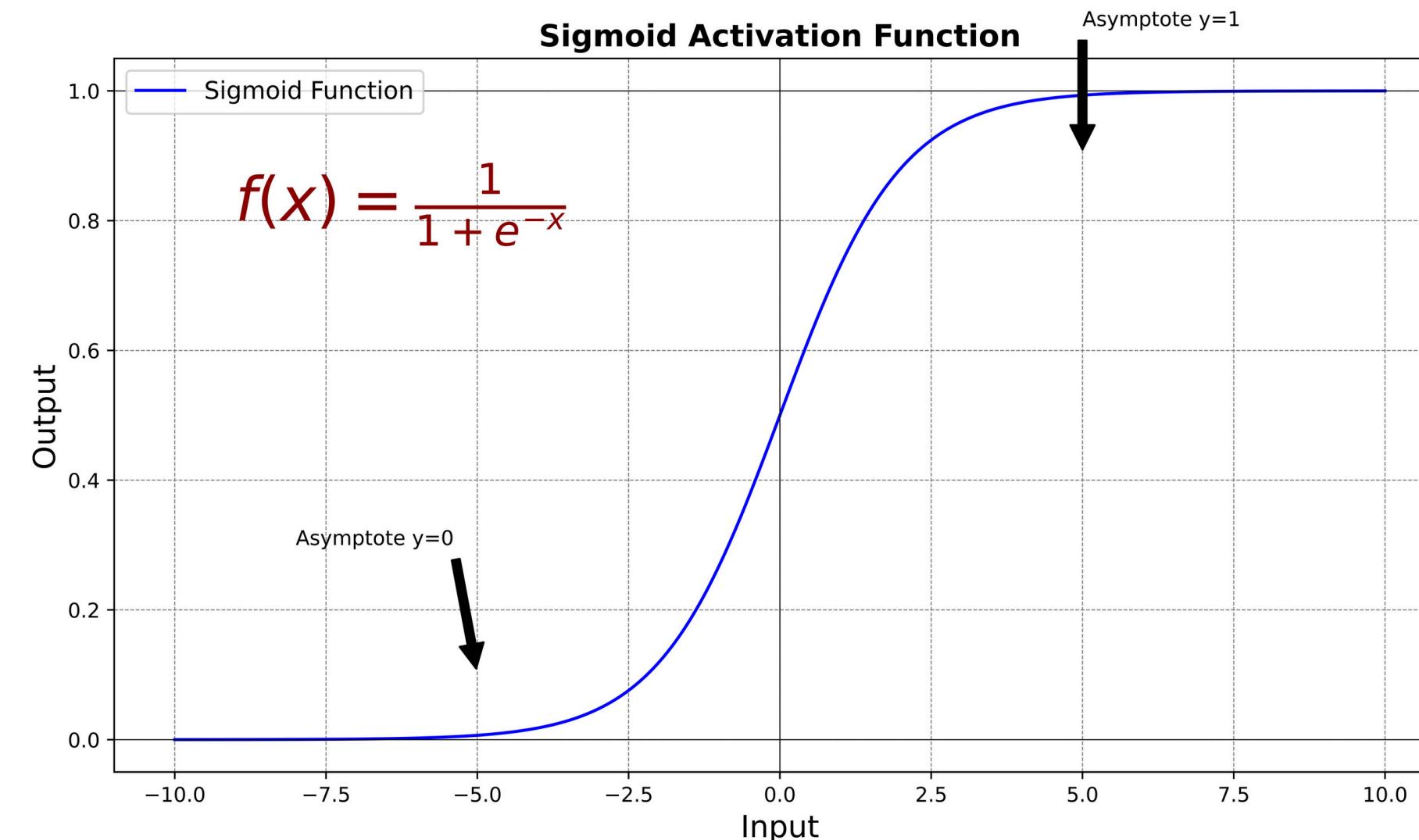


INPUT LAYER

HIDDEN LAYER

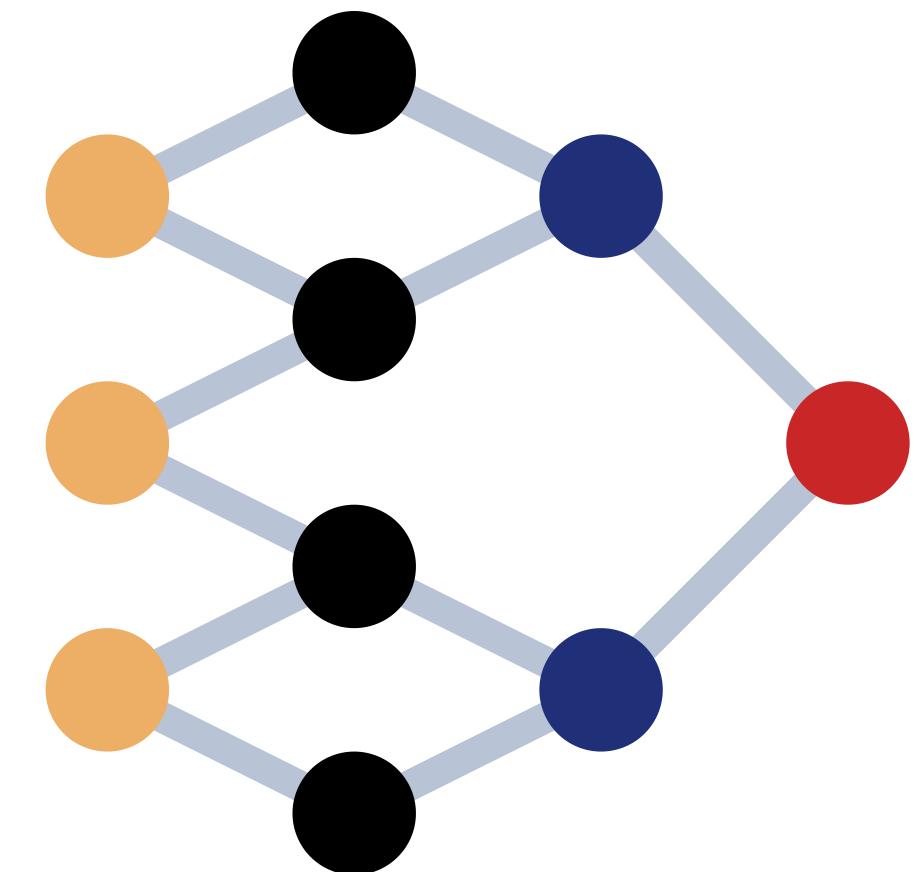
WIEGHT

ACTIVATION
FUNCTION

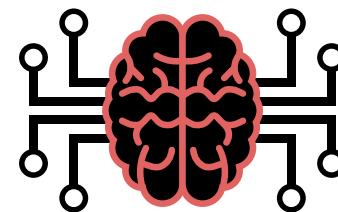


The Artificial Neural Networks

$$z_{k,i} = w_{0,i}^{(k)} + \sum_{j=1}^{n_{k-1}} g(z_{k-1,j}) w_{j,i}^{(k)}$$



The Artificial Neural Networks



In this section, we'll learn about Analyze the key computations underlying deep learning, then use them to build and train deep neural networks

TOPICS WE'LL COVER:

L-Layer

Forward Propagation

WEIGHT

ACTIVATION
FUNCTION

GOALS FOR THIS SECTION:

- Describe the successive block structure of a deep neural network
- Build a deep L-layer neural network
- Analyze matrix and vector dimensions to check neural network implementations
- Use a cache to pass information from forward to back propagation
- Explain the role of hyperparameters in deep learning
- Build a 2-layer neural network

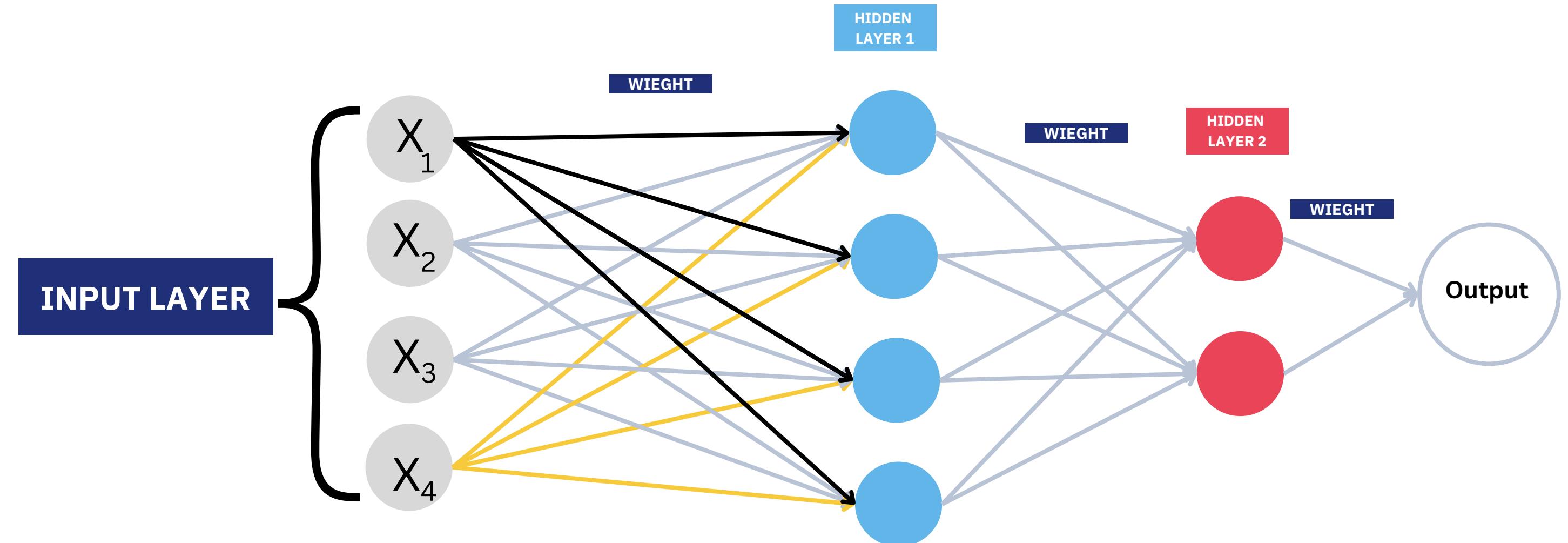
L-Layer Neural Network

L-Layer Neural Network

Forward Propagation

Types of Regression

The Model Workflow



Forward Propagation

Forward propagation is the process in a neural network where the input data is passed through the network's layers to generate an output.

L-Layer Neural Network

Forward Propagation

Types of Regression

The Model Workflow

Forward Propagation

