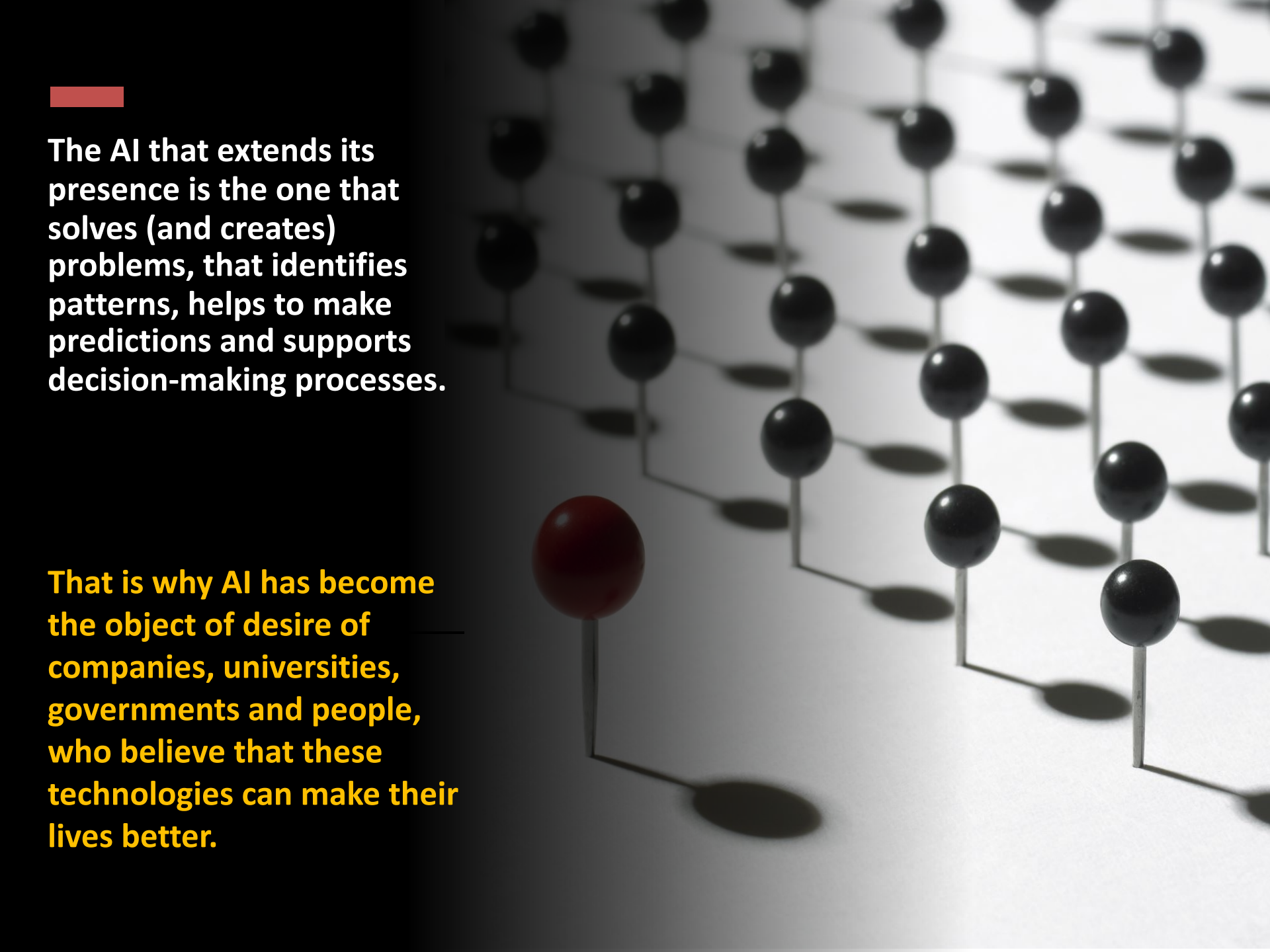


**AI has become
ubiquitous in our
daily life.
But not the AI of
fictional narratives**



The background of the slide features a molecular model. It consists of numerous black spheres connected by thin, light-colored rods, forming a complex, repeating lattice structure. In the lower-left foreground, a single, larger red sphere is attached to a rod, standing out from the rest of the model. The lighting creates soft shadows on the surface below the spheres.

The AI that extends its presence is the one that solves (and creates) problems, that identifies patterns, helps to make predictions and supports decision-making processes.

That is why AI has become the object of desire of companies, universities, governments and people, who believe that these technologies can make their lives better.

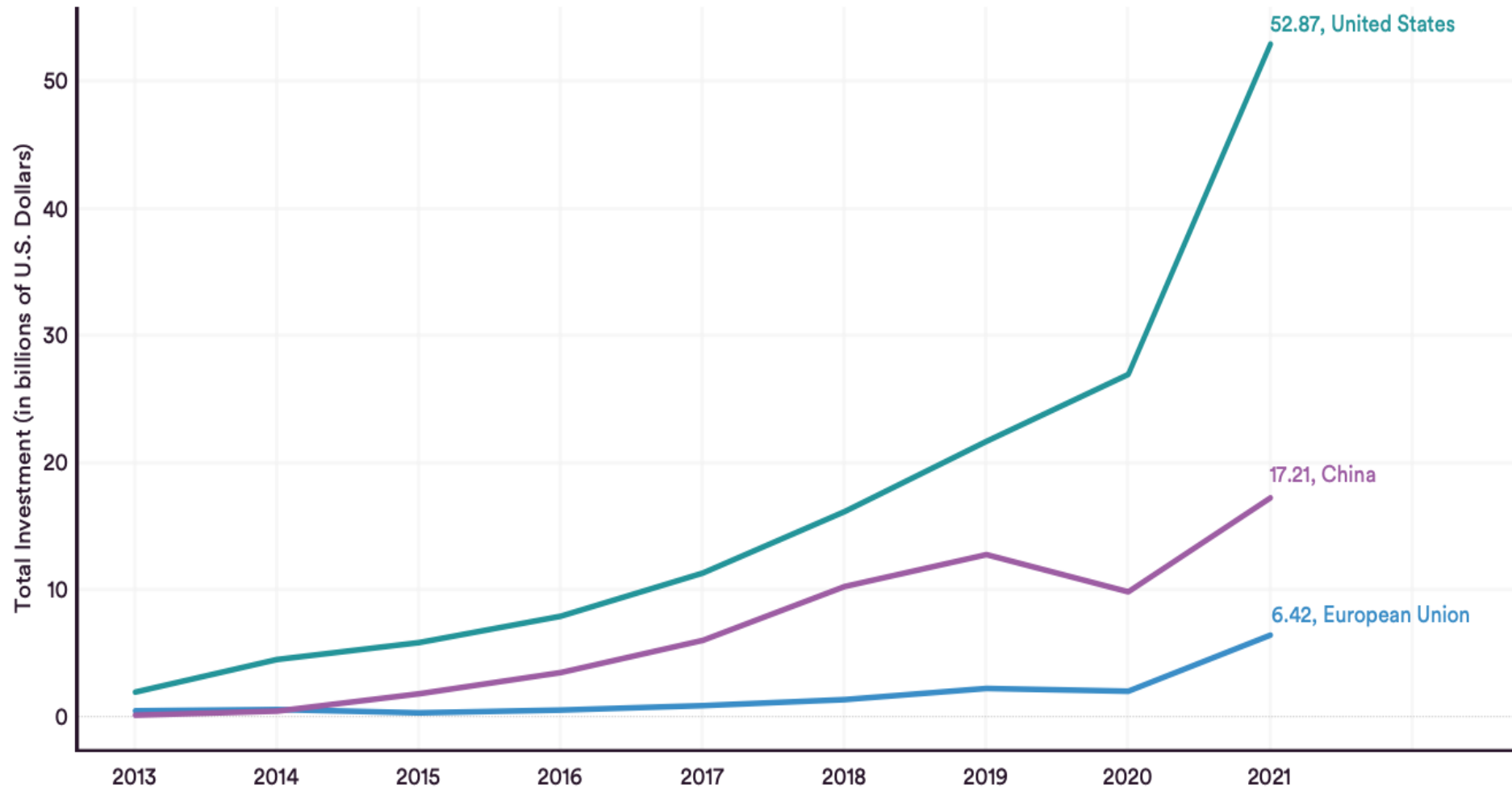


How is the reception of AI in business, academic and public world?

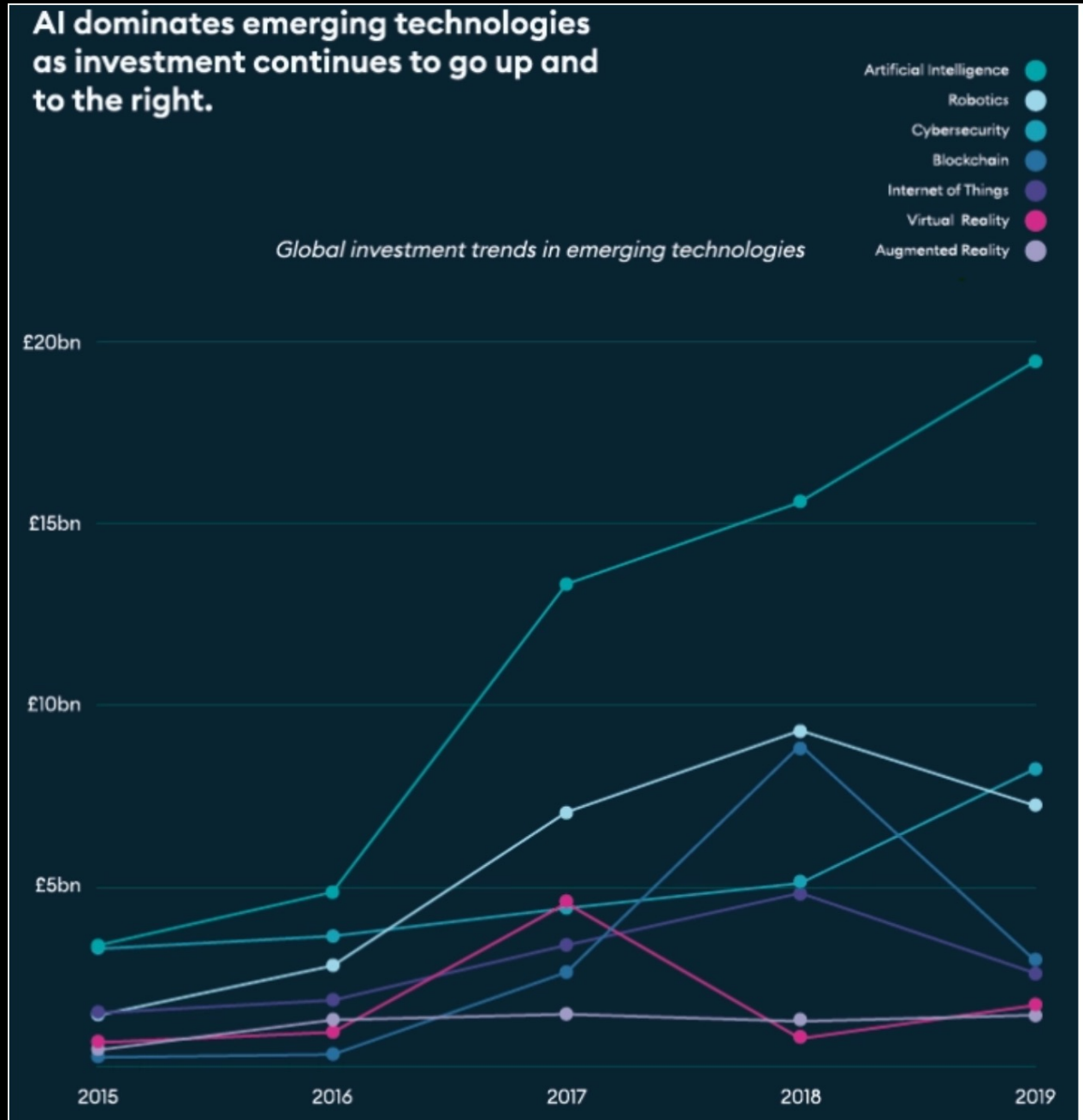
Private investment booms

PRIVATE INVESTMENT in AI by GEOGRAPHIC AREA, 2013–21

Source: NetBase Quid, 2021 | Chart: 2022 AI Index Report



Global Investment in Emerging Technologies

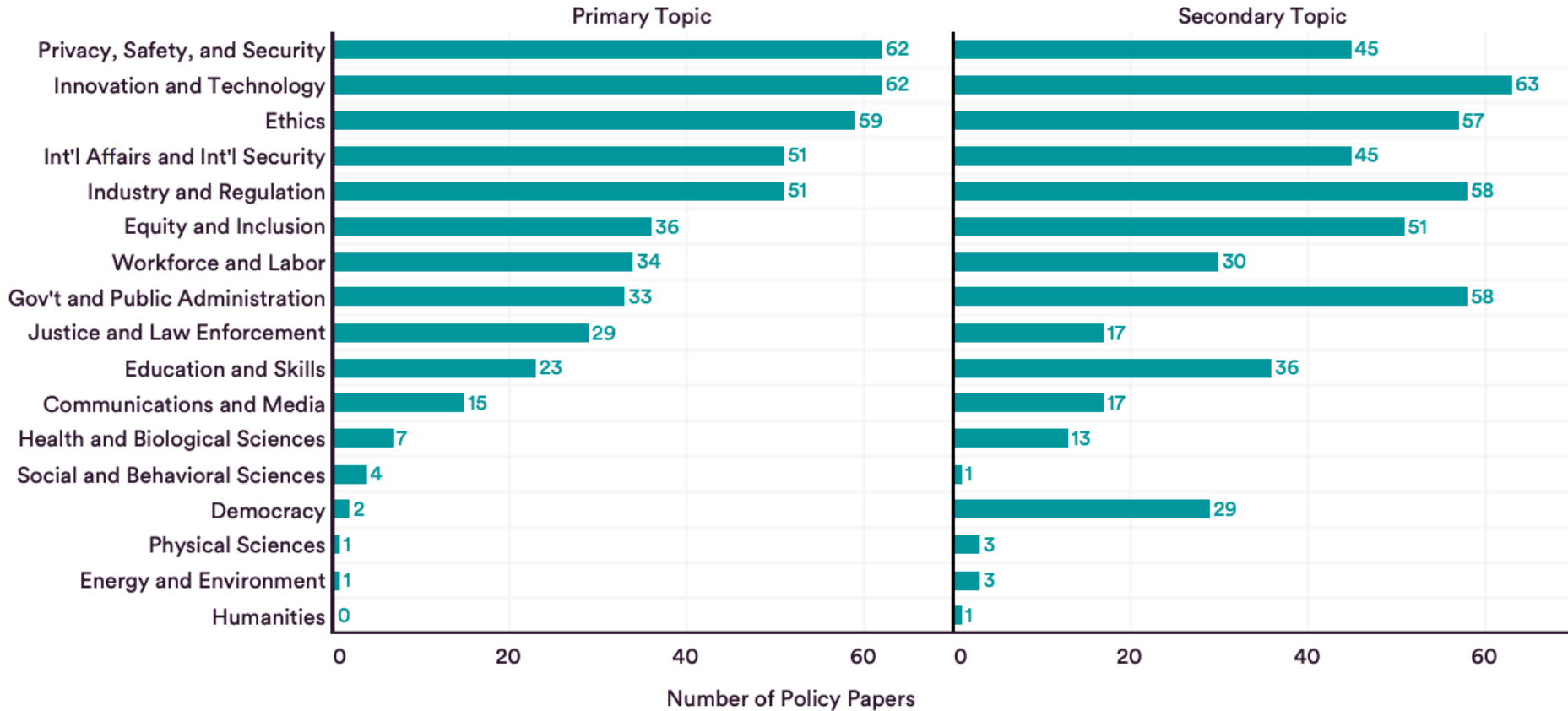


Above: Tech Nation: AI investments relative to other emerging technologies

Research

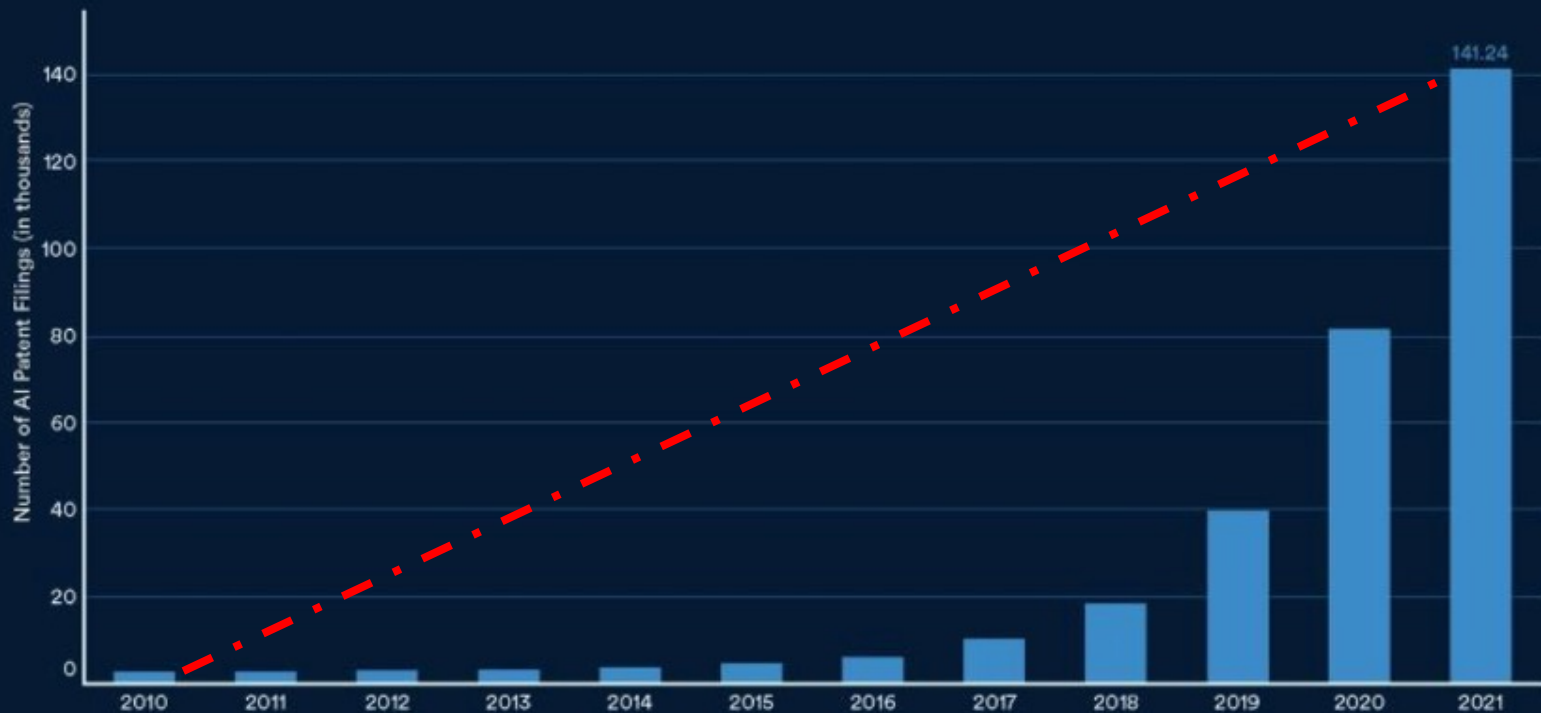
NUMBER of AI-RELATED POLICY PAPERS by U.S.-BASED ORGANIZATIONS by TOPIC, 2021

Source: AI Index, 2021 | Chart: 2022 AI Index Report



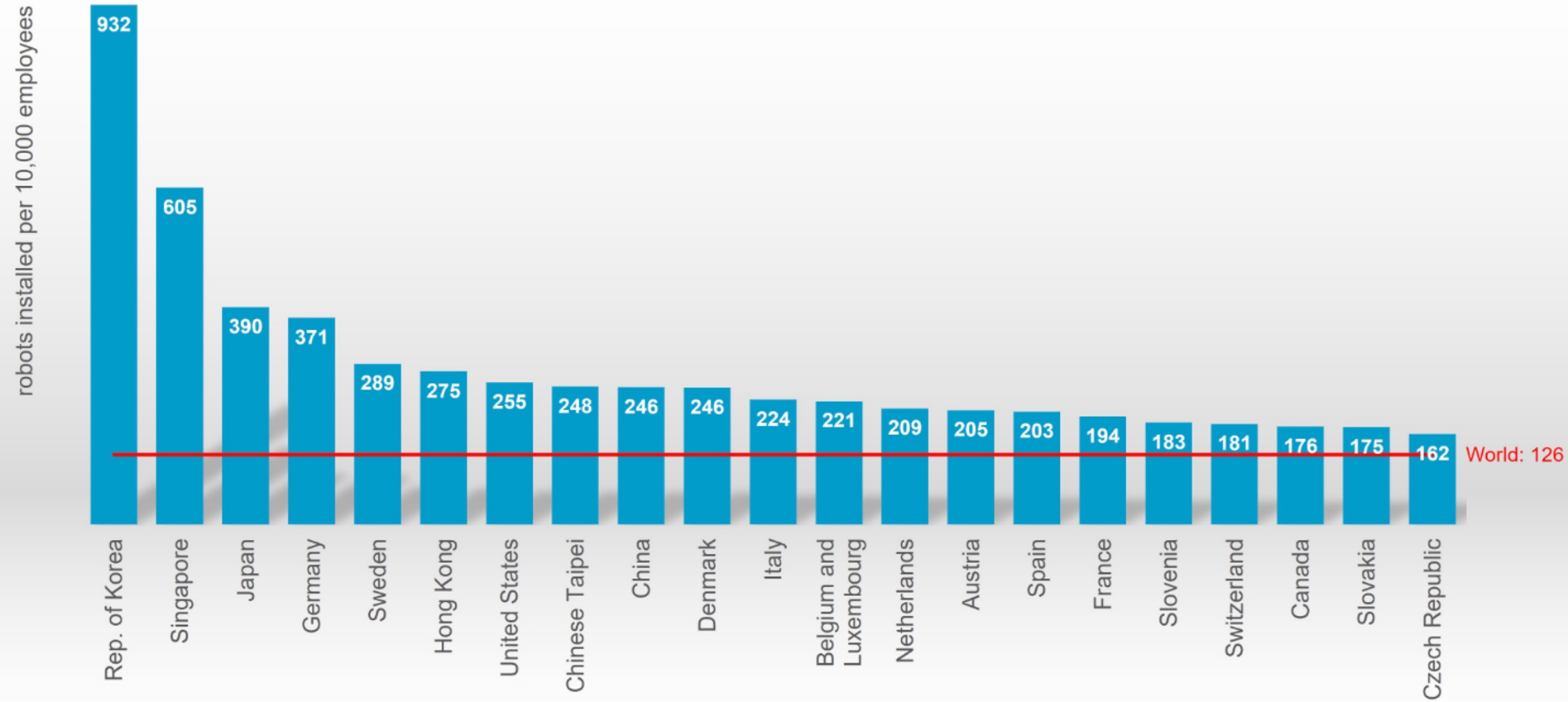
AI patents skyrocket

Number of AI Patent Filings



Source: OECD AI, 2021

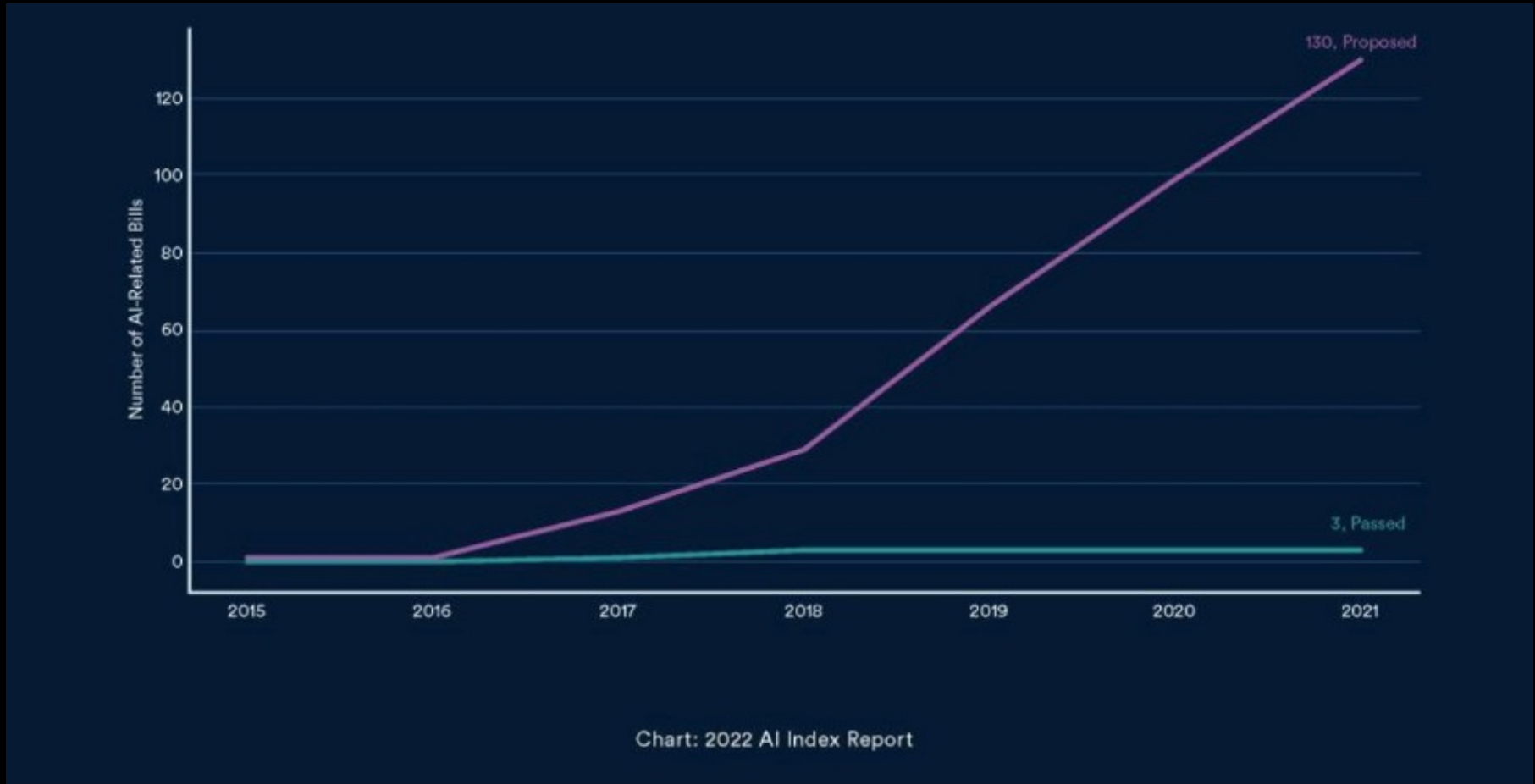
Industrial Robots: cheaper and more capable



Source: World Robotics 2021

Source: International Federation of Robotics, 2021

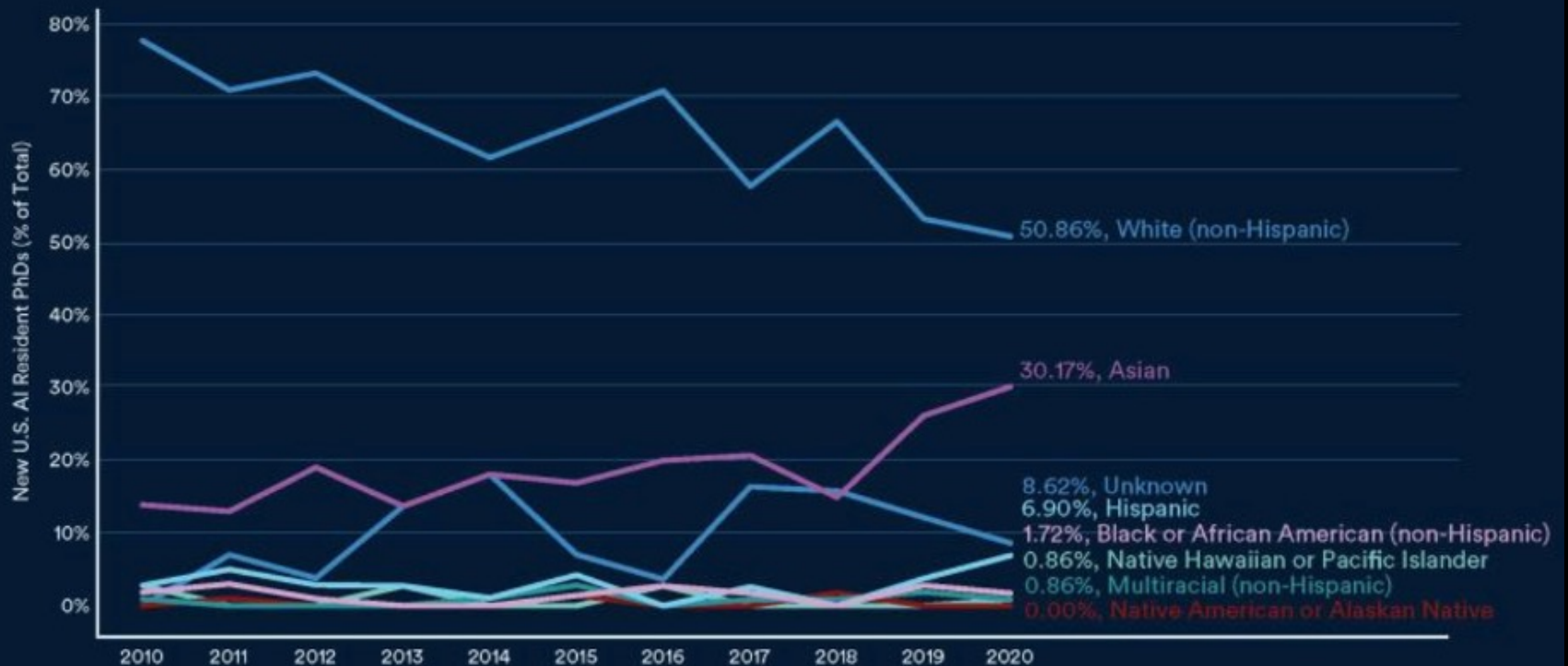
Globally, AI regulation continues to expand



Since 2015, 18 times more bills related to AI were passed into law in legislatures of 25 countries around the world

A diversity shortage

New U.S. Resident AI PhDs (% of Total) by Race/Ethnicity



Source: CRA Taulbee Survey, 2021

Mapping AI enablers



Key AI enablers

PREREQUISITES TO AI DEVELOPMENT

TALENT

the human capital and skills to develop and understand AI systems, looking at both early STEM education, AI-focused tertiary education and lifelong learning.

DATA

large, high-quality datasets that are used to train AI/ML algorithms ensuring minimization of pre-existing biases and discriminatory outcomes.

INFRASTRUCTURE

telecommunications infrastructure, access to basic internet and computing power needed to for AI systems to function and be scaled up.

DRIVING STAKEHOLDERS & INSTITUTIONS

GOVERNMENT

to develop the policy frameworks that regulate AI development. For example, UK's Office of AI, UAE's Artificial Intelligence Office.

PRIVATE SECTOR

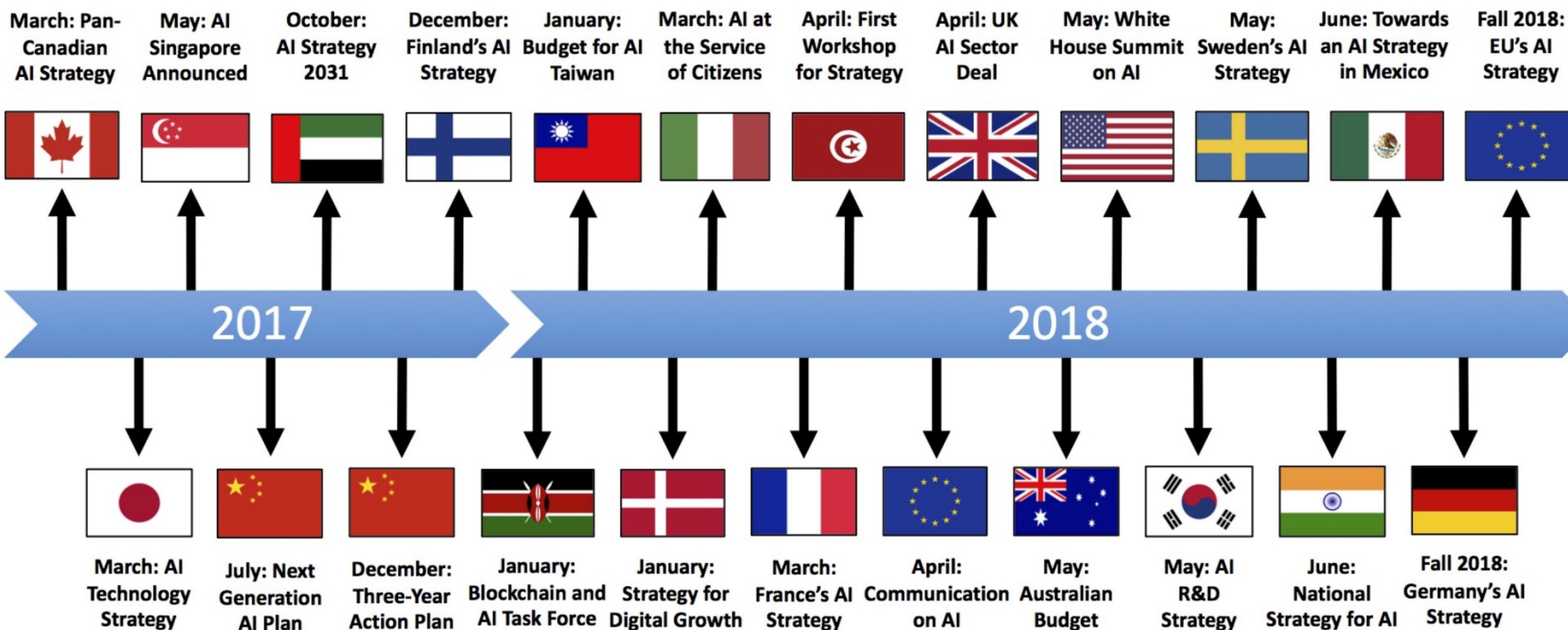
to spur innovation, invest in technologies and contribute to economy. These can range from emerging start-ups to more established technology companies.

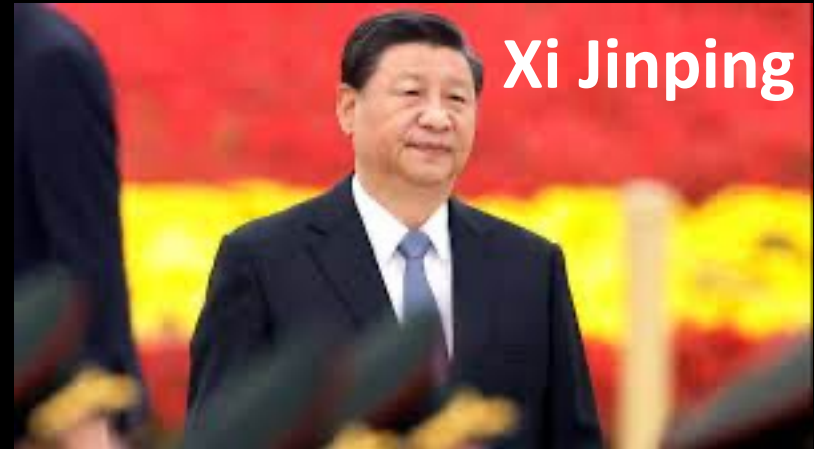
ACADEMIA

to support R&D efforts and support the development of a AI-focused workforce.

More than 60 countries with national AI strategies

Artificial Intelligence Strategies





Xi Jinping

"By 2030, we shall make AI theory, technology, and application at the world's leading level,"

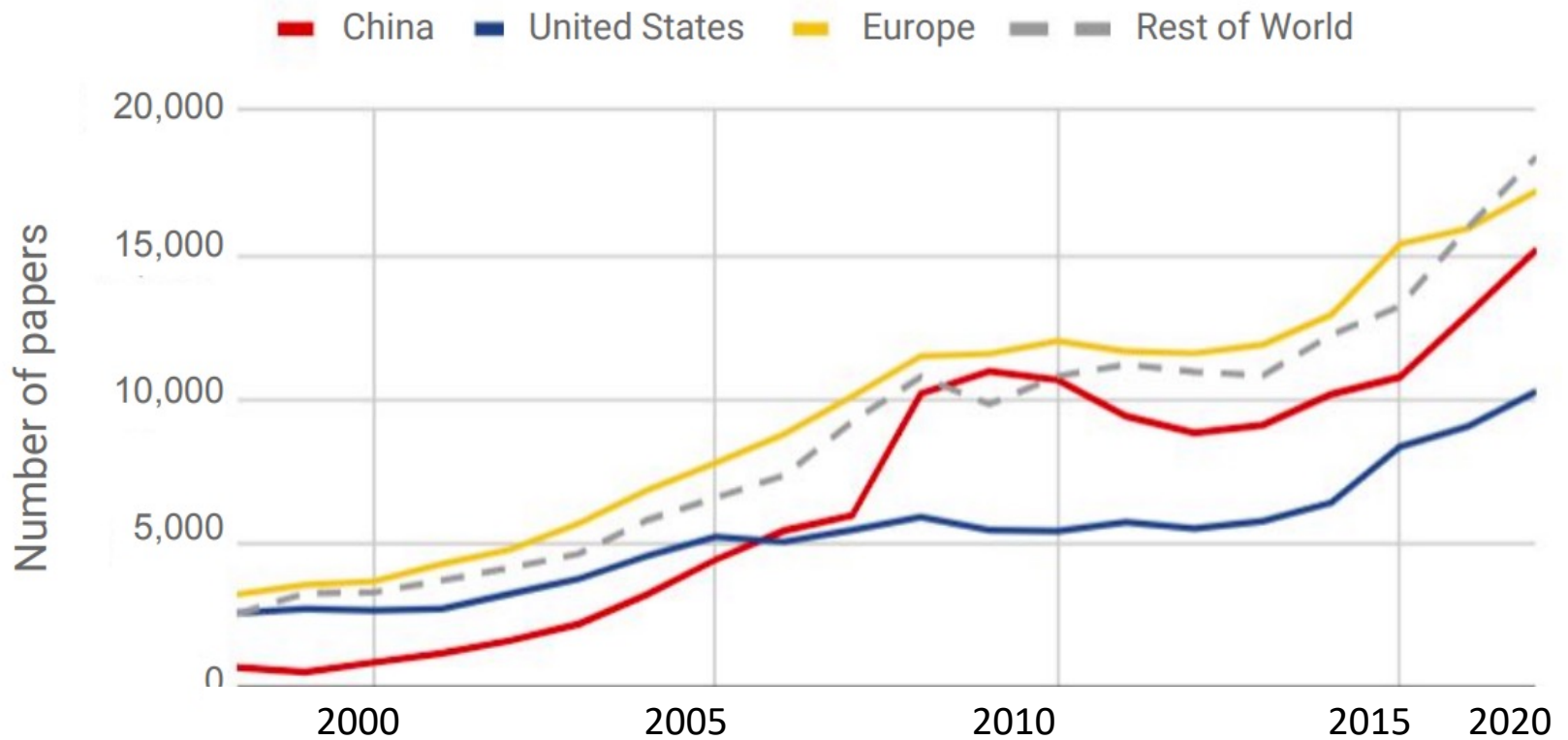


Putin

"The nation that leads in AI will be the ruler of the world"

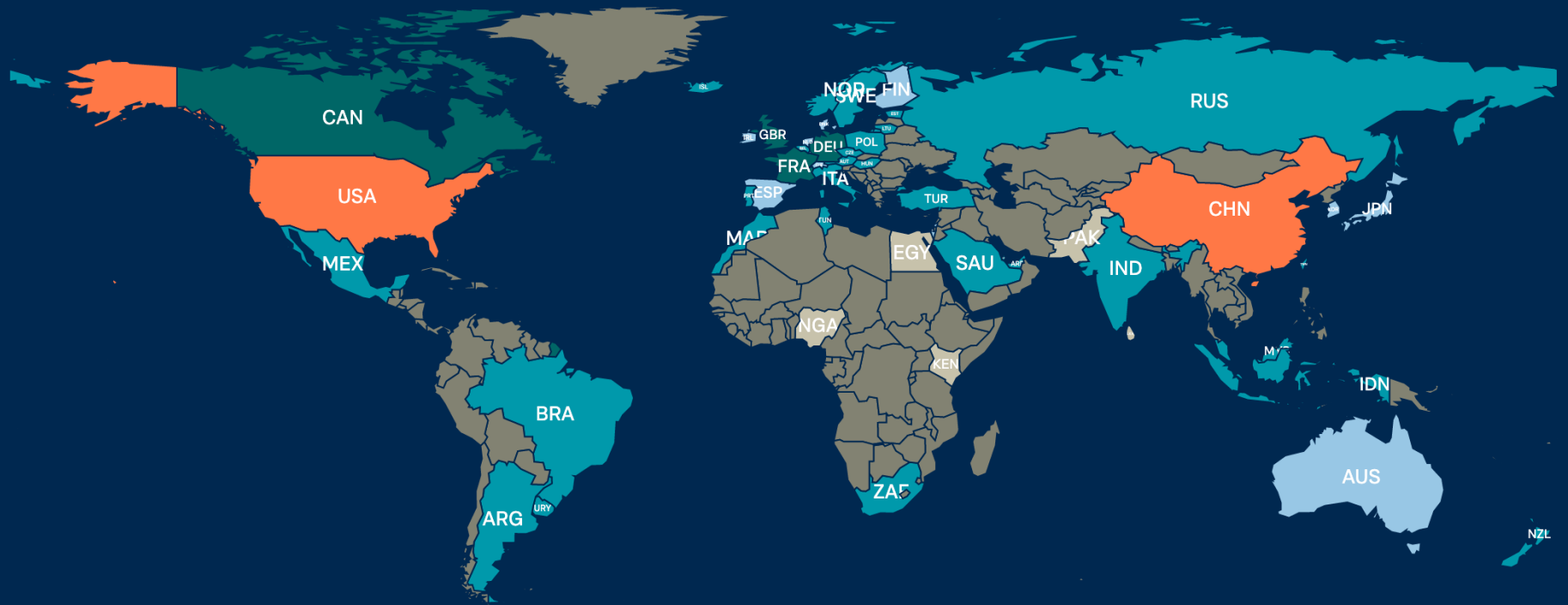
AI papers indexed por região(nº)

Annually published AI papers – Scopus (1998-2020)



AI global map. Countries by skill level

● Power players ● Traditional champions ● Rising stars ● Waking up ● Nascent



Huge investments



EUA

- Amazon: US\$ 16 bi, Alphabet: \$14 bi, Face, Apple, Alphabet, Amazon & Microsoft: US\$ 54 bi

China

- Governo: US\$ 1 tri até 2030
- US\$ 30 bi somente em VC

Top 10: Amazon, Apple, Google, Facebook, Microsoft, Tencent, Baidu, Alibaba, Huawei, Bytedance

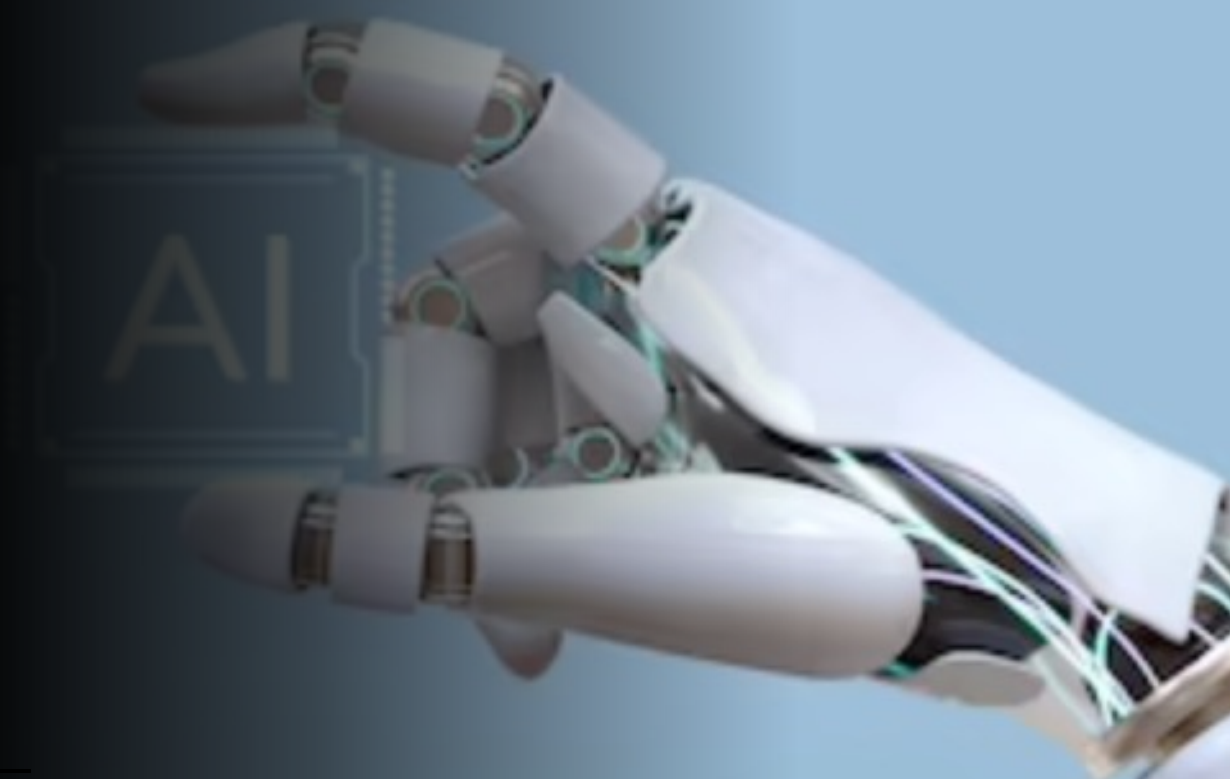


What is AI?

- Definitions of intelligence include awareness, self-awareness, use of language, ability to learn, grasp the abstract, plan, adapt, and reason.
- Russell & Norvig, (AI: Modern Approach) presents at least 8 definitions of AI organized into 4 categories: thinking humanely, acting humanely, thinking rationally and acting rationally.

Difficulties are related to the term “intelligence” linked to “artificial”





There is no consensual definition

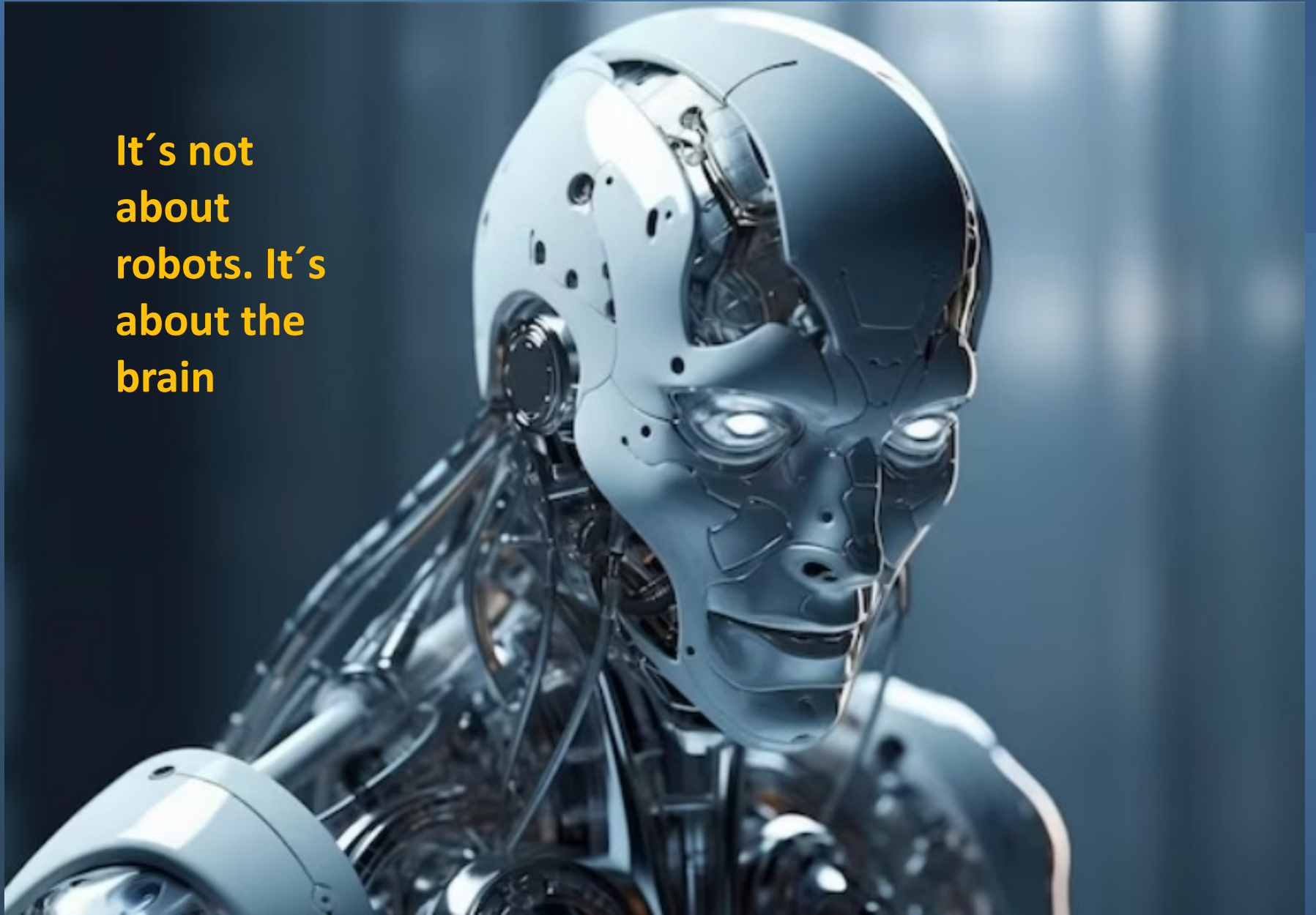
“IA se refere às atividades de computação que são tidas como inteligentes quando realizadas por pessoas.”

John McCarthy, 1956

“A Machine-based system that ca, for a given set of human defined objectives, make predictions, recommendations or decisions influencing real or virtual environments

OECD, 2019

**It's not
about
robots. It's
about the
brain**



AI types



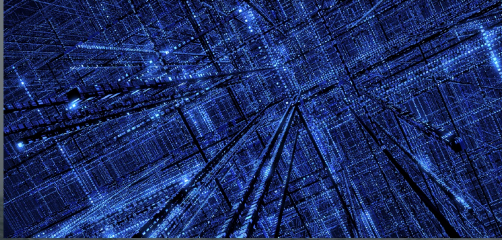
3 TYPES of Artificial Intelligence

ANI Artificial **NARROW** Intelligence

AGI Artificial **GENERAL** Intelligence

ASI Artificial **SUPER** Intelligence

ASI Artificial **SUPER** Intelligence



Smarter than humans in **EVERY WAY**

AGI Artificial **GENERAL** Intelligence

7 ABILITIES:

1. Reason
2. Plan
3. Solve problems
4. Think abstractly
5. Comprehend complex ideas
6. Learn quickly
7. Learn from experience

ANI Artificial **NARROW** Intelligence



Specialised in **ONE** area



AI Research Fields

AI is a constellation of technologies

10 BUILDING BLOCKS of AI



KNOWLEDGE
ENGINEERING



ROBOTICS



SPEECH
RECOGNITION



NATURAL
LANGUAGE
PROCESSING



NATURAL
LANGUAGE
GENERATION



IMAGE
ANALYSIS



MACHINE
LEARNING



DEEP
LEARNING



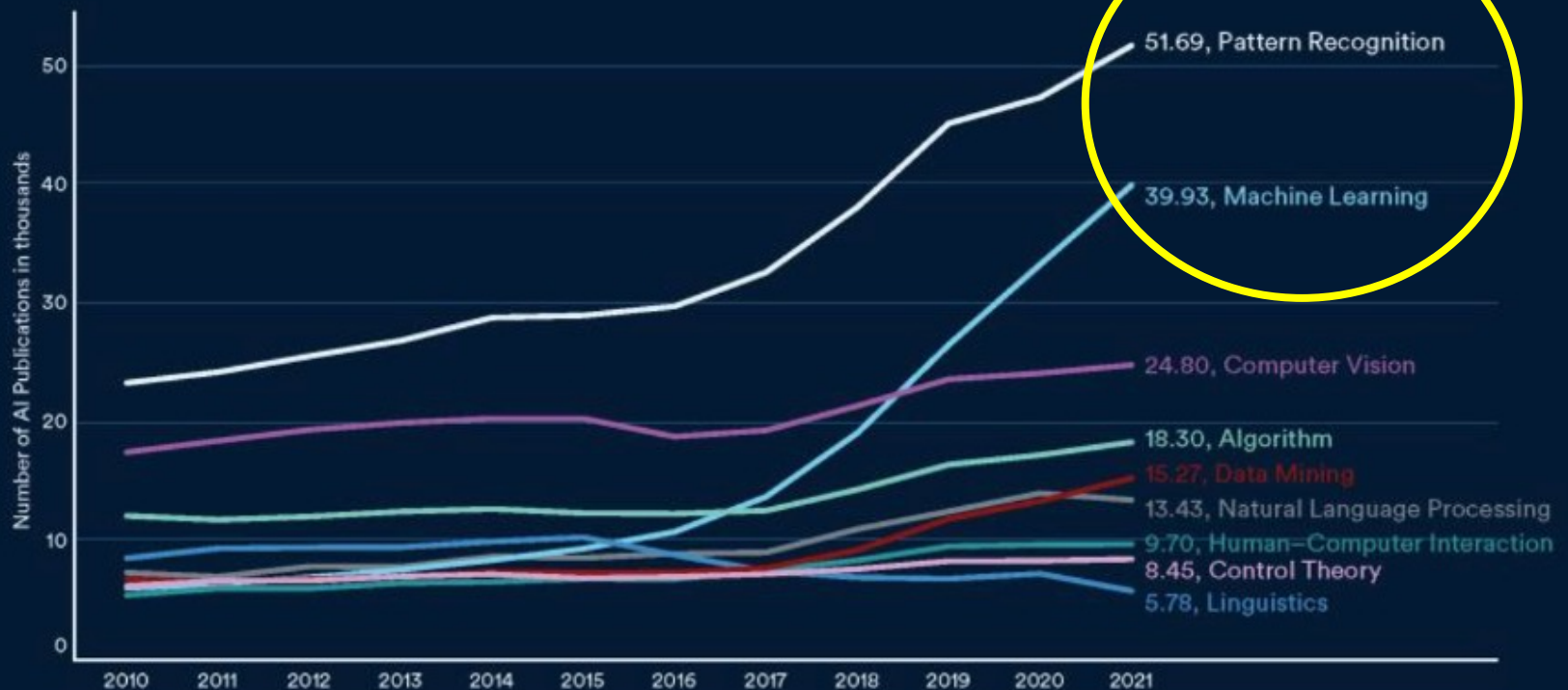
SENSORY
PERCEPTION



COGNITION

Where is research concentrated in AI?

Number of AI Publications by Field



Source: Center for Security and Emerging Technology, 2021

Overview

AI – ML – DL

Artificial Intelligence

Any technique that enables computers to mimic human intelligence, using logic, if-then rules, decision trees and machine learning (including deep learning).

Machine Learning

A subset of AI that includes complex statistical techniques that enable machines to improve at tasks with experience. The category includes deep learning.

Deep Learning

The subset of machine learning composed of algorithms that permit software to train itself to perform tasks, like speech and image recognition, by exposing multilayered neural networks to vast amounts of data.

EIU, 2021



Key Point

Machine Learning, one of the AI technologies, took off since 2010-12 and took over the scene.

This is how the field of Deep Learning and its neural networks became almost synonymous with AI



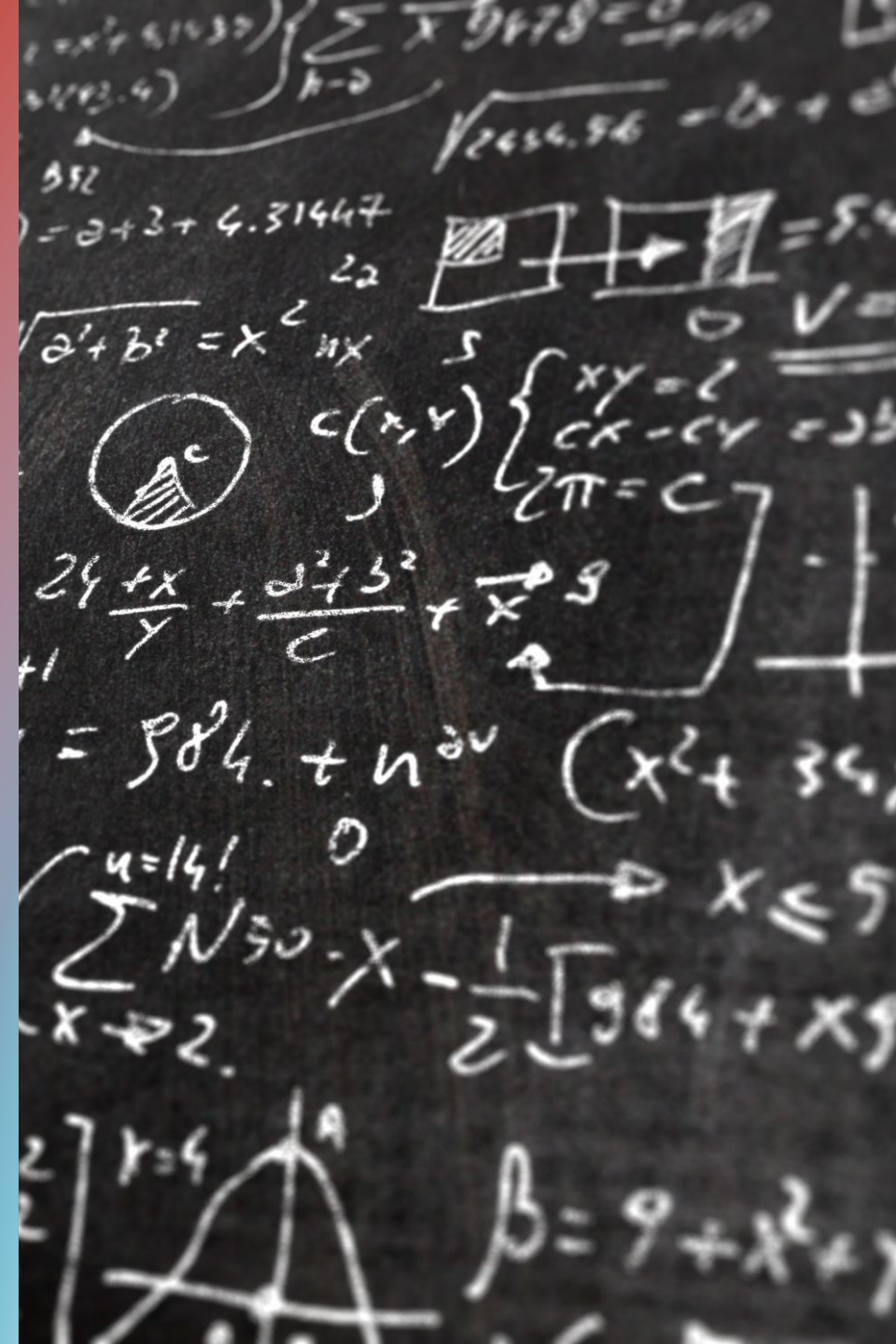
AI Origenes

- **Alan Turing**
- **1956:** John McCarthy coined the term AI, in preparing the Dartmouth Summer Research Project
- **Marvin Minsky:** Society of Minds
- **McCarthy:** “there is no solid definition of intelligence that doesn’t depend on relating it to human intelligence (...) we cannot yet characterize in general what kinds of computational procedures we want to call intelligent.”



What is Machine Learning/Deep Learning?

Deep learning basically operates with so-called neural networks, which are, in fact, sophisticated **mathematical functions** that functions by **similarity**



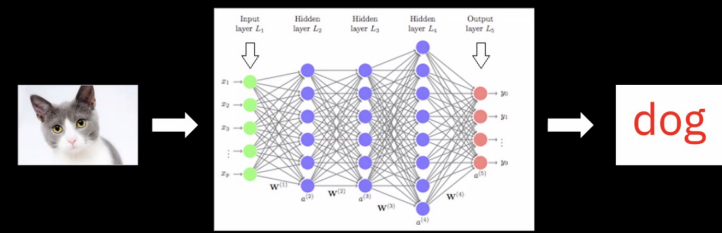
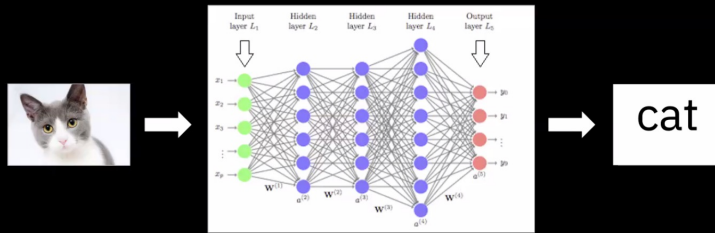
What is an algorithm?

In computer science, an algorithm is a set of instructions/rules oriented towards solving problems or performing tasks, based on available alternatives.

Neural Networks are complex math functions

The examples adjust the parameters using “back propagation”

Example:

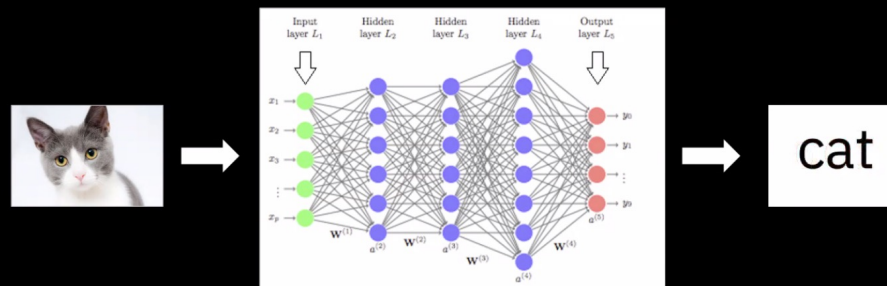


math function
(lots of parameters)

back propagation
(adjusts parameters)

So the next time the answer is correct

Example:



recalculate example

Text to image: great



vibrant portrait painting of Salvador Dalí with a robotic half face



a shiba inu wearing a beret and black turtleneck



a close up of a handpalm with leaves growing from it

<https://analyticsindiamag.com/openai-to-change-the-digital-image-making-game-with-dall-e-2-its-text-to-image-generator/>

Text to image: great but sometimes weird ...



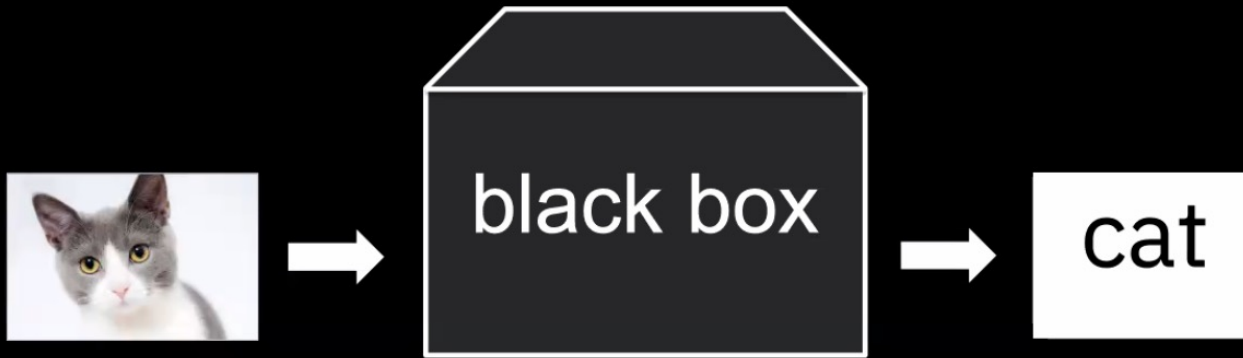
“specialized full suspension gravel bike” (DreamStudio)



“exhausted cyclist slumped over bicycle with sweat on their forehead with dark skies and lightning” (DreamStudio)

<https://cyclingtips.com/2022/08/the-weird-and-wonderful-world-of-ai-generated-images-for-cycling/>

Neural Networks are powerful black boxes



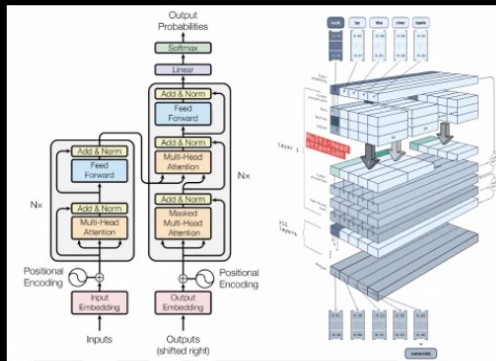
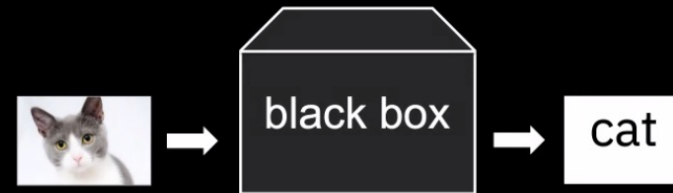
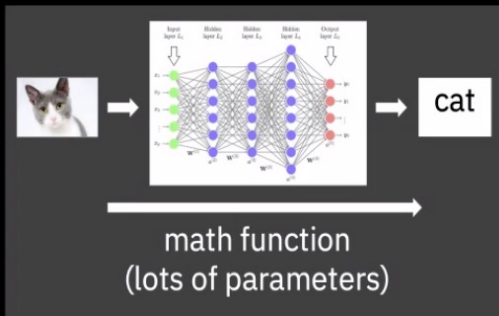
PROS

- graceful
- non-linear-model
- solve by similarity using human data

CONs

- probabilistic (at best) outputs
- unpredicable, unverifiable behavior
- extremely hard to understand

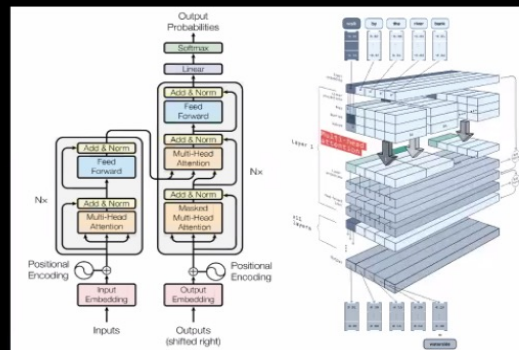
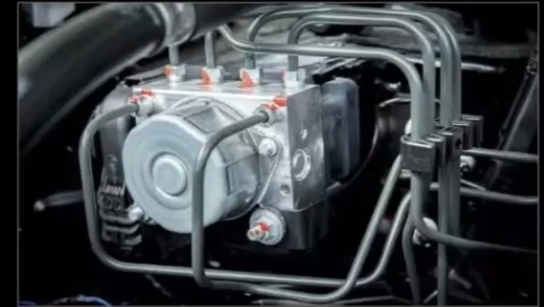
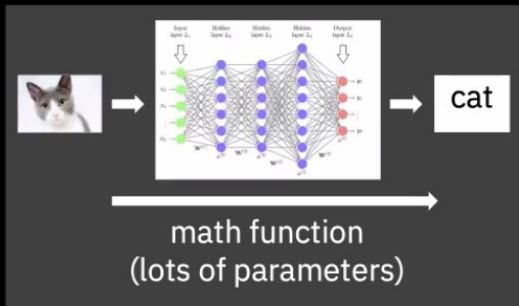
Neural Networks are black boxes



1. PROBABILISTIC
2. UNPREDICTABLE
3. NOT UNDERSTANDABLE

We live surrounded by black boxes

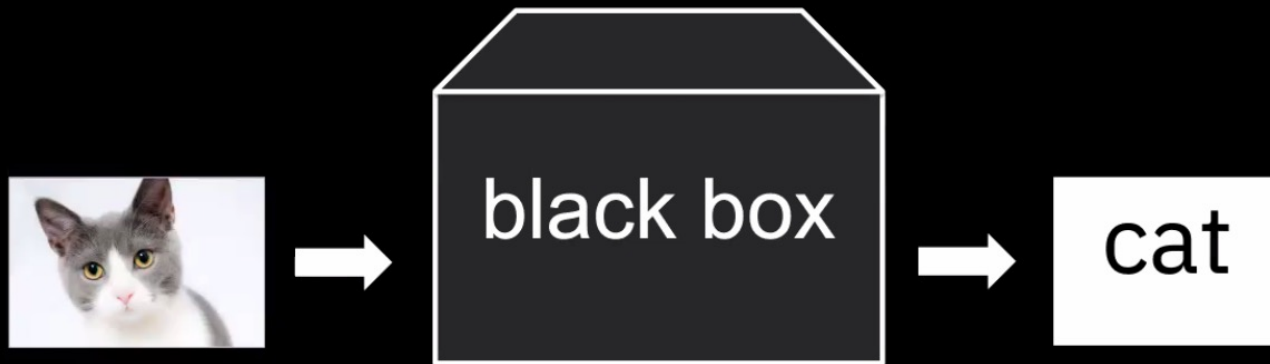
Almost all our infrastructure are black boxes



What is the problem with black boxes in AI?

The problem is believing (mistakenly) that they are intelligent and sensitive. That is, to attribute human characteristics to neural networks





“Intelligent” behavior of [ML] machines is no more than human behavior reflected back to us.”

So, what is the problem with AI black boxes?

The problem with AI black boxes is the mistaken belief they are intelligent, sensitive and human

The last wave: GPT - LLMs



Inteligência Artificial (1950 – ...)

Representação
e Raciocínio

Processamento de
Linguagem Natural

Tomada de Decisão

Visão Computacional

Aprendizado
de Máquina

Fonte: Cozman, F., 2023

Hoje: Mega-dados / Mega-modelos

Representação
e Raciocínio

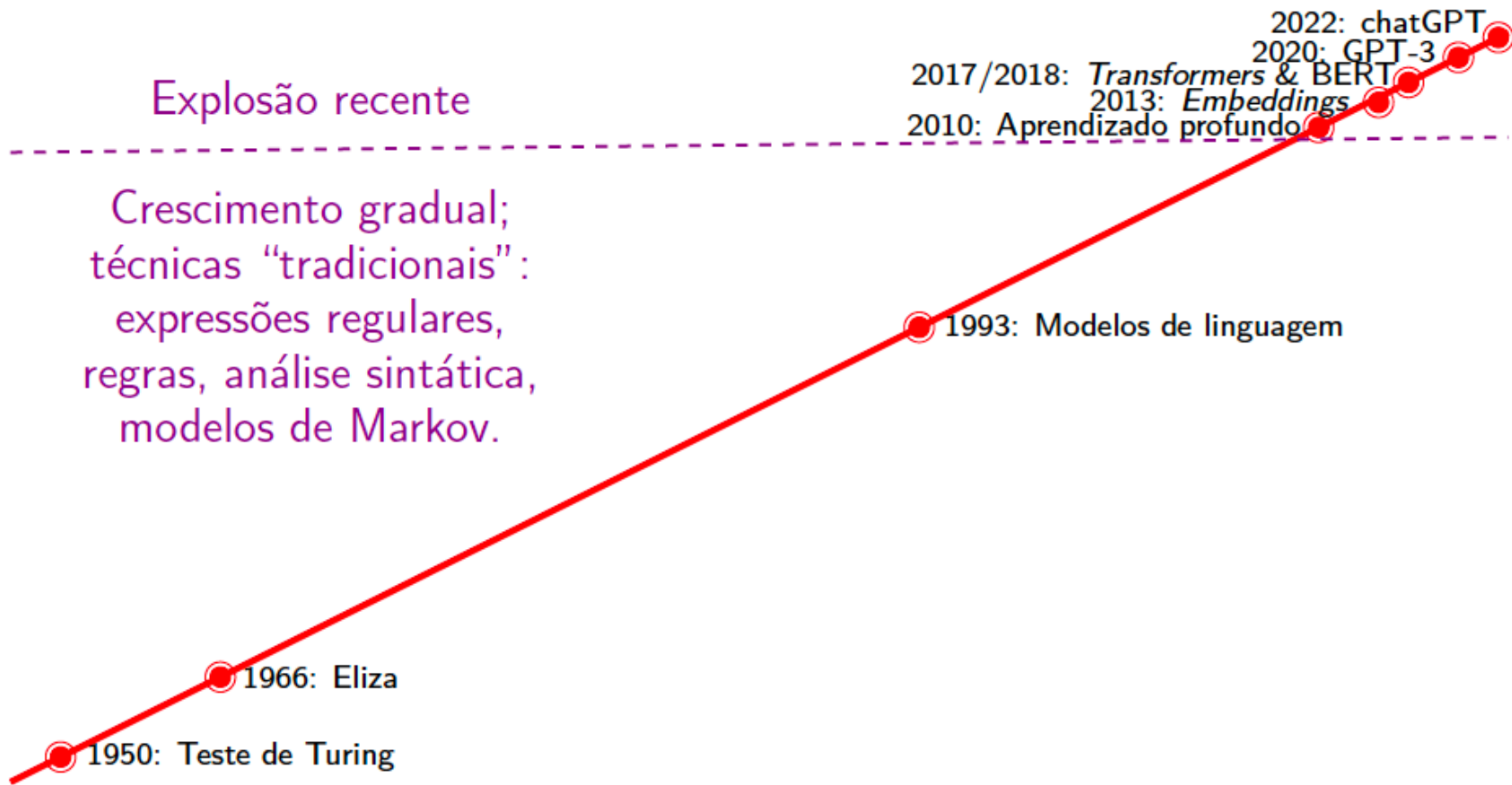
Processamento de
Linguagem Natural

Tomada de Decisão

Visão Computacional

Aprendizado
de Máquina

Processamento de Linguagem Natural



Uma Primeira Revolução:

- ▶ Probabilidade da próxima palavra dado o que foi visto.
- ▶ Exemplo:

Segue anexo ofício para X $\left\{ \begin{array}{l} \textit{providências?} \\ \textit{pizza?} \end{array} \right.$

Modelos “Generativos”

*Segue anexo ofício para... providências...
cabíveis... dos... docentes... ministrando... disci-
plinas...*

Mistakes and Hallucinations

- **Ability to answer questions, propose solutions, correct, synthesize and collate similar to human texts**
- **Incorrect, inappropriate answers, without citation of a source and without commitment to the facts**

Negative consequences:

- **Acceptance of answers as true**
- **Dissemination of fake news**
- **Plagiarism**
- **Indolence in the face of knowledge...**

Large Language Models and Generative Pre-trained Transformer (GPT)

- It is based on the Large Language Models
- It is powered by Deep Learning algorithms
- And feeds on massive amounts of data

OpenAI's experiments with ChatGPT, Dall-E, and several other similar systems marked a turning point in the trajectory of AI. For the first time, AI becomes accessible directly to the population

Despite the problems it generates, AI is promising

- **Enables the creation of systems capable of solving problems**
- **Expands the individualization of approaches**
- **Identifies patterns in huge volumes of unstructured data**
- **Improves forecasting mechanisms**
- **Helps improve decision-making processes**





**AI is consolidating as a
General Purpose
Technology**

AI is the new electricity

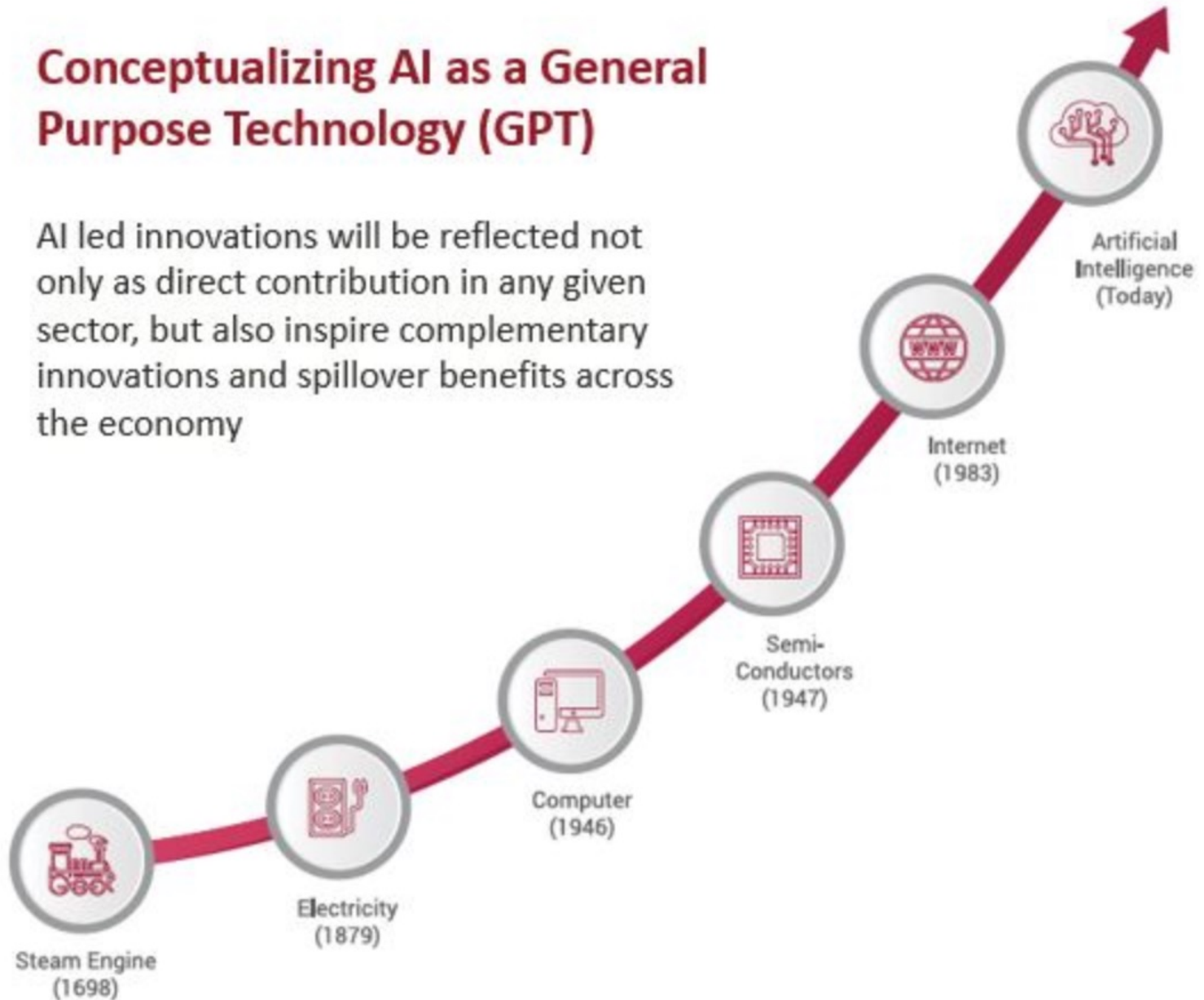
Andrew Ng



Stanford University

Conceptualizing AI as a General Purpose Technology (GPT)

AI led innovations will be reflected not only as direct contribution in any given sector, but also inspire complementary innovations and spillover benefits across the economy



The potential of AI



- GPTs are characterized by the potential for pervasive use in a wide range of sectors and by their technological dynamism
- GPTs are transformative because they open up new opportunities for innovation and economic growth
- GPT become essential for innovation processes.

For Sociology, researching AI is an opportunity to increase understanding of what it is to be human

Thanks