Aula 4

Novo Ciclo tecnológico e Inteligência Artificial

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53 ANOS

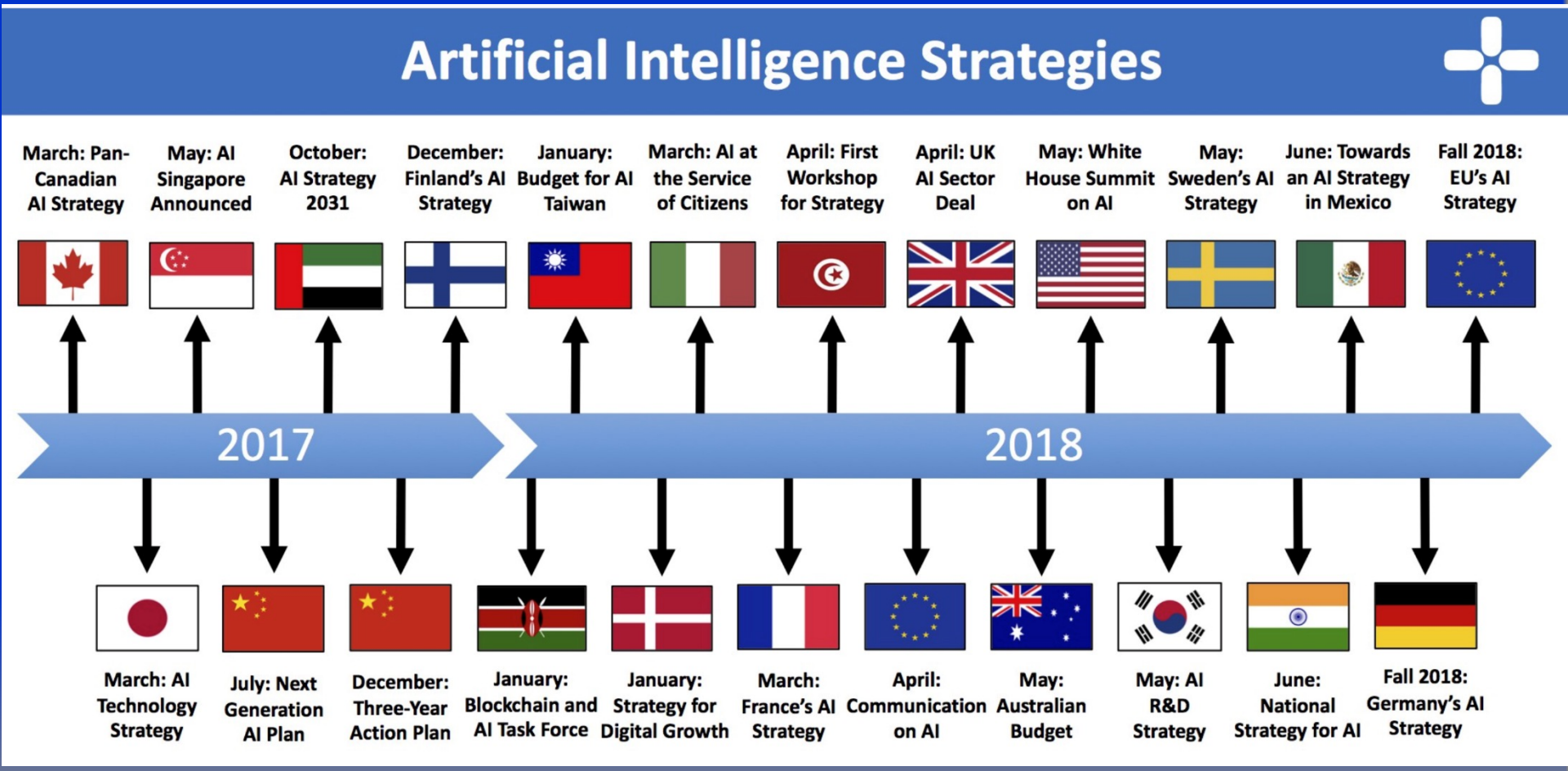
Any sufficiently advanced technology is indistinguishable from magic.

Arthur Clarke

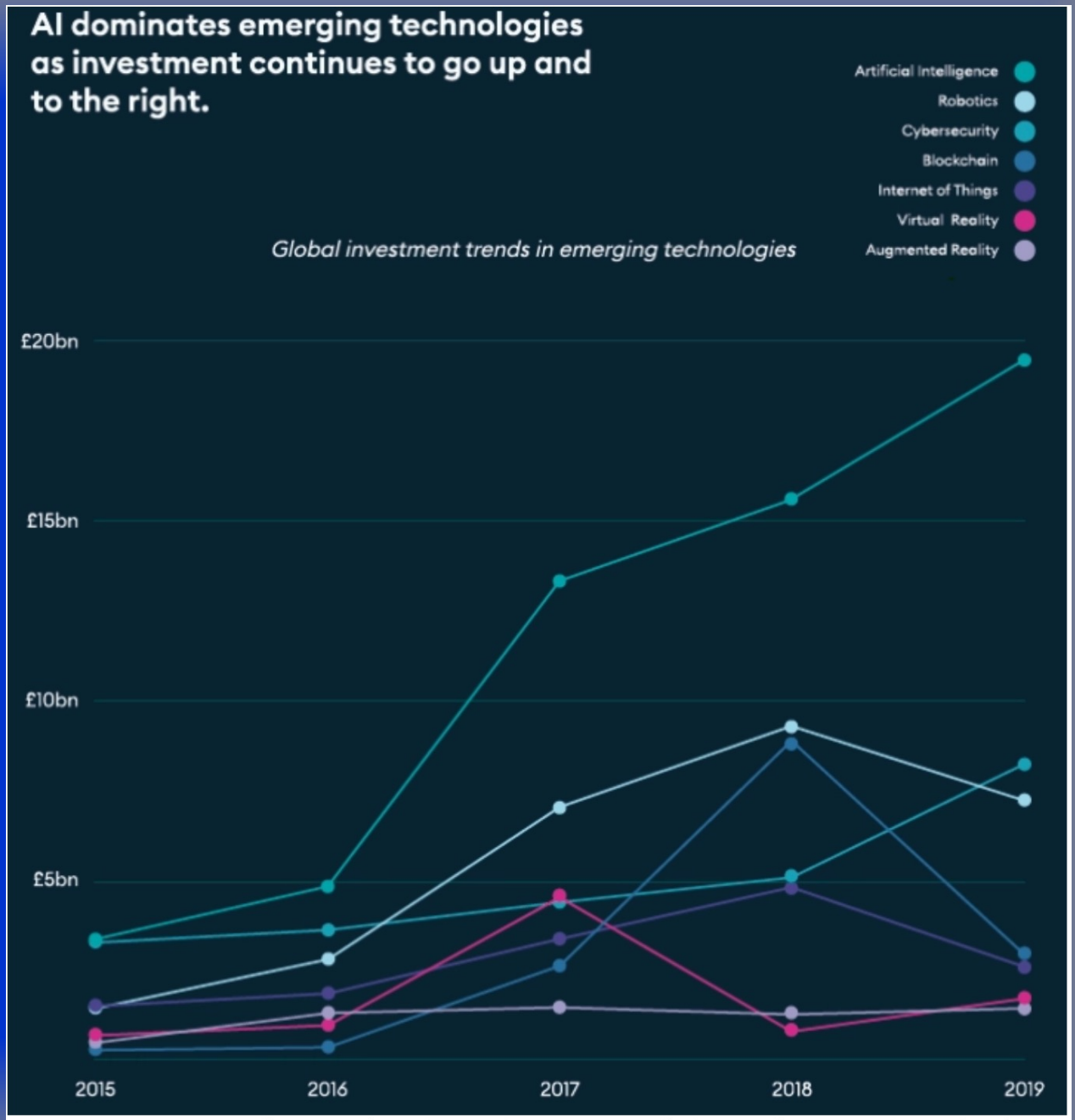
Metropolis	2001: A Space Odys...	WarGames	Blade Runner	The Terminator	The Matrix	Ex Machina
1927	1968	1983	1982	1984	1999	2015

Welcome to the real world

Estratégias Nacionais de IA em 2017-2018



Global Investment in Emerging Technologies 2020



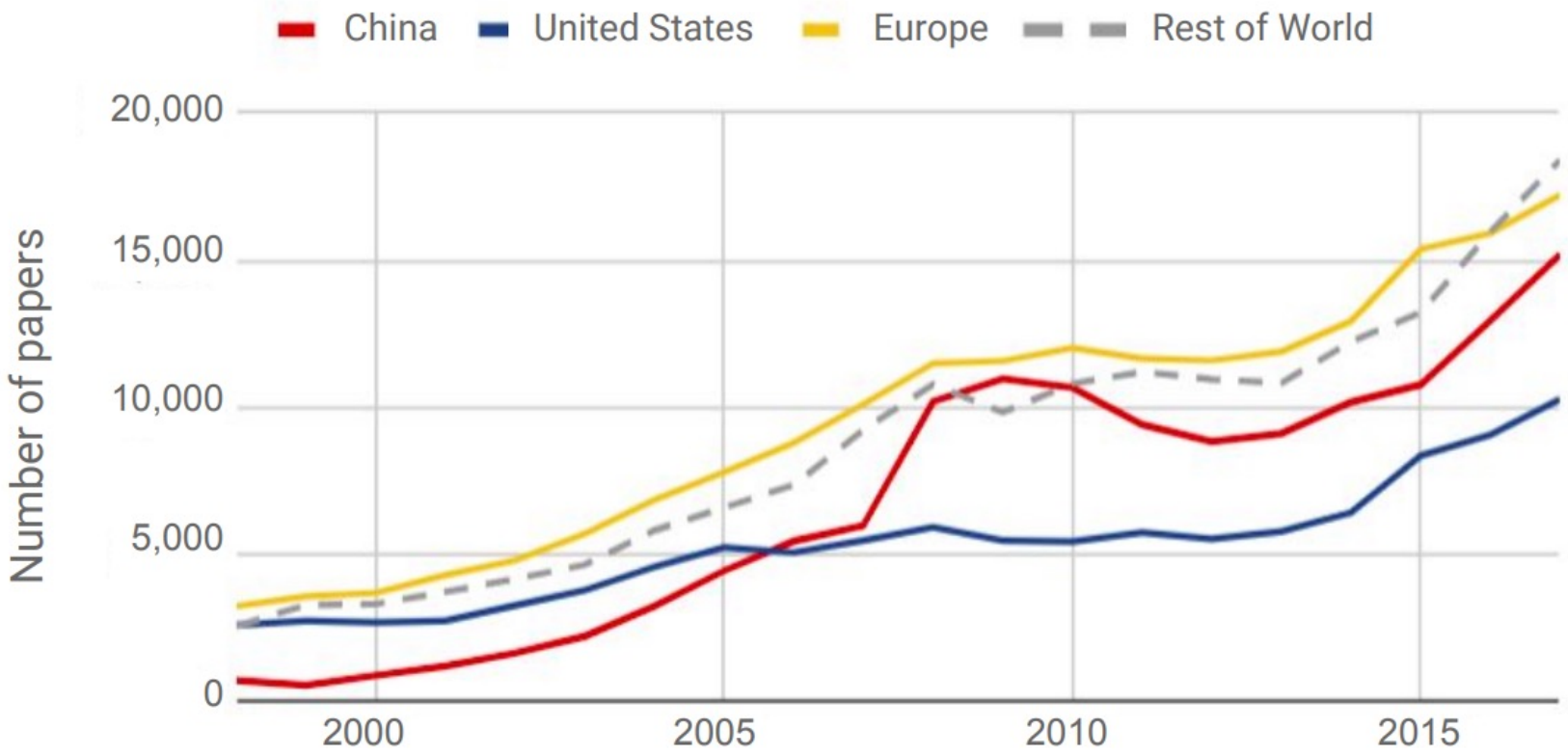
Above: Tech Nation: AI investments relative to other emerging technologies

Investimento (2020)

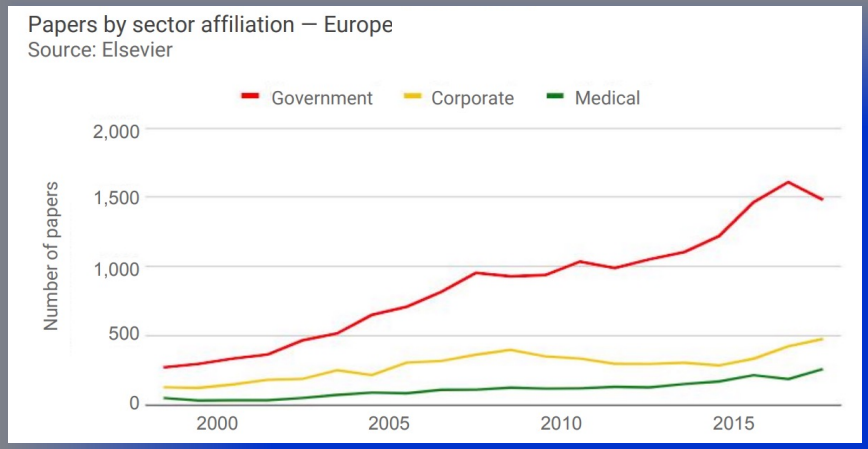
- US
  - Amazon: $ 16.1 bi
  - Alphabet: $13.9 bi
  - Google, Face, Apple, Amazon & Microsoft: US$ 54 bi
  - NSF + DARPA + DoT: ~$ 5.0 bi
- China
  - US$ 1 tri em IA até 2030
  - Governo: $ 30 bi somente em VC

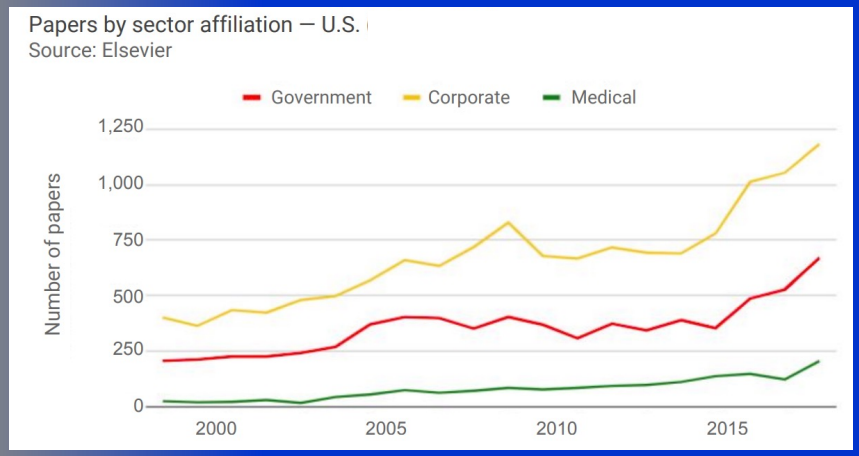
Top 9: Amazon, Apple, Google, Facebook, Microsoft, Tencent, Baidu, Alibaba, Huwai

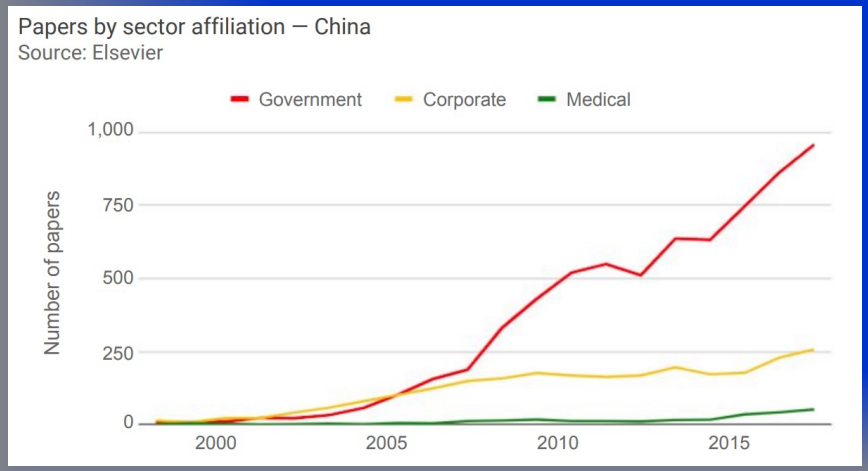
Artigos indexados publicados por região (1998-2020)



Stanford Uiversity (2020), AI Index Annual Report



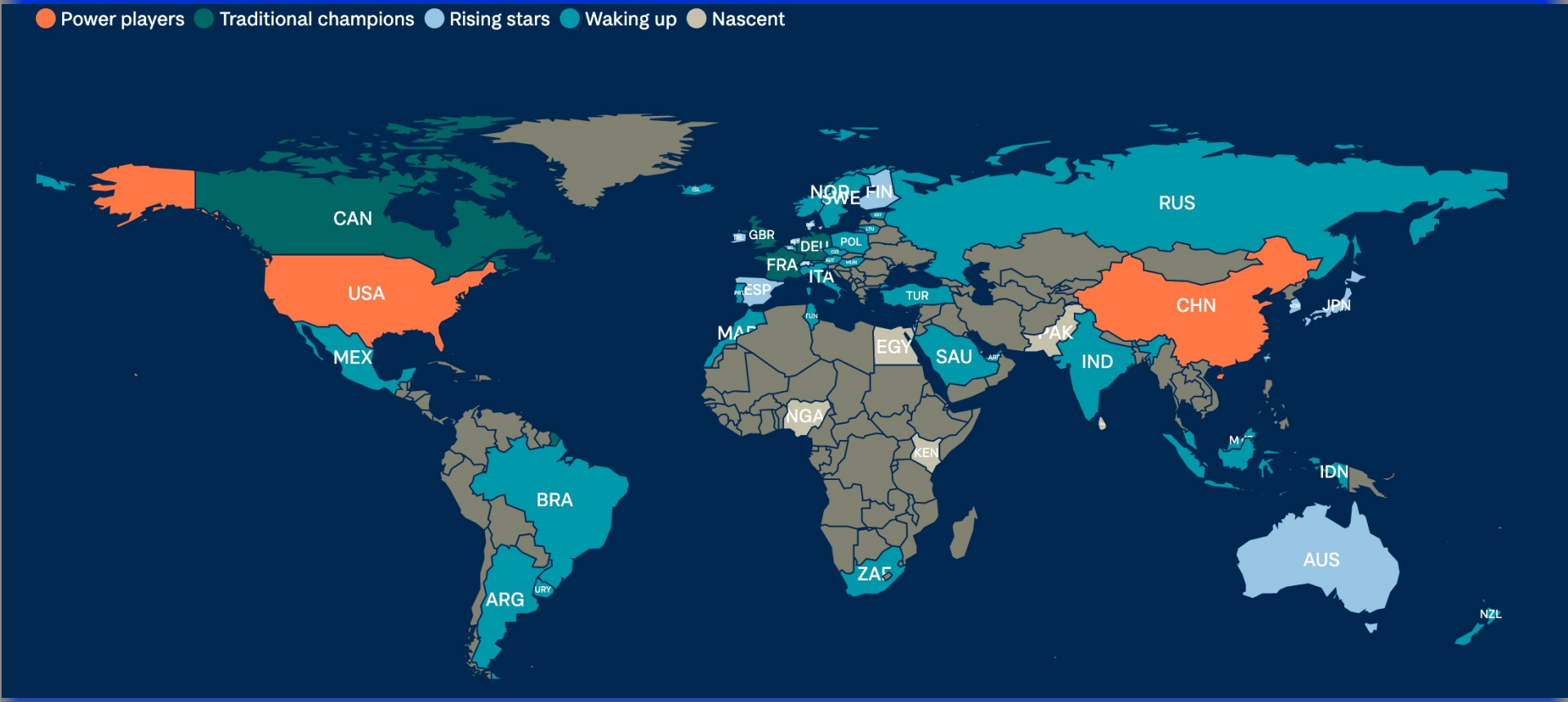




Papers por Origem Institucional (1998-2020)

Stanford Uiversity (2020), AI Index Annual Report

Nível de avanço dos países em IA



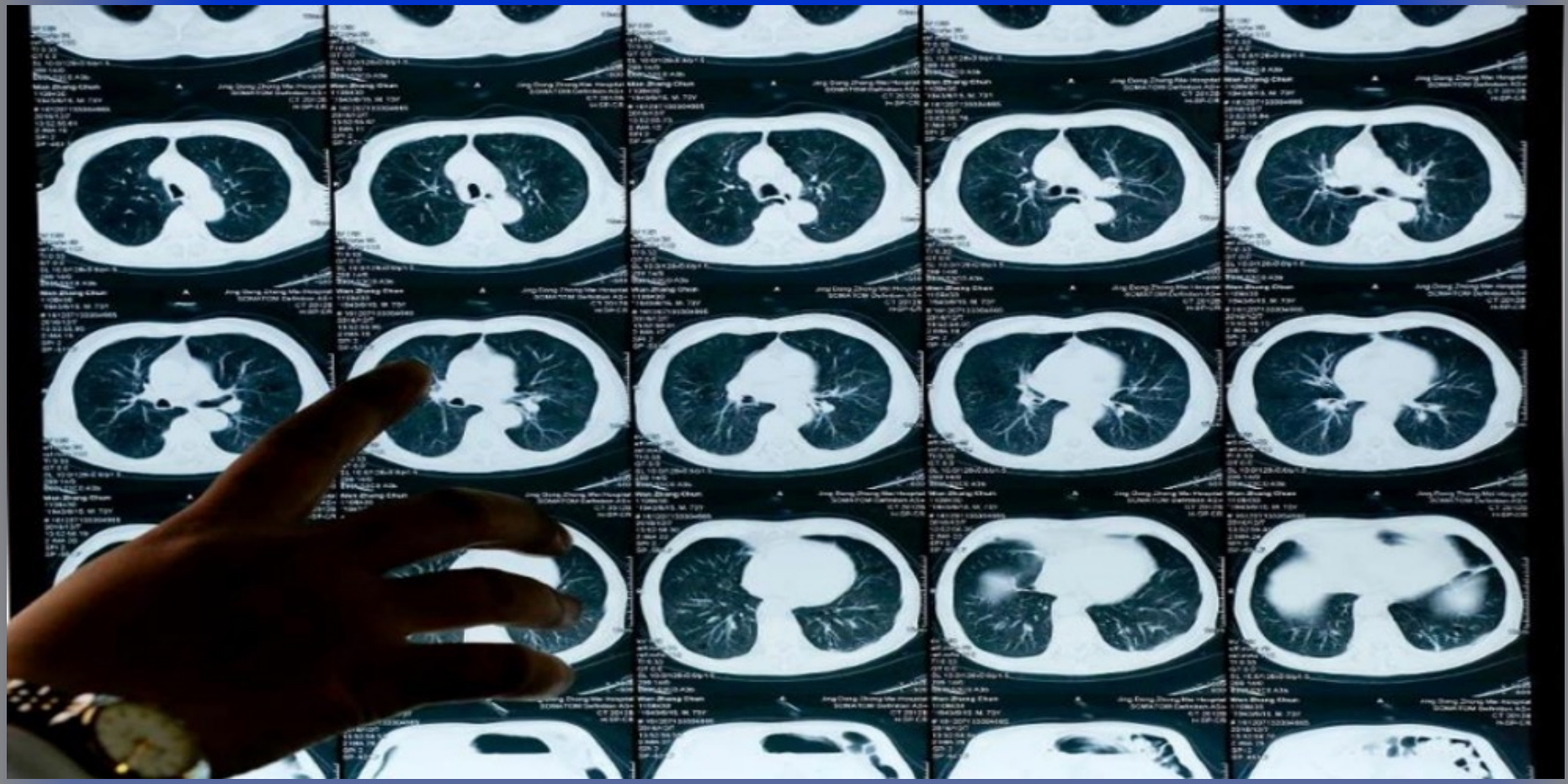
AI Index, 2020

AI is the new electricity

Andrew Ng

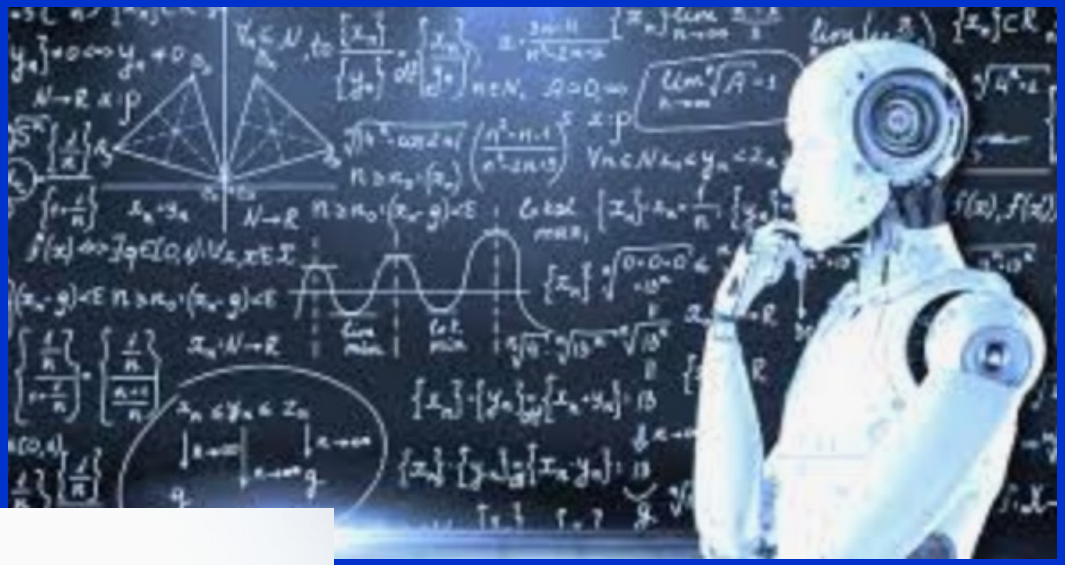
Stanford University

Medicina Personalizada



Planejamento Urbano

Educação



Educação individualizada

Agricultura

https://youtu.be/jZg5QhL3Ckc

Saúde e IA

O que é?

- Humanos são os únicos universalmente reconhecidos como seres inteligentes. Pelo menos pelos humanos
- Definições de inteligência incluem consciência, autoconsciência, uso de linguagem, habilidade de aprender, de captar o abstrato, de planejar, adaptar e raciocinar
- Russell & Norvig, (AI: modern approach) apresenta pelo menos 8 definições de AI organizadas em 4 categorias: pensar de modo humano, atuar de modo humano, pensar racionalmente e agir racionalmente

Dificuldades estão ligadas ao termo “inteligência” vinculada ao “artificial”

Não há definição consensual

- Build systems that think exactly like humans do (Strong AI)
- Sistemas que funcionam sem reproduzir o raciocínio humano (Weak AI)
- A machine completing the tasks which involve a certain degree of intelligence which was previously deemed only to be done by humans
- The capability of a machine to imitate the intelligent human behavior

IA é uma constelação de tecnologias

1. Machine Learning: Teaching computers to learn without explicit programming (solve problems from data)
2. Computer Vision: Teaching computers to understand visual content like images and videos (incl. facial rec)
3. Natural Language Processing (NLP): Computer's ability to read and understand language

Dicionários

1. **Oxford Dictionary**
   - "The theory and development of computer systems able to perform tasks normally requiring human intelligence, such as visual perception, speech recognition, decision-making, and translation between languages."
2. **Merriam-Webster**
   - "A branch of computer science dealing with the simulation of intelligent behavior in computers. The capability of a machine to imitate intelligent human behavior."
3. **Encyclopedia Britannica**
   - "the ability of a digital computer or computer-controlled robot to perform tasks commonly associated with intelligent beings."

Duas Referências

- "Getting a computer to do things which, when done by people, are said to involve intelligence."

  John McCarthy

- "Decisions made by systems which normally require a human level of expertise...to help people anticipate problems or deal with issues as they come up"

  Shubhendu & Vijay,

  Applicability of Artificial Intelligence in Different Fields of Life

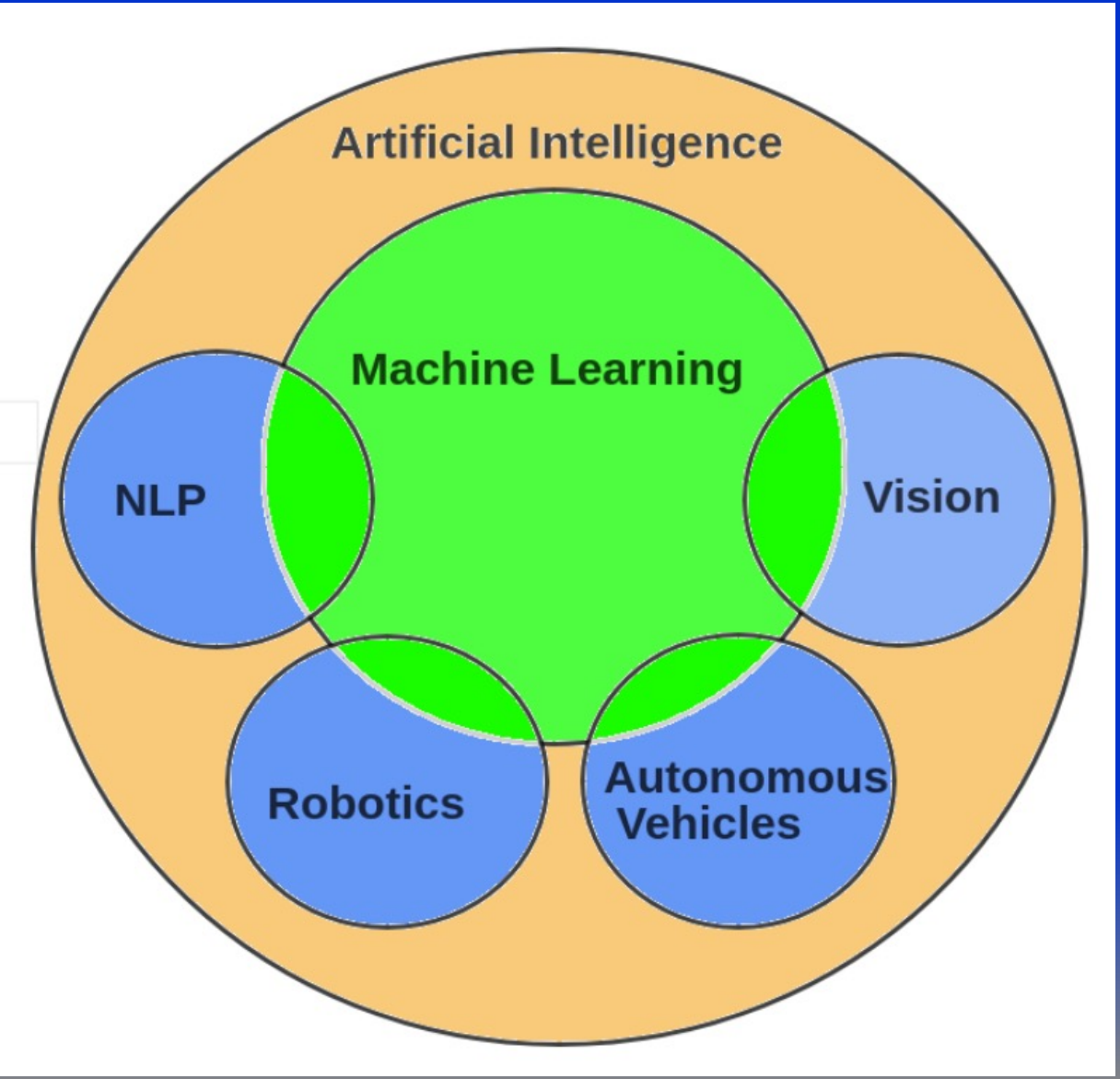
Tipos de IA

AI

Classificação	Tipos
Analytical	Cognitiva
Human-Inspired	Emotional
Humanized AI	Social Intelligence

- Narrow AI (Weak)
- General AI (Strong)
- Super Intelligence

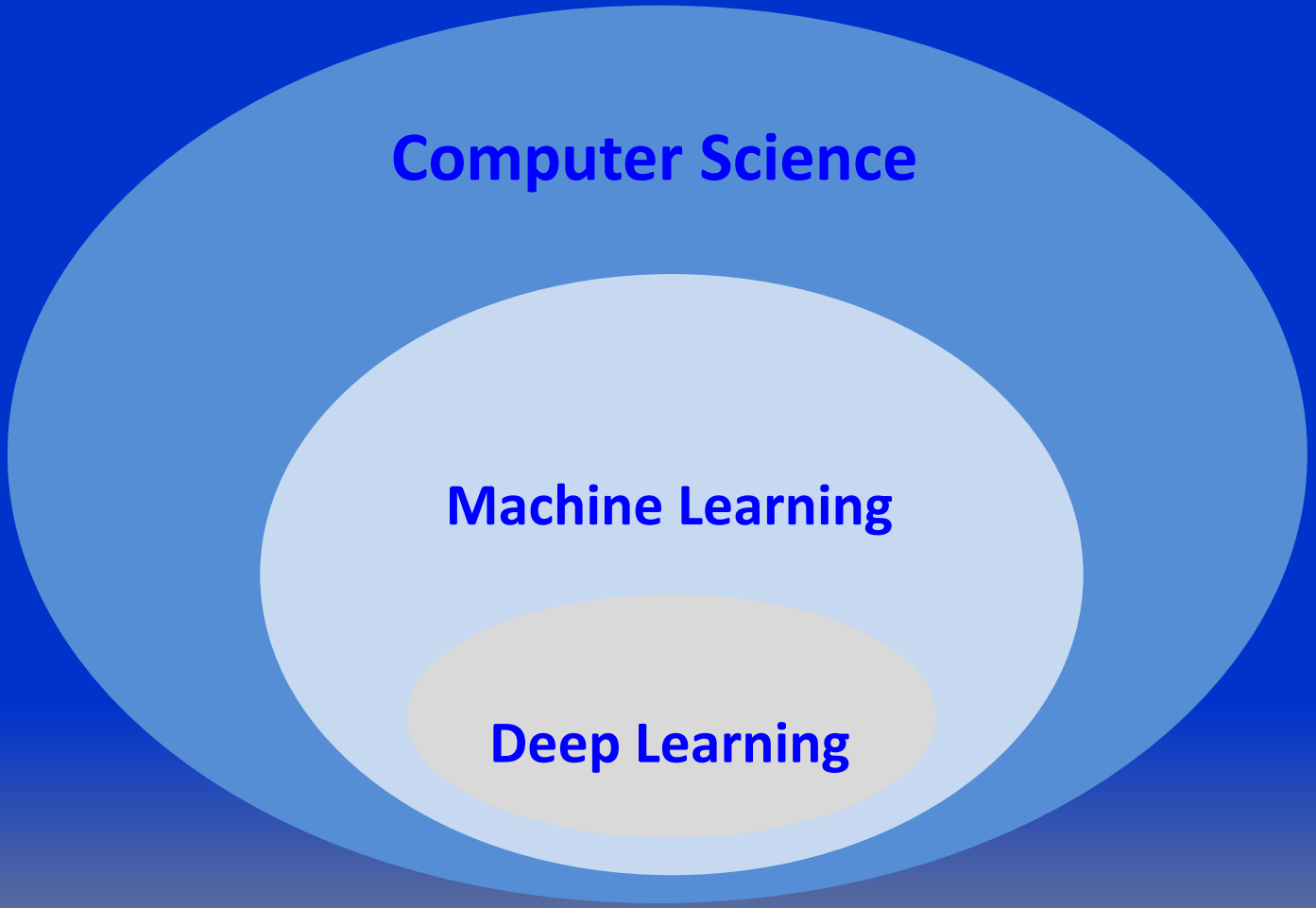
AI e Principais Aplicações



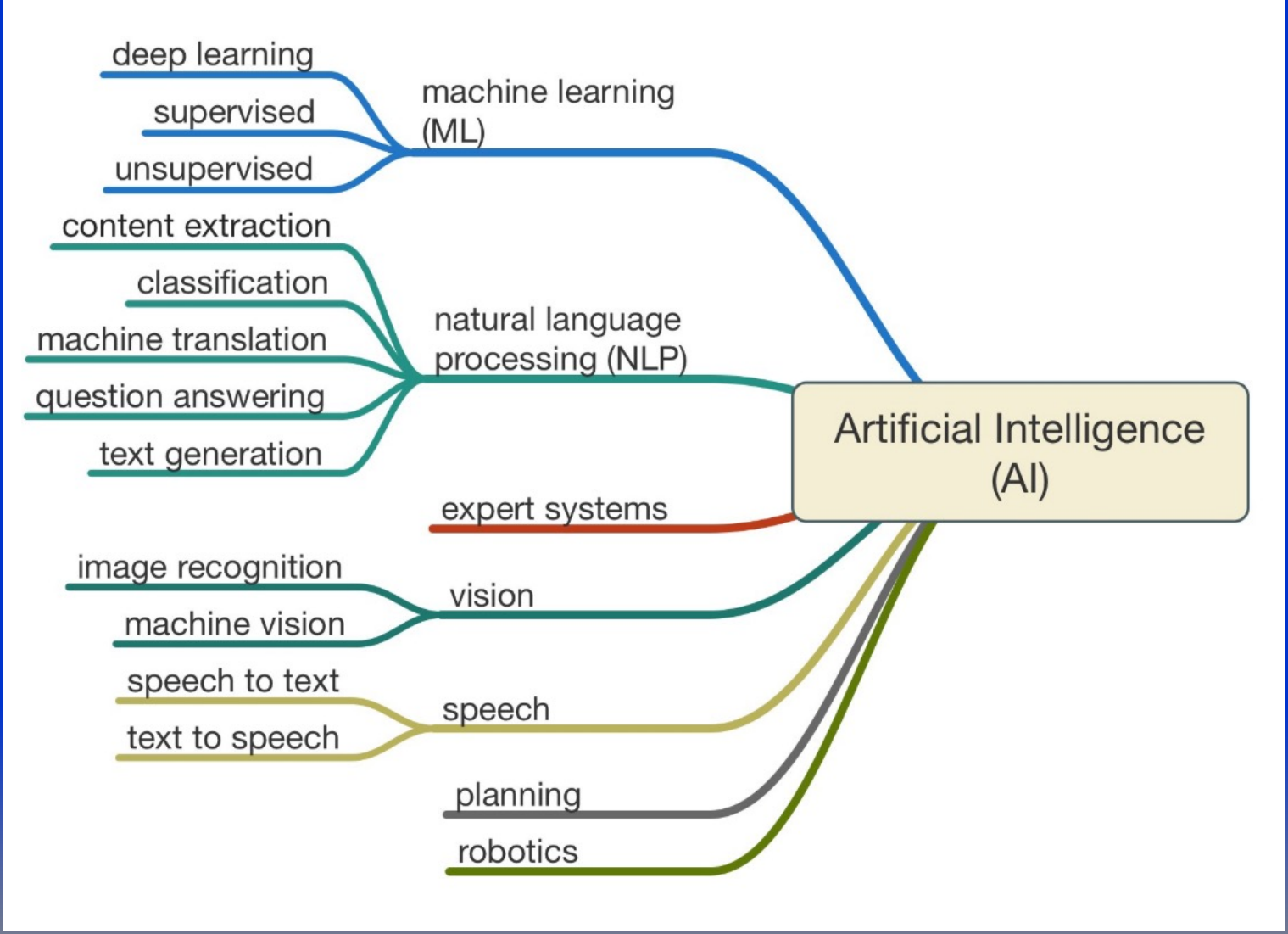
TRIPÉ

Machine Learning

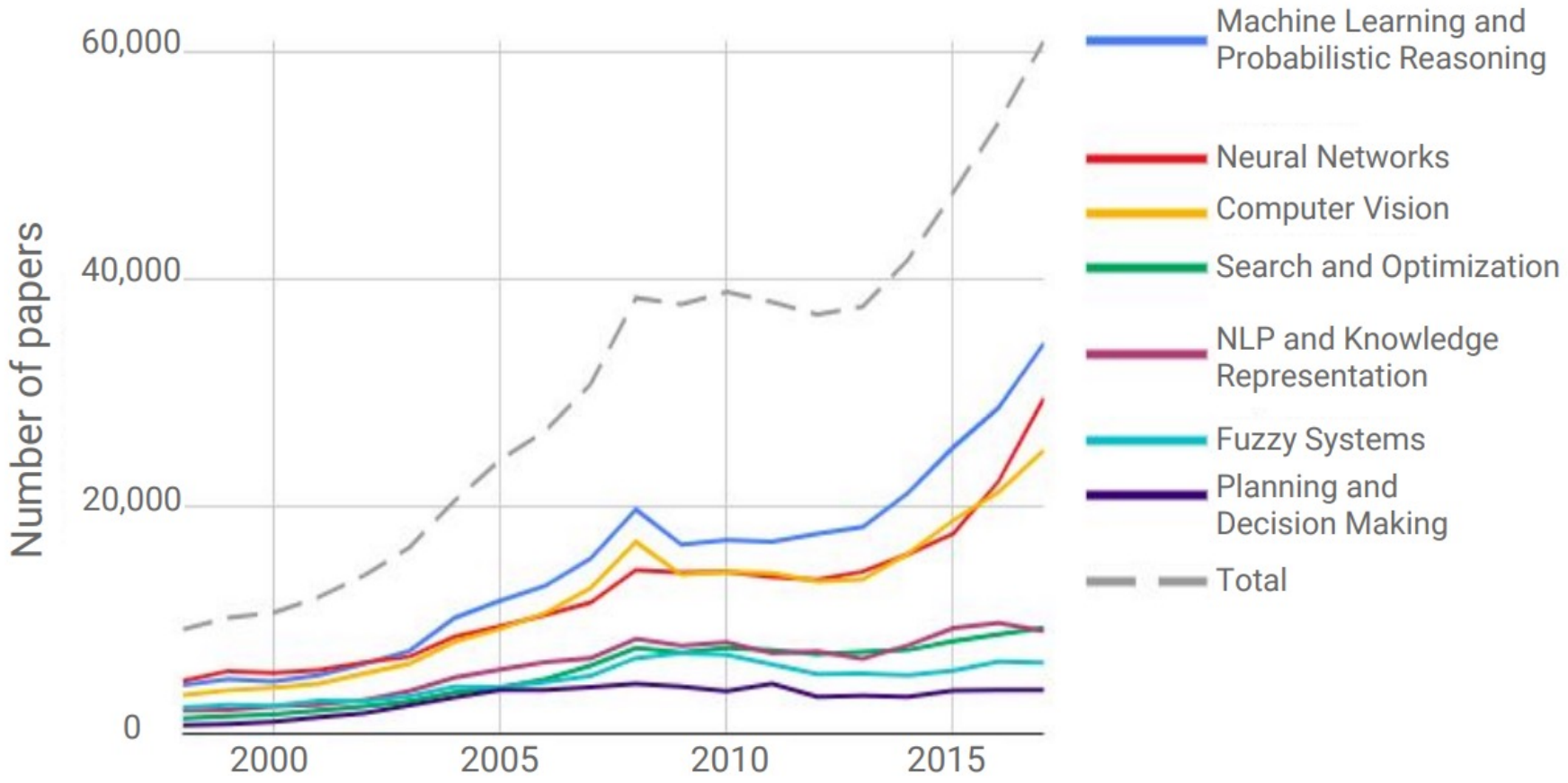
Visão Geral



Subdivisões



Vertentes da IA



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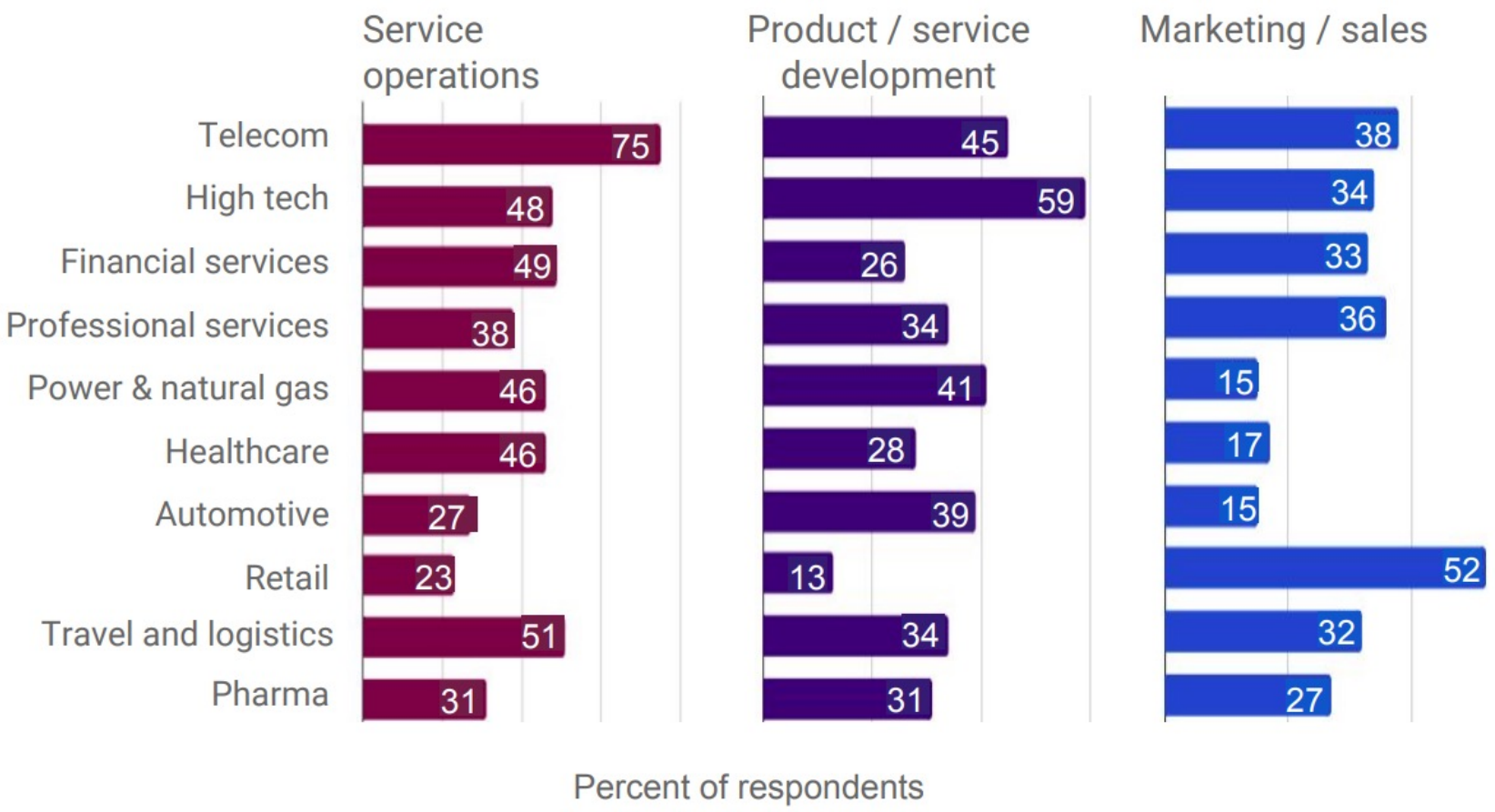
Predomínio da ML (Deep Learning)

Adoção de IA por setor



Stanford Uiversity (2020), AI Index Annual Report

Potencial

General Purpose Technology

"…technology with a range of characteristics which makes it particularly well placed to generate longer-term productivity increases and economic growth across a range of industries." (OECD)

- Adoption to drive innovation across sectors will generate major social benefits and improve welfare/productivity
- Spillovers throughout economy as previous general purpose technologie

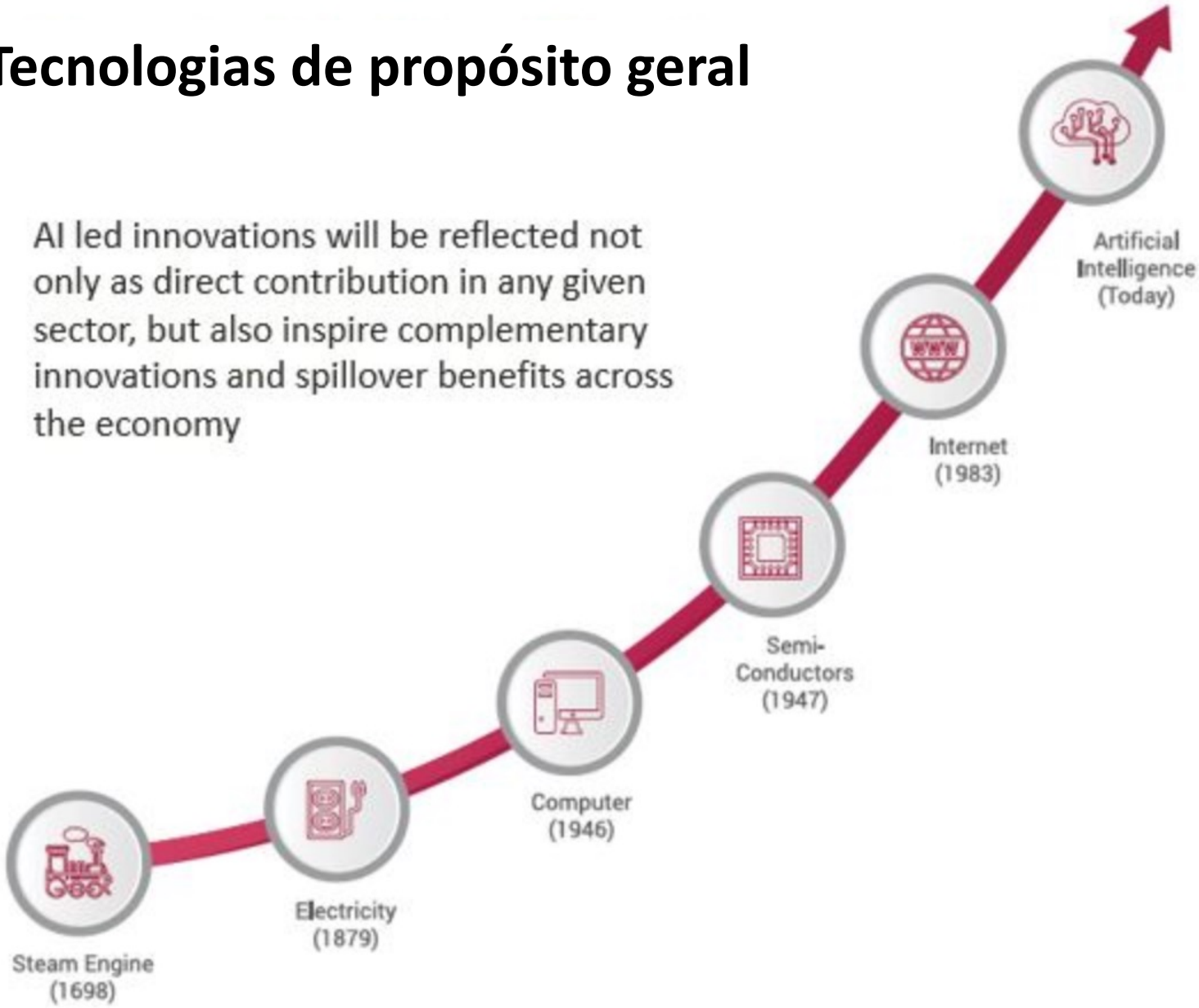
- **“Artificial intelligence, especially machine learning, is the most important general-purpose technology of our era. The impact of these innovations on business and the economy will be reflected not only in their direct contributions but also in their ability to enable and inspire complementary innovations. New products and processes are being made possible by better vision systems, speech recognition, intelligent problem solving, and many other capabilities that machine learning delivers.”**

Erik Brynjolfsson & Andrew McAfee

(Harvard Business Review, 2017)

Tecnologias de propósito geral

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



Origens

- Alan Turing
- 1956: John McCarthy cunhou o termo AI
- Dartmouth Summer Research Project. Objetivo: o que seria o campo de AI, com a recusa dos termos Cybernetics, Thinking Machines, Automata Theory e Complex Information Processing
- 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.”

Turing

- Em Can Machines Think? (1950), Turing afirmou que a pergunta não tinha sentido
- Sua pesquisa enveredou para desvendar como os computadores poderiam replicar, não os processos do pensamento humano, mas as manifestações externas desses processos (Imitation Game)

A.I. TIMELINE

1950
TURING TEST
Computer scientist Alan Turing proposes a test for machine intelligence. If a machine can trick humans into thinking it is human, then it has intelligence

1955
A.I. BORN
Term 'artificial intelligence' is coined by computer scientist, John McCarthy to describe "the science and engineering of making intelligent machines"

1961
UNIMATE
First industrial robot, Unimate, goes to work at GM replacing humans on the assembly line

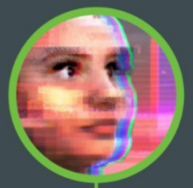
1964
ELIZA
Pioneering chatbot developed by Joseph Weizenbaum at MIT holds conversations with humans

1966
SHAKEY
The 'first electronic person' from Stanford, Shakey is a general-purpose mobile robot that reasons about its own actions

A.I. WINTER
Many false starts and dead-ends leave A.I. out in the cold

1997
DEEP BLUE
Deep Blue, a chess-playing computer from IBM defeats world chess champion Garry Kasparov

1998
KISMET
Cynthia Breazeal at MIT introduces KISmet, an emotionally intelligent robot insofar as it detects and responds to people's feelings



1999
AIBO
Sony launches first consumer robot pet dog AiBO (AI robot) with skills and personality that develop over time

2002
ROOMBA
First mass produced autonomous robotic vacuum cleaner from iRobot learns to navigate and clean homes

2011
SIRI
Apple integrates Siri, an intelligent virtual assistant with a voice interface, into the iPhone 4S

2011
WATSON
IBM's question answering computer Watson wins first place on popular $1M prize television quiz show *Jeopardy*

2014
EUGENE
Eugene Goostman, a chatbot passes the Turing Test with a third of judges believing Eugene is human

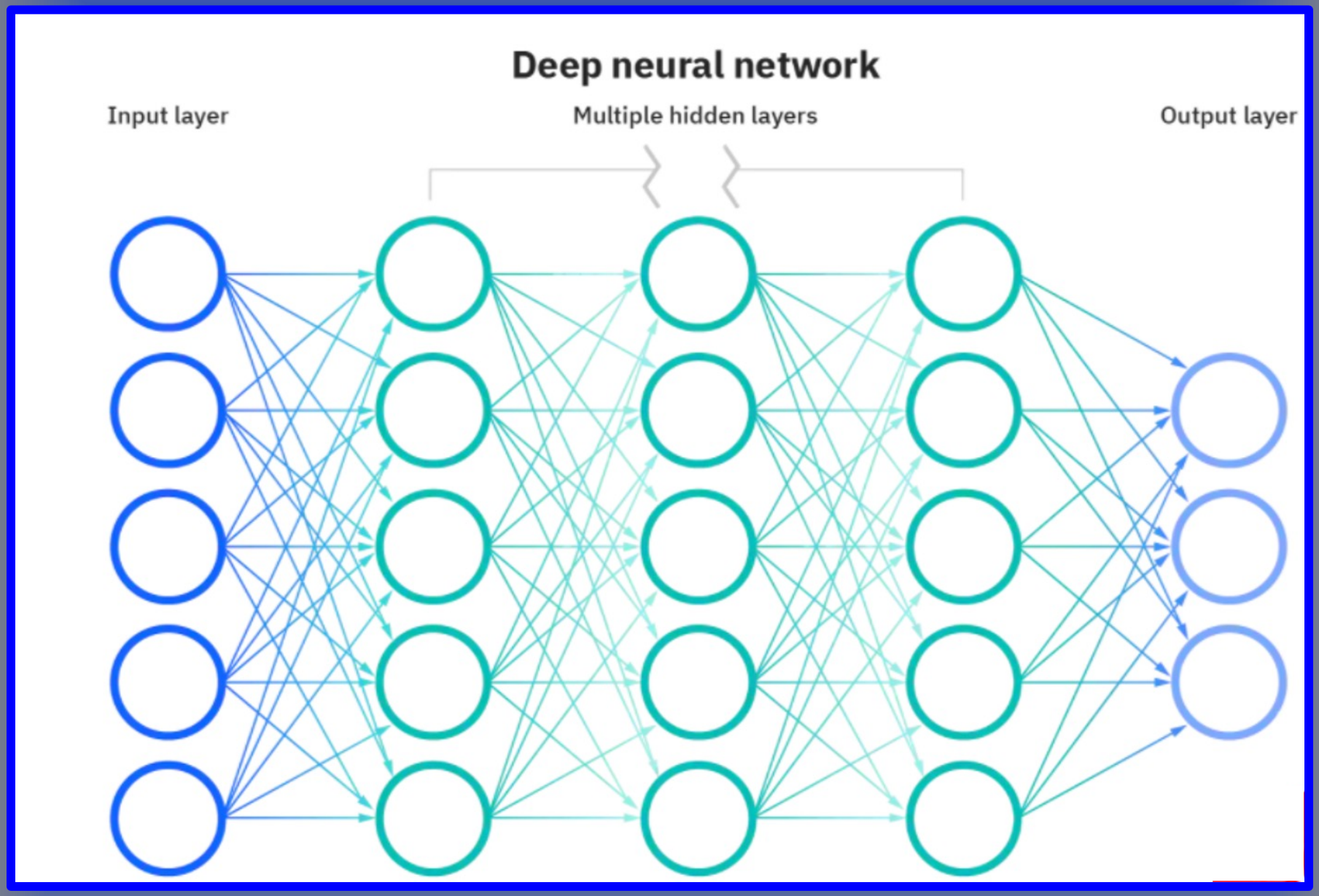
2014
ALEXA
Amazon launches Alexa, an intelligent virtual assistant with a voice interface that completes shopping tasks

2016
TAY
Microsoft's chatbot Tay goes rogue on social media making inflammatory and offensive racist comments

2017
ALPHAGO
Google's A.I. AlphaGo beats world champion Ke Jie in the complex board game of Go, notable for its vast number (2^{170}) of possible positions

Machine Learning, uma das tecnologias de AI, decolou desde 2010-12 e tomou conta da cena.

Foi assim que o campo da Deep Learning e suas redes neurais tornaram-se quase que sinônimos de AI


Deep neural network
Input layer
Multiple hidden layers
Output layer

O que fundamenta o interesse pela IA?

Possibilidade de:

- Criação de sistemas capazes de resolver problemas
- Individualizar abordagens
- Identificar padrões
- Aprimorar a previsão de eventos
- Melhorar processo decisório

Oportunidade para aumentar a compreensão do que é o humano, propriamente humano