

# DATA LAB

## GUARDA AVANTI

**Big Data**, nuove competenze per nuove professioni.



"Anticipare la crescita con le nuove competenze sui Big Data - Edizione 3" Operazione Rif. PA 2021-16029/RER approvata con DGR n° 927 del 21 giugno 2021 e co-finanziata dal Fondo Sociale Europeo PO 2014-2020 Regione Emilia-Romagna

The background of the image is a photograph of an underwater scene. A scuba diver in a black wetsuit and yellow fins is positioned in the lower-left foreground, facing right and holding a camera. To the right of the diver is a massive, dense school of small, silvery-blue fish swimming in a circular pattern. The water is a deep, clear blue.

Deep Learning

DATA LAB.

# The Evolution of A.I.

## The 1<sup>st</sup>. Period 1950-1970

Trivial problem solving, no practicality, GOFAI - Good Old Fashioned Artificial Intelligence

1942	The 3 Laws of Robotics by Isaac Asimov. Other sets of laws have been proposed by researchers since then.	1950	The Turing Test - proposed by Alan Turing	1952	The first self learning game program	1956	Dartmouth Conference First Use of the term "Artificial Intelligence/A.I."	1957	General Problem Solver (GPS) (by Newell)	1958	McCarthy developed Lisp programming language	1959	The MIT AI Lab (McCarthy and Minsky)	1959	The term "Machine Learning" by Samuel	1961	First Industrial Robot (Unimate) working at GM	1961	SAINT - the first expert system by Slagle (MIT)	1964	STUDENT The first A.I. program which understands natural language	1965	ELIZA - The first A.I. based chatbot and expert system	1966	Shakey - the first locomotive and intelligent robot (SRI)	1966	MAC HACK - chess-playing program (by Greenblatt, MIT)
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1968	SHRDLU, an early natural language understanding robot (Waseda University) computer program	1970	WABOT-1 the first anthropomorphic programming language	1972	Prolog logic	1973	Lighthill Report The poor progress report caused the First A.I. winter (Reduced funding for AI research)	1974	MYCIN - The first rule based AI expert system for medical diagnostics	1974	The first autonomous vehicle, a mechanical "slider" (Stanford)	1980	LISP based machines developed and marketed	1980	INTERNIST-I The first Commercial Expert System	1986	A driverless van by Mercedes-Benz, with cameras and sensors	1988	Bayesian Network (BNs or belief nets) is invented by Pearl	1988	The chatbots, Jabberwocky and Cleverbot invented by Carpenter	1989	The first autonomous vehicle created by CMU using neural network	1993	Polly, the tour guide robot; behavior-based robotics (MIT)
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## The 2<sup>nd</sup>. Period 1980-2000

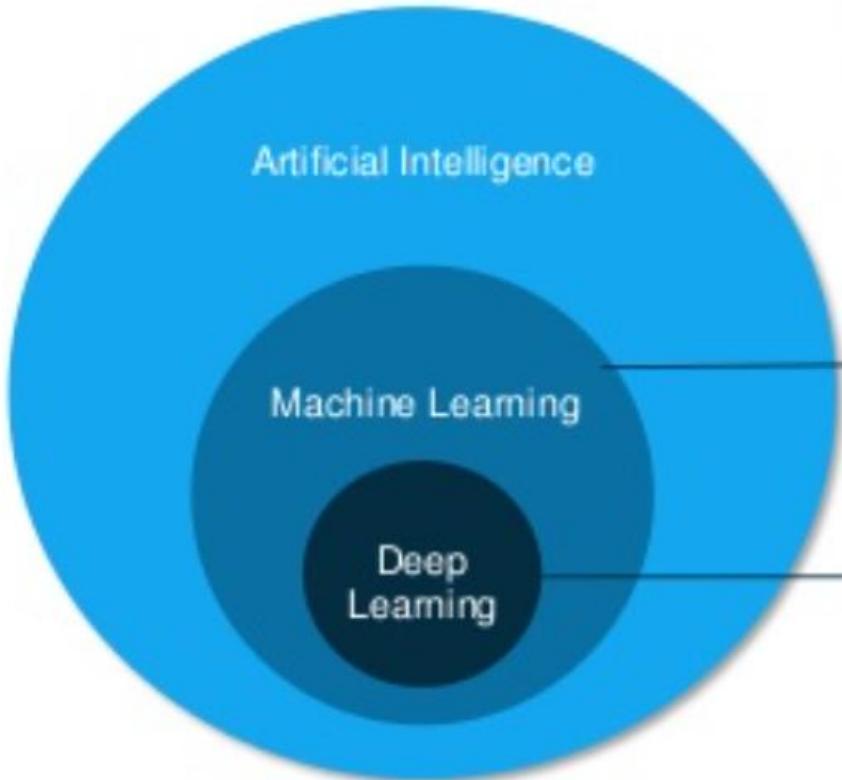
Researchers feeding machines with labeled data. Projects: ICOT - Japan '82, MCC - US '83, Alvey - UK '84. Algorithms began to appear as parts of larger systems. AI solutions proved to be useful throughout the technology industry, such as data mining, industrial robotics, logistics, speech recognition, banking software, medical diagnosis and search engines

1997	IBM's Deep Blue beats Gary Kasparov in chess	1998	Furby - The first "pet" toy robot for children	1999	Kismet - Emotional AI, (MIT AI Lab)	1999	AIBO	2000	ASIMO, humanoid robot released by Honda	2002	Roomba, autonomous robot vacuum is released by i-Robot	2004	The first challenge for autonomous vehicles by DARPA	2004	NASA rovers Spirit and Opportunity exploring Mars	2005	AI based recommendation engines	2006	"Machine reading" unsupervised autonomous understanding of text	2007	ImageNet - visual database for object recognition software research	2007	NVIDIA launches CUDA, a parallel computing platform and programming interface
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## The 3<sup>rd</sup>. Period 2010-

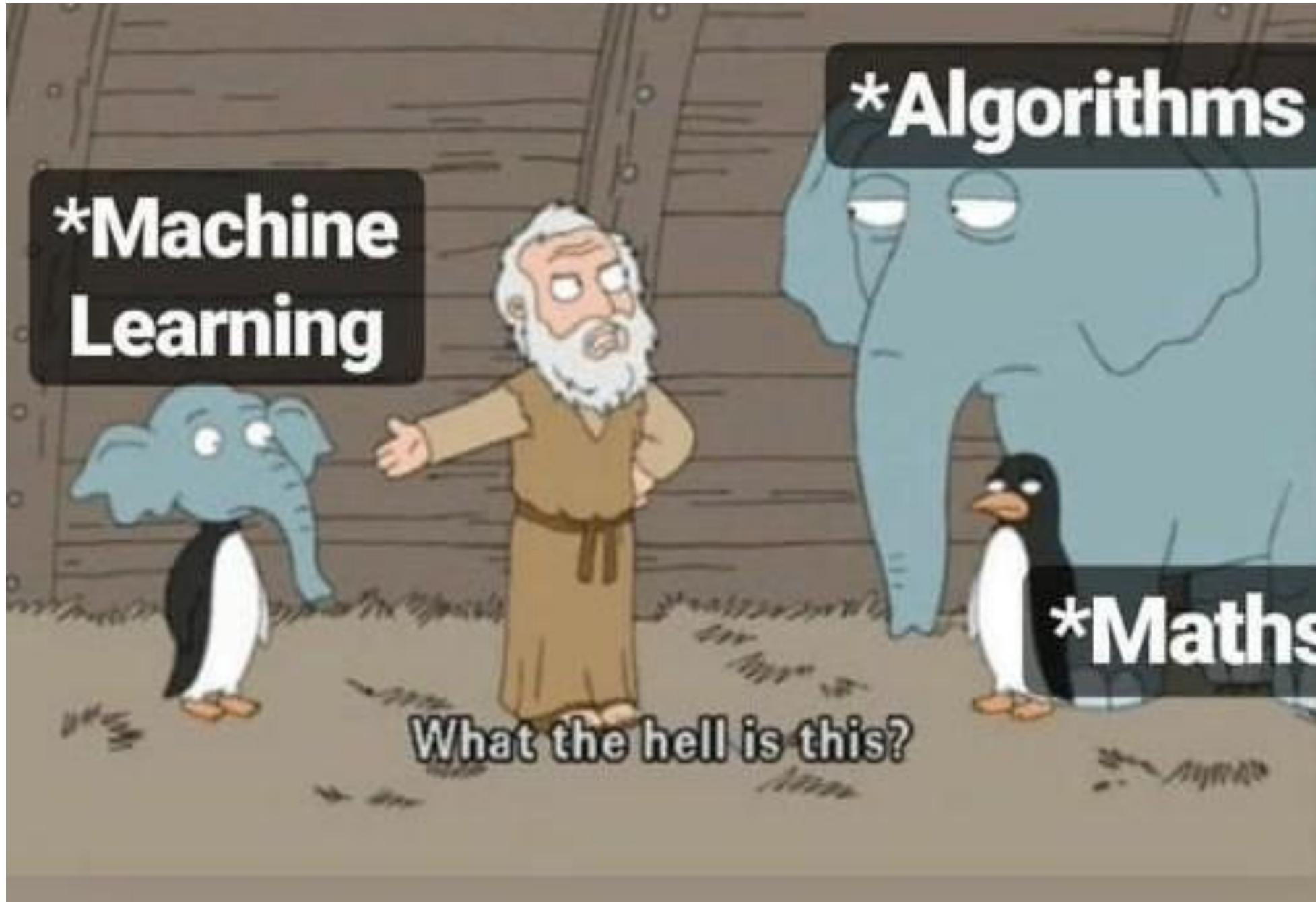
The age of machine learning. Computers acquire knowledge from data, not humans. Large tech companies invest in commercial applications of AI/ML.

2016	Sophia humanoid robot by Hanson Robotics, the first "robot citizen"	2016	PyTorch Open source ML Library	2017	The Facebook AI Research Lab trained two chatbots to communicate with each other in order to learn how to negotiate. The chatbots diverged from human language and invented their own language to communicate with one another	2017	Caffe Open source DL framework	2018	BERT (Google), the first bidirectional, unsupervised language representation	2018	Samsung introduces Bixby	2018	Facebook detects faces and shares photos with friends to whom those photos belong	2018	Alibaba language processing AI outscored human intellect at a Stanford reading and comprehension test	2020	DeepMind team uses DL algorithms (Agent57) that outperforms humans at Atari games with deep reinforcement learning	2020	Widespread 5G network deployments worldwide
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INTELLIGENZA  
ARTIFICIALE





**\*Machine  
Learning**

**\*Algorithms**

**\*Maths**

**What the hell is this?**



**Analisi di rischio**

**Elaborazione del linguaggio parlato**

**Riconoscimento di oggetti**

**Fraud detection**

**Customer segmentation**

**Recommender system**

**Veicoli a guida autonoma**

**Diagnosi mediche**

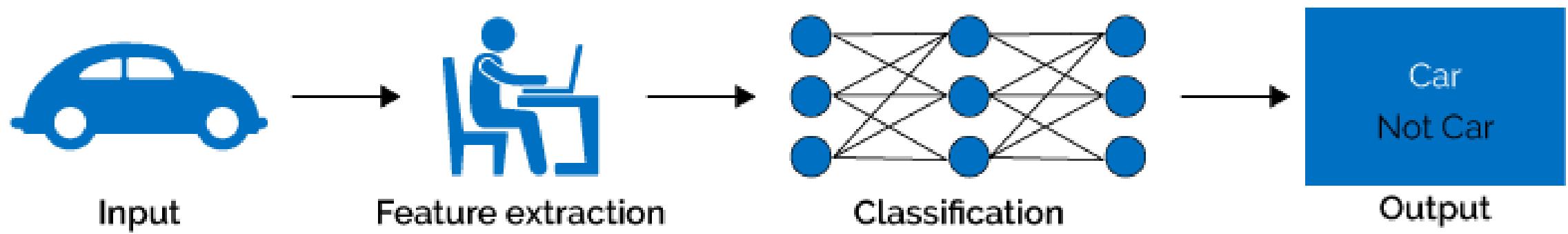
becomes  
continue models  
machine AI  
use still COVID IoT  
applications year work  
technology used time about  
people value science  
start model  
healthcare GPT digital being business  
new management another NLP Deep  
Language real life need  
MLOps Analytics  
issues  
organizations learning

CAN I KNOW WHAT IS

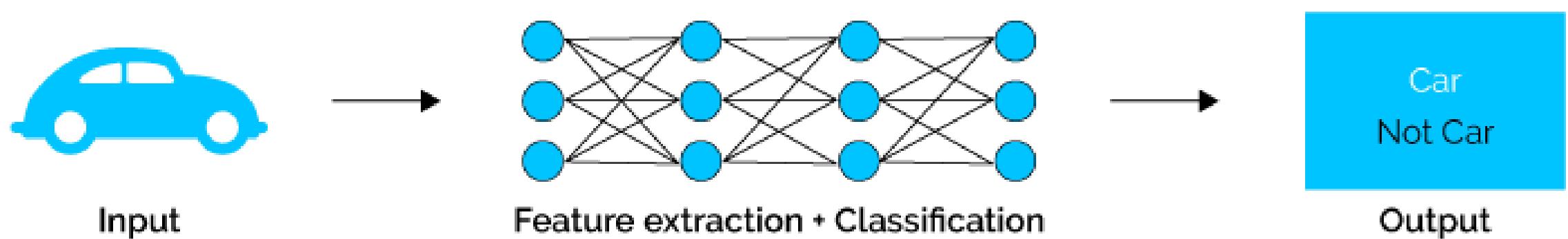


DEEP LEARNING?

# Machine Learning

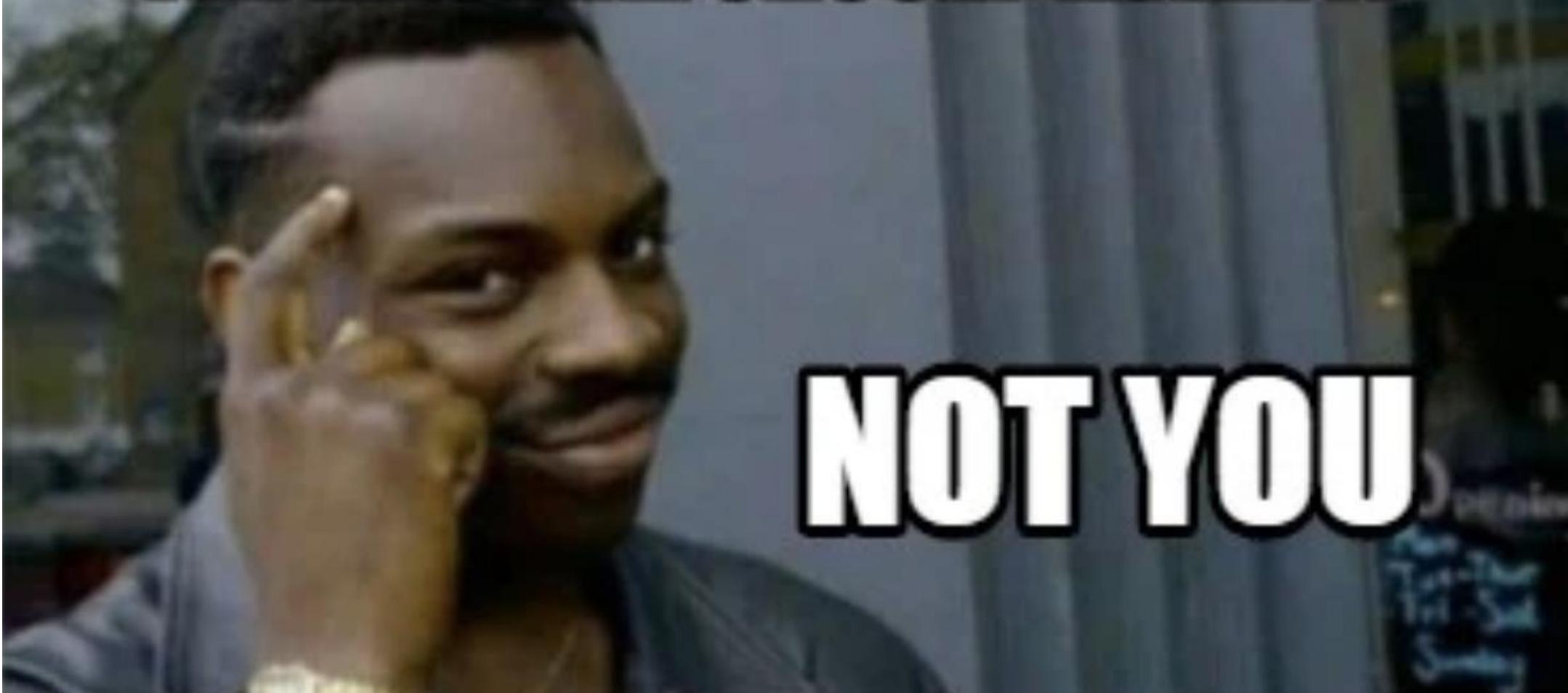


# Deep Learning



**IF IT IS CALLED "MACHINE LEARNING"  
THE MACHINE SHOULD LEARN IT**

**NOT YOU**



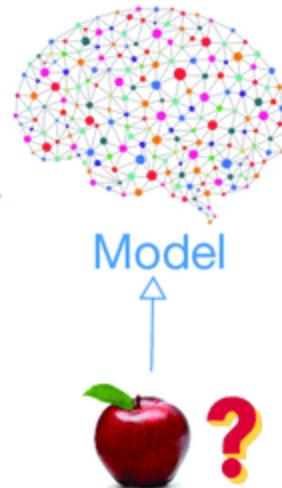
## supervised learning

Input data



Annotations

These are  
apples



Prediction

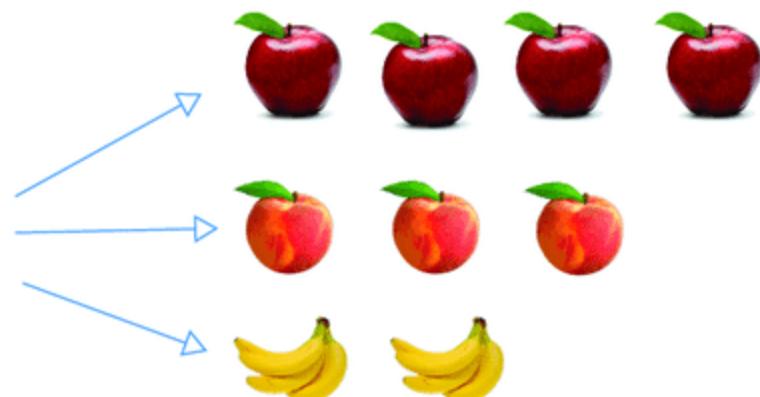
Its an  
apple!

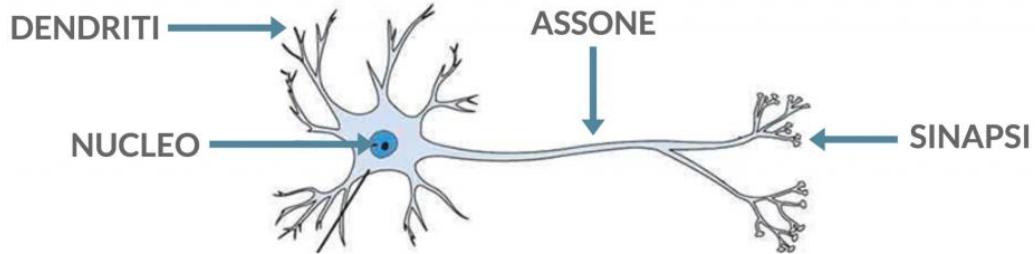
## unsupervised learning

Input data

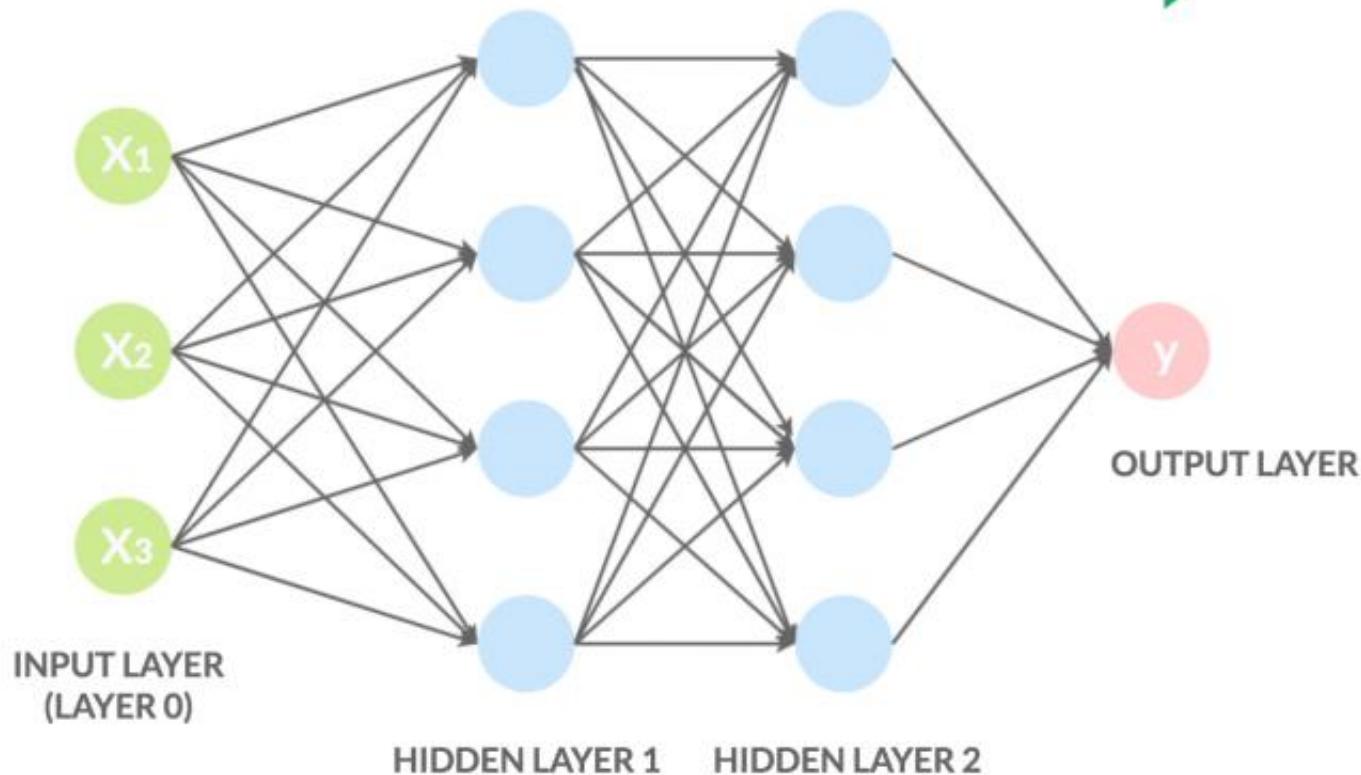


Model





**FORWARD PROPAGATION:** Calcolare le predizioni



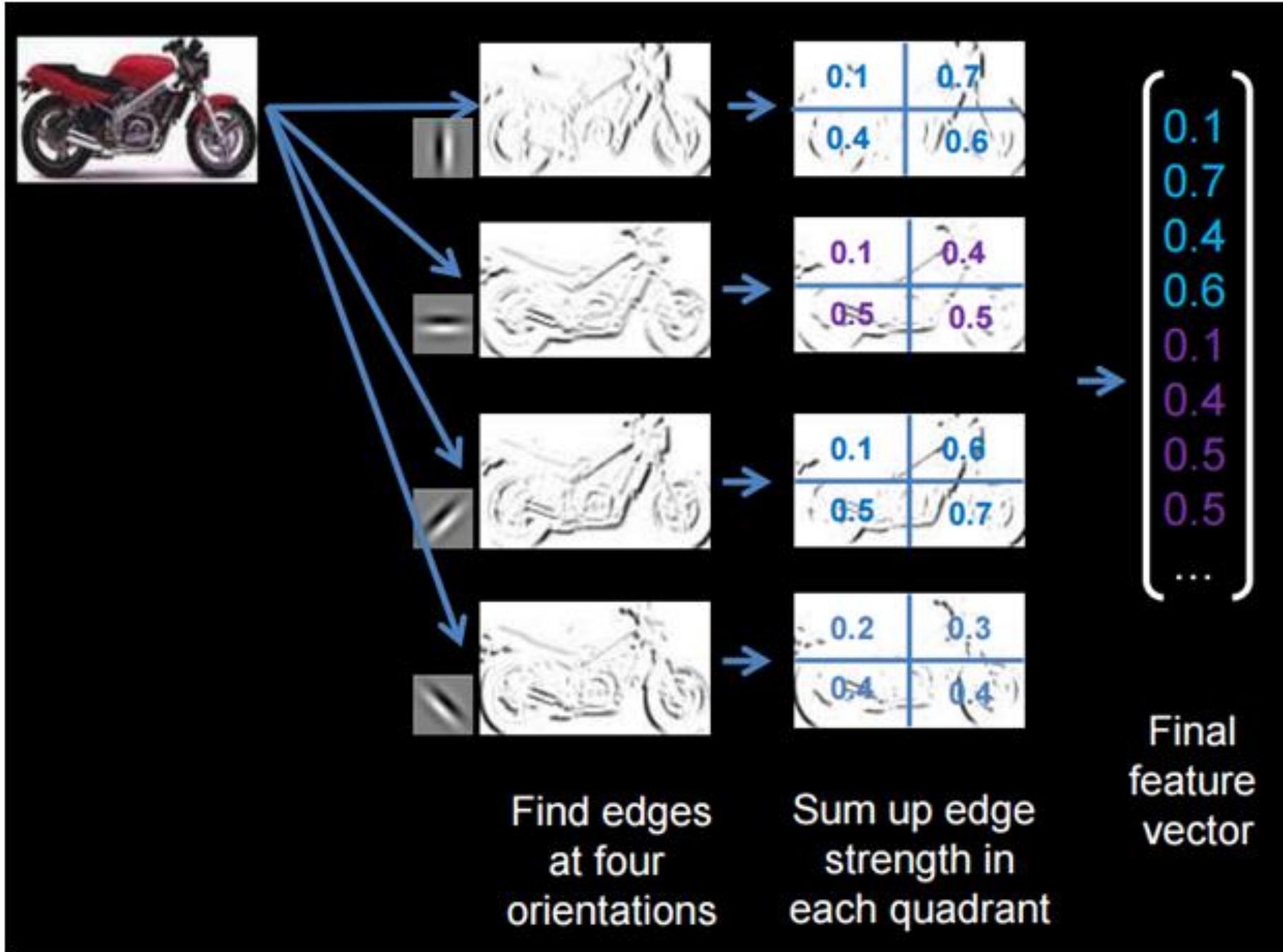
**BACKWARD PROPAGATION:** Aggiornare i pesi

### PROBLEMA

Una rete neurale ha un enorme numero di pesi, per eseguire il gradient descend dobbiamo sapere quanto ogni peso di ogni layer ha influenzato l'errore.

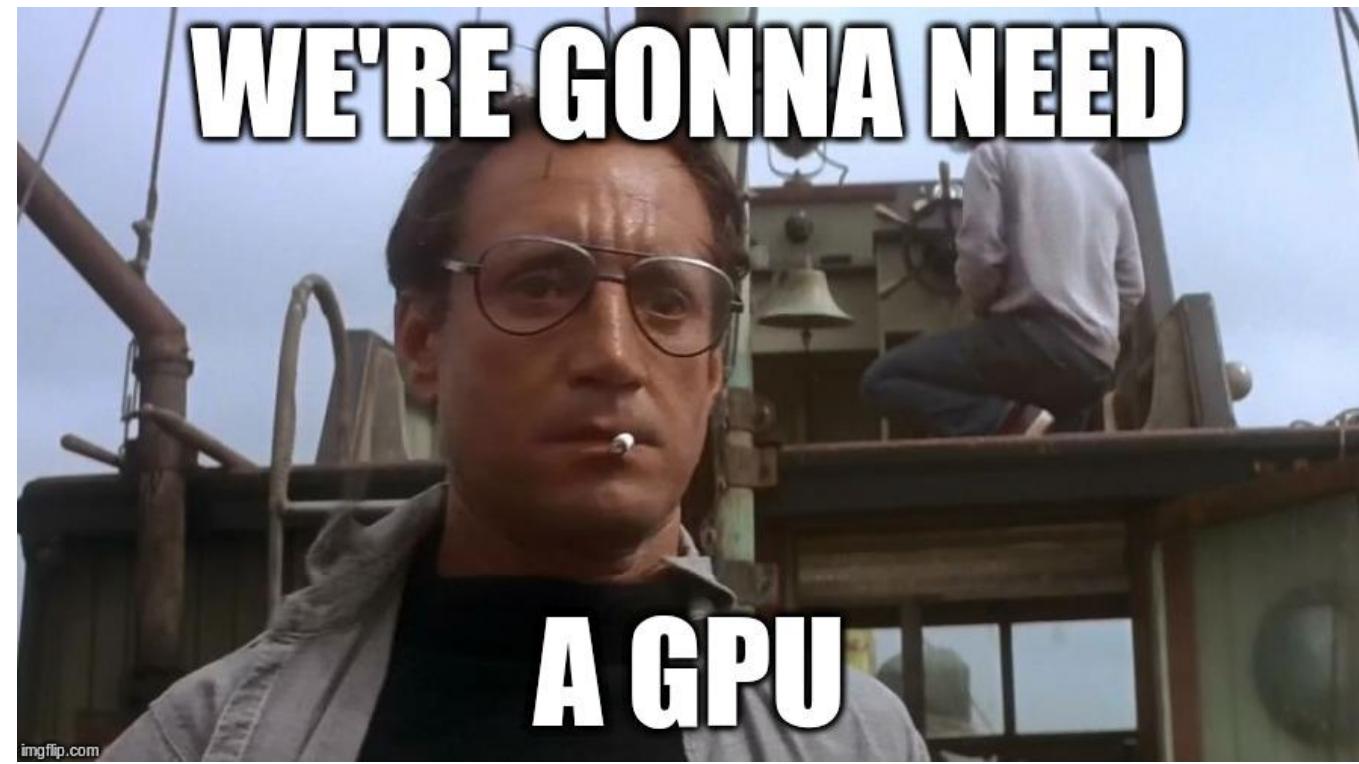
### SOLUZIONE: BACKPROPAGATION

Propagando all'indietro l'errore la backpropagation ci permette di sapere in che quantità ogni nodo di ogni layer ha influito sull'errore e possiamo utilizzare questi valori per aggiornare i pesi eseguendo il gradient descend.



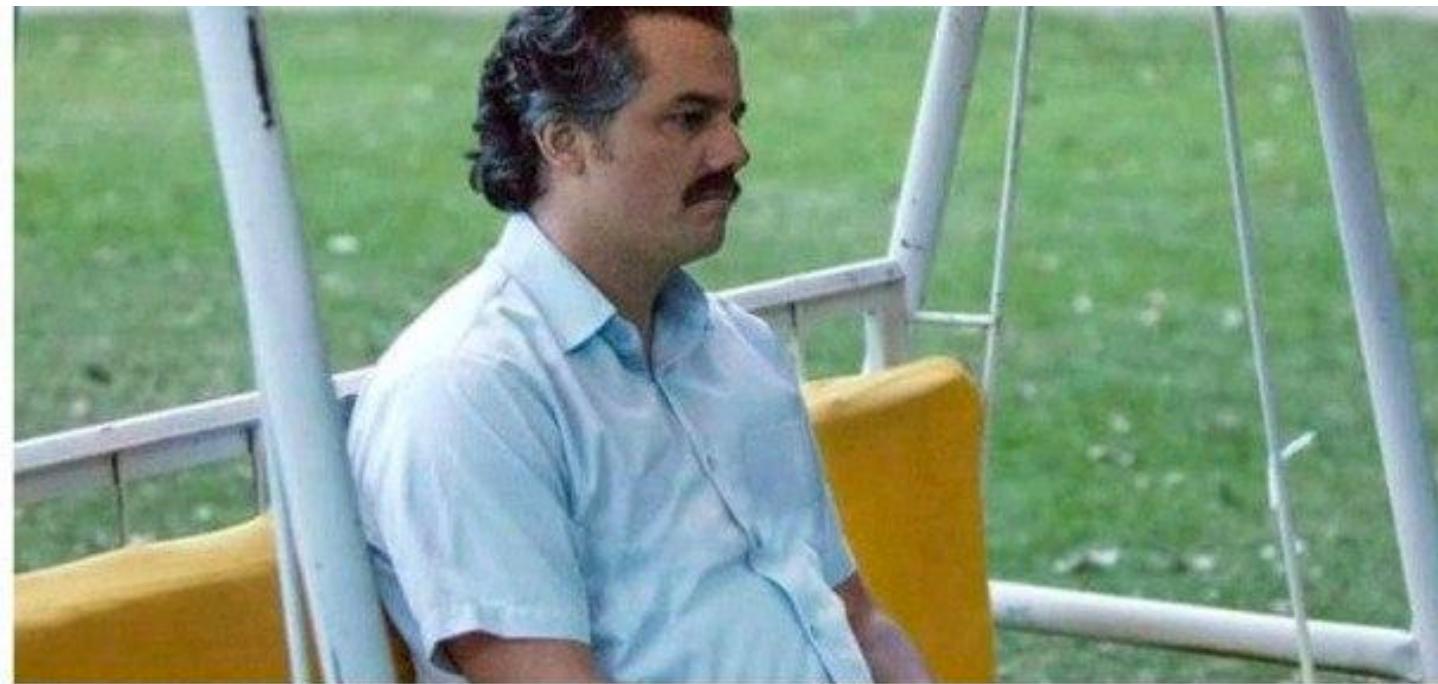
# HEXWII

STILL WAITING



FOR MY NEURAL NETWORK TO  
TRAIN

[memegenerator.net](http://memegenerator.net)



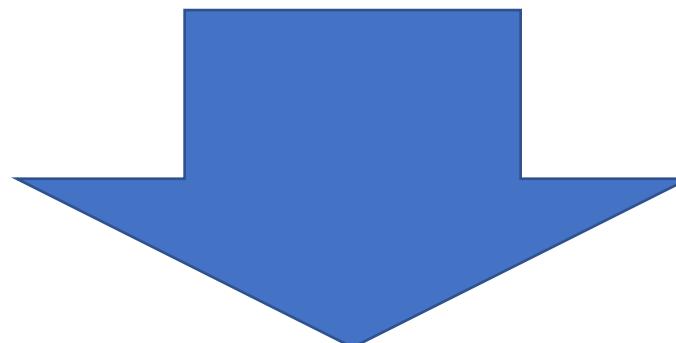
**Waiting for an experiment to finish on my local machine.**

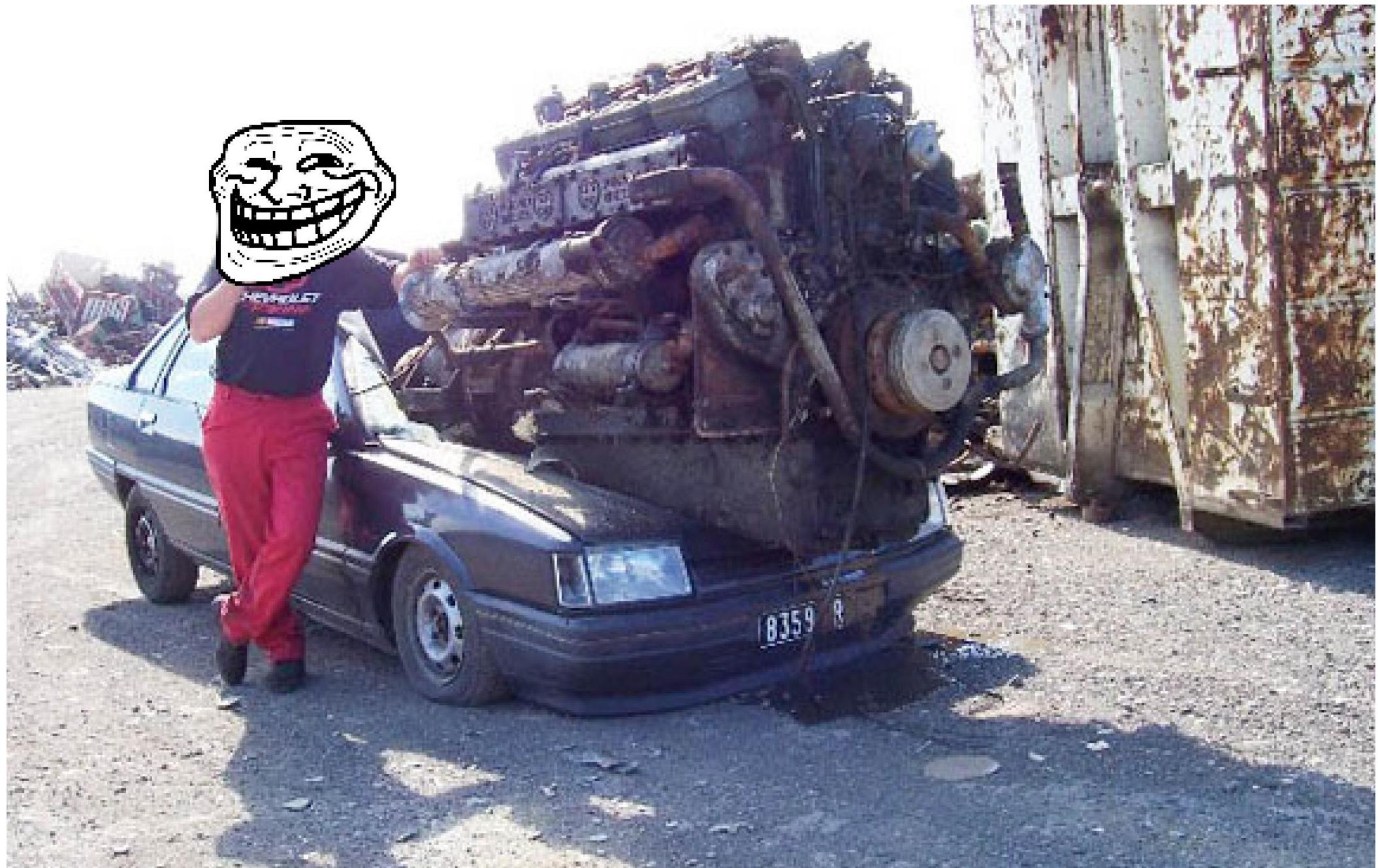
**ML infrastructure could help.**

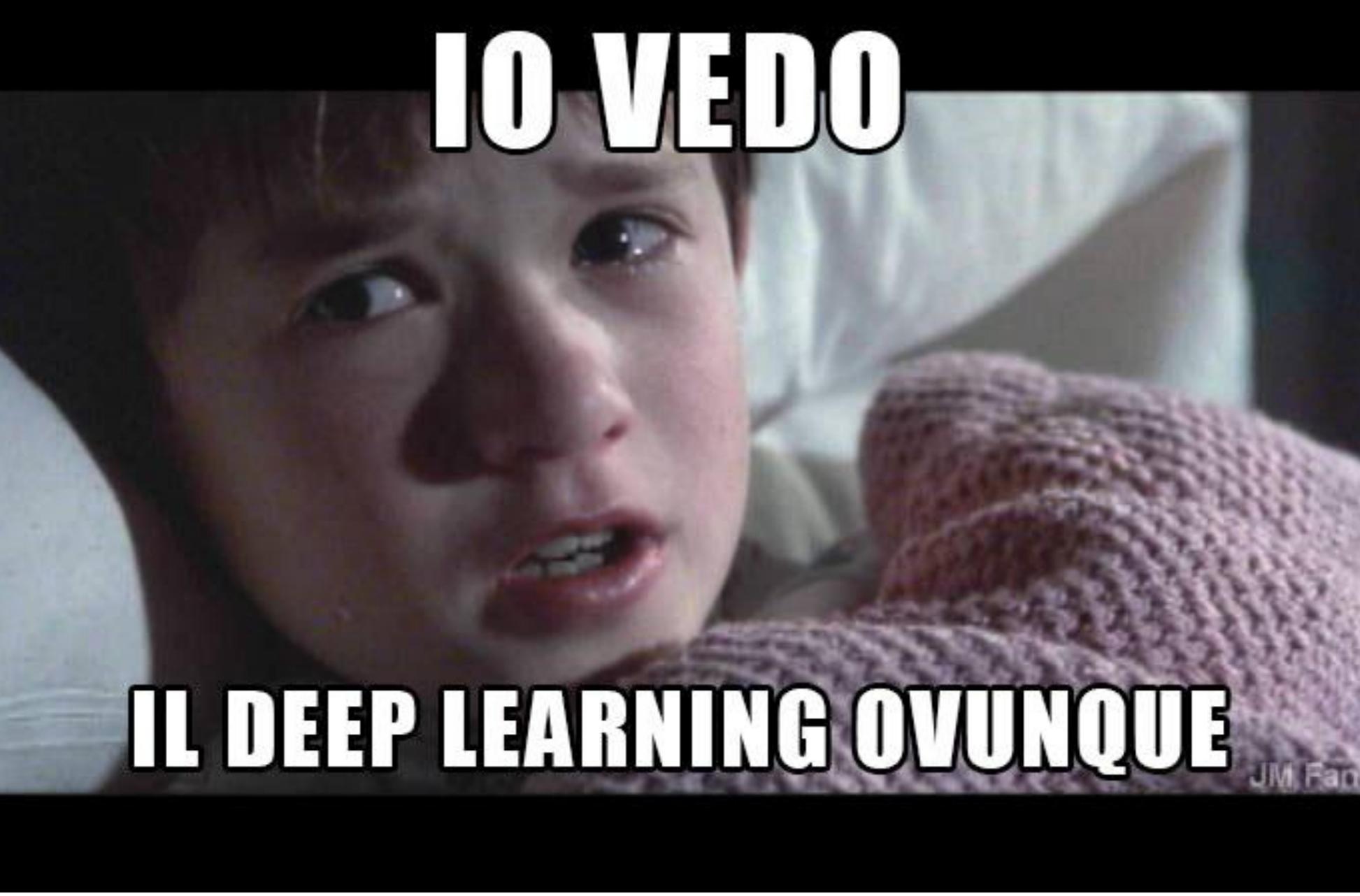
# The GPU War



**WHAT DOES NEURAL  
NETWORKS MEAN  
TO ME?**



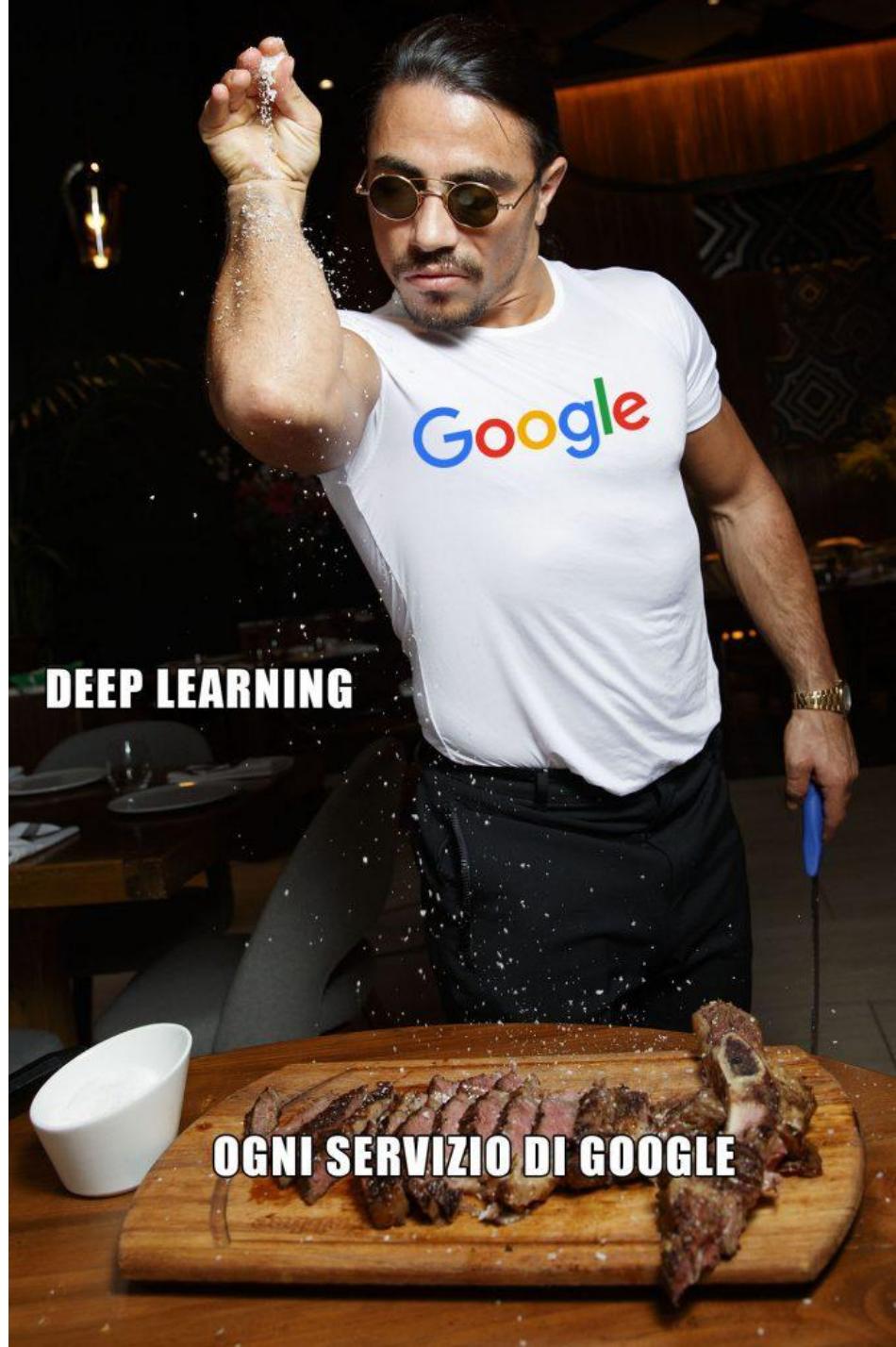




**IO VEDO**

**IL DEEP LEARNING OVUNQUE**

JM Rap



DEEP LEARNING

OGNI SERVIZIO DI GOOGLE



# THE LANDSCAPE OF AI AND ITS USE CASES

Perform Specific Tasks

Gen AI

Content Generation:  
(Image, video, text, audio)

Data  
Mining

Can behave  
in a Human-  
like way

AGI

Traditional  
AI

Facial Detection  
Image Recognition  
Speech Recognition / TTS  
NLP

Pattern  
Recognition

ASI

Advanced virtual  
assistants

Medical Diagnosis/  
Treatment

Addressing  
Climate Change

Accelerate  
Scientific  
Research

Personalized  
Education

Solving Global  
Challenges

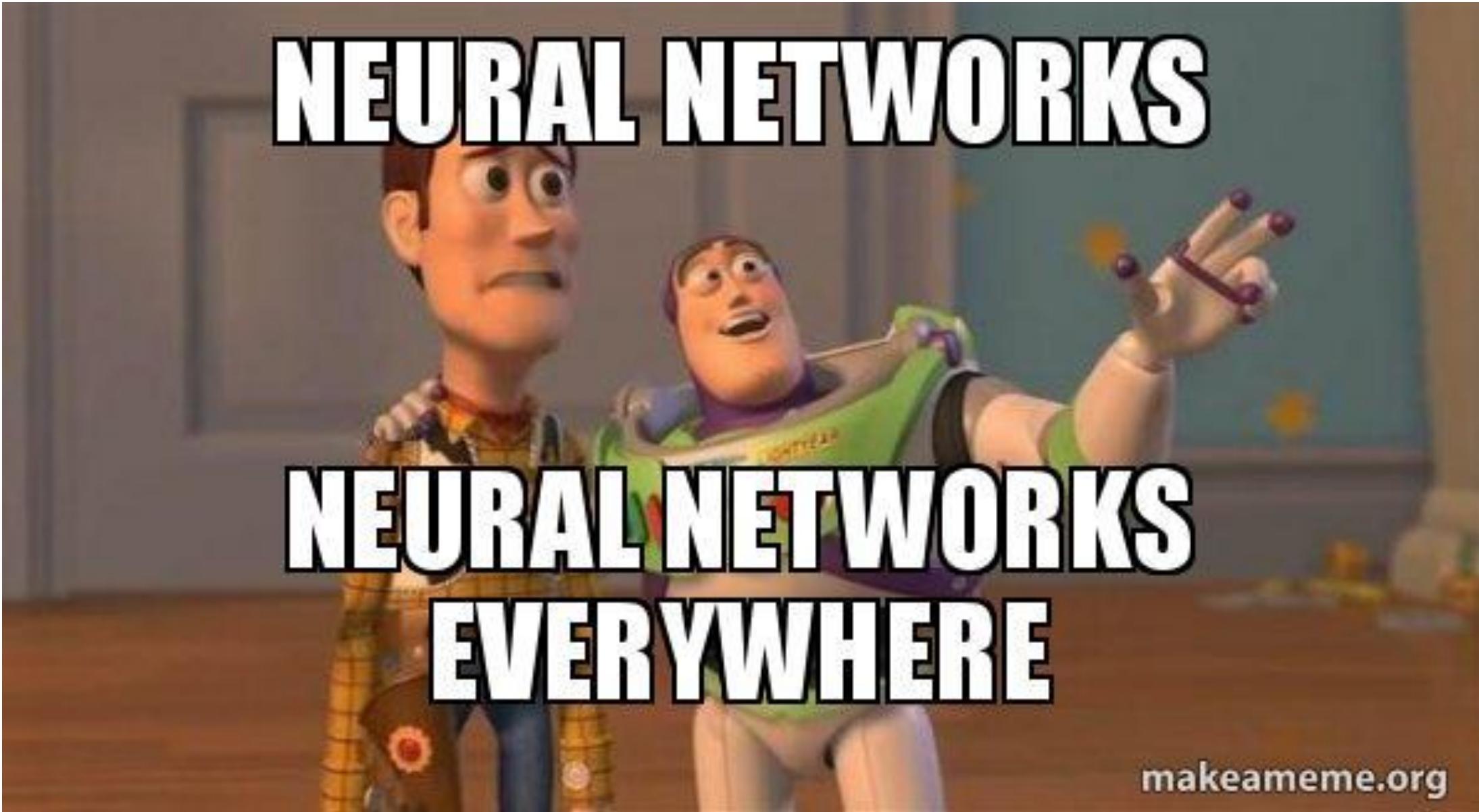
Healthcare  
Revolution

Space  
Exploration

Environmental  
Management

Art/Books  
that understand  
human emotion

Smarter than  
Humans  
(hypothetical)



**NEURAL NETWORKS**

**NEURAL NETWORKS  
EVERYWHERE**

My Answer.....

**BAD DATA**

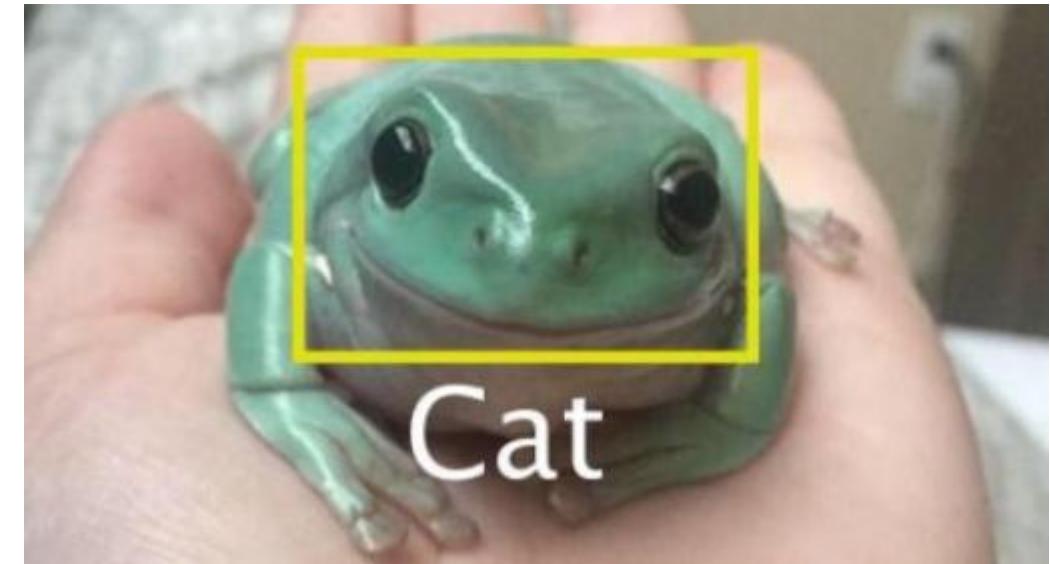
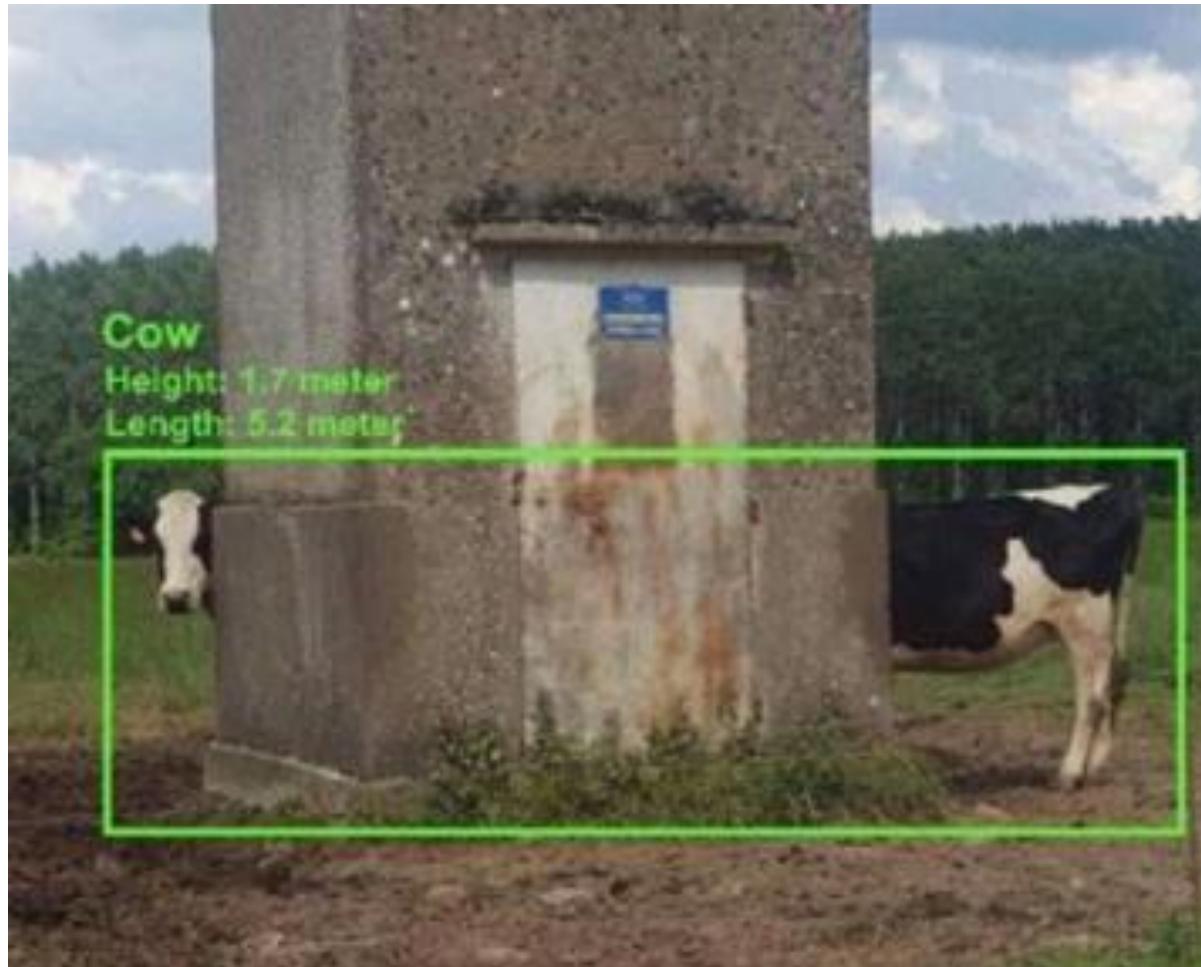
**BAD DATA EVERYWHERE**

and last but  
not least...

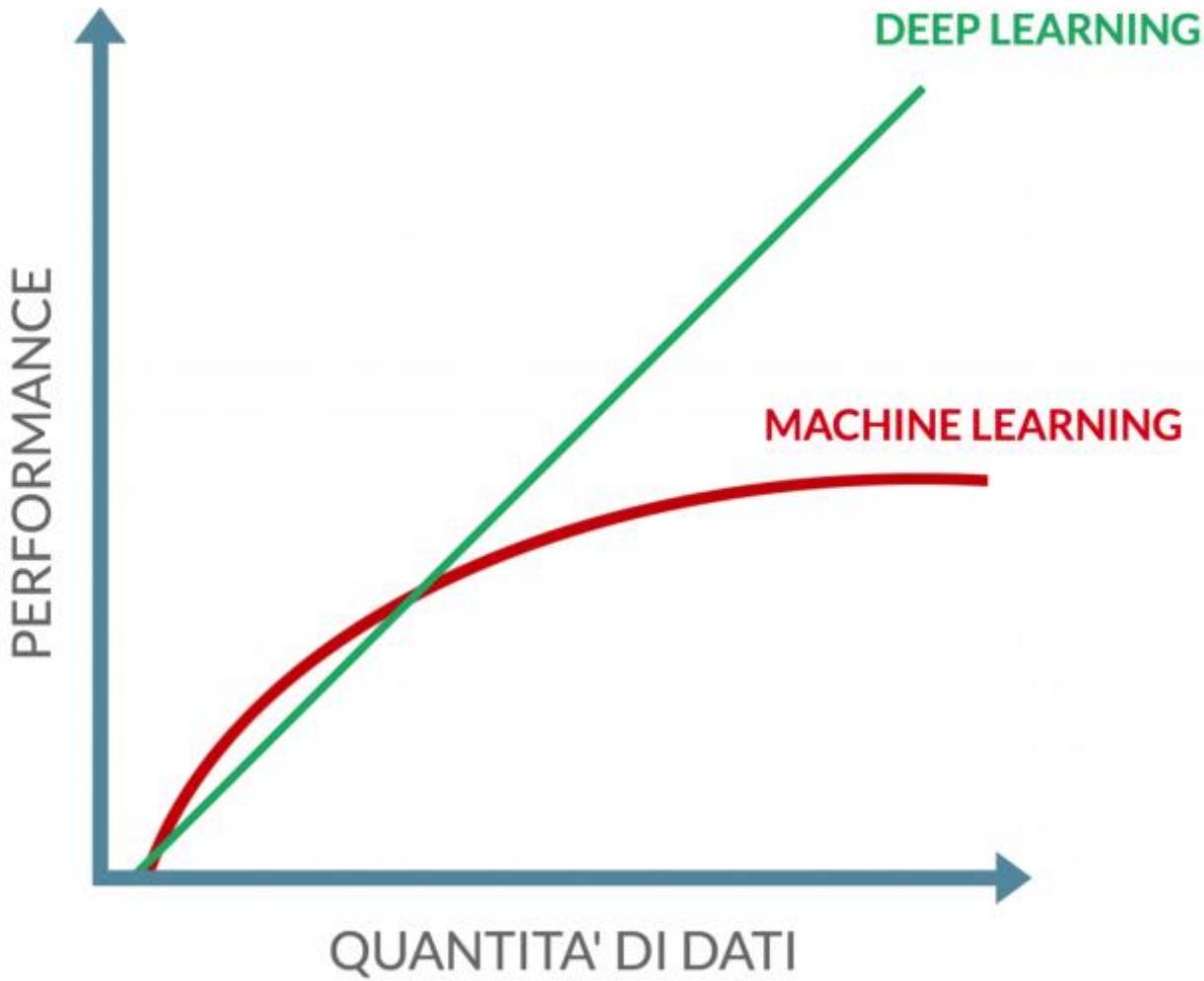
A scene from Toy Story featuring Woody and Jessie. Woody, on the left, has a serious expression and is looking upwards. Jessie, on the right, is smiling and pointing her right index finger upwards. Both characters are wearing their signature clothing: Woody in his brown vest and Jessie in her green flight suit.

**BIAS**

**BIAS EVERYWHERE**



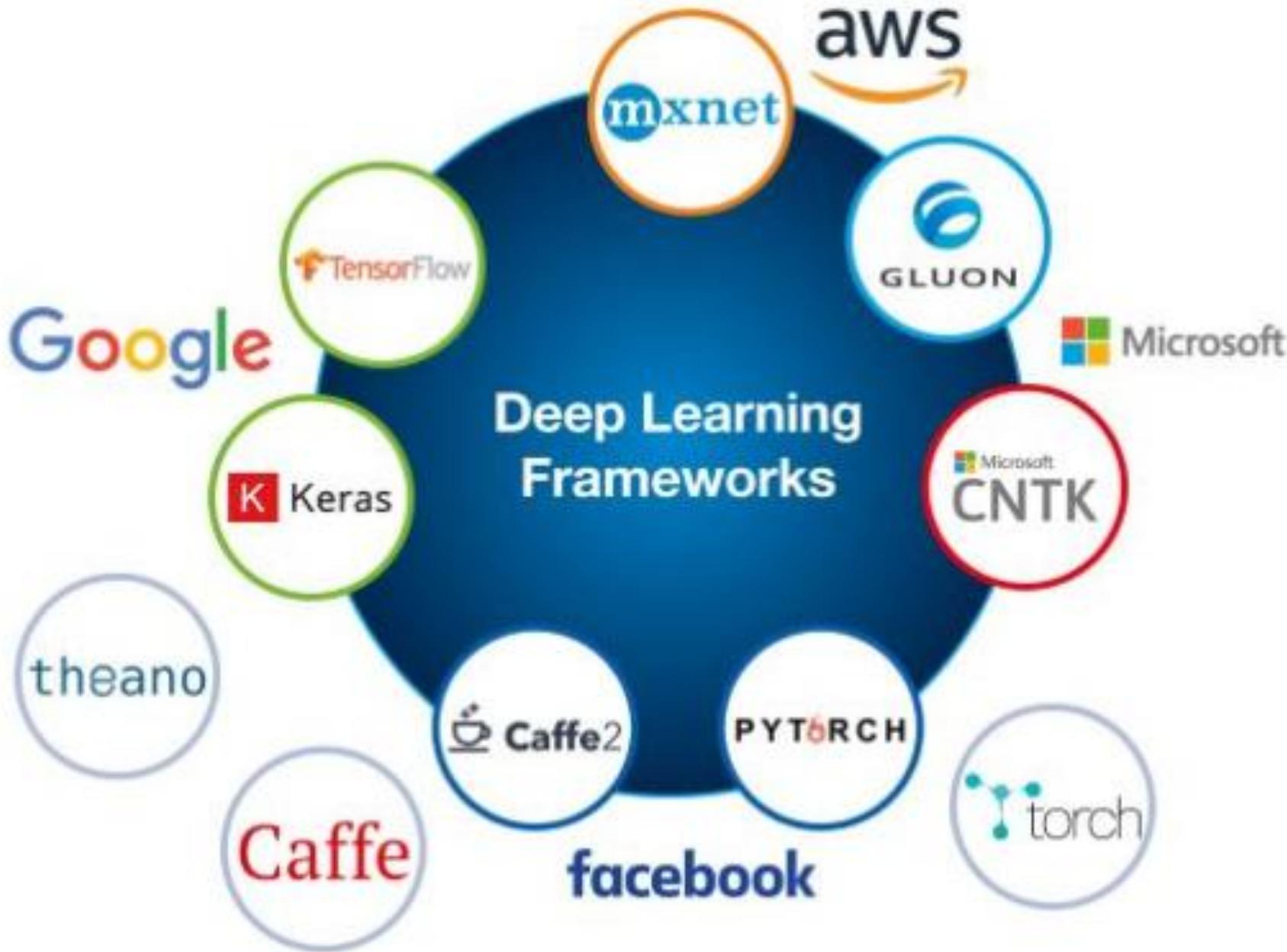
## SIMPLE PROBLEM WITH NEURAL NETWORKS

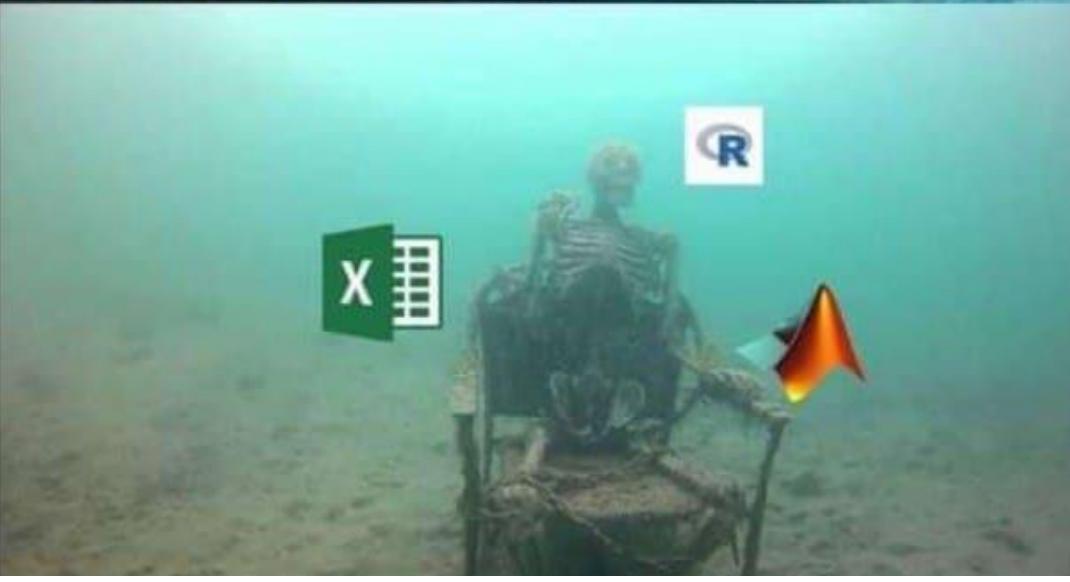


**SAY DEEP LEARNING**



**ONE MORE TIME**



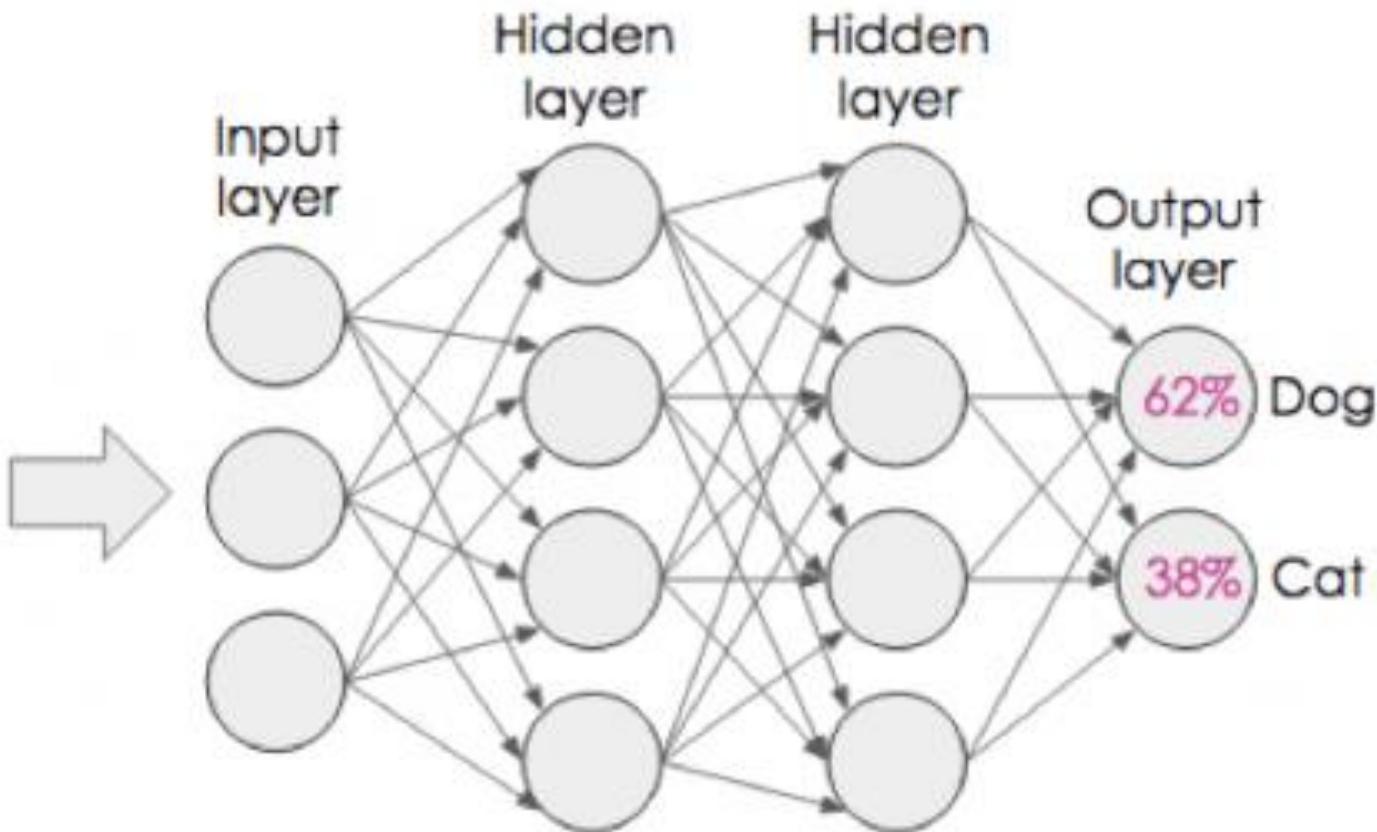


# How Neural Networks work?

## Neurons:

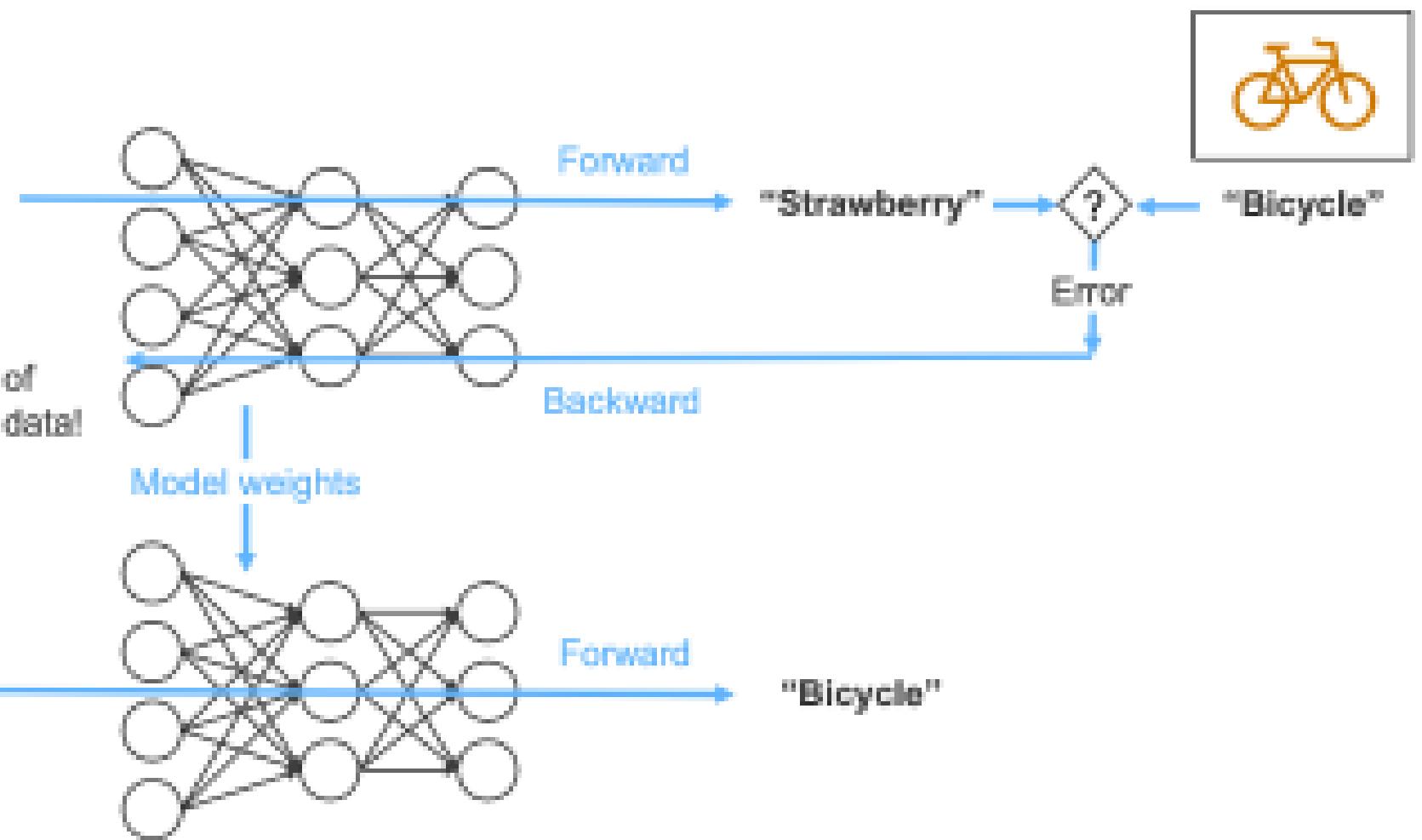
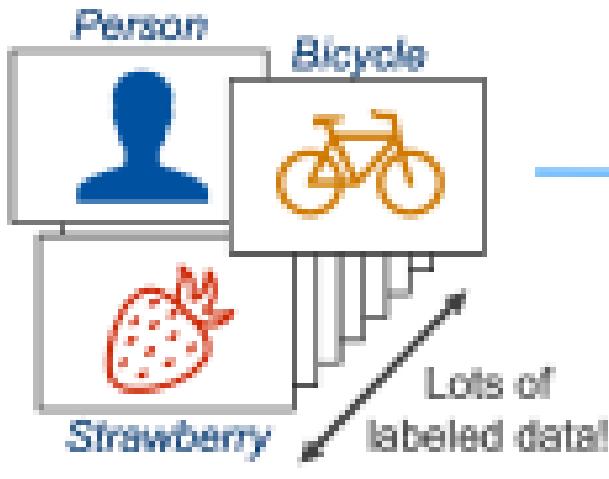


I know a guy who knows a guy

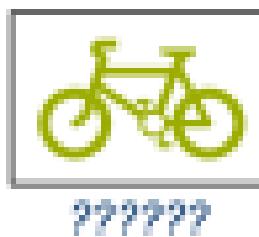


It should be  
100% Cat :(

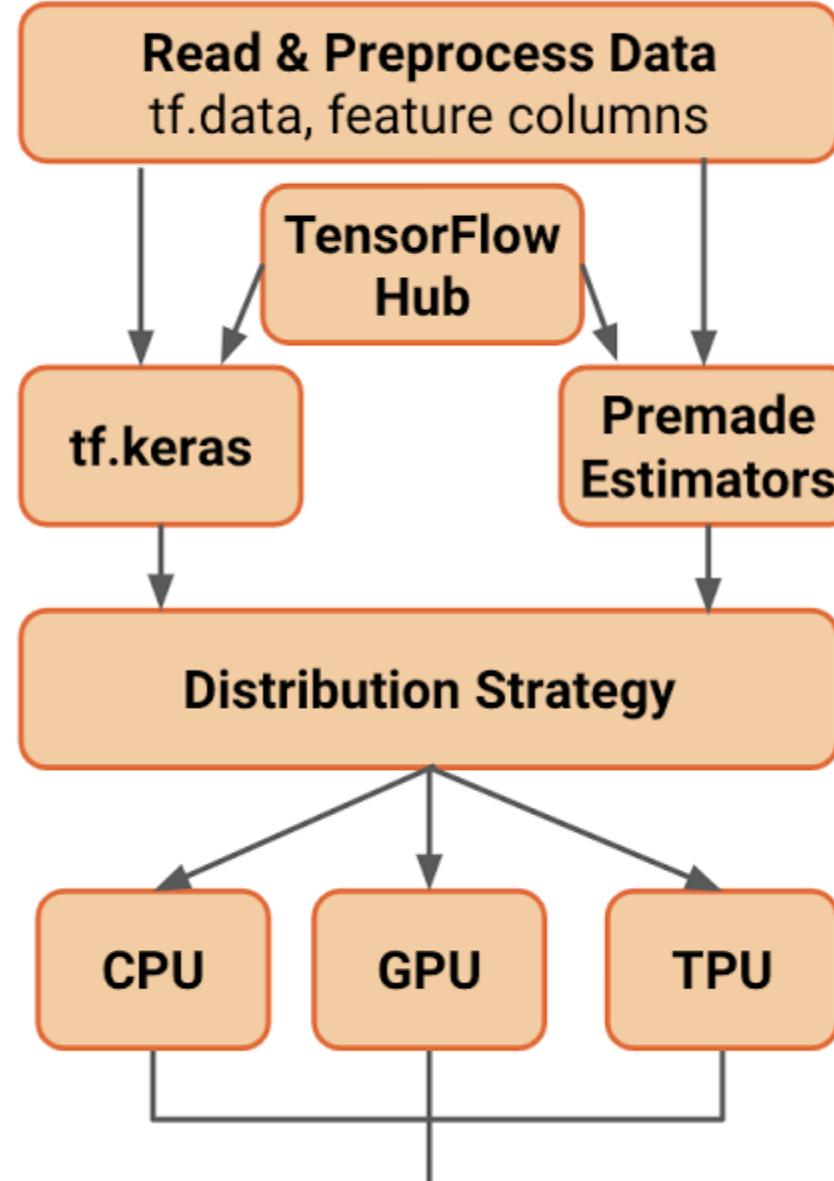
## Training



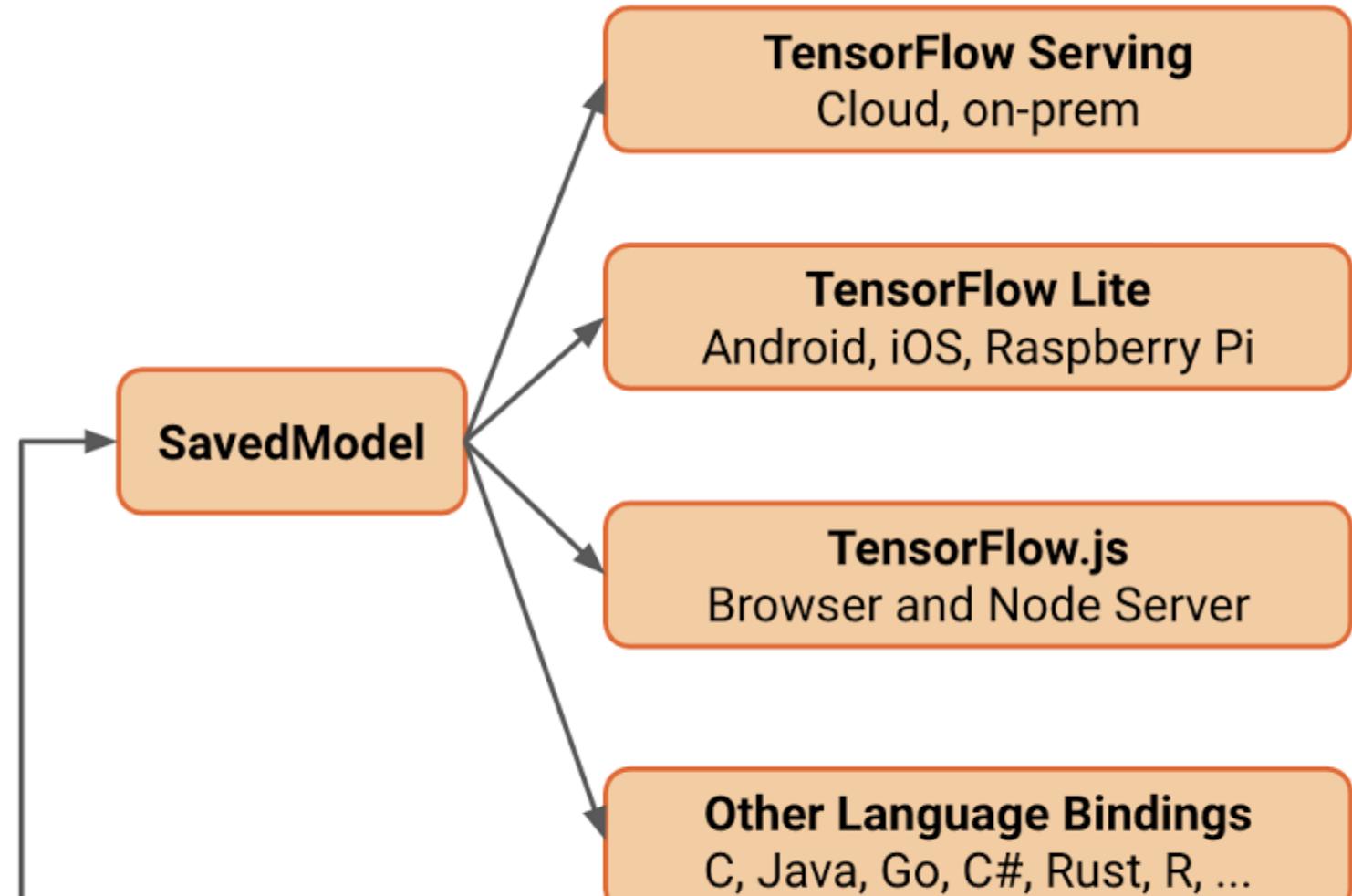
## Inference

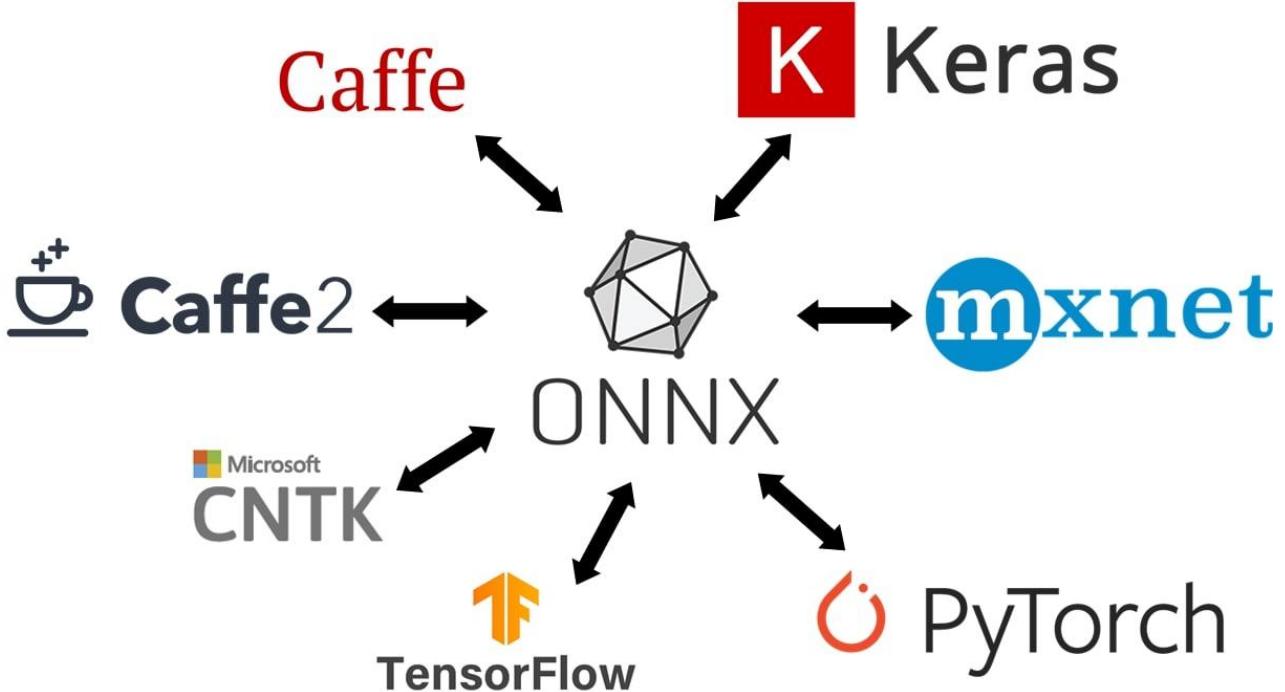


## TRAINING



## DEPLOYMENT

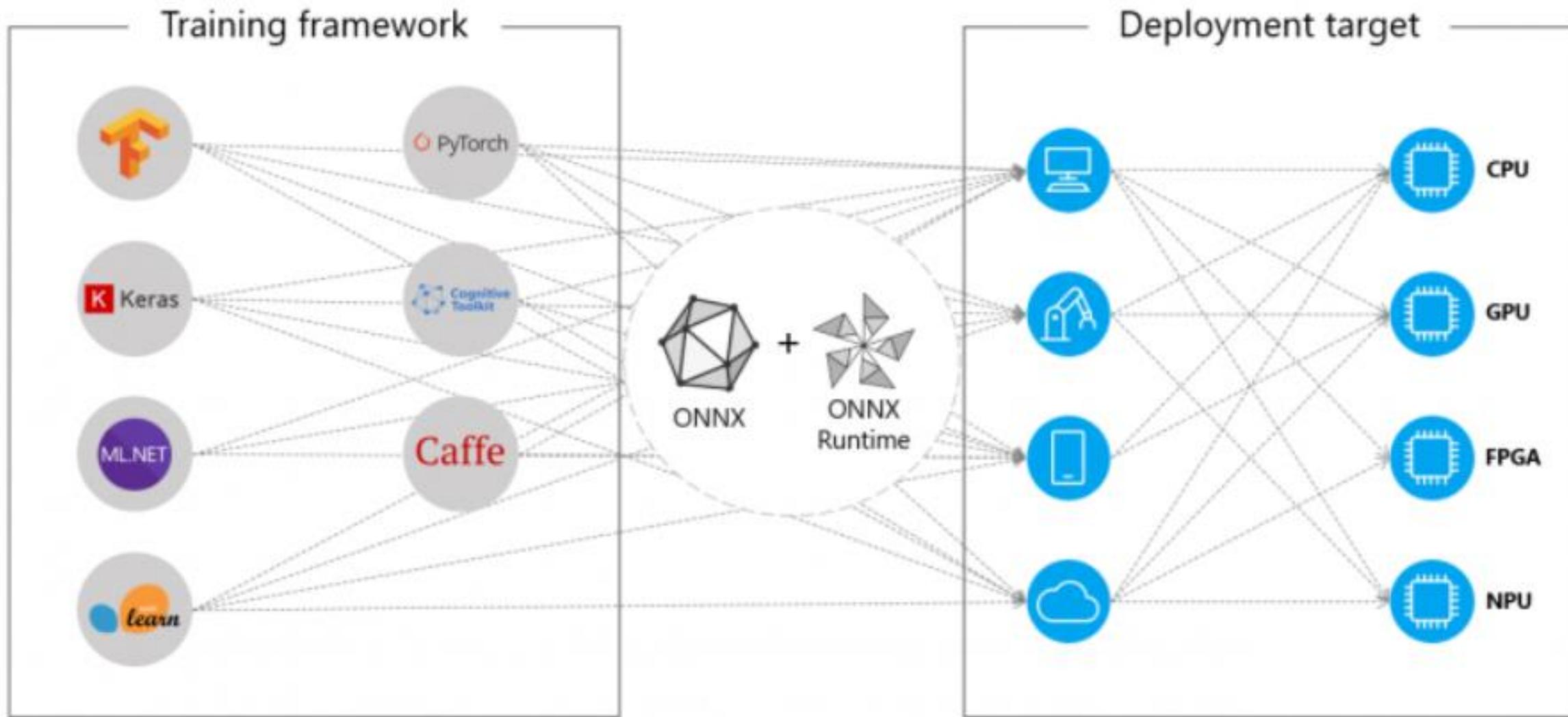


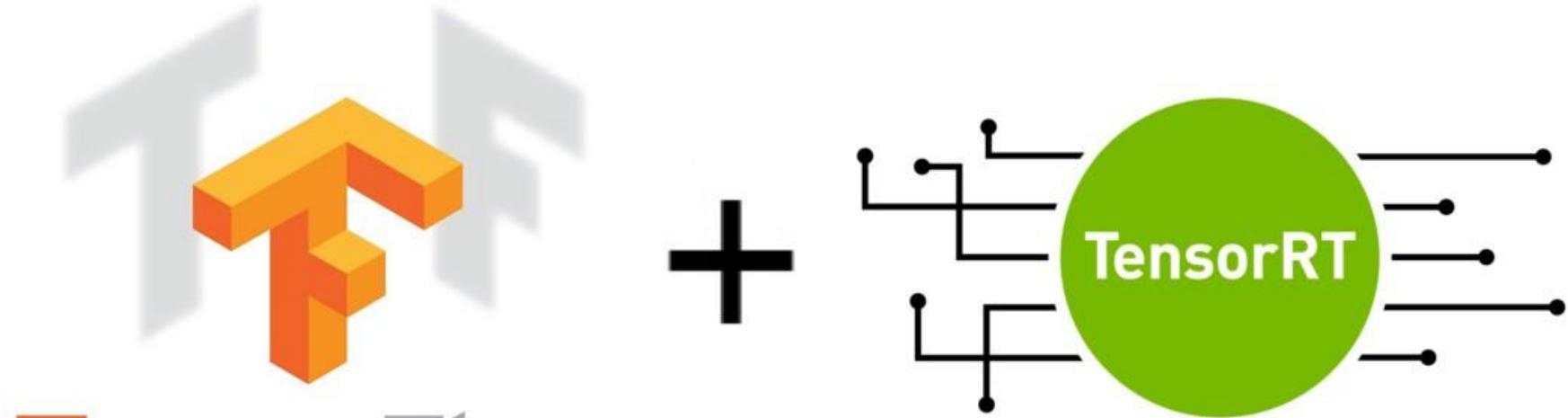


#### ONNX converters for popular frameworks

- Native Support
  - Pytorch
  - CNTK
- Open sourced Converter Tools
  - Tensorflow: onnx/tensorflow-onnx
  - Keras: onnx/keras-onnx
  - Scikit-learn: onnx/sklearn-onnx
  - CoreML: onnx/onnxmltools
  - LightGBM: onnx/onnxmltools
  - LibSVM: onnx/onnxmltools
  - XGBoost: onnx/onnxmltools

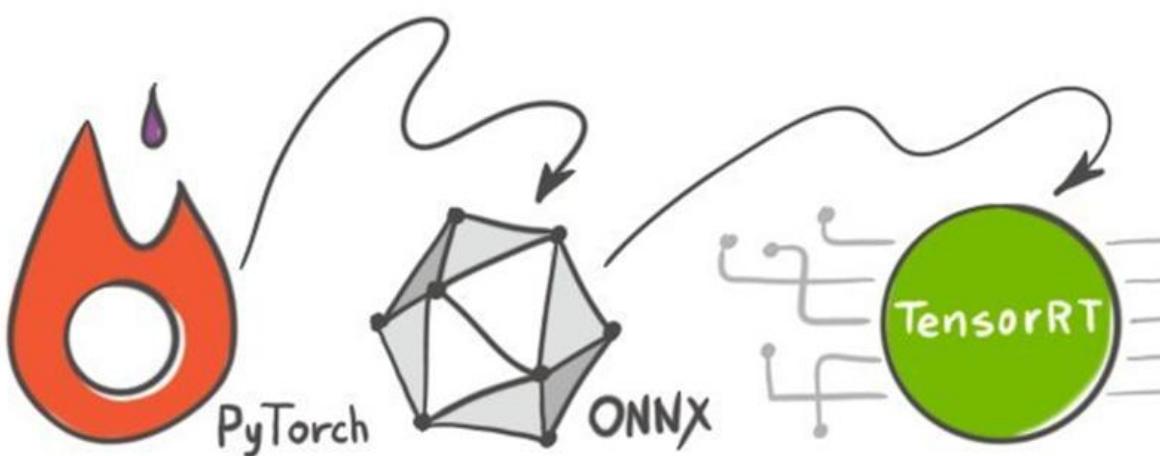






# TensorFlow

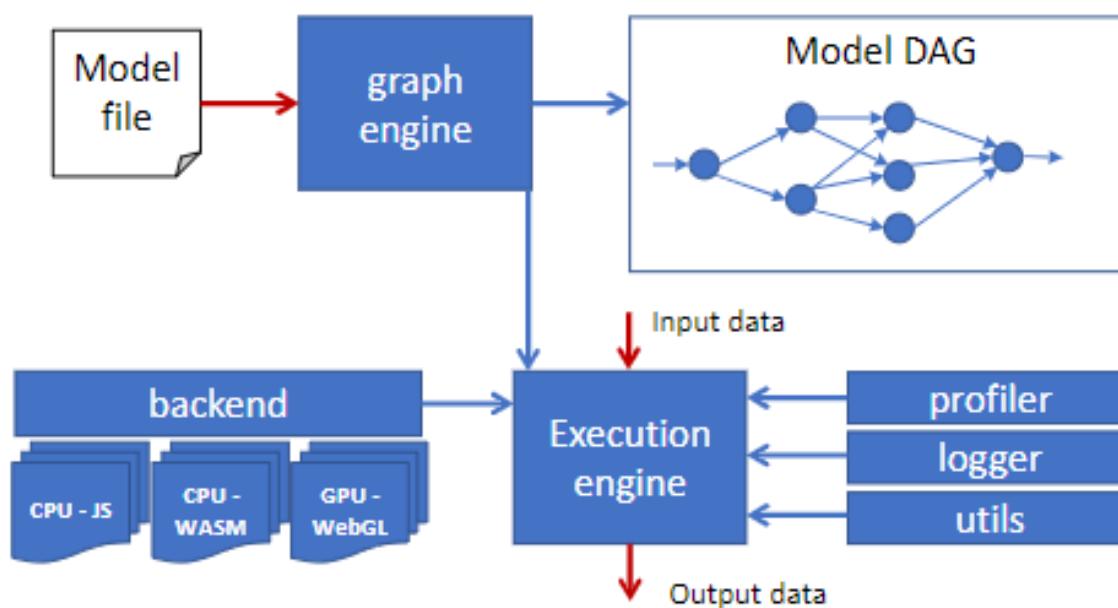
LEARNOPENCV.COM



## How To Run Inference Using TensorRT C++ API

# ONNX.js

- A pure JavaScript implementation of ONNX framework
- Optimize ONNX model inference on both CPUs and GPUs
- Support a variety of browsers on major OSes



Desktop Platforms

OS/Browser	Chrome	Edge	FireFox	Safari	Opera	Electron	Node.js
Windows 10	✓	✓	✓	-	✓	✓	✓
macOS	✓		✓	✓	✓	✓	✓
Ubuntu LTS 10.04	✓	-	✓	-	✓	✓	✓

Mobile Platforms

OS/Browser	Chrome	Edge	FireFox	Safari	Opera
iOS	✓	✓	✓	✓	✓
Android	✓	✓	Coming soon	-	✓

# HTML example to use ONNX.js

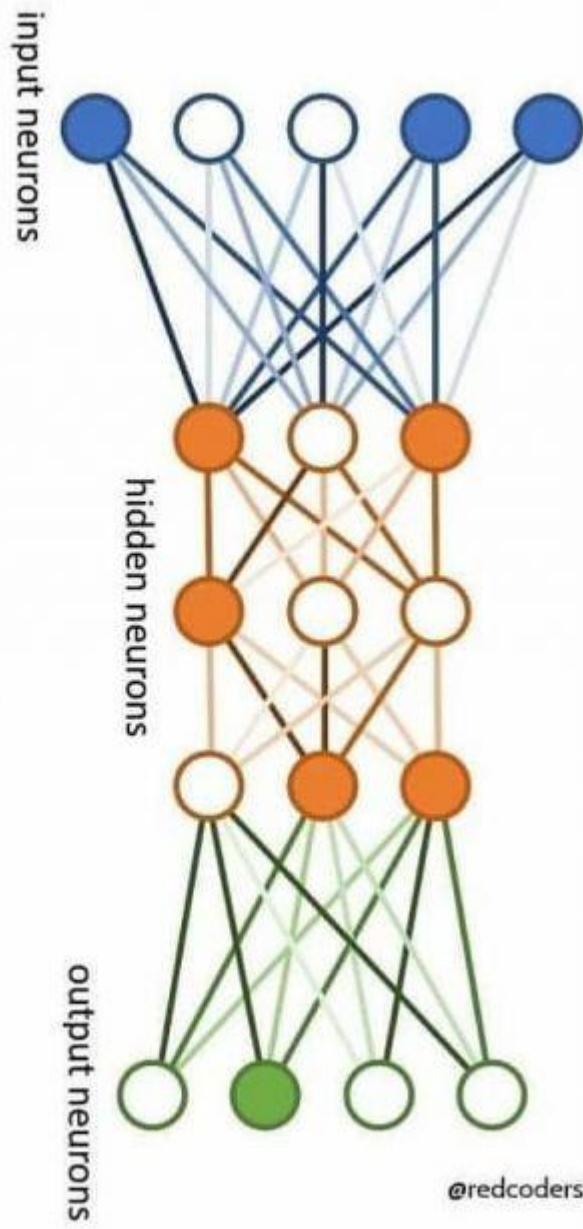
```
<html>
  <head>
    </head>

  <body>
    <!-- Load ONNX.js -->
    <script src="https://cdn.jsdelivr.net/npm/onnxjs/dist/onnx.min.js"></script>
    <!-- Code that consume ONNX.js -->
    <script>
      // create a session
      const myOnnxSession = new onnx.InferenceSession();
      // load the ONNX model file
      myOnnxSession.loadModel("./my-model.onnx").then(()=>{
        // generate model input
        const inferenceInputs = getInputs();
        // execute the model
        session.run(inferenceInputs).then(output=>{
          // consume the output
          const outputTensor = output.values().next().value;
          console.log(`model output tensor: ${outputTensor.data}`);
        });
      })
    </script>
  </body>
</html>
```

**THIS IS A NEURAL  
NETWORK.**

**IT MAKES MISTAKES.  
IT LEARNS FROM THEM.**

**BE LIKE A NEURAL  
NETWORK.**



@redcoders

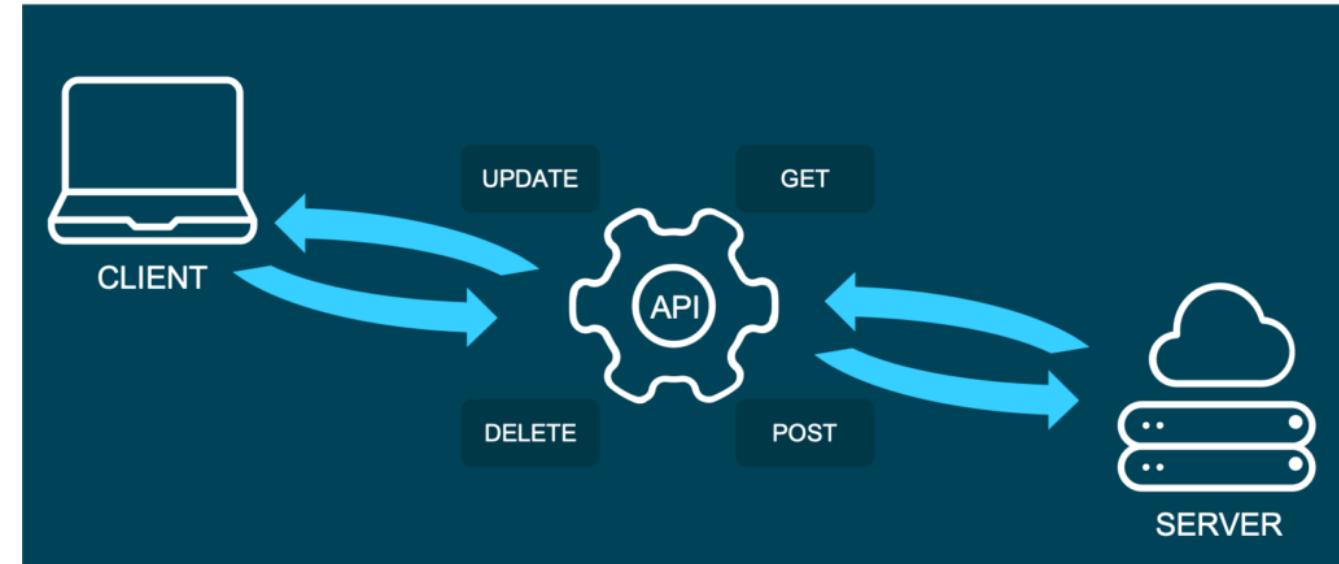
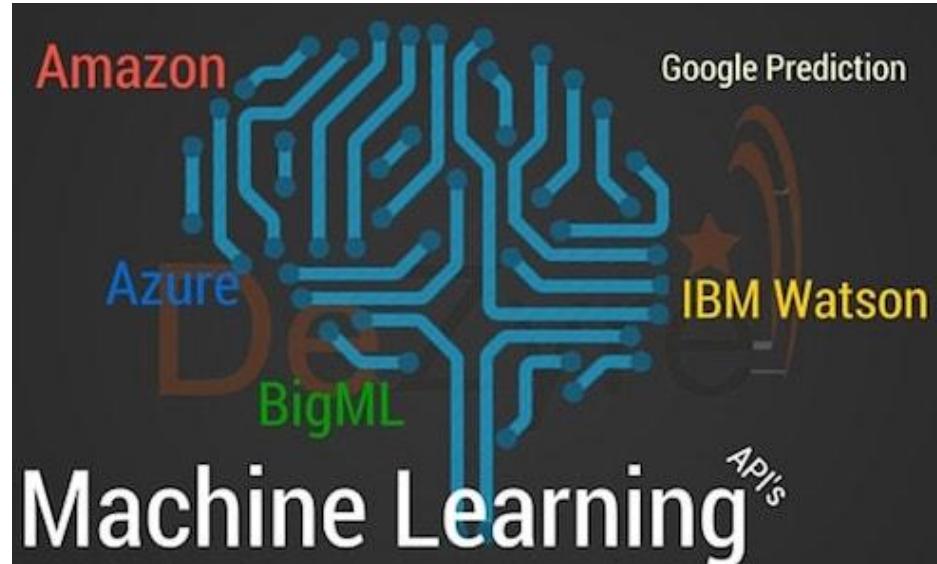
**SO YOU'RE TELLING ME**

**MEMES ARE REAL?**

made with Allodium

# API





Custom ML models



TensorFlow



Machine Learning  
Engine

Pre-trained ML models



Vision API



Speech API



Jobs API



Natural  
Language API



Translation  
API



Video  
Intelligence API



That's all folks!



It's Just  
The Beginning