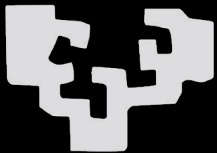


eman ta zabal zazu



Universidad
del País Vasco

Euskal Herriko
Unibertsitatea

HITZ

Hizkuntza Teknologiako Zentroa
Basque Center for Language Technology

German Rigau Claramunt

hitz.eus



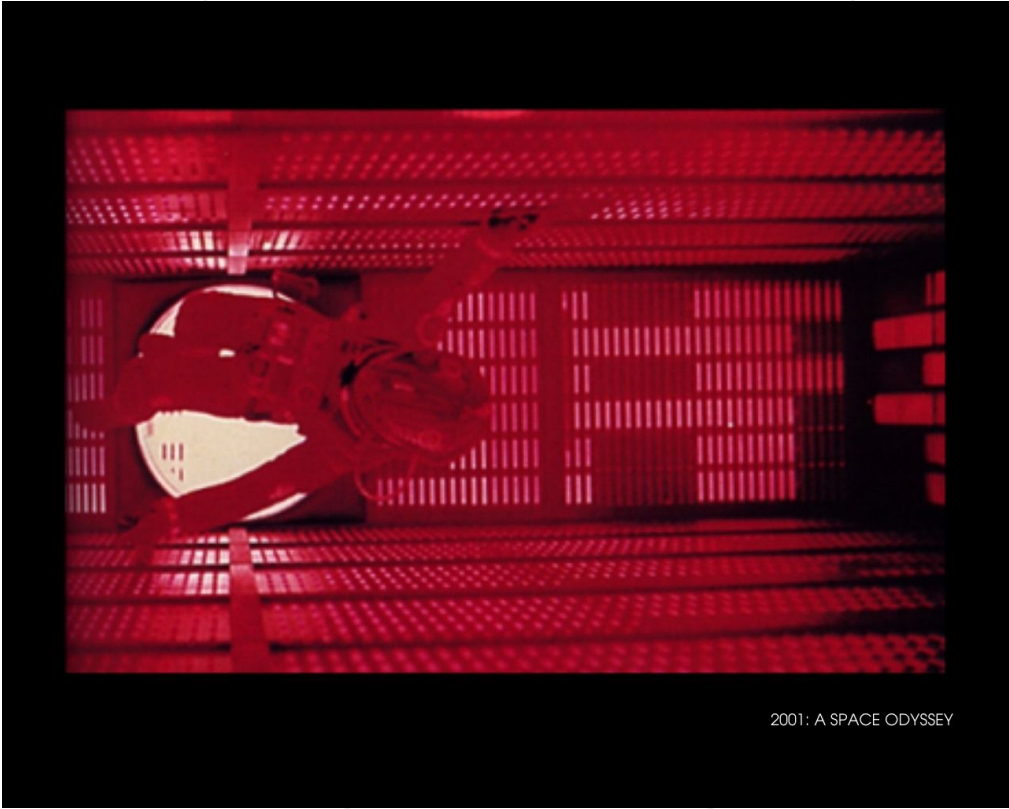
Artificial Intelligence



Artificial Intelligence



Artificial Intelligence



2001: A SPACE ODYSSEY

Artificial Intelligence

HAL's Legacy 2001's Computer as Dream and Reality

Edited by [David G. Stork](#)

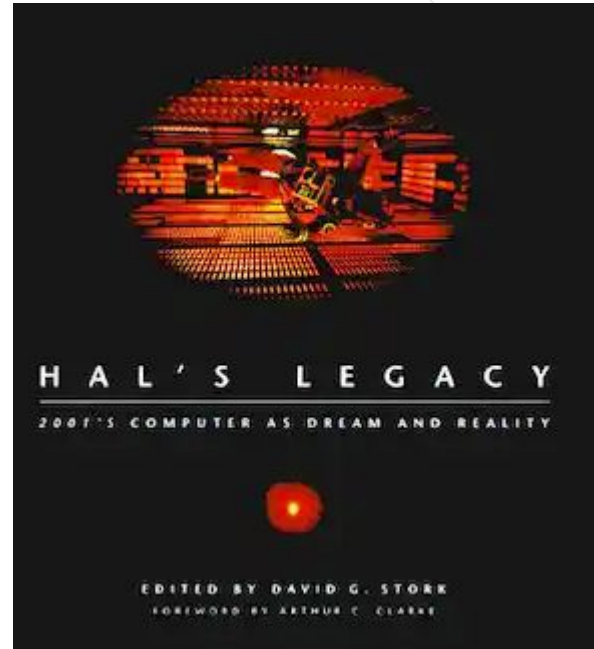
Foreword by [Arthur C. Clarke](#)

384 pp., 8 x 9 in, Paperback

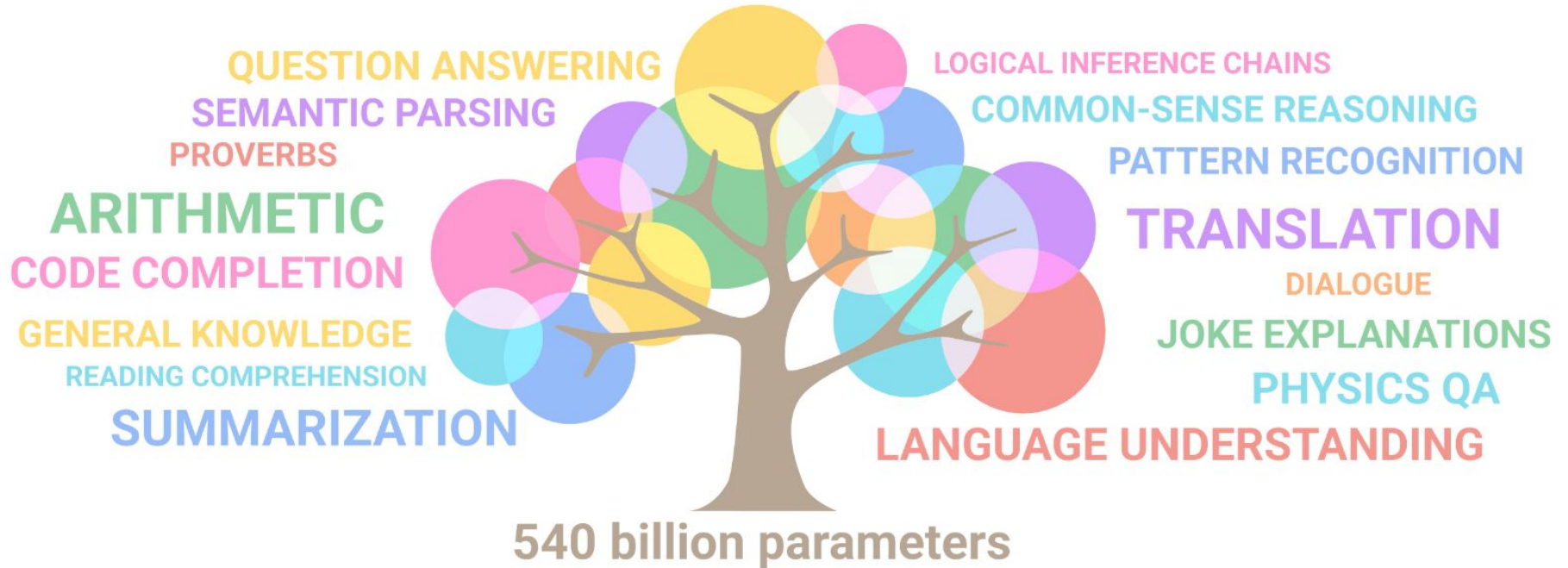
ISBN 9780262692113

Published: March 2, 1998

Publisher: The MIT Press



Artificial Intelligence



PaLM: Scaling Language Modeling with Pathways (2022)
Aakanksha Chowdhery, + 67 authors

Preface

“Cuando creíamos que teníamos todas las respuestas, de pronto, cambiaron todas las preguntas.”

- Mario Benedetti

“Just when we thought we had all the answers, suddenly all the questions changed.”





1

(Brief) History of AI & NLP

History of IA & NLP

- 1950 [Turing test](#)



History of IA & NLP

- 1950 Turing test
- 1956 [DSRPAI](#)



History of IA & NLP

- 1950 Turing test
- 1956 [DSRPAI](#)
- 1960s Rule-based AI & NLP
- 1966 [ALPAC](#) report



History of IA & NLP

- 1950 Turing test
- 1956 [DSRPAI](#)
- 1960s Rule-based AI & NLP
- 1966 [ALPAC](#) report
- 1970s Noam Chomsky



History of IA & NLP

- 1950 Turing test
- 1956 [DSRPAI](#)
- 1960s Rule-based AI & NLP
- 1966 [ALPAC](#) report
- 1970s Noam Chomsky
- 1992 [WordNet](#)



History of IA & NLP

- 1950 Turing test
- 1956 [DSRPAI](#)
- 1960s Rule-based AI & NLP
- 1966 [ALPAC](#) report
- 1970s Noam Chomsky
- 1990s Statistical AI & NLP, Machine Learning
- 2010s Neural AI & NLP
 - 2013 Word Embeddings, 2017 **Transformers**, 2018 BERT, 2022 ChatGPT, ...
- 20XXs? AGI (singularity)



A large white circle is centered on a black background. To its left, there is a series of overlapping circles: a dark grey circle with a white number '1' inside, followed by a medium grey circle, and then a white circle. To the right of the large white circle, there is a series of five concentric white circles of decreasing size.

1

New AI paradigm

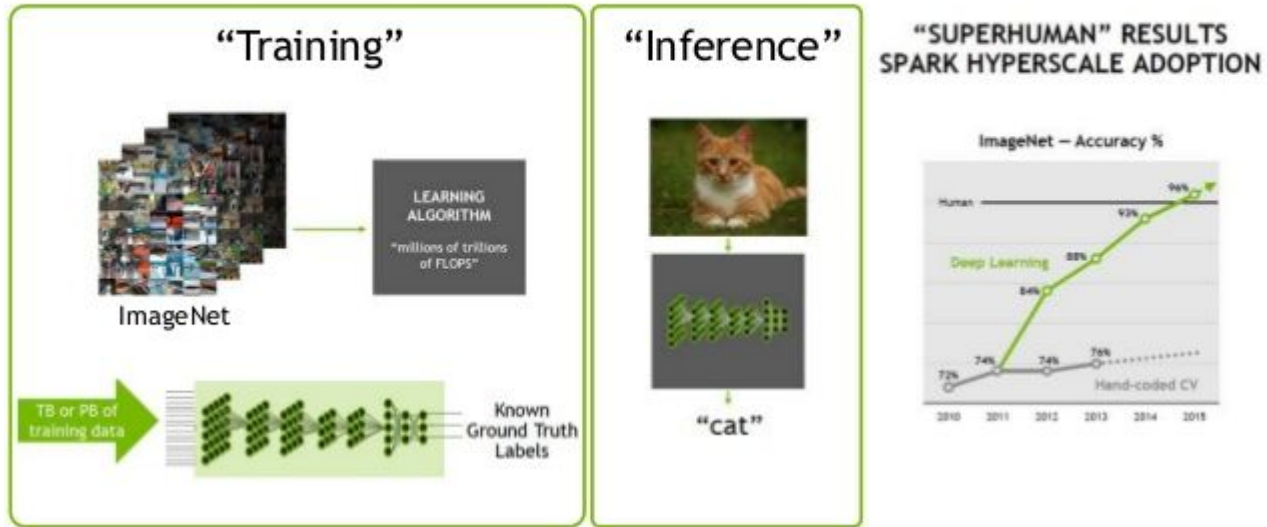
New AI paradigm

- **Accelerated** discovery cycle
- Impressive progress
 - **Superior** to humans in many tasks
- **Deep** and **reinforcement learning**
 - **Deep** neural networks
- Application in **Language**, Vision, Robotics
- Require
 - **Experts, Supercomputing, Data**
 - [LLaMA-2](#) (70B) : 1.7M GPU hours A100-80Gb (~ 1000 A100 71 days)



Deep Learning: HPC

DEEP LEARNING - A NEW COMPUTING MODEL

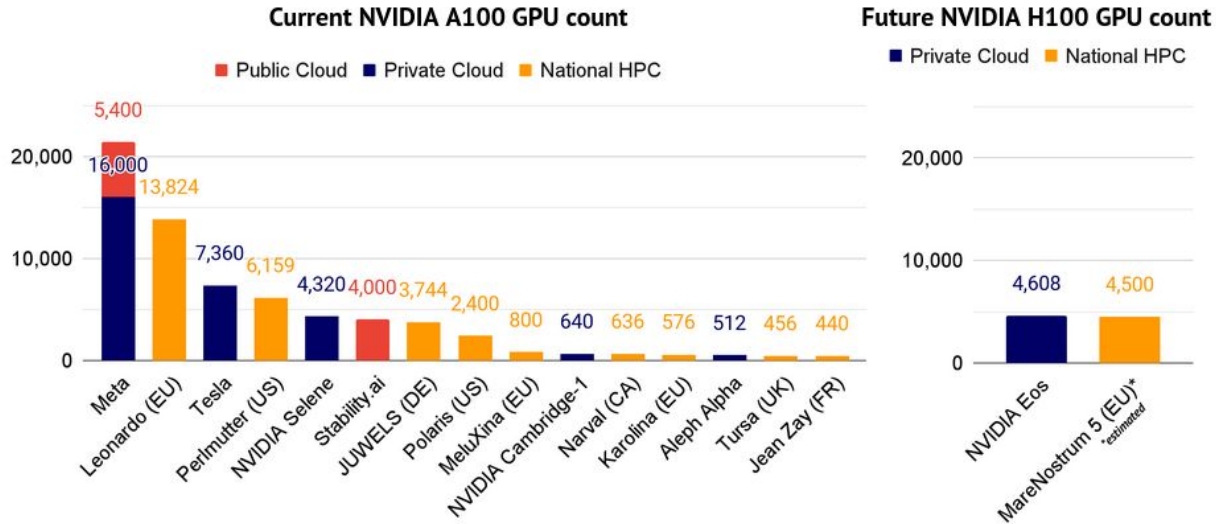


From Andy Steinbach (NVIDIA, 2016)

Deep Learning: HPC

In a gold rush for compute, companies build bigger than national supercomputers

▶ “We think the most benefits will go to whoever has the biggest computer” – Greg Brockman, OpenAI CTO



stateof.ai 2022

<https://www.stateof.ai/>

https://eurohpc-ju.europa.eu/about/our-supercomputers_en

Deep Learning: HPC

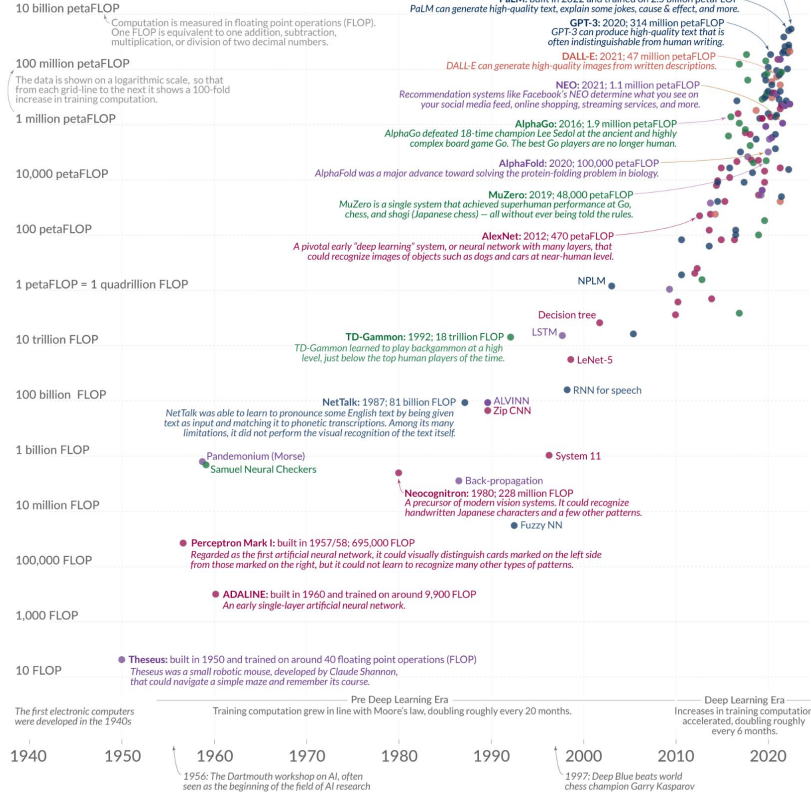
<https://www.visualcapitalist.com/cp/charted-history-exponential-growth-in-ai-computational-growth-in-ai-computational/>

The rise of artificial intelligence over the last 8 decades: As training computation has increased, AI systems have become more powerful

Our World in Data

The color indicates the domain of the AI system: ● Vision ● Games ● Drawing ● Language ● Other

Shown on the vertical axis is the training computation that was used to train the AI systems.



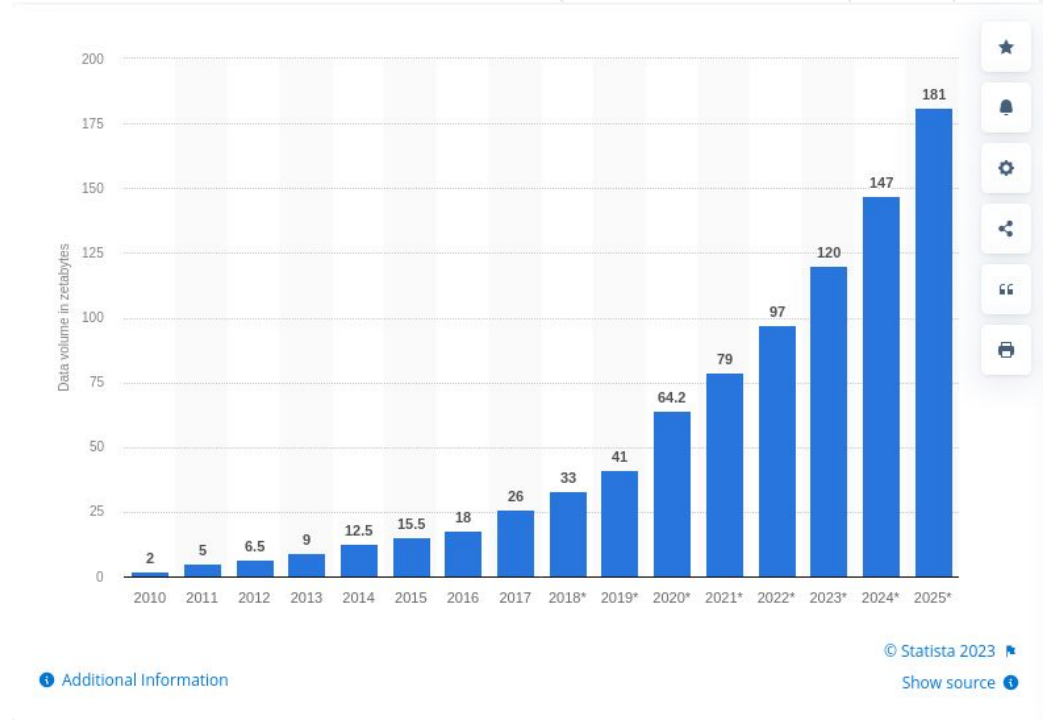
GPT-3

The data on training computation is taken from Sevilla et al. (2022) – Parameter, Compute, and Data Trends in Machine Learning. It is estimated by the authors and comes with some uncertainty. The authors expect the estimates to be correct within a factor of two. OurWorldinData.org – Research and data to make progress against the world's largest problems.

Licensed under CC-BY by the authors Charlie Giattino, Edouard Mathieu, and Max Roser

Deep Learning: Data

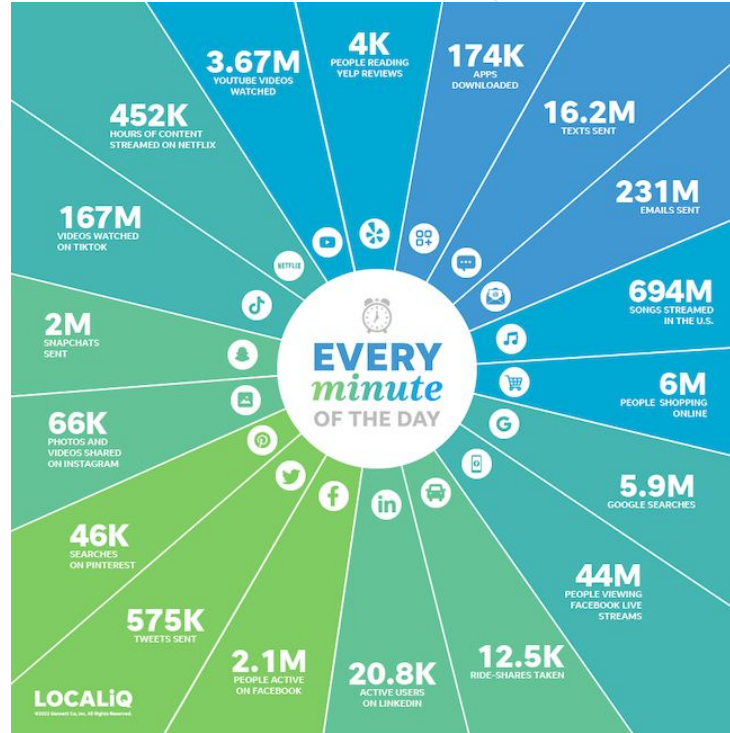
Volume of data/information created, captured, copied, and consumed worldwide from 2010 to 2020, with forecasts from 2021 to 2025 (in zettabytes)



<https://www.statista.com/statistics/871513/worldwide-data-created/>

Deep Learning: Data

Every minute of the day in Internet 2022 ...



<https://localiq.com/blog/what-happens-in-an-internet-minute/>

Deep Learning: Data

- Information **overload**
- infobesity, infoxication!



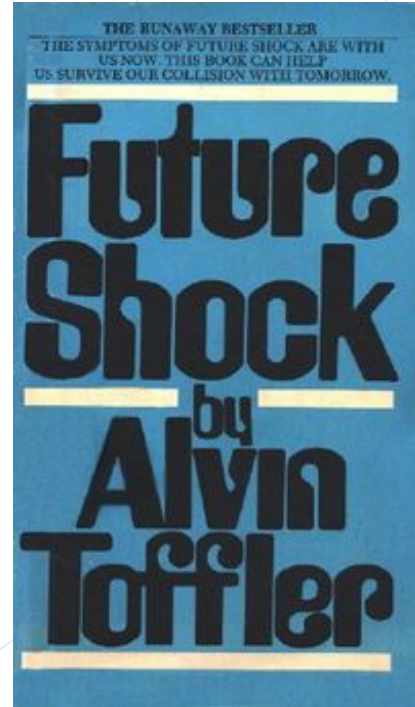
Deep Learning: Data

- Information **overload**
- infobesity, infoxication!
- by Bertram Gross, *The Managing of Organizations: The administrative struggle* (1964)



Deep Learning: Data

- Information **overload**
- infobesity, infoxication!
- by Bertram Gross, *The Managing of Organizations: The administrative struggle* (1964)
- by Alvin Toffler, *Future Shock* (1970)



Deep Learning: Data

- Information **overload**
- infobesity, infoxication!
- by Bertram Gross, The Managing of Organizations: The administrative struggle (1964)
- by Alvin Toffler, Future Shock (1970)

- Seneca complained that
“the abundance of books is distraction”
in the 1st century AD!



Deep Learning: Data

INFORMATION IS



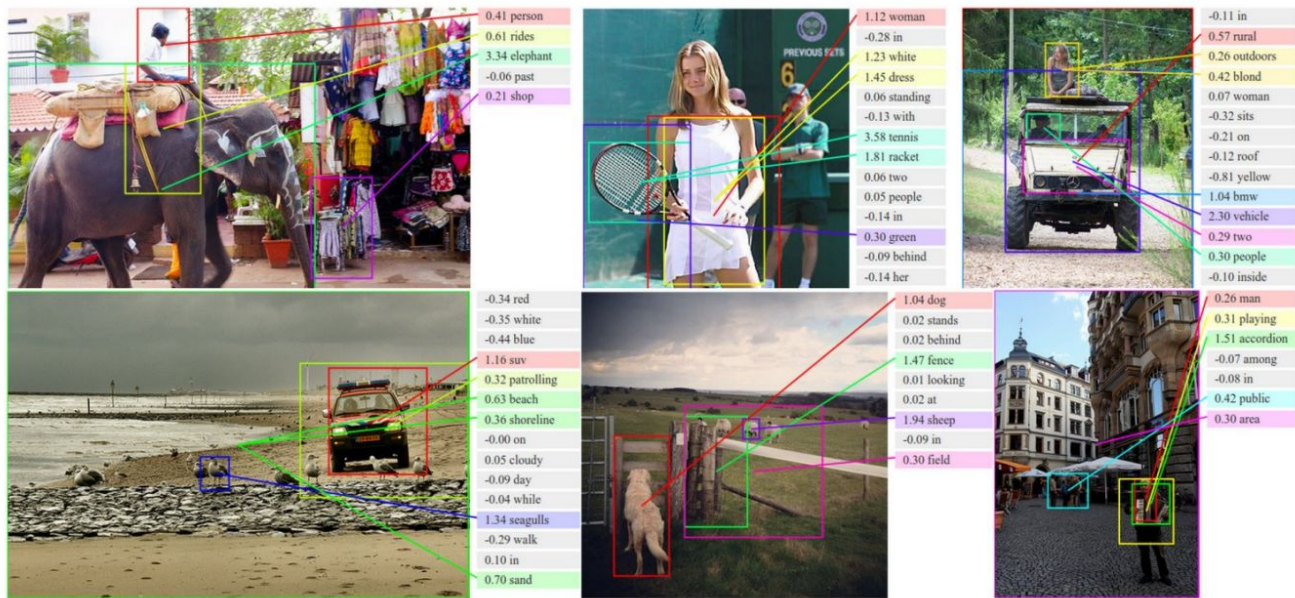
POWER

KNOWLEDGE

IS

POWER

Deep Learning



Deep visual-semantic alignments for generating image descriptions (2014)

A Karpathy, L Fei-Fei

Deep Learning



LipNet: Sentence Level Lipreading (2016)

Yannis M. Assael, Brendan Shillingford, Shimon Whiteson, Nando de Freitas

Deep Learning

A Style-Based Generator Architecture for Generative Adversarial Networks (2018)

Tero Karras, Samuli Laine, Timo Aila

<https://thispersondoesnotexist.com>



Figure 2. Uncurated set of images produced by our style-based generator (config F) with the FFHQ dataset. Here we used a variation of the truncation trick [40, 5, 32] with $\psi = 0.7$ for resolutions $4^2 - 32^2$. Please see the accompanying video for more results.

Deep Learning

Recursively Summarizing Books with Human Feedback (2021)

Jeff Wu, Long Ouyang, Daniel M. Ziegler,
Nisan Stiennon, Ryan Lowe, Jan Leike,
Paul Christiano



Deep Learning

Zero-Shot Text-to-Image Generation

(2021) Aditya Ramesh, Mikhail Pavlov, Gabriel Goh, Scott Gray, Chelsea Voss, Alec Radford, Mark Chen, Ilya Sutskever

<https://openai.com/blog/dall-e/>

[DALL-E 2](#)
[Midjourney](#)
[Stable Diffusion](#)

...

TEXT PROMPT

an illustration of a baby daikon radish in a tutu walking a dog

AI-GENERATED IMAGES



Edit prompt or view more images ↓

TEXT PROMPT

an armchair in the shape of an avocado [...]

AI-GENERATED IMAGES



Edit prompt or view more images ↓

TEXT PROMPT

a storefront that has the word 'openai' written on it [...]

AI-GENERATED IMAGES



Edit prompt or view more images ↓

Deep Learning: pictures and video



v3 August 22

v4 November 22

v5 March 23

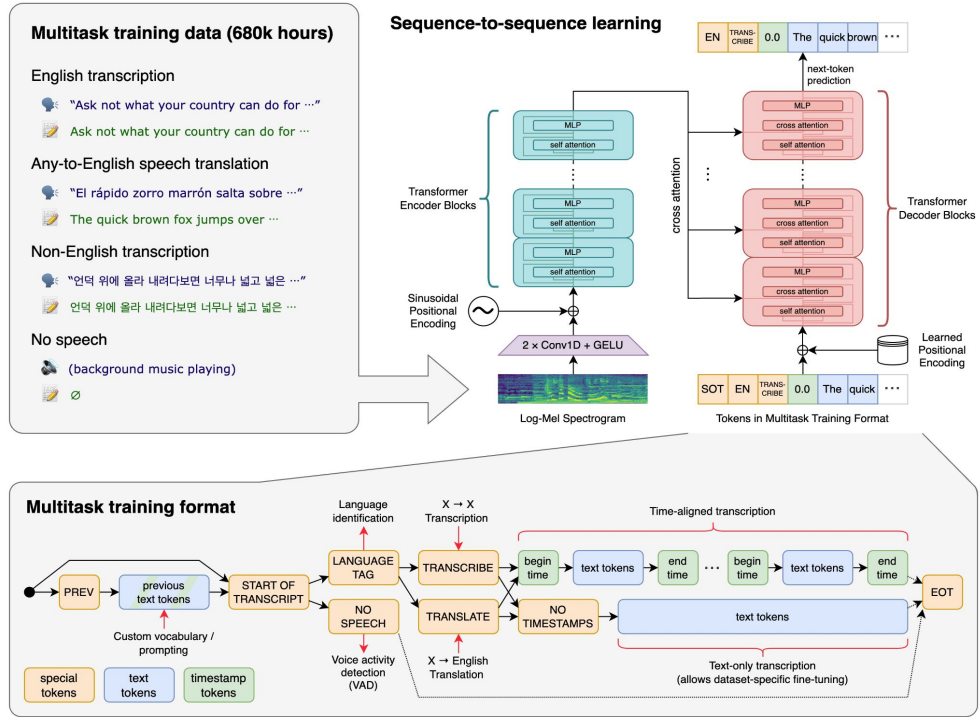
<https://arstechnica.com/information-technology/2023/03/ai-imager-midjourney-v5-stuns-with-photorealistic-images-and-5-fingered-hands/>

Deep Learning: music, speech

MusicLM: Generating Music From Text (2023) 13 authors

[MusicLM](#)
[Elevenlabs](#)
[Whisper](#)
[PromptTT2](#)

...



Deep Learning: coding, programming

[Evaluating Large Language Models Trained on Code \(2021\)](#)

58 authors

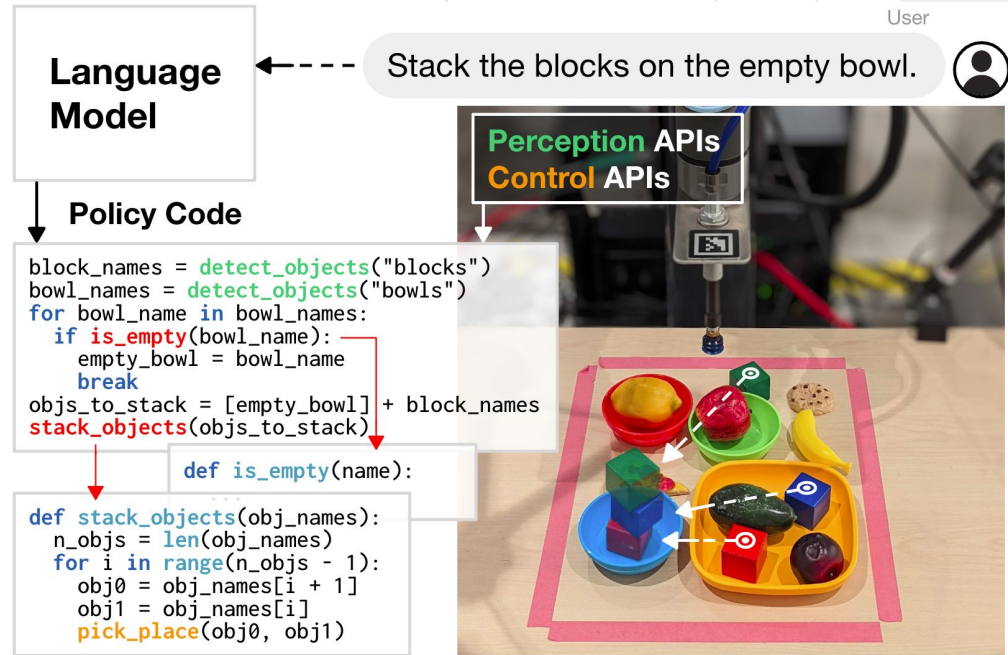
[Codex](#)
[Copilot](#)
[Codewhisperer](#)
[ChatGPT](#)

...

```
runtime.go course.rb time.js lsPrimeTest.java
1 package main
2
3 type Run struct {
4     Time int // in milliseconds
5     Results string
6     Failed bool
7 }
8
9 // Get average runtime of successful runs in seconds
10 func averageRuntimeInSeconds(runs []Run) float64 {
11     var totalTime int
12     var failedRuns int
13     for _, run := range runs {
14         if run.Failed {
15             failedRuns++
16         } else {
17             totalTime += run.Time
18         }
19     }
20
21     averageRuntime := float64(totalTime) / float64(len(runs) - failedRuns) / 1000
22     return averageRuntime
23 }
```

Deep Learning: coding, programming

[Code as Policies: Language Model Programs for Embodied Control](#)
(2022)
8 authors



Deep Learning: 3D objects

[DreamFusion: Text-to-3D using 2D Diffusion \(2022\)](#)

4 authors

[POINT-E](#)
[Magic3D](#)

...



Deep Learning: videos

[Make-A-Video: Text-to-Video Generation without Text-Video Data \(2022\)](#)

Uriel Singer, Adam Polyak, Thomas Hayes, Xi Yin, Jie An, Songyang Zhang, Qiyuan Hu, Harry Yang, Oron Ashual, Oran Gafni, Devi Parikh, Sonal Gupta, Yaniv Taigman

[Make-a-video](#)

[VEED.IO](#)

[GliaStudio](#)

[Sora \(video\)](#)

...



Deep Learning: language



Example of using [ChatGPT](#), [Synthesia](#) and [Descript](#).
<https://slator.com/we-prompted-chatgpt-to-be-a-translation-manager/>








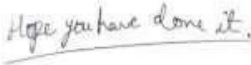
Deep Learning: multimodal

Language Is Not All You Need: Aligning Perception with Language Models (2023)

14 authors

Kosmos-1 Unified-IO 2

...

Input Prompt	 An image of	 An image of	 Question: What coffee shop is in the background? Answer:	 Question: What is inside this canned good? Answer:
Completion	a girl blowing out a candle on her birthday cake. (1)	a group of people posing for a wedding photo. (2)	Starbucks (3)	Corn (4)
Input Prompt	 Question: What is on the pillowcase? Answer:	 Question: What is the title of this book? Answer:	 An image of	 An image of
Completion	a Texas Longhorns pillow case. (5)	A Fine, Fine School (6)	a parking sign that says "Waiting? Please turn off your engine." (7)	Hope you have done it (8)

Deep Learning: dubbing



[Example of translating, dubbing and changing facial expressions](#) by HeyGen

Deep Learning: robotics



[Atlas from Boston Dynamics](#)

A large white circle is centered on a black background. To its left, there are several overlapping circles of varying shades of gray, with the number '2' in white. To its right, there are several concentric white circles of varying diameters.

2

Language-centered AI

AI overview

- **AI techniques/methods:** ML, DL, RL, etc.
- **Functional applications:**
 - Language Technology
 - vision
 - robotics
 - *Data Science*
- **Fields of application:**
 - Health, public administrations, tourism, internet, technological surveillance, security, etc.



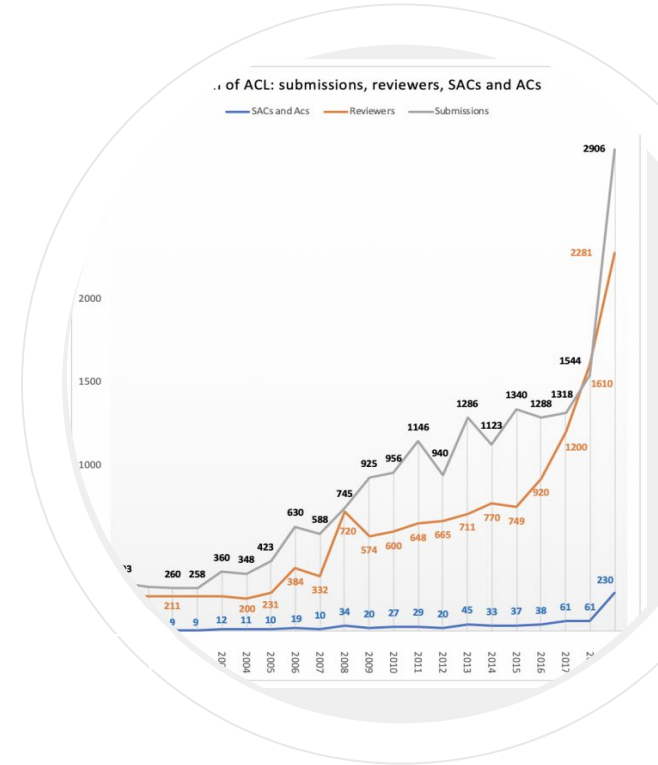
Language Technology

> **80% unstructured** digital information

Text (multilingual), audio, video

Natural Language Processing is the area of Artificial Intelligence that deals with written and spoken (or sign) language

- Automatic Translation
- Extraction and Recovery of information
- Speech Recognition and Synthesis
- Conversational systems (chatbots)
- ...



Large Language Models

Explaining a joke

Prompt

Explain this joke:

Joke: Did you see that Google just hired an eloquent whale for their TPU team? It showed them how to communicate between two different pods!

Model Response

Prediction: TPUs are a type of computer chip that Google uses for deep learning. A "pod" is a group of TPUs. A "pod" is also a group of whales. The joke is that the whale is able to communicate between two groups of whales, but the speaker is pretending that the whale is able to communicate between two groups of TPUs.

PaLM explains an original joke with two-shot prompts.

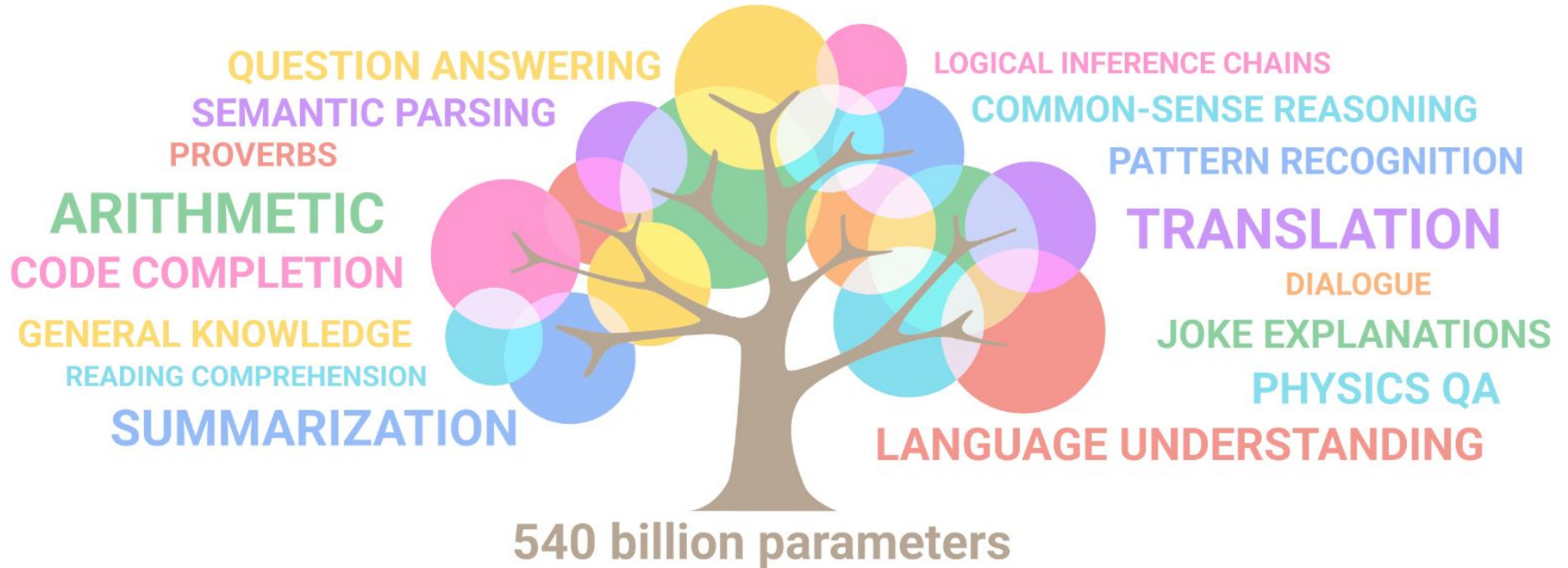
PaLM: Scaling Language Modeling with Pathways (2022)

Aakanksha Chowdhery, + 67 authors



Experts, Data, HPC

Large Language Models



PaLM: Scaling Language Modeling with Pathways (2022)

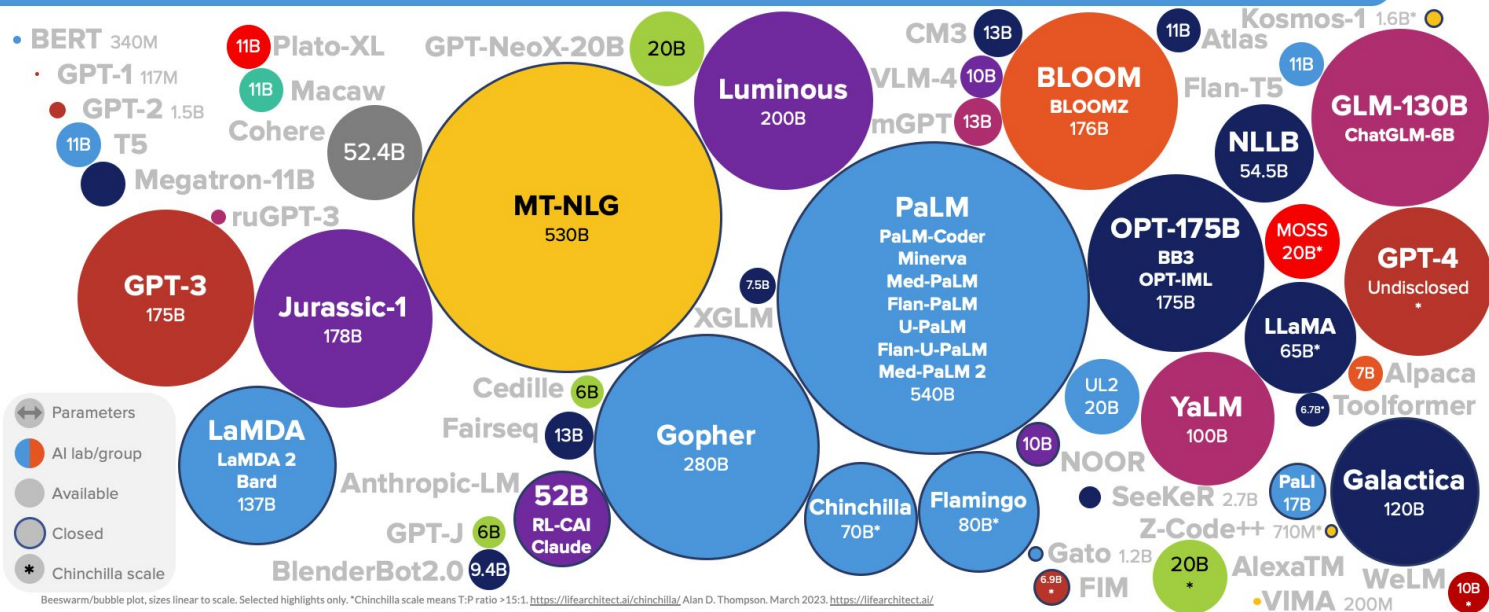
Aakanksha Chowdhery, + 67 authors



Experts, Data, HPC

Large Language Models

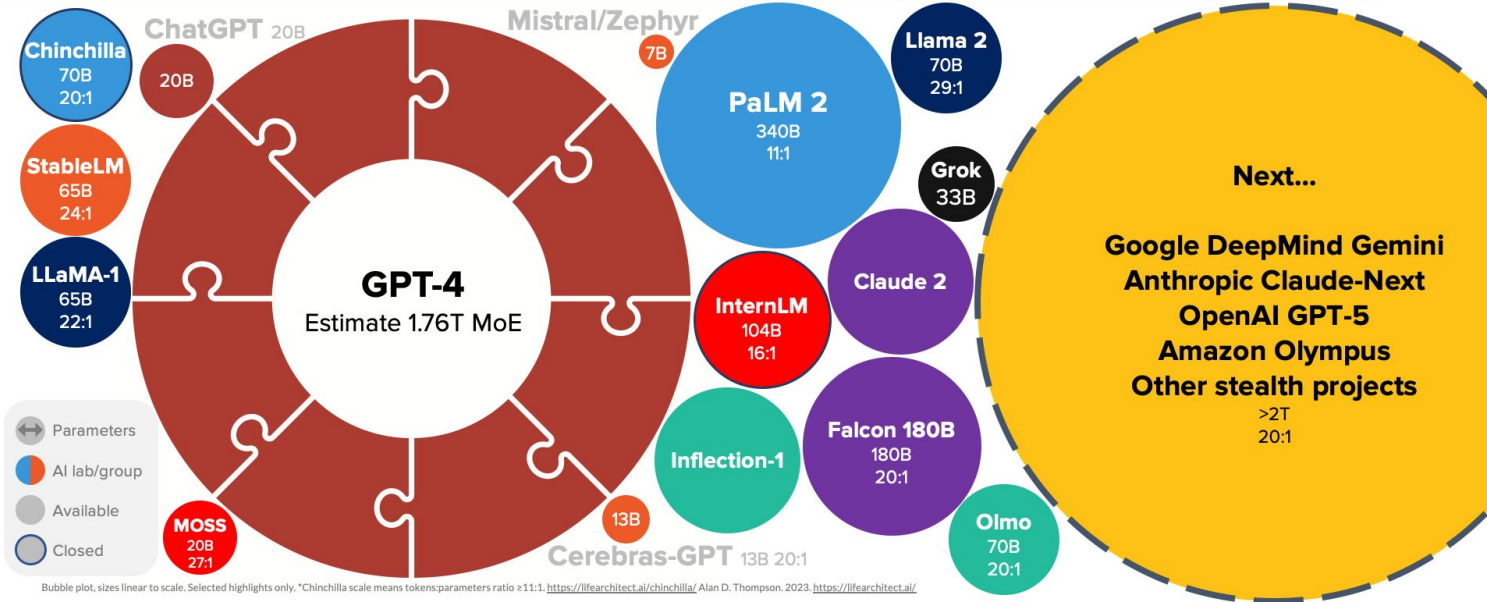
LANGUAGE MODEL SIZES TO MAR/2023



Large Language Models

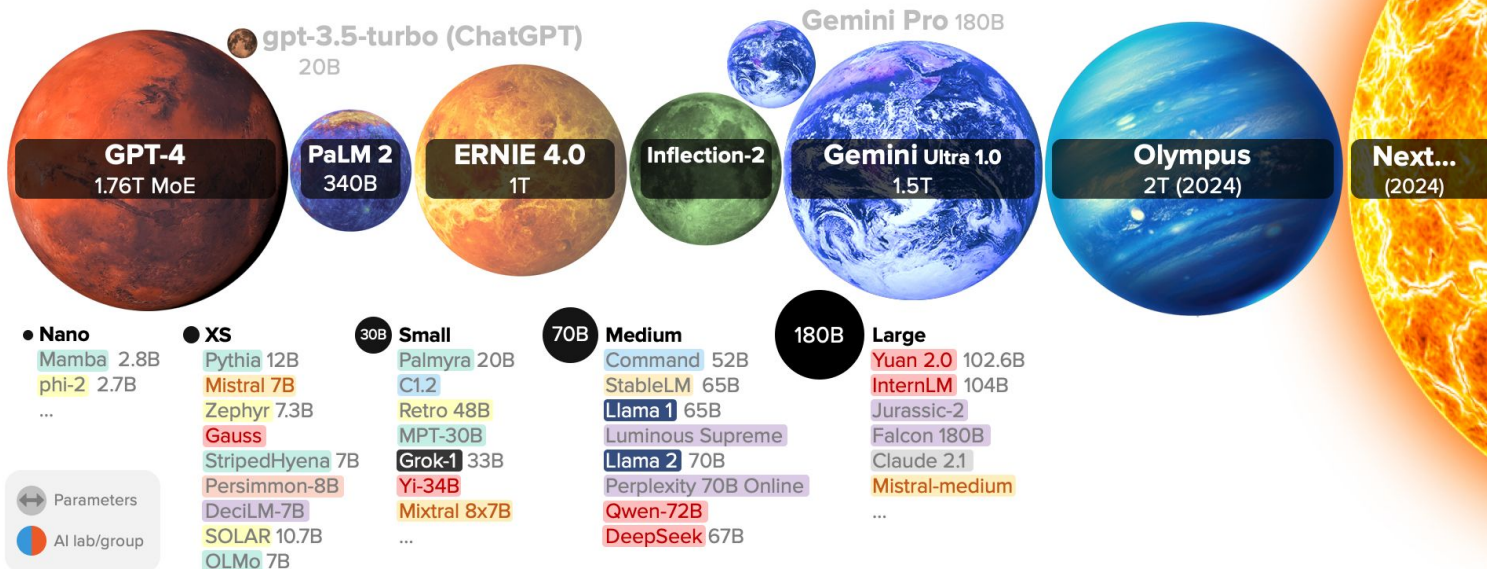
2023-2024 OPTIMAL LANGUAGE MODELS

NOV/
2023



Large Language Models

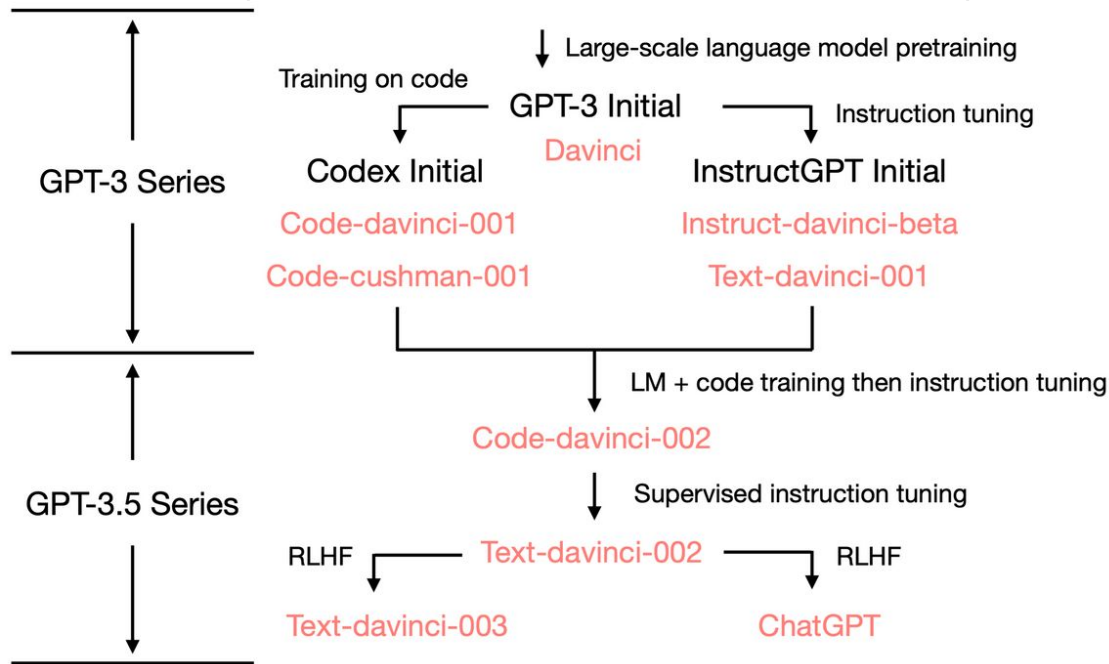
LARGE LANGUAGE MODEL HIGHLIGHTS (FEB/2024)



Sizes linear to scale. Selected highlights only. All models are available. All models are Chinchilla-aligned (20:1 tokens:parameters) <https://lifearchitect.ai/chinchilla/>, All 200+ models: <https://lifearchitect.ai/models-table/>, Alan D. Thompson, 2023-2024.

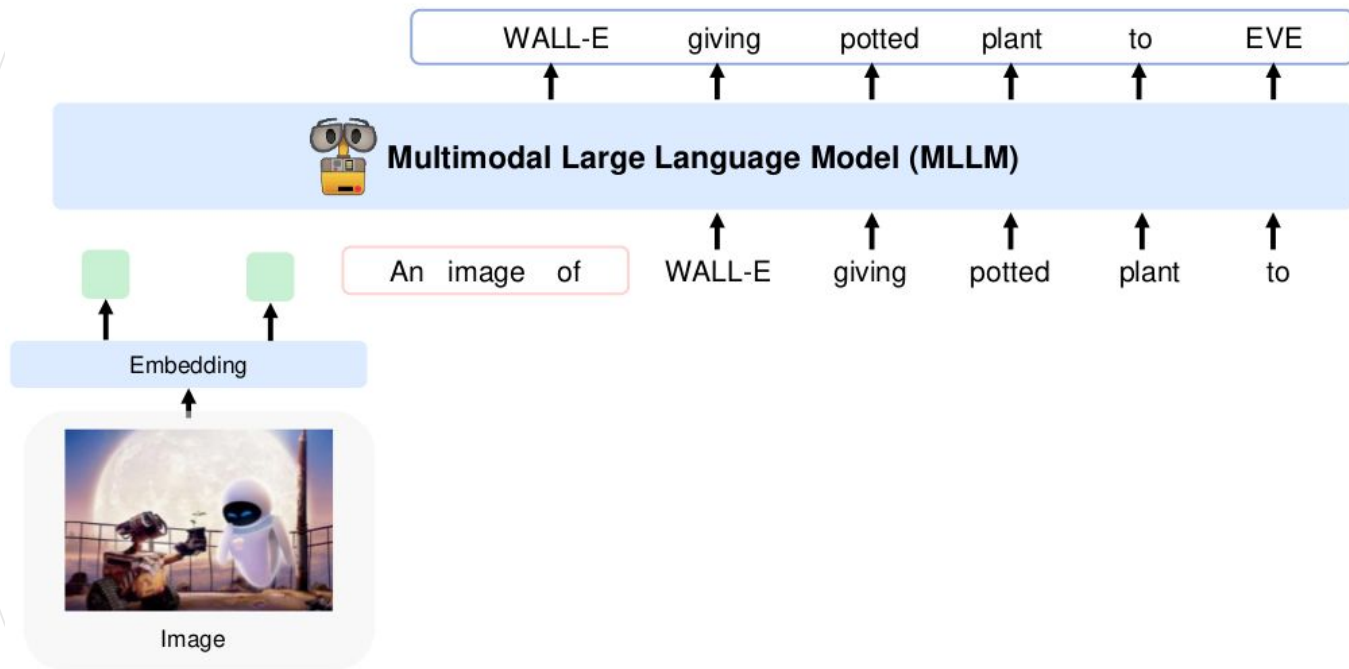


Large Language Models



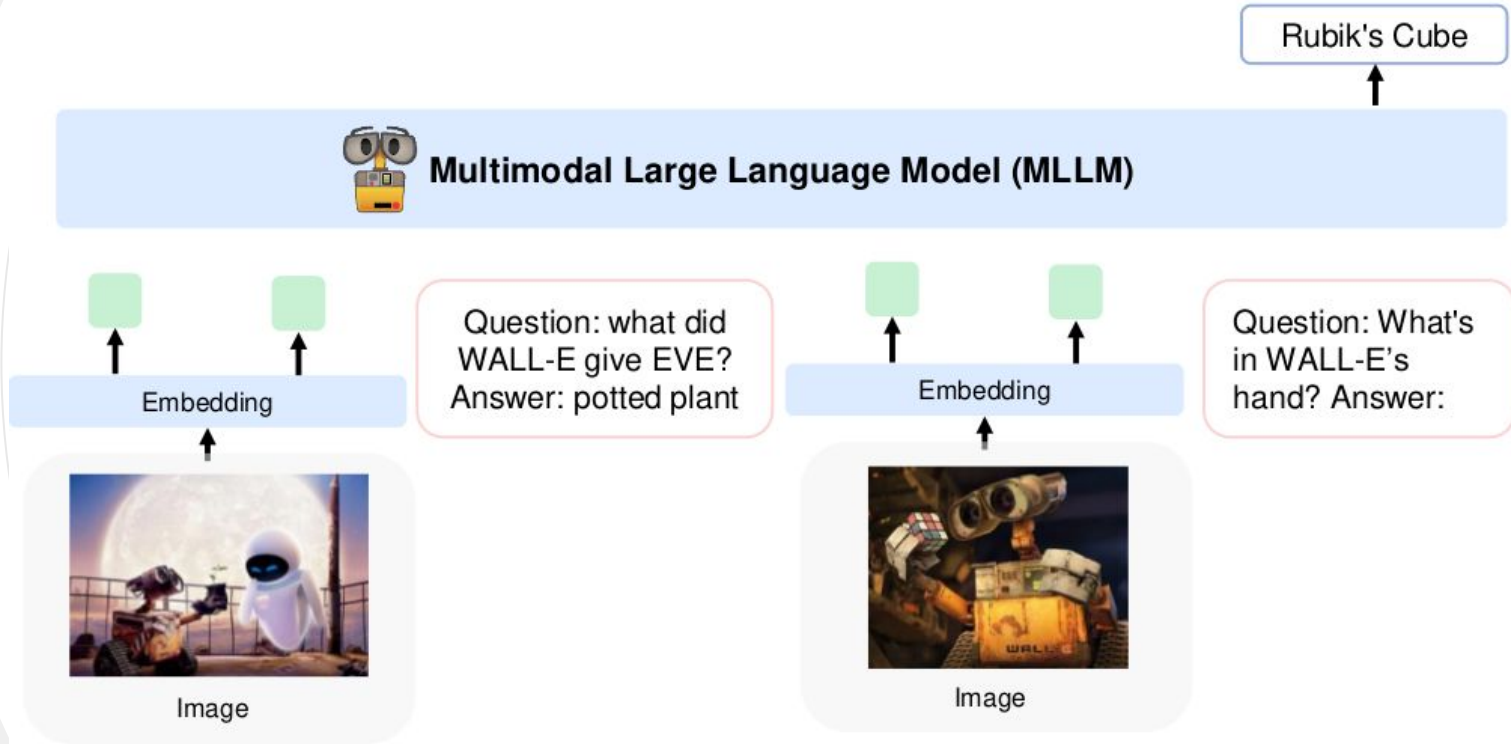
<https://yaofu.notion.site/How-does-GPT-Obtain-its-Ability-Tracing-Emergent-Abilities-of-Language-Models-to-their-Sources-b9a57ac0fc74f30a1ab9e3e36fa1dc1>

LLMs: Zero-shot



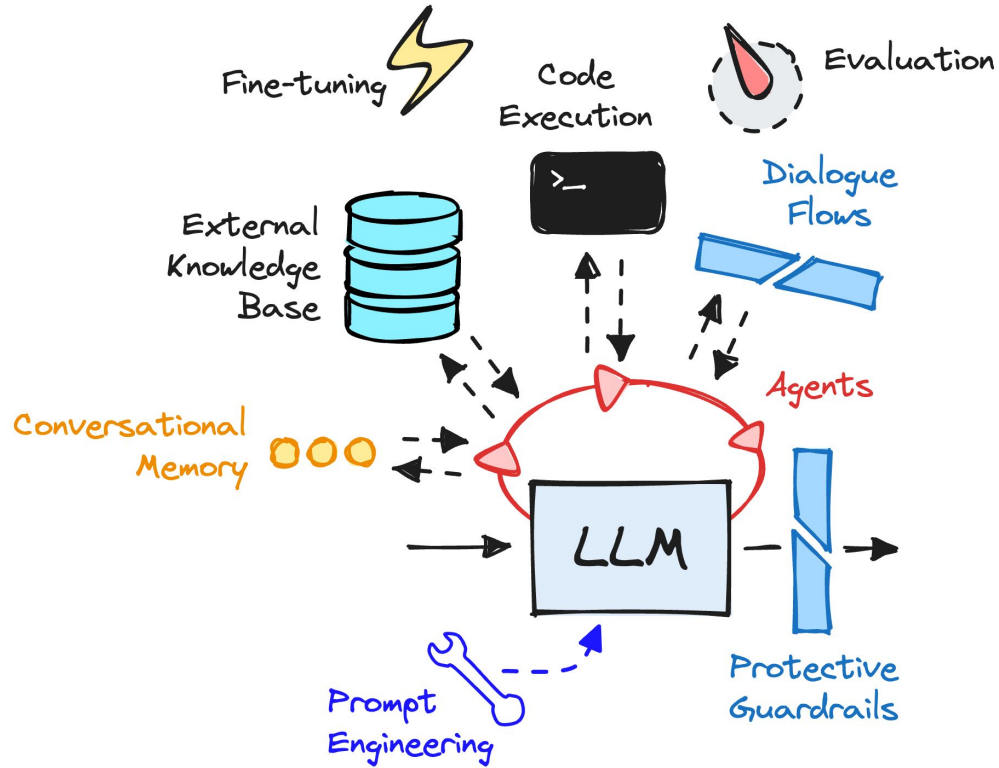
(a) Zero-shot learning

LLMs: few-shot



(b) Few-shot learning

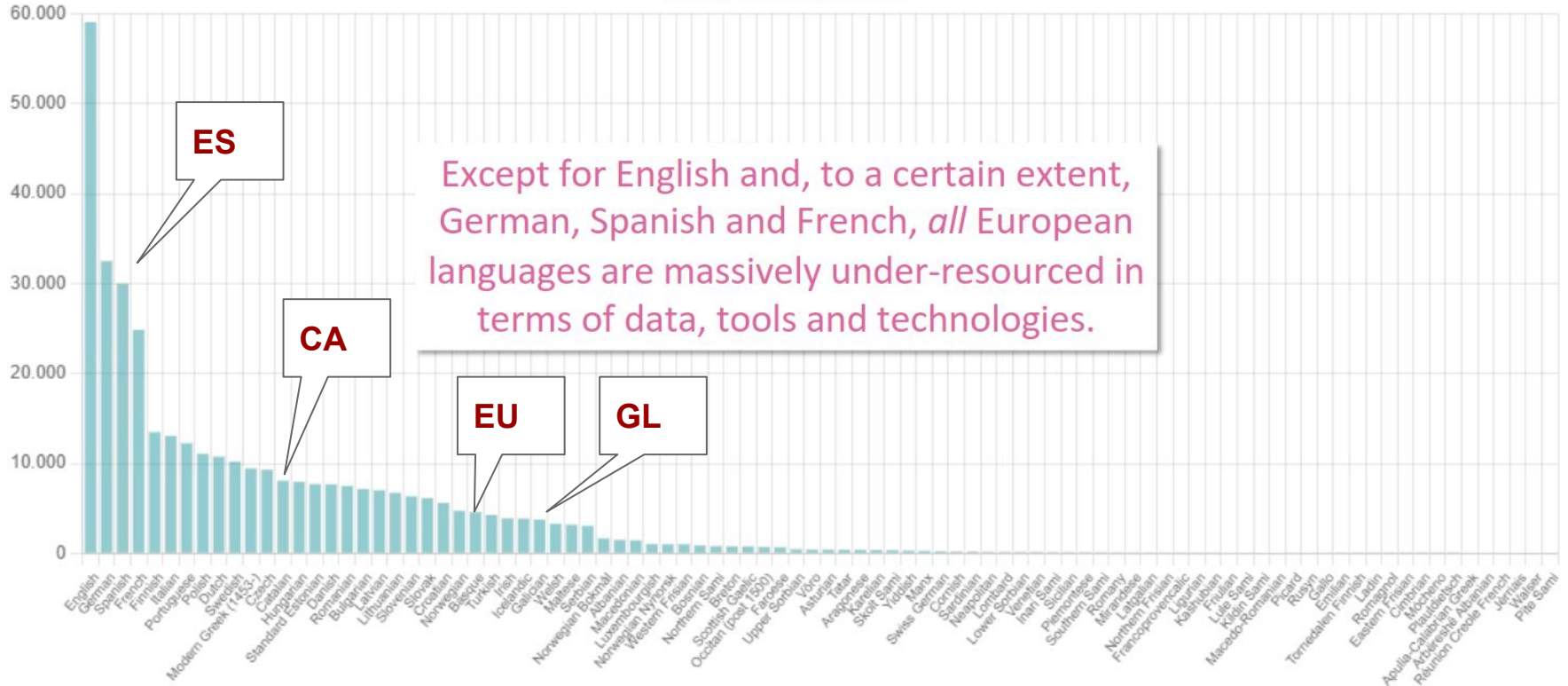
Language Agents



[LLM ecosystem components.](#)

DLE Metric: Technological Scores

Technological factors



European Language Equality



3

**Some
reports**

Reports AI & LT

- [The AI index](#)
- [State of AI](#)
- [AI watch](#)
- [OECD.AI](#)

- [European Language Equality](#)



A large white circle is centered on a black background. To its left, there is a smaller, semi-transparent grey circle containing the number '4'. To its right, there are several concentric white circles of varying sizes, some overlapping the white circle.

4

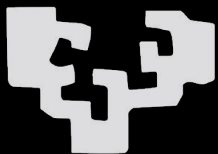
Summary

Summary

- **Unthinkable** AI applications just a few years ago
- Even more **amazing** results in the near future (day by day)
- Experts, Supercomputing, Data ...

- Resources (funding) Experts, Supercomputing, **Data** ...
- **Coordination** and cooperation (EU, national, regional)
 - Administration, academia, technology centers, companies

eman ta zabal zazu



Universidad
del País Vasco

Euskal Herriko
Unibertsitatea

HITZ

Hizkuntza Teknologiako Zentroa
Basque Center for Language Technology

German Rigau Claramunt

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