



# COINPI/2025

IA na Vida Acadêmica  
e Pesquisa Científica

*Michael Souza (UFC)*

# Da Curiosidade à Necessidade

"IA é o avanço tecnológico mais significativo desde a interface gráfica.

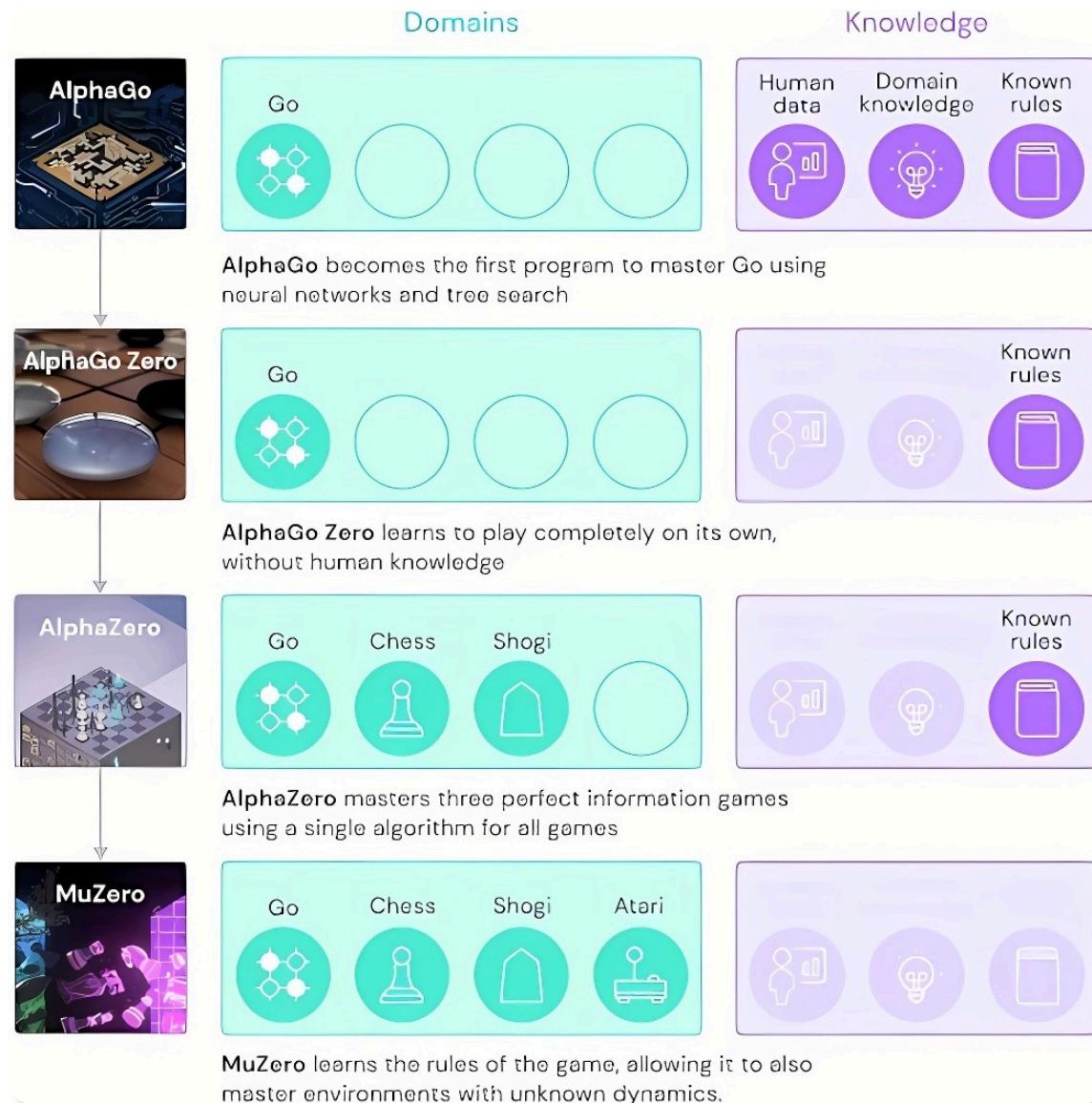
Assim como o microprocessador e a Internet, ela transformará a maneira como trabalhamos, aprendemos, viajamos e nos comunicamos."

Bill Gates  
Microsoft



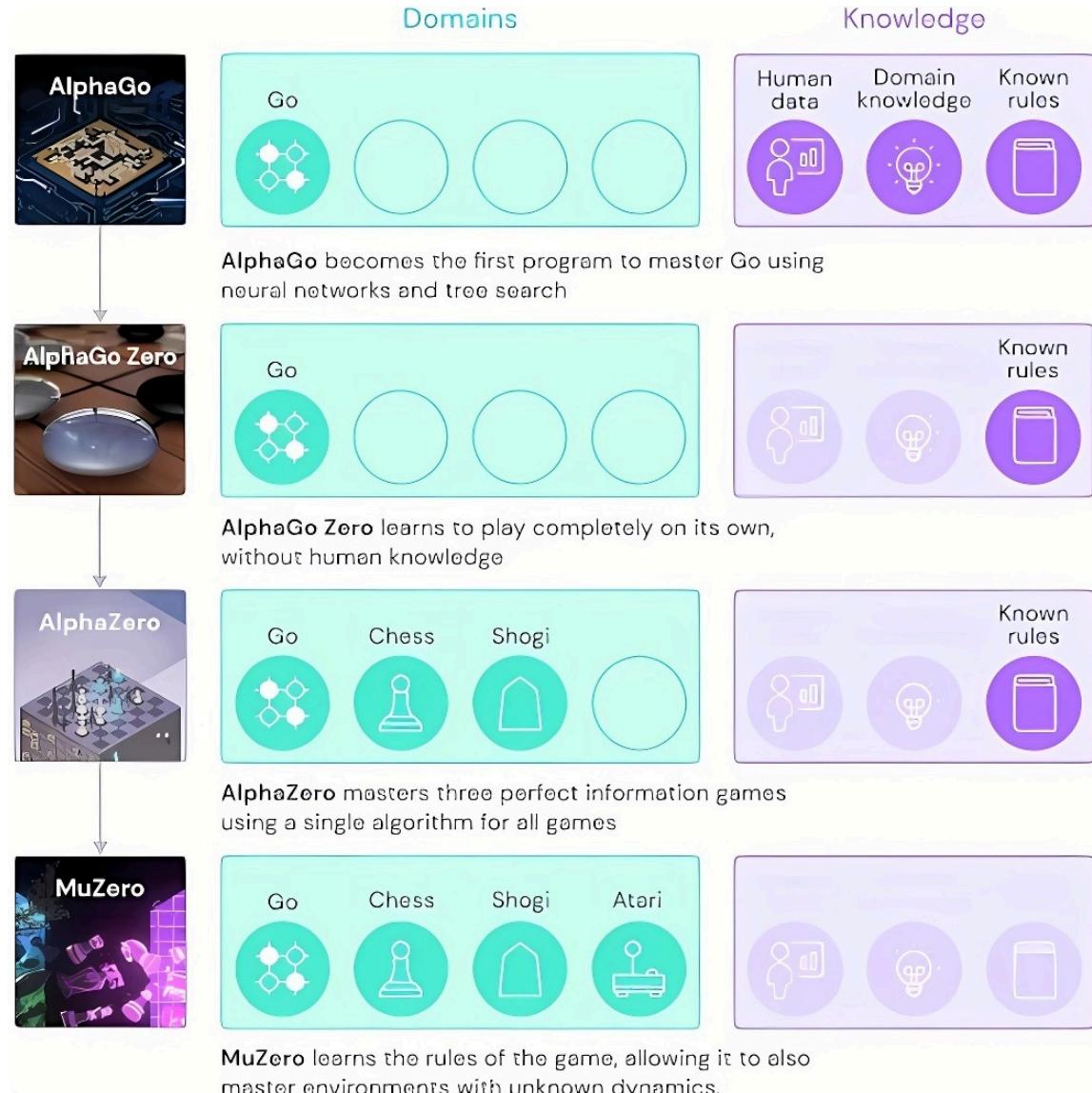
*The Age of AI has begun [Bill Gates, 2023]*

Jan, 2016

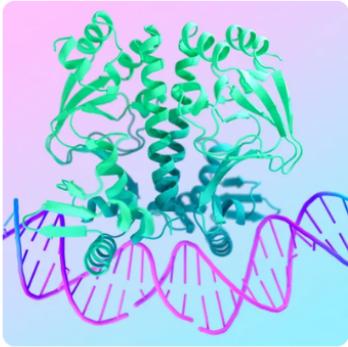


*MuZero: Mastering Go, chess, shogi and Atari without rules [DeepMind, 2020]*

Jan, 2016



## AlphaFold

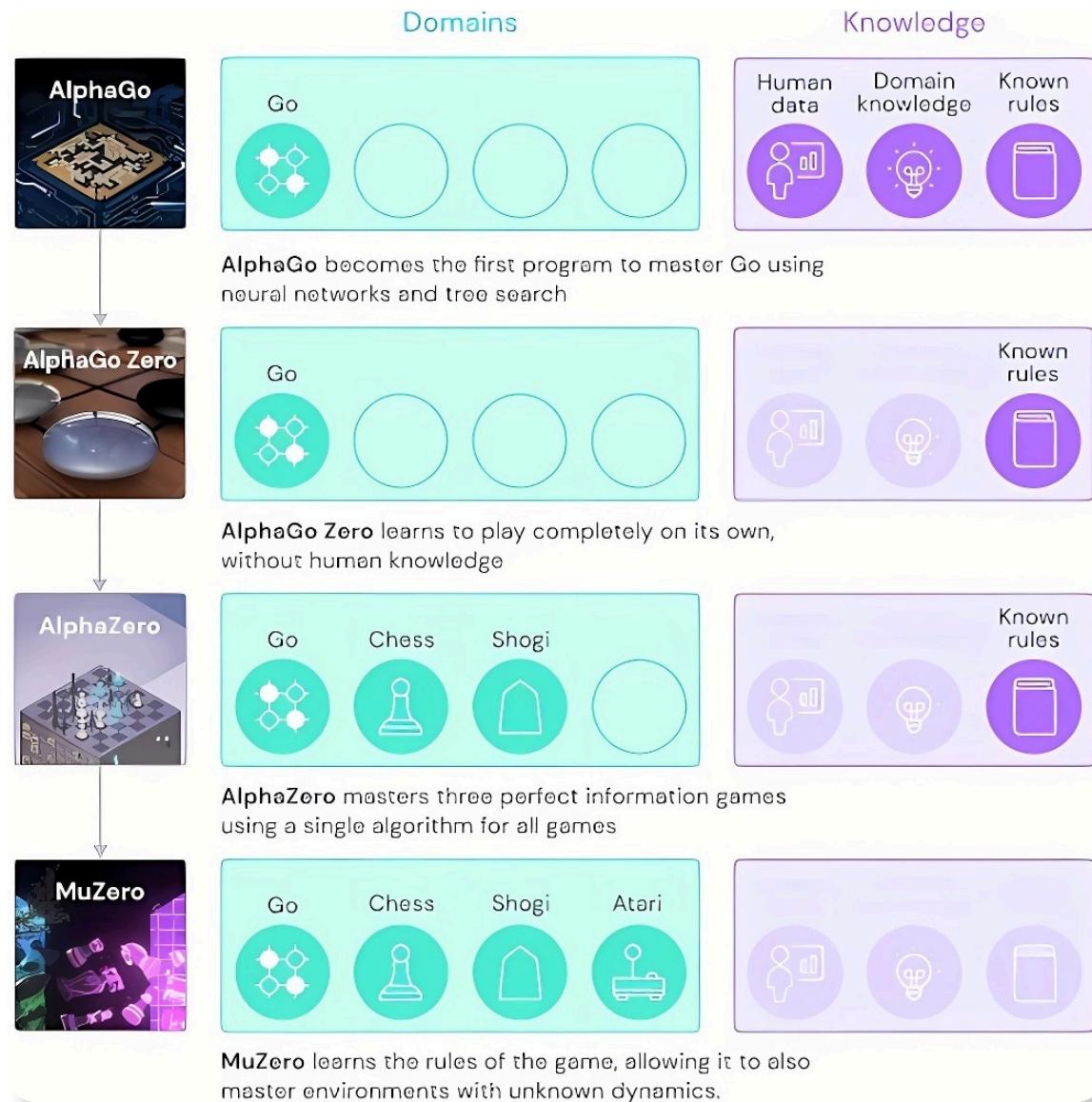


Nov, 2020

"O que nos levou **meses e anos** para fazer, o AlphaFold conseguiu fazer em um **fim de semana**."  
*McGeehan, Univ. Portsmouth*

*'It will change everything': DeepMind's AI makes gigantic leap in solving ... [Callaway, 2020]*

Jan, 2016



Nobel, 2024

**Geoffrey Hinton**  
(esquerda) e **Demis Hassabis** (direita)  
ganhadores de Nobel de  
Física e Química  
contribuições em IA.

*'Is AI physics or chemistry? Nobel Prize wins spark debate about tech's role in science [Davies, 2024]'*



Fev, 2022



Abr, 2022



Jul, 2022

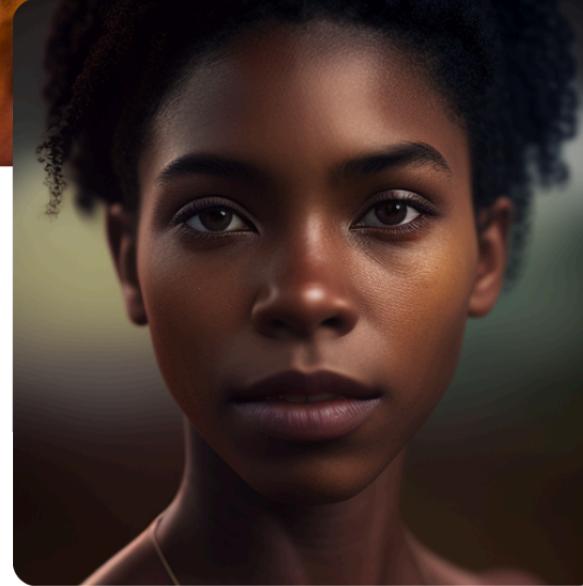
[Midjourney, 2022-2023]



Fev, 2022

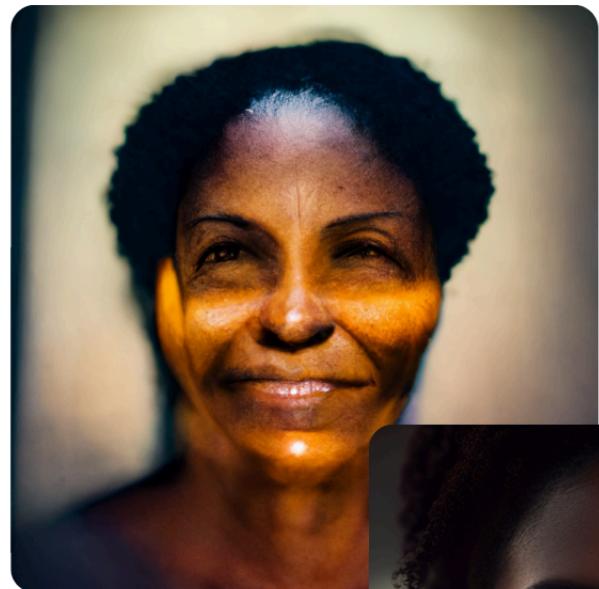


Jul, 2022



Nov, 2022

[Midjourney, 2022-2023]



Fev, 2022



Nov, 2022

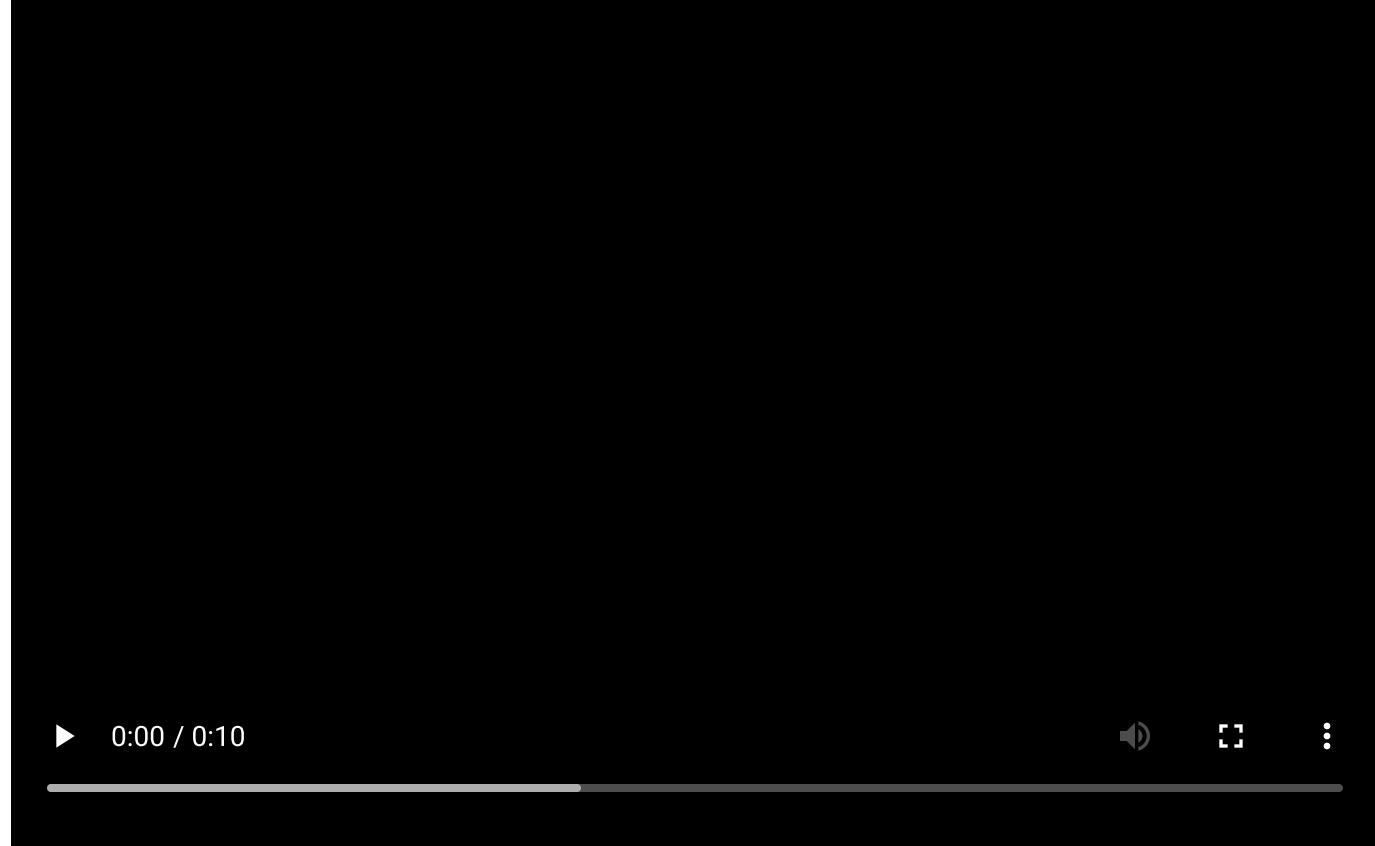


Mai, 2023

[Midjourney, 2022-2023]



2024



[Runway, 2024]



2025



[Veo 3, 2025]



**"She's like me,  
without the jetlag"**

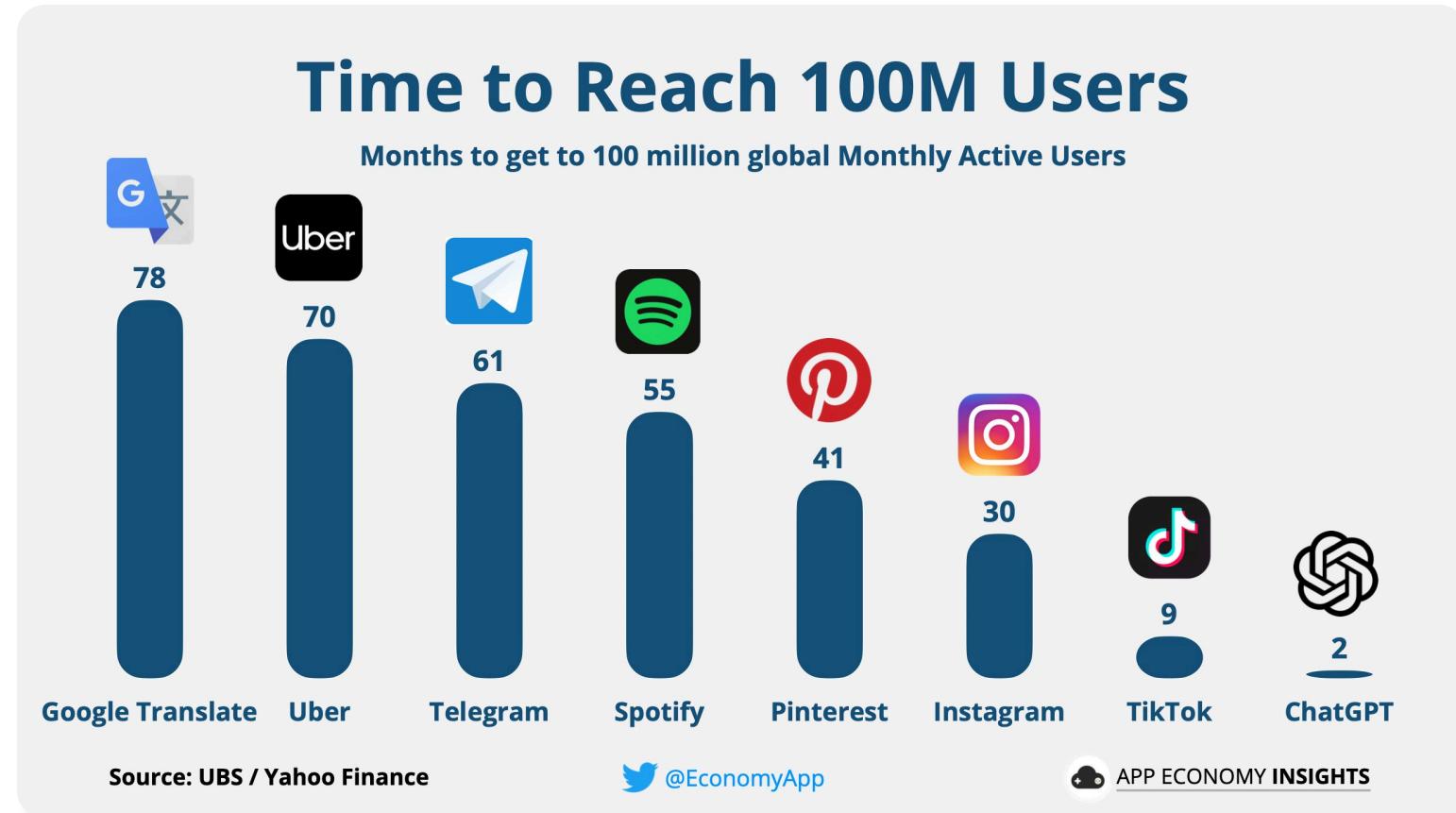
- Mathilda

Mathilda Gvariani / NEXT New York

Digital Twin

*H&M Knows Its AI Models Will Be Controversial [Bain, 2025]*

# Tempo para alcançar 100 milhões de usuários

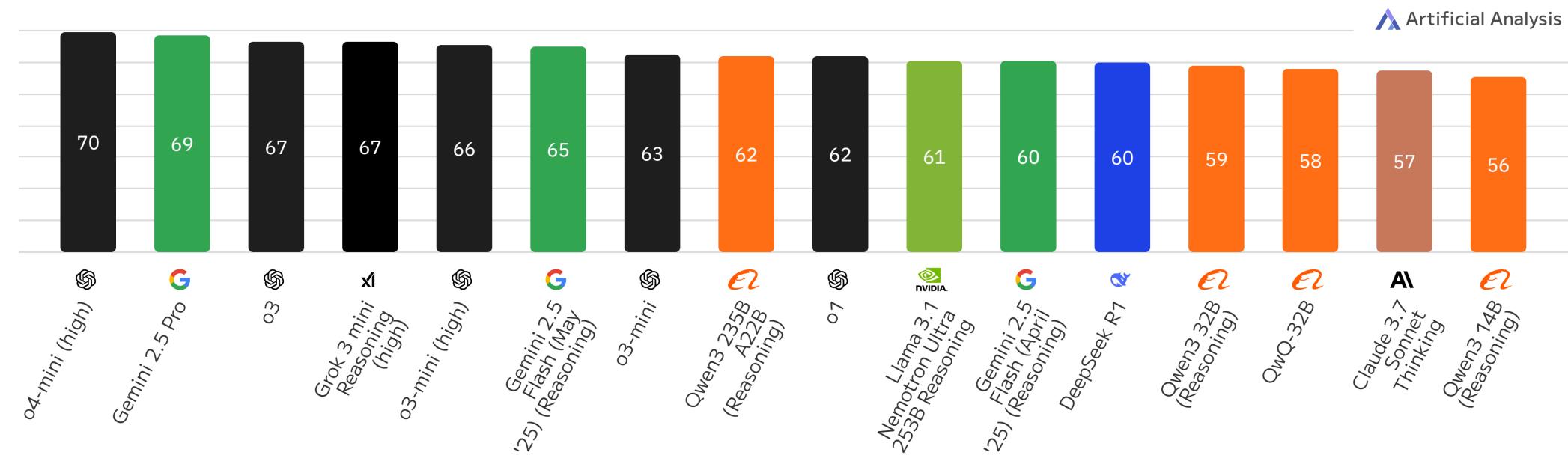


*Threads becomes fastest-ever app to surge past 150 MILLION ... [Daily Mail, 2023]*

## Artificial Analysis Intelligence Index

### Frontier Models

Intelligence Index incorporates 7 evaluations: MMLU-Pro, GPQA Diamond, Humanity's Last Exam, LiveCodeBench, SciCode, AIME, MATH-500



Artificial Analysis Intelligence Index (Frontier Models) [Artificial Analysis, 21/05/2025]

# The Cybernetic Teammate: A Field Experiment on Generative AI Reshaping Teamwork and Expertise

Fabrizio Dell'Acqua  
Charles Ayoubi  
Hila Lifshitz  
Raffaella Sadun  
Ethan Mollick  
Lilach Mollick

Yi Han  
Jeff Goldman  
Hari Nair  
Stew Taub  
Karim R. Lakhani

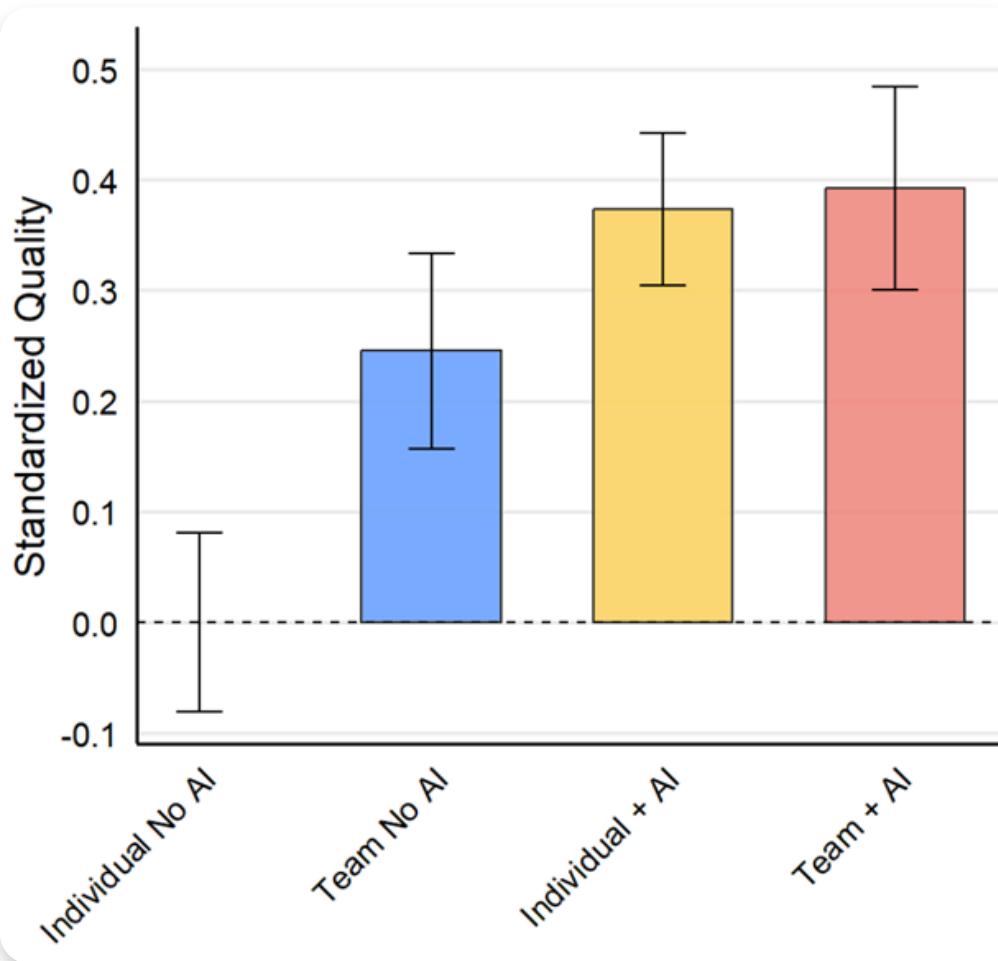
## Abstract

We examine how artificial intelligence transforms the core pillars of collaboration—performance, expertise sharing, and social engagement—through a pre-registered field experiment with 776 professionals at Procter & Gamble, a global consumer packaged goods company. Working on real product innovation challenges, professionals were randomly assigned to work either with or without AI, and either individually or with another professional in new product development teams. Our findings reveal that AI significantly enhances performance: individuals with AI matched the performance of teams without AI, demonstrating that AI can effectively replicate certain benefits of human collaboration. Moreover, AI influenced the way professionals worked: R&D professionals tended to suggest more technical solutions, while Commercial professionals leaned towards commercially-oriented proposals. Professionals using AI produced balanced solutions, regardless of their professional background. Finally, AI's language-based interface prompted more positive self-reported emotional responses among participants, suggesting it can fulfill part of the social and motivational role traditionally offered by human teammates. Our results suggest that AI adoption at scale in knowledge work reshapes not only performance but also how expertise and social connectivity manifest within teams, compelling organizations to rethink the very structure of collaborative work.

**Keywords:** Artificial intelligence, Teamwork, Human-machine interaction, Productivity, Skills, Innovation, Field experiment.



Harvard  
Business  
School



*The Cybernetic Teammate: A Field Experiment on Generative AI Reshaping Teamwork and Expertise*  
[Dell'Acqua et. al, 2025] (776 professionals at Procter and Gamble)

# Melhoria vs Transformação



*... What the Success of Chalkboards Tells Us About the Future of Computers ... [Krause, 2000]*

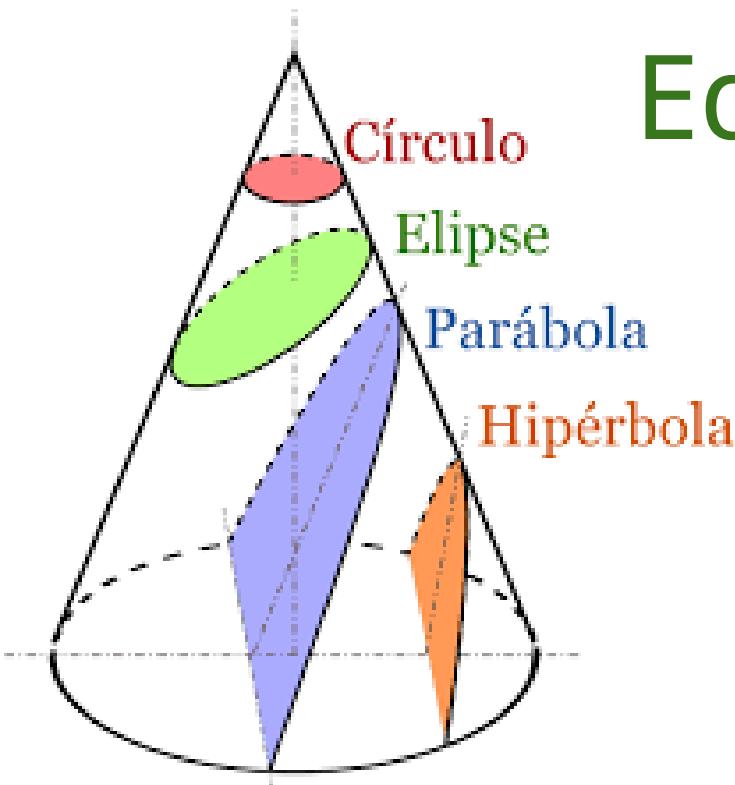


# Um mundo pixelado

## Os riscos da IA na educação

- Redução do pensamento crítico
- Dependência tecnológica
- Imprecisão e viés
- Impactos sociais e tecnológicos

*Socrates on the Forgetfulness that Comes with Writing [Plato, 370 a.C.]*



# Educação: Conteúdo e Forma

- Em 1825, o quadro negro foi adotado na universidade de Yale.
- Em 1830, os alunos passaram a ser obrigados a reproduzir de memória partes dos livros nos quadros.

*Conic Sections Rebellion - Degenerates (Yale) [Lucy Rycroft-Smith, 2018]*

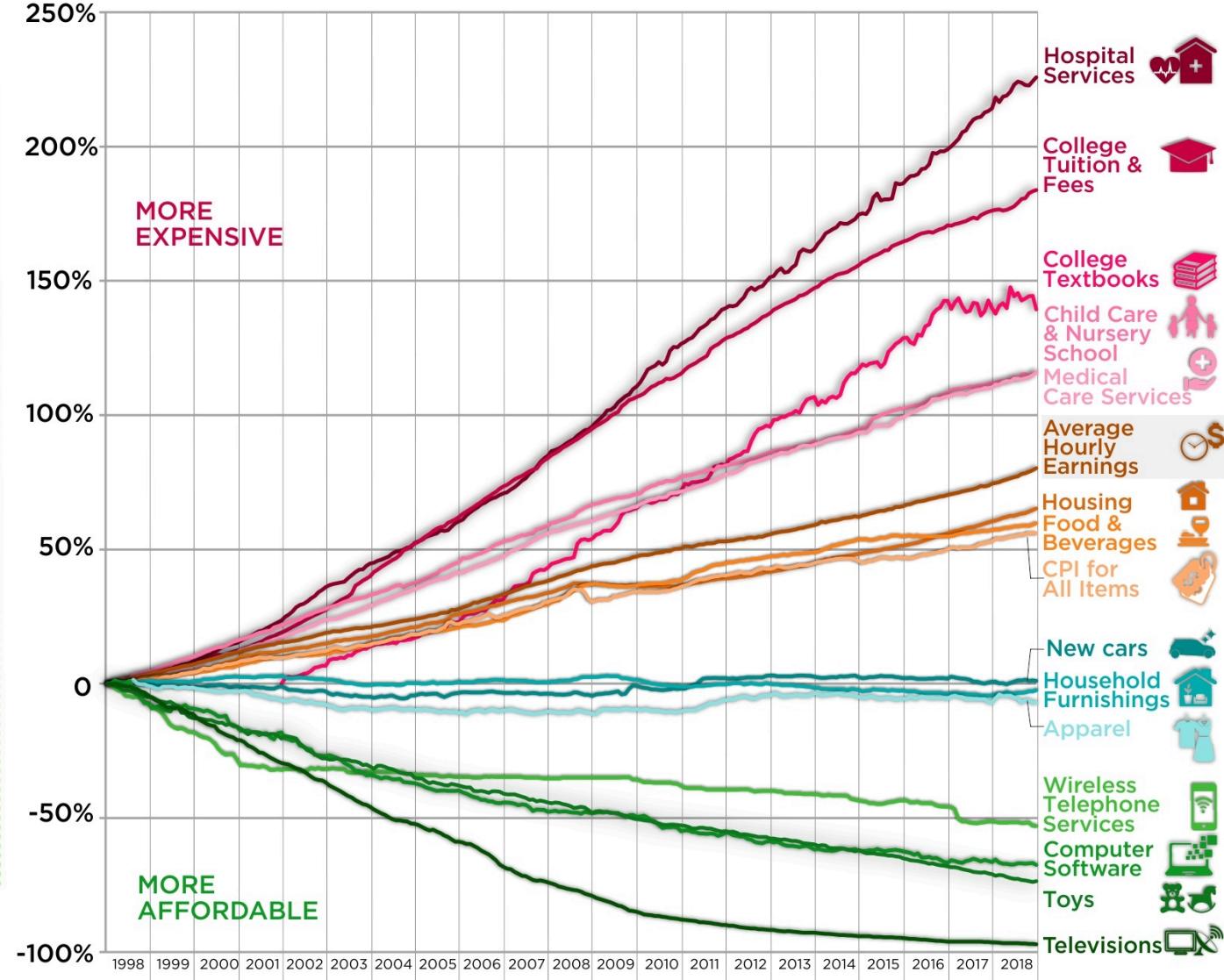


# Universalizar vs. Pasteurizar

- *Descentralização Curricular*
- *Educação Inclusiva*
- *Avaliações Personalizadas*
- *Feedbacks Contínuos*

## 20 Years of Price Changes in The United States

Selected Consumer Goods & Services, Wages (January 1998 to December 2018)



Article & Sources:

<https://howmuch.net/articles/price-changes-in-usa-in-past-20-years>

CPI and other price indices - Bureau of Labor Statistics - <https://data.bls.gov/PDQWeb/cu>

Average hourly earnings - Bureau of Labor Statistics - <https://data.bls.gov/timeseries/CES0500000008>

## Efeito Baumol

- *Custos crescentes sem ganhos de produtividade*
- *Impacto na oferta de serviços essenciais*

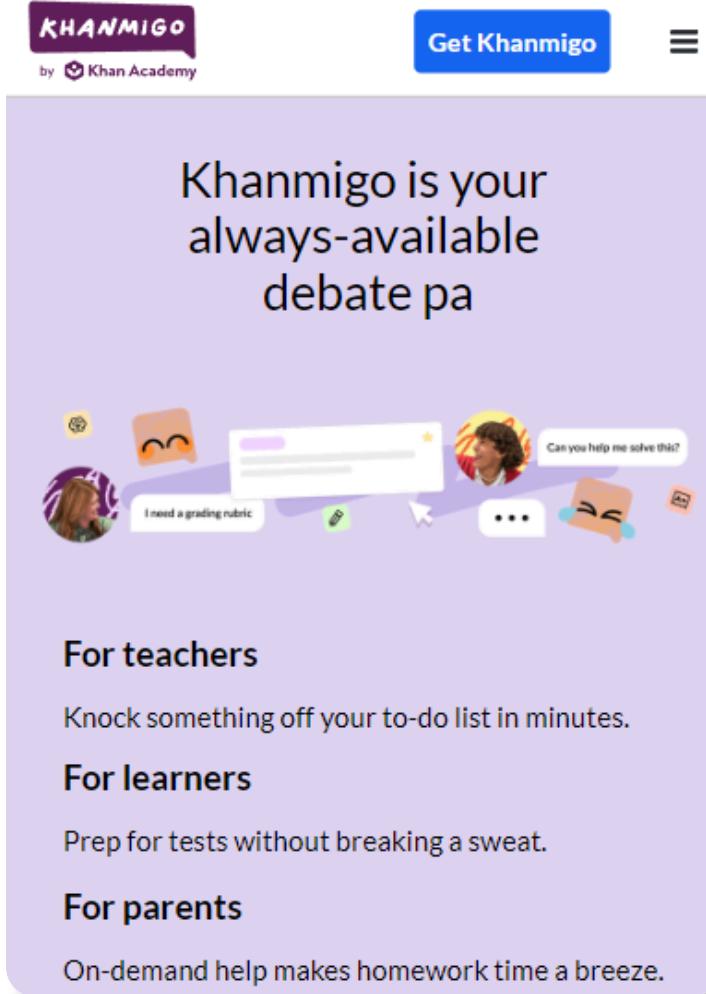


# IA na Educação (GPT4-o, Sal & Imran Khan)

GPT-4o (Omni) math tutoring demo on Khan Academy



[Youtube, 2024]



KHANMIGO  
by Khan Academy

Get Khanmigo

Khanmigo is your always-available debate pa

For teachers  
Knock something off your to-do list in minutes.

For learners  
Prep for tests without breaking a sweat.

For parents  
On-demand help makes homework time a breeze.

"Os educadores podem acessar um ***banco de dados de exercícios*** recomendados para os alunos, ***analisar tendências*** da turma e ***simplificar tarefas*** administrativas."

***Sal Khan (CEO Khan Academy)***

*Bill Gates Visits First Avenue School: Commends Innovative Use of Technology [NPS, 2024]*

# First Avenue School

- 1.081 alunos
- 98% minorias, 86% econ. desfavorecidos
- Relação aluno-professor: 15:1
- Atende do PK (4 anos) ao 8º ano
- Proficiência 21% matemática, 36% leitura



*First Avenue School Makes U.S. News Rankings for 2024 [NPS, 2024]*

# Limitações

- Erros na resolução de problemas
- Ajuda excessiva durante as avaliações
- Alinhamento pedagógico
- Mais treinamento para professores



*Newark Public Schools Among 1st in US to Pilot New AI Tutor [Mosaic, 2024]*



Stanford  
University

# Can large language models provide useful feedback on research papers? A large-scale empirical analysis.

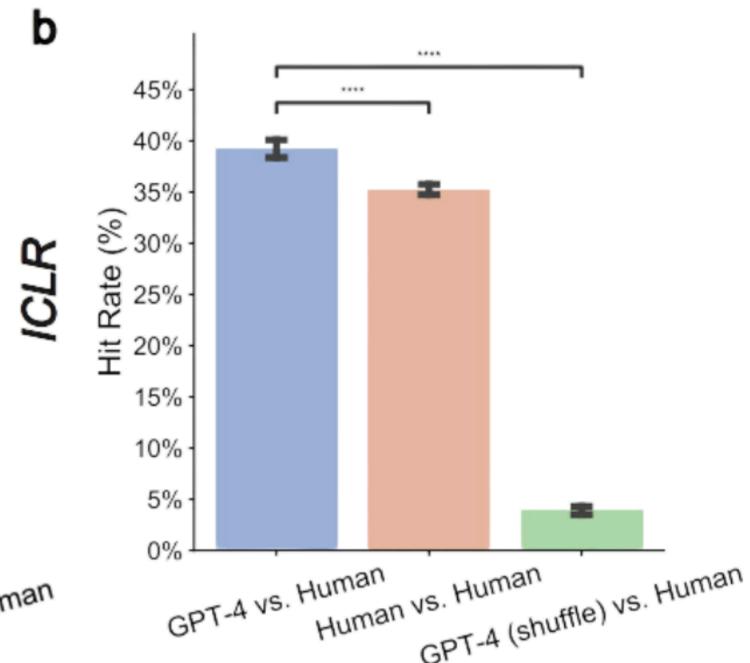
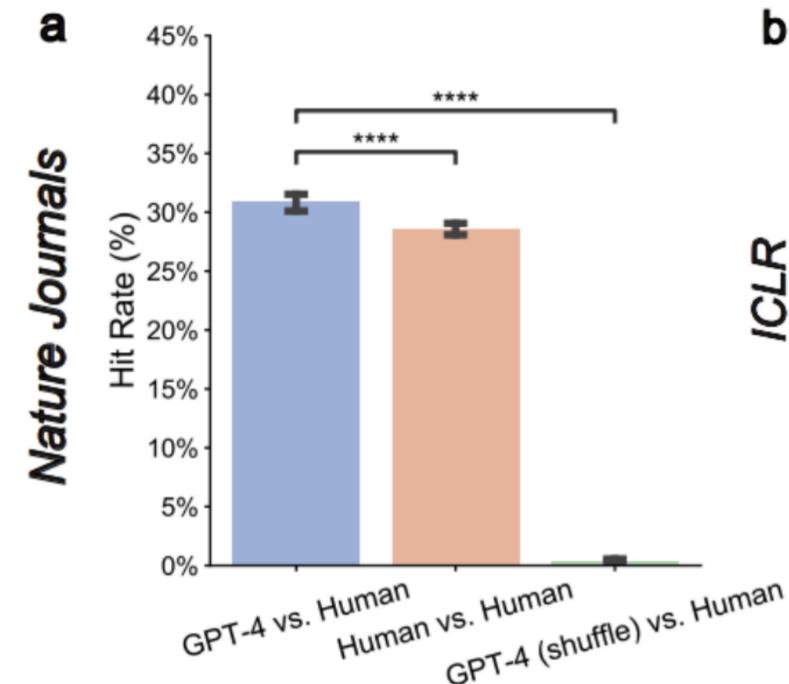
Weixin Liang<sup>1\*</sup>, Yuhui Zhang<sup>1\*</sup>, Hancheng Cao<sup>1\*</sup>, Binglu Wang<sup>2</sup>, Daisy Yi Ding<sup>3</sup>, Xinyu Yang<sup>4</sup>, Kailas Vodrahalli<sup>5</sup>, Siyu He<sup>3</sup>, Daniel Scott Smith<sup>6</sup>, Yian Yin<sup>4</sup>, Daniel A. McFarland<sup>6</sup>, and James Zou<sup>1,3,5+</sup>

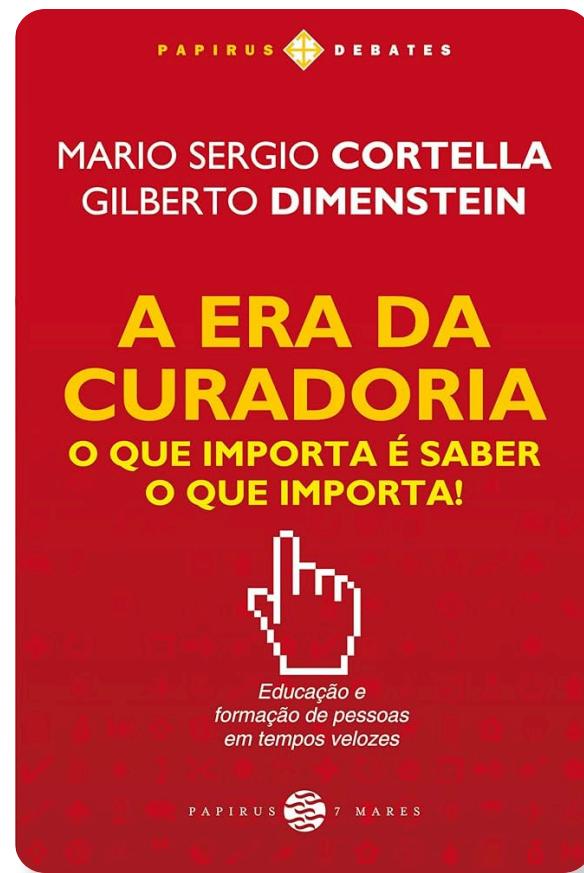
Peer review costs \$2.5 billion/year

ICLR's growth from 960 to 4,966 submissions between 2018 and 2023.

## Amostra

3.096 Artigos  
308 Pesquisadores  
110 US Instituições





# A Era da Curadoria

- Sobrecarga de Informação
- Informação vs Conhecimento
- Educador/Instituições como curadores
- Contexto e Experiência

*A Era da Curadoria - O que Importa é Saber o que Importa! [Cortella & Dimenstein, 2023]*



## Computer Science

### Common Requests

Create and debug C++ programs

Troubleshoot Python code and errors

Teach programming fundamentals with examples

Explain machine learning concepts

Develop and fix data visualization code



## Natural Sciences & Mathematics

### Common Requests

Solve and explain statistics problems

Work through physics problems with detailed explanations

Answer earth science questions

Tackle calculus problems with step-by-step explanations

Solve chemistry calculation problems

## Business

### Common Requests

Provide assistance with accounting concepts and problems

Analyze business case studies

Answer finance questions with calculations

Explain project management concepts

Create practical negotiation exercises

## Social Sciences & History

### Common Requests

Support academic writing about international relations

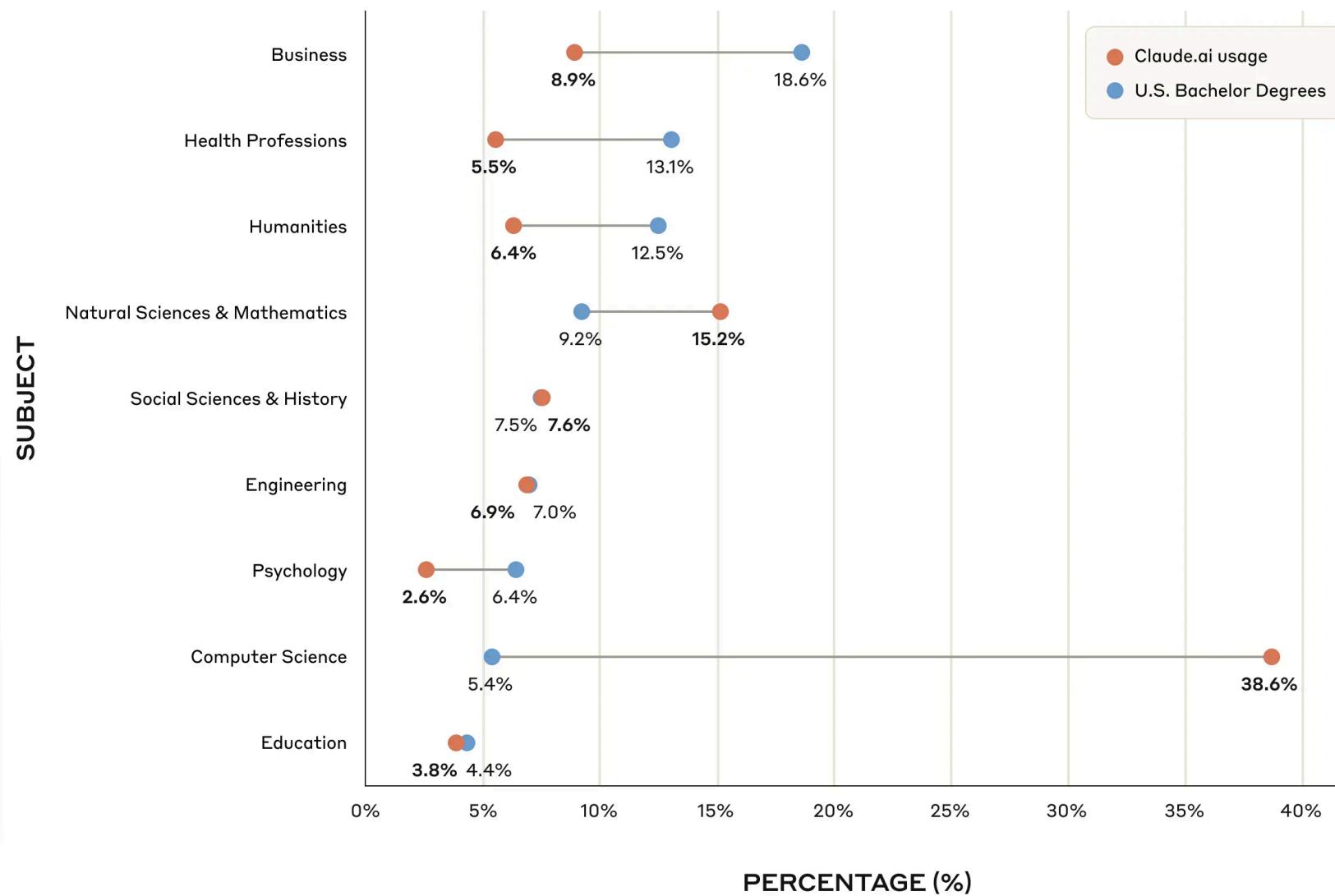
Explain social science theories

Debug and write Stata code for data analysis

Analyze specific court cases

Solve game theory problems

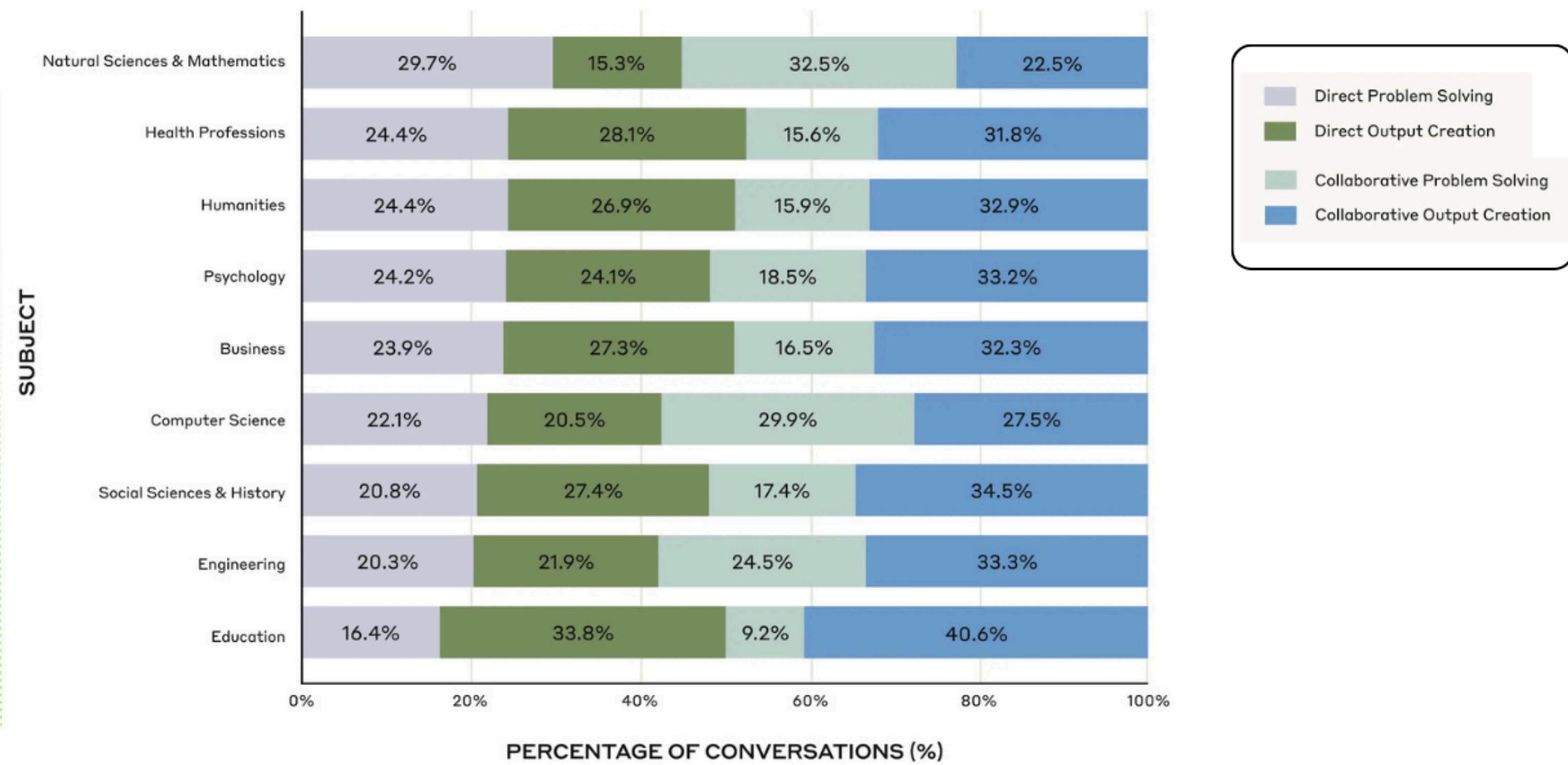
# Claude.ai Usage vs. U.S. Bachelor Degrees



*Anthropic Education Report: How University Students Use Claude [Anthropic, 2025]*

Problem Solving	Output Creation	
Direct	<p>Student seeks direct solutions or explanations</p> <p>Example:</p> <p>“Solve and explain differentiation problems in calculus”</p>	<p>Student seeks complete materials</p> <p>Example:</p> <p>“Create academic text summaries and condensed versions”</p>
Collaborative	<p>Student seeks guided problem solving</p> <p>Example:</p> <p>“Teach programming fundamentals with Python examples”</p>	<p>Student seeks iterative refinement</p> <p>Example:</p> <p>“Provide feedback and revision for student writing assignments”</p>

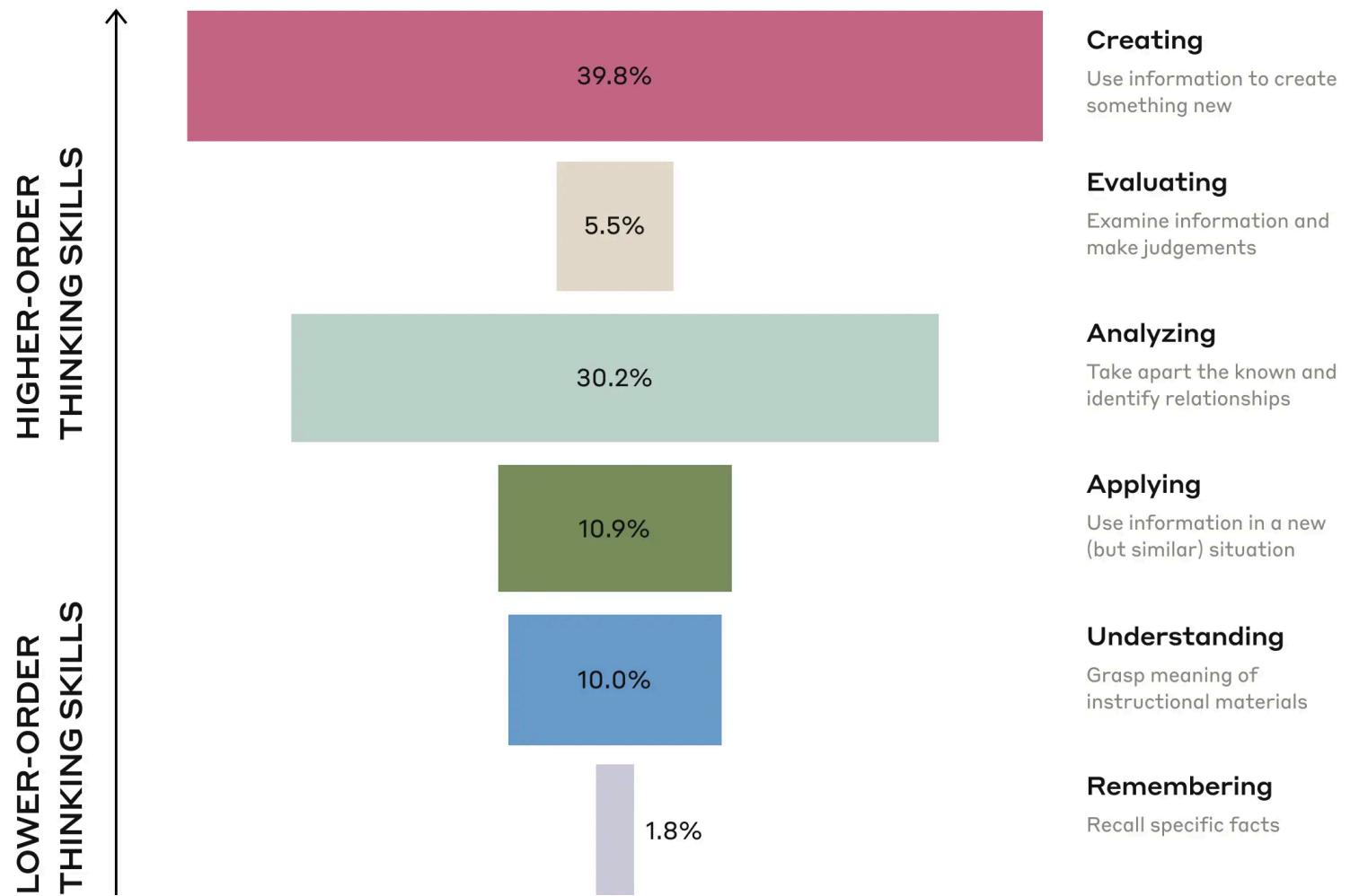
# Interaction Styles by Subject



*Anthropic Education Report: How University Students Use Claude [Anthropic, 2025]*



## Claude's skills on Bloom's Taxonomy



*Anthropic Education Report: How University Students Use Claude [Anthropic, 2025]*

# Regulação Jurídica

- O que é a autoria?
- Qual é o limite de uso?
- Segurança vs Open Source
- Modelos compensatórios

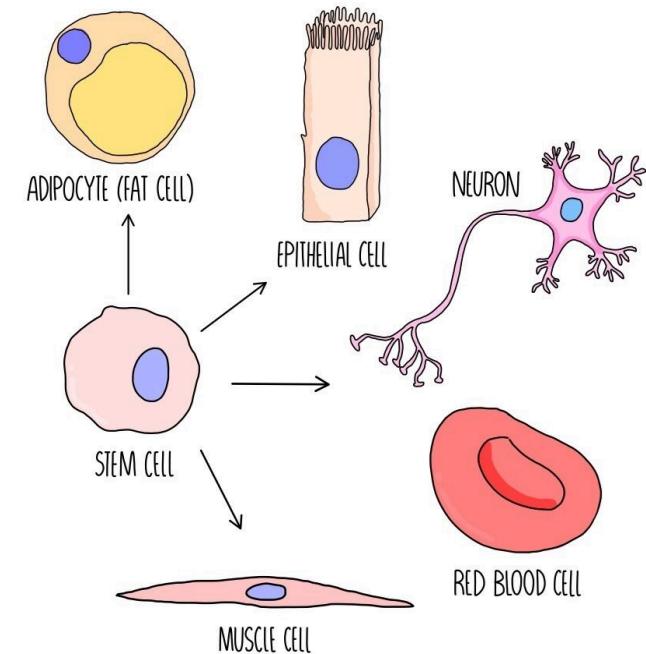


*ChatGPT: A Case Study on Copyright Challenges for Generative Artificial Intelligence ... [Lucchi, 2023]*

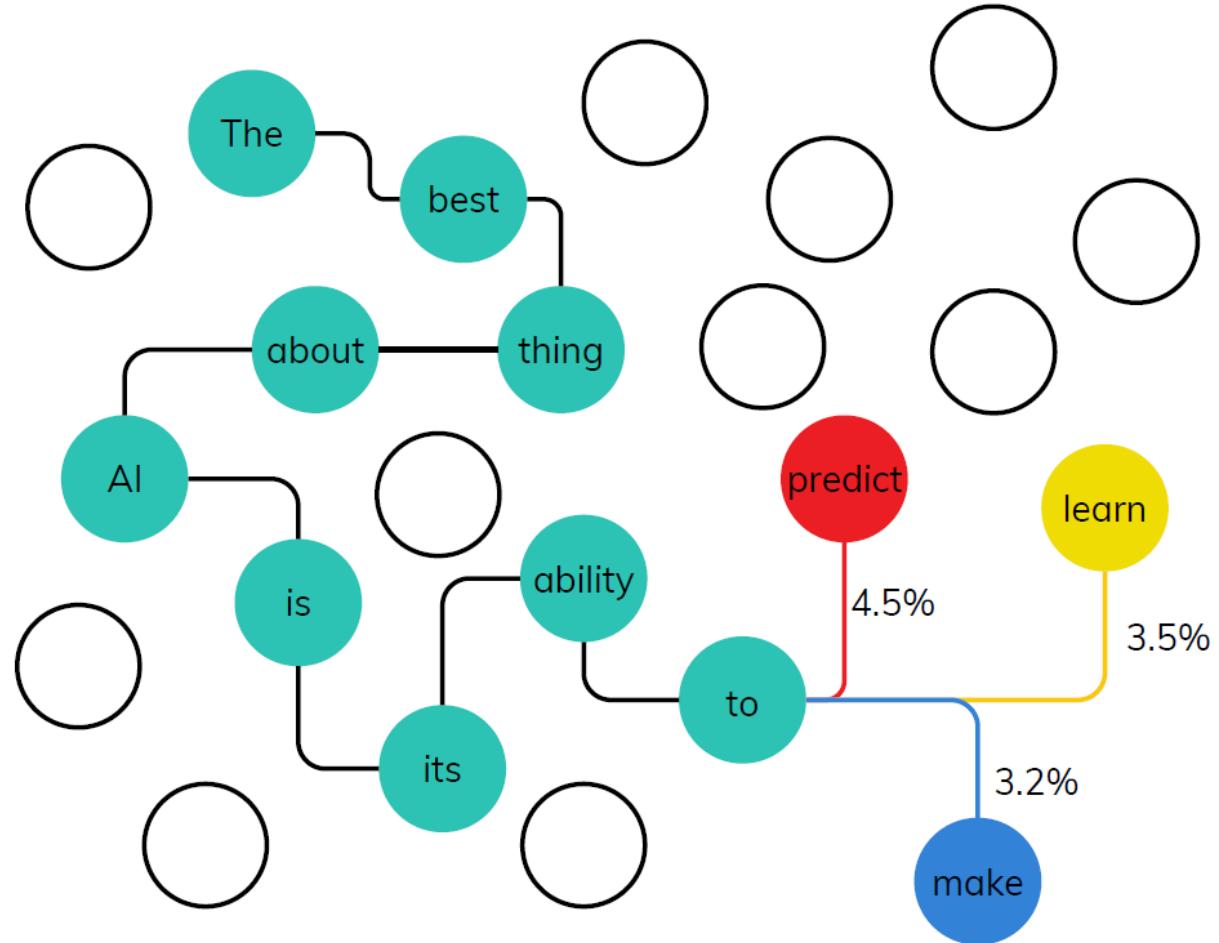
# PNL: Problema Fundamental

- Tradução de texto
- Correção gramatical
- Sumarização de texto
- Extração de informações

A abordagem tradicional é treinar uma rede neural para cada tarefa específica, utilizando grandes bancos de dados.



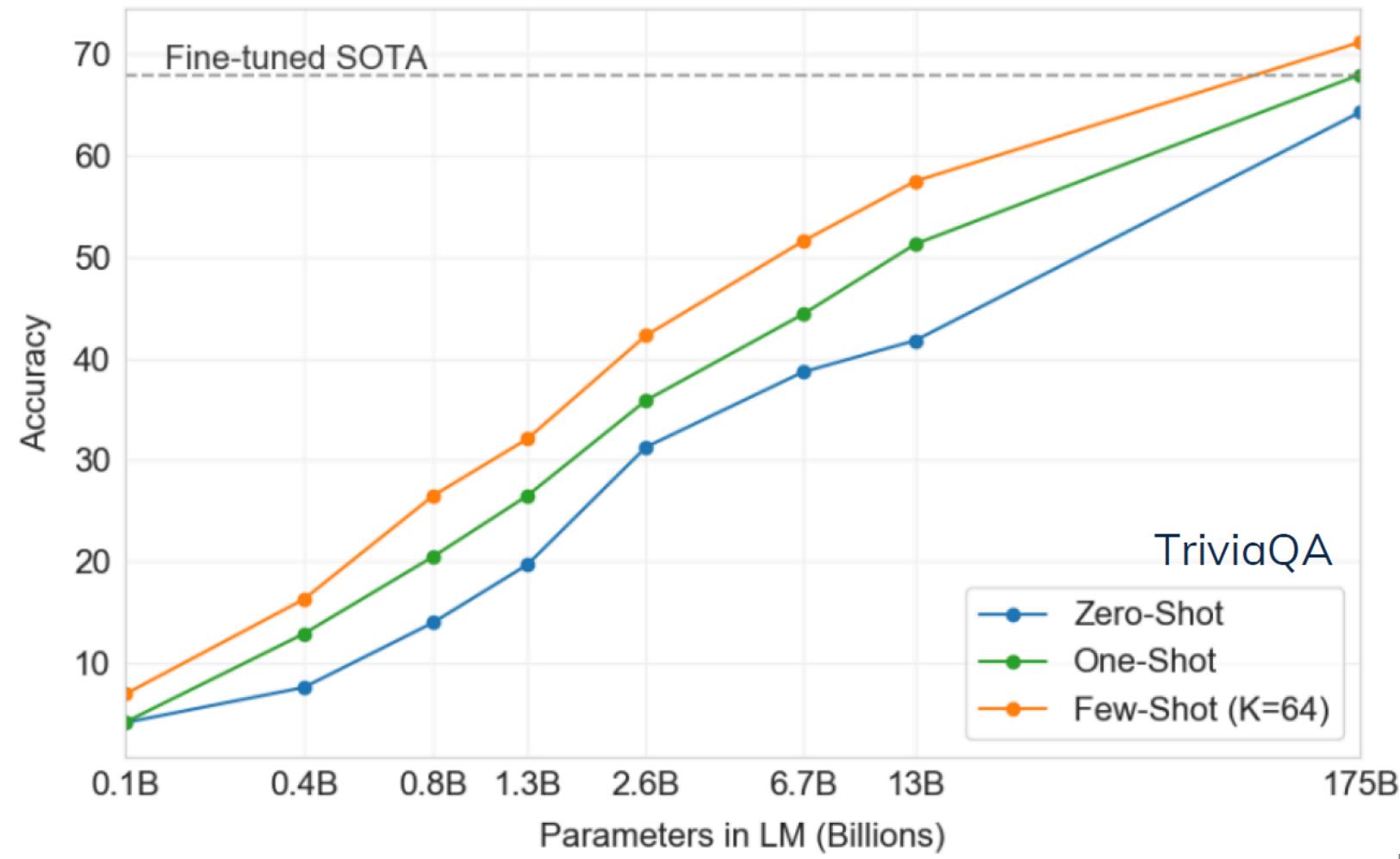
*The best thing about AI is its ability to \_\_\_\_\_*



A próxima  
palavra é?

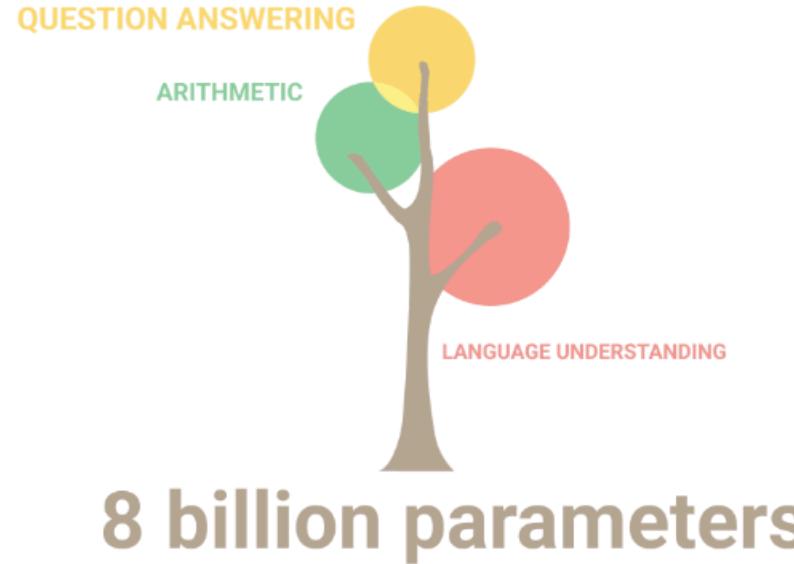
*What Is ChatGPT Doing ... and Why Does It Work? [Stephen Wolfram, 2023]*

# PNL: QA



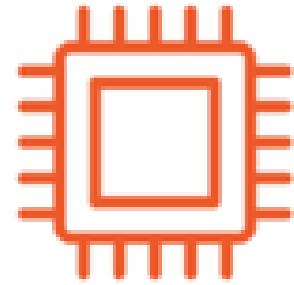
*Language Models are Few-Shot Learners [Brown et al., 2020]*

# Habilidades Emergentes



*Scaling Laws and Emergent Properties [Clément Thiriet, 2023]*

# Por que agora?



**Hardware**



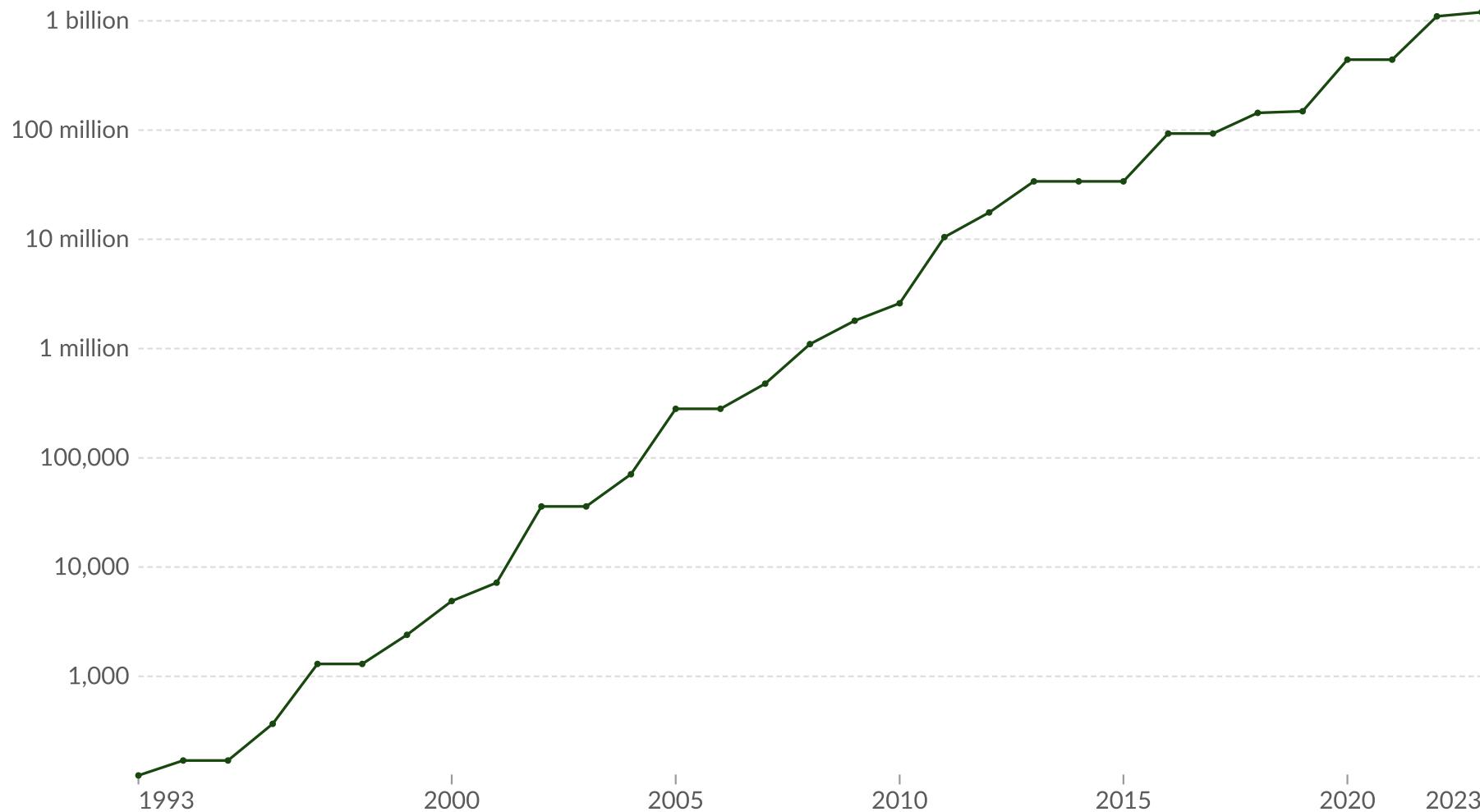
**Dados**



**Algoritmos**

# Computational capacity of the fastest supercomputers

The number of floating-point operations<sup>1</sup> carried out per second by the fastest supercomputer in any given year. This is expressed in gigaFLOPS, equivalent to  $10^9$  floating-point operations per second.



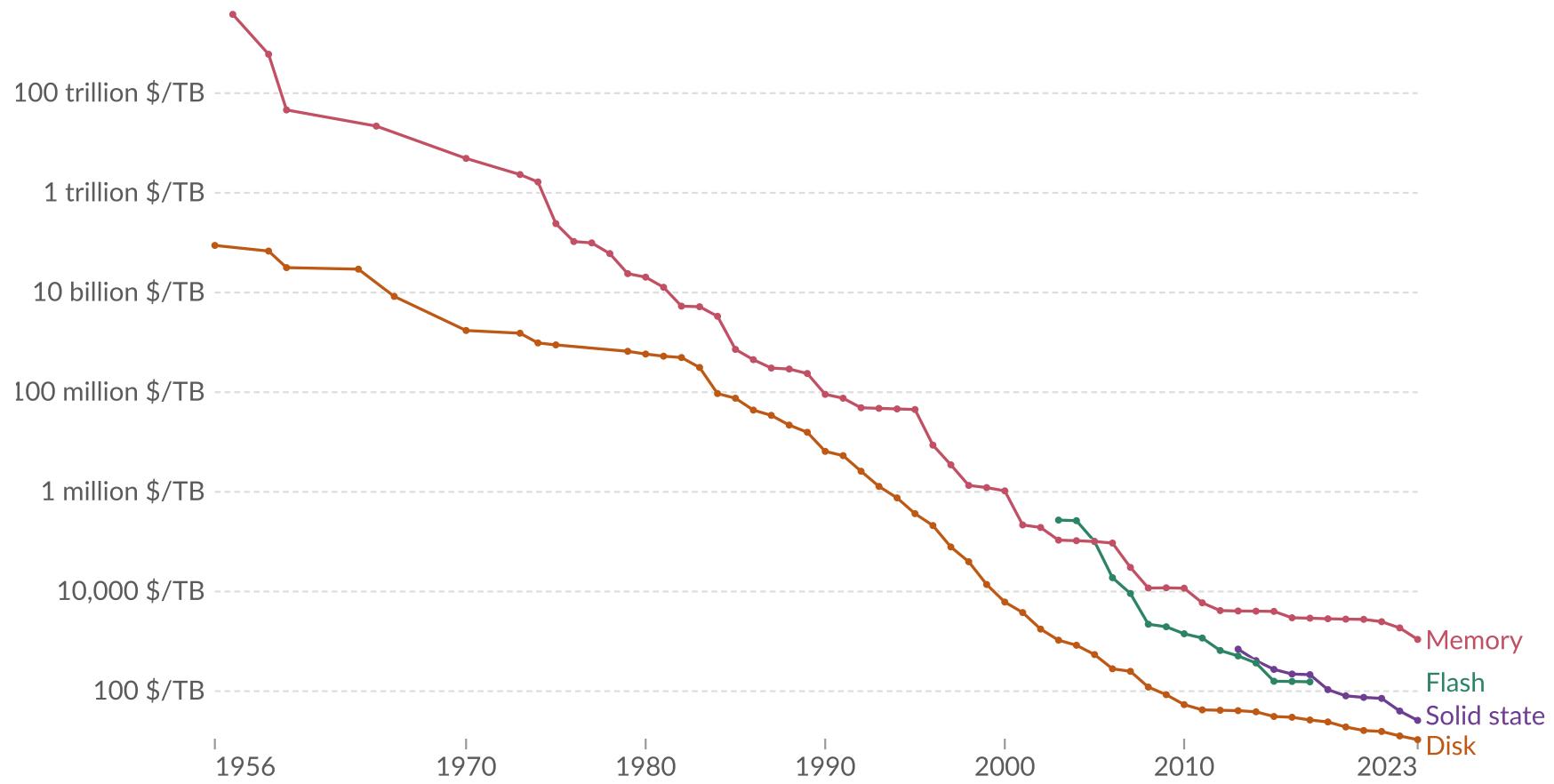
Data source: Dongarra et al. (2023)

[OurWorldInData.org/technological-change](https://OurWorldInData.org/technological-change) | CC BY

Moore's Law [Roser et. al, 2023]

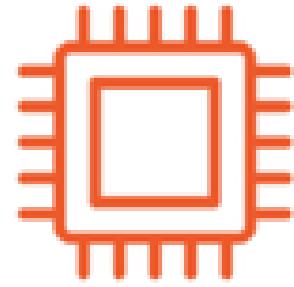
## Historical price of computer memory and storage

This data is expressed in US dollars per terabyte (TB), adjusted for inflation. "Memory" refers to random access memory (RAM), "disk" to magnetic storage, "flash" to special memory used for rapid data access and rewriting, and "solid state" to solid-state drives (SSDs).



*Moore's Law [Roser et. al, 2023]*

# Por que agora?



**Hardware**



**Dados**



**Algoritmos**

# Explosão de Dados

## *Dados por minuto*

 **41,666,667**

messages shared  
by WhatsApp users

 **347,222**

stories posted by Instagram users

 **1,388,889**

video / voice calls made  
by people worldwide

 **150,000**

messages shared by Facebook users

 **404,444**

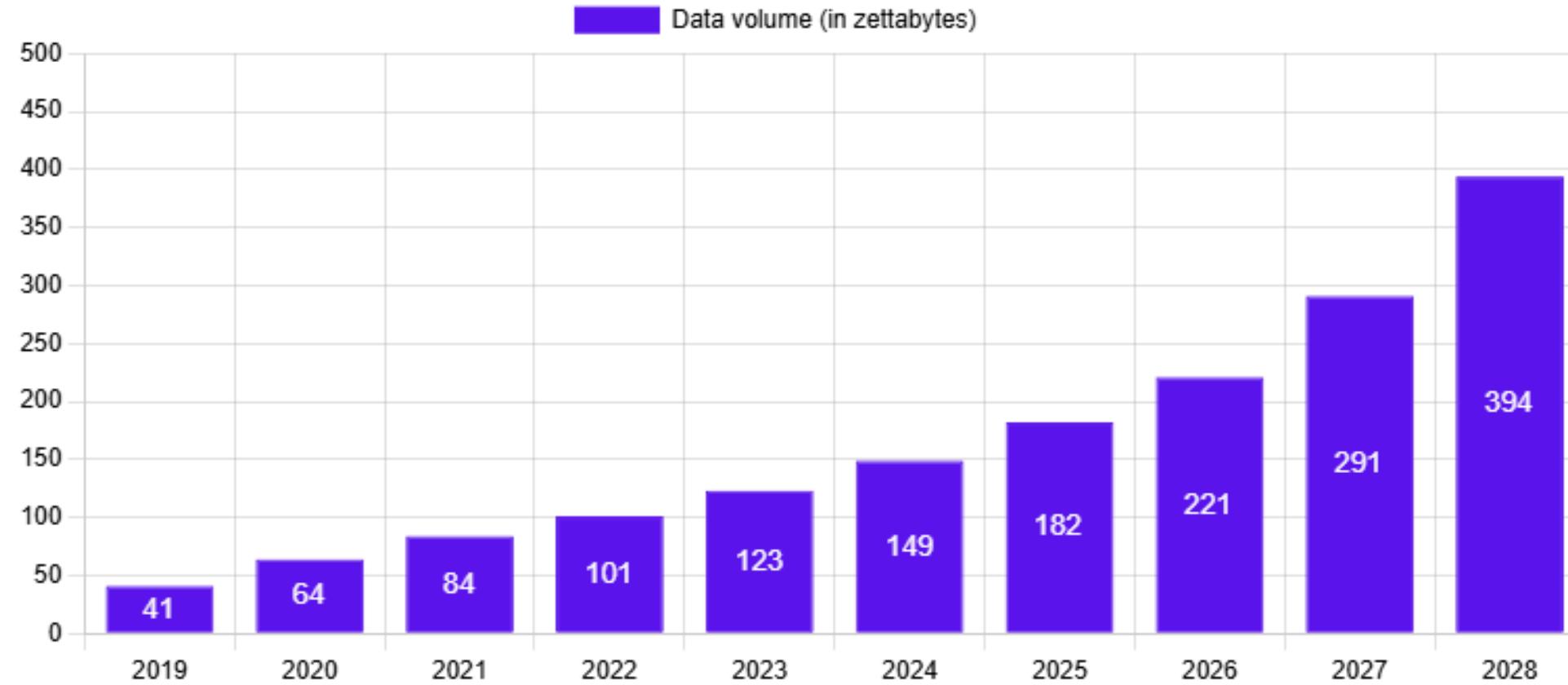
hours of video streamed  
by Netflix users

 **147,000**

photos shared by Facebook users

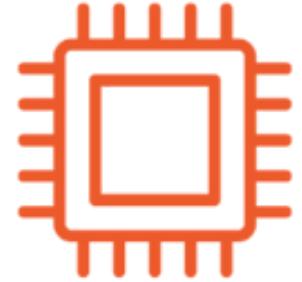
# Explosão de Dados

**Created, captured, copied, and consumed data globally**



*Volume of data/information created, captured, copied, and consumed ... [Mat, 2024]*

# Por que agora?



**Hardware**



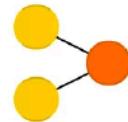
**Dados**



**Algoritmos**

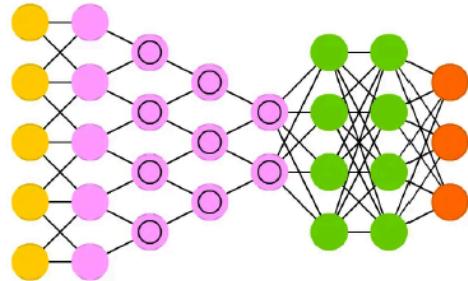
McCulloch '43

Perceptron (P)



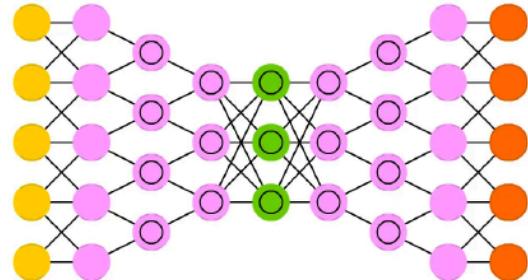
Cun'80

Deep Convolutional Network (DCN)



Kulkarni'15

Deep Convolutional Inverse Graphics Network (DCIGN)

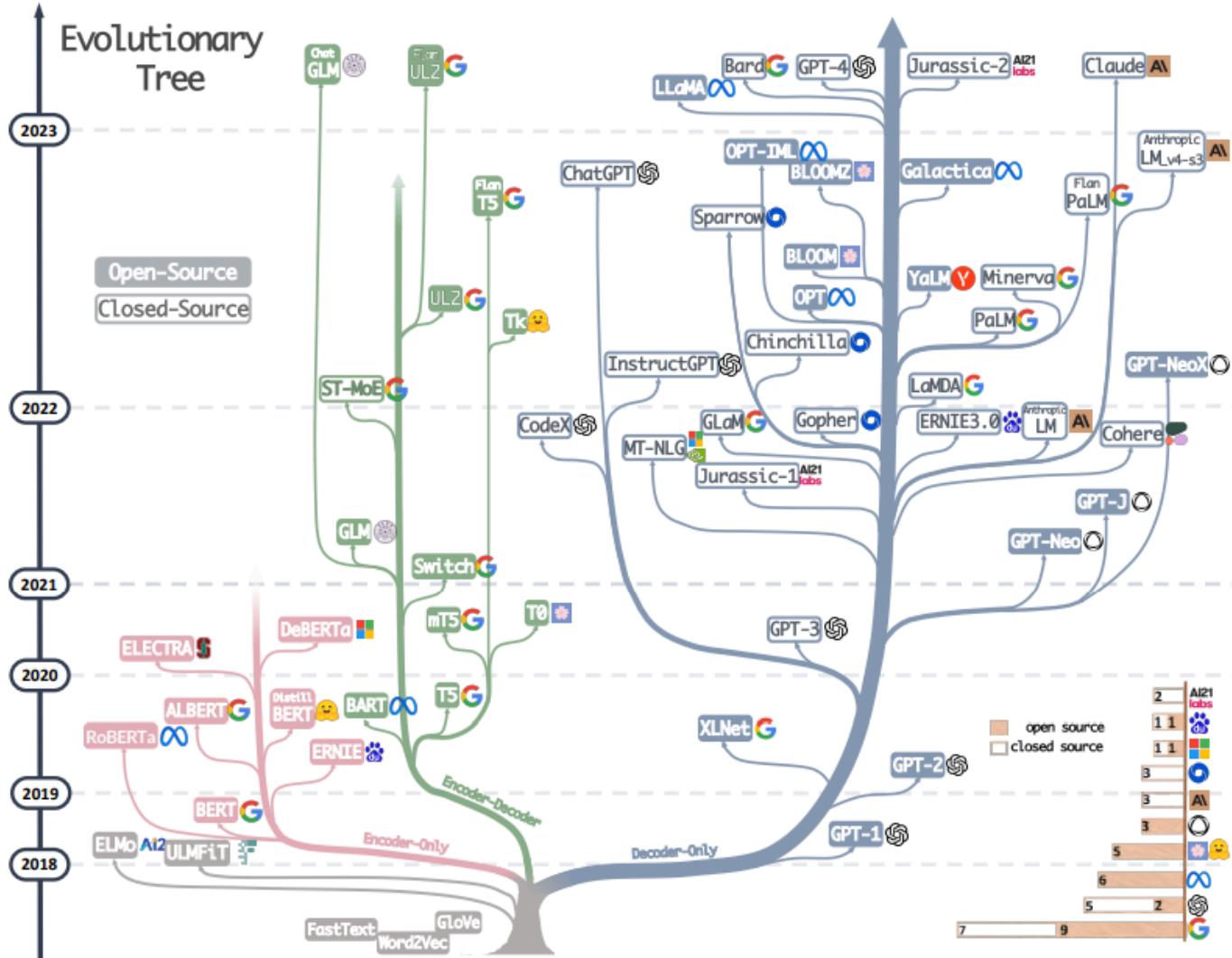


# Redes Neurais

Rank	Citations	Title	Year
1	305,148	Protein measurement with the folin phenol reagent	1951
2	213,005	Cleavage of structural proteins during the assembly of the head of bacteriophage T4	1970
3	180,543	Attention is all you need	2017

*Attention is All You Need [Vaswani et al., 2017]*

# Explosão de Modelos de Linguagem



*Harnessing the Power of LLMs in Practice: A Survey on ChatGPT and Beyond [Yang et. al, 2023]*



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**UNIVERSITÁRIO**  
MACICO DE BATURITÉ