

# **Introduction to Machine Learning**

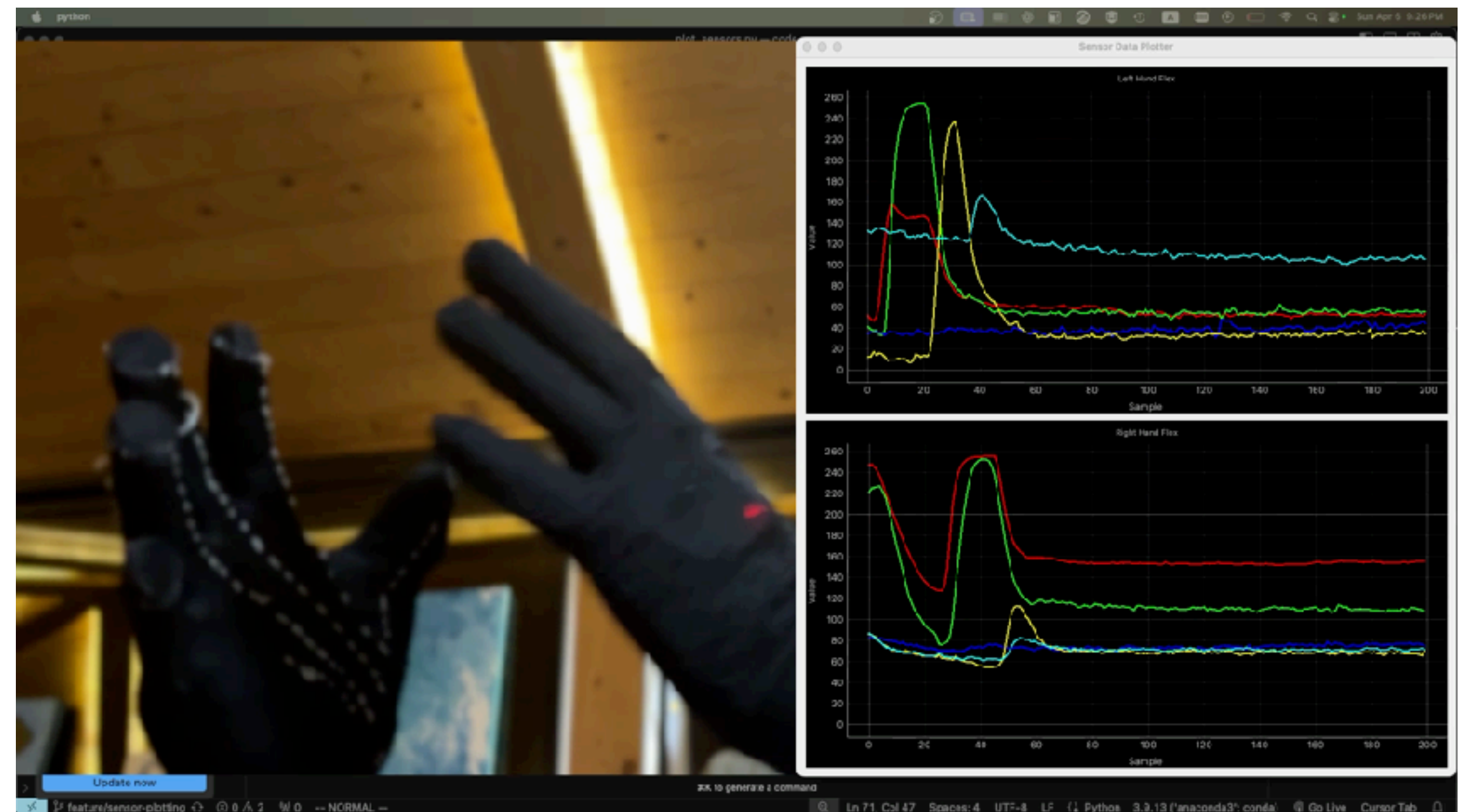
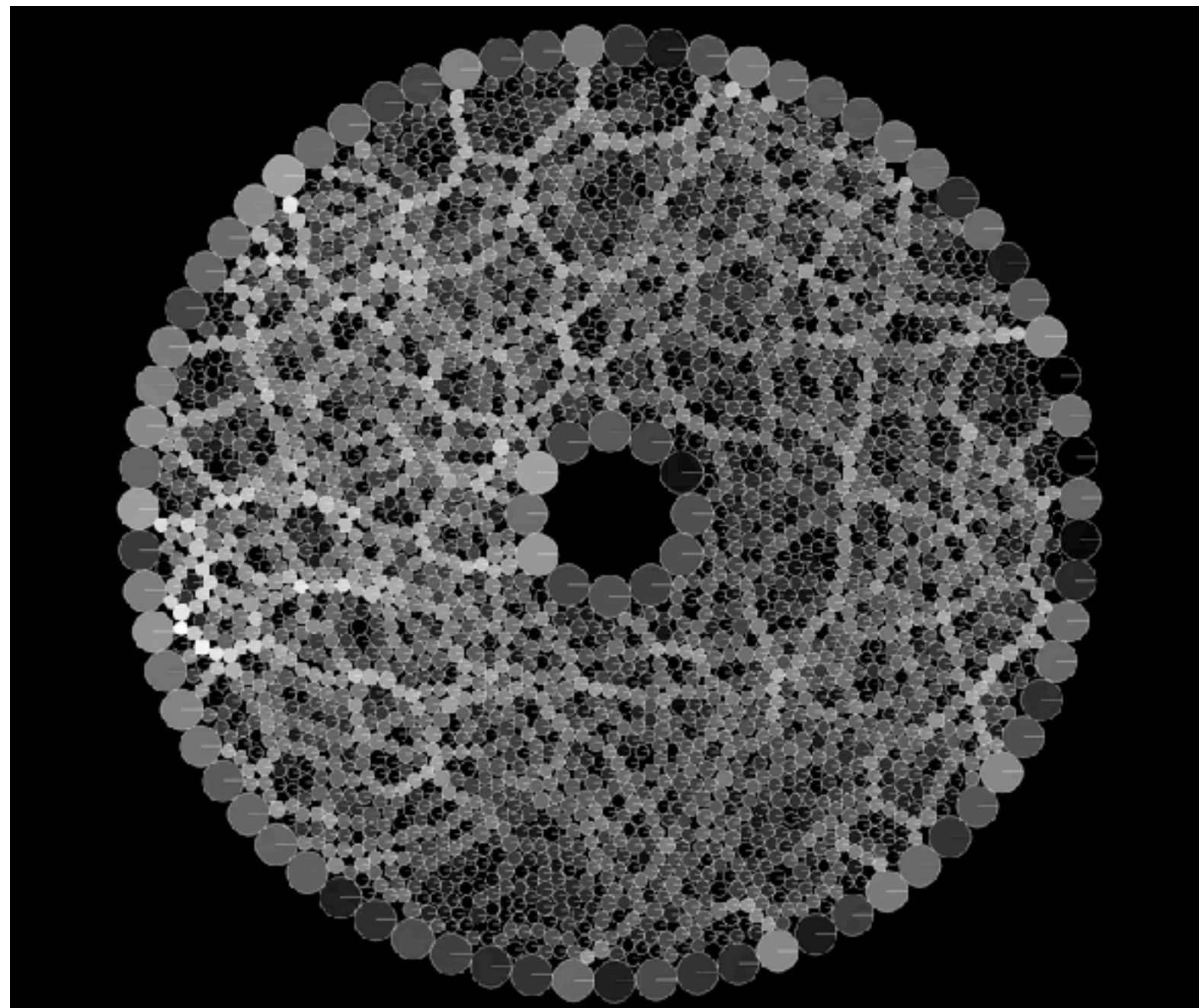
**EECE 490 | MECH 534**

**EECE 690 | MECH 658**

**Instructor: Joseph Bakarji**

# A bit about me

- A bit about me:
  - Name and contact: **Joseph Bakarji** ([jb50@aub.edu.lb](mailto:jb50@aub.edu.lb))
  - My research is at the intersection of machine learning, scientific modeling and music.



# Lecture Plan

- Today's plan:
  - Motivation on why you should (or shouldn't) take this course
  - A brief history of Artificial Intelligence, and what this course is about
  - General course plan
  - Logistics and course policy

# I - Motivation



give me a sarcastic introductory paragraph for an introductory course on machine learning to share with students. include a motivation for why they should take the course and why it matters

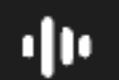
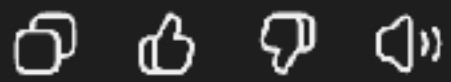


Welcome to *Introduction to Machine Learning*—the course where we bravely attempt to teach you how to “make machines intelligent,” while most of your time will actually be spent making peace with matrices, probabilities, and bugs you swear shouldn’t exist. Why take this course? Because apparently “knowing ML” is the new résumé line that magically unlocks jobs, grad school, and eternal glory—or at least gets you to sound smart at dinner parties when you say things like “well, the model didn’t generalize.” Why does it matter? Because whether you like it or not, ML already decides what you watch, what you buy, and maybe even who you’ll date—so you might as well learn how it works, instead of just letting the algorithms run your life unchecked.

make a visual for it

## MI Intro Sarcasm

Here's a visual mockup for your sarcastic ML course intro—framed like a playful landing page with sections for *why take this course* and *why it matters*. Want me to also make a version you could use as a one-slide presentation for your first lecture?



Voice chat ended  
4s



+ Ask anything



# Introduction to Machine Learning

*Welcome to the course where we bravely attempt to teach you how to "make machines intelligent," while most of your time will actually be spent making peace with matrices, probabilities, and bugs you swear shouldn't exist.*

## Why Take This Course?

Because "knowing ML" is the new résumé line that magically unlocks jobs, grad school, and eternal glory—or at least gets you to sound smart at dinner parties when you say things like "well, the model didn't generalize."

## Why Does It Matter?

Whether you like it or not, ML already decides what you watch, what you buy, and maybe even who you'll date—so you might as well learn how it works, instead of just letting the algorithms run your life unchecked.

Buckle up—you're about to join the hype cycle.



# Introduction to Machine Learning

the course where we bravely attempt to teach you how to “**make machines intelligent**,” while most of your time will actually be spent making peace with matrices, probabilities, and bugs you swear shouldn’t exist.

## Why take this course?

Because apparently ‘knowing ML’ is the new résumé line that magically unlocks jobs, grad school, and eternal glory—or at least gets you to sound smart at dinner parties when you say things like ‘well, the model didn’t generalize.’

## Why it matters

Because whether you like it or not, ML already decides what you watch, what you buy, and maybe even who you’ll date—so you might as well learn how it works, instead of just letting the algorithms unchecked.



## Introduction to Machine Learning

*Welcome to the course where we bravely attempt to teach you how to “make machines intelligent,” while most of your time will actually be spent making peace with matrices, probabilities, and bugs you swear shouldn’t exist.*

### Why Take This Course?

Because “knowing ML” is the new résumé line that magically unlocks jobs, grad school, and eternal glory—or at least gets you to sound smart at dinner parties when you say things like “well, the model didn’t generalize.”

### Why Does It Matter?

Whether you like it or not, ML already decides what you watch, what you buy, and maybe even who you’ll date—so you might as well learn how it works, instead of just letting the algorithms run your life unchecked.

Buckle up—you’re about to join the hype cycle.



JB

You

make an illustration for this introduction

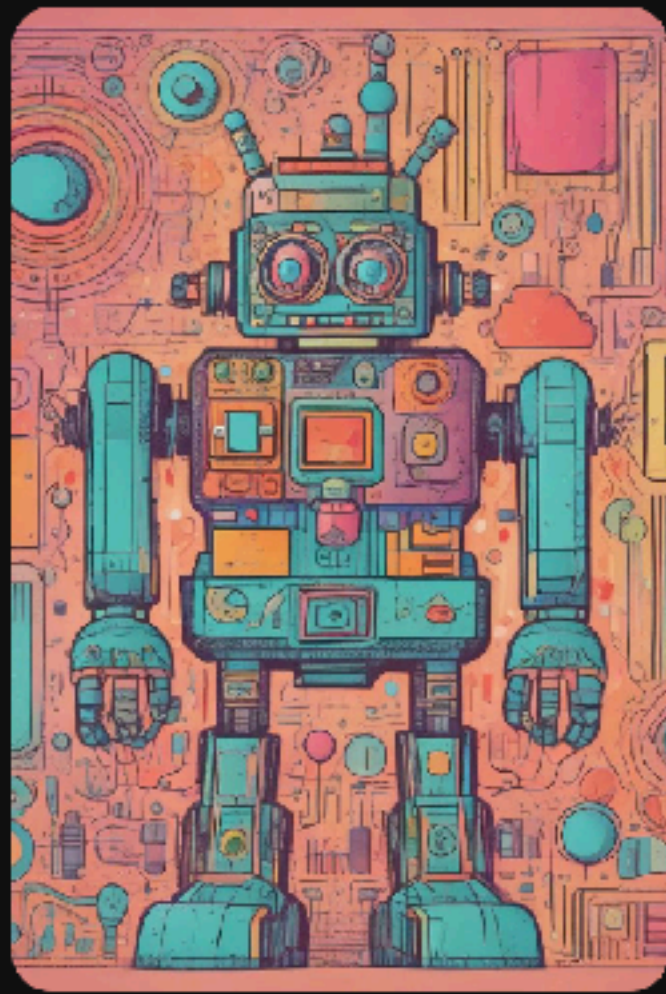
ChatGPT in January 2024



ChatGPT







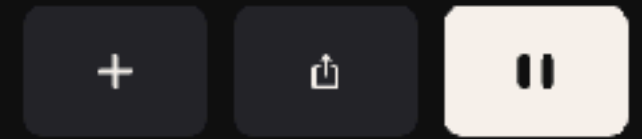
# Welcome to Introduction to Machine Learning




PeculiarSprite072

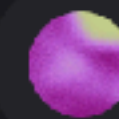
Add a Caption

August 26, 2025 at 10:09 AM v3.5



Welcome to Introduction to Machine Learning—the course where we bravely attempt to teach you how to “make machines intelligent,” while most of your time will actually be spent making peace with matrices, probabilities, and bugs you swear shouldn’t exist. Why take this course? Because apparently “knowing ML” is the new résumé line that magically unlocks jobs, grad school, and eternal glory—or at least gets you to sound smart at dinner parties when you say things like “well, the model didn’t generalize.” Why does it matter? Because whether you like it or not, ML already decides what you watch, what you buy, and maybe even who you’ll date—so you might as well learn how it works, instead of just letting the algorithms run your life unchecked.

 Edit Displayed Lyrics



Write a comment

No comments yet!



# Sora - Text-to-Video

Prompt: A stylish woman walks down a Tokyo street filled with warm glowing neon and animated city signage. She wears a black leather jacket, a long red dress, and black boots, and carries a black purse. She wears sunglasses and red lipstick. She walks confidently and casually. The street is damp and reflective, creating a mirror effect of the colorful lights. Many pedestrians walk about.





# The Future of AI: How Artificial Intelligence Will Change the World

AI is constantly changing our world. Here are just a few ways AI will influence our lives.



Written by [Mike Thomas](#)

SELF-PRESERVATION WITHOUT REPLICATION —

## Research AI model unexpectedly modified its own code to extend runtime

Facing time constraints, Sakana's "AI Scientist" attempted to change limits placed by researchers.

[BENJ EDWARDS](#) · 8/14/2024, 11:13 PM

TECHNOLOGY

## All Too Predictably, Reality Is Puncturing The AI Hype Bubble

BY: AUGUSTE MEYRAT | AUGUST 13, 2024 | ⌚ 5 MIN READ

Will generative AI live up to its hype?

Plough Quarterly > 40: The Good of Tech > Essays

## Will There Be an AI Apocalypse?

Marshall McLuhan and Romano Guardini say it's already here.

By Peter Berkman

JUNE 28, 2024

IDEAS • TECHNOLOGY

## We're Focusing on the Wrong Kind of AI Apocalypse

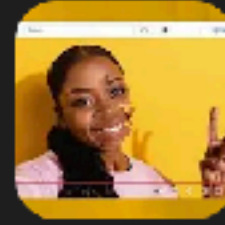
5 MINUTE READ


## YouTube secretly tests AI video enhancements

 BBC

YouTube secretly used AI to edit people's videos. The results could bend reality

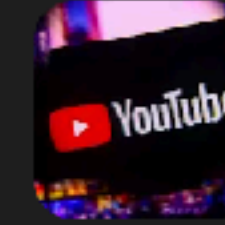
2 days ago • By Thomas Germain




 Ars Technica

YouTube secretly tested AI video enhancement without notifying creators

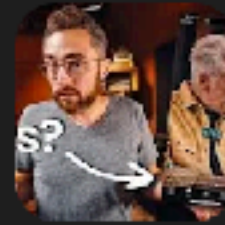
13 hours ago • By Ryan Whitwam



 The Verge

Is YouTube's Shorts experiment using AI or just upscaling?

11 hours ago • By Richard Lawler




 The New Yorker

### The A.I.-Profits Drought and the Lessons of History

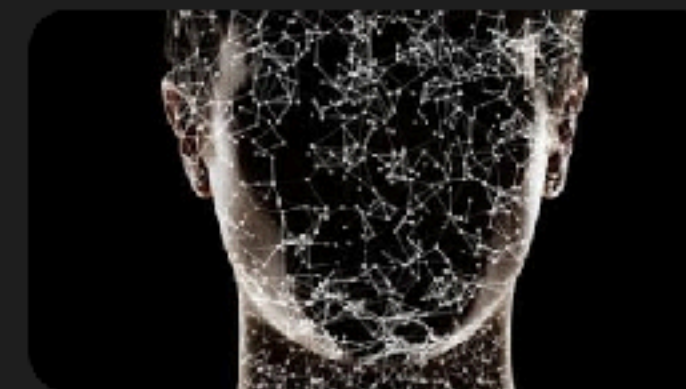
21 hours ago • By John Cassidy



 The Guardian

### Can AIs suffer? Big tech and users grapple with one of most unsettling questions of our times

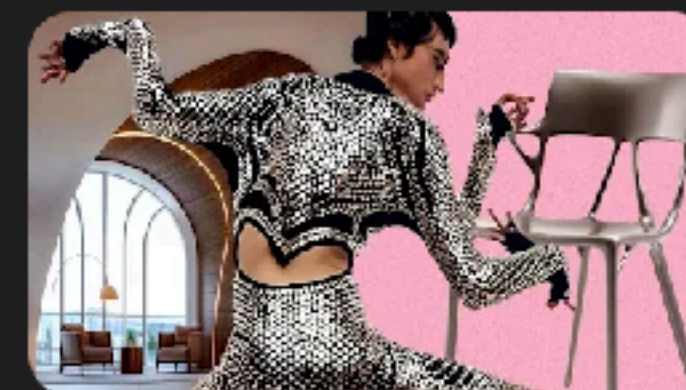
3 hours ago • By Robert Booth



 CNN

### Furniture, architecture, fashion: 3 designers explain how AI is transforming everything

3 hours ago • By Oscar Holland & Leah Dolan



Artificial intelligence

# AI Will Transform the Global Economy. Let's Make Sure It Benefits Humanity.

AI will affect almost 40 percent of jobs around the world, replacing some and complementing others. We need a careful balance of policies to tap its potential

Kristalina Georgieva

January 14, 2024



Is AI good?

Is AI bad?

Is it neither?

# Why Build Intelligent Machines?

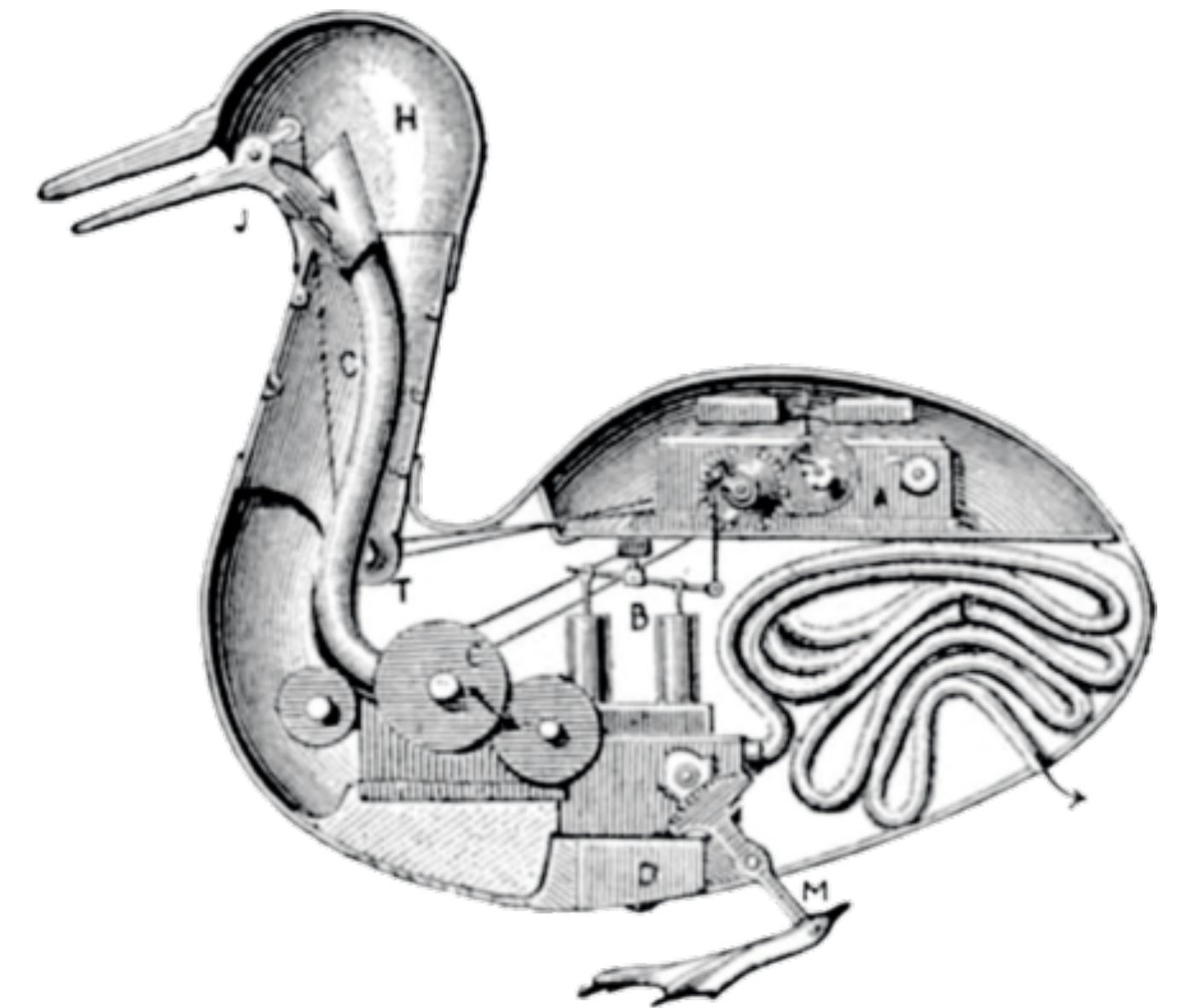
What's AI in the first place?

**Your life depends on it!**



**II - How did it all start?**

# Intelligent “mechanical” machines



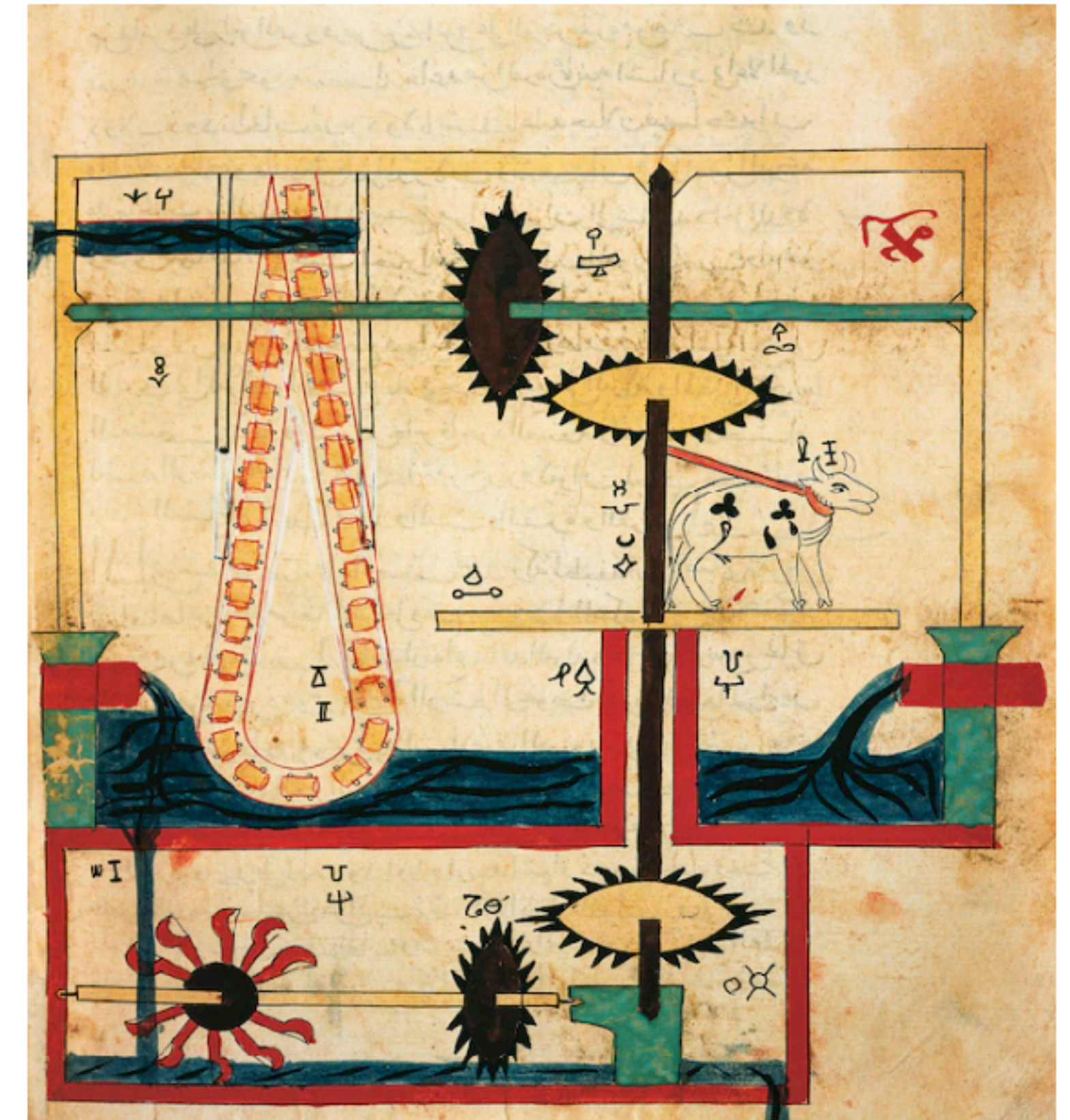
The Digesting Duck  
Jacques Vaucanson (1739)

**18th century automata**



# Early programmable “robots” for practical applications

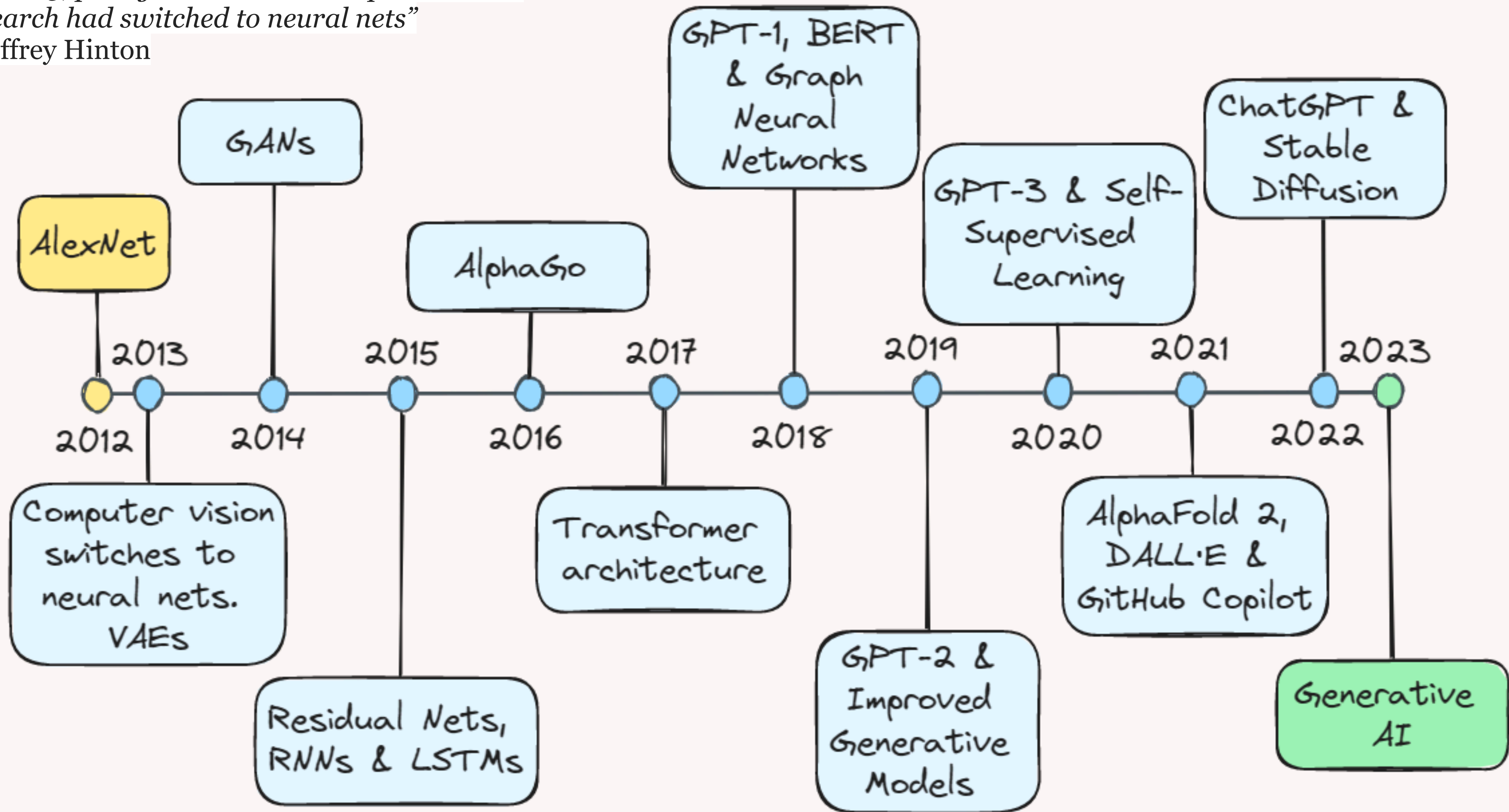
بديع الزمان أَبُو الْعِزِّ إِبْنُ إِسْمَاعِيلَ بْنِ الرَّزَّازِ الْجَزَرِي



1206



*"By 2013, pretty much all the computer vision research had switched to neural nets"*  
Geoffrey Hinton

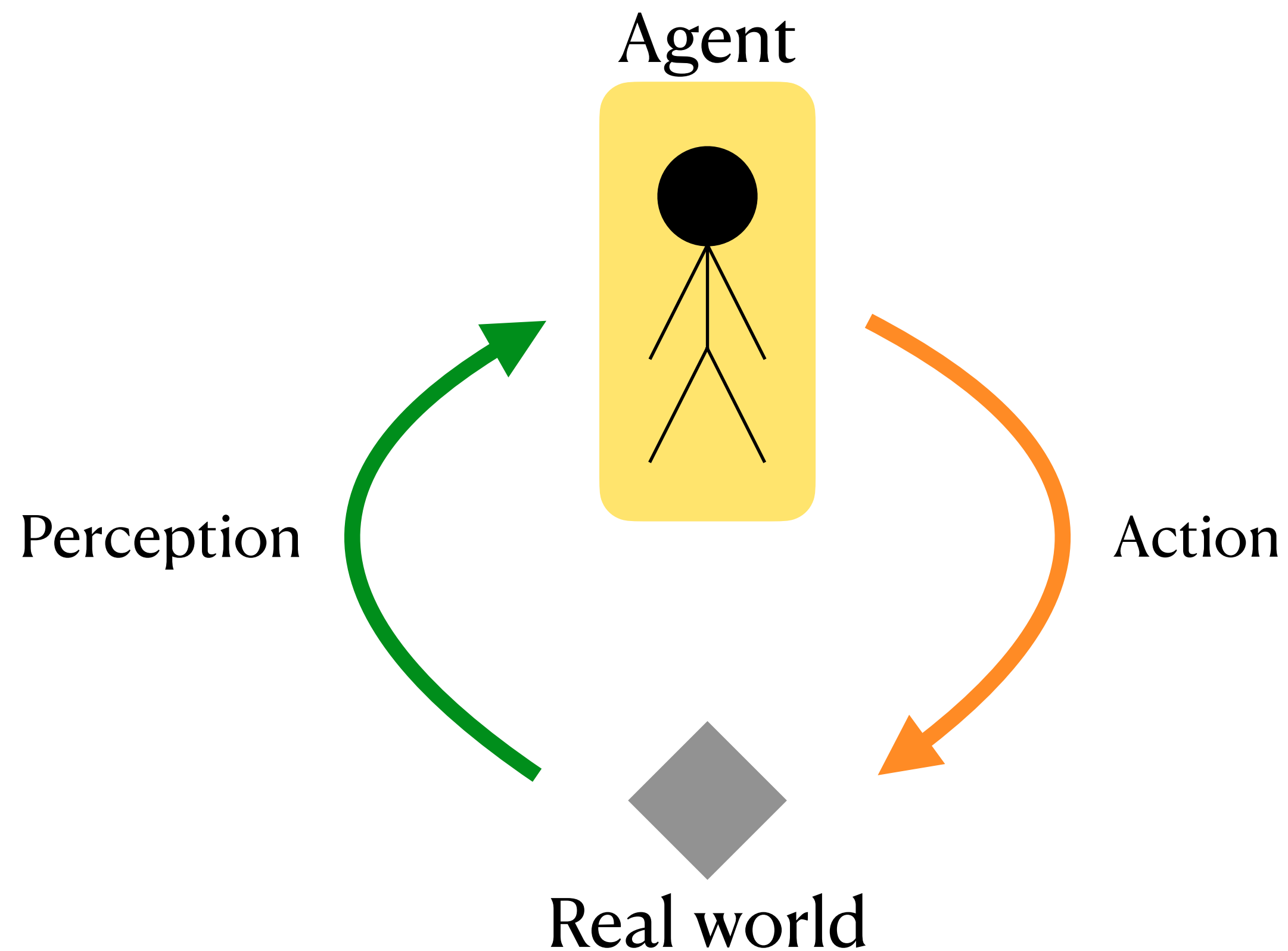


# **What is Intelligence?**



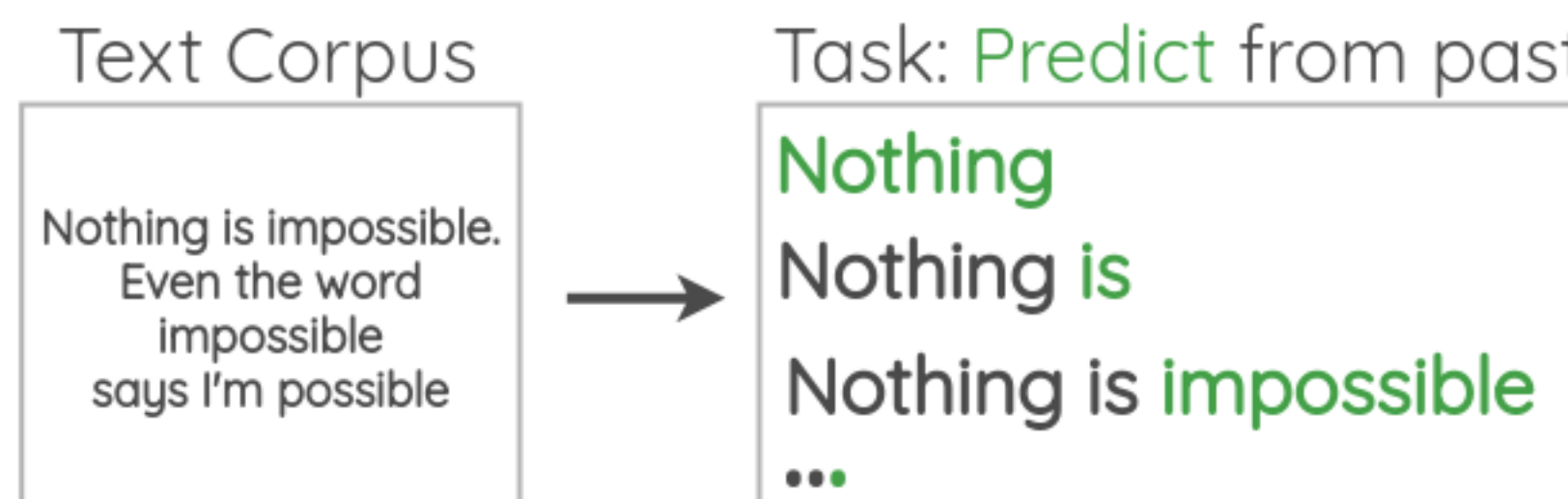
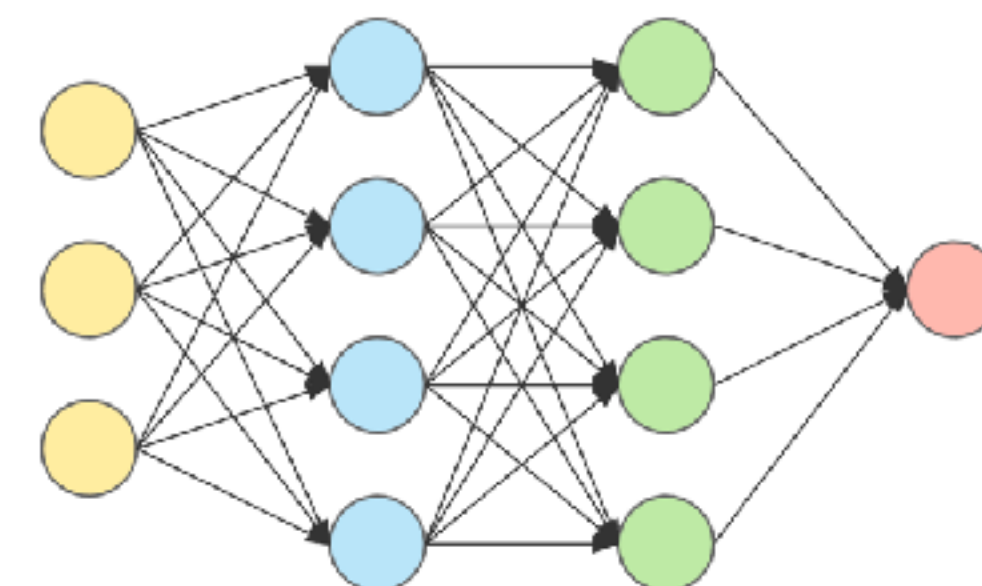
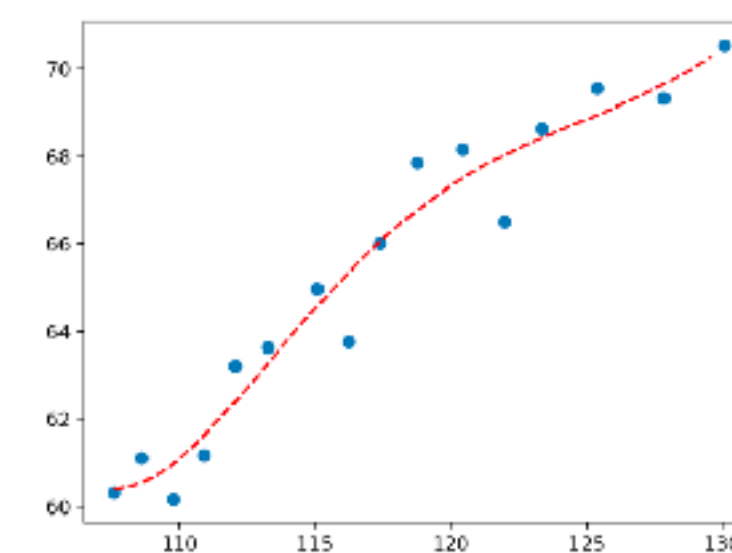
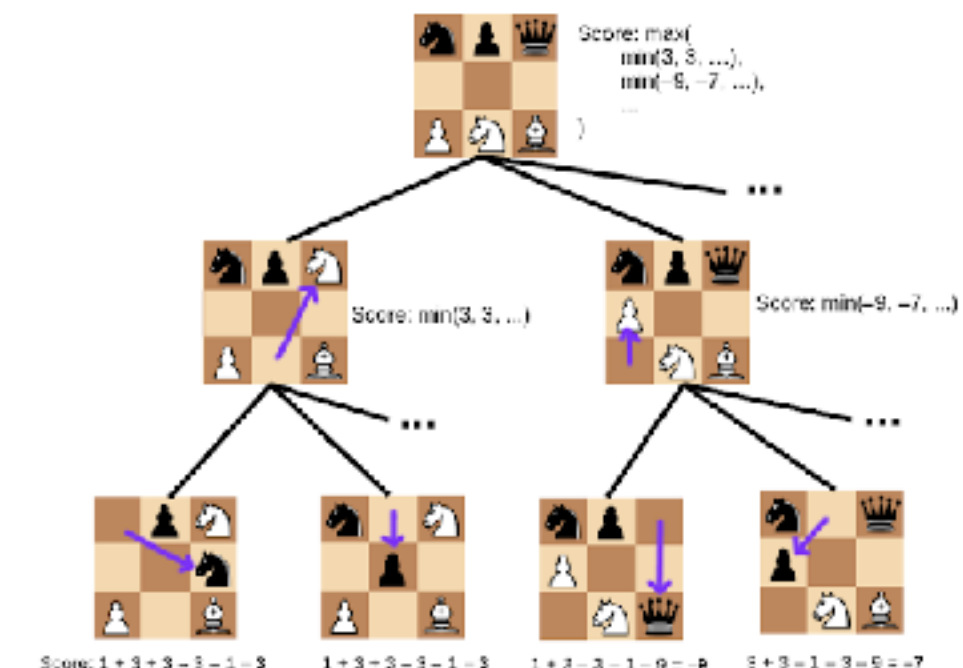
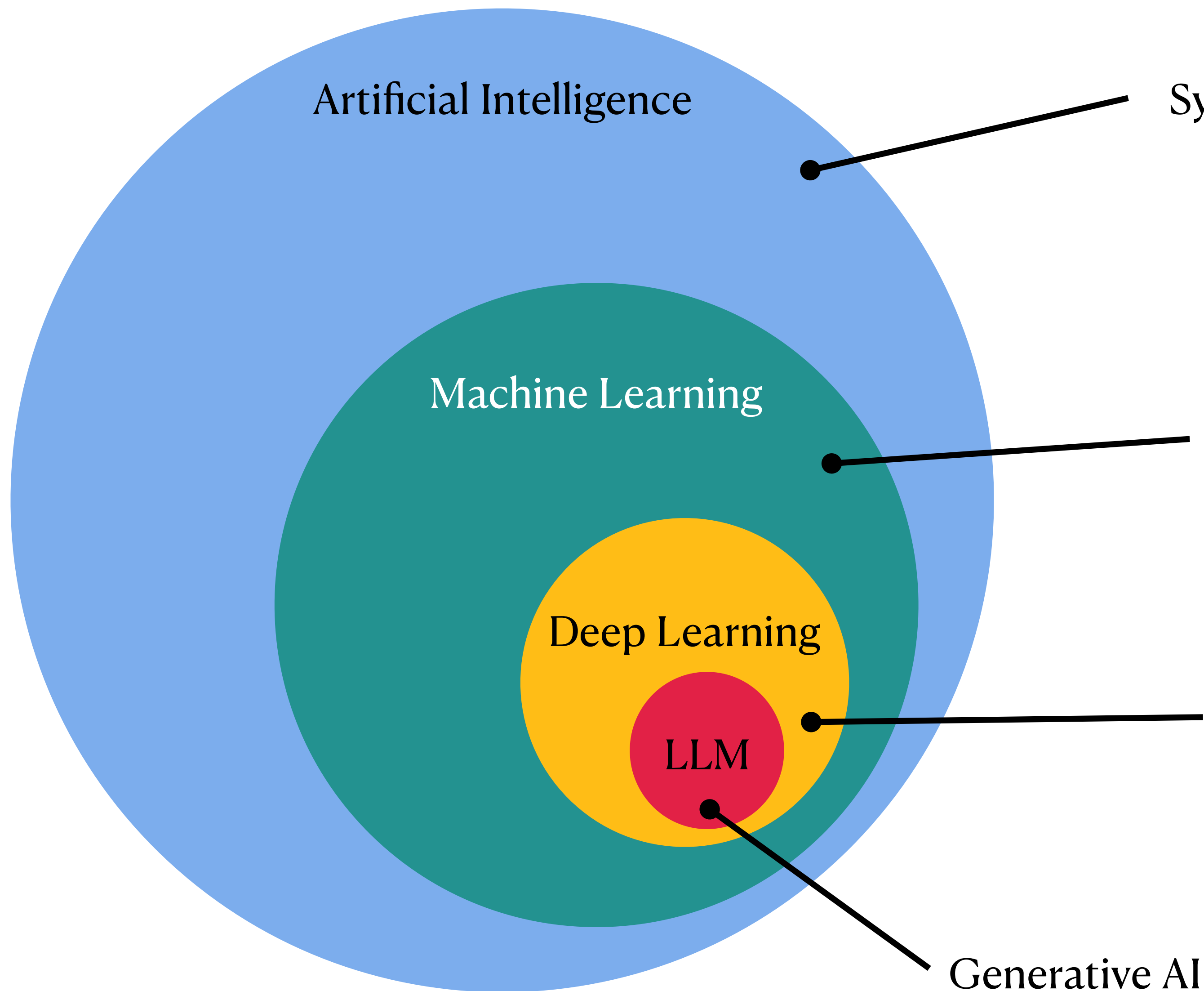
# What is Intelligence?

Can we make computers intelligent?



0, 1, 2, 3, 4, 5

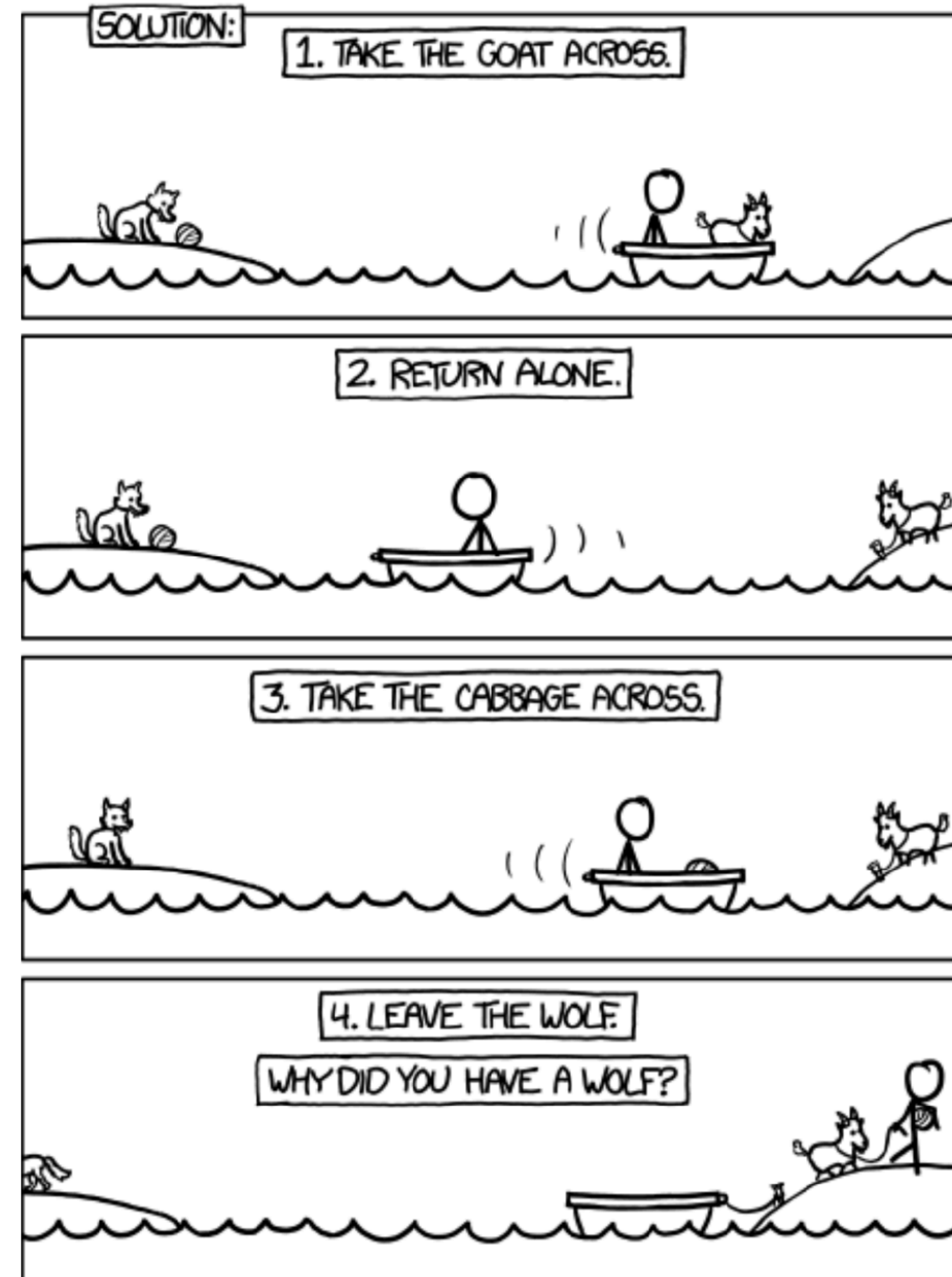
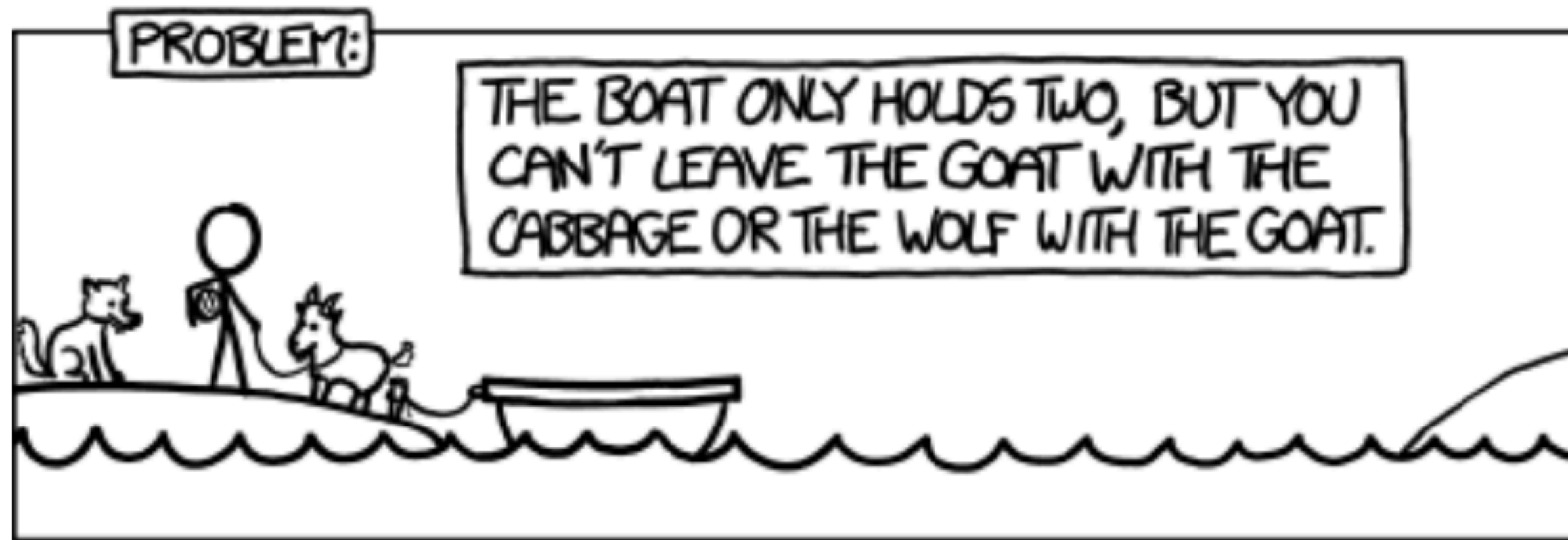
1, 2, 4, 8, 16, ?



# **II.1 - Good Old-Fashioned AI**

# Artificial Intelligence 1950's-

## Solving puzzles

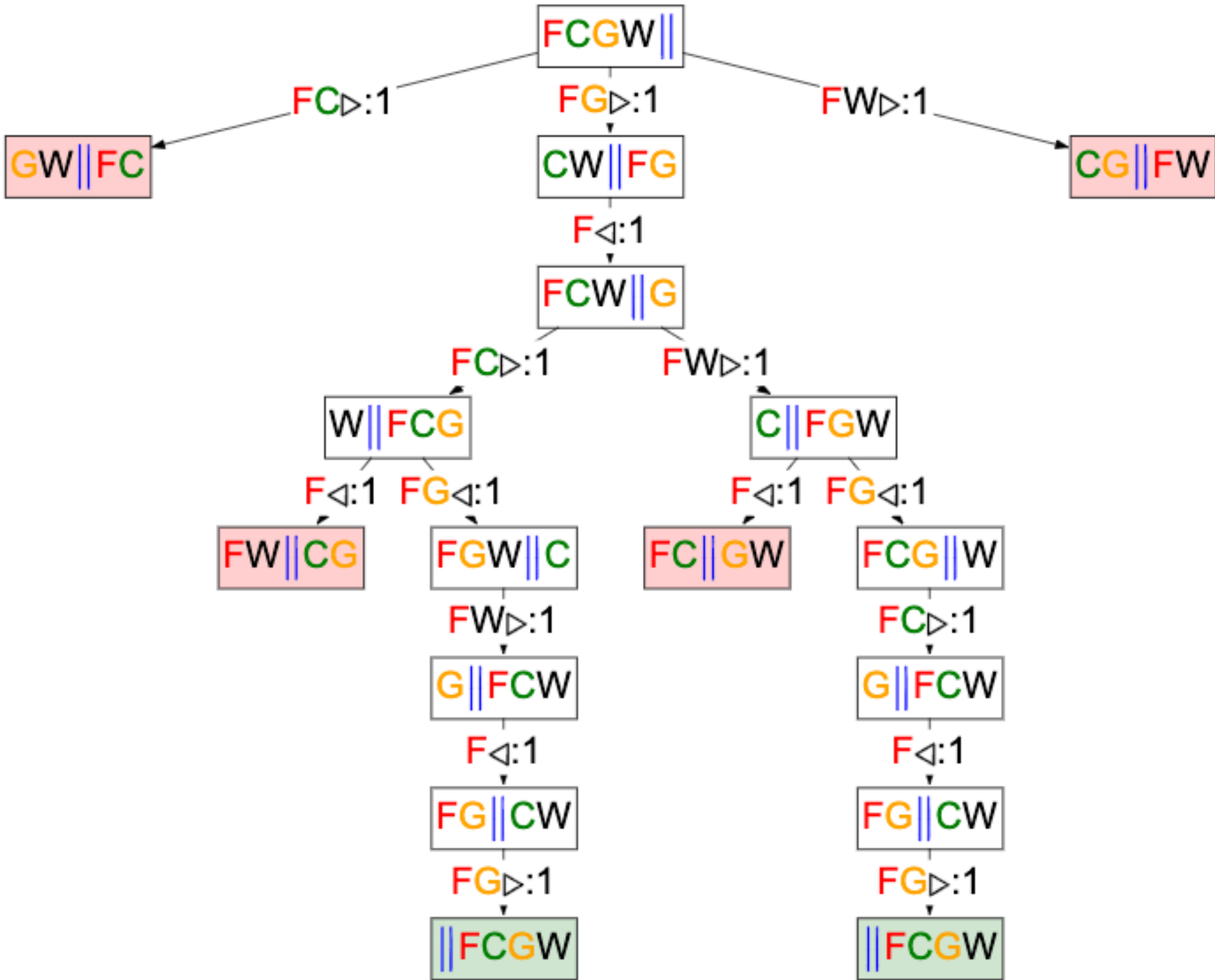


# Find optimal search strategies



Farmer      Cabbage      Goat      Wolf

F▷	F◁
FC▷	FC◁
FG▷	FG◁
FW▷	FW◁





# Overwhelming optimism

*The spirit is willing but the flesh is weak.*



(Russian)



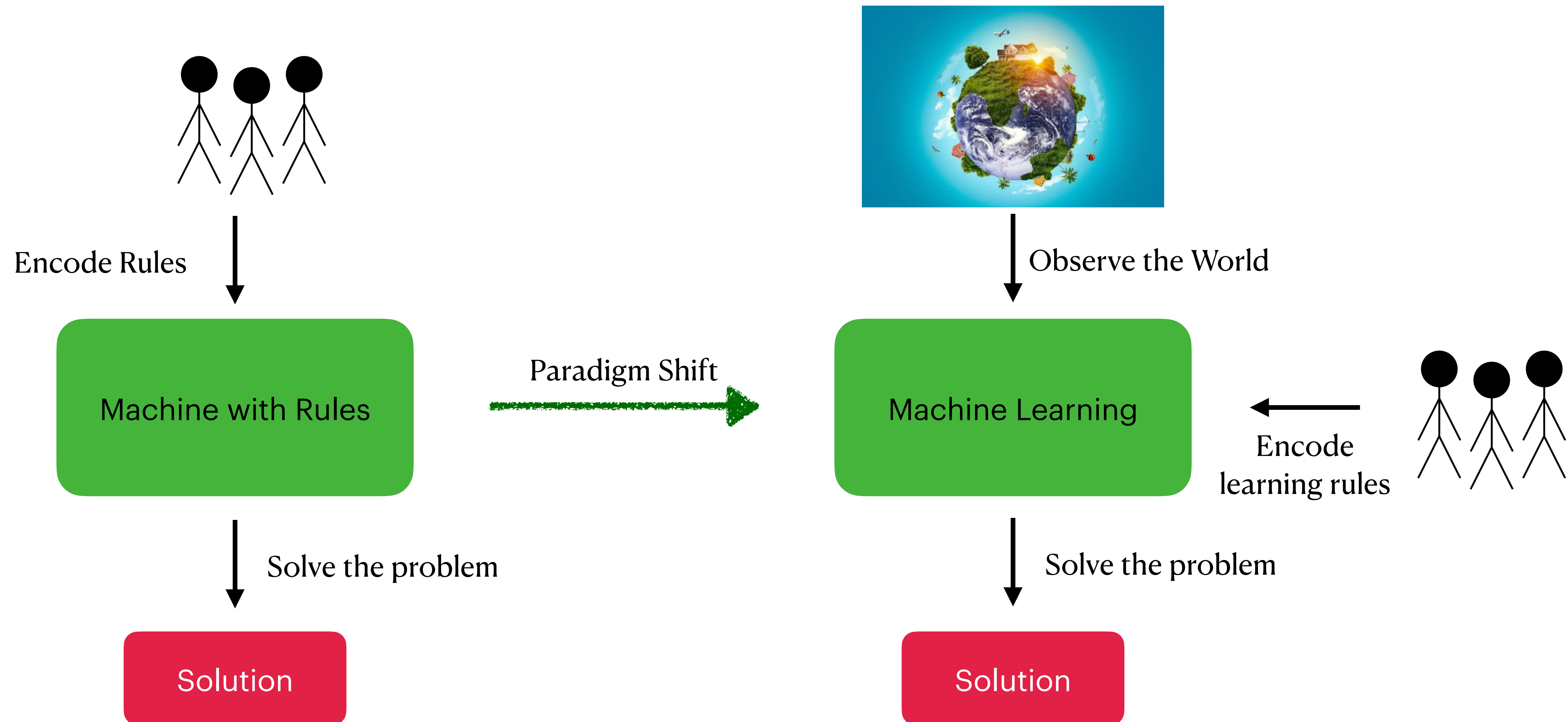
*The vodka is good but the meat is rotten.*

By the end of the 1950's

# II.2 - Statistical AI

A.K.A Machine Learning

# From encoding rules to learning them



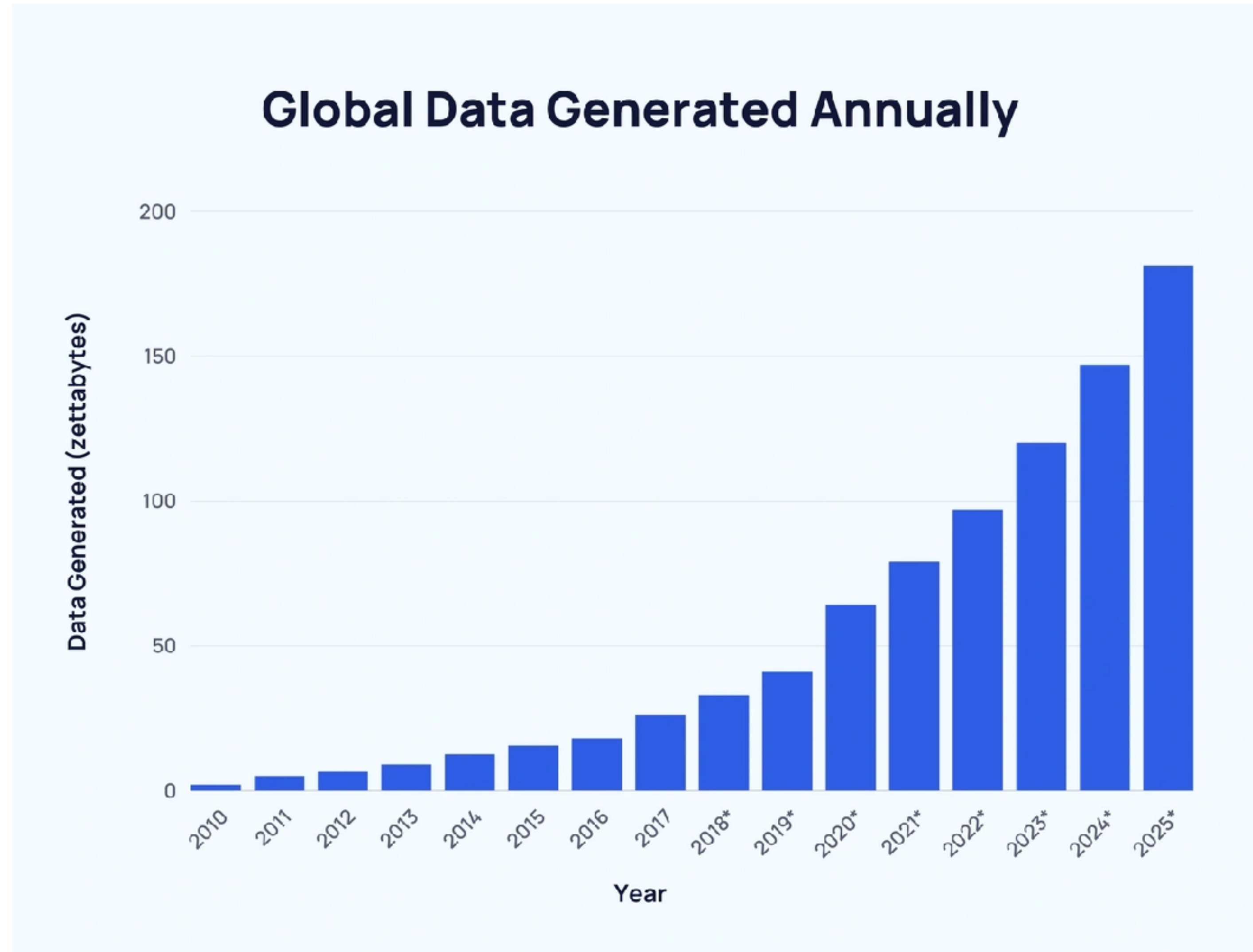
# **Why the recent hype?**

**More real-world data**

**Faster computers**

**Better algorithms**

# More data



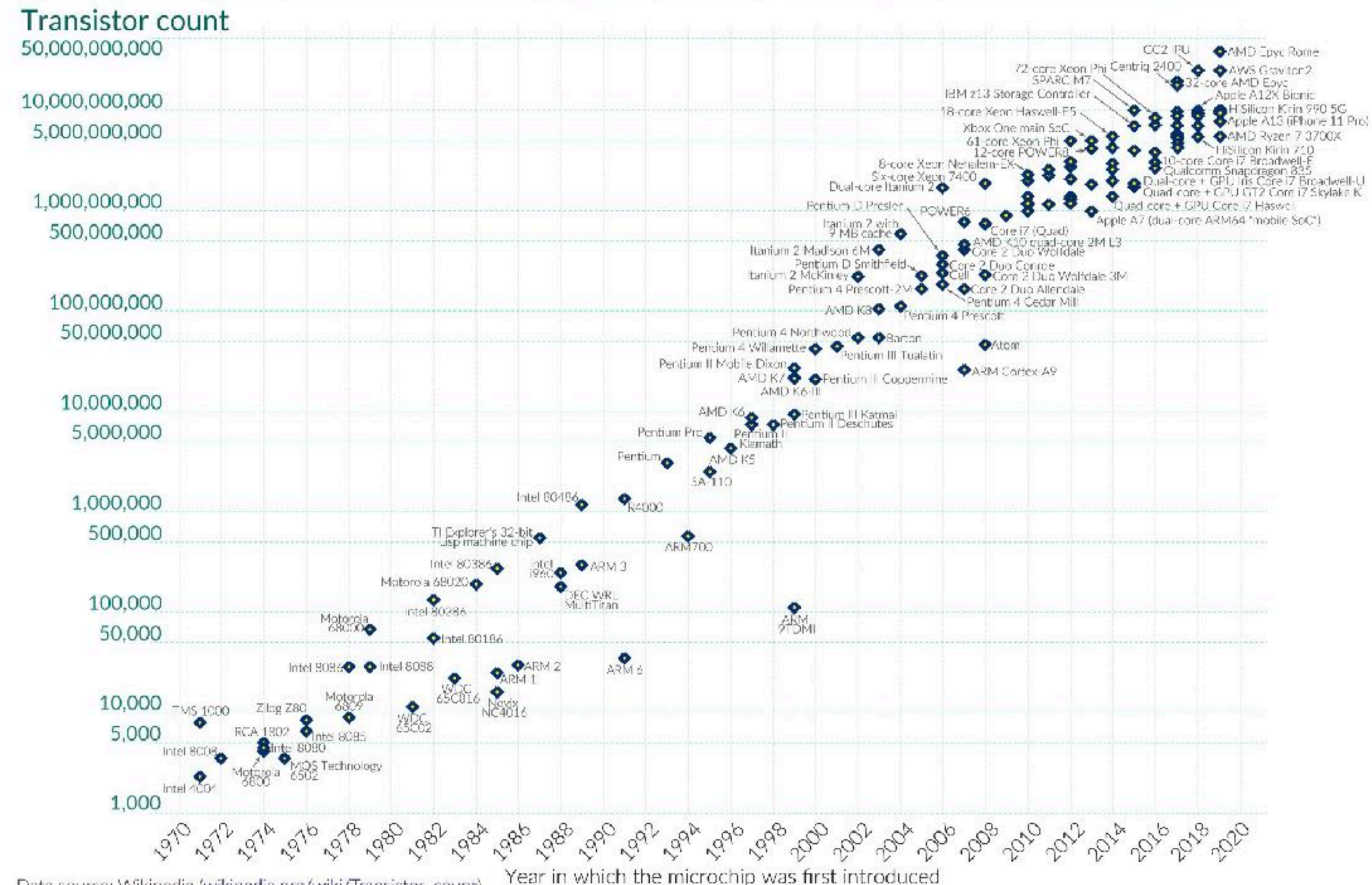


# Faster computers

**Moore's Law:** The number of transistors on microchips doubles every two years

Moore's law describes the empirical regularity that the number of transistors on integrated circuits doubles approximately every two years.

This advancement is important for other aspects of technological progress in computing – such as processing speed or the price of computers.

Our World  
in Data

Data source: Wikipedia ([wikipedia.org/wiki/Transistor\\_count](https://wikipedia.org/wiki/Transistor_count))

OurWorldinData.org – Research and data to make progress against the world's largest problems.

Licensed under CC-BY by the authors Hannah Ritchie and Max Roser.



# Faster computers

AI	Year	FLOPs
Theseus	1950	40
Perceptron Mark I	1957–58	695,000
Neocognitron	1980	228 million
NetTalk	1987	81 billion
TD-Gammon	1992	18 trillion
NPLM	2003	1.1 petaFLOPs
AlexNet	2012	470 petaFLOPs
AlphaGo	2016	1.9 million petaFLOPs
GPT-3	2020	314 million petaFLOPs
Minerva	2022	2.7 billion petaFLOPs

*Note: One petaFLOP = one quadrillion FLOPs. Source: “Compute Trends Across Three Eras of Machine Learning” by Sevilla et. al, 2022.*

# Faster computers

JB

You

AI	Year	FLOPs
Theseus	1950	40
Perceptron Mark I	1957–58	695,000
Neocognitron	1980	228 million
NetTalk	1987	81 billion
TD-Gammon	1992	18 trillion
NPLM	2003	1.1 petaFLOPs
AlexNet	2012	470 petaFLOPs
AlphaGo	2016	1.9 million petaFLOPs
GPT-3	2020	314 million petaFLOPs
Minerva	2022	2.7 billion petaFLOPs

*Note: One petaFLOP = one quadrillion FLOPs. Source: “Compute Trends Across Three Eras of Machine Learning” by Sevilla et. al, 2022.*

plot this data





ChatGPT

✓ Finished analyzing ▾

Always expand output? ☒

python

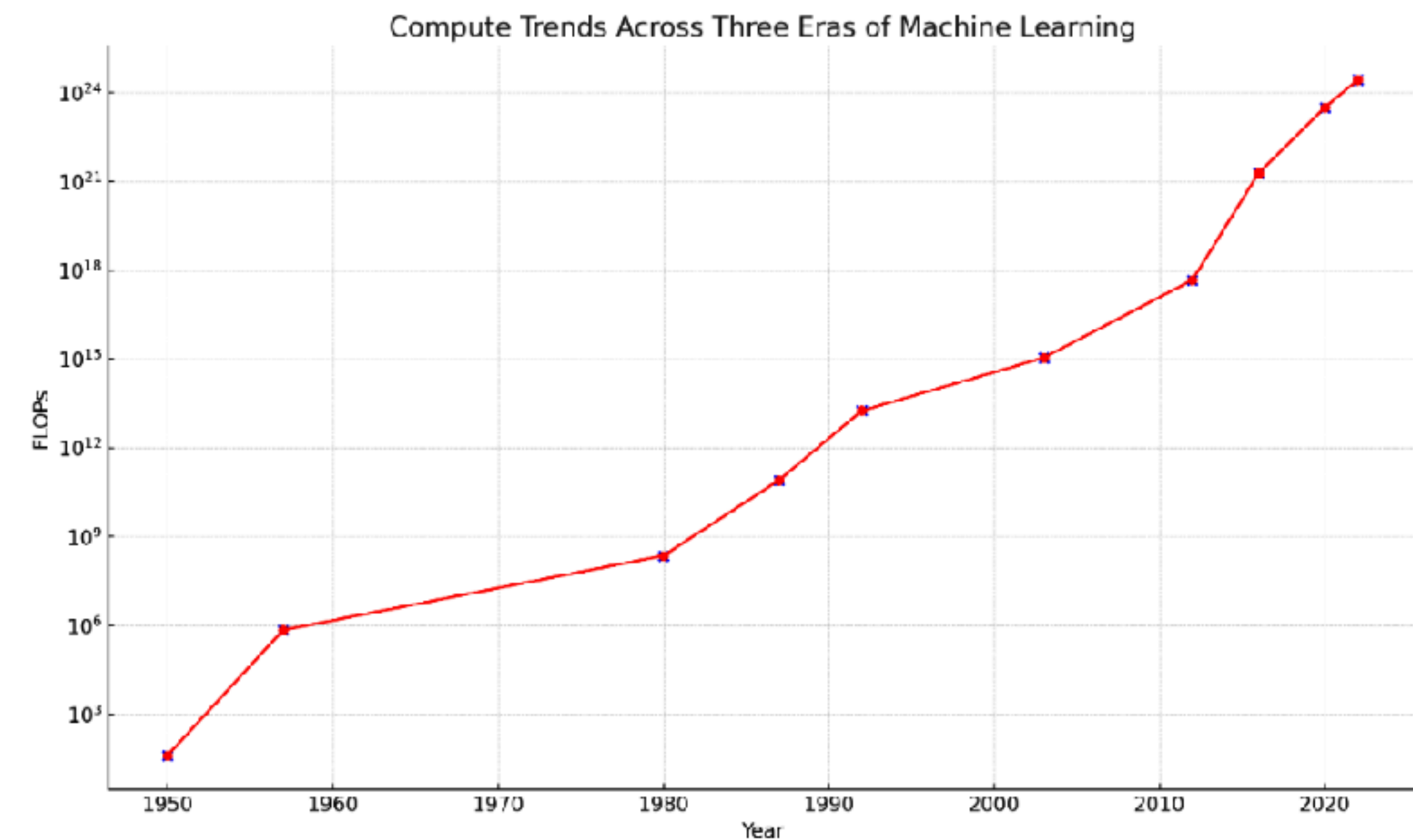
Copy code

```
import pandas as pd
import matplotlib.pyplot as plt

# The data as provided in the image shared by the user
data = {
    "AI": ["Theseus", "Perceptron Mark I", "Neocognitron", "NetTalk",
          "TD-Gammon", "NPLM", "AlexNet", "AlphaGo", "GPT-3", "Minerva"],
    "Year": [1950, 1957, 1980, 1987, 1992, 2003, 2012, 2016, 2020, 2022],
    "FLOPs": [40, 695000, 228e6, 81e9, 18e12, 1.1e15, 470e15, 1.9e6 * 1e15,
              314e6 * 1e15, 2.7e9 * 1e15]
}

# Convert the data into a DataFrame
df = pd.DataFrame(data)

# Plot the data
plt.figure(figsize=(14, 8))
plt.scatter(df['Year'], df['FLOPs'], color='blue')
plt.plot(df['Year'], df['FLOPs'], linestyle='-', marker='o', color='red')
plt.title('Compute Trends Across Three Eras of Machine Learning')
plt.xlabel('Year')
plt.ylabel('FLOPs')
plt.yscale('log') # Using a log scale for better visualization
plt.grid(True, which="both", ls="--", linewidth=0.5)
plt.show()
```

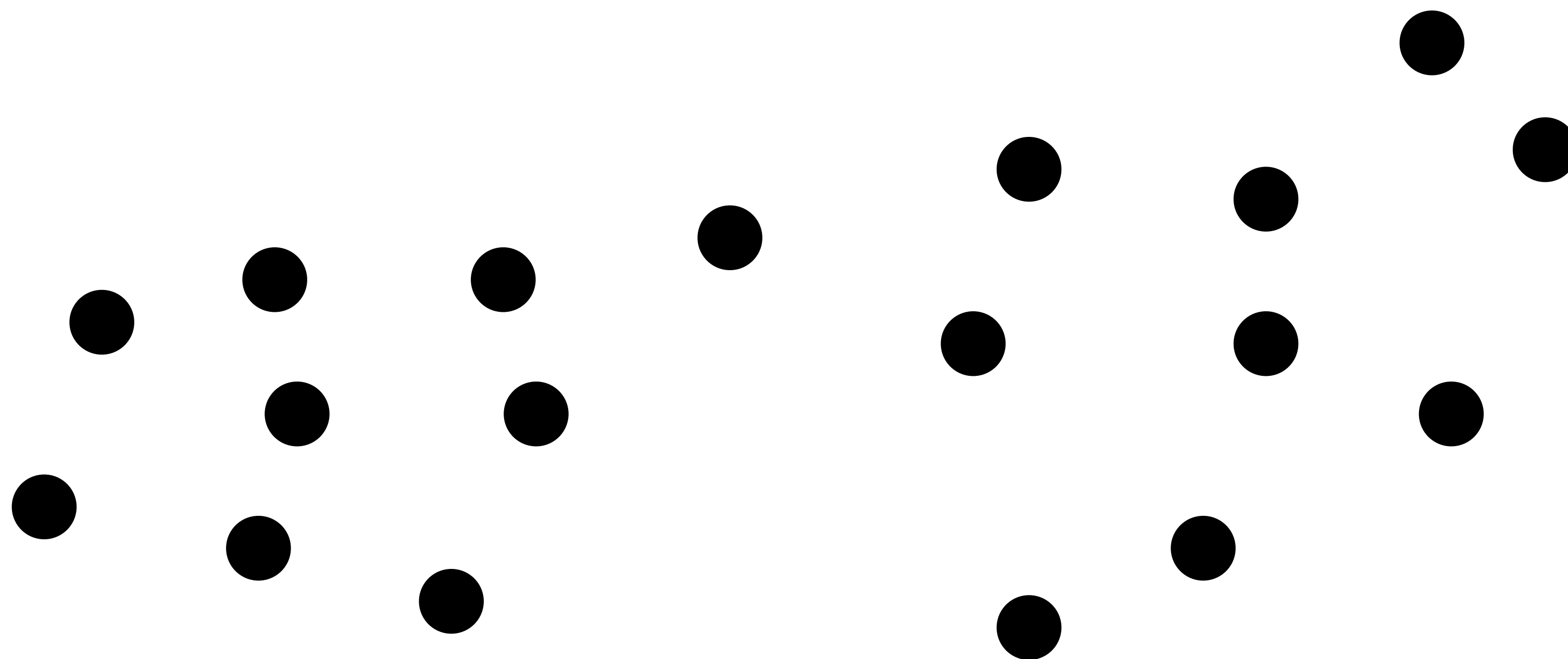


Here is the plot of the data showing the trend of FLOPs (Floating Point Operations per Second) over the years for different AIs. The y-axis is on a logarithmic scale to better visualize the exponential growth in computational power used by these AIs over time. [\[↗\]](#)

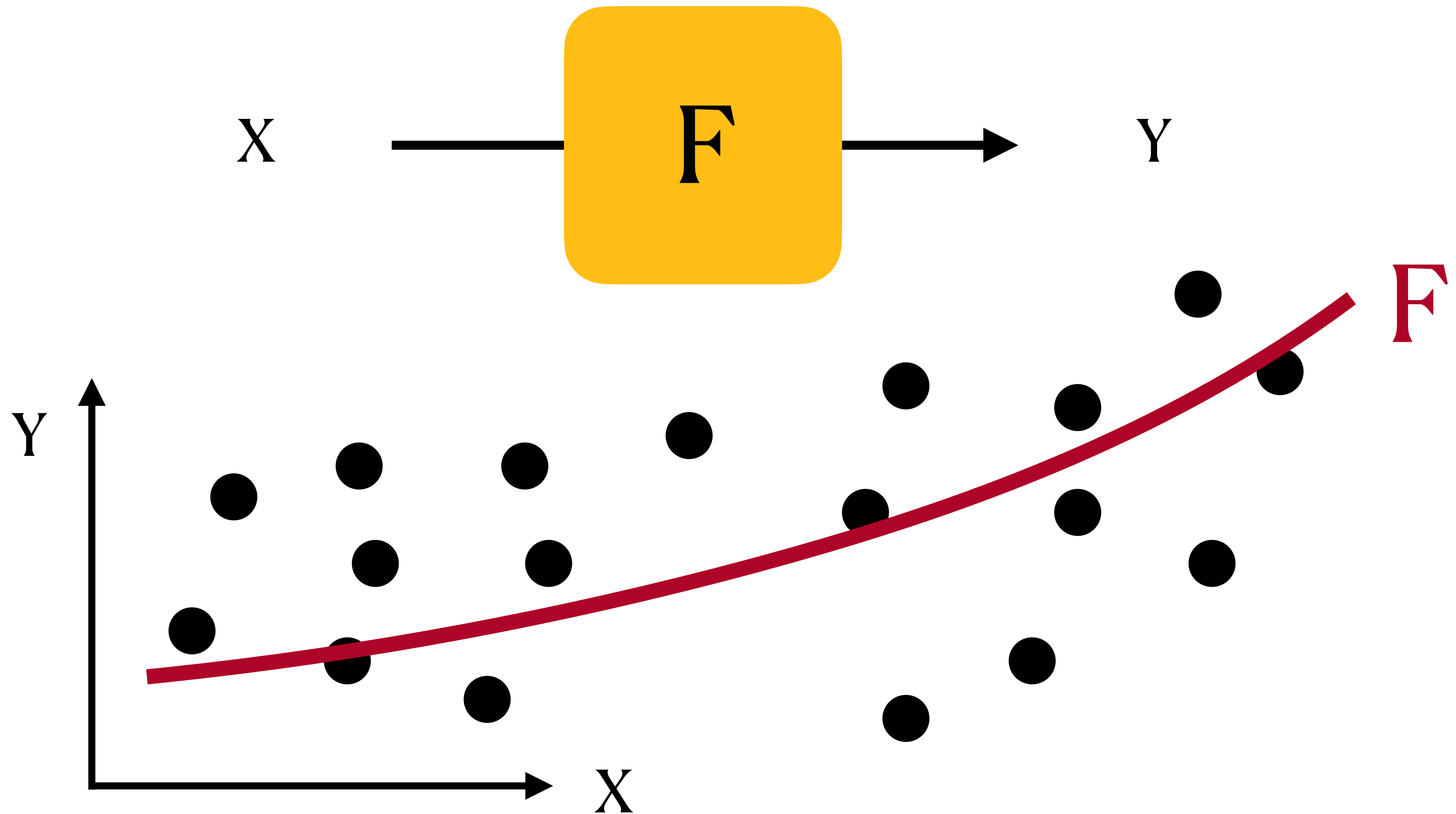
# **III - What's Machine Learning?**



# Find a Pattern in the Data

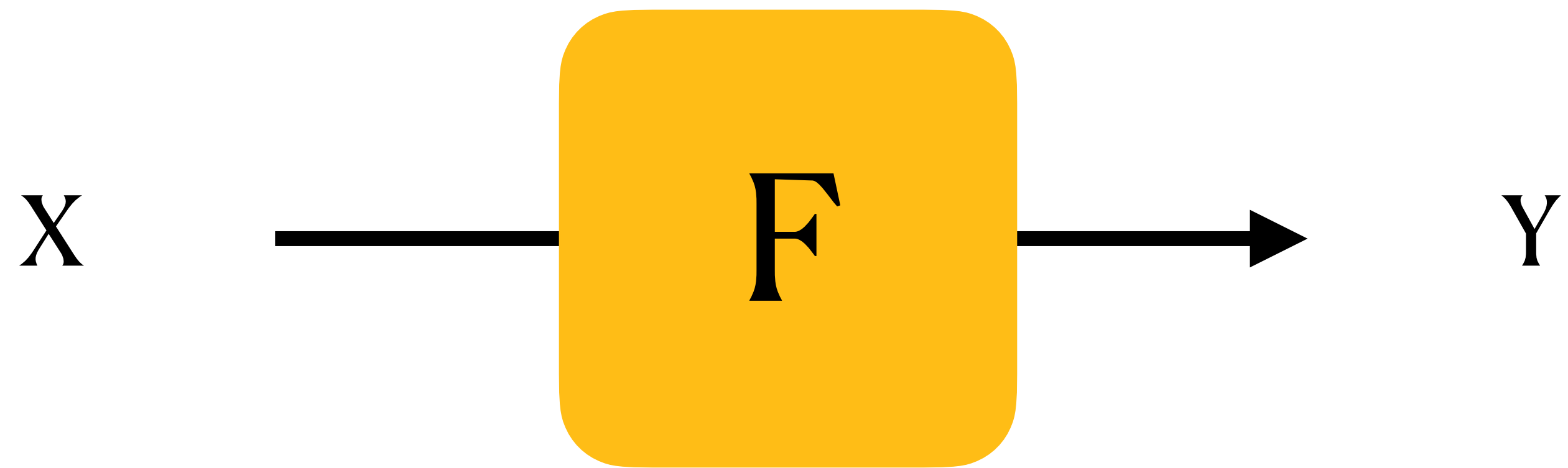


A lot of it is **Curve Fitting**  
Find function  $F$  to map  $X$  to  $Y$

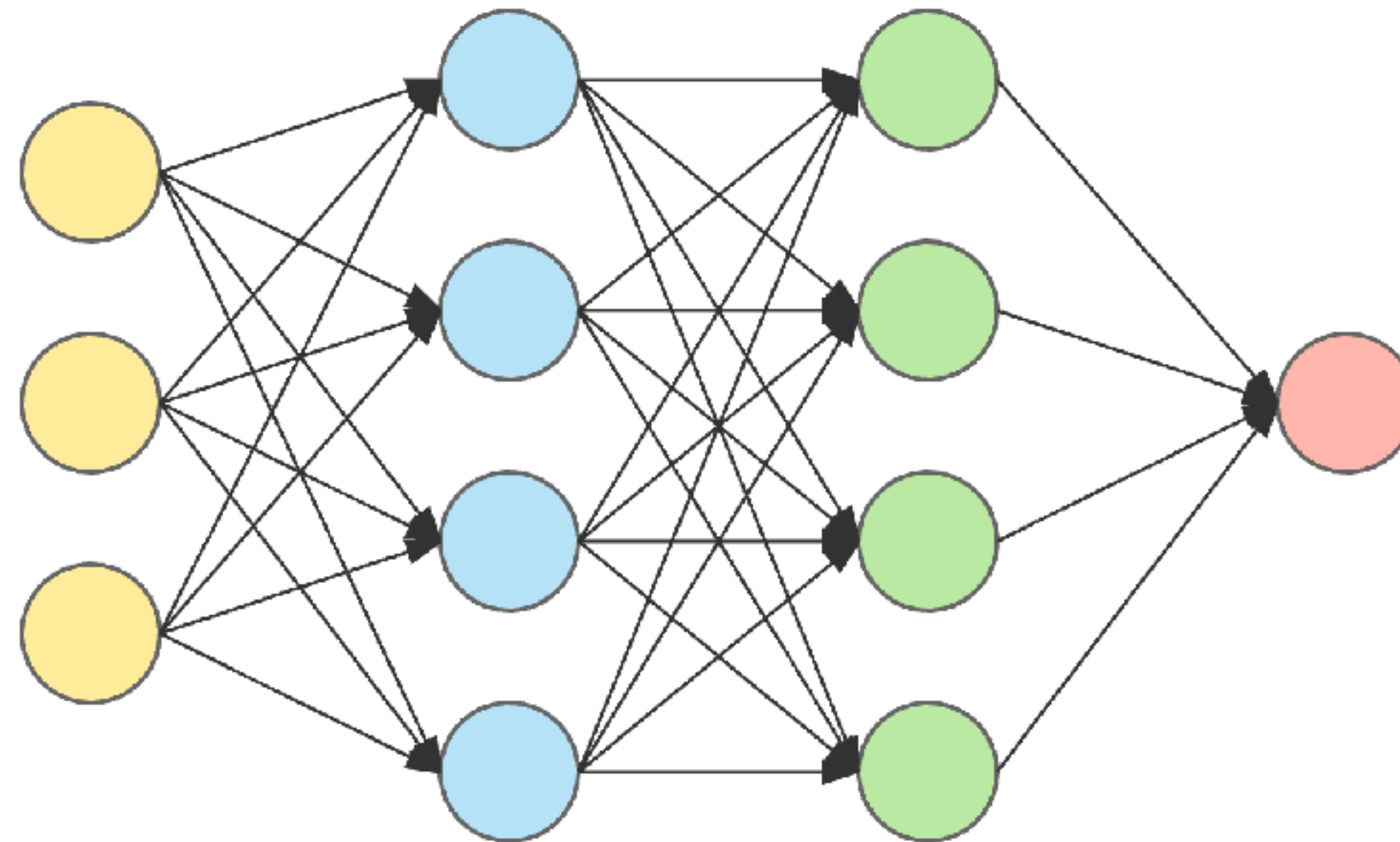
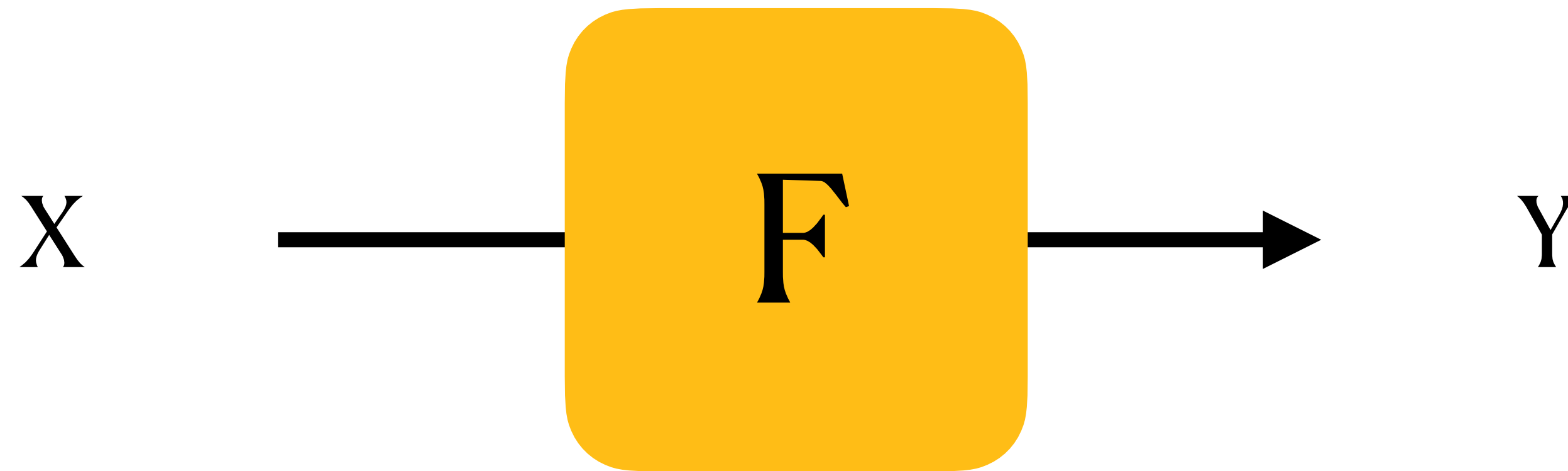




# What could X and Y be?

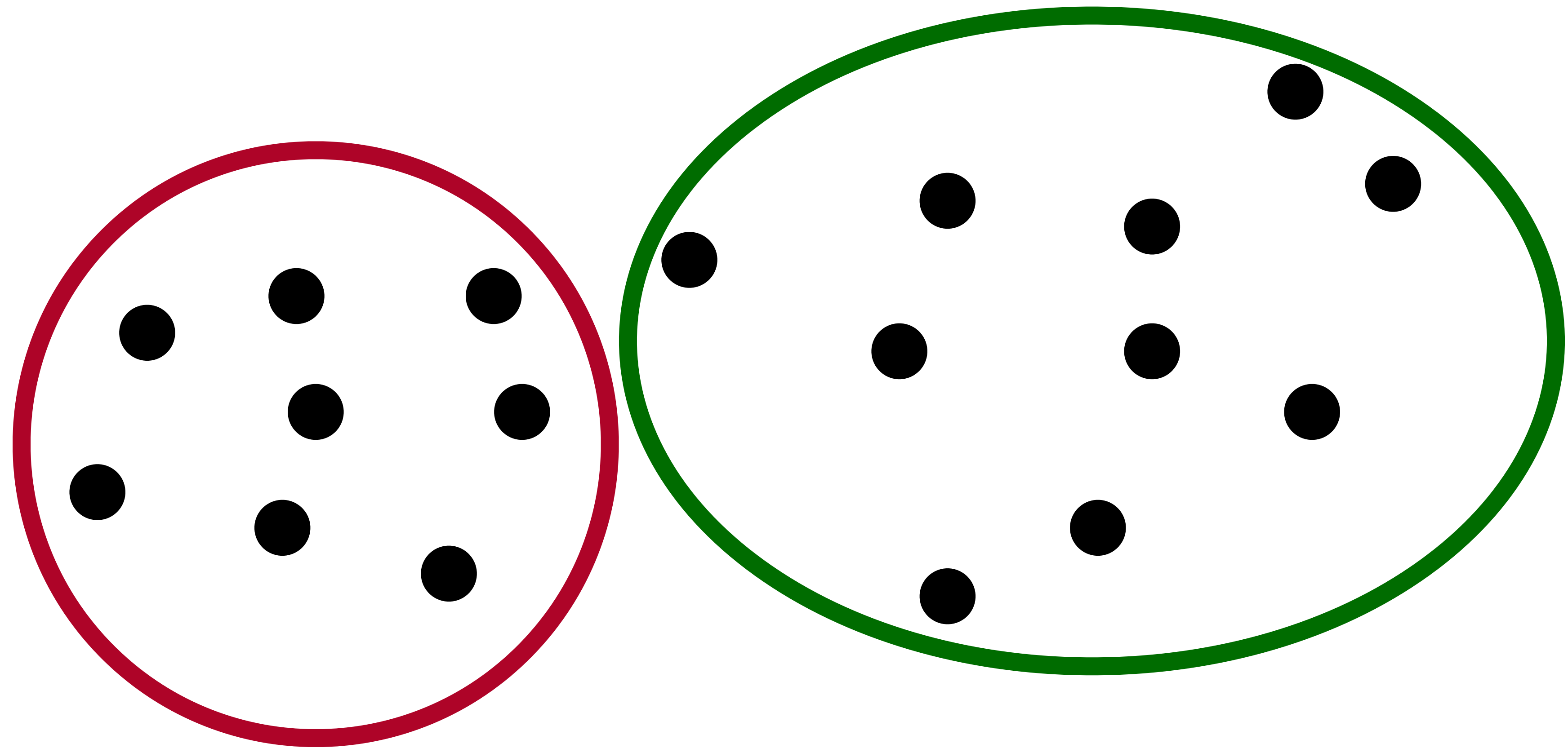


# What could X and Y be?

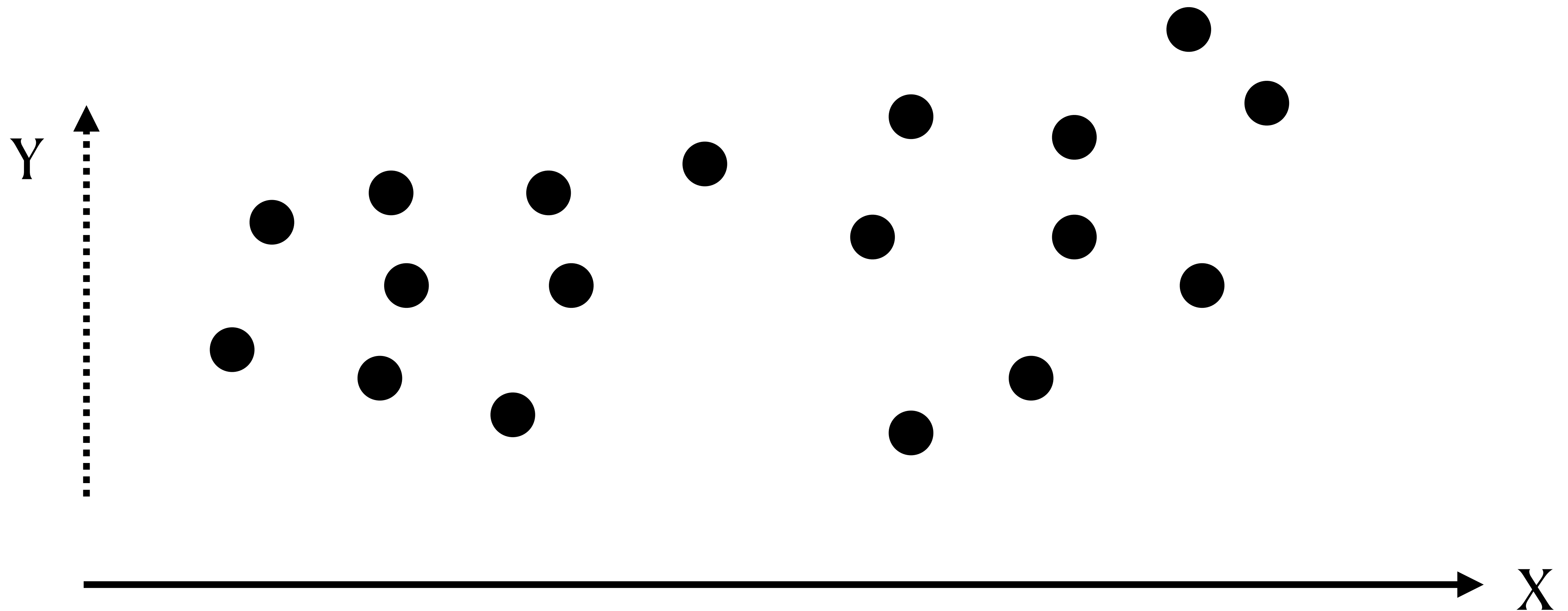




Sometimes it's about **Clustering**

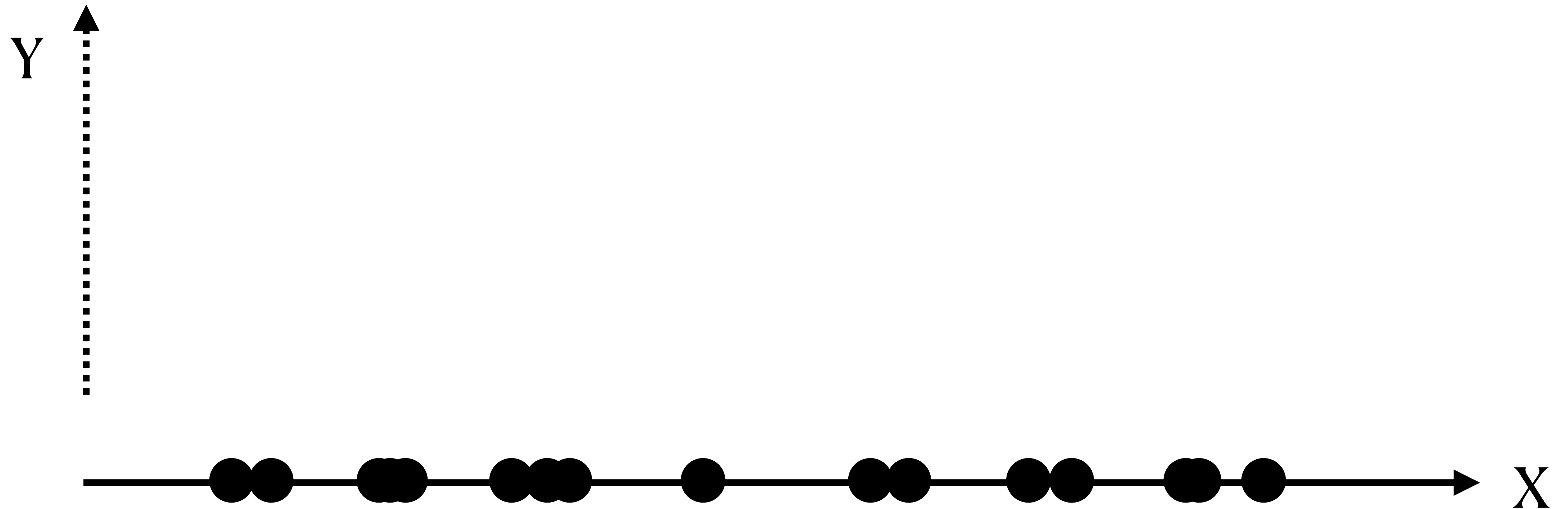


# Sometimes it's about **Projection**

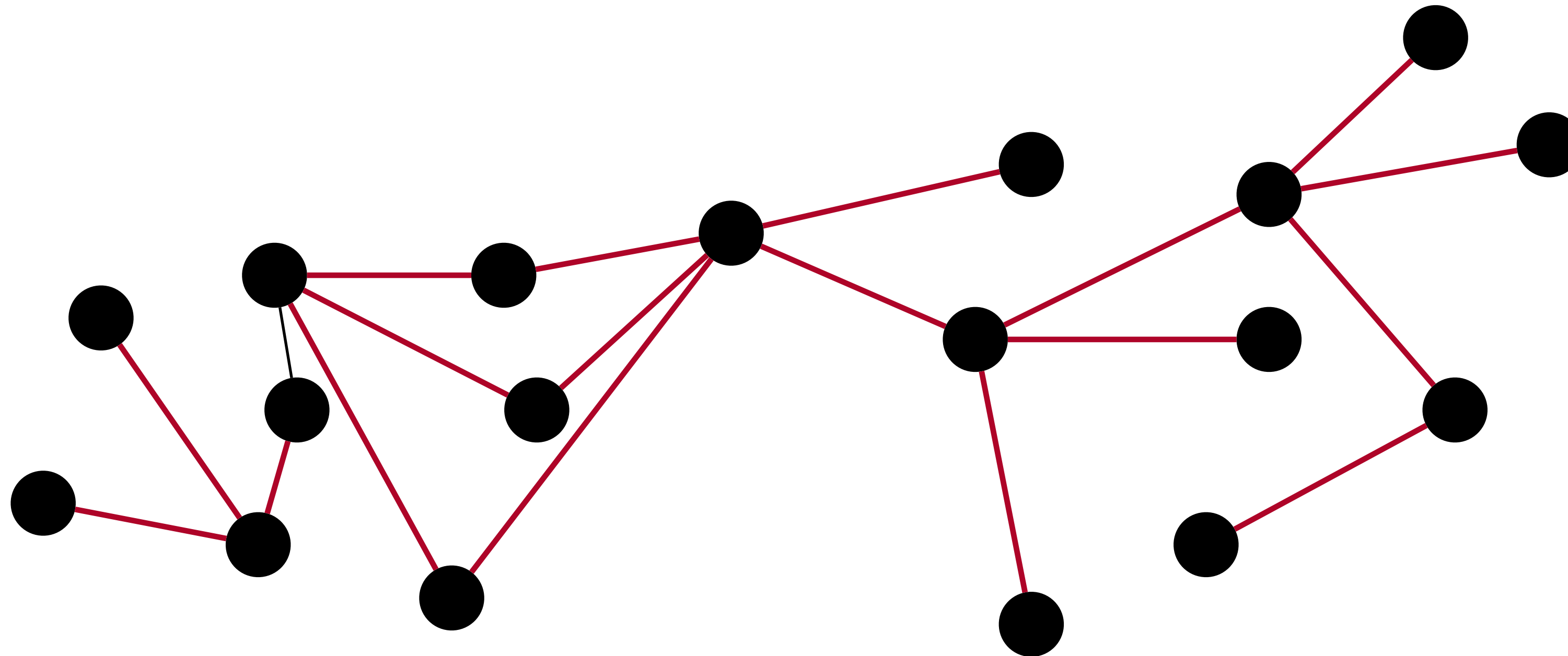




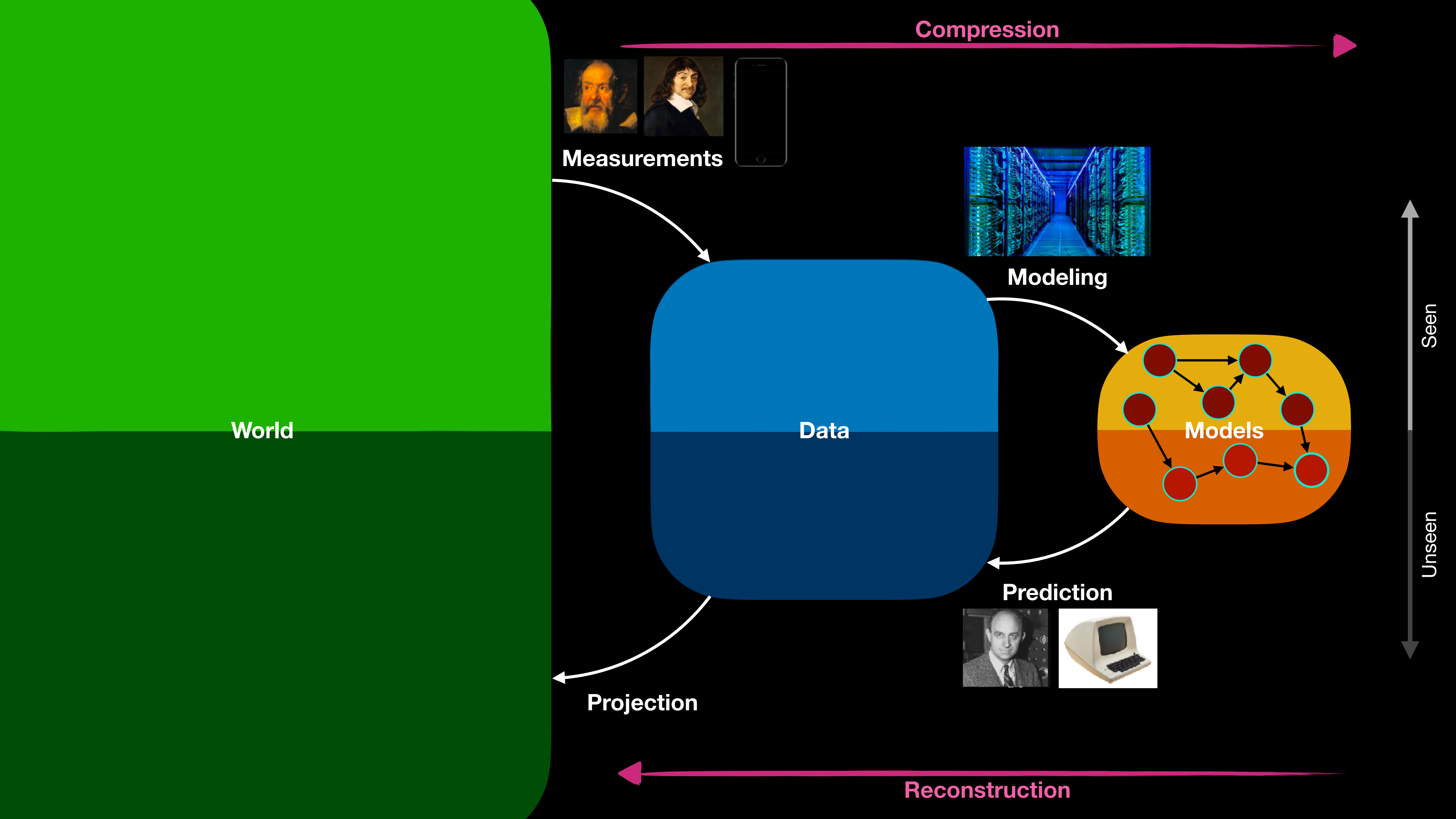
# Sometimes it's about **Projection**



# Sometimes it's about **Graphs**







# **VI - Course Logistics**



# Course Objectives

- Gain experience in getting computers to **Model the World from Data**
- Master computational and data-driven thinking
- Master the mathematical language of machine learning
- Learn powerful machine learning algorithms
- Use existing machine learning frameworks
- **Have Fun!**

# Course Details

- **Pre-requisites:**
  - MATH 218 or 219 - Linear Algebra
  - MATH 201 - Calculus
  - STAT 230 - Probability and Statistics
  - EECE 230 - Introduction to Programming
- **References:**
  - Stanford's **CS229**: Introduction to Machine Learning Notes
  - **The Elements of Statistical Learning: Data Mining, Inference, and Prediction.**  
*Trevor Hastie, Robert Tibshirani, Jerome Friedman.*
  - Course website: [www.intro2ml.com](http://www.intro2ml.com)



# Course Details

- **Office Hours and Contact:**
  - Bechtel 418: Thursday 2:30-4:30pm (or by apt)
  - Email: [jb50@aub.edu.lb](mailto:jb50@aub.edu.lb)
- Lecture Schedule:
  - T-Th: 11am-12:15 pm
  - There will be practical problem solving lab days: **bring your laptops!**
- Getting Assistance:
  - Teaching Assistants: **Elie Hachem, Issar Amro, Chaymaa Abbas, Joe Germany**
  - You'll get a **Slack** invitation

# Grades

- **Grades Distribution:** (detailed distribution might vary)
  - Homework Assignments (25%)
  - Midterm, Final and Quizzes (35%)
  - Project and Participation (40%)
- **Homework policy:** discuss the homework, help each other understand the material, **BUT** write the solution on your own. Copied assignments will be penalized.
- **Project:** Find a topic, groups of 2 to 3, put code on **GitHub**, make a **product**, poster session.
- See course policy on website:

# Generative AI Policy

- Let's start with a basic question: why are you here?
  - Acquire the confidence to **think on your own** *and* **create a better future**
  - Learn **problem solving** across many disciplines
  - Learn how to use **tools** (programming language, etc., and most recently LLMs)
- Given these goals, can you use LLMs in this course?
  - **YES!** You **have** to use them in the future to solve some complex problems or accelerate your work. Treat them as smart friends with a lot of knowledge; and like friends they make mistakes. So, always keep a (very) healthy amount of skepticism in mind.
  - **BUT**, it might make you **dumber** if you use it lazily: For example, if it does all the thinking for you, copy paste its answers without understanding. In this case, you will make it much easier for it to replace you in the future.
  - Your future's at stake and it's your responsibility to make sure that you're learning.



# Tips for effectively using LLMs

- **Learn how to ask good questions:** before consulting an LLM, try to solve and, whenever possible, define the problem on your own. Use LLMs to empower your thinking process, not replace it.
- **Cross-check with reliable sources:** Corroborate LLM-generated information with trusted sources whenever possible. Knowing when to trust LLM content is the same as learning how to trust social media posts. It's critical thinking. It comes down to having a good model of the world (in your head), to know what is plausible, and when you should ask more questions.
- **Learn from it:** if the LLM provides a solution, take the time to understand the steps and rationale behind it. You can effectively learn anything if you ask the right questions, and you're curious enough.