# One of the most popular models for ML & DL: ANN

## Where is an ANN (Artificial Neural Network) used?

- ANNs are **inspired by the structure of the human brain**, the way our brains evolve every time we learn something new, and that is what the artificial neural network tries to mimic.

- ANNs are particularly useful for **solving nonlinear problems**.

- They can be used in a **wide range of applications**, from image processing and face recognition to speech recognition and generation, stock market predictions and many more.

How do ANNs work?

1 The input layer takes the input data and sends it to the hidden layers

2 The hidden layers transfer the information to the output layer

3 The output layer calculates the output

▶ The data is transferred through the network until it reaches the neurons of the output layer – **"forward propagation"**

input layer

hidden layer 1

hidden layer 2

output layer
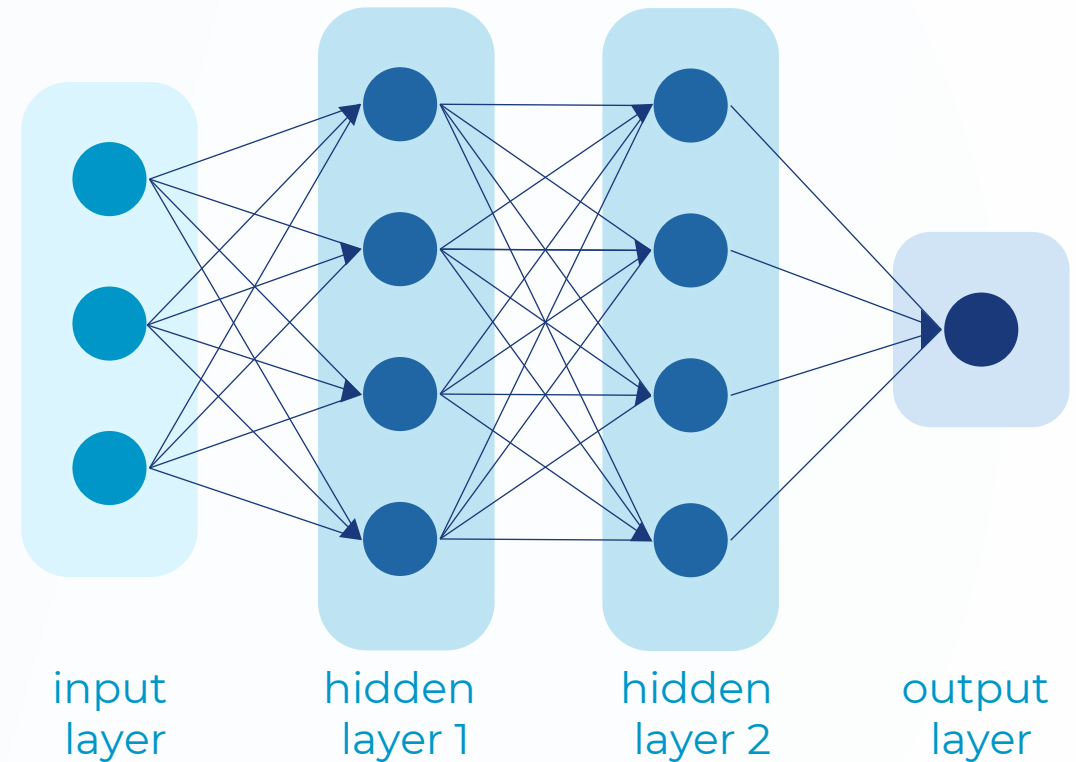
What is perceptron?
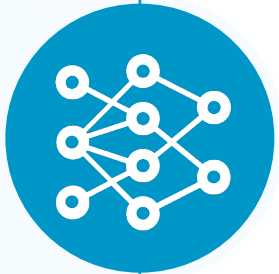
The ANN layers are made up of a number of interconnected nodes that are called **"perceptrons"** and these mimic human neurons.

Recalling two familiar terms from regression: weight & bias

Weight

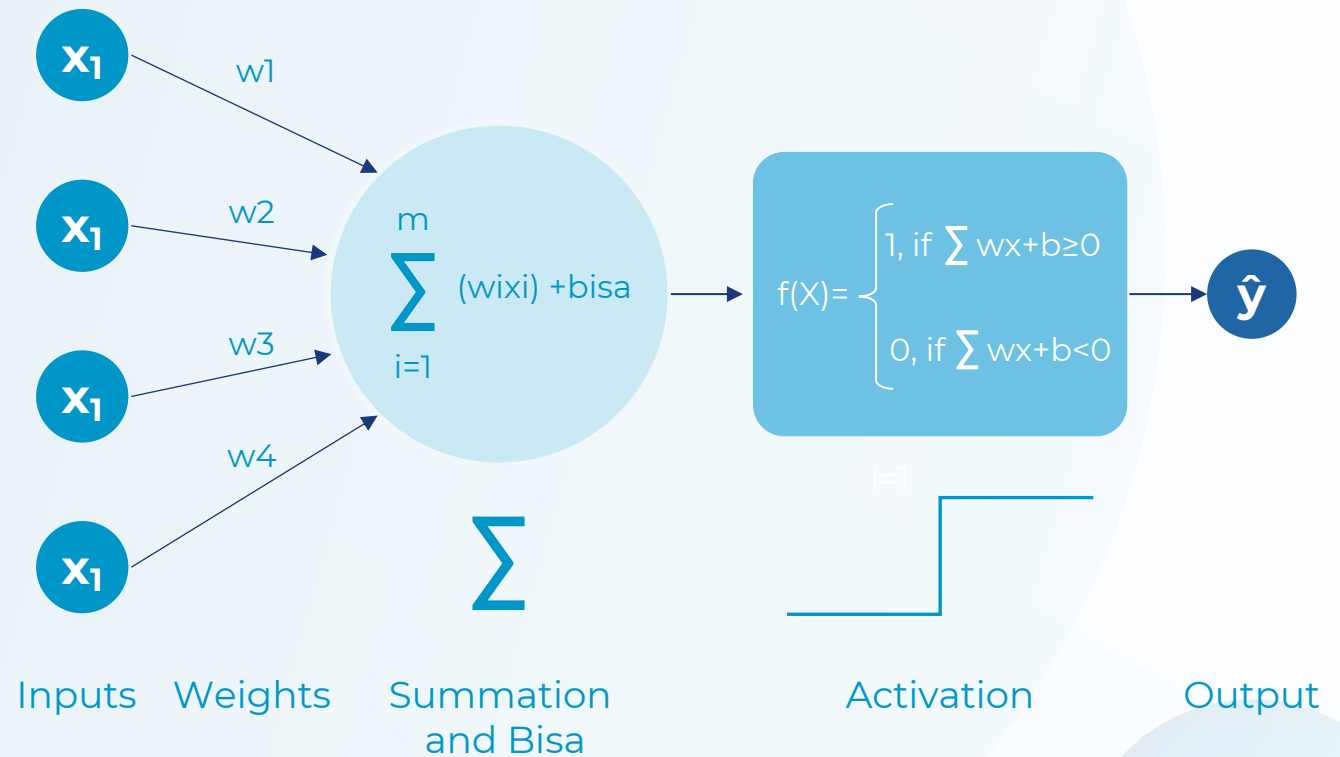The impact of the input on the output

Bias

The equivalent to the intercept in linear regression

Activation function for transforming the input

How do activation functions work?

They work like a threshold and determines the output between the desired range (e.g., 0,1 or -1,1) so that they can **activate** or **deactivate the perceptron** and determine whether it will **pass its value to the next layer.**

x_1 w1

x_1 w2

x_1 w3

x_1 w4

$$\sum_{i=1}^{m} (w_i x_i) + bisa$$

$$\sum$$

$$f(X)= \begin{cases} 1, & \text{if } \sum wx+b \geq 0 \\ 0, & \text{if } \sum wx+b < 0 \end{cases}$$

$\hat{y}$

Inputs   Weights   Summation and Bisa   Activation   Output

Evaluating & improving the model: backpropagation

What is backpropagation?

After finishing all the way through forward propagation and comparing the results with ground truth, we can use a method called **"Backpropagation"** to **improve** the model. This means **going backwards** and **do the crosscheck** to adjust the weights, biases, and **minimize error** in the classification task.

input layer

hidden layer 1

hidden layer 2

output layer