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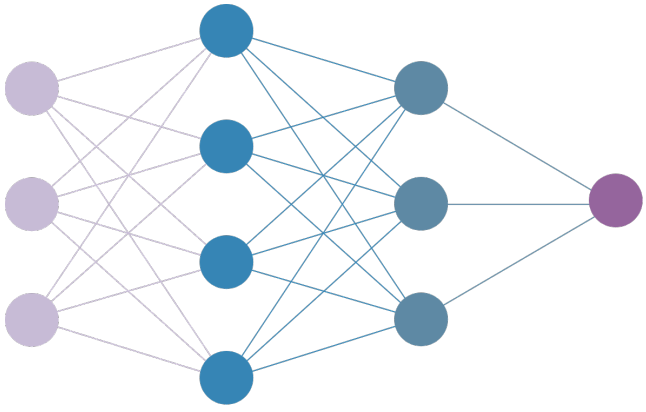
B-INN-000

A.I. Masterclass

Identifying the Genre of a Song with Neural Networks



MASTERCLASS EXPLANATION:

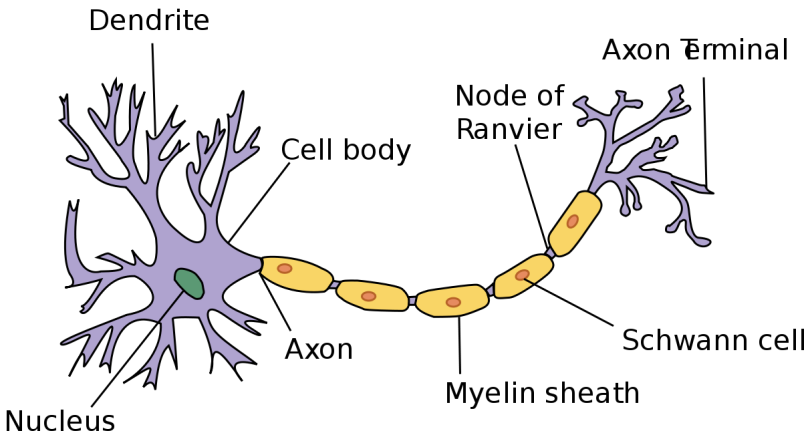
The masterclass is a series of workshop / lessons that will help you to understand how to use neural networks.
The masterclass will last 2 days and will be divided into 3 parts:
* Part 1: **Introduction to neural networks and the basics of the machine learning**
* Part 2: **Developing a neural network**
* Part 3: **Testing and Upgrading the neural network**

You need to be confortable with basic mathematics and have at least Python 3.8 installed on your computer

Part 1: Introduction to N.N.

Part 1.1: Where come from neural networks ?

The idea of neural networks began as a model of how neurons in the brain function.
The goal of neural networks was to mimic the brain. So we used the same model as the neurons in the brain.

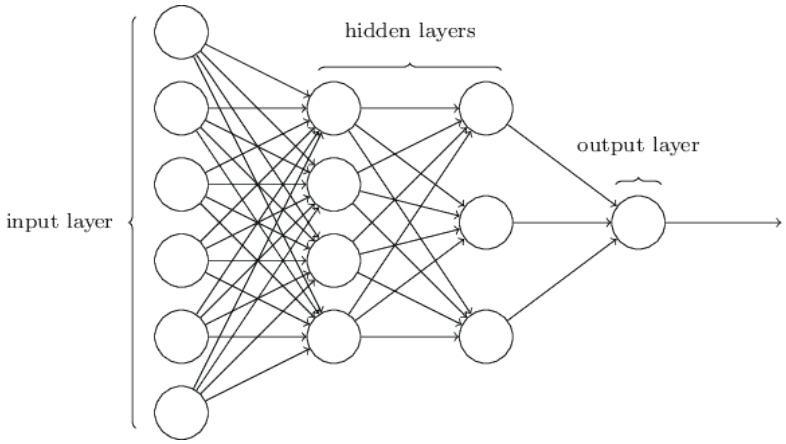


The information(s) that comes from the dendrites are the inputs.
The information(s) passes through the axon to end up in another neuron

Part 1.2: Describing the neural network

The neural network is a set of neurons that are connected to each other.
The NN has the particularity that it is a set of layers. 3 types of layers exactly:

- The input layer is the layer that contains the input data.
- The hidden layer is the layer that contains the neurons that process the input data.
- The output layer is the layer that contains the output data.

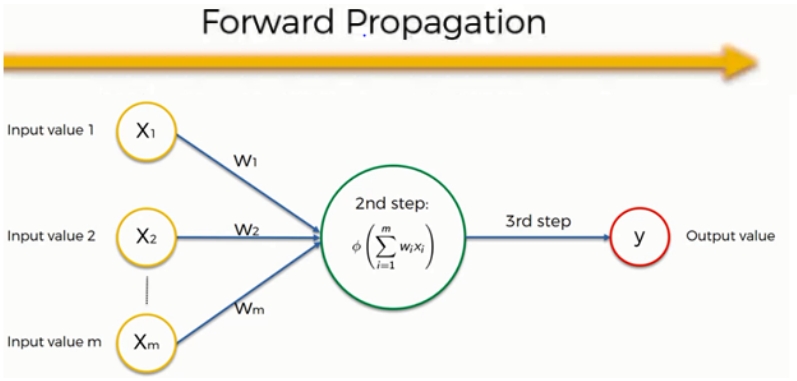


Each layer has his own functionnality and has a number of neurons.

Each neuron has his own weights and biases. We'll see how to use them in the next part.
We'll see that each neuron in the hidden layer has a function called activation function.
The NN can have several units in the output layer in the case of **multiclass classification**.
A **multiclass classification problem** is a problem that has multiple existing solutions.
We can take the example of the object recognition problem. We have a set of images of objects and we want to know which one of them is the object we are looking for. So, the possible solutions are maybe a chair, a table, a sofa, a lamp etc.

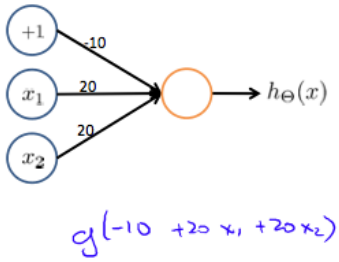
PART 1.3: HOW THE NEURAL NETWORK LEARNS ?

First, the neural network uses the input data and the weights of the hiden layers' units to compute the output data.
This technique is called the **forward propagation**.



To illustrate the forward propagation, we will use the following example:
Let's say we want to compute the OR binary function. We'll use 2 inputs units, 1 hidden layer with 1 unit and 1 output unit. We already have the weights of the hidden layer.

Example: OR function



x_1	x_2	$h_\Theta(x)$
0	0	$g(-10) \approx 0$
0	1	$g(10) \approx 1$
1	0	≈ 1
1	1	≈ 1

The activation function g will take the following form:
g(x) with g being the sigmoid function and x equal to :
x = (-1 * 10) + 20 * x1 + 20 * x2

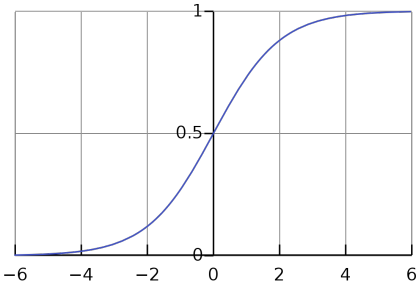
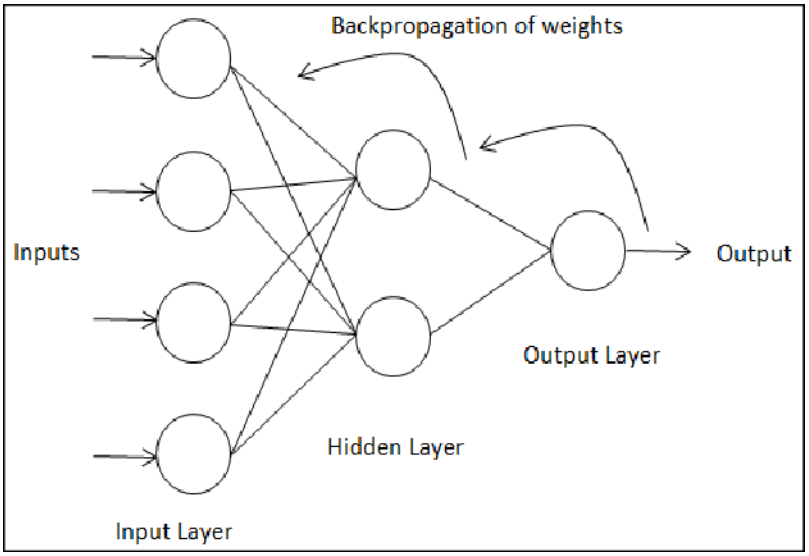


Table of calculation of the activation function:

x1	x2	g(x)
0	0	g(-10) = 0
0	1	g(10) = 1
1	0	g(10) = 1
1	1	g(30) = 1

You can try to find the weights for the AND or XOR function

Then, the neural network tries to improve the output data by changing the weights.
So, the neural network learns the relationship between the input data and the output data.
This technique is called the **back propagation**.



Behind this simple reprensentation, the Neural Network computes the following calculus:

Summary: the equations of backpropagation

$$\delta^L = \nabla_a C \odot \sigma'(z^L) \qquad \text{(BP1)}$$

$$\delta^l = ((w^{l+1})^T \delta^{l+1}) \odot \sigma'(z^l) \qquad \text{(BP2)}$$

$$\frac{\partial C}{\partial b^l_j} = \delta^l_j \qquad \text{(BP3)}$$

$$\frac{\partial C}{\partial w^l_{jk}} = a^{l-1}_k \delta^l_j \qquad \text{(BP4)}$$

Part 2: Developing a neural network

Terminal

```
~/B-INN-000> mkdir DiscordBotWorkshop
cd DiscordBotWorkshop
npm init
npm install discord.js
npm install axios
```

Ici nous avons crée un projet DiscordBotWorkshop, Ou nous avons installé discord.js et axios.
axios est une lib de node qui permet de faire des requetes a une api.
Par exemple nous pouvons faire ça:

```
const axios = require('axios');

axios.get('http://54.36.183.102:2900/anime/832').then(function (response) {
    console.log(response.data);
}).catch(function (error) {
    console.log(error);
});
```

Ici nous faisons une request a une api ou l'on lui demande d'avoir l'id 832 d'un anime
Maintenant nous allons crée le bots.

Configuration

Tout d'abord nous allons allez sur le Discord Portal: https://discordapp.com/developers/applications/
Puis vous allez crée une application
Maintenant va dans **Bot** and *Add a Bot*.
Une fois le bot crée il faut l'invité sur le serveur.
Allez dans OAuth2 et cliquez sur bot et Admin
Copier le link générer, ouvrer le puis ajouter le bot au serveur
c
Ensuite nous allons allez sur le site my.epitech.eu
Une fois sur le site l'objectif est de récupérer le token d'authentification avec la console du navigateur (F12)

Création du bot

Maintenant nous allons pouvoir commencer a coder
Tout d'abord crée un fichier json avec le nom config.json:

```
{
    "tokenDiscord": "LE TOKEN",
    "tokenEpitech": "LE TOKEN",
    "prefix": "!"
}
```

Puis il vous faudra crée un fichier bot.js ou nous allons pouvoir commencer a coder.

```
const { Client, Intents } = require('discord.js');
const config = require('./config.json');
const bot = new Client({ intents: [Intents.FLAGS.GUILDS, Intents.FLAGS.GUILD_MESSAGES
    ]});

bot.on('ready', () => {
    console.log('Ready!');
    bot.user.setActivity('Bot Launch')
});

bot.login(config.tokenDiscord);
```

Puis lancer le bot:

```
Terminal
~/B-INN-000> node bot.js
```

Ce bout de code nous permet de lancer le bot et de faire qu'au moment du lancement nous auront le message "Logged in as {Nom du bot}" et de changer l'activité du bot par "First bot launch".

Embed Message

Maintenant que vous savez répondre autant mettre de la forme faite un message embed de votre commande !ping
Qui contienne :

- En titre le Nom de celui qui envoie le messages
- En description le messages de votre choix
- En Footer le nom de votre bot

Je vous invite a regarde new Discord.MessageEmbed()