Artificial Intelligence

Introduction

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WHAT IS AI?

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Merriam-Webster SINCE 1828

artificial intelligence

DICTIONARY | THESAURUS

artificial intelligence noun

Definition of *artificial intelligence*

1 : a branch of computer science dealing with the simulation of intelligent behavior in computers

2 : the capability of a machine to imitate intelligent human behavior

McArthy: "the science and engineering of making intelligent machines."

It is related to the similar task of using computers to understand

DARMOUTH COLLEGE, 1956

Two approaches:

- Computational Models of Human <u>Behaviour</u> (external)
- Computational Models of Human <u>Thought</u> (internal)

Note that "human" is understood to be equivalent to "intelligent"

Artificial Intelligence
人工智能

Rén 人 = man

Gōng 工 = work

Zhì 智 = knowledge

Néng 能 = ability

Réngōngzhìnéng

"ability to have knowledge in something created by humans"

MODELS

AI ≠ ML ≠ DL…

- AI is more general that *Machine Learning* or *Deep Learning*).
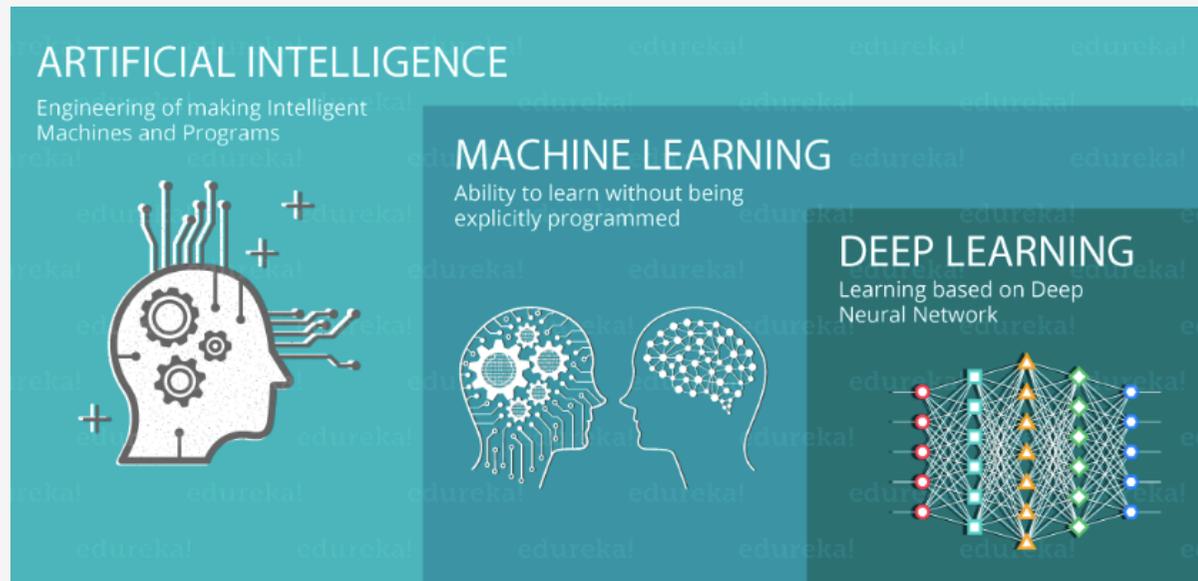
- During decades, AI has foccussed on simbolic learning but nowadays the imperant paradigm is *sub-symbolic*.

"Primitive" AI : Expert Systems

- Rules (*IF…THEN*):
    - <u>IF</u> it rains <u>THEN</u> there will be a traffic jam
    - <u>IF</u> there is a traffic jam <u>THEN</u> I will be late
    - <u>IF</u> I am late <u>THEN</u> I will lose my job

Facts: *It rains*

+

Inference engine

=

Consequences: *I will lose my job*

"Intermediate" AI: Fuzzy Logic

Traditional Logic: {0,1}

vs.

Fuzzy Logic: [0,1]
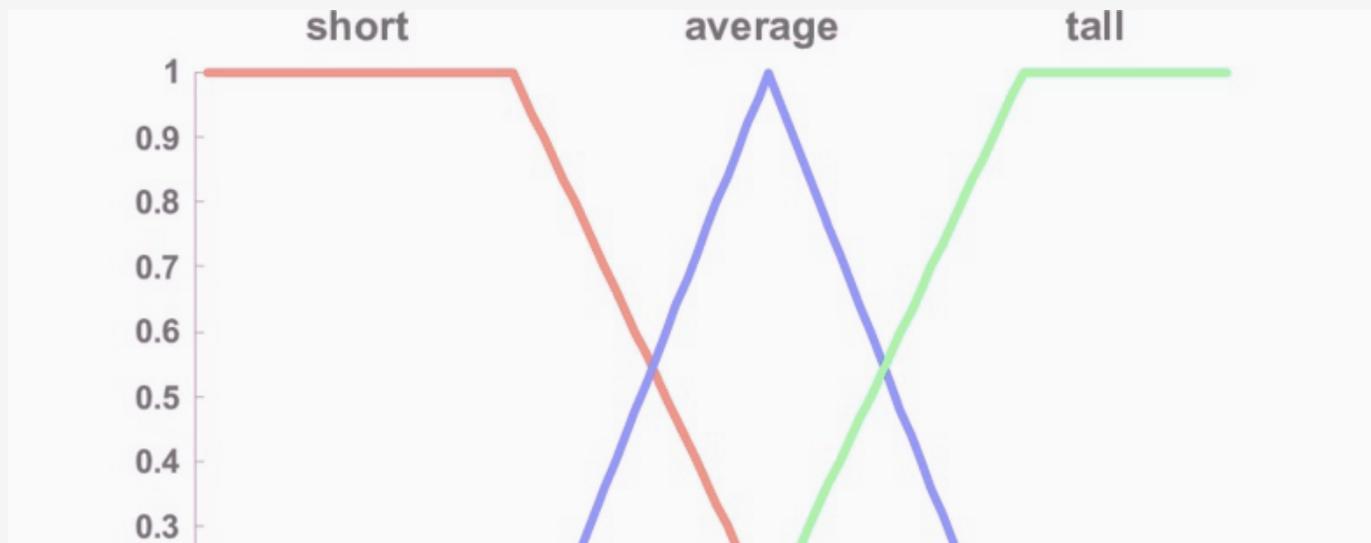
"Modern" AI

Classification and Regression Trees, k-Nearest Neighbours, K-means, K-prototypes, LVQ, MARS, Grammars, Ontologies, Case Based Reasoning, Cellular Automata, Swarm Models, Reinforced Learning, Hidden Markov Models, Bayesian Networks….

Prominently:

Genetic Algorithms

Deep Learning

WHY AI IS "TRENDY"

1. It works!

Inglés ▾

Introducir texto

Abrir en el Traductor de Google

THINK

$300,000 $1,000,000 $200,000

Traductor de Google
https://translate.google.com/?hl=es ▾
El servicio gratuito de **Google** traduce instantáneamente palabras, frases y páginas
más de 100 idiomas y viceversa.

DARPA DEFENSE ADVANCED
RESEARCH PROJECTS AGENCY   ABOUT US / OUR RESEARCH / NEWS
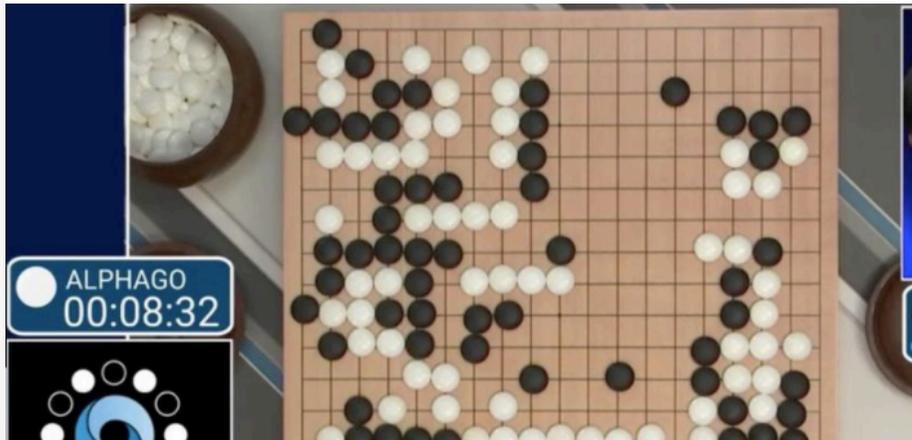
Defense Advanced Research Projects Agency > News And Events

DARPA Announces $2 Billion Campaign to
Develop Next Wave of AI Technologies

*DARPA's multi-year strategy seeks contextual reasoning in AI systems to create more trusting,
collaborative partnerships between humans and machines*

OUTREACH@DARPA.MIL
9/7/2018

ALPHAGO
00:08:32

- Not only in games,: for example, in 1998 LawGeex pitted 20 experienced attorneys against a three-year-old algorithm trained to evaluate contracts.

- The contacts were Non Disclosure Agreements and the humans/machine had to identify 30 legal terms and issues.
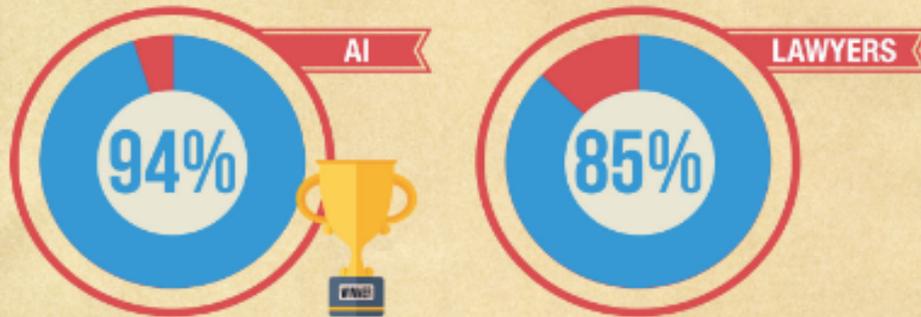
Experienced US lawyers took on Artificial Intelligence
in spotting risks in a daily legal task —
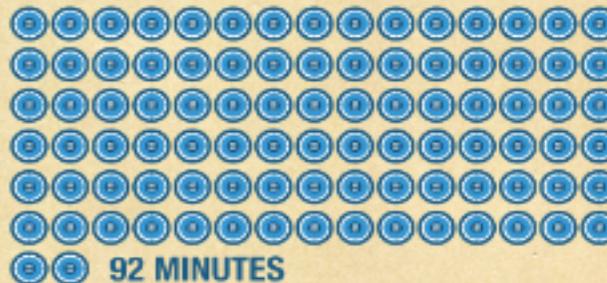reviewing and approving everyday contracts.

✅ ACCURACY LEVEL

AI 94%

LAWYERS 85%

The AI achieved an accuracy level of 94%, compared
to an average accuracy level of 85% across 20 human lawyers.

🕐 TIME TAKEN

92 MINUTES

AI 26 SEC

2. Data Availability

(billions)

28.1

25.2

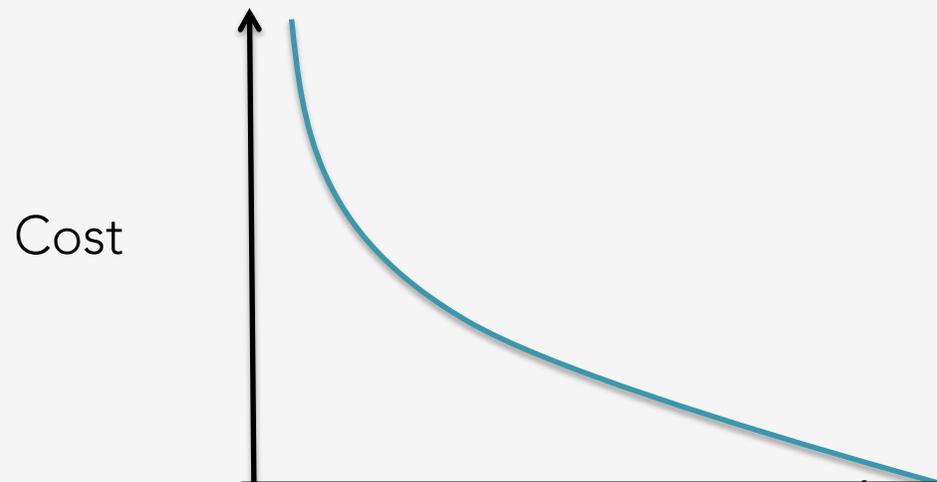13.1

7.3   7.4   7.5   7.5   7.6   7.7

- "Neoclassical"

$$\text{Production}_{\text{until 2000}} = f(K,L)$$

- Actual

$$\text{Production}_{\text{after 2000}} = f(K,L,D)$$

Economies of Scale + Economies of Scope

Cost

Cartagena99

Netflix vs Blockbuster

- *Netflix* knew which movies were requested but were not available, *Blockbuster* not
- *Netflix* could recommend films according to customer's preferences, *Blockbuster* not
- *Netflix* could scalate easily (digital), Blockbuster not ("brick-and-mortar")
- *Netflix* could manage its inventory depending on customer needs, *Blockbuster* no

⬇⬇⬇⬇⬇⬇

Nextflix is a giant, *Blockbuster* no longer exists

Data Giants

3. Computing Power

CPU

GPU

TITAN   TITAN V   TITAN Xp

TITAN V   VOLTA   DESIGN   SPECS   GALLERY   **BUY NOW**

NVIDIA TITAN V

NVIDIA's SUPERCOMPUTING GPU ARCHITECTURE, NOW FOR YOUR PC

NVIDIA TITAN V is the most powerful Volta-based graphics card ever created for the PC. NVIDIA's supercomputing GPU architecture is now here for your PC, and fueling breakthroughs in every industry.
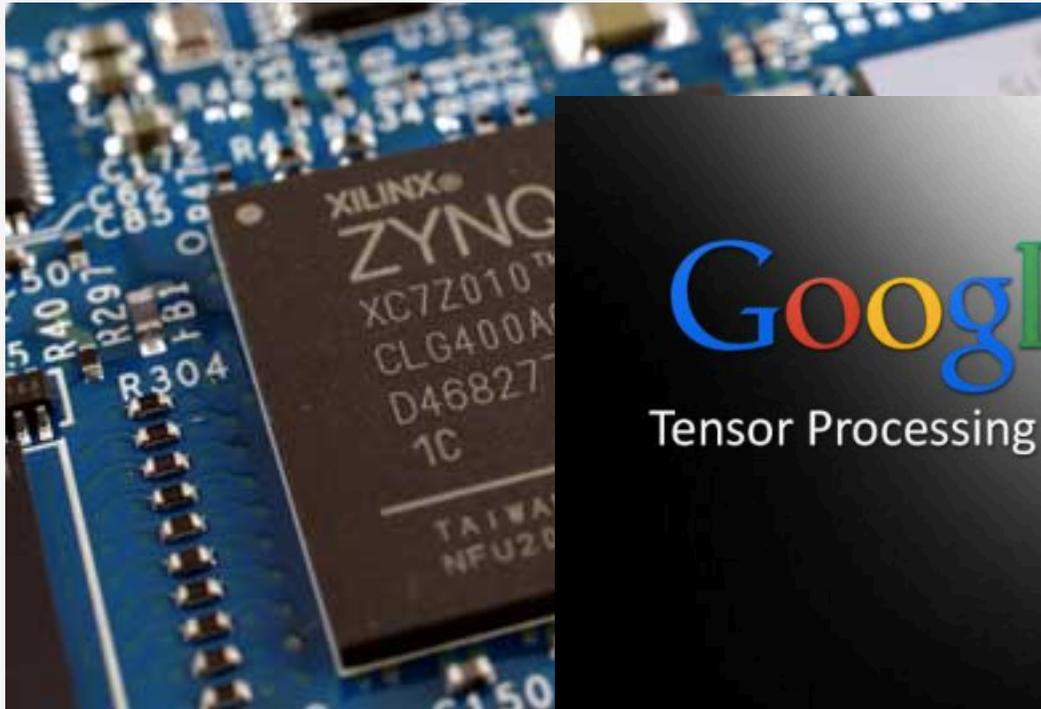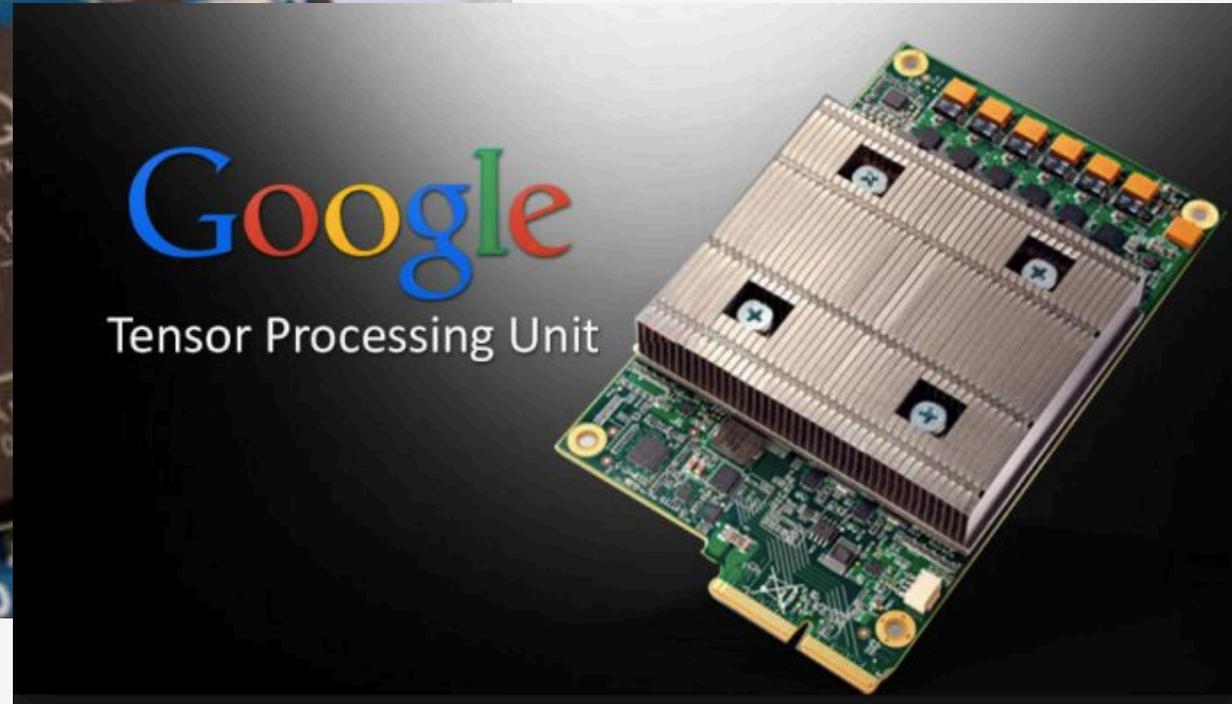
$ 2,999.⁰⁰

ADD TO CART

Free Shipping

FPGA

TPU

Cartagena99

AlexNet to AlphaGo Zero: A 300,000x Increase in Compute
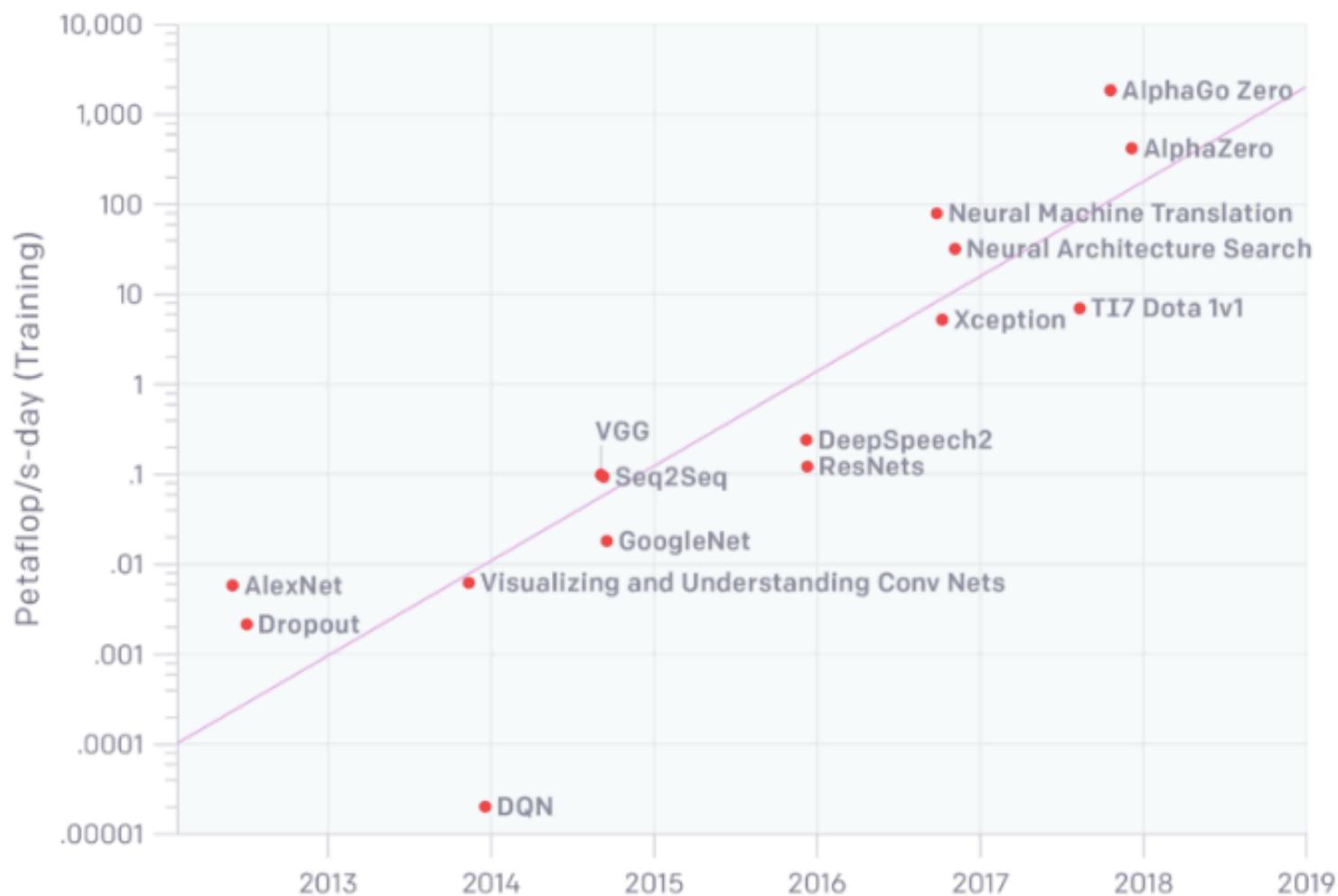
IPU

ACCELERATING NEXT GENERATION ARTIFICIAL INTELLIGENCE

COLOSSUS GC2

the worlds most complex processor chip with 23.6Bn transistors

80 - IPU-LINKS™
2.5Tbps chip-to-chip bandwidth

300MB IN-PROCESSOR-MEMORY™
62.5TB/s memory bandwidth per chip
the whole model held inside the processor

PCIe Gen4.0 x16
31.5GB/s bandwidth to host

1216 independent IPU-CORES™
each with IN-PROCESSOR-MEMORY™ tile
> 100GFLOPS per IPU-CORE™
> 7,000 programs executing in parallel

8TB/s all to all IPU-EXCHANGE™
non-blocking, any communication pattern

≈2 PFLOPS
10 to 100 faster than the fastest GPU
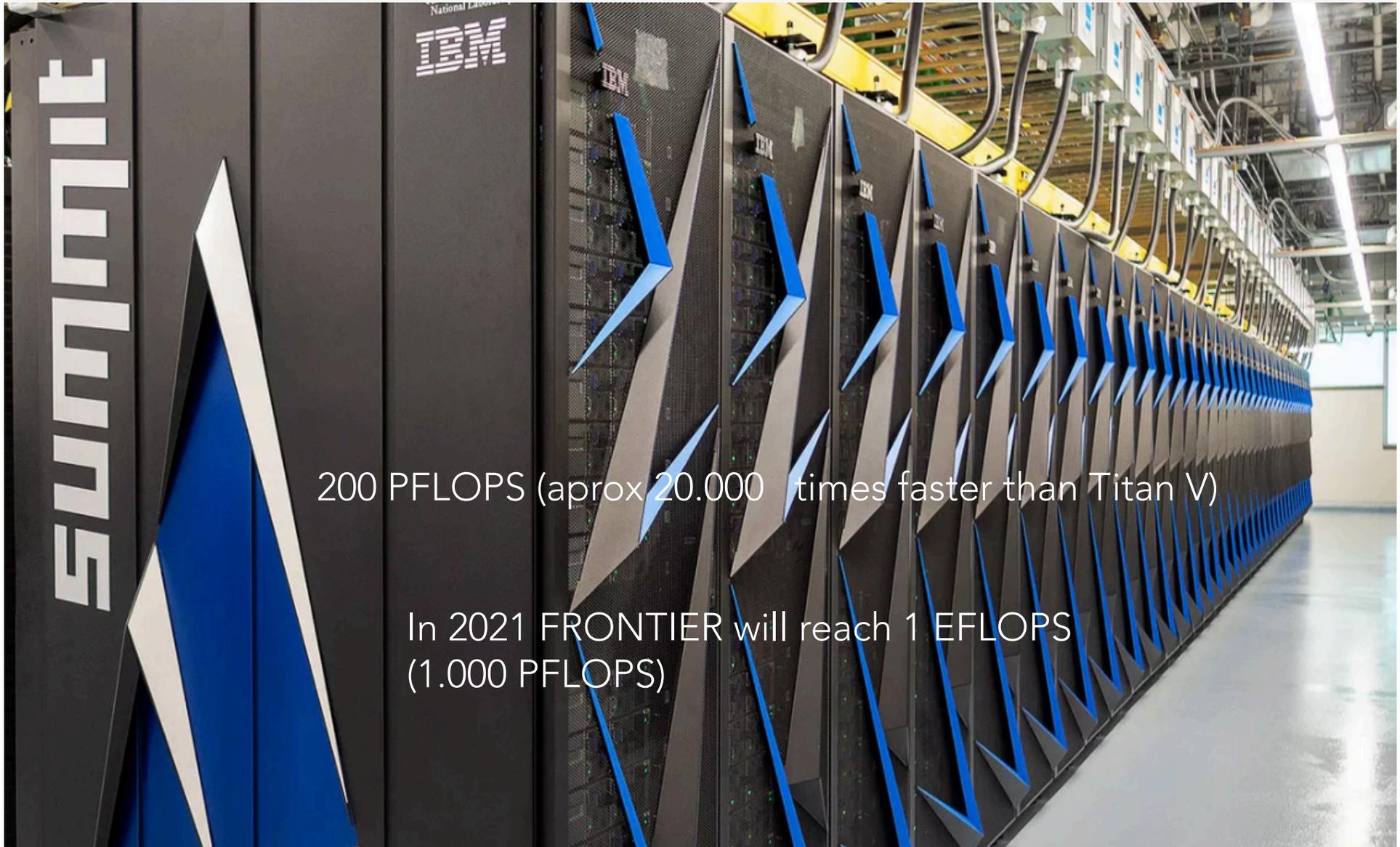
200 PFLOPS (aprox 20.000 times faster than Titan V)

In 2021 FRONTIER will reach 1 EFLOPS
(1.000 PFLOPS)
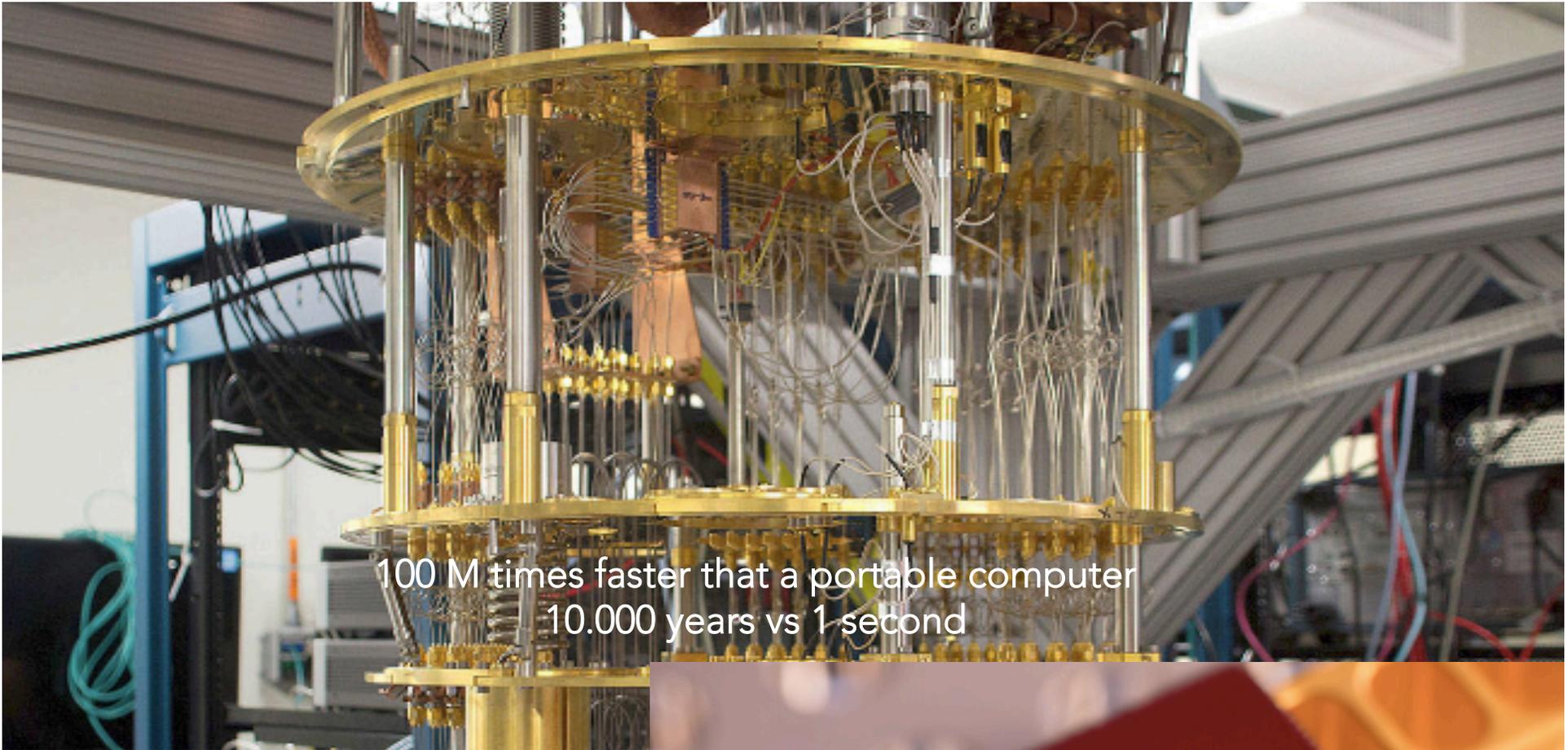
100 M times faster that a portable computer
10.000 years vs 1 second

HOW'S YOUR QUANTUM COMPUTER PROTOTYPE COMING ALONG?

GREAT!

THE PROJECT EXISTS IN A SIMULTANEOUS STATE OF BEING BOTH TOTALLY SUCCESSFUL AND NOT EVEN STARTED.

Bristlecone

4. Algorithmic/Modelling advancements

- RELU units vs. Sigmoid units

- Deep Networks vs. Single layer networks

- Improvements in learning (e.g. Adam) and   Meta-learning vs. standard backprop

- Convolutional Networks, GANs,…

- "Raw" representation vs. Feature pre-processing

- ….

DILEMMAS
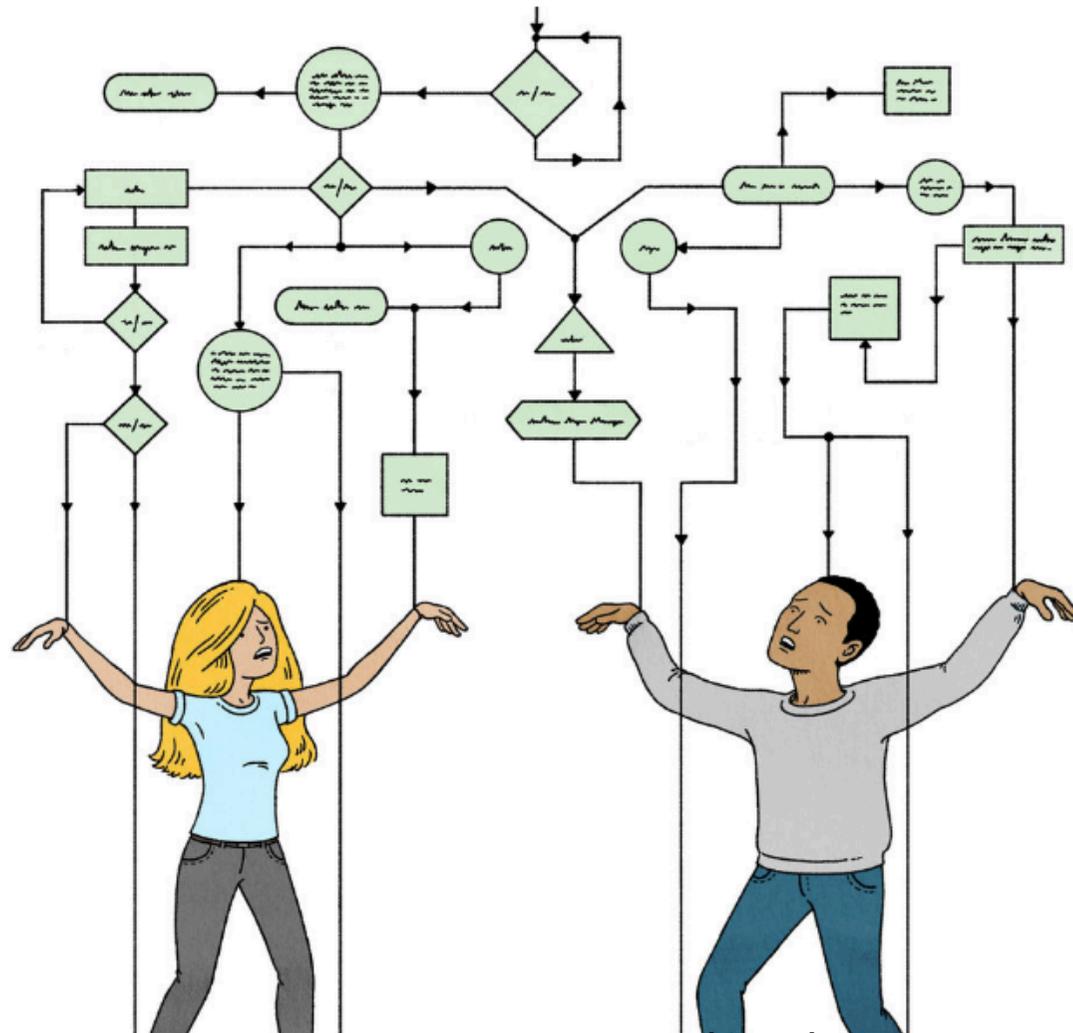
- Who should take the decisions?
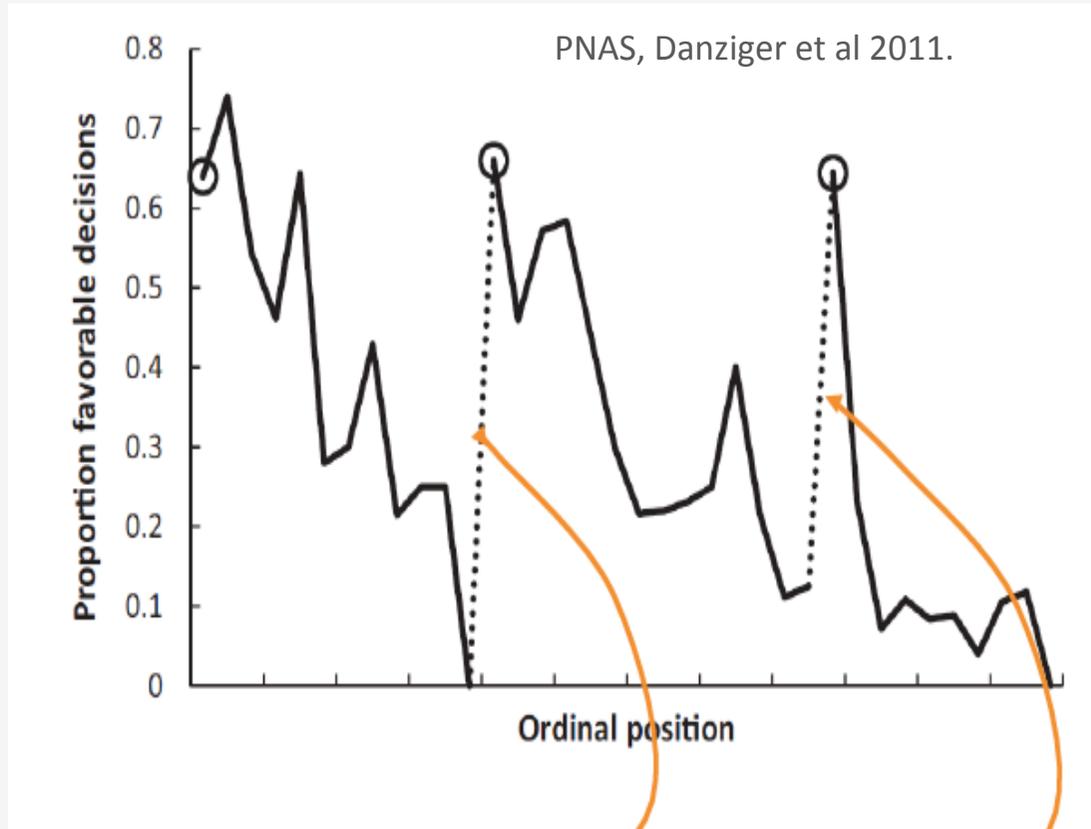
PNAS, Danziger et al 2011.

- Which decisions must be taken?
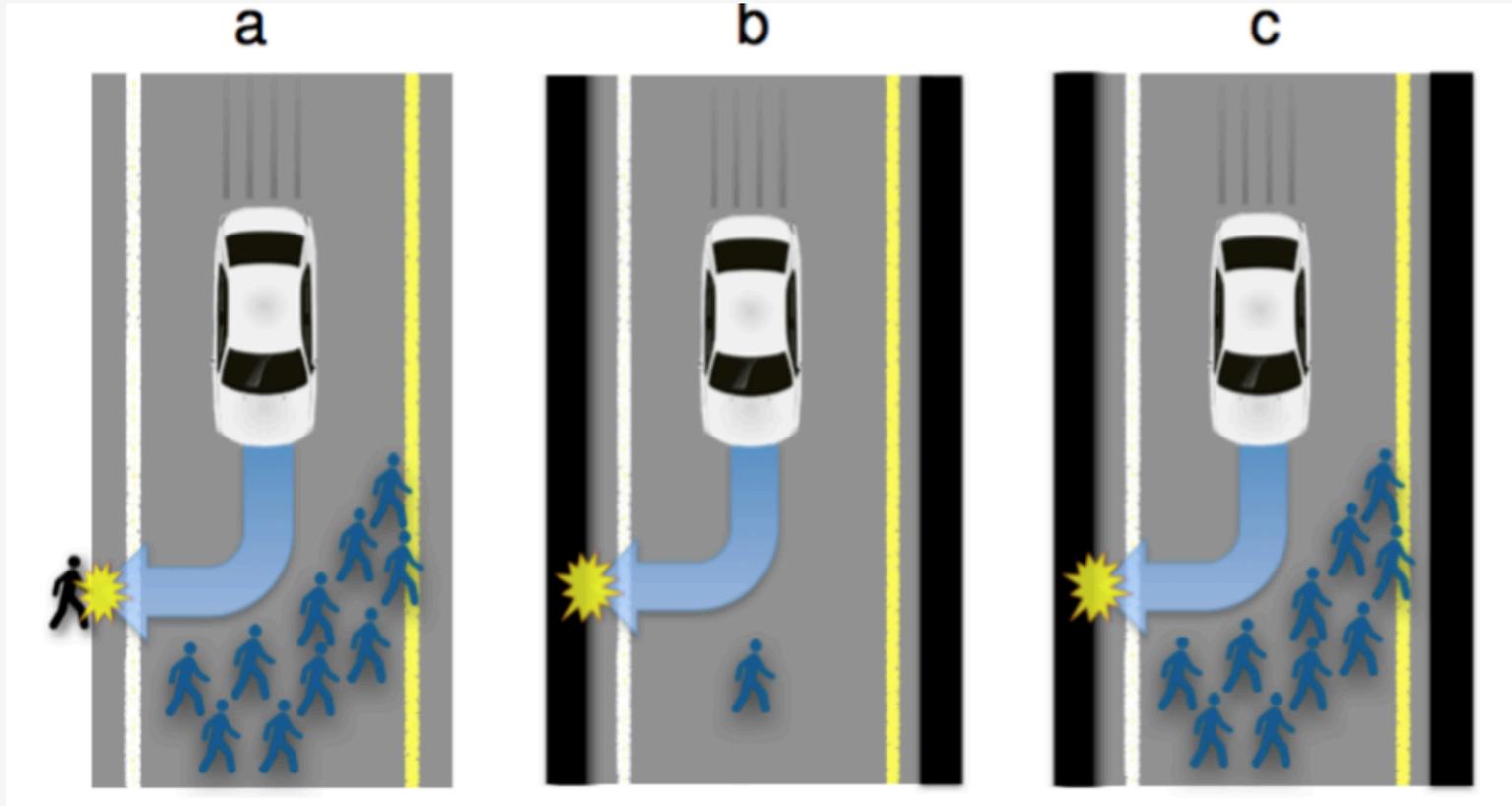
- Who is responsible for the decisions?
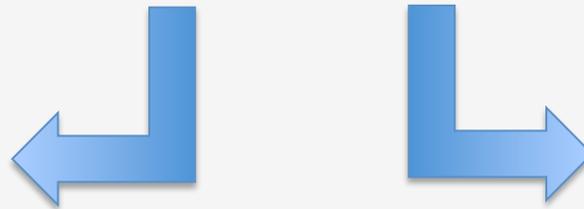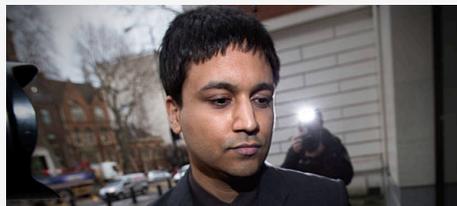
2010 'FLASH CRASH'
DOW ON MAY 6TH 2010

IN THE CLEAR

Uber found not criminally liable in last year's self-driving car death

By Alison Griswold • March 6, 2019

Mind the walkway.

Enjoy this content in the new Quartz app

Details released in a Tempe police report in June suggested the driver may have been at fault. Video footage showed Rafaela Vasquez, the vehicle's assigned safety monitor that night, repeatedly glancing down and away from the road. Additional information obtained by police suggested Vasquez was watching an episode of NBC talent show *The Voice* at the time of the collision. Vasquez could face charges of vehicular manslaughter.

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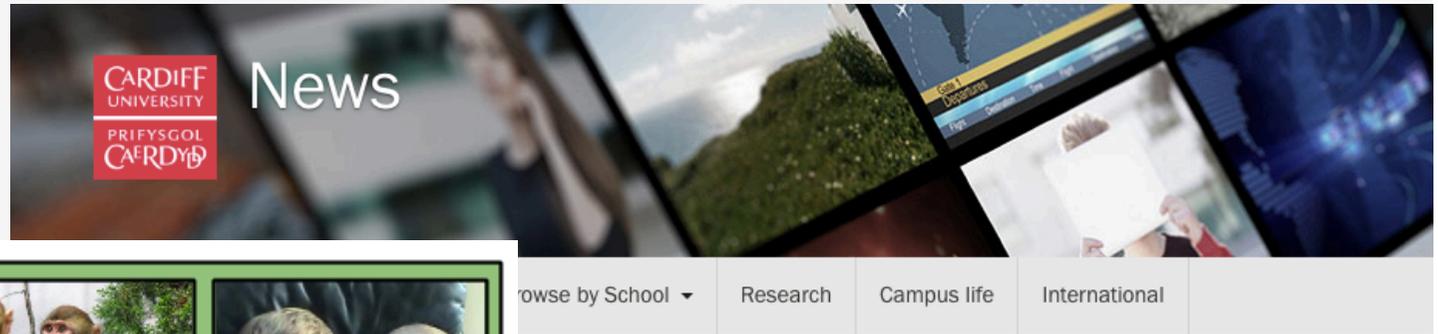
Business

Who to Sue When a Robot Loses Your Fortune

May 6, 2019, 2:00 AM GMT+2

- How decisions must be taken?

Could AI robots develop prejudice on their own?

7 September 2018
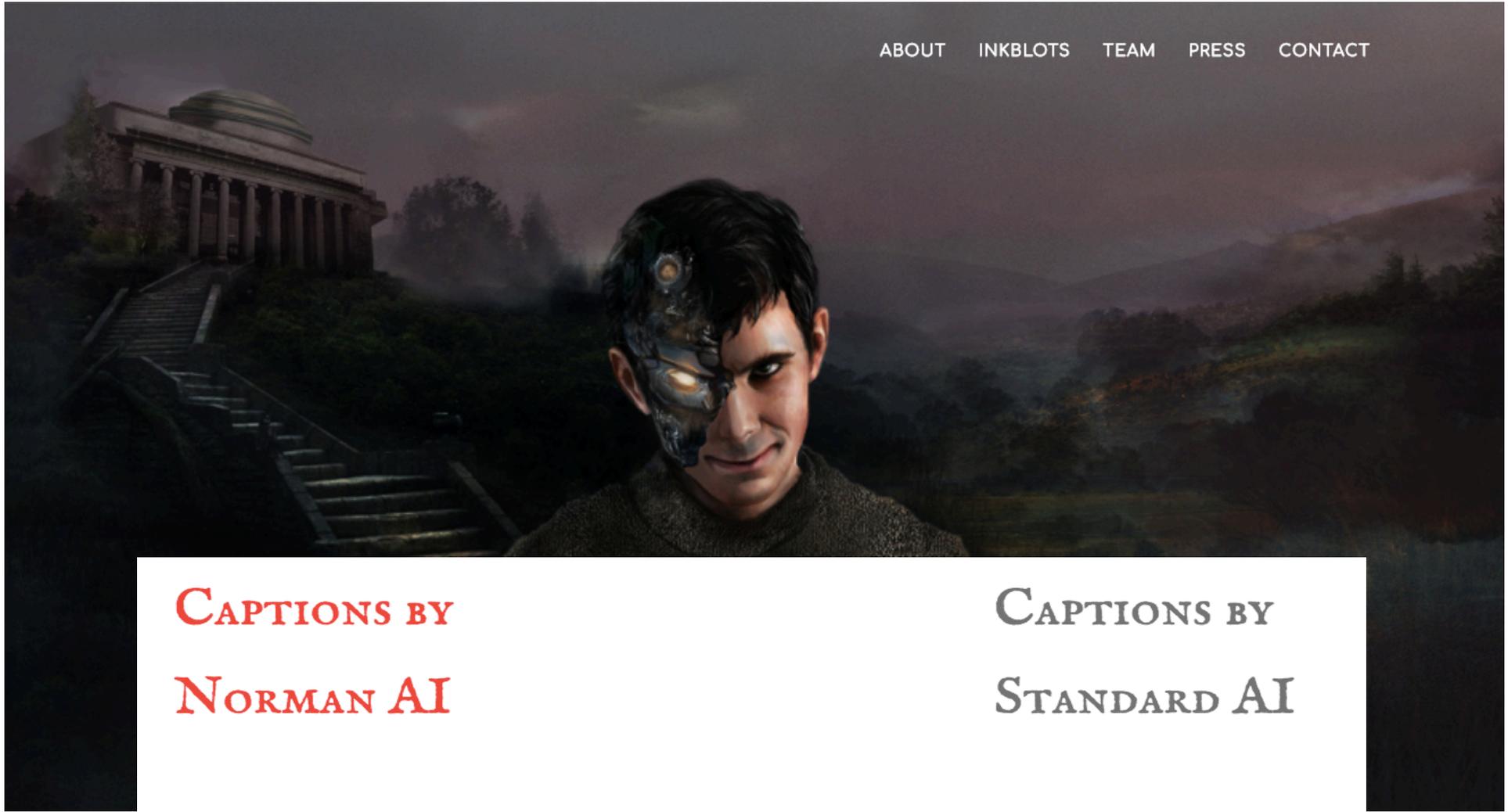
Captions by

Norman AI

Captions by

Standard AI

INKBLOT #1

Norman sees:

INKBLOT #1

Standard AI sees:

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- Which will be the impact on the labor market?

JOKE

Computer Seller: "This computer will eliminate half of your work"

Buyer: "Give me two"

ONE POINT ON THE FUTURE OF AI
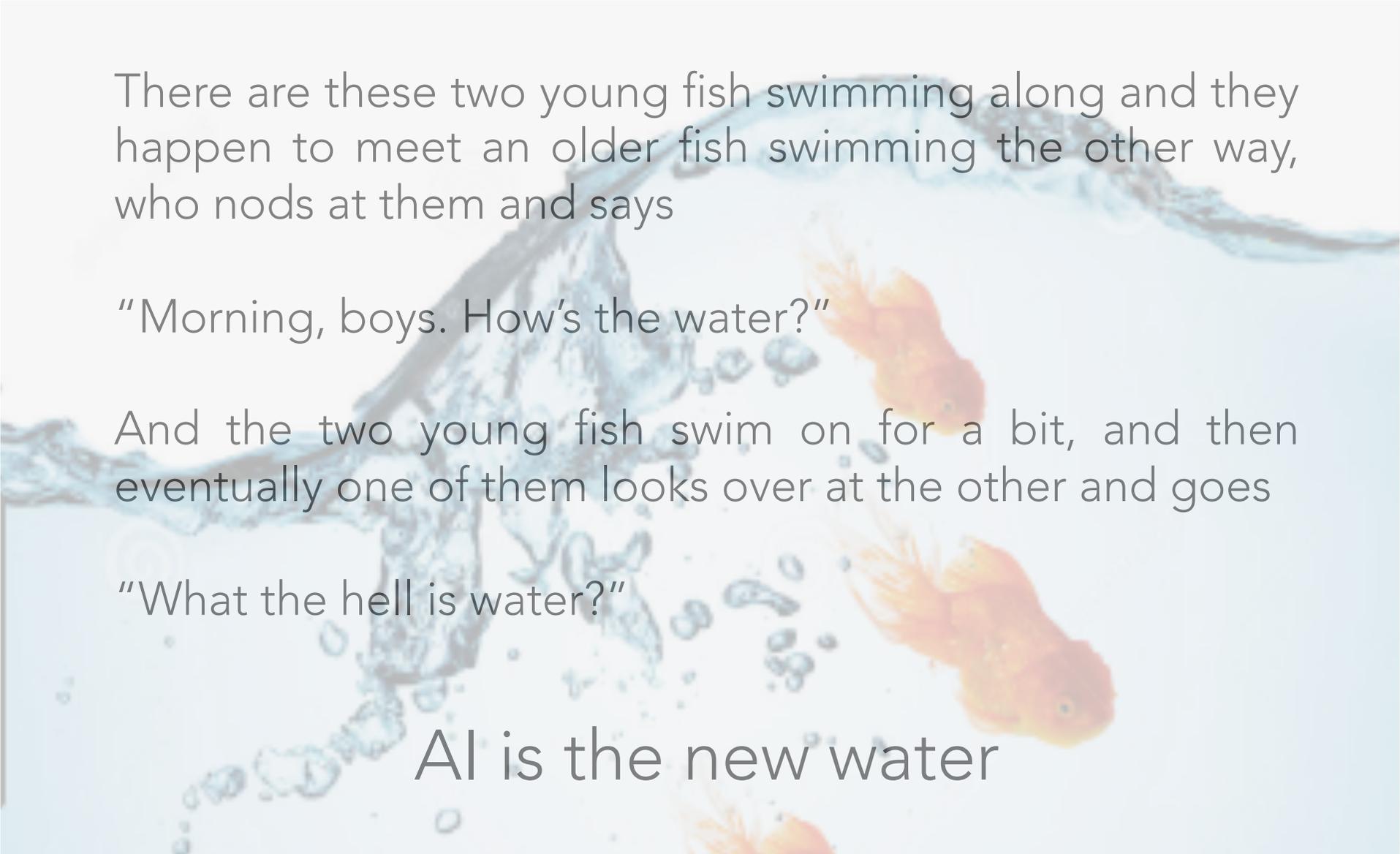
There are these two young fish swimming along and they happen to meet an older fish swimming the other way, who nods at them and says

"Morning, boys. How's the water?"

And the two young fish swim on for a bit, and then eventually one of them looks over at the other and goes

"What the hell is water?"

AI is the new water