The brain

Its pretty useful

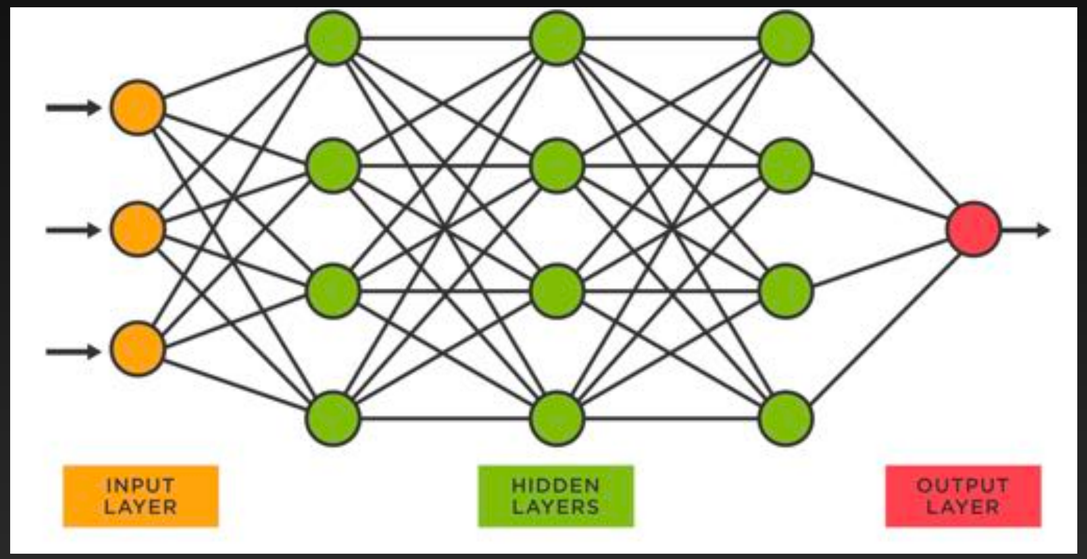
- It's the control center of your body, which means you'd be lost without it. Literally.
- Your brain is like a Swiss Army knife
- It's the ultimate multitasker, letting you listen to music, chat with friends, and browse memes all at the same time.
- Your brain is a master at pattern recognition
- Your brain is incredibly energy-efficient.

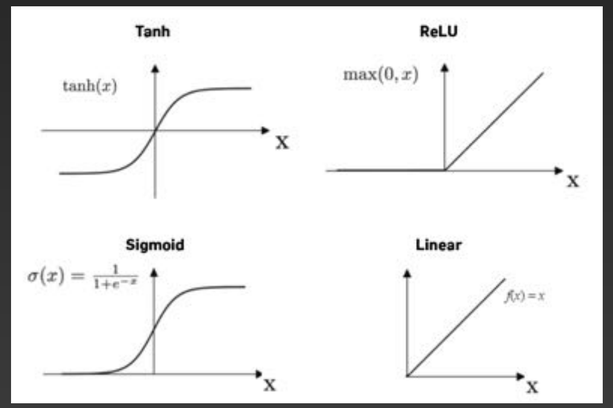
Build the artificial brain

Would also be useful

- The term machine learning was coined in 1959 by Arthur Samuel
- AI winter 1970s —> Pretty bad time for ML
- ReDiscovery of Backprop (its just fancy chain rule)

So what do neural networks look like





What was the other big breakthrough

- 2009: deep learning neural networks were trained with Nvidia GPUs

What are we trying to do

Lets take a step back

- Predict whether the sun will rise:

$$P(\text{Sun} = \text{Rise} \mid \text{Past}) = 1$$

- What about prediction ND from MRI?

$$F : \text{Input} \rightarrow \text{Output}$$

- By universal approximation theorem (simplified):

Given a sufficient amount of depth and width a neural network can approximate a wide array of functions*

What are we trying to do

- By universal approximation theorem (simplified):

  Given a sufficient amount of depth and width a neural network can approximate a wide array of functions*

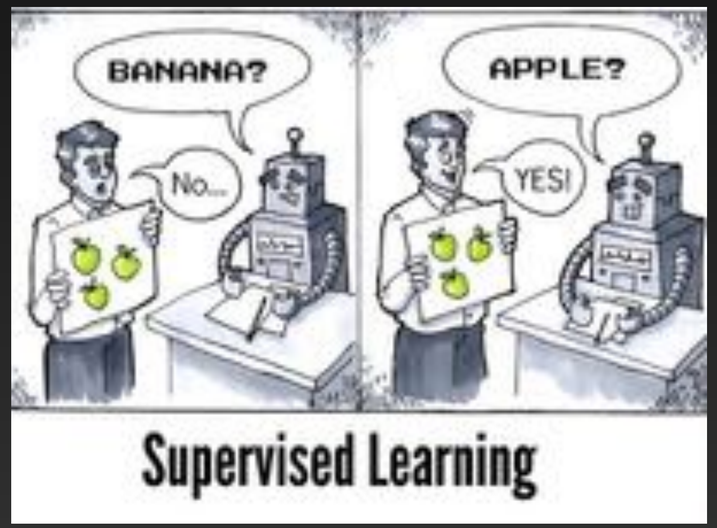
- *This is existence - there is no defined construction!

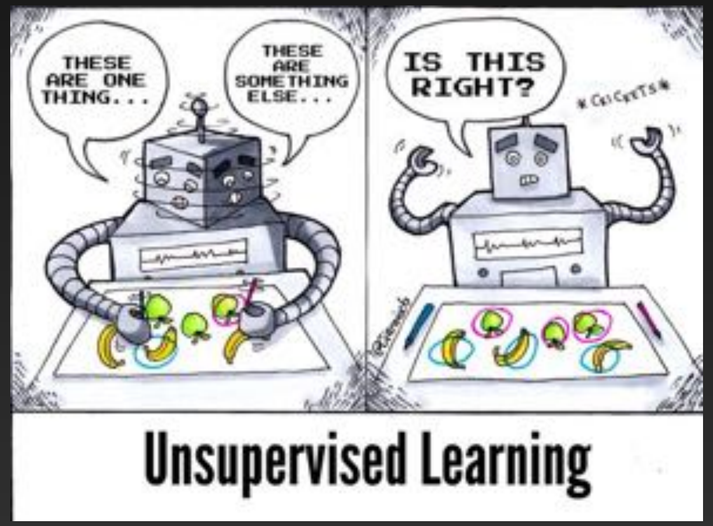
- Training (its an optimisation problem):

  1. Backprop
  2. Cost function

There tracks of ML

Different cost functions lead to different things





How to implement NNs

There are a lot of ways

- From scratch
- JAX, TensorFlow, Keras
- PyTorch:
  - Pythonic
  - Big community
  - Lots of packages