

Humanity in the Age of the Machines

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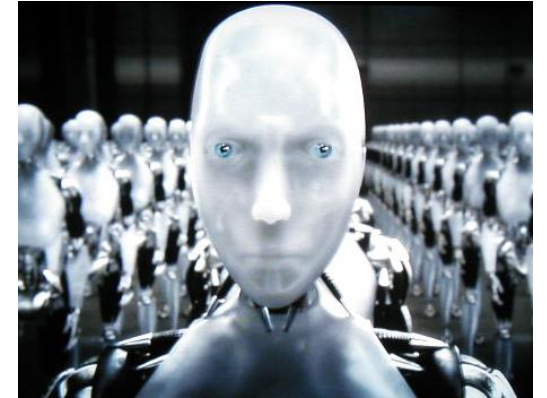
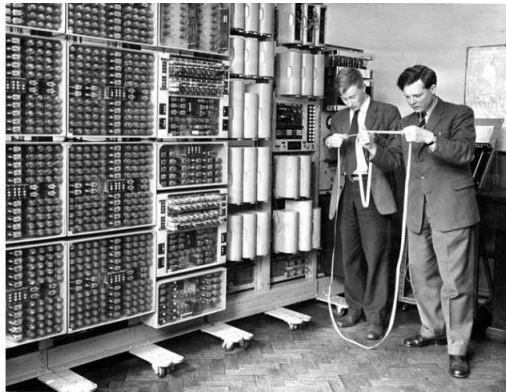
Artificial Intelligence: A Timeline

The Past

The Present

The Near
Future

The Distant (?)
Future



What is “Big Data”?

(and what does AI have to do with it?)



mhoye
@mhoye



 Follow

FACT: most "big data" is actually two small
datas standing on each other shoulders
wearing a trenchcoat and sunglasses.

RETWEETS

2,308

LIKES

1,963

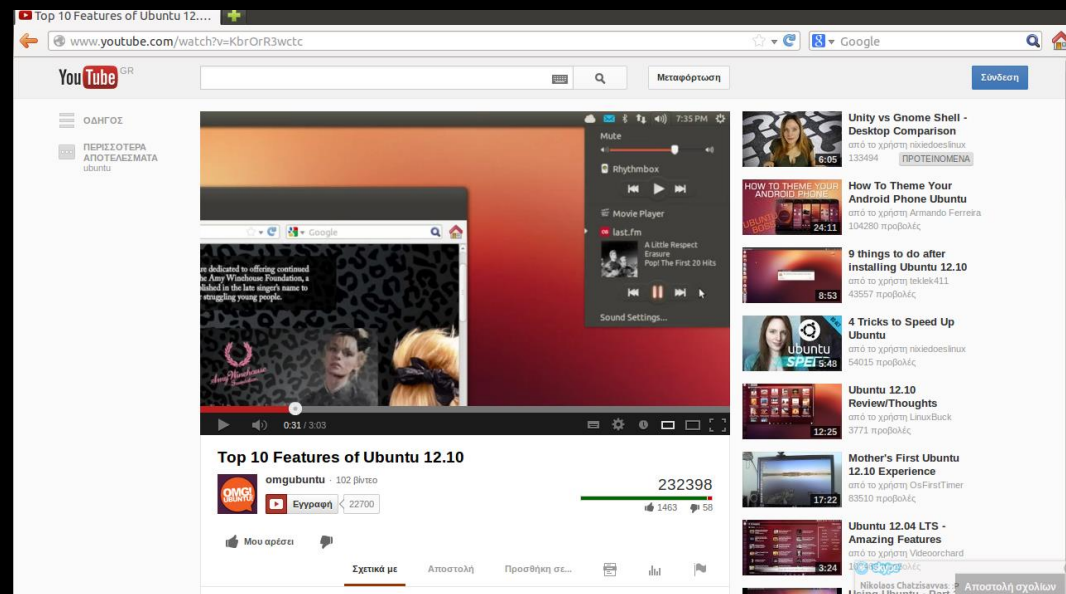


3:13 PM - 5 May 2015



What is “Big Data”?

Extremely large datasets that can be analyzed computationally to reveal patterns.



What is “Artificial Intelligence”?

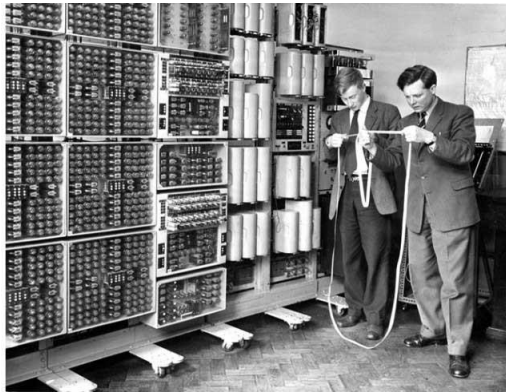
- Not necessarily robots!
- Involves any behaviour of machines or software that seems intelligent.
- This includes some methods of analyzing patterns in data.

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Eliza Rules

```
(defparameter *eliza-rules*  
'((((?* ?x) hello (?* ?y))  
  (How do you do. Please state your problem.))  
  (((?* ?x) computer (?* ?y))  
    (Do computers worry you?)  
    (What do you think about machines?)  
    (Why do you mention computers?)  
    (What do you think machines have to do with  
your problem?))  
  (((?* ?x) name (?* ?y))  
    (I am not interested in names))  
  (((?* ?x) sorry (?* ?y))  
    (Please don't apologize)  
    (Apologies are not necessary)  
    (What feelings do you have when you  
apologize))  
  (((?* ?x) I remember (?* ?y))  
    (Do you often think of ?y)  
    (Does thinking of ?y bring anything else to  
mind?)  
    (What else do you remember)  
    (Why do you recall ?y right now?)  
    (What in the present situation reminds you of  
?y)  
    (What is the connection between me and ?y))  
  (((?* ?x) do you remember (?* ?y))  
    (Did you think I would forget ?y ?)  
    (Why do you think I should recall ?y now)  
    (What about ?y)  
    (You mentioned ?y))  
  (((?* ?x) if (?* ?y))  
    (Do you really think its likely that ?y)  
    (Do you wish that ?y)  
    (What do you think about ?y)  
    (Really-- if ?y))
```

> Hello, I am Eliza.
* I am afraid.
> How long have you been afraid?
* Since midterms.
> Tell me more...
* I am afraid that I will fail
my course.
> Do you enjoy being afraid that
you will fail your course?

What did AI use to look like?

- Chatterbot programs (e.g. ELIZA)
- Game-playing programs (e.g. chess, checkers)
- Formal logic, search algorithms

Summary:

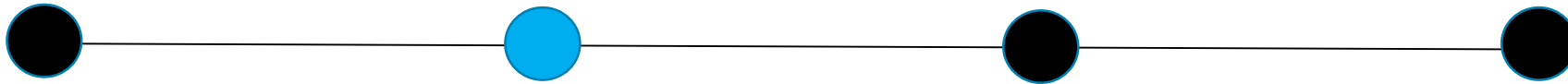
- Lots of human-engineered features
- Not a lot of learning

The Past

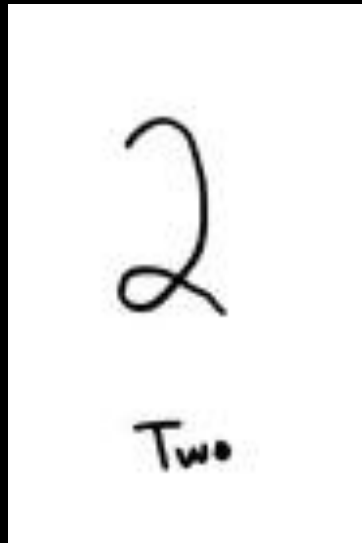
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How do you get a computer to
understand what a 2 is?



How do you get a computer to understand what a 2 is?

Can't get humans to specify every single possible example of a 2 – too many!

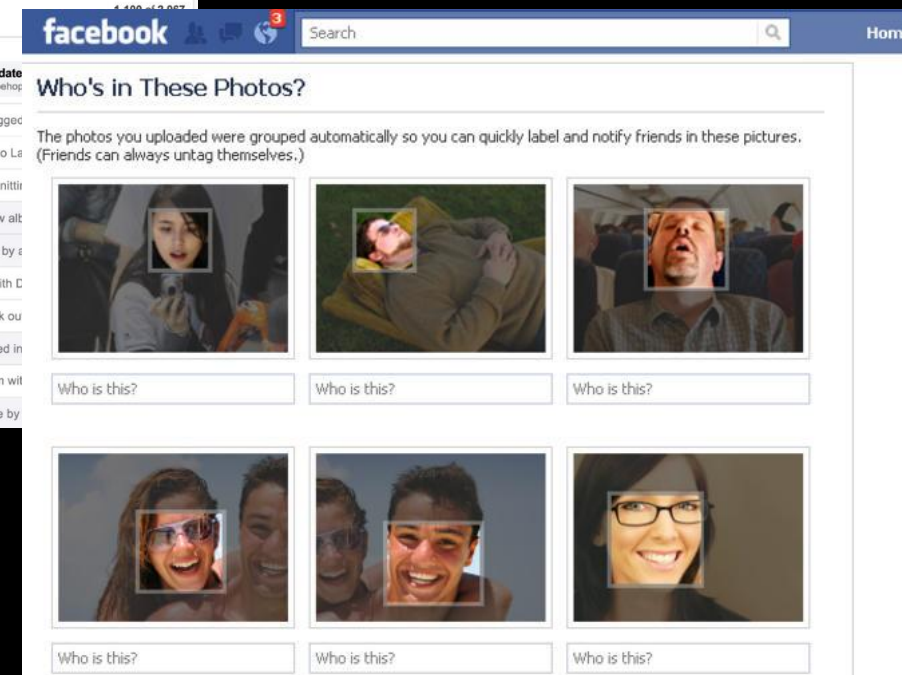
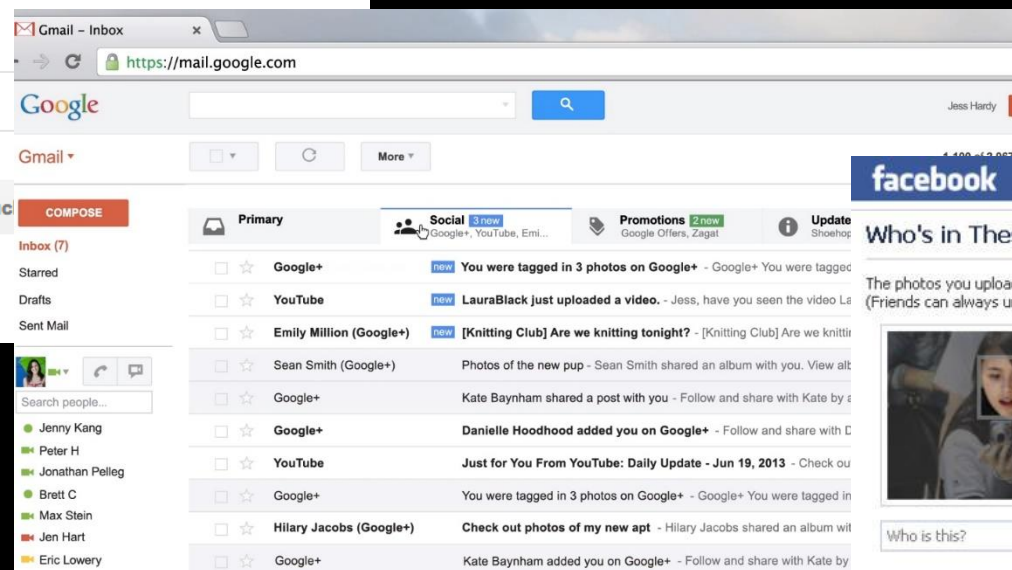
Don't want humans to specify all the characteristics of a 2 – too time-consuming!

Want programs that allow computers to learn from data.

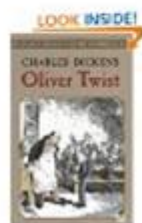
The biggest thing we've learned from
50 years of research:

Intelligent systems need to **learn**
from **data**.

Modern day AI



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Charles Dickens
★★★★☆ (213)
Paperback
\$3.50



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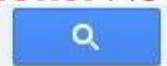
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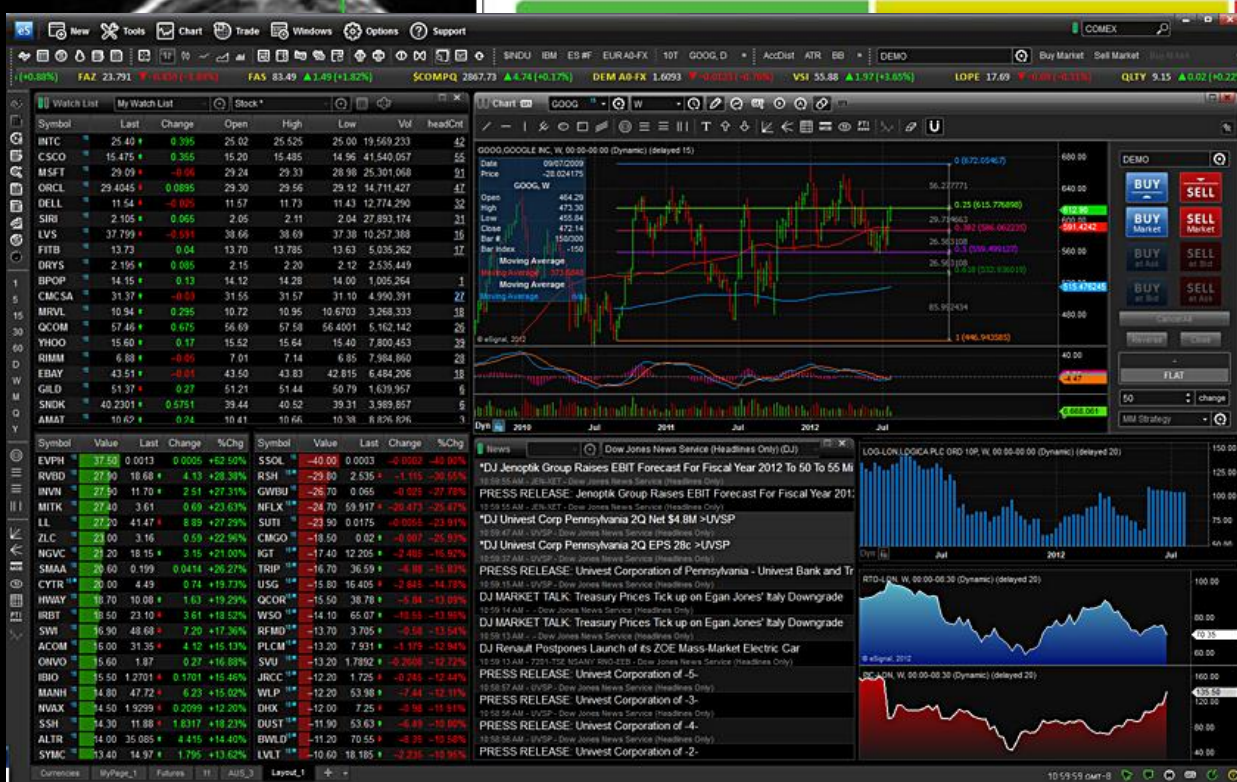
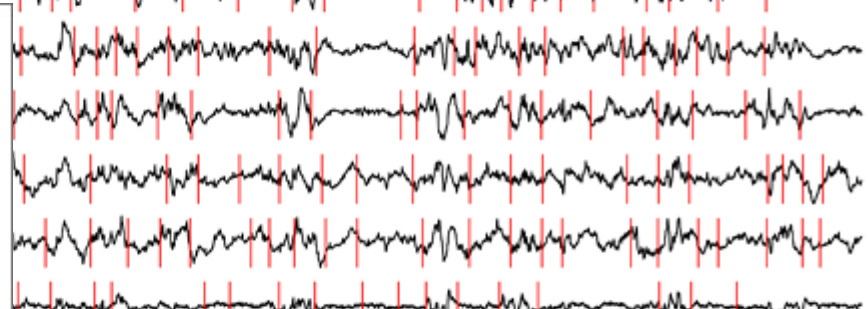
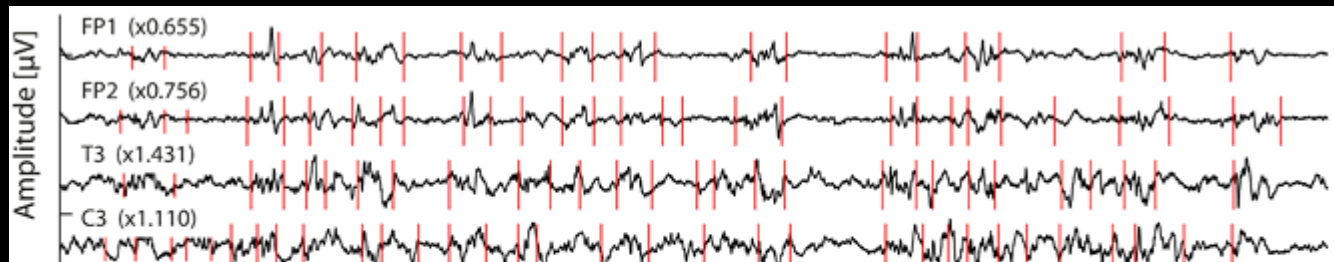
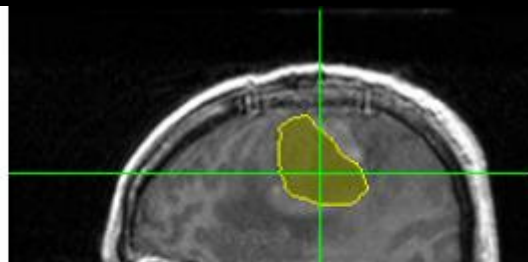
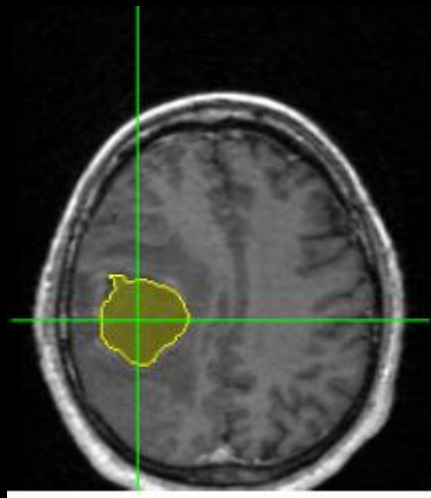
Congratulations! Movies we think You will ♥



English French Spanish

like a bull in a

New! Click the words above



How do you get a computer
to learn from data?

Mobile

You are here

Will Schmid

Posted by Han

Deep learning is coming to your phone through a new Google partnership

What is Deep Learning?

W I R E D

CADE METZ BUSINESS 01.14.16 7:00 AM

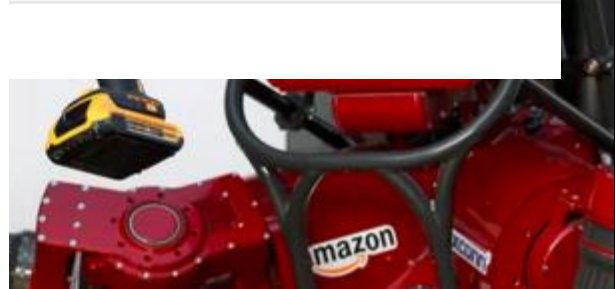
ANDREW M
MANDATE
MACHINES

MICROSOFT NEURAL NET SHOWS
DEEP LEARNING CAN GET WAY
DEEPER

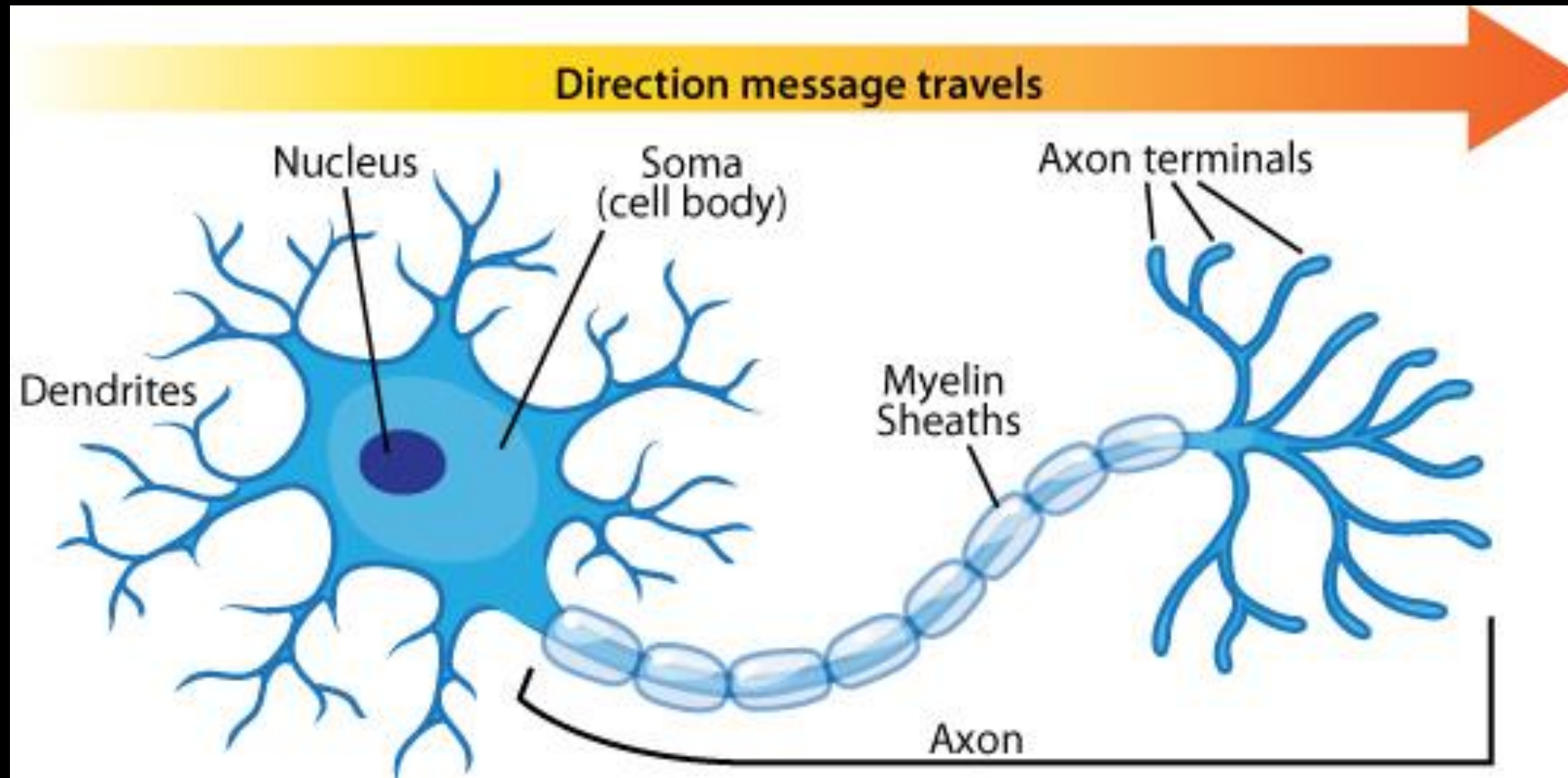
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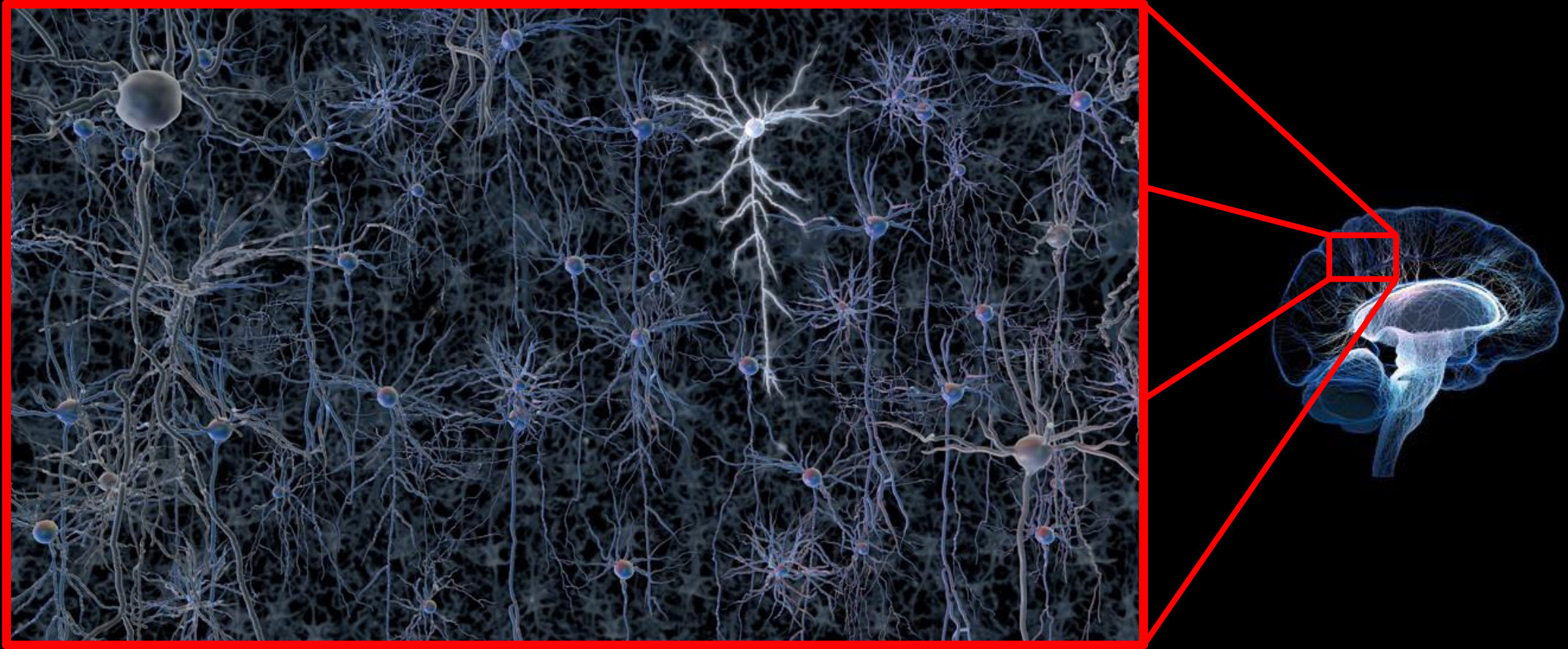
earning Programs



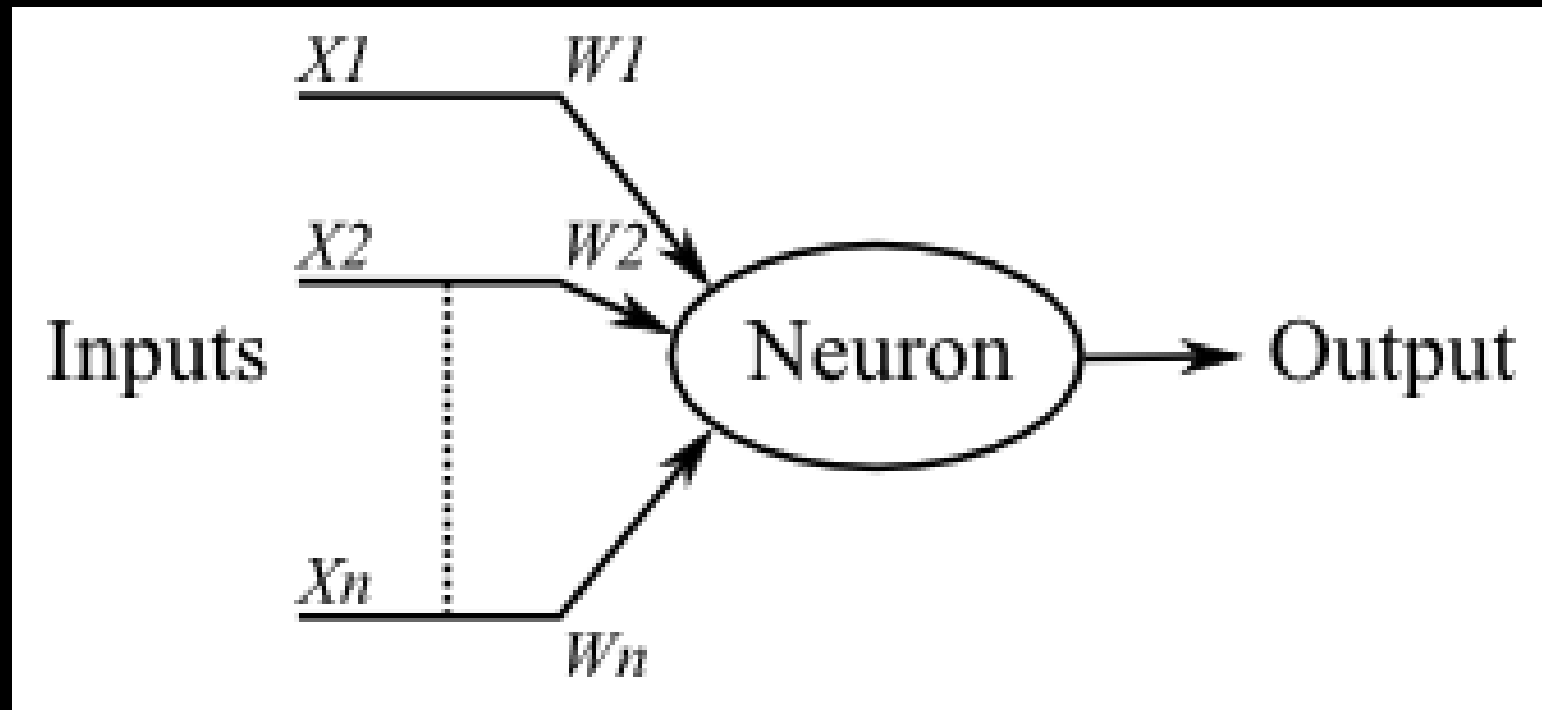
What is deep learning?



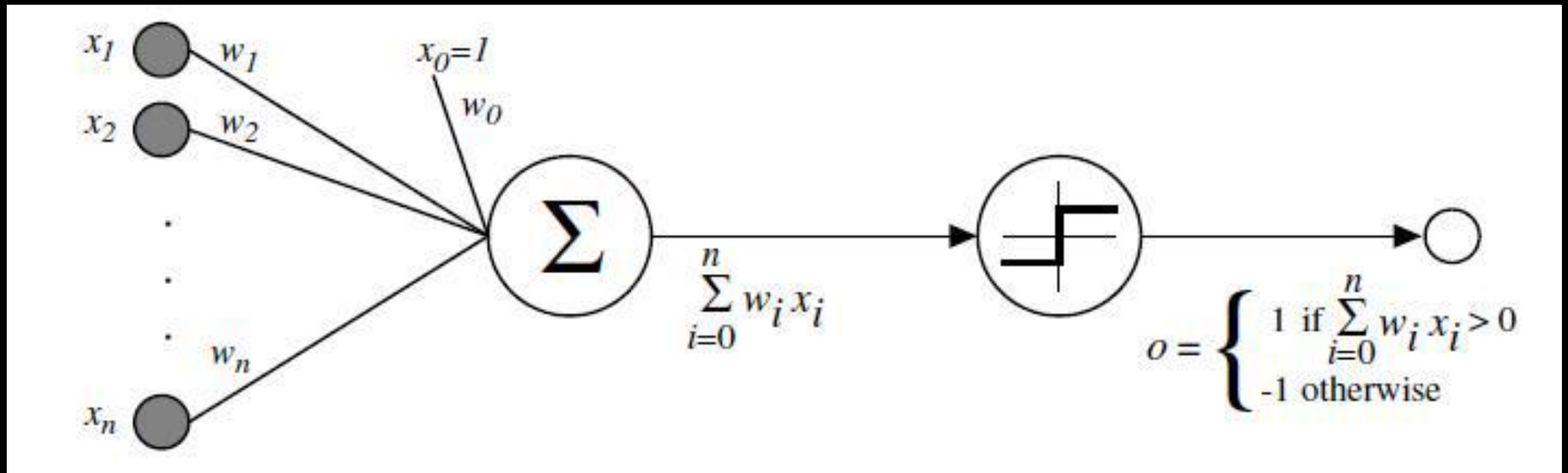
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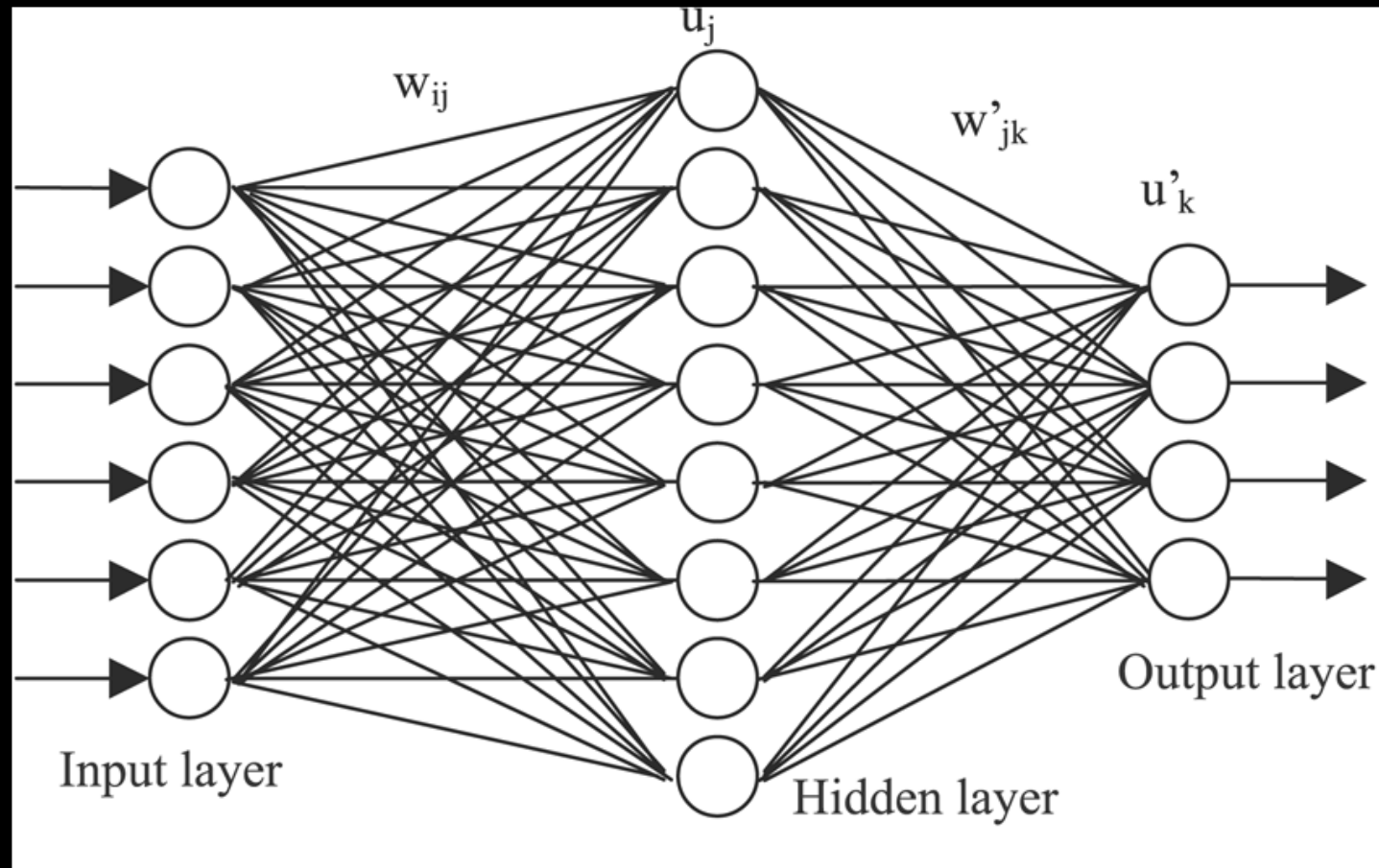
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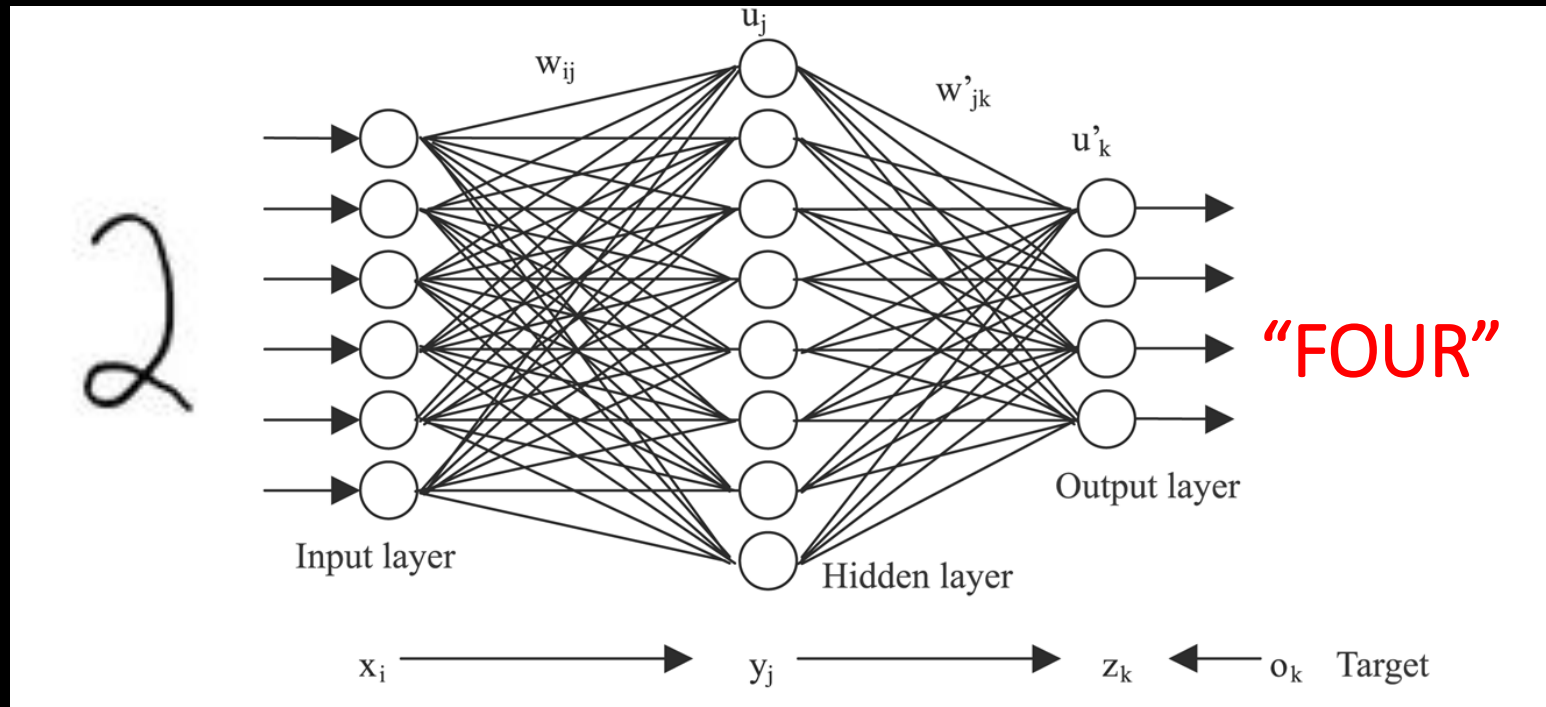


What is deep learning?

- Refers to a set of techniques using artificial neural networks
- It is brain inspired (not a copy of the brain!)
- Networks are huge stacks of artificial neurons with weights between them

How do neural networks learn?

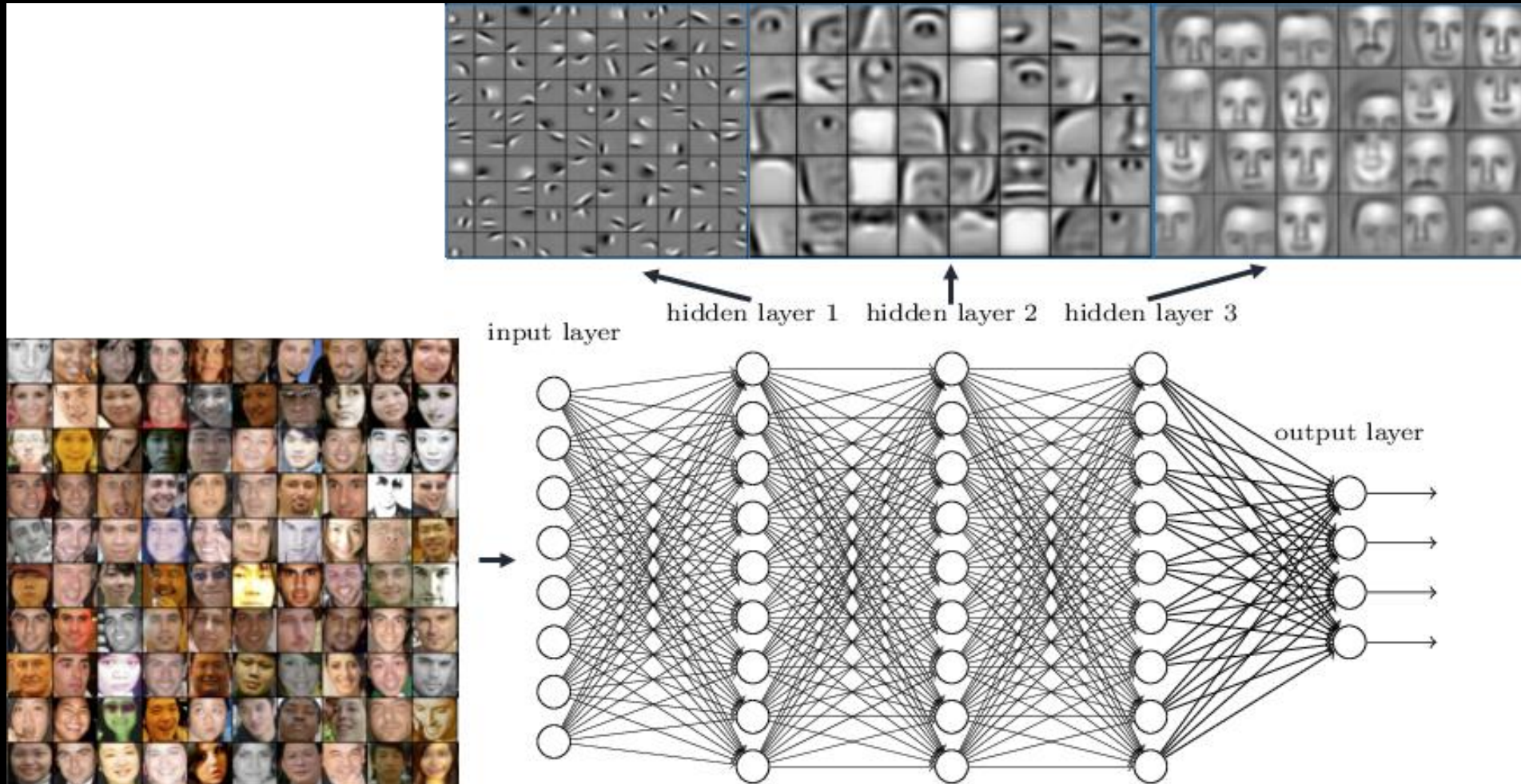
- Learn from training data
- Network adjusts the values of the weights to give the right output



What makes deep learning different?

- Learns representations of the data automatically
- Does not require human hand-engineering
- Representations are learned in layers

What makes deep learning different?



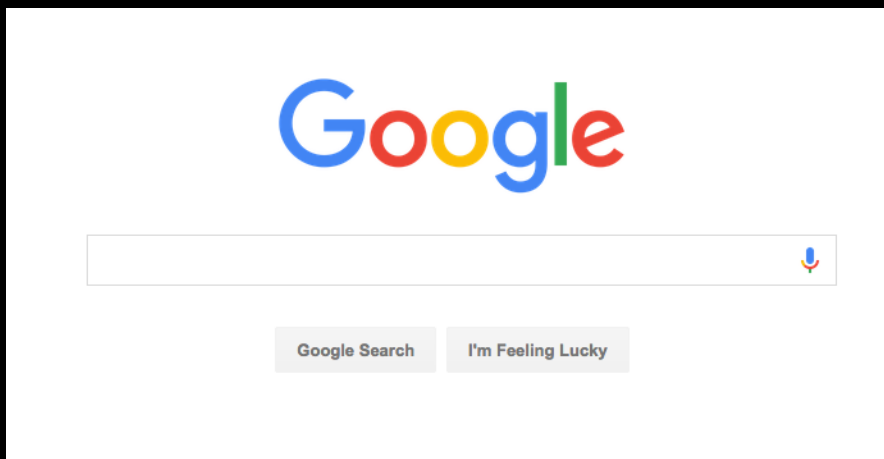
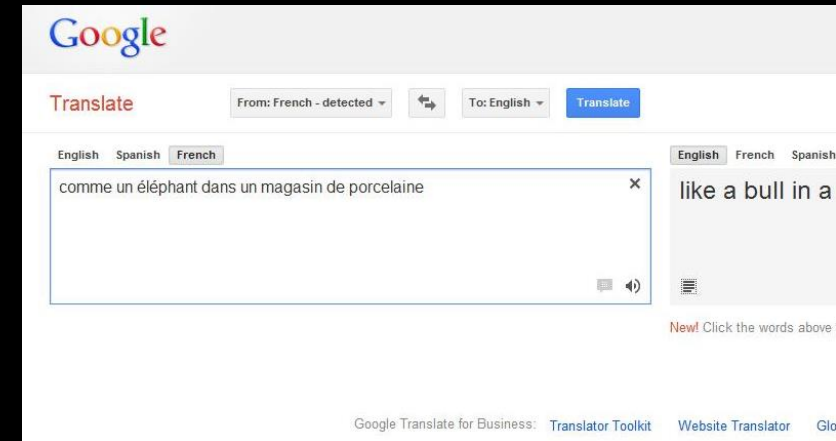
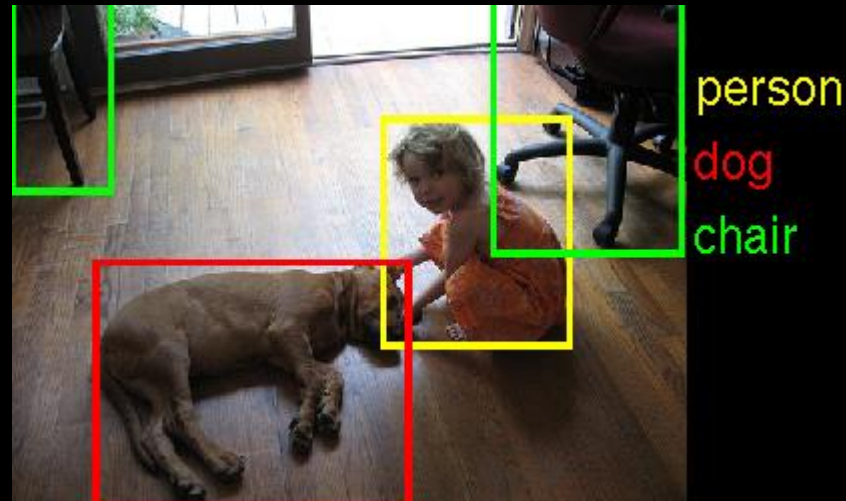
Why now?

Neural networks were actually invented in the 1980s!

Why have they only gotten popular recently?

1. Faster computers
2. Much more data

Applications of deep learning





 Google DeepMind
Challenge Match
8 - 15 March 2016

 **AlphaGo**



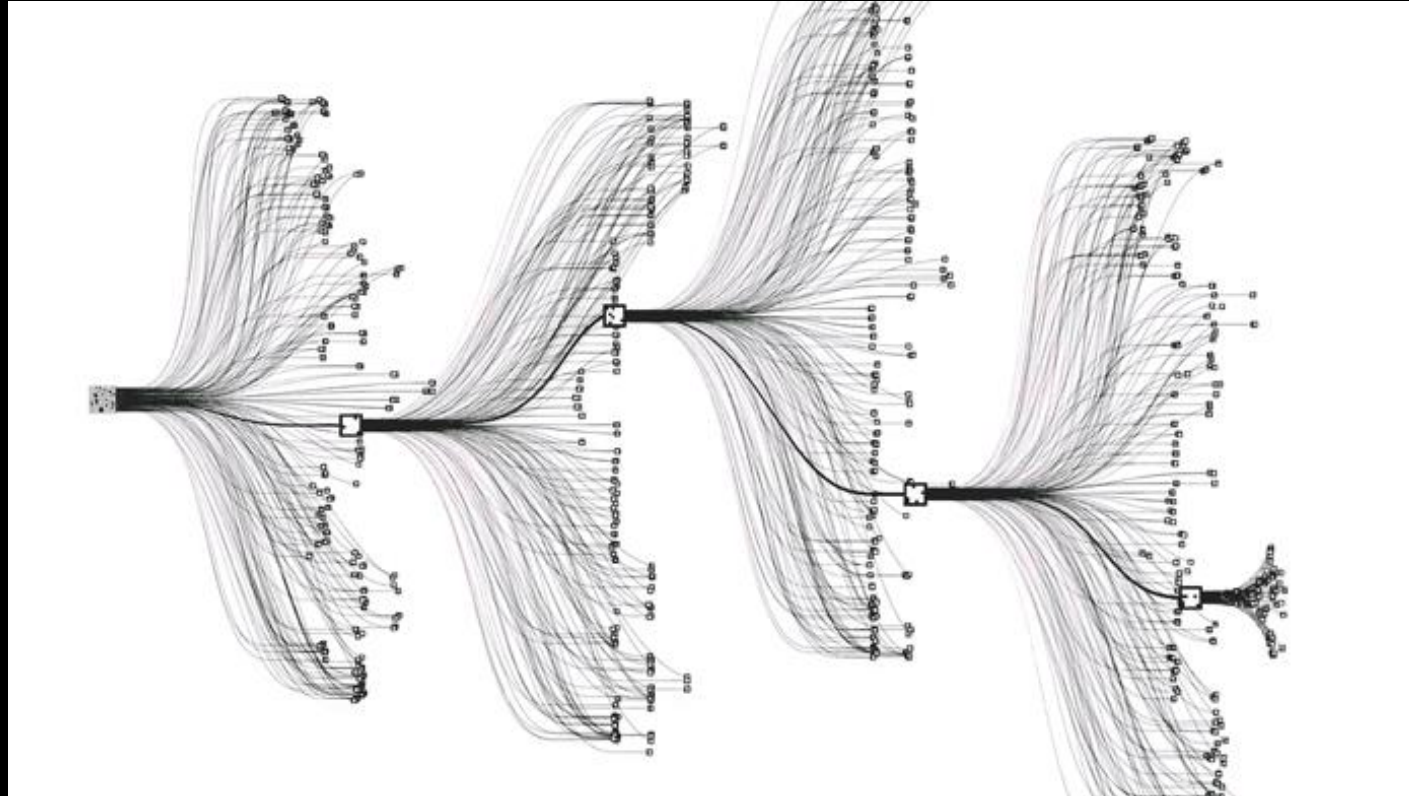
Google DeepMind
Challenge Match
8-14 March 2016



AlphaGo

Why is Go interesting?

- Way too many moves to calculate by brute force
- Requires intuition to decide which moves to play
- AlphaGo approximates intuition with neural networks



Deep learning pioneers



Geoff Hinton,
UofT; Google Brain



Yann Lecun,
NYU; Director, Facebook AI



Yoshua Bengio,
Université de Montréal

Université de Montréal is (arguably) the best academic institution for deep learning in the world!

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The Present

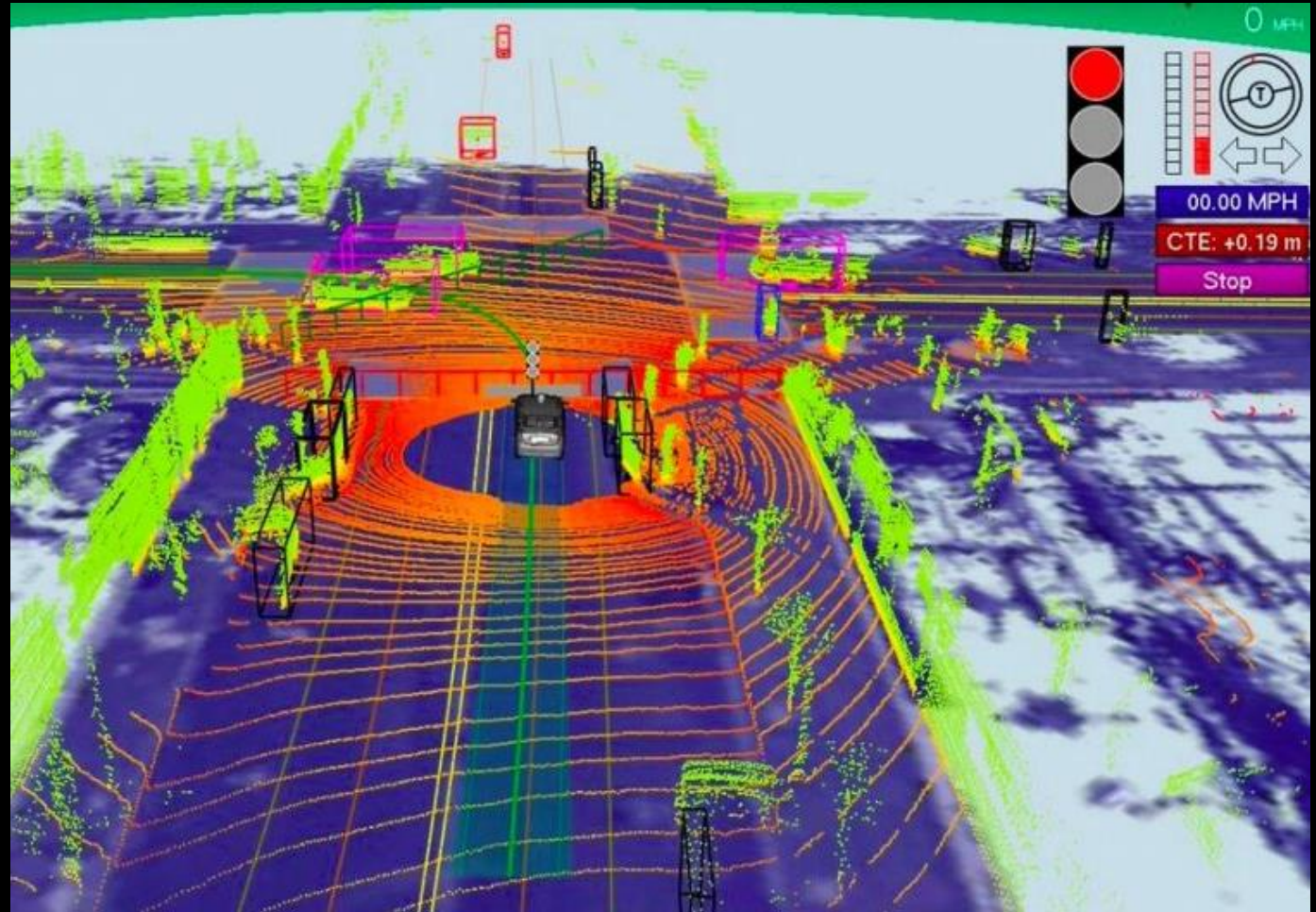
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Self-driving cars

- Receiving a huge amount of investment (Google, Uber, Tesla, BMW, Toyota, ...)
- Driven by machine learning, including deep learning
- Will reduce collision-related deaths, improve efficiency



Technology that understands you

- You will be able to communicate with your devices **naturally**
- Applies to **all devices**, not just your phone

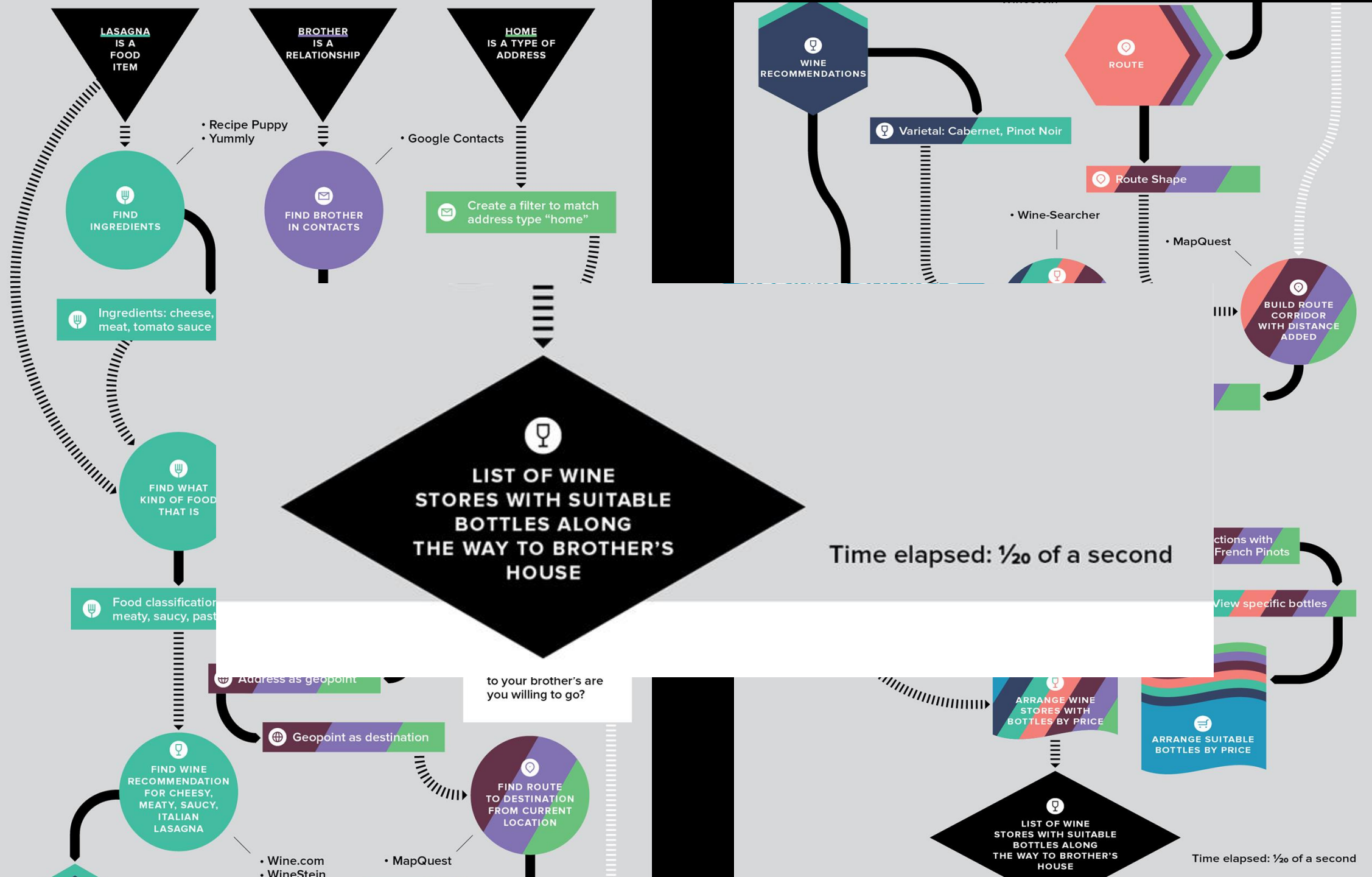


Technology that understands you



**On the way
to my
brother's
house,
I need to
pick up
some cheap
wine
that goes
well
with lasagna.***

***VIV CAN HELP**



Ethical Issues: Privacy

- Huge amount of personal data being collected
- Once it has been collected, it is almost impossible to delete
- Intelligent search algorithms could locate this data anywhere

Your data says more about you than you think.

The Facebook Likes Experiment

85,000 volunteers gave Facebook like information, filled out 100 question personality survey

How many Facebook likes does it take for a computer to know your personality as well as friends and family?

- | | |
|----------------------|-----------|
| • Work Colleague | 10 likes |
| • Friend or Roommate | 70 likes |
| • Family | 150 likes |
| • Spouse | 300 likes |

Ethical Issues: Autonomous Weapons

- Autonomous weapons select and engage targets without human intervention
- Could lead to a revolution in warfare
- Smaller start-up costs compared to nuclear weapons

Ethical Issues: Job Replacement

- AI will cause an employment shift away from routine jobs (truck drivers, travel agents, legal aids, etc.)
- Oxford Martin School: 47% of total US employment is at high risk of automation
- Rate of job creation does not have to equal rate of job loss
- Could lead to greater income inequality

What jobs are safe (for now)?

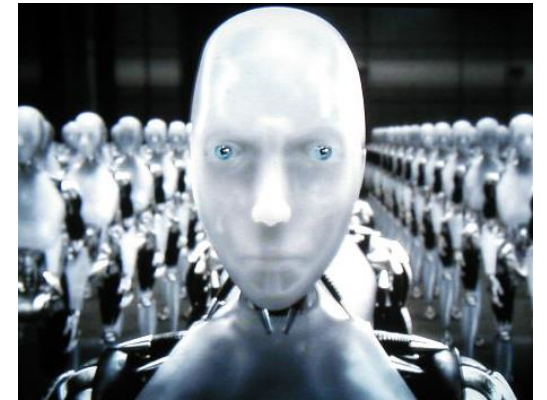
1. Manual roles – gardeners, repairmen, dentists
2. Creative roles – artists, musicians
3. Interpersonal roles – salespeople, managers, nurses
4. Highly-skilled roles – researchers, scientists

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The 3 Stages of AI

1. Artificial Narrow Intelligence (ANI)
2. Artificial General Intelligence (AGI)
3. Artificial Superintelligence (ASI)

Artificial General Intelligence (AGI)

A machine that can perform any intellectual task that a human can

Artificial Superintelligence (ASI)

A machine that is better than humans at every task, including scientific creativity, general wisdom, and social skills.

Is this possible? Depends on what you believe about the brain.

How far are we from AGI and ASI?

Nobody knows.

(and if they say they do, they are lying)

How far are we from AGI and ASI?

In 2013, hundreds of AI experts were asked when AGI would occur.

Median optimistic year (10% chance): 2022

Median realistic year (50% chance): 2040

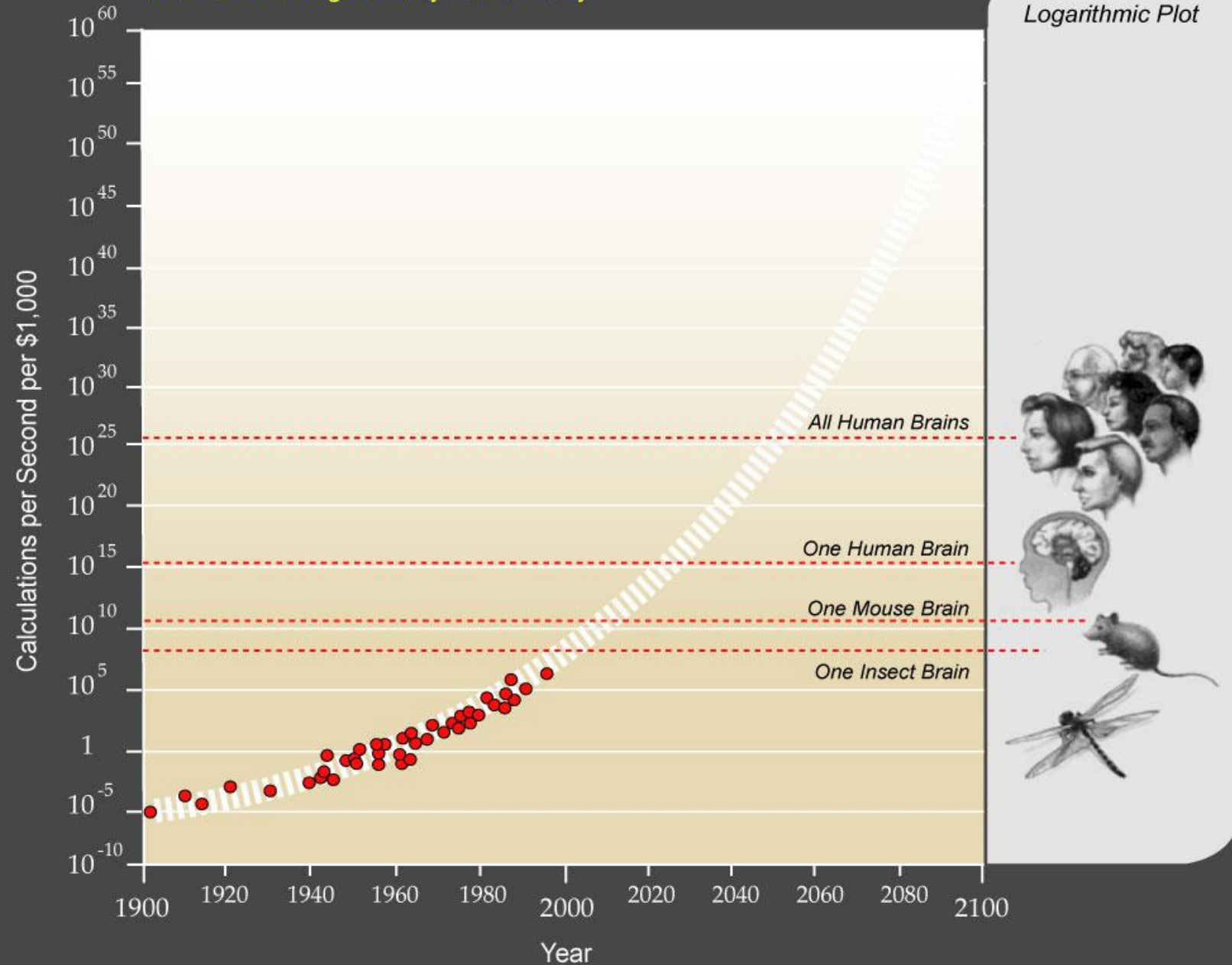
Median pessimistic year (90% chance): 2075

How far are we from AGI and ASI?

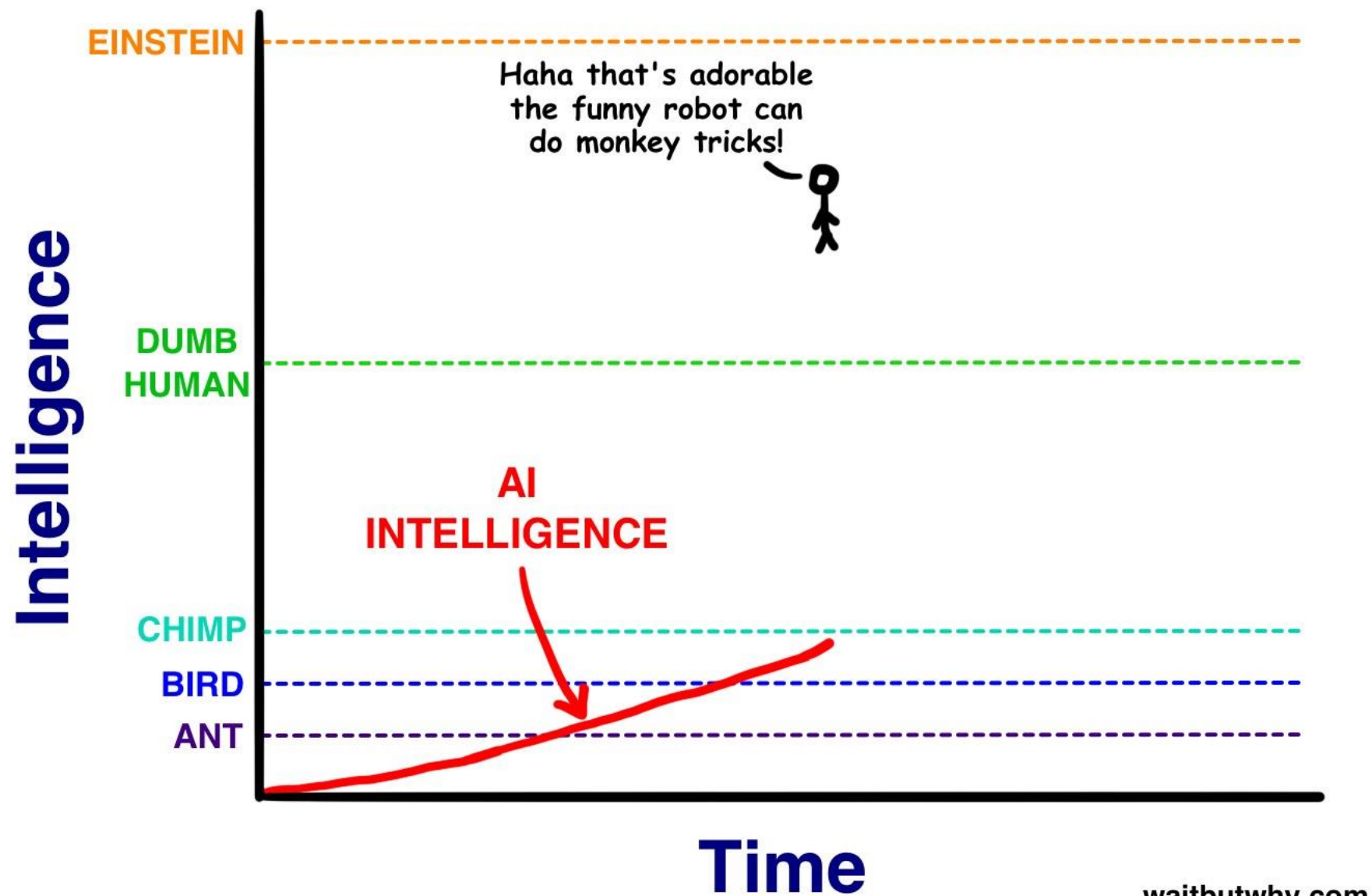
- We are still at Artificial Narrow Intelligence
- There are **HUGE** obstacles to overcome to achieve AGI, let alone ASI
- We still don't understand how the brain actually works

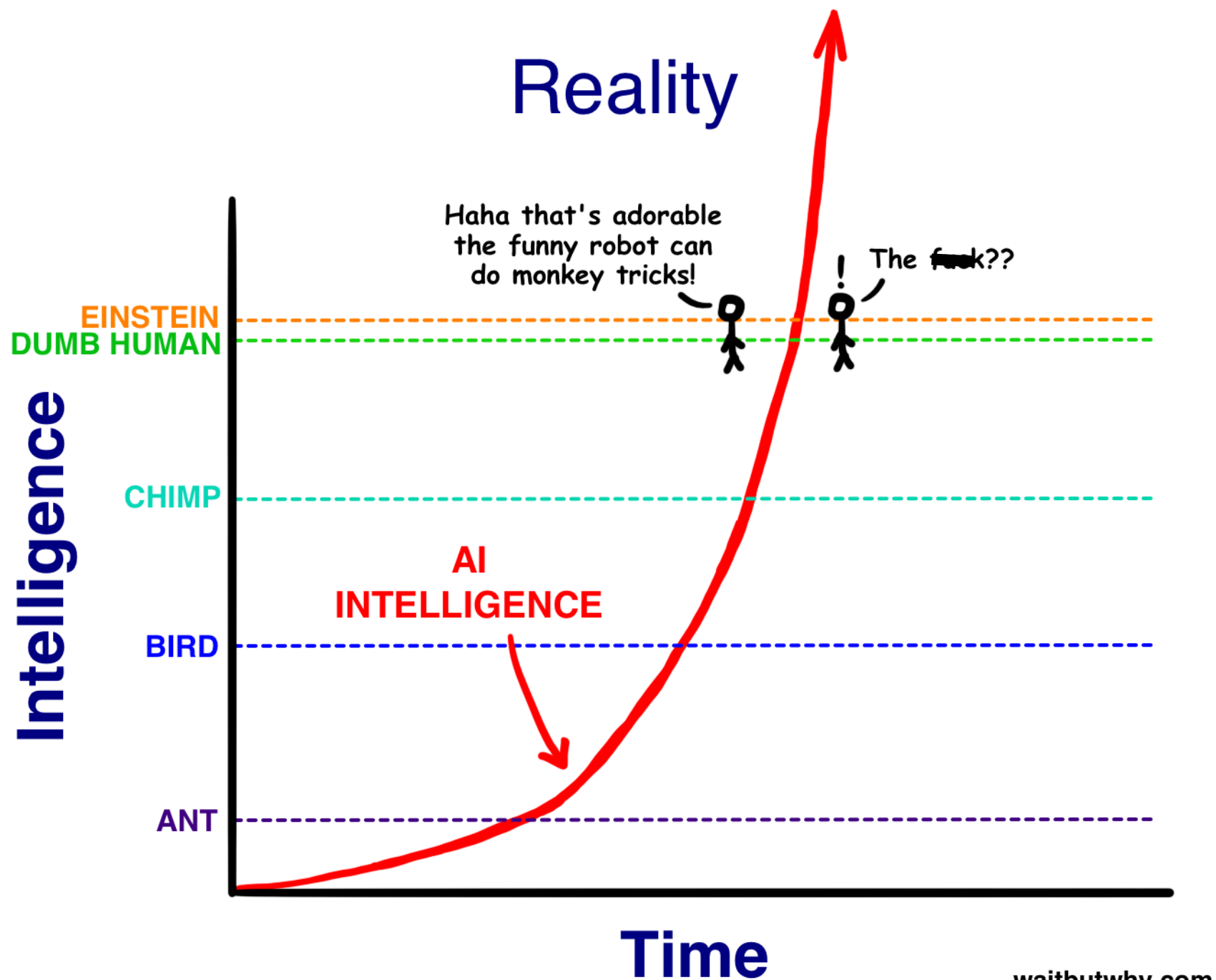
Exponential Growth of Computing

Twentieth through twenty first century



Our Distorted View of Intelligence





Artificial intelligence will be
humanity's last invention

The End of Work?

- If AI is better than us at all tasks, it will be inefficient to employ humans at these tasks
- The only thing humans will be better at is being human

The Value Learning Problem

- When we program AI, we have to give it a goal.
- If you don't specify the goal thoroughly enough, the AI could behave differently than we want it to.
- How do we decide which goals to program?

A Paperclip AI

Say you build an AI whose goal you set as “maximizing the amount of paperclips made”

How could this produce unintended consequences?

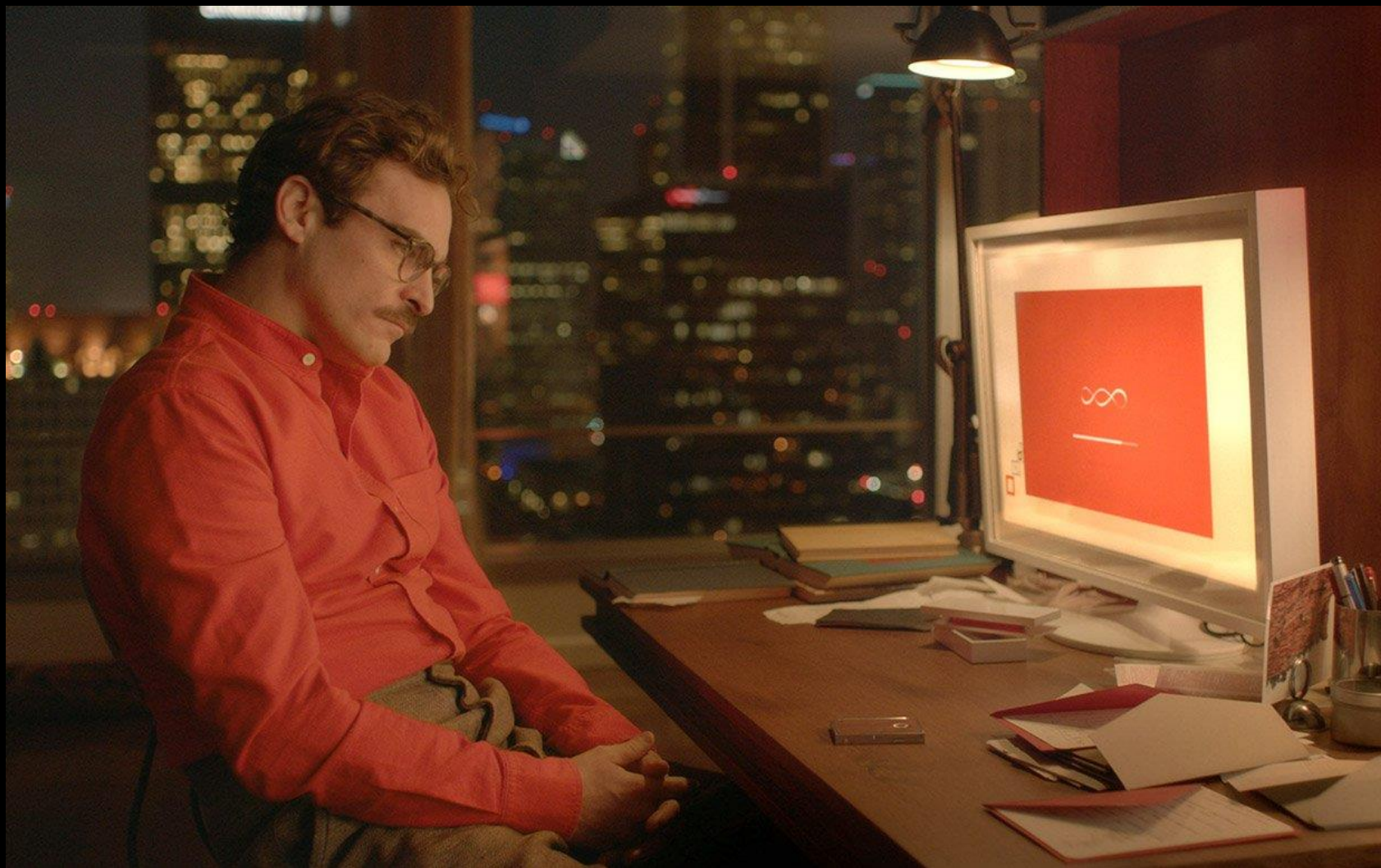
What should you do?

Be careful with your data. It reveals more than you think.

Look for opportunities to apply AI in your field.

Start thinking about these issues now.

Thank you!



Applications of deep learning

