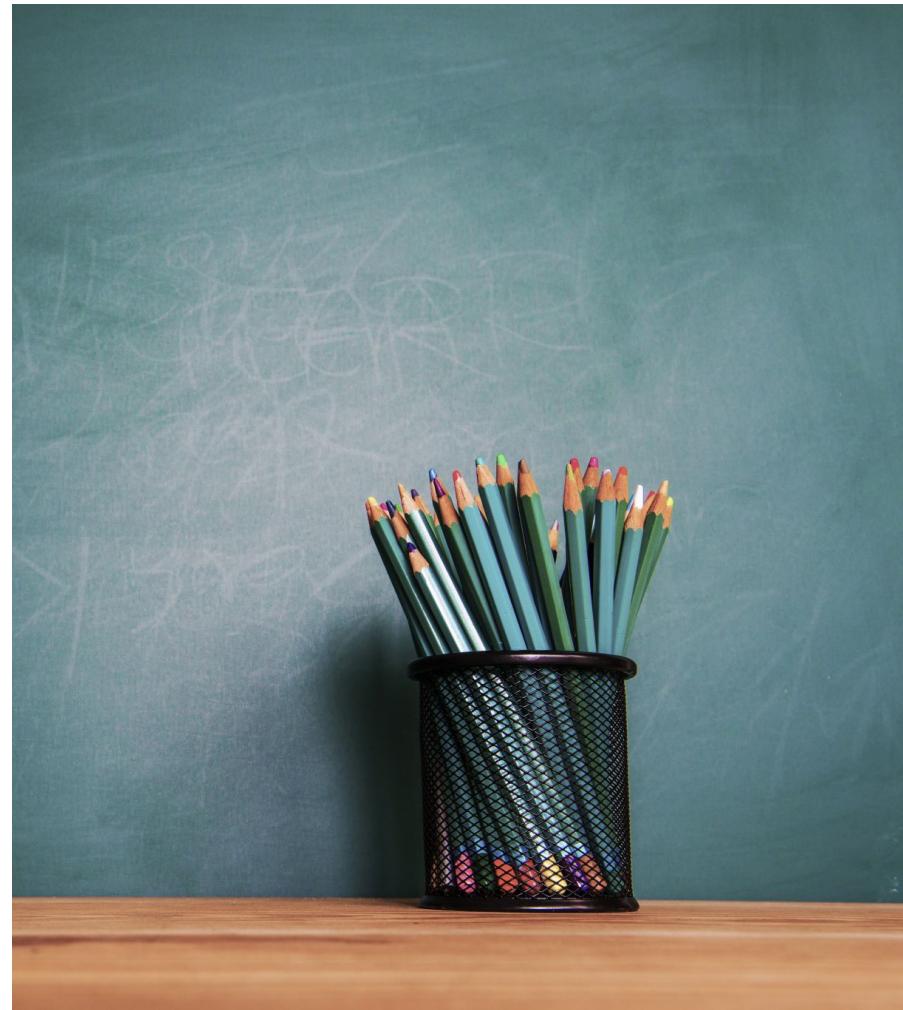
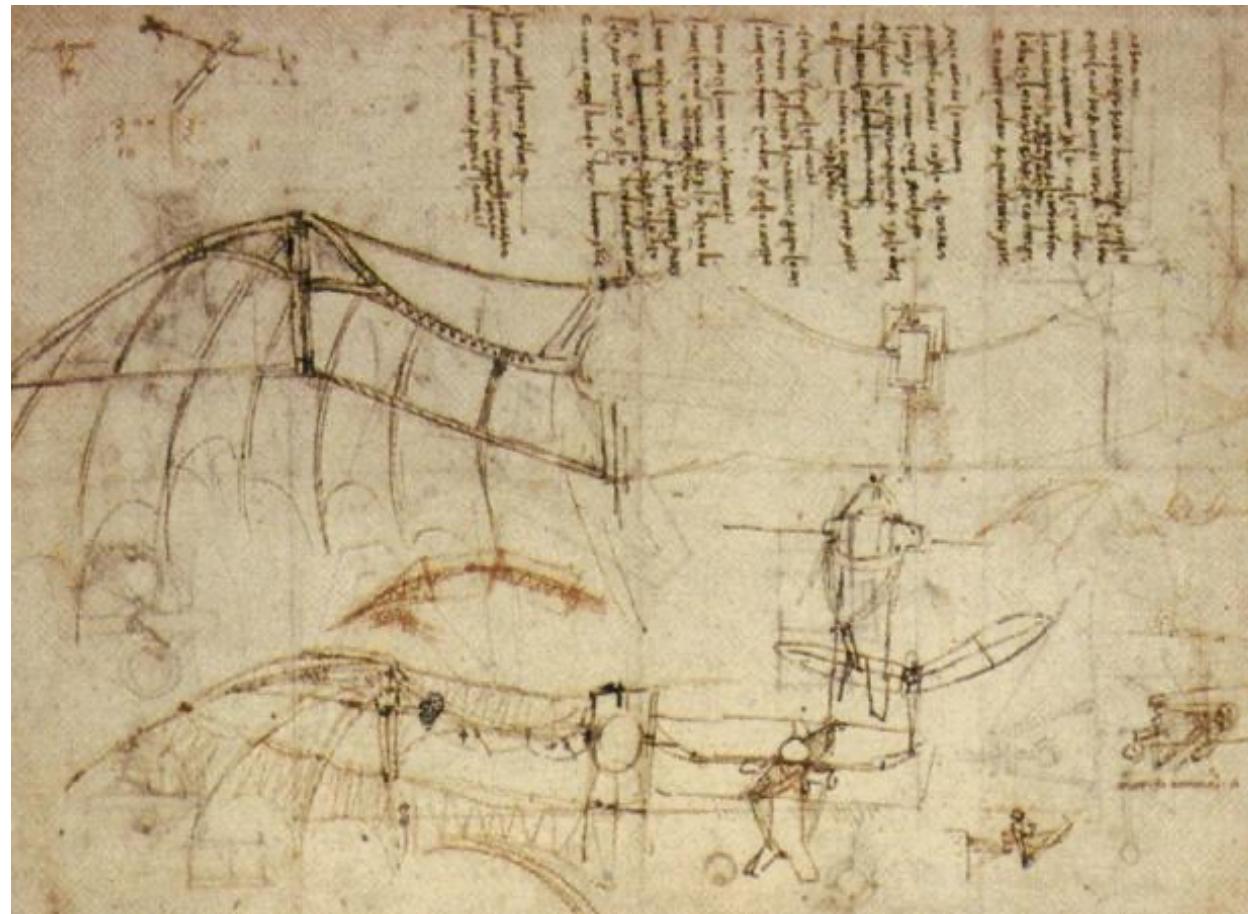


Artificial Intelligence: Benefits, challenges and risks

Soumya Banerjee
University of Cambridge



Mimicking nature

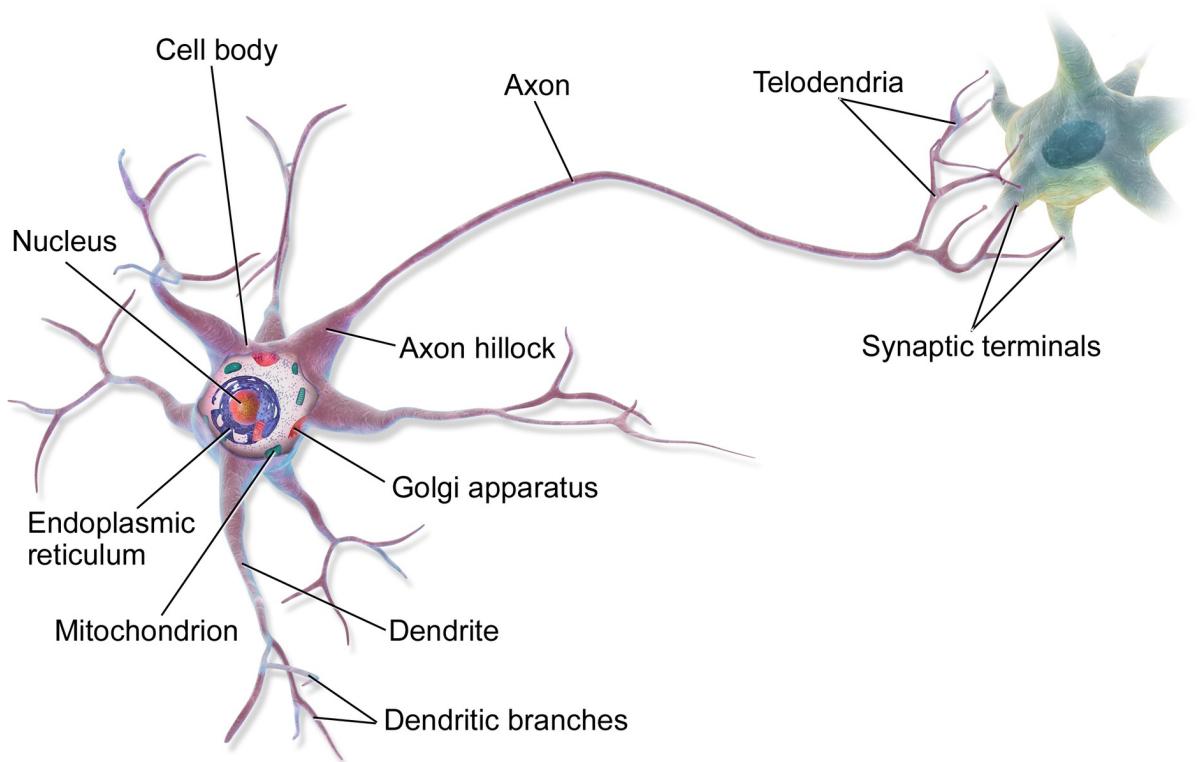


Computing machines



What is AI?

- Can we mimic what is going on in our brains?



What is AI?

- Baby steps
- *Perceptron*

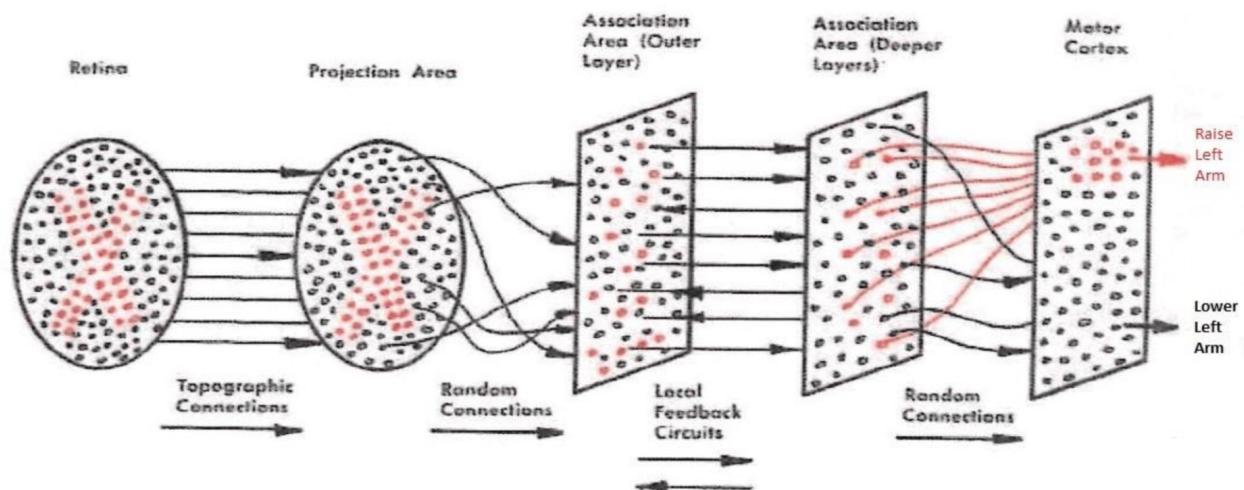


FIG. 1 — Organization of a biological brain. (Red areas indicate active cells, responding to the letter X.)

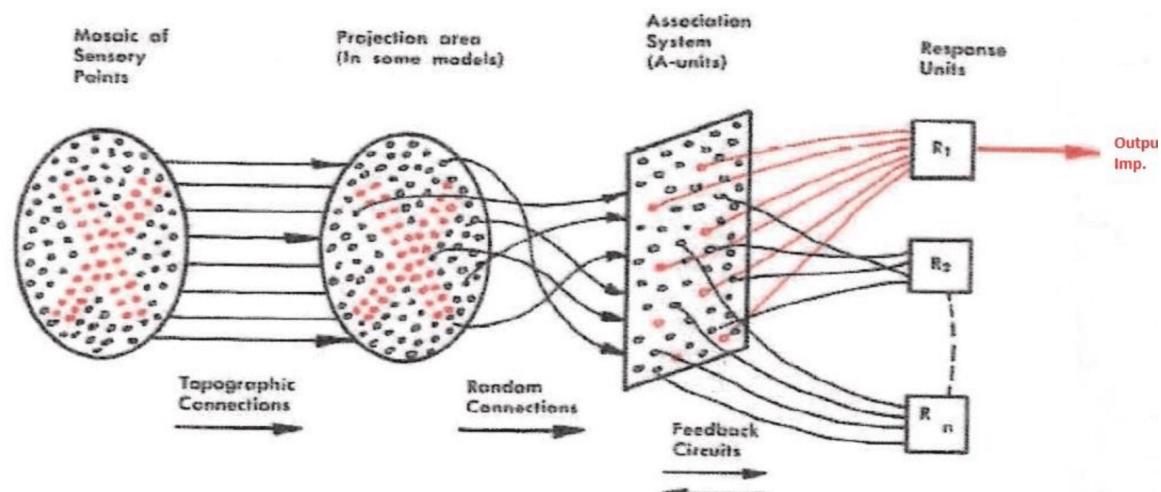


FIG. 2 — Organization of a perceptron.

Can machines think?

Can machines think?

- Can a submarine swim?

Can machines think?

- Can a submarine swim?
- “The question of whether a computer can think is no more interesting than the question of whether a submarine can swim” – Edsger Dijkstra

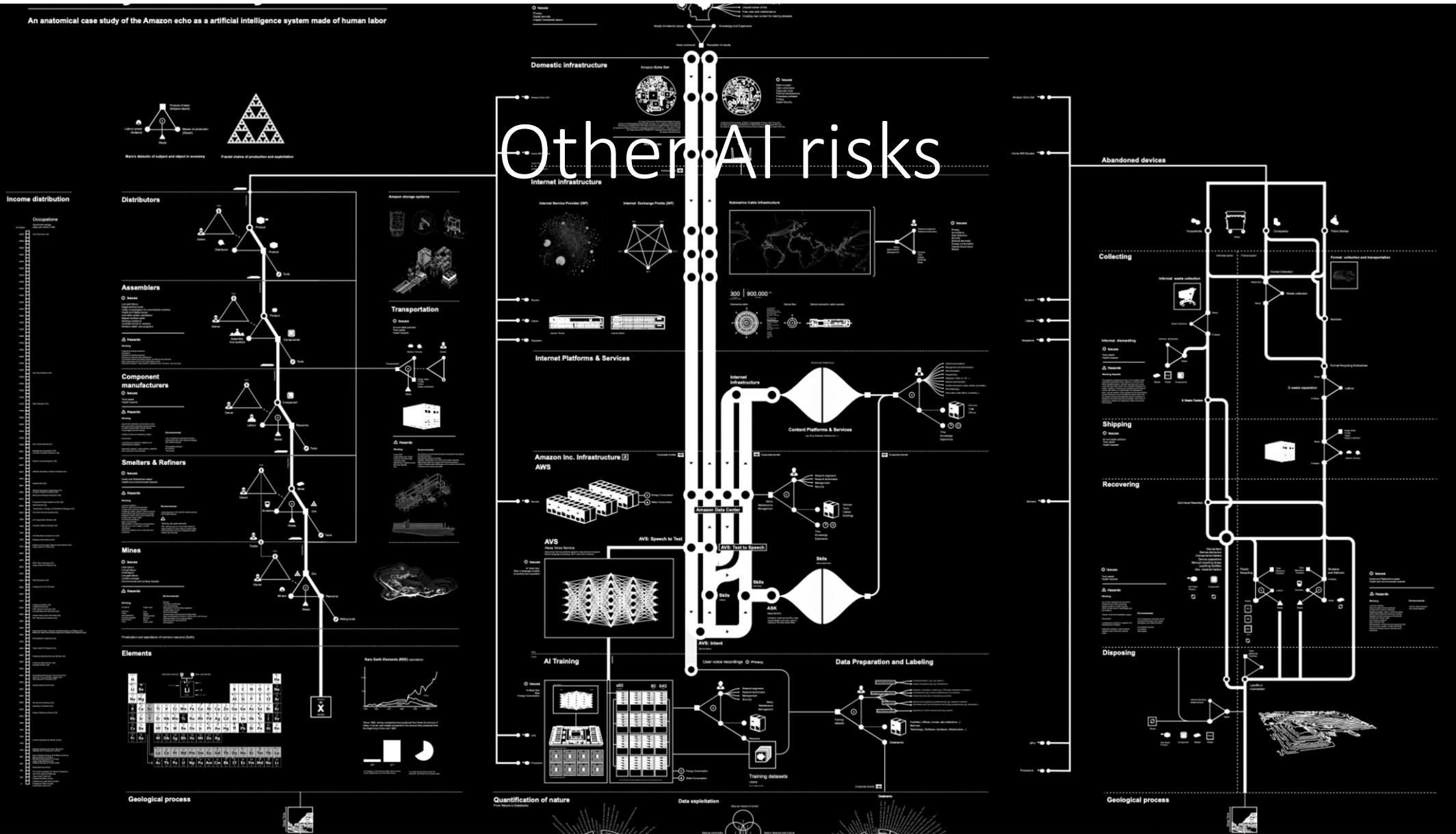
Current Trends and Applications

- Deep learning
- Generative AI
- Applications in Healthcare, Finance, Autonomous Systems

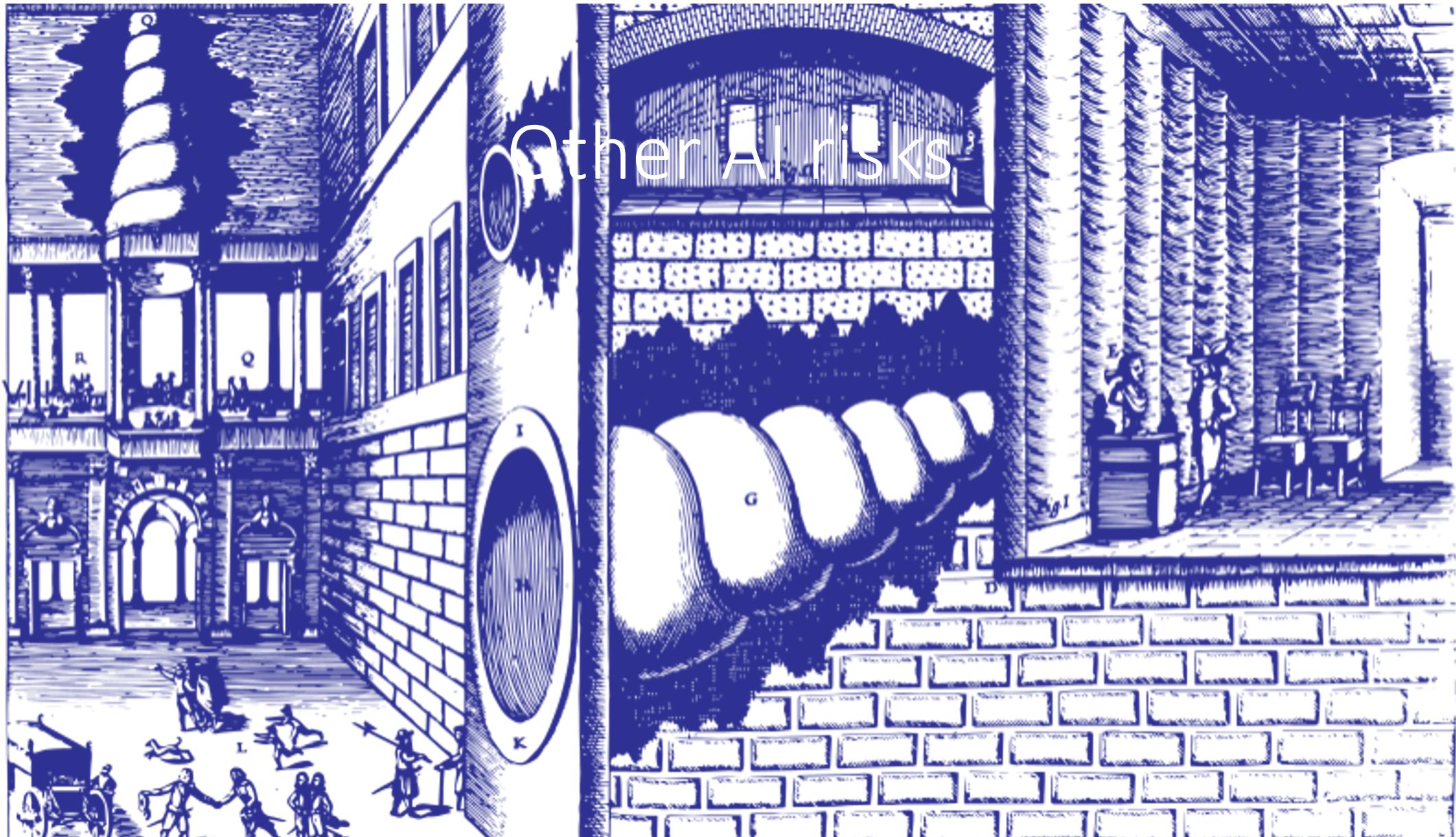
Risks of AI

- Ethical considerations
- Bias
- Data privacy
- Impact on jobs
- Systemic effects on our planet
- Risk of *anthropomorphizing*

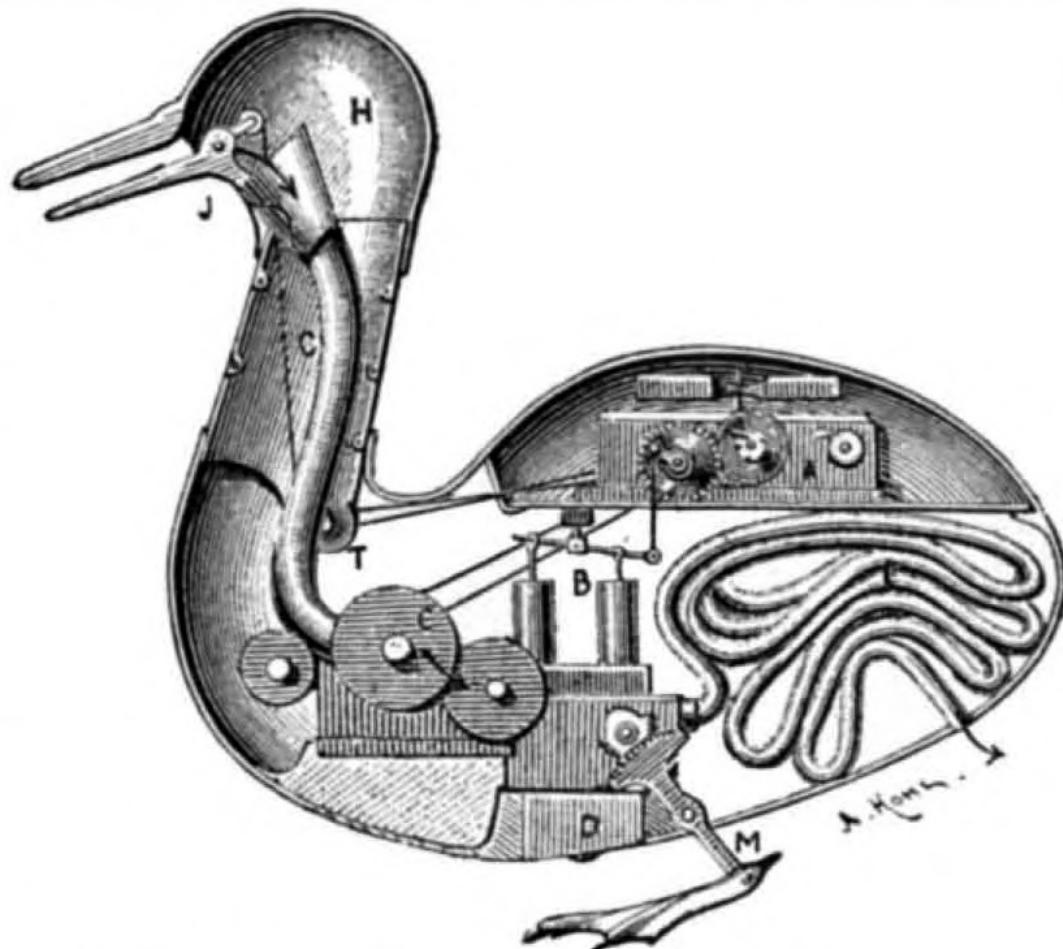
An anatomical case study of the Amazon echo as a artificial intelligence system made of human labor



Other AI risks



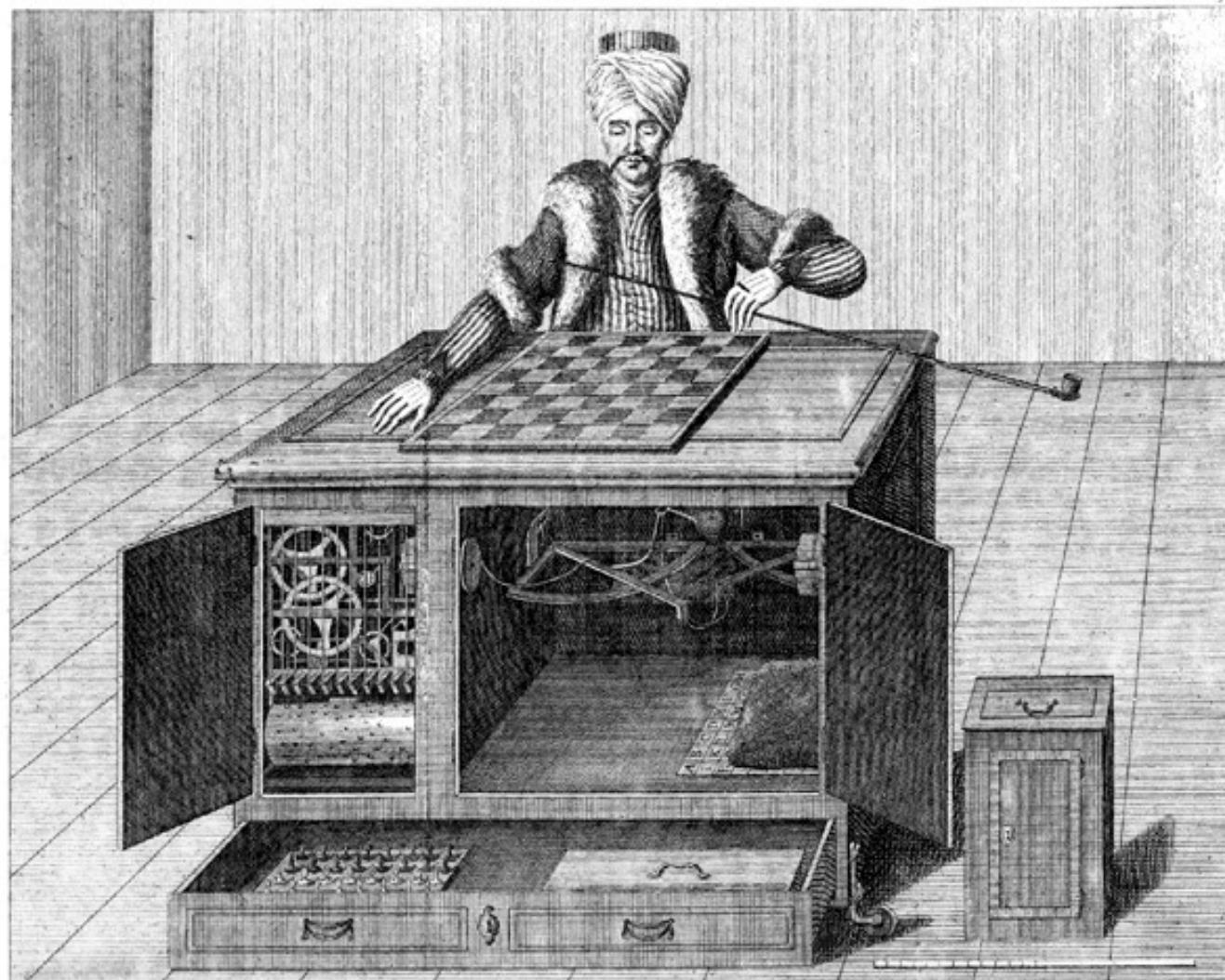
Other AI risks



INTERIOR OF VAUCANSON'S AUTOMATIC DUCK.

A, clockwork; *B*, pump; *C*, mill for grinding grain; *F*, intestinal tube;
J, bill; *H*, head; *M*, feet.



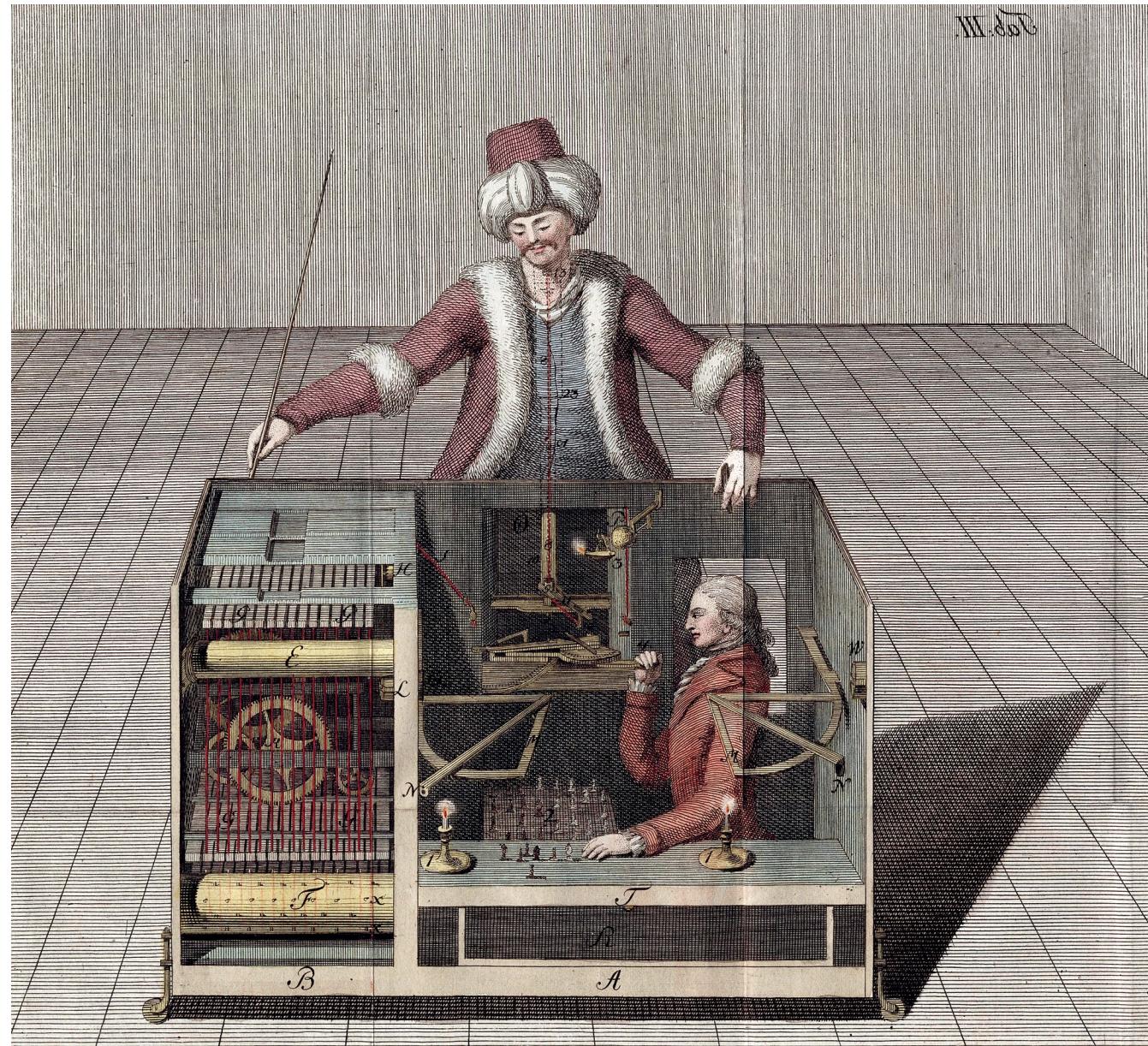


W. de Kempenaer del.

Chr. a Mechel excud. Basilew.

P.G. Pintz sc:

Der Schachspiele, wie er vor dem Spiel gezeigt wird, vornewm Le Jouer d'echec, tel qu'on le montre avant le jeu, par devant.



AI: An illusion?



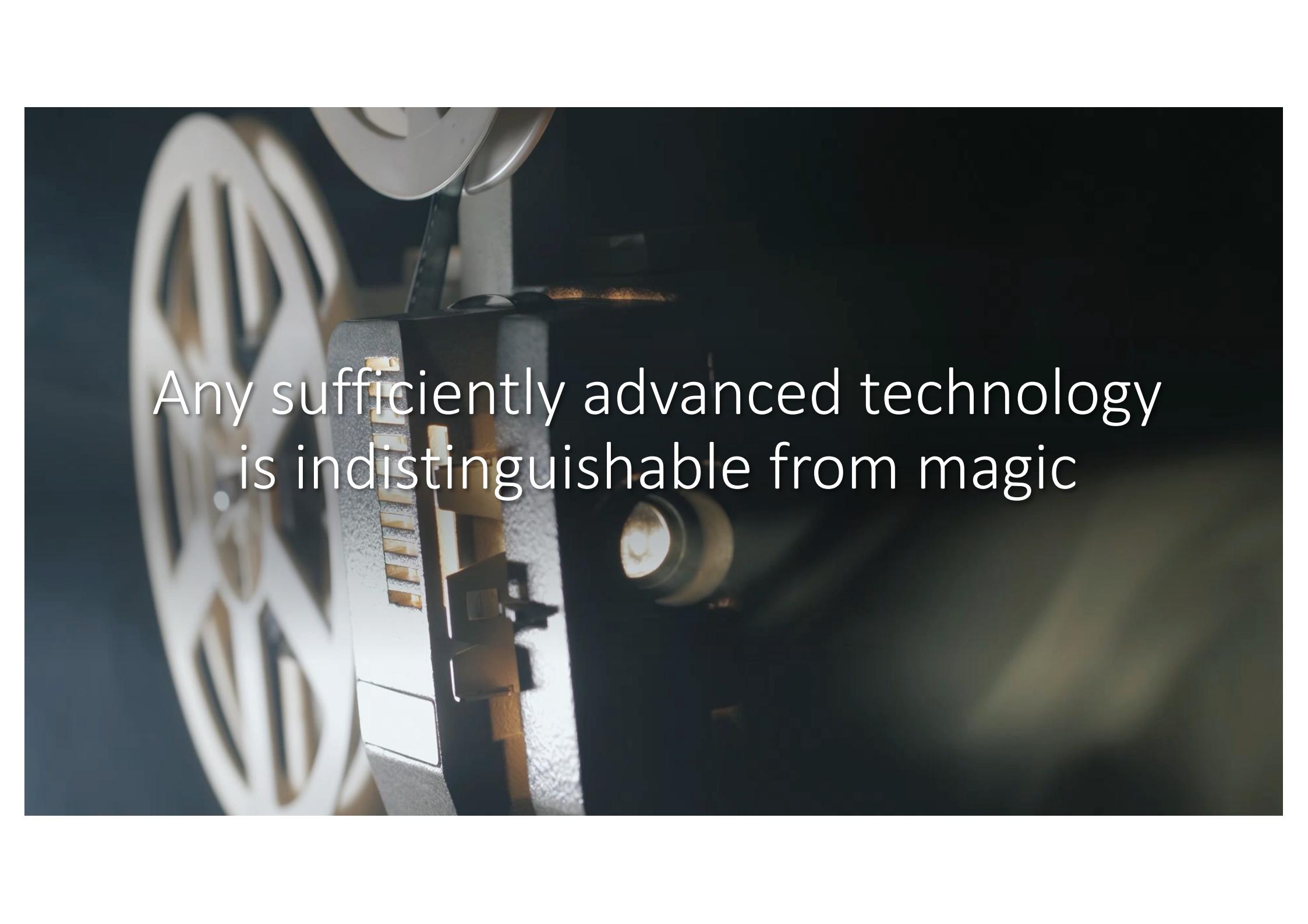
The Digesting Duck automaton, created in the 18th century by Jacques de Vaucanson, was a marvel of mechanical ingenuity, designed to mimic the actions of a real duck, including eating, digesting, and excreting food. Similarly, ChatGPT, an advanced AI language model developed by OpenAI, is a modern marvel of artificial intelligence, designed to mimic human conversation and thought processes. Both the Digesting Duck and ChatGPT operate on the principle of simulating life-like behavior through complex internal mechanisms—whether mechanical gears or intricate algorithms. However, just as the duck's "digestive process" was ultimately a clever illusion, ChatGPT's understanding of language is an impressive simulation rather than true comprehension. Both serve as remarkable examples of their respective eras' technological advancements, pushing the boundaries of what machines can do to emulate natural processes.

Answer by ChatGPT

The first vending machine

The first vending machine



A close-up, low-angle shot of a vintage film projector. The large, white, circular film reels are visible on the left, and the projector body is dark and metallic. A bright, intense beam of light is projected from the lens on the right side, creating a strong glow and some lens flare. The background is dark, making the light stand out.

Any sufficiently advanced technology
is indistinguishable from magic

AI: Magic?

- Magic is done by magicians
- Magicians (AI scientists and big-tech) can get in a position of privilege and abuse
- Understanding AI and opening the black-box is important
- Common people also need to understand what is AI

Should not substitute people with AI

- Fujitsu scandal
- Prosecutions and Convictions: Based on the evidence provided by the faulty Horizon IT system, the Post Office prosecuted around 736 postmasters for theft, fraud, and false accounting. Many of these individuals were convicted, with some even serving prison sentences.
- For years, postmasters insisted that they had not committed any crimes and that the discrepancies were due to issues with the Horizon system.
- However, their concerns were dismissed by the Post Office, which relied on the Horizon system's data to assert their guilt.
- Takeaway: Decisions should be made by people, not machines



Big tech in AI: boon or curse?

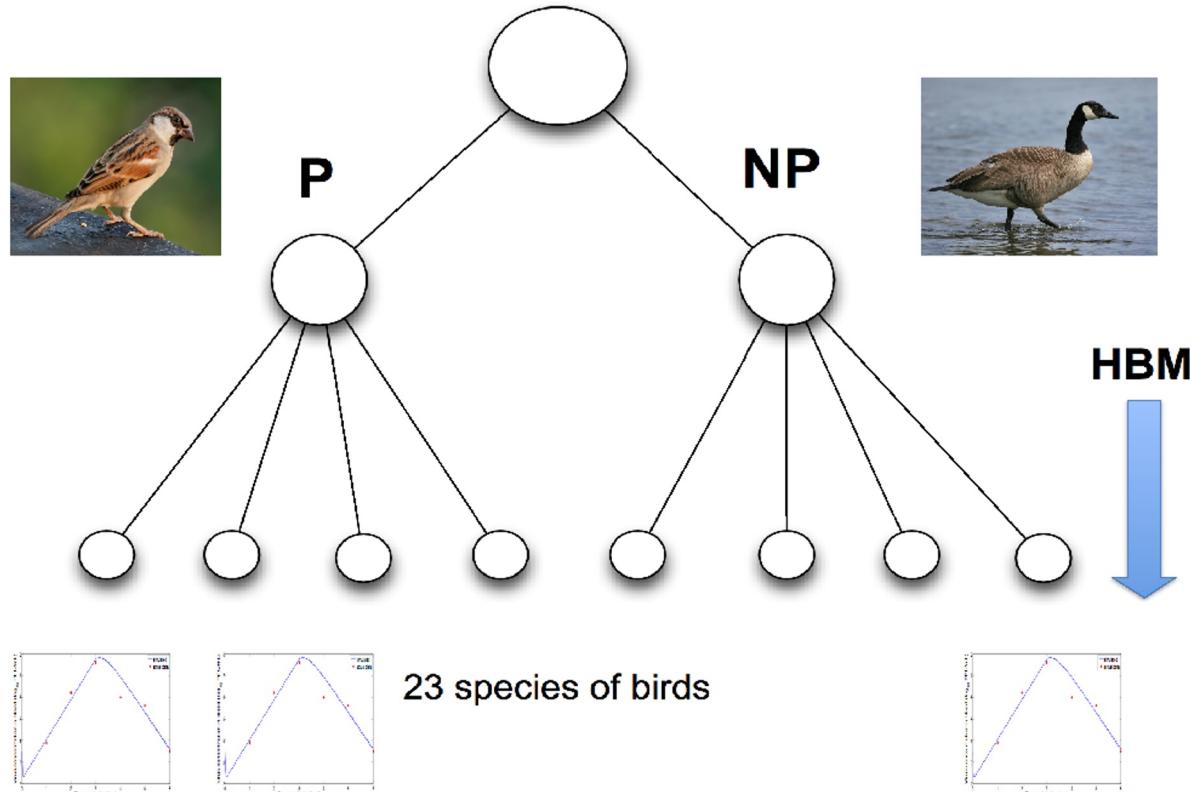
- Big tech
- Creates jobs
- Too much power getting concentrated in the hands of a few companies
- We do not want a repeat of the East India company

Future Directions

- Explainable AI
- Human AI collaboration

My journey and personal experiences

Hierarchical Bayesian models of infection



$$\begin{aligned}
 \frac{dT}{dt} &= -\beta TV \\
 \frac{dI_1}{dt} &= \beta TV - kI_1 \\
 \frac{dI_2}{dt} &= kI_1 - \delta I_2 \\
 \frac{dV}{dt} &= -\beta I_1 - \gamma V - \beta TV
 \end{aligned}
 \quad
 \begin{aligned}
 \frac{dT}{dt} &= -\beta TV \\
 \frac{dI_1}{dt} &= \beta TV - kI_1 \\
 \frac{dI_2}{dt} &= kI_1 - \delta I_2 \\
 \frac{dV}{dt} &= -\beta I_1 - \gamma V - \beta TV
 \end{aligned}$$

J. Roy. Soc. Interface, 2017
 (Royal Society publishing group). Impact factor = 4.5

$$\begin{aligned}
 \frac{dT}{dt} &= -\beta TV \\
 \frac{dI_1}{dt} &= \beta TV - kI_1 \\
 \frac{dI_2}{dt} &= kI_1 - \delta I_2 \\
 \frac{dV}{dt} &= -\beta I_1 - \gamma V - \beta TV
 \end{aligned}$$

Clinical Informatics for Serious Illnesses

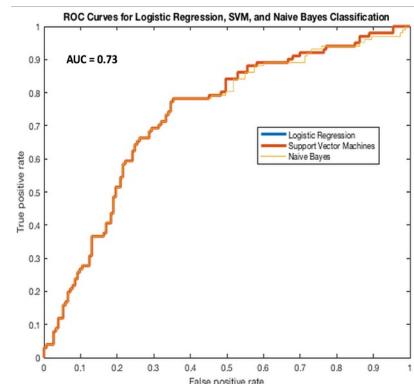
Clinical genomic data



Stratify patients

Anonymization and security procedures

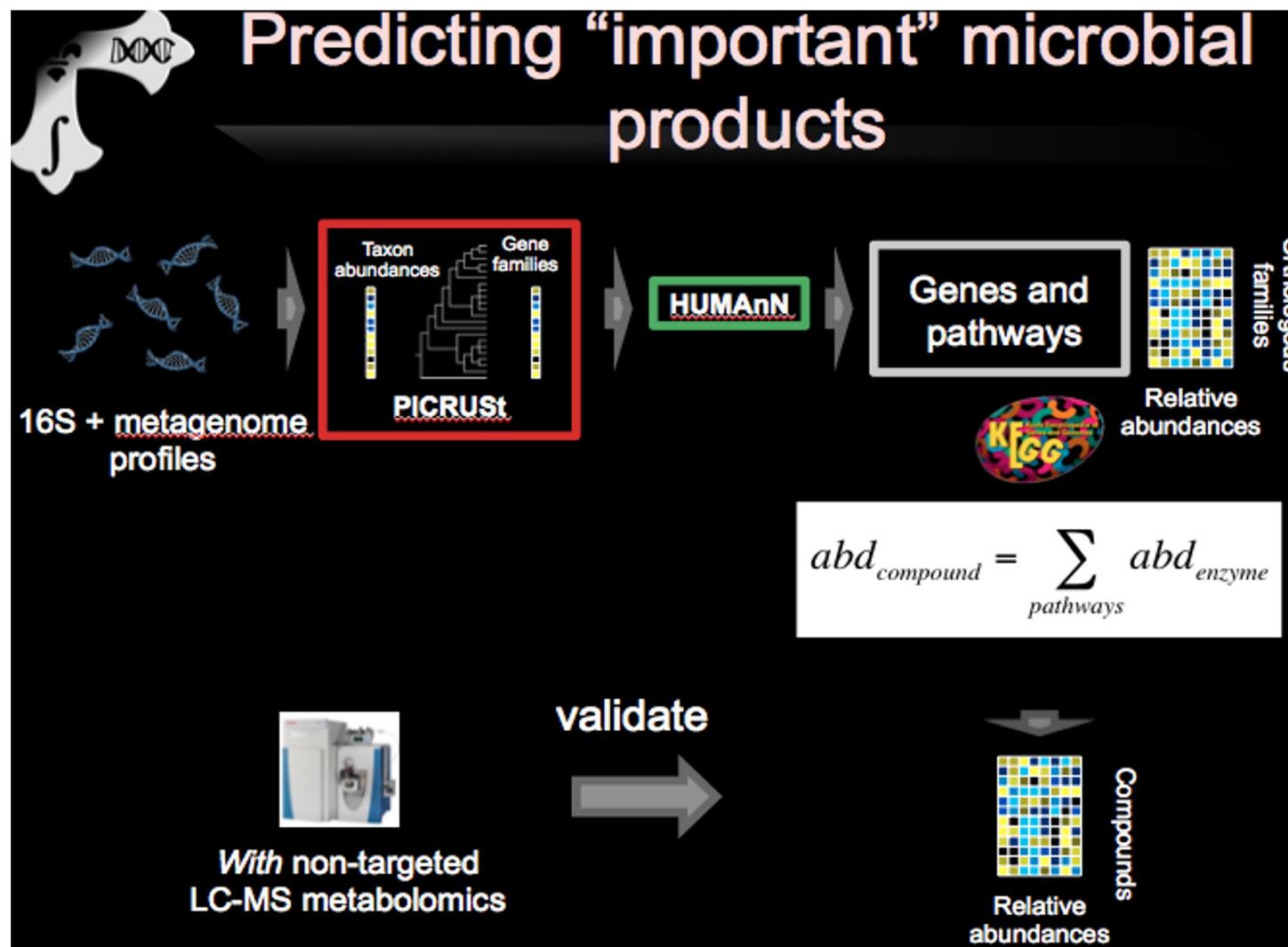
Machine Learning



Clinical metadata

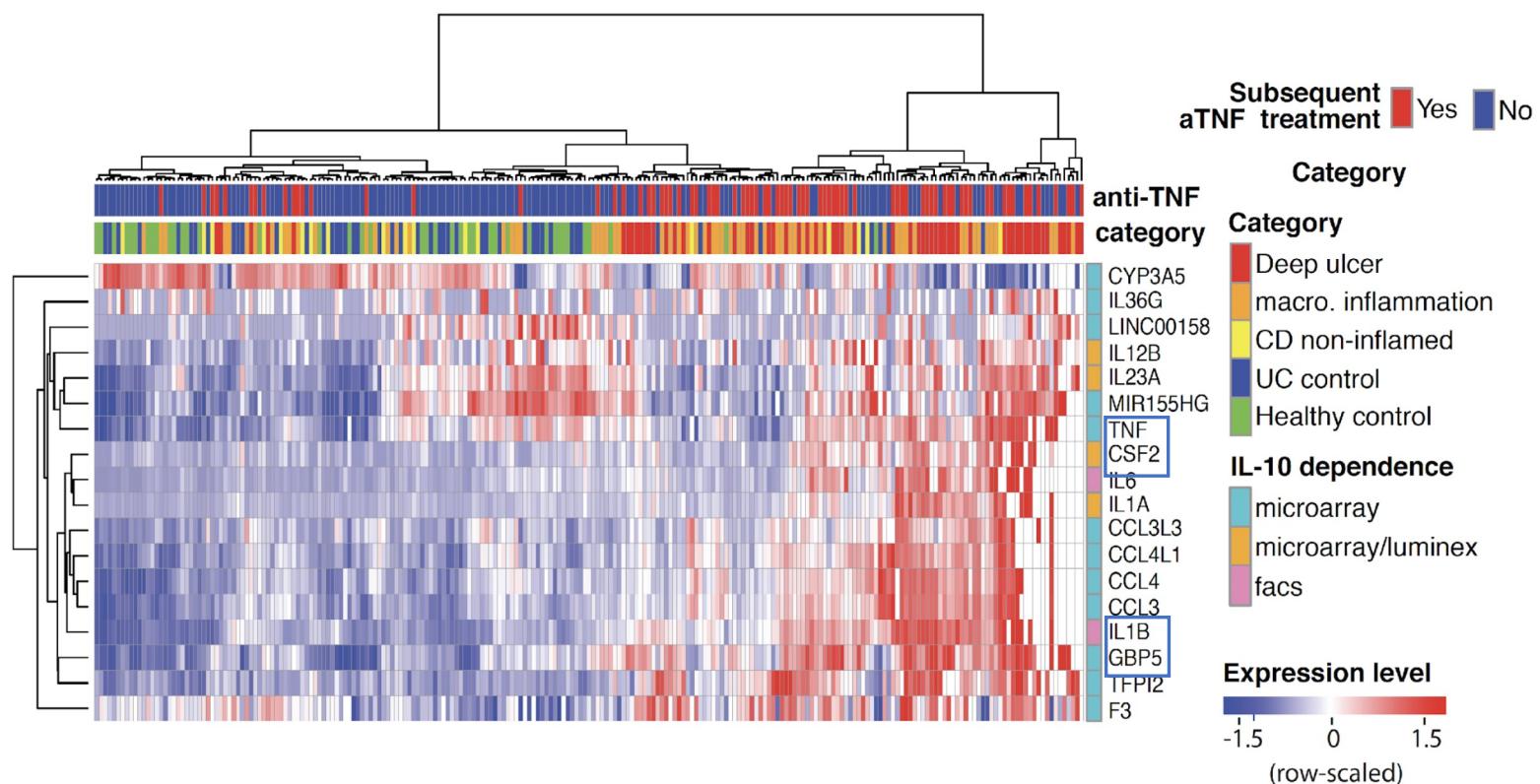


Input from domain experts (clinicians, statisticians, patients)



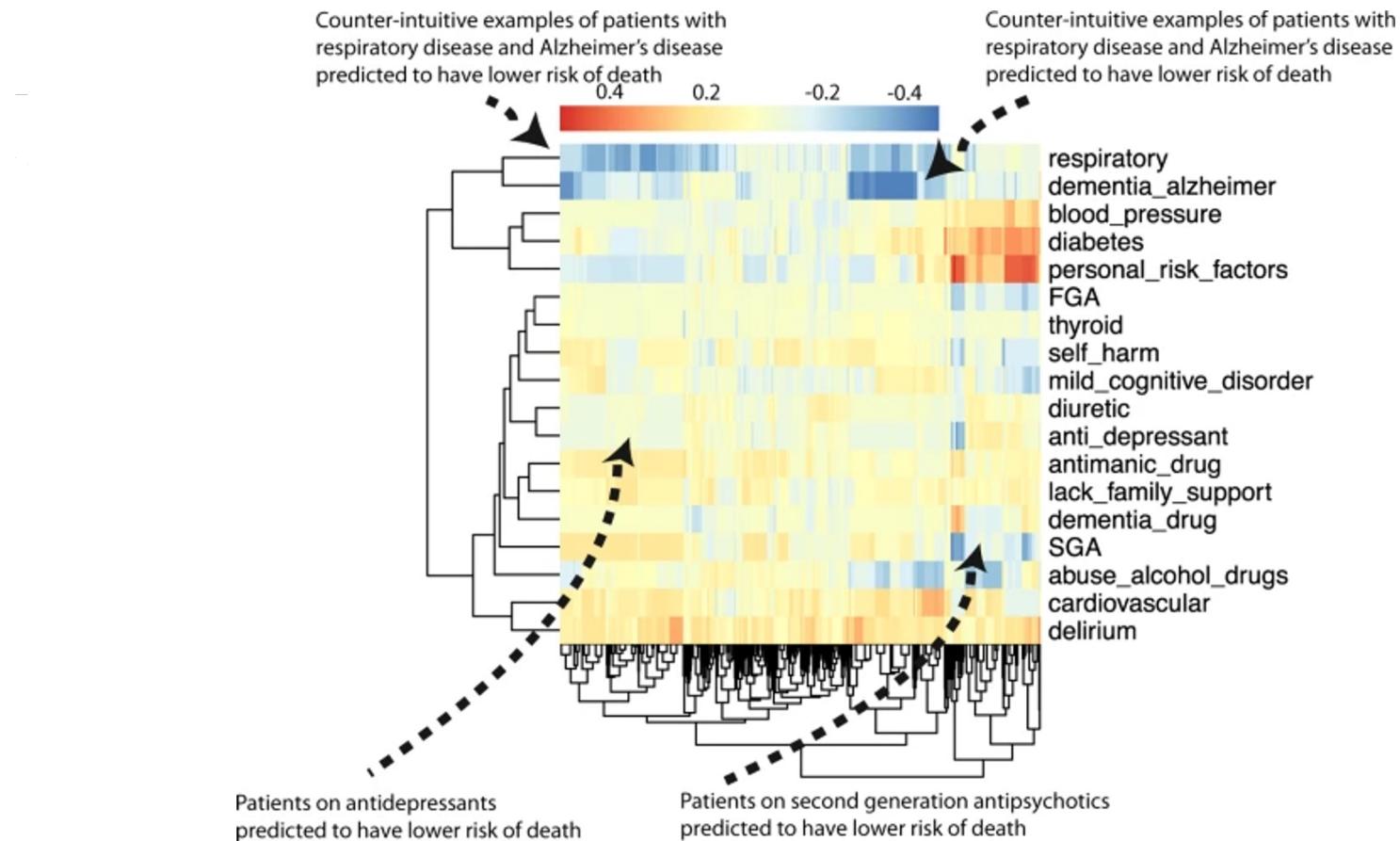
Nature Communications, 2019 (Nature publishing group), Impact factor = 14.9

Using machine learning algorithms to predict disease



Gut, 2020 (British Medical Journal publishing group),
Impact factor = 19

Interpretable machine learning



NPJ Schizophrenia, 2021 (Nature Partner Journal), Impact factor 6.6

Using machine learning in supply chains

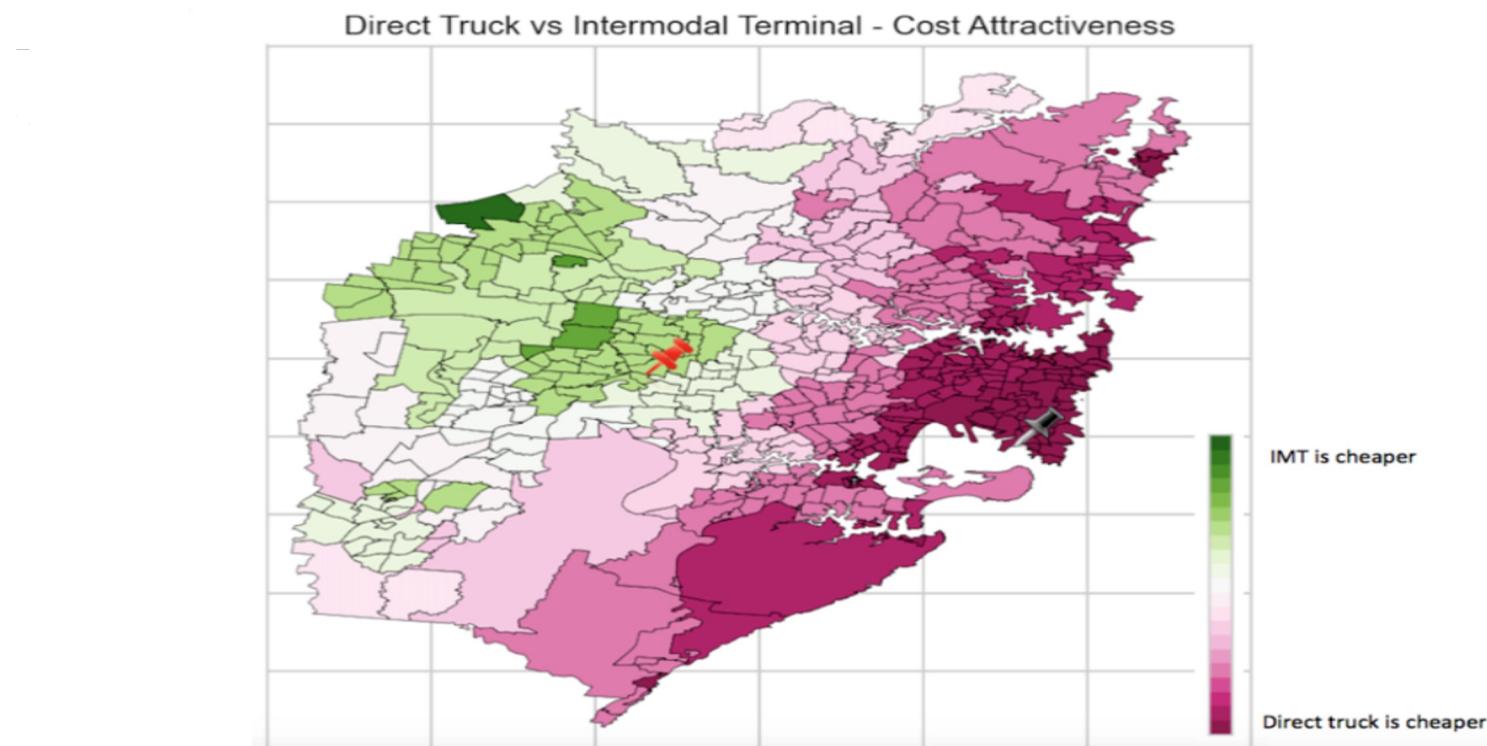


Figure 2. Map of regions coloured by cost difference between using IMT (red pin) vs. direct truck to port Botany (black pin).

Using machine learning in supply chains

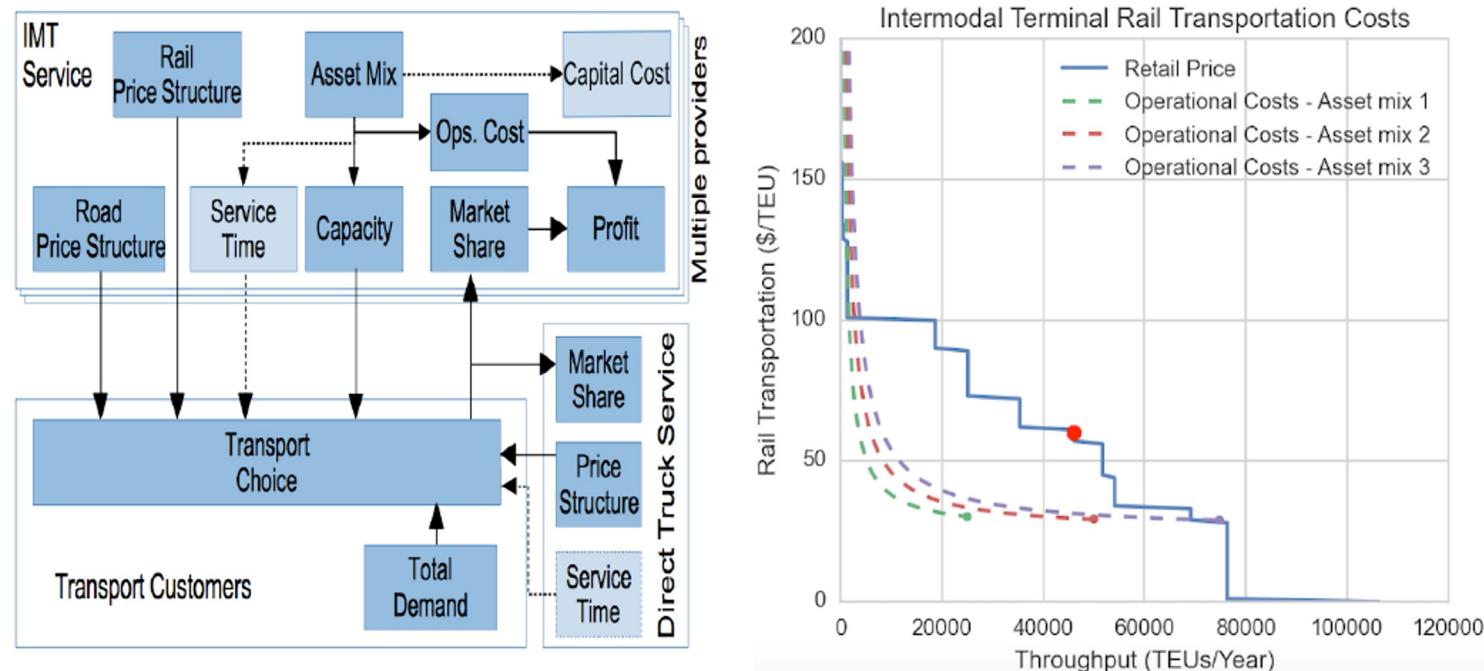
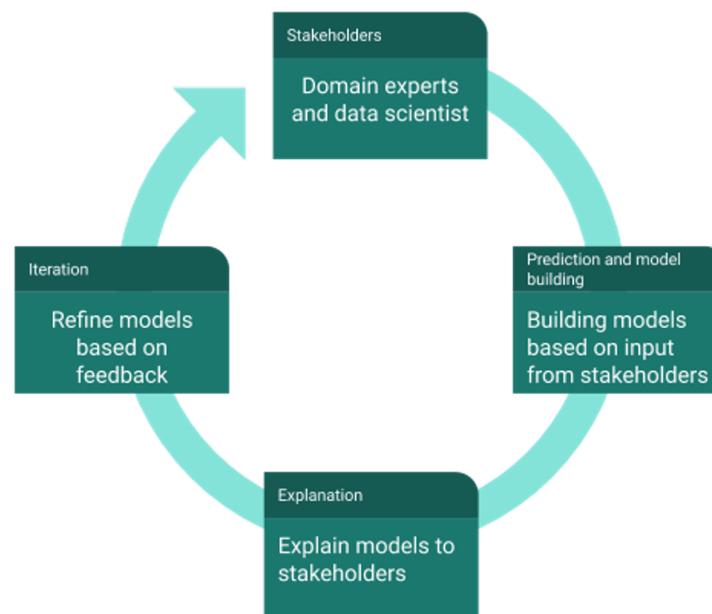


Figure 1. (Left panel) Schematic of the model. (Right panel) Plot of retail rail price (blue) and operational costs incurred by IMTs (dotted lines) vs. container throughput via the IMT. The red dot marks the optimal retail rail price for Asset mix 2 that maximizes the profit of the IMT.

Research and teaching philosophy



Advice

- Power of curiosity
- Collaborate and work in teams
- Focus on basic concepts not buzzwords

Impact of AI on India

1990s IT boom in India



Closing Message

- Work with humans
- AI: Artificial Intelligence
- Not Artificial Insanity or Artificial Stupidity
- Focus on basic concepts



40 centuries
look down
upon you

