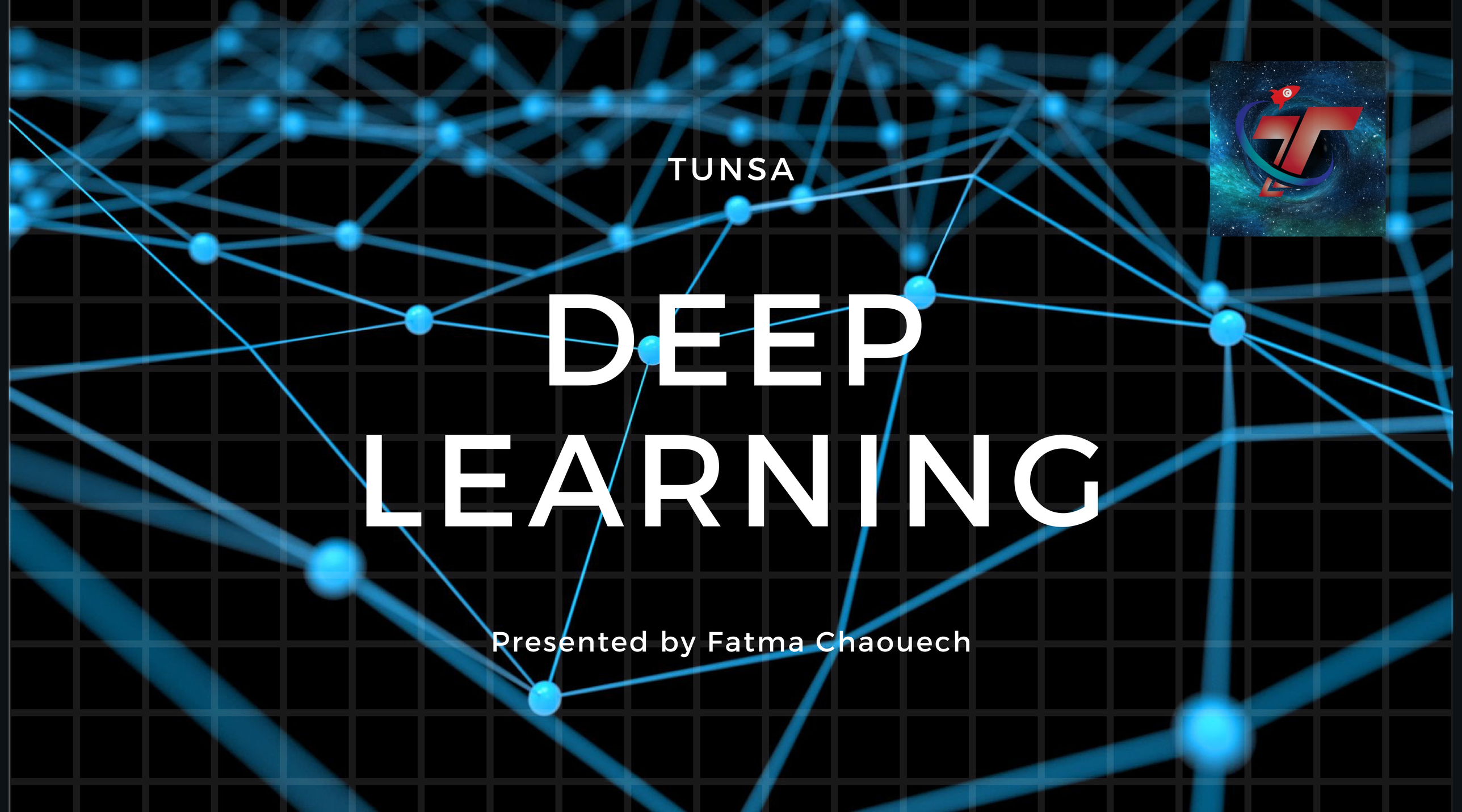


TUNSA

DEEP LEARNING

Presented by Fatma Chaouech

What is Deep Learning?

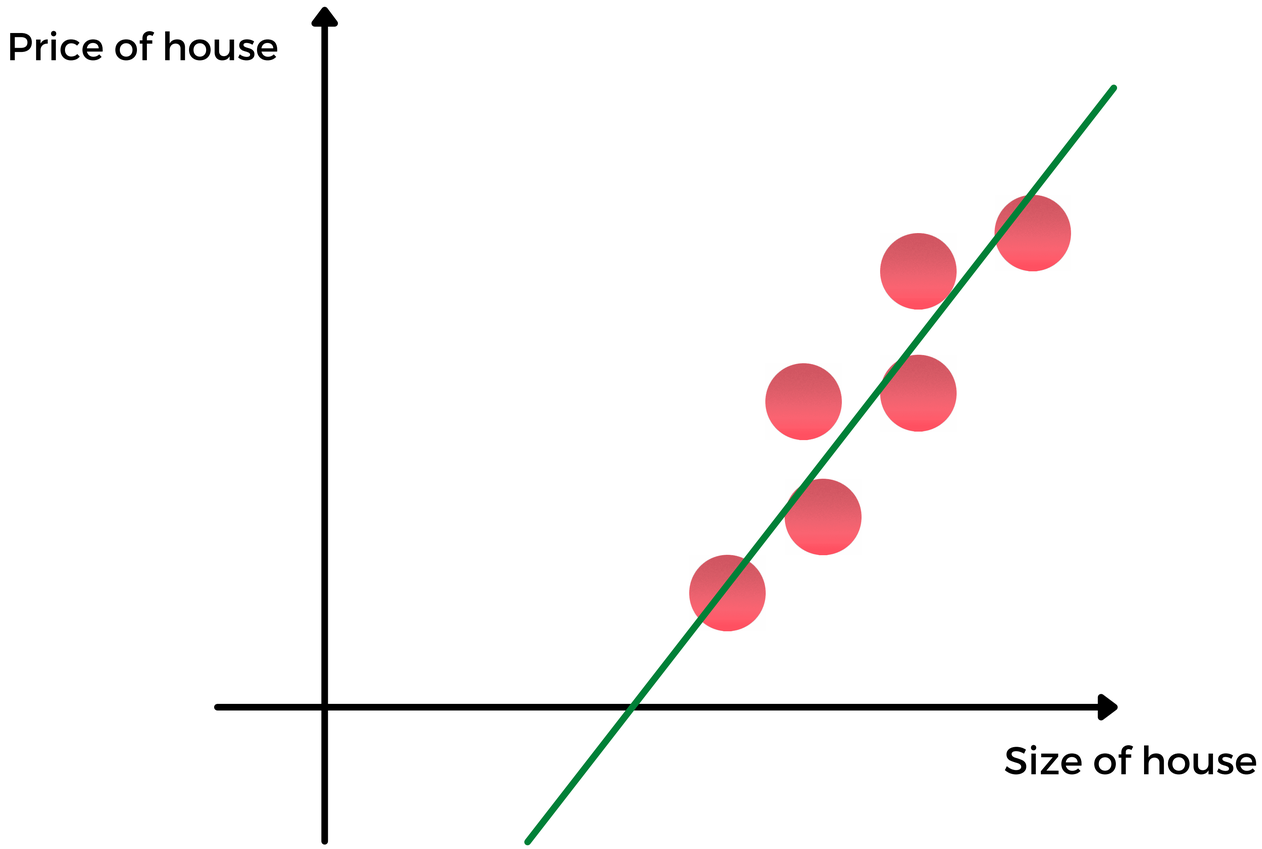
“**Deep learning** models introduce an extremely **sophisticated** approach to machine learning and are set to tackle these challenges because they've been specifically modeled after the **human brain.**”

-Flatiron School

Neural Networks

House Price Prediction

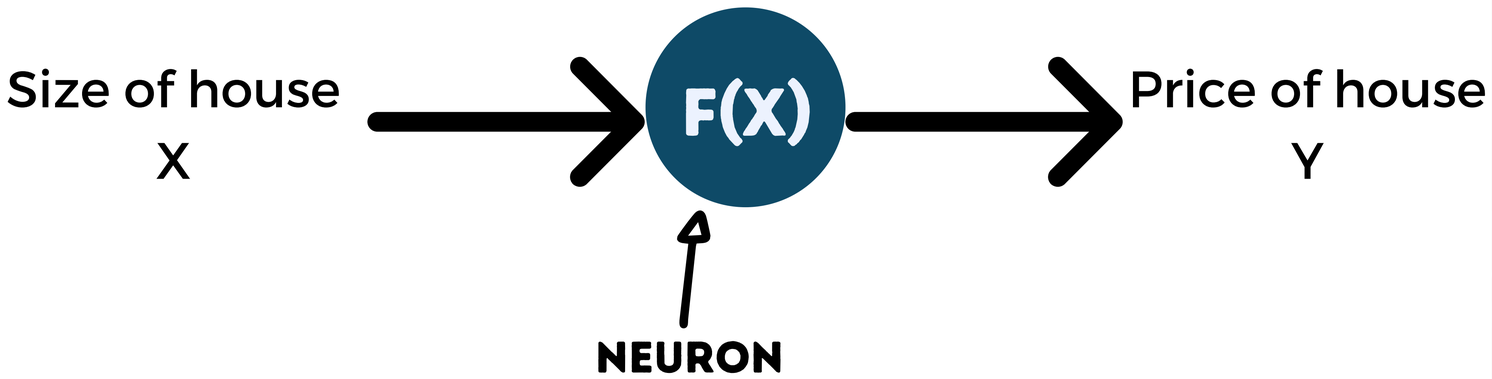
What We used to do :



Neural Networks

House Price Prediction

We can see it as :

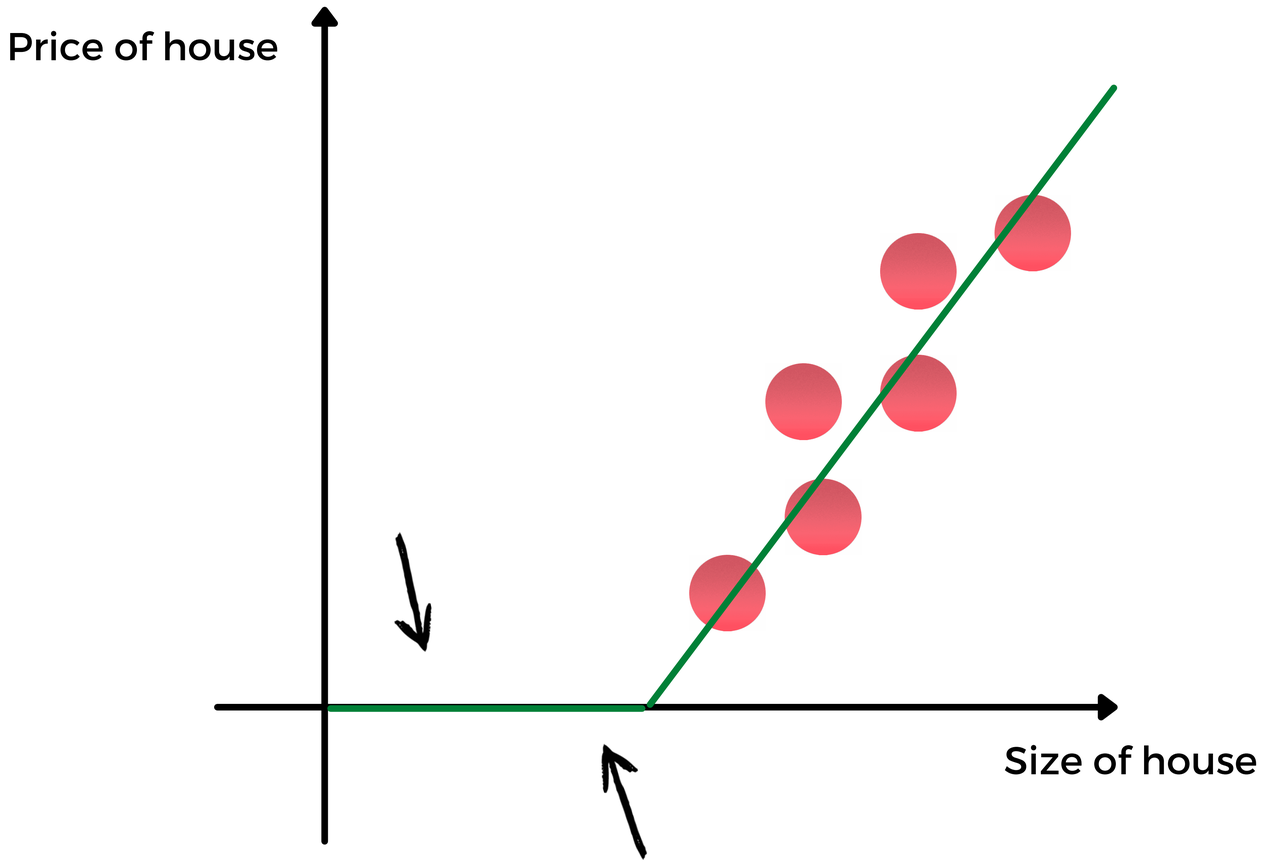


The neuron here is going to compute the function f(x). In our case, it'll try to find the best theta_0 and theta_1 so that f(X) = theta_0 + theta_1 * X fits our data the best way possible.

Neural Networks

House Price Prediction

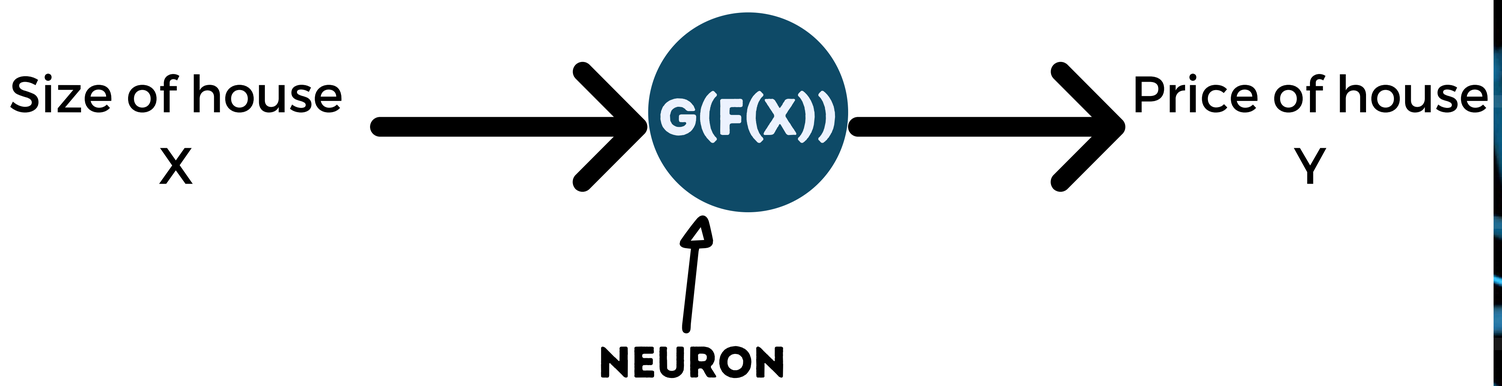
What a simple neural network can do :



Neural Networks

House Price Prediction

But how?

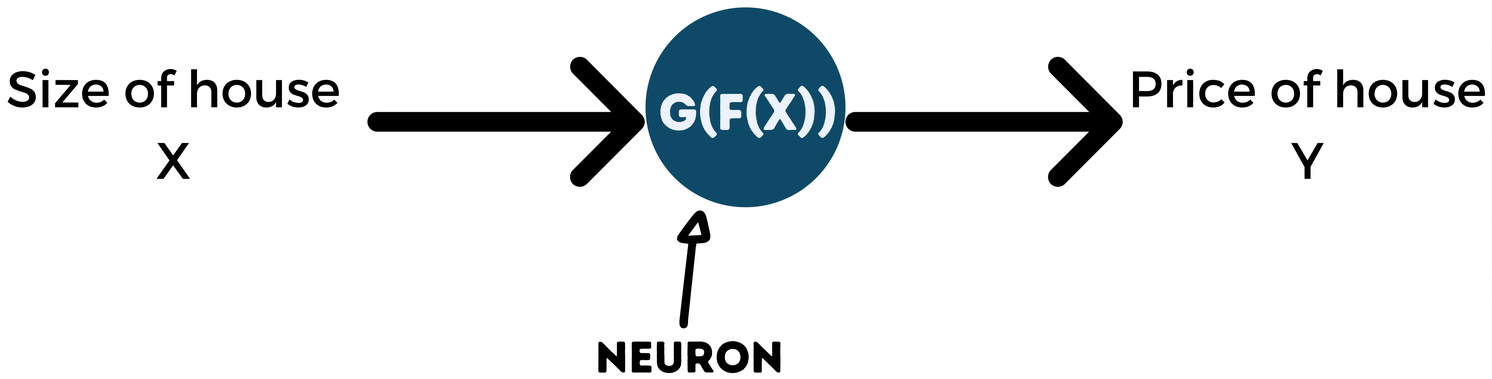


The neuron of a neural network will compute f(x) then pass it to a non-linear function called activation function. We saw an example of a non-linear function (sigmoid function). We used it to return a value between 0 and 1.

Neural Networks

House Price Prediction

But how?

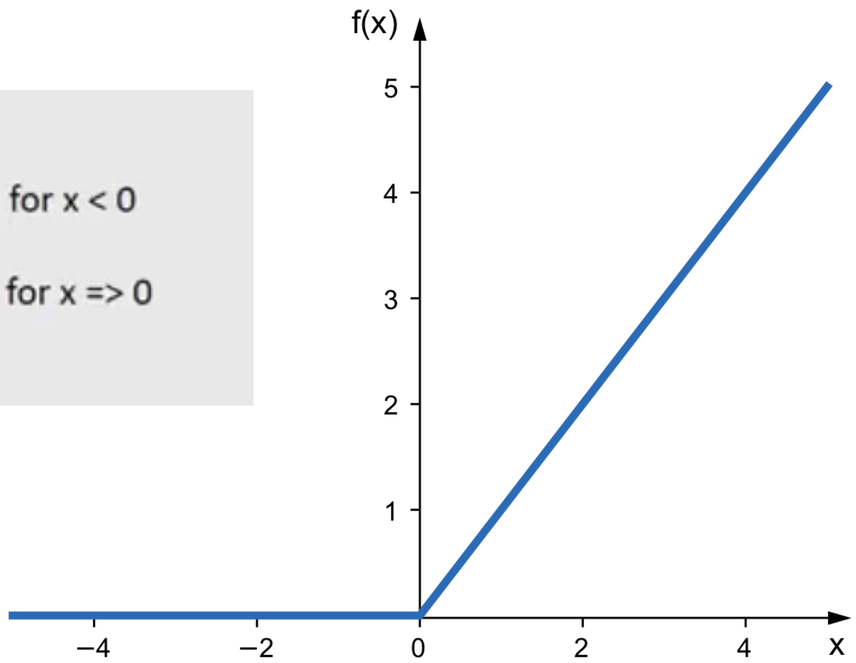


In our case, We don't need the non-linear function to return a value between 0 and 1. Thus, we will use a non-linear function called ReLU function (Rectified Linear Unit).

Neural Networks

ReLU activation function

$$f(x) = \begin{cases} 0 & \text{for } x < 0 \\ x & \text{for } x \Rightarrow 0 \end{cases}$$

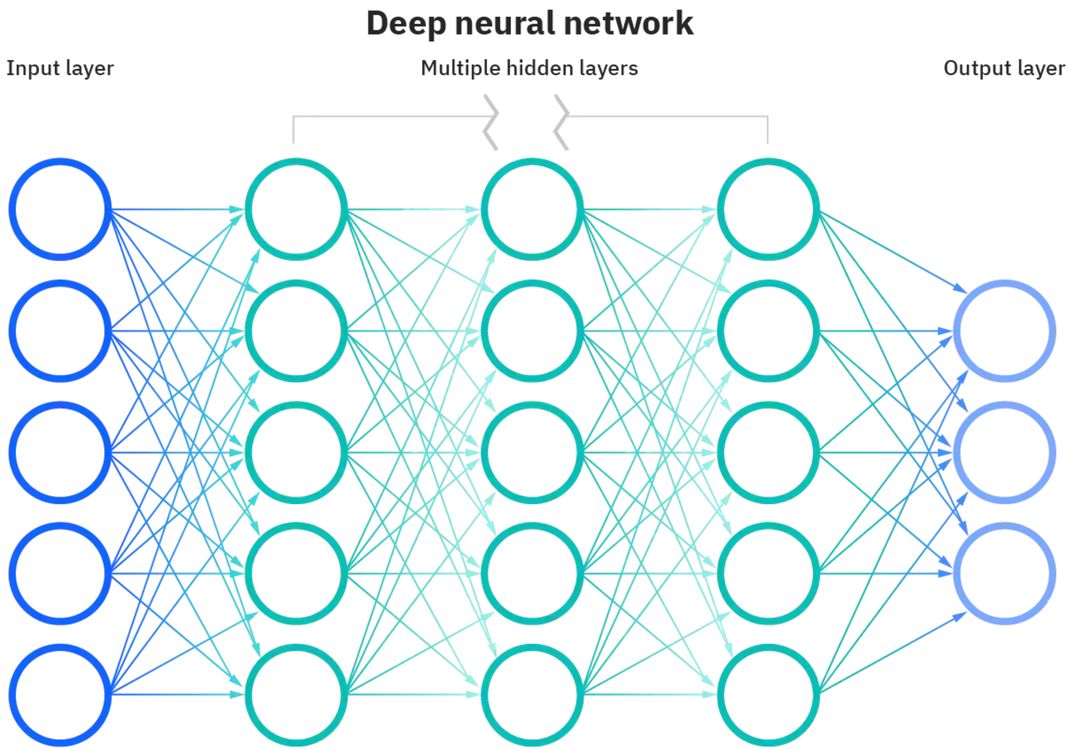


Why use Neural Networks

- Works very well even on unstructured data.
- Captures more complex and hidden patterns.

Types of Neural Networks

1. Standard Neural Network :



Applications :

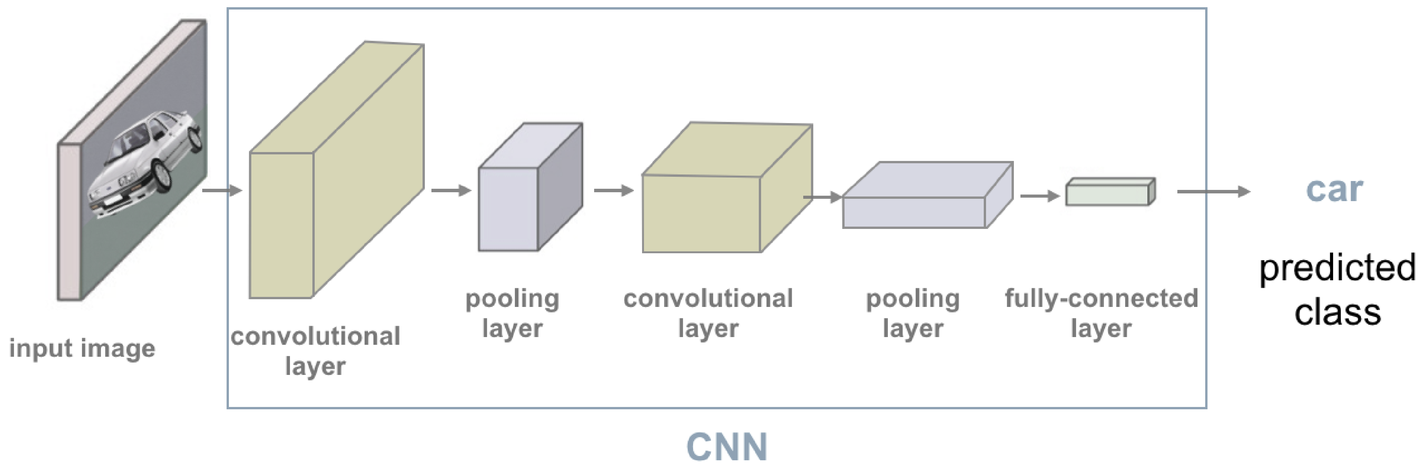
- Real Estate (price prediction)
- Advertising

Types of Neural Networks

2. Convolutional Neural Network (CNN)

Application :

- Image Recognition

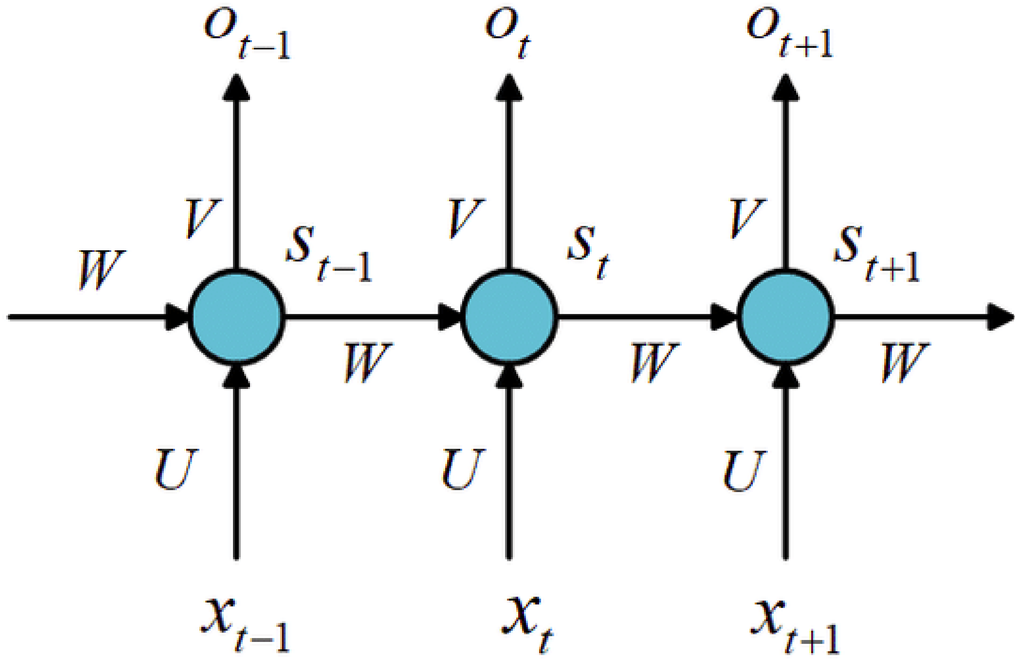


Types of Neural Networks

3. Recurrent Neural Network (RNN) :

Applications :

- Speech Recognition
- Machine Translation



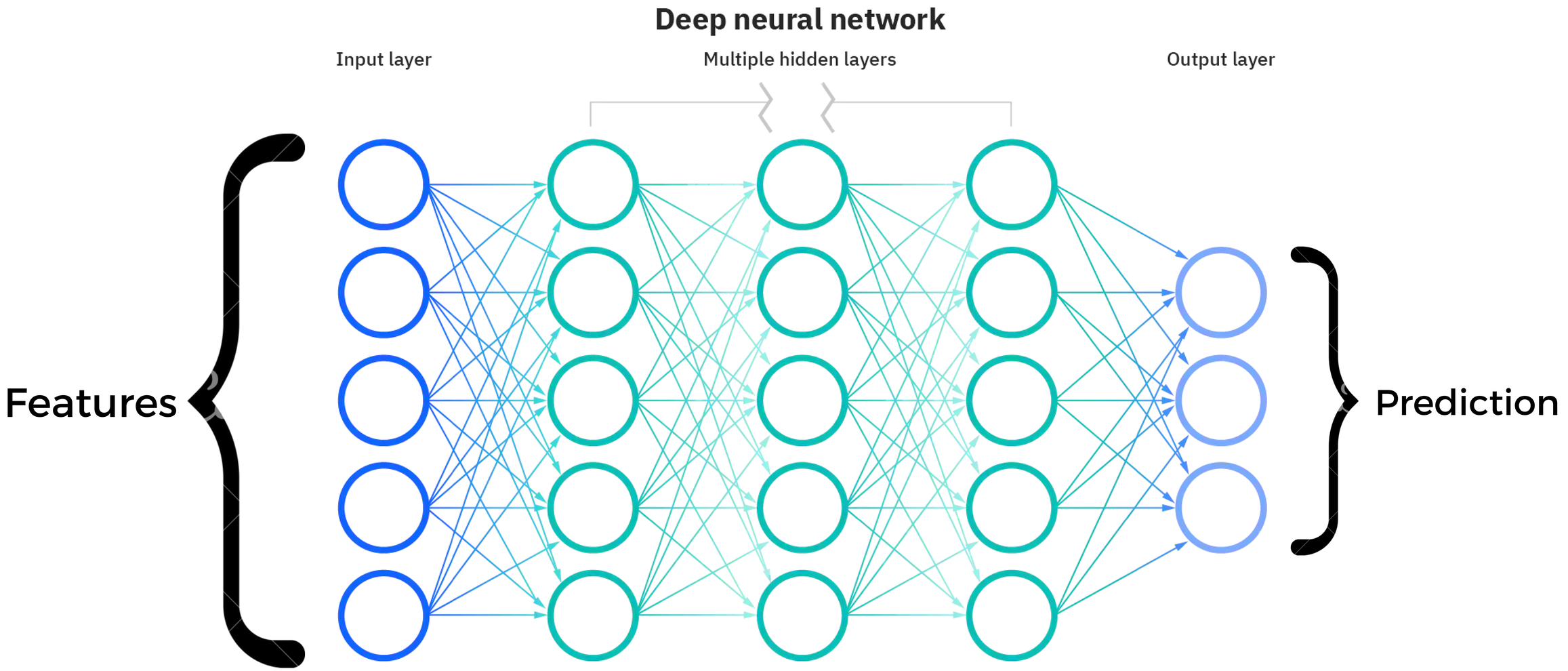
Types of Neural Networks

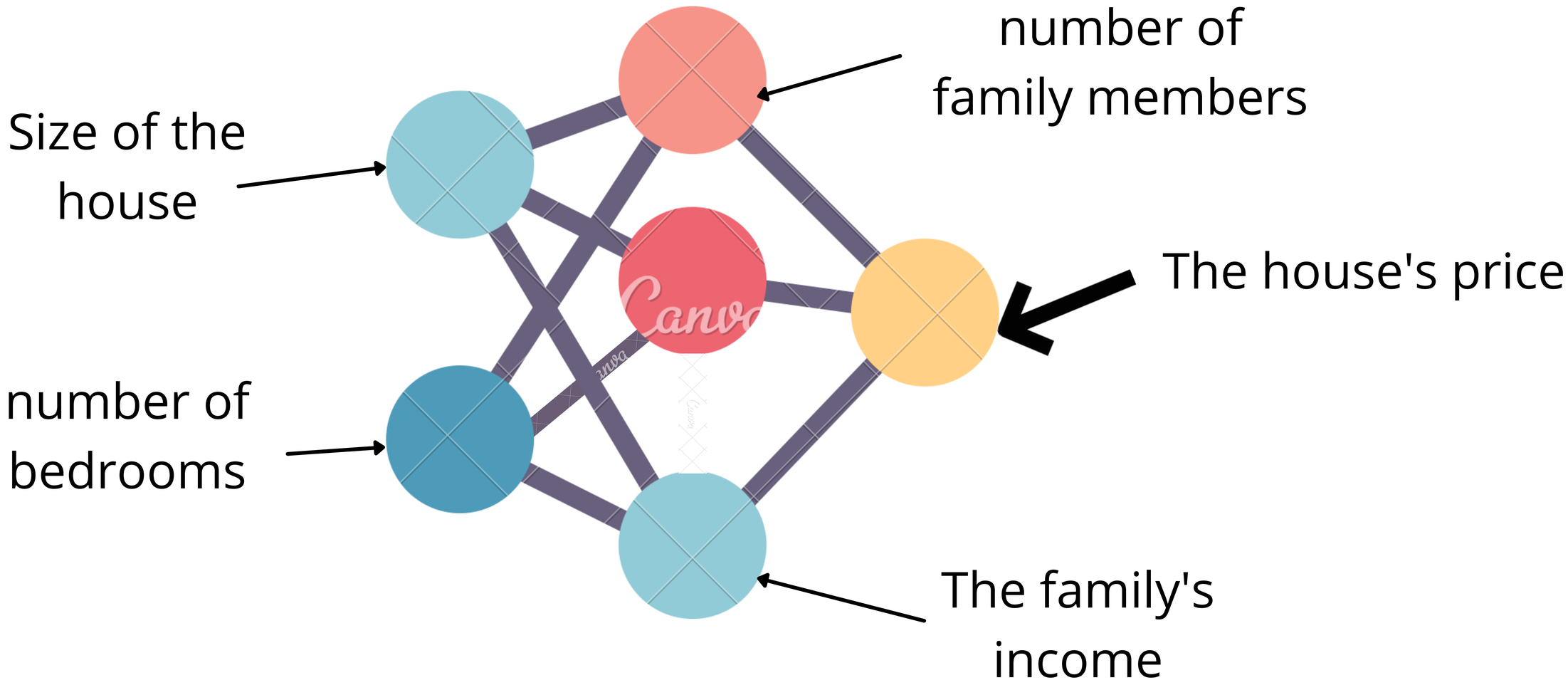
4. Custom/Hybrid Neural Network

Application :

- Self Driving Cars

Architecture of a Standard Neural Network for supervised learning


Deep neural network
Input layer
Multiple hidden layers
Output layer
Features
Prediction


number of
family members
Size of the
house
The house's price
number of
bedrooms
The family's
income

How does the Neural Network train?

Steps

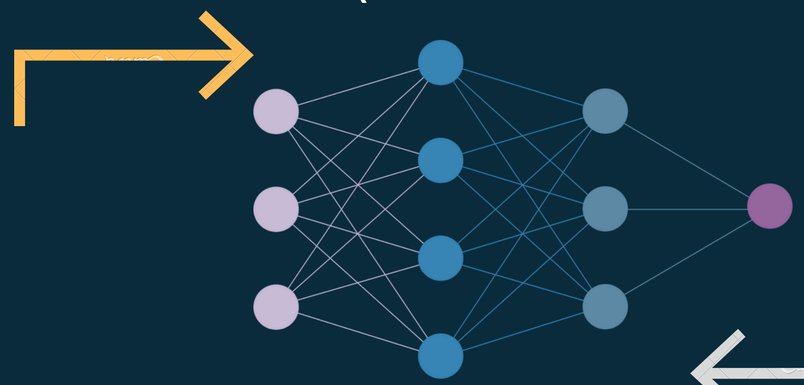
0. Initialize randomly the parameters.

Repeat :

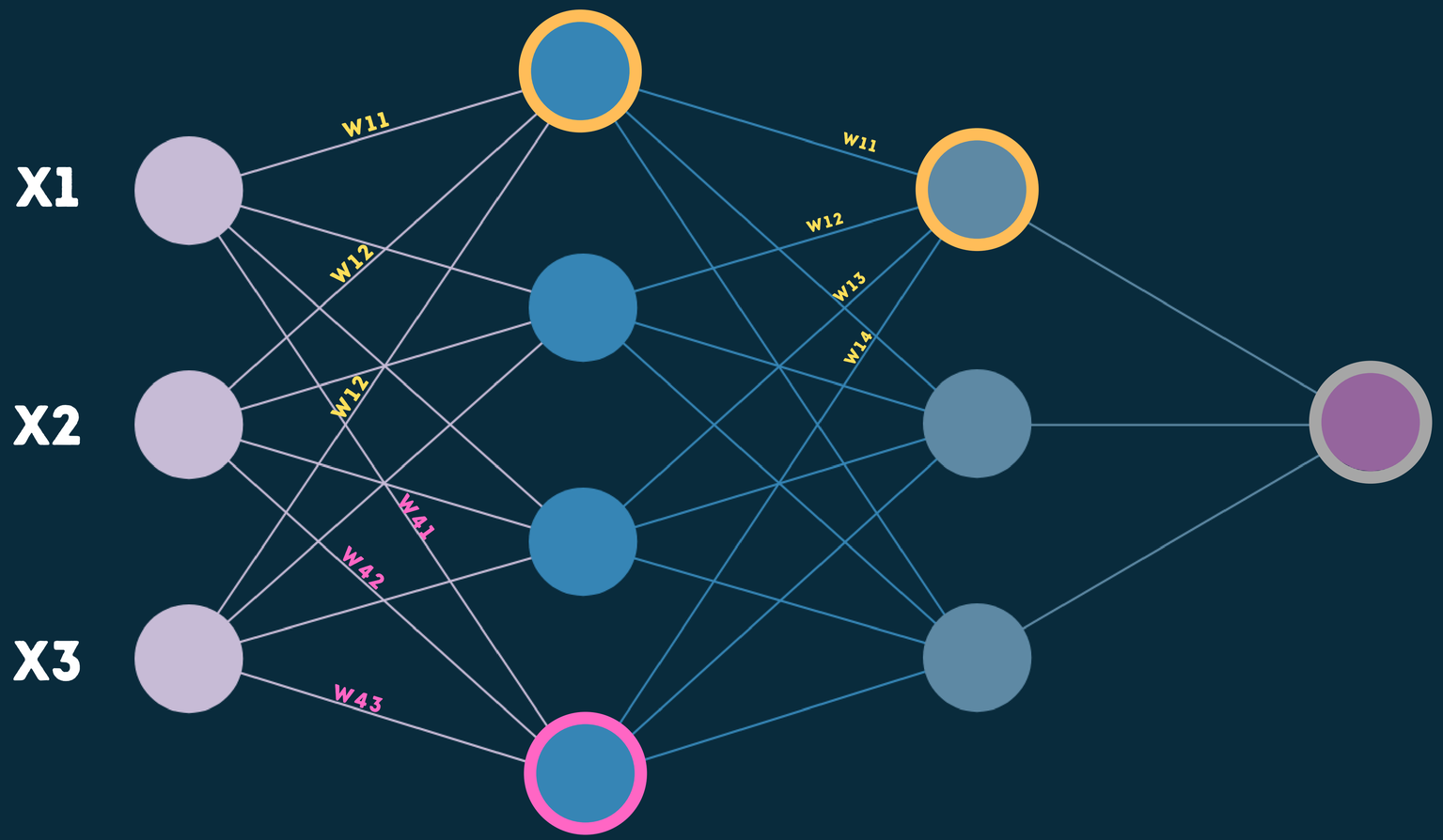
1. Compute the output of each data point of the dataset.
2. Calculate the errors.
3. Improve the parameters (i.e. Gradient Descent).

FORWARD PROPAGATION

BACKPROPAGATION

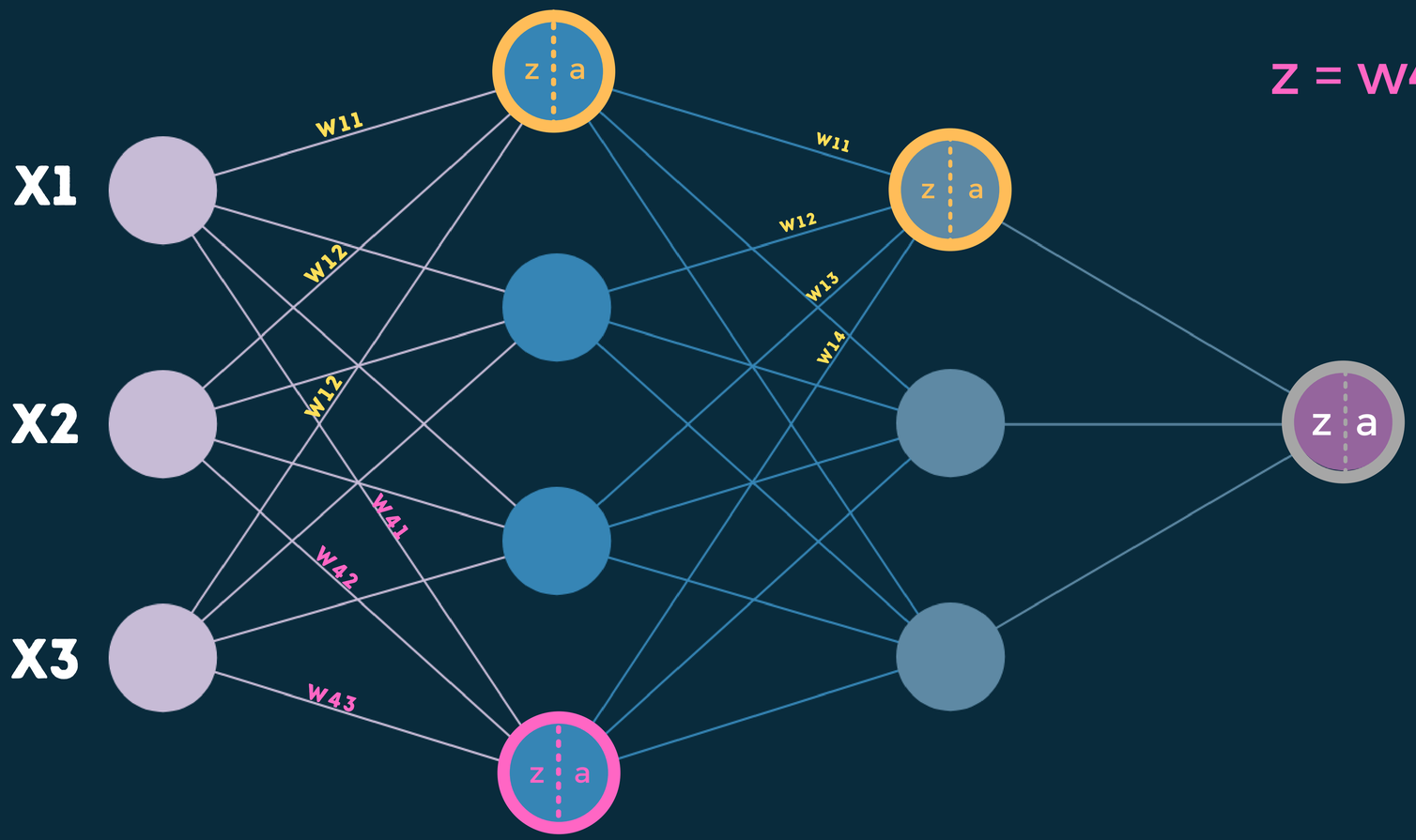


Parameters of a Neural Network



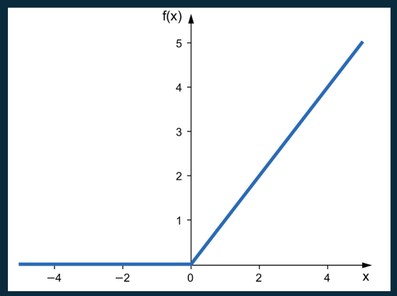
Forward propagation

Regression case



$$z = w41*x1 + w42*x2 + w43*x3$$

$$a = \sigma(z)$$



Forward propagation
Regression case

Calculate the cost function

Ex : MSE

$$J(\theta_0, \theta_1) = \frac{1}{2m} \sum_{i=1}^{m} (\hat{y}_i - y_i)^2 = \frac{1}{2m} \sum_{i=1}^{m} (h_\theta(x_i) - y_i)^2$$

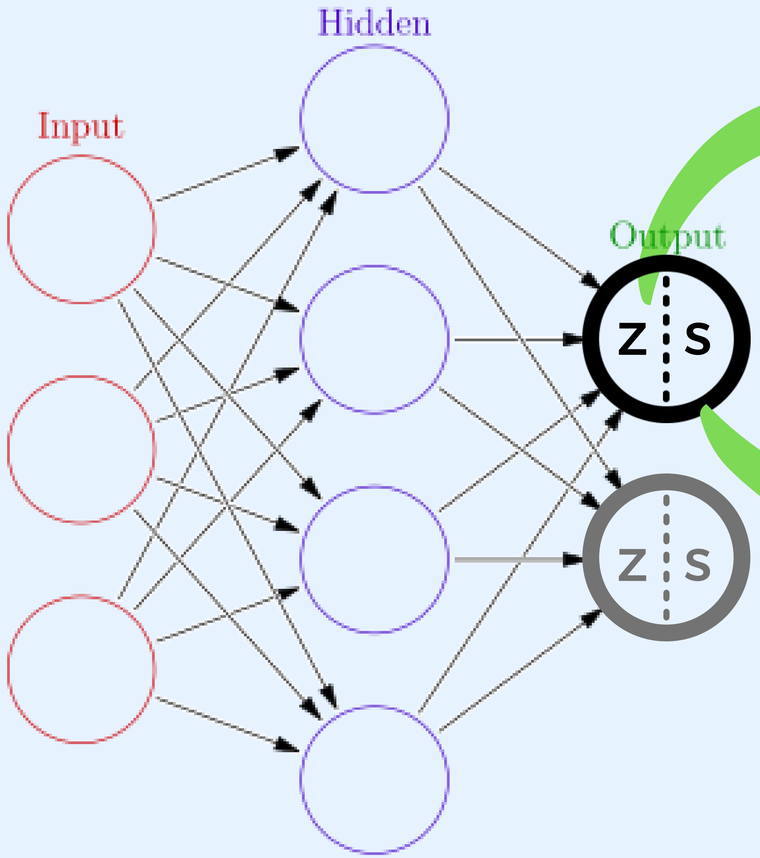
error

squared

mean

Forward Propagation

Classification case

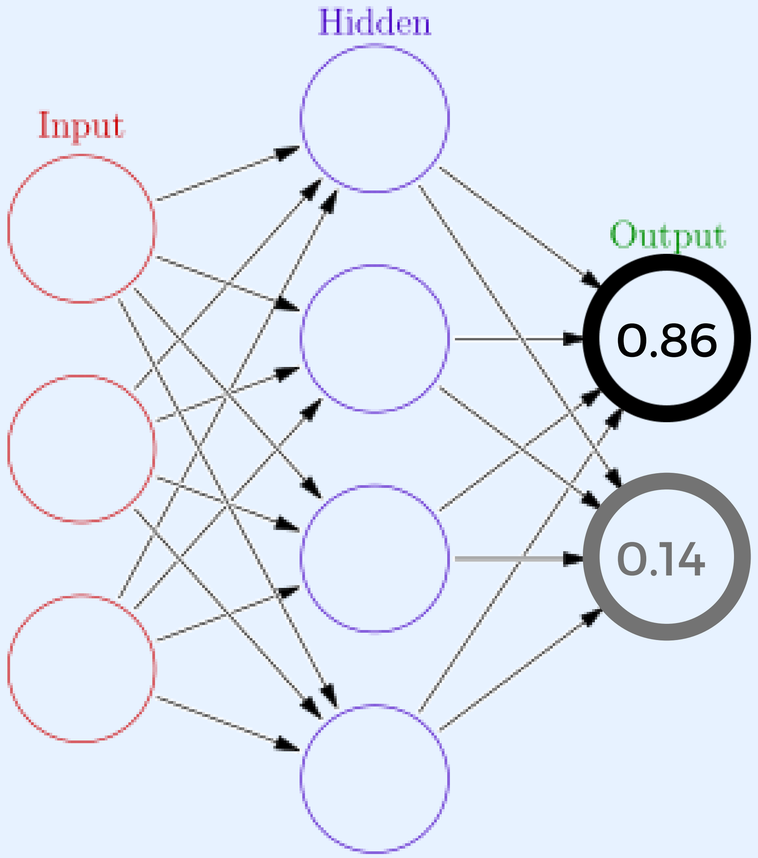


$z = w11*x1 + w12*x2 + w13*x3 + w14*x4$

$s = \text{sigmoid}(z)$

Forward Propagation

Classification case



Forward propagation
Classification case

Calculate the cost function

Ex : for a binary classification problem :

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

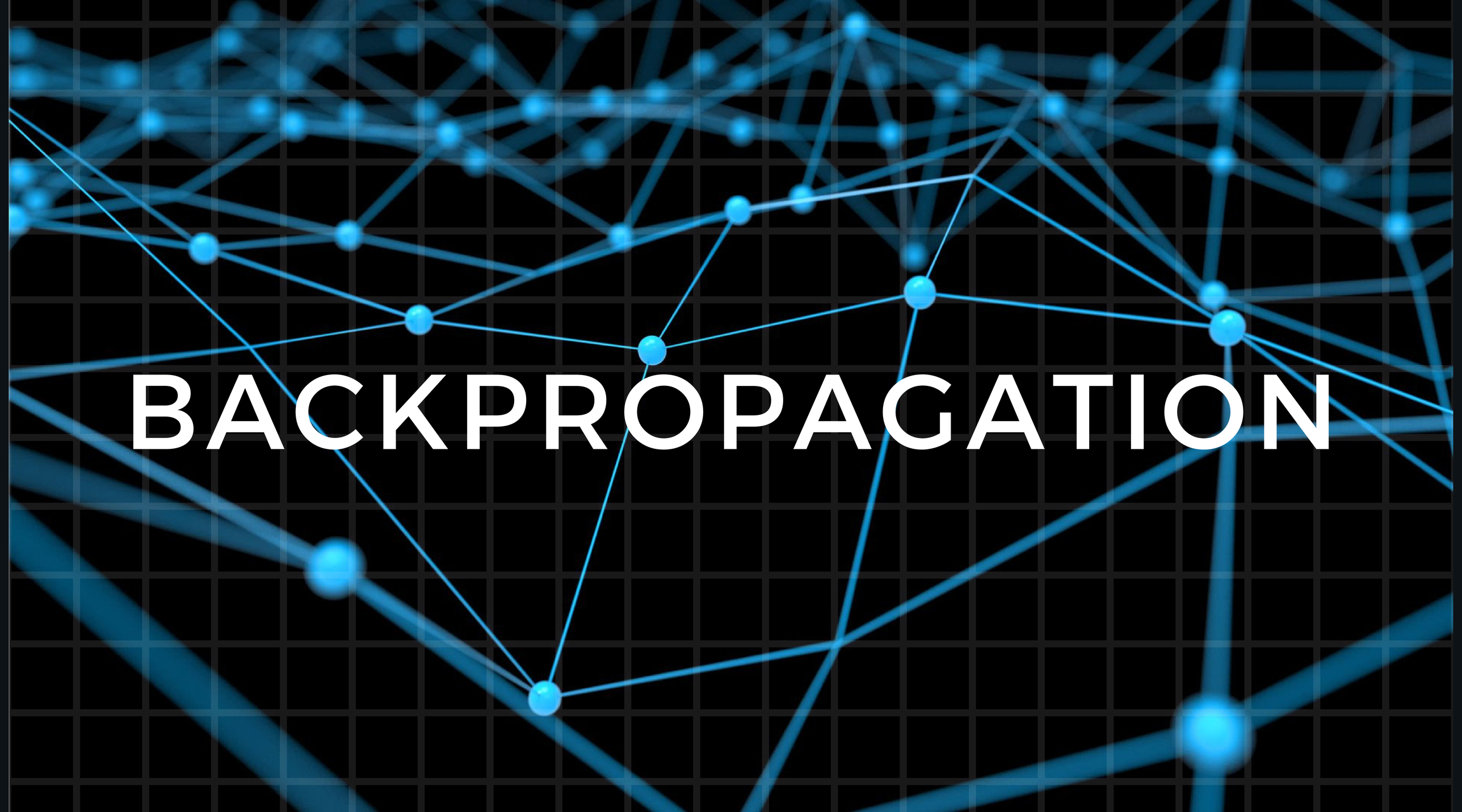
Forward propagation
Classification case

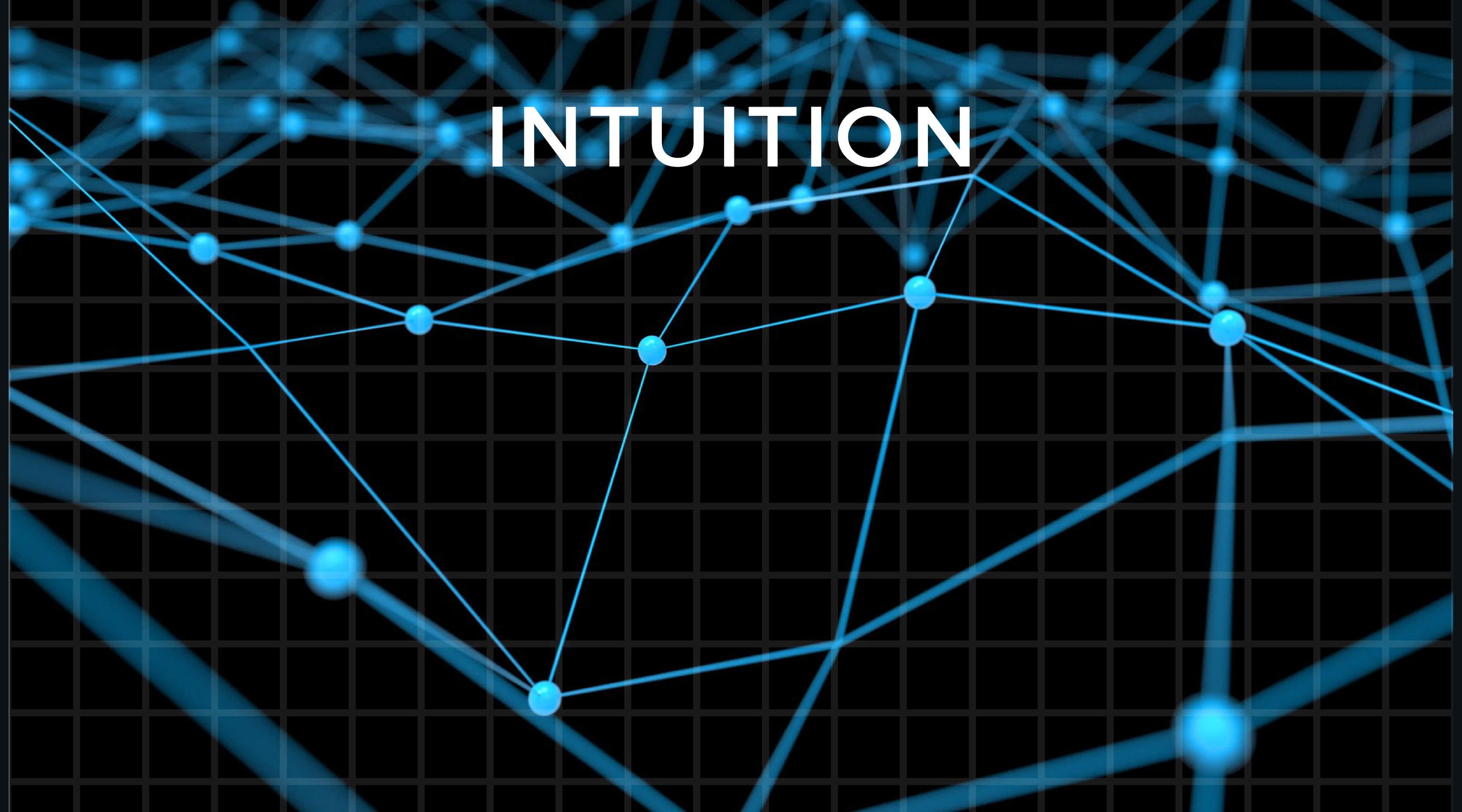
Calculate the cost function

Ex : for a binary classification problem :

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


PRACTICE
TIME !


BACKPROPAGATION


INTUITION