Artificial Intelligence

Everything you wanted to know but were afraid to ask ☺

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Goal

- Demystify the term AI
- Explain what AI is made of
- Give some examples where AI is used

Defining *Artificial Intelligence*

The exciting new effort to make computers think…[as] machines with minds, in the full and literal sense. **(Haugeland, 1985)**

[The automation of] activities that we associate with human thinking such as decision-making, problem-solving, learning. **(Bellman, 1978)**

The art of creating machines that perform functions that require intelligence when performed by people. **(Kurzweil, 1990)**

Defining *Artificial Intelligence*

The study of how to make computers do things which, at the moment, people are better. **(Rich and Knight, 1991)**

The study of the computations that make it possible to perceive, reason, and act. **(Winston, 1992)**

Making machines intelligent; intelligence is that quality that enables an entity to function appropriately and with foresight in its environment. **(Nils Nilsson)**

Why define AI?

If we create AI policy, which systems are we addressing ?

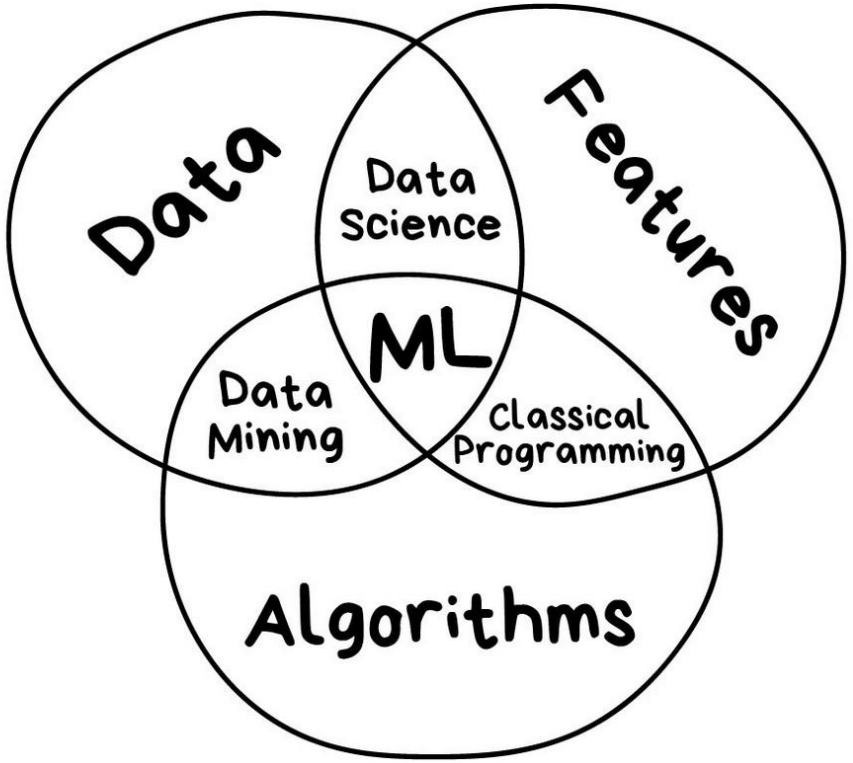
The fact that it’s so hard to define AI is telling us something important.

AI is more than just automated decision making.

Defining AI and machine learning

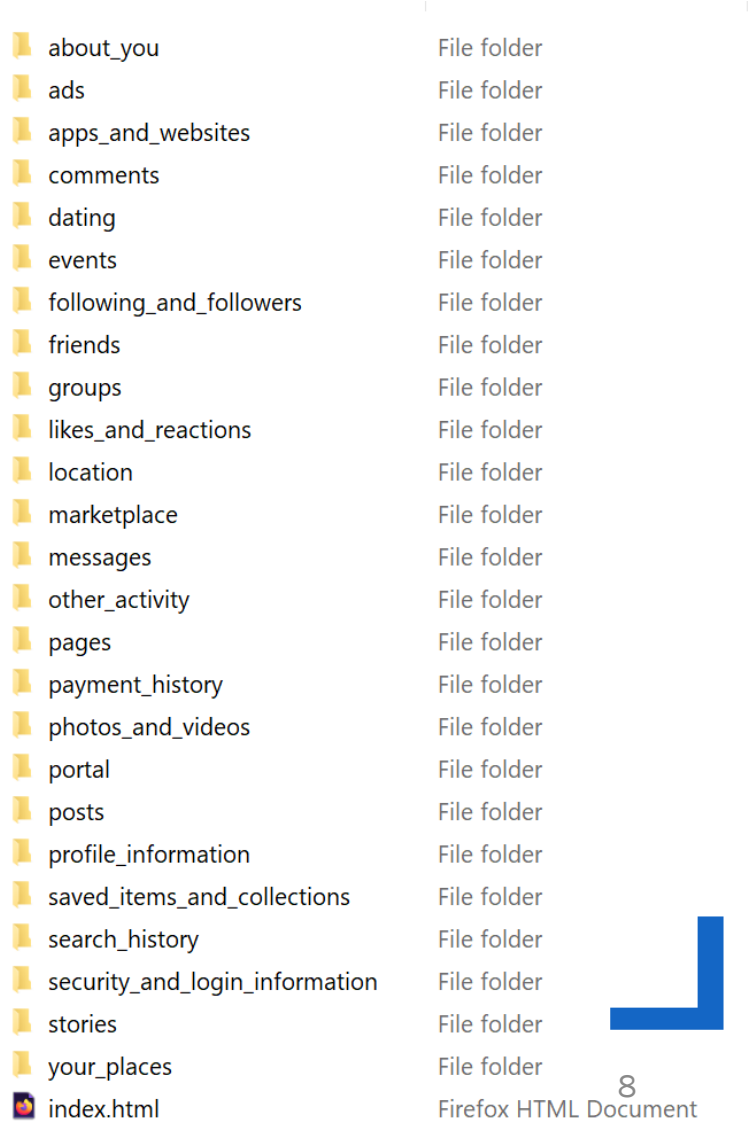
Developing a **model** of a process by learning from **past experience** (*i.e.*, existing data) to make predictions in **new situations** (*i.e.*, on new data).

3 components of machine learning



Facebook data: over 400 meg of data

- Places you visited
- Photos shared
- Videos
- Search history
- .....

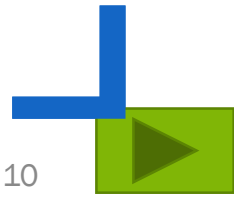


Data

- In order to learn you need data:
  - Detecting spam ? Get tons of spam messages
  - Want to forecast stocks? Find the price history
  - Want to find out user preferences? Parse their activities on Facebook
- There are two ways to collect data:
  - Manual : very expensive
  - Automatic: the Google example, here and there
- Data is very hard to collect.

Features

- These are the parameters used for machine learning
- Variables like car price, temperature…
- But what about cat images? Maybe the ear shape…



Algorithms

- The core of the process
- Each question will need a different algorithm
- But… without good data, an algorithm is useless

In mathematics and computer science, an **algorithm** is a finite sequence of well-defined, computer-implementable instructions, typically to solve a class of problems or to perform a computation

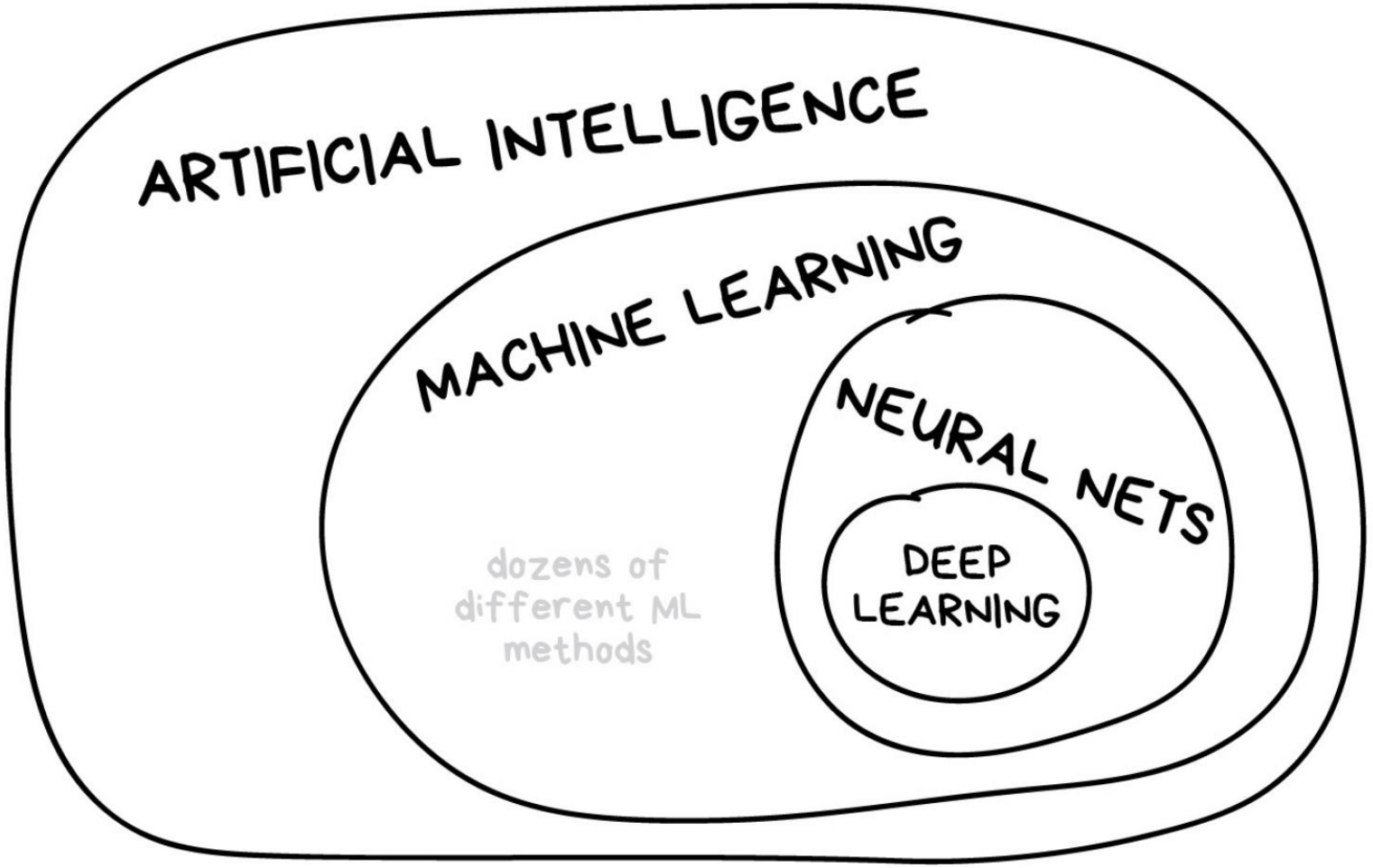
Muḥammad ibn Mūsā al-Khwārizmī

Statue of al-Khwārizmī carrying Astrolabe in Amir Kabir University, Tehran

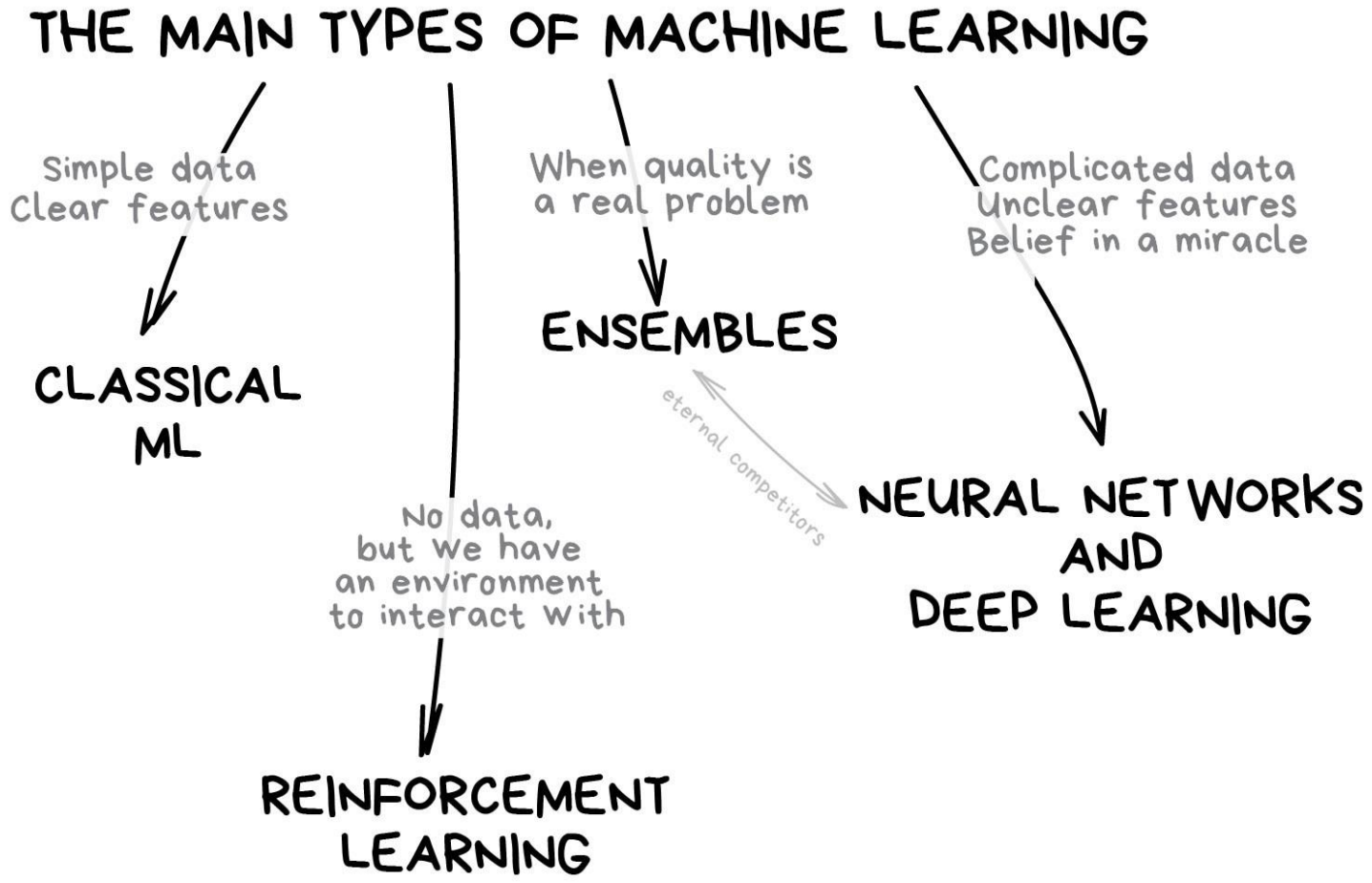
Machine cans and cannots

Machine can	Machine cannot
Forecast	Create something new
Memorize	Get smart really fast
Reproduce	Go beyond their task
Choose best item	Kill all humans

Giving it a name

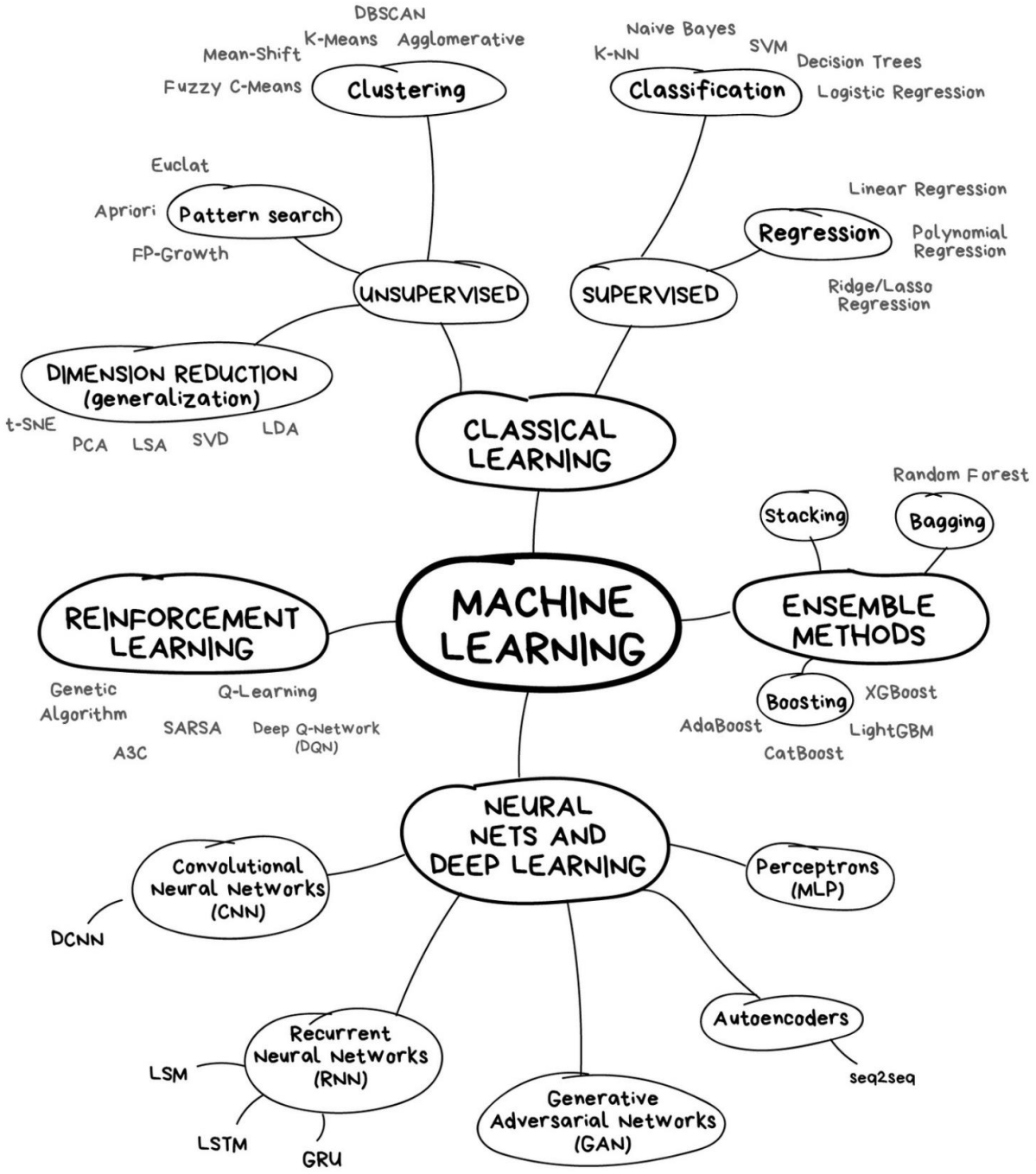


Different types of ML, data driven



Scary picture!

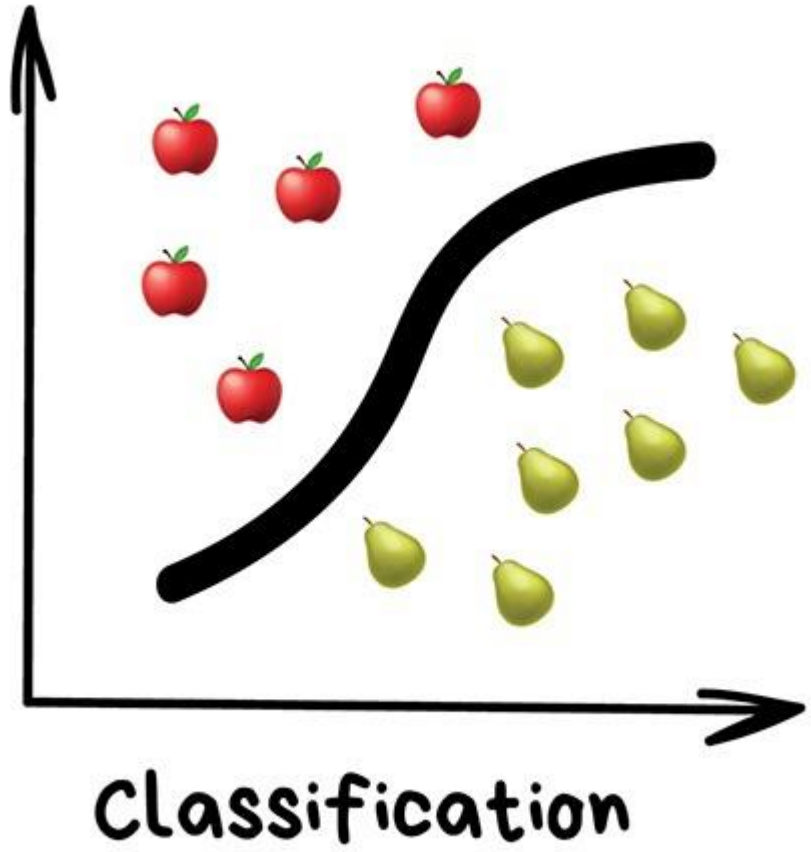
A global view of all the areas of today's different types of machine learning



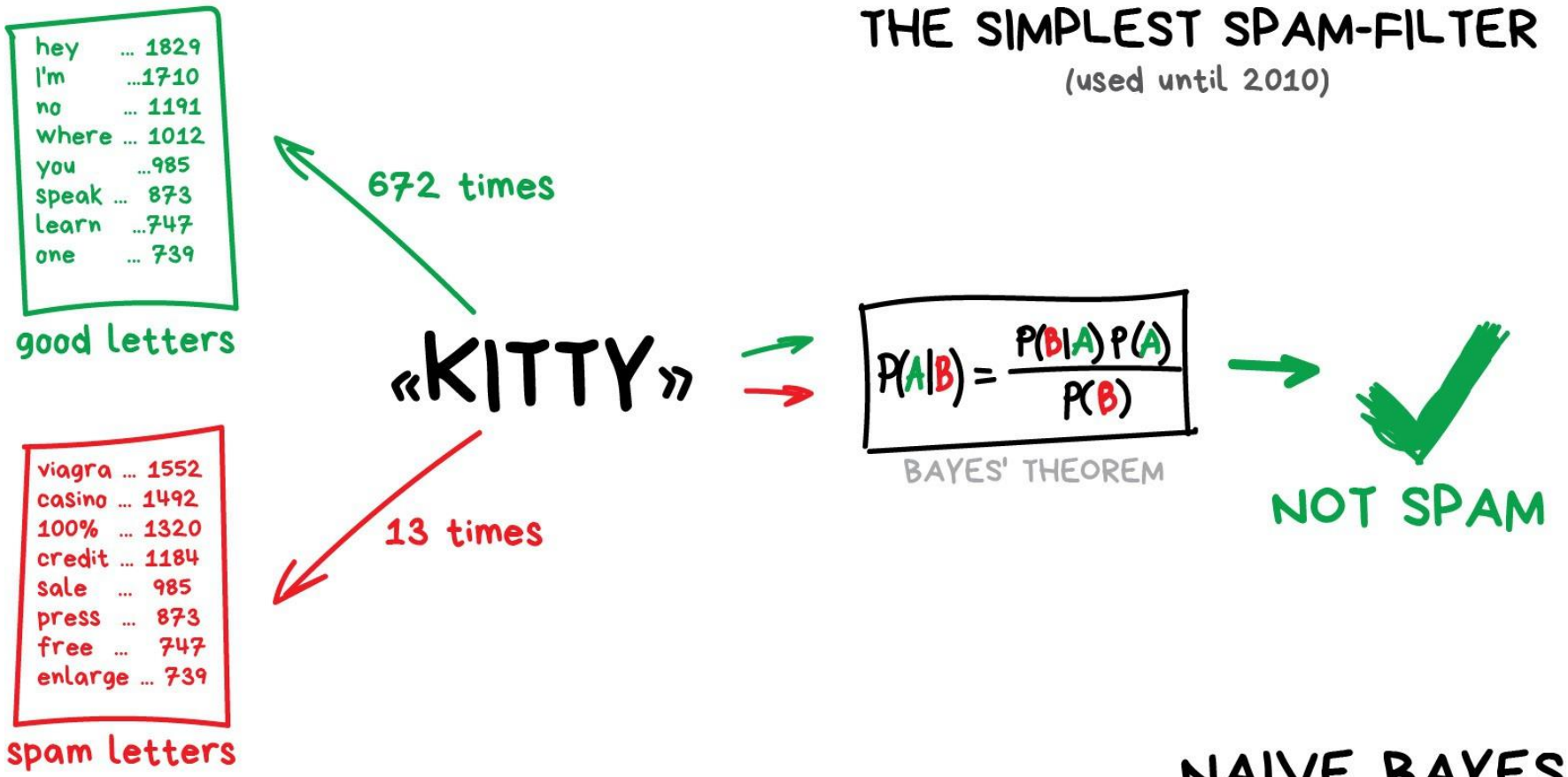
Classification

Sorting amongst several categories.

- **Cat** or **dog**?
- Vote for **petitioner** or **respondent**?
- **The same person** or **different people?**



Classification



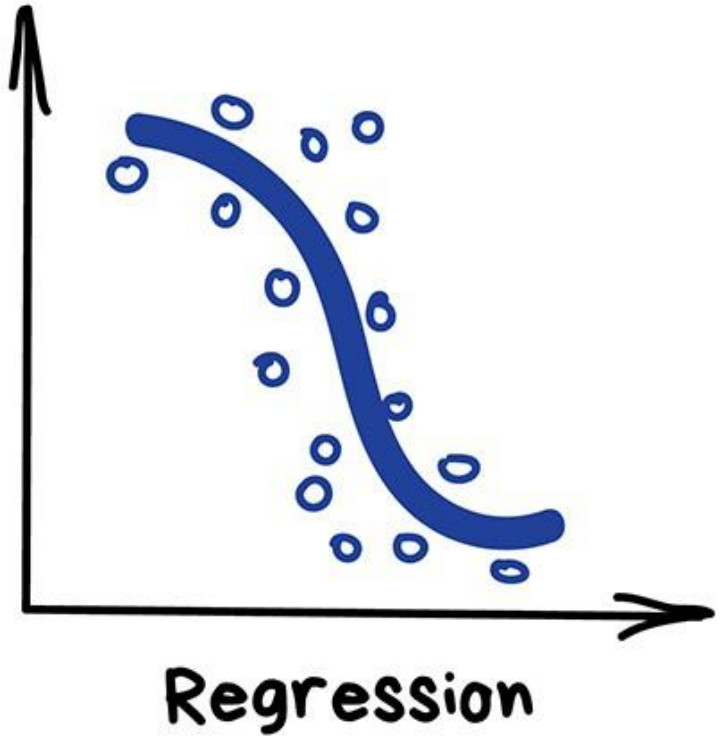
Regression

Any number is a valid output.

- What will the **temperature** be tomorrow?
- How many **points** will the economy grow by?
- How **fast** will the hurricane's winds be?

Regression

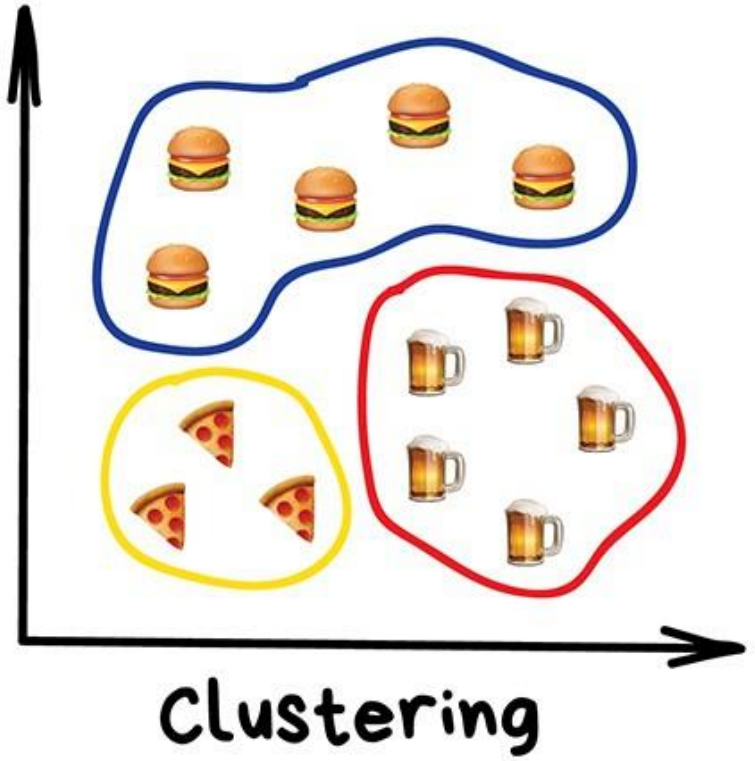
Regression is basically classification where we forecast a number instead of category. Examples are car price by its mileage, traffic by time of the day, demand volume by growth of the company etc. Regression is perfect when something depends on time.



Unsupervised learning: Clustering

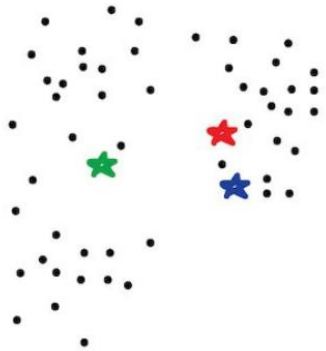
Grouping objects with unknown features together, used in:

- Merging close points on a map
- Detecting anomalies
- Marker on a web page

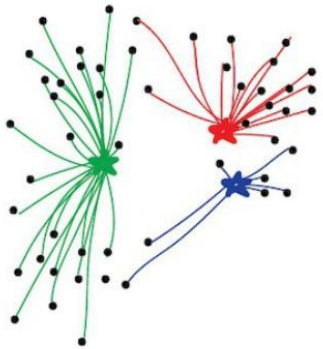


PUT KEBAB KIOSKS IN THE OPTIMAL WAY

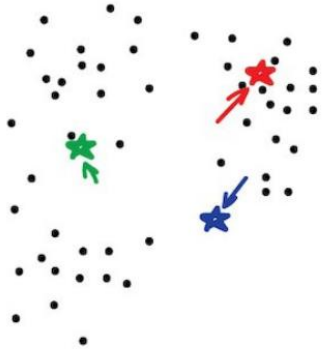
(also illustrating the K-means method)



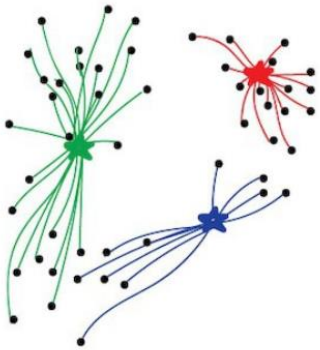
1. Put kebab kiosks in random places in city



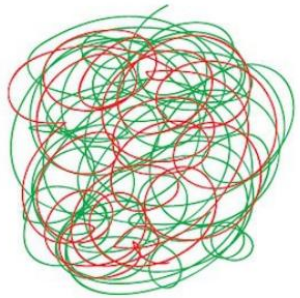
2. Watch how buyers choose the nearest one



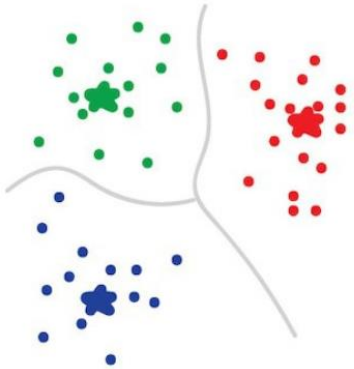
3. Move kiosks closer to the centers of their popularity



4. Watch and move again



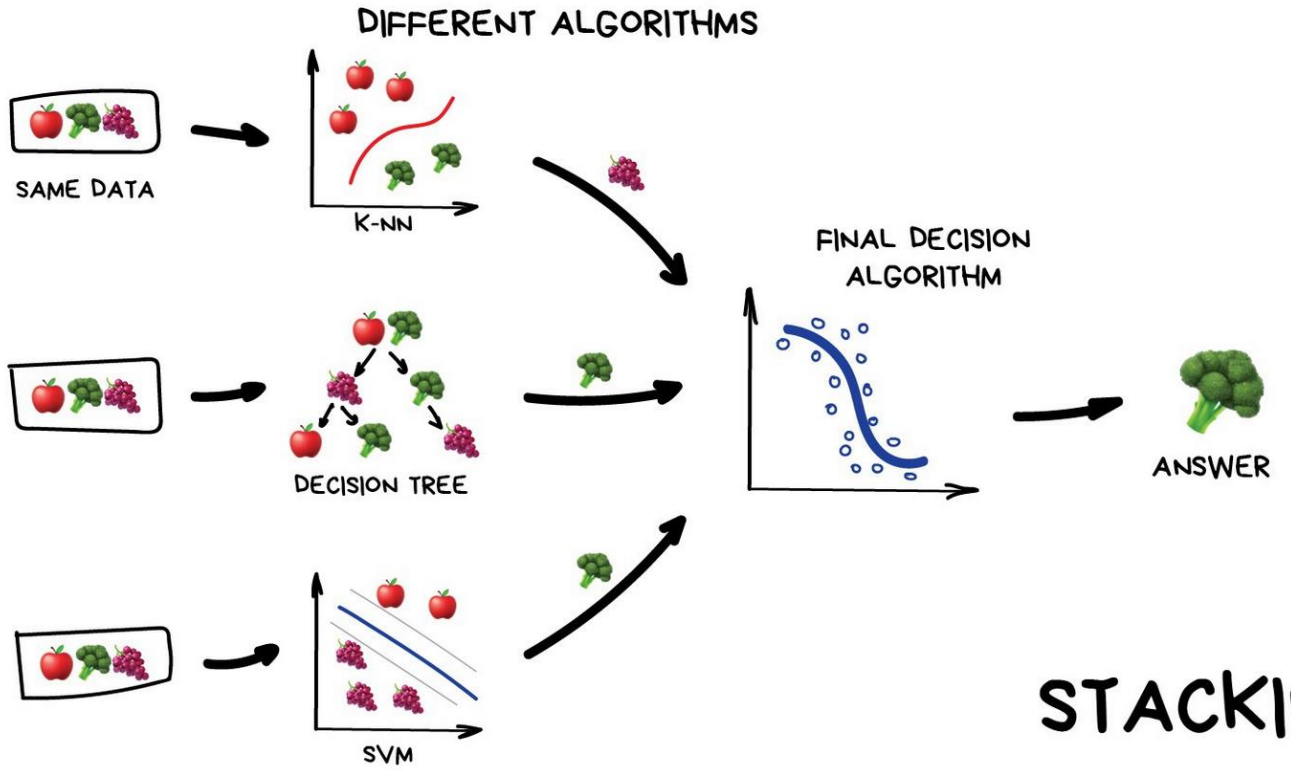
5. Repeat a million times



6. Done!
You're god of kebabs!

Ensemble methods: Random Forest

- Using many different inefficient algorithms creating ensembles (sets) to solve the same problem and forcing them to correct each other.
- Very efficient
- Used in
  - Computer vision
  - Object detection

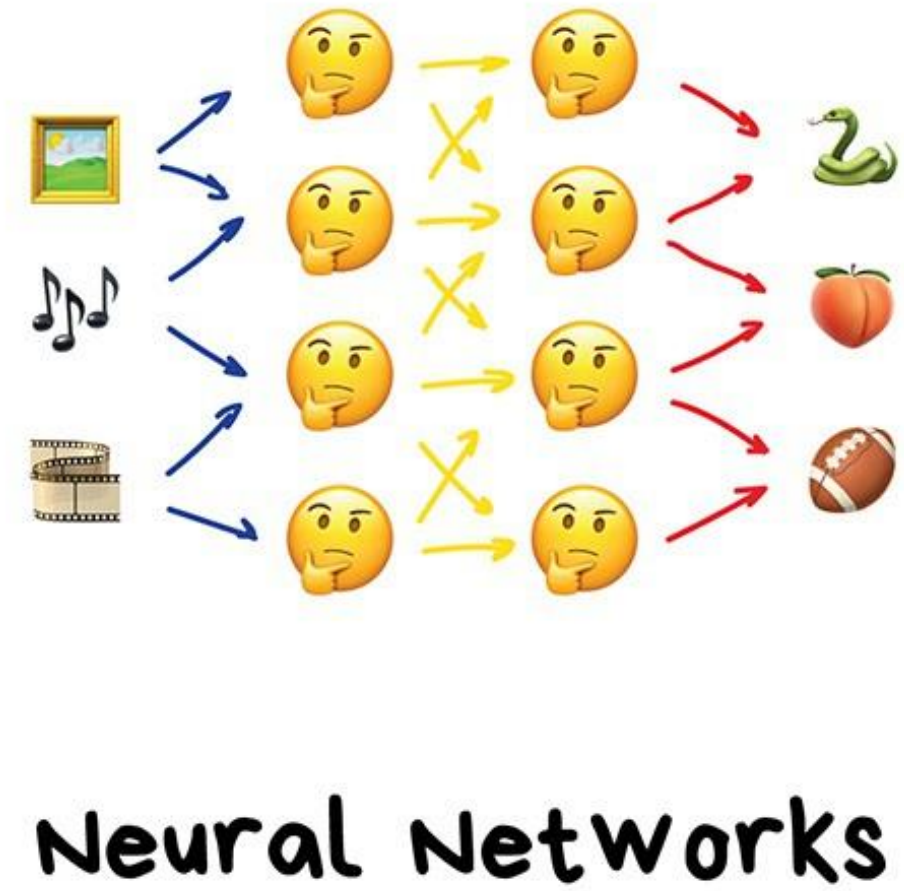


STACKING

Neural networks

Used for :

- Replacement of all the algorithms above
- Object identification
- …

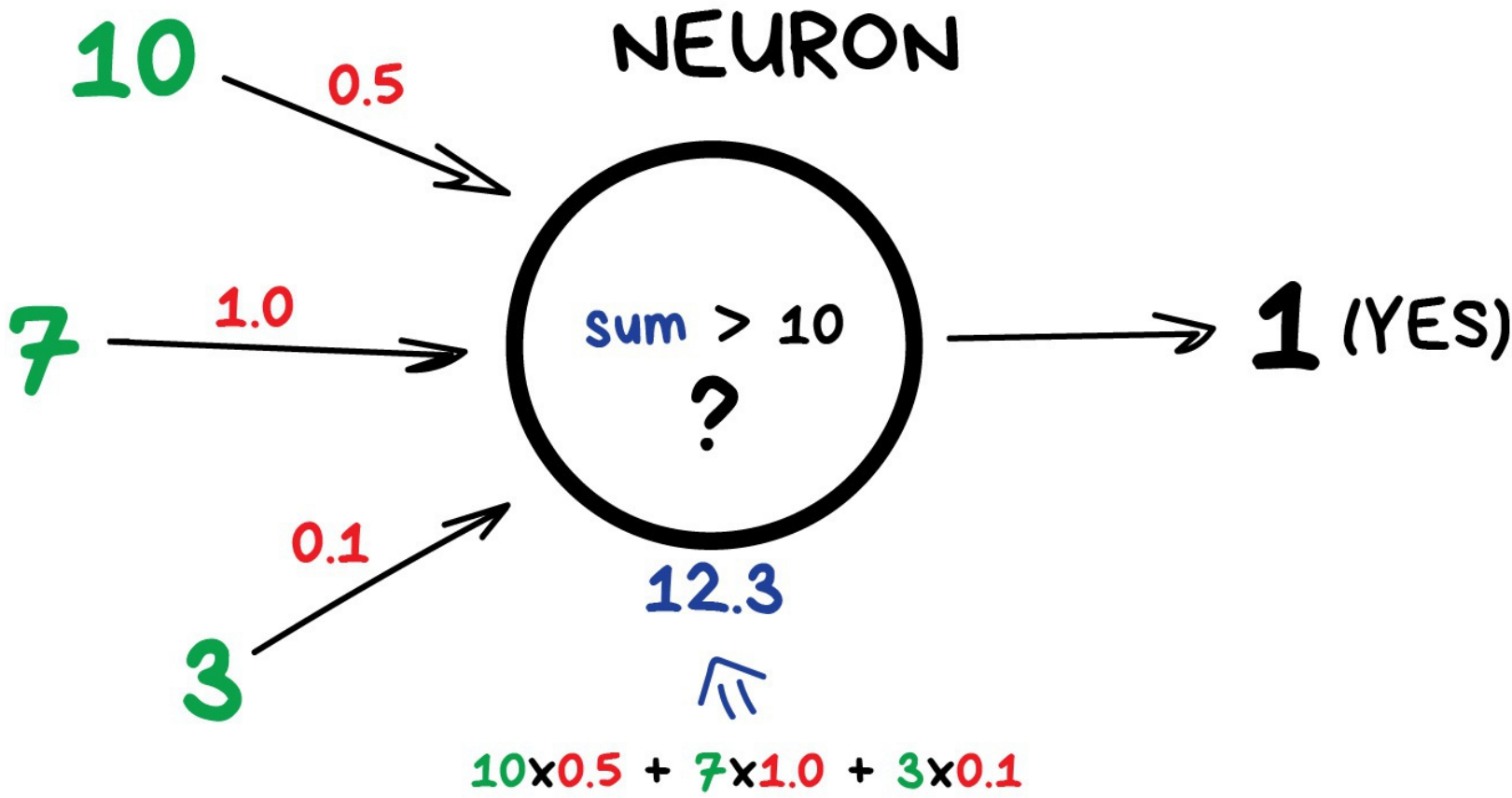


Neural networks

Mimics neurons and synapses in the brain (very bad analogy)

It's more like a network of functions and links

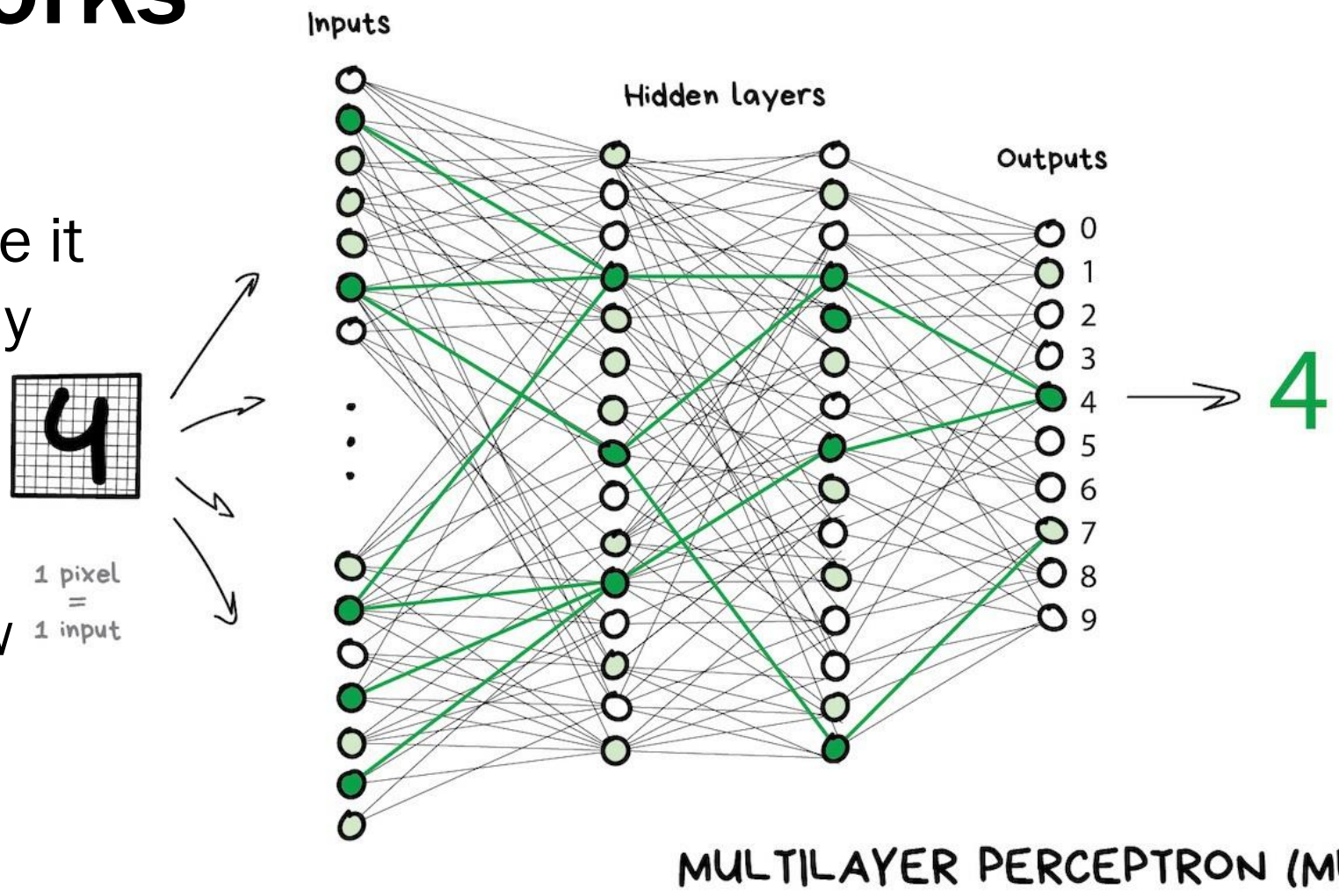
Many interconnected layers



Neural networks

Old idea rediscovered because of GPUs since it is very computationally expensive

Many open-source libraries available now (tensorflow, pytorch)



Some areas where AI is already at work

- Waze, google maps: uses **anonymized** data to estimate the traffic
- Uber , Lyft : for ETAs for rides, estimated meal delivery times on UberEATS, computing optimal pickup locations, as well as for fraud detection.
- Google: for detecting spam.
- Turnitin: plagiarism detection using a similarity algorithm.
- Mobile Check Deposits
- Credit Decisions
- Facebook: suggesting new friends via face recognition
- Voice-to-Text
- Create music work
- Detect breast cancer as good as expert.
- Chatbot

Conclusion

This is only scratching the surface of the AI process

There are many other types of algorithms used for very specific tasks

Data collection is key to any AI process (privacy issues, Google Chrome is NOT your friend, think Firefox)

AI can be seen like chemistry, physics, and other sciences…

Conclusion

Ok, multiply 1680 by 950 right now in your mind.

I know you won't even try.

But give you a calculator — you'll do it in two seconds.

Does this mean that the calculator just expanded the capabilities of your brain?

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Thank you… questions? please note that link !

http://bit.ly/2TpfGAq