A gentle introduction to LLMs and LLaMa

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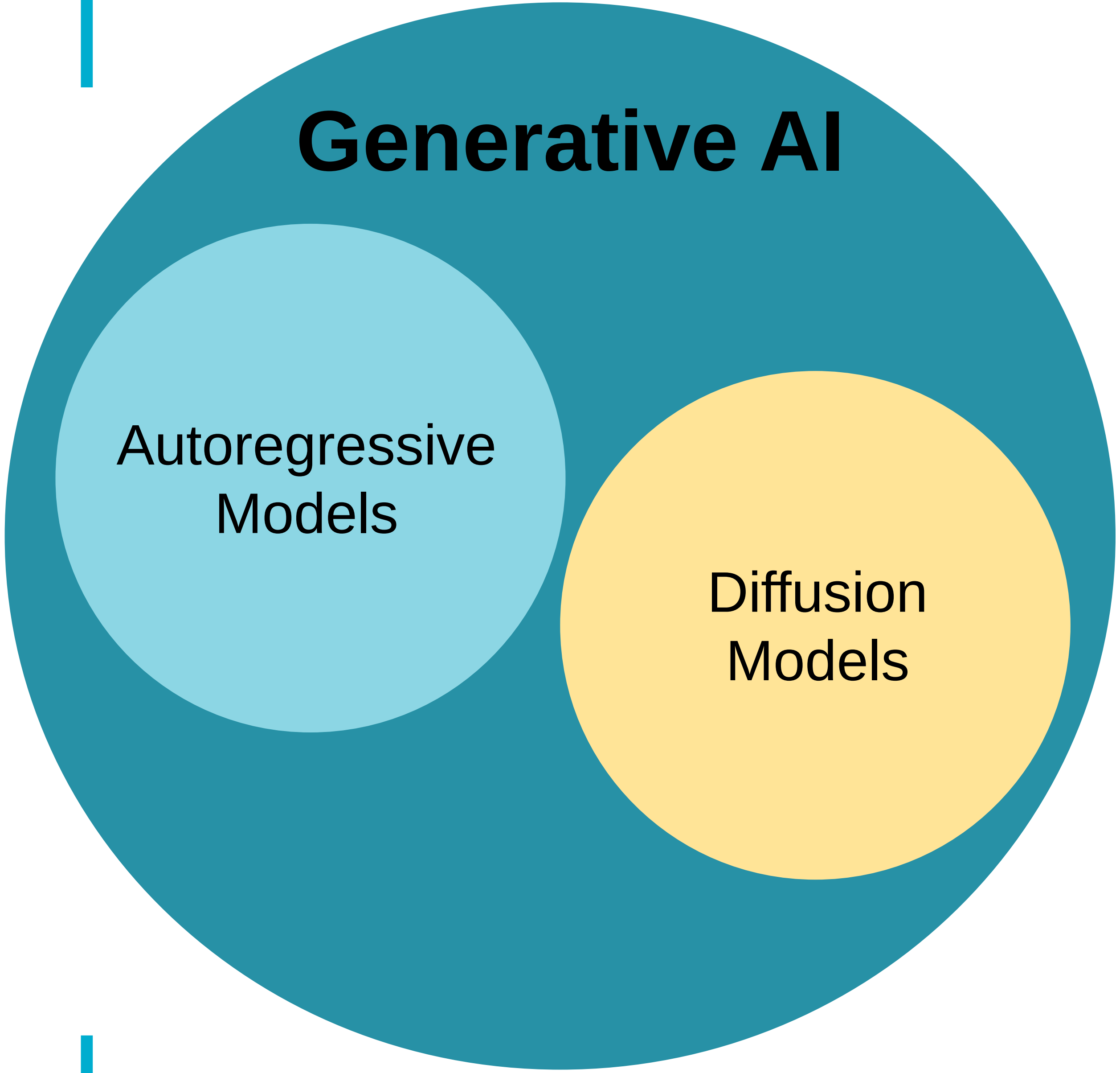
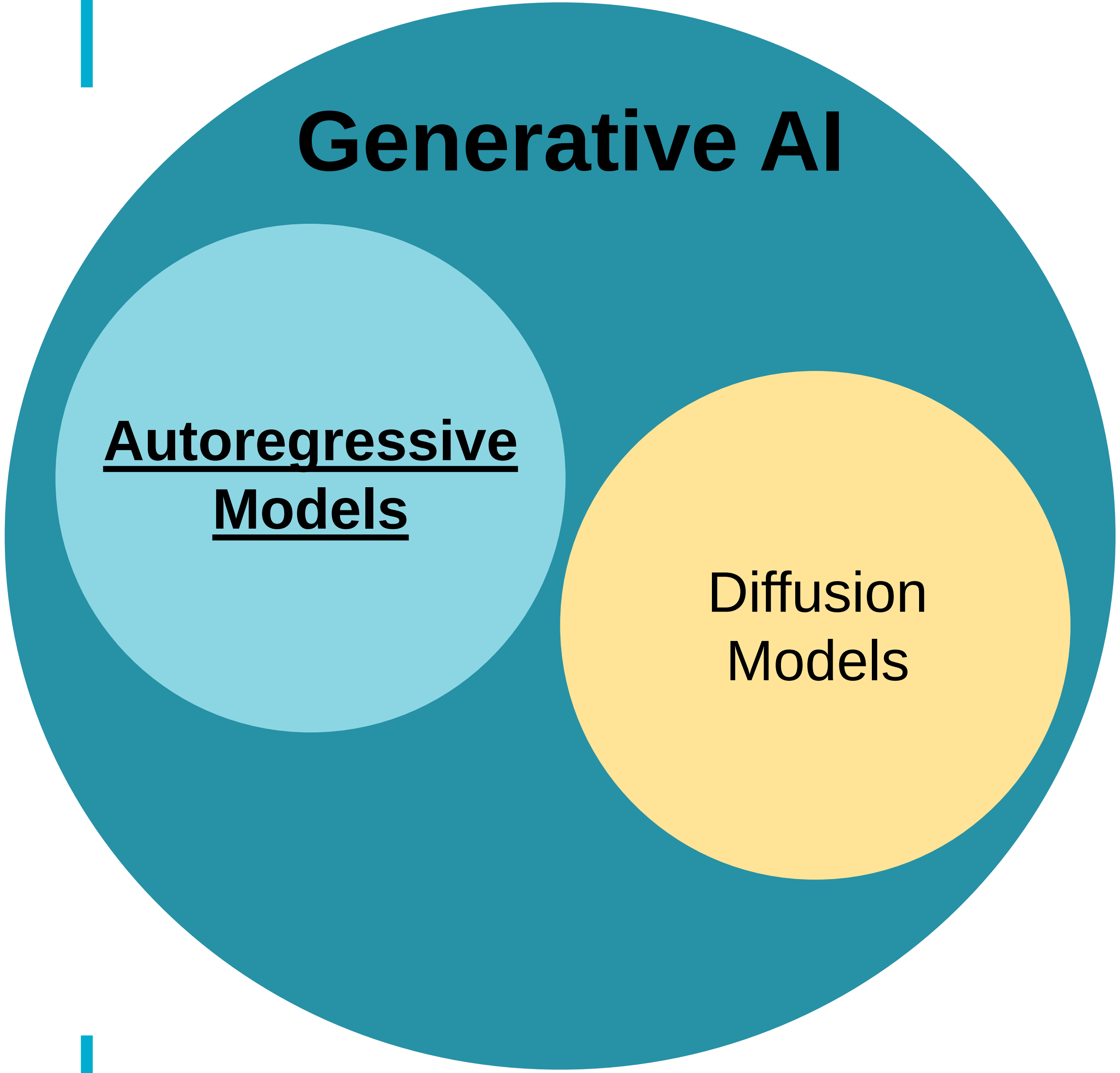
Gen AI



With **Gen AI** we refer to applications of AI where **new data is created** (generated) upon user interaction

- ChatGPT/LLaMa generate language
- DALL-E / Midjourney generate images
- SORA / Pika generate video
- SUNO / udio generate sound/music

Gen AI



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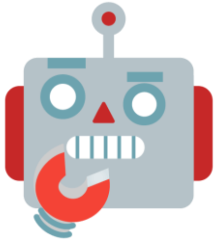
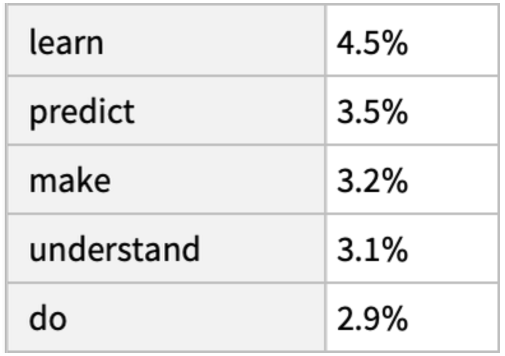
Autoregressive Language Models



The best thing about AI is its ability to



learn	4.5%
predict	3.5%
make	3.2%
understand	3.1%
do	2.9%

- Autoregressive models generate data **sequentially**, one step at a time.

- In the case of text generation, autoregressive models **predict the next token** (word or subword) **based on the previously generated tokens**.

- The generation process is **iterative**, with each step depending on the output of the previous steps.

Llama Generation Flow

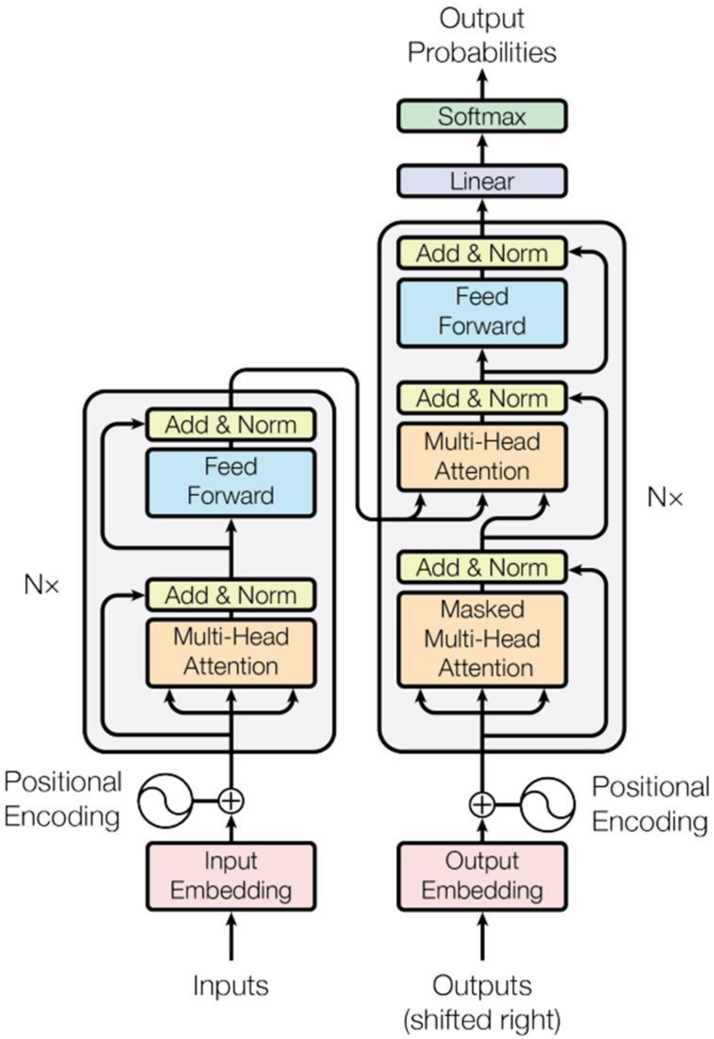


Image from: Attention Is All You Need, Ashish Vaswani et al.

Llama Generation Flow

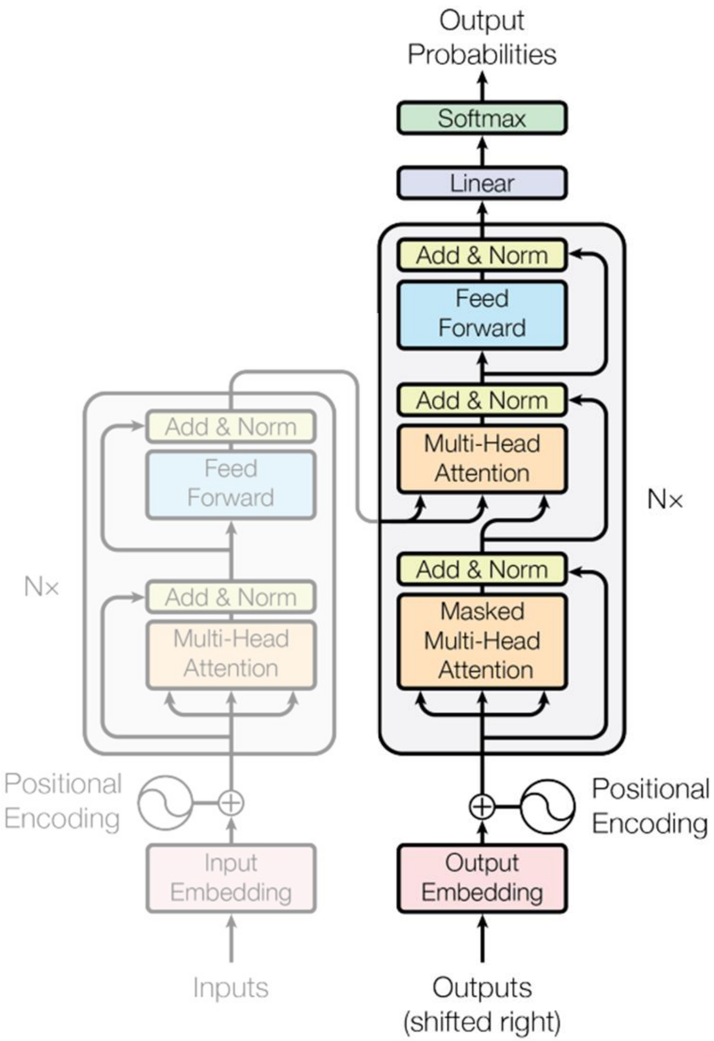


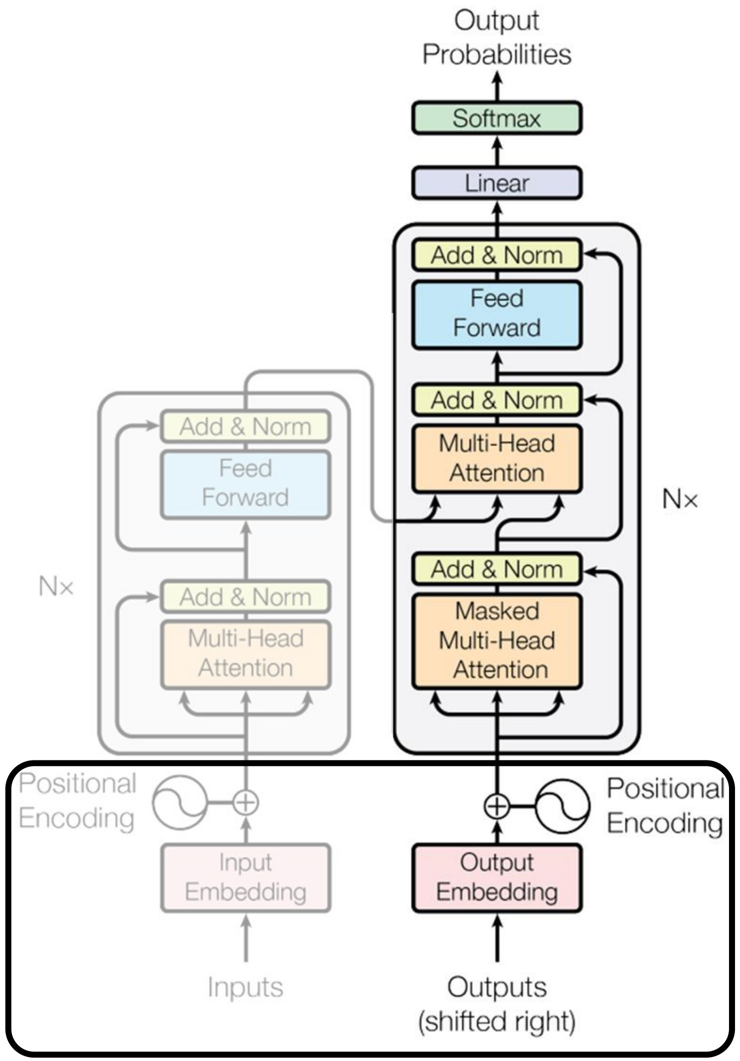
Image from: Attention Is All You Need, Ashish Vaswani et al.

Llama Generation Flow

1

Input Processing

- **Tokenization**: Breaking down input text into tokens (using BPE)
- **Embedding**: Converting tokens into dense semantic vectors (learned)
- **Positional Encoding**: Adding position information to the embeddings



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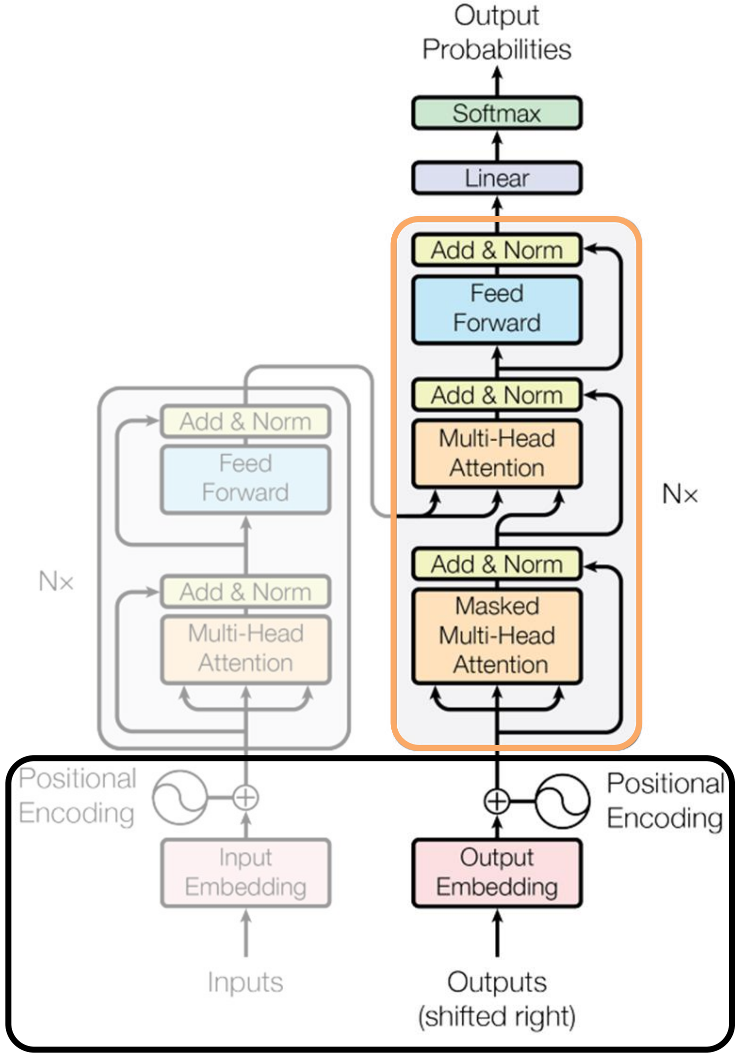
Transformer Decoder Architecture

- **Multi-Head Self-Attention**: Attending to different parts of the input
- **Feed Forward Neural Network**: Processing the attended information
- **Residual Connections and Layer Norm**: Enabling stable training



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Llama Generation Flow

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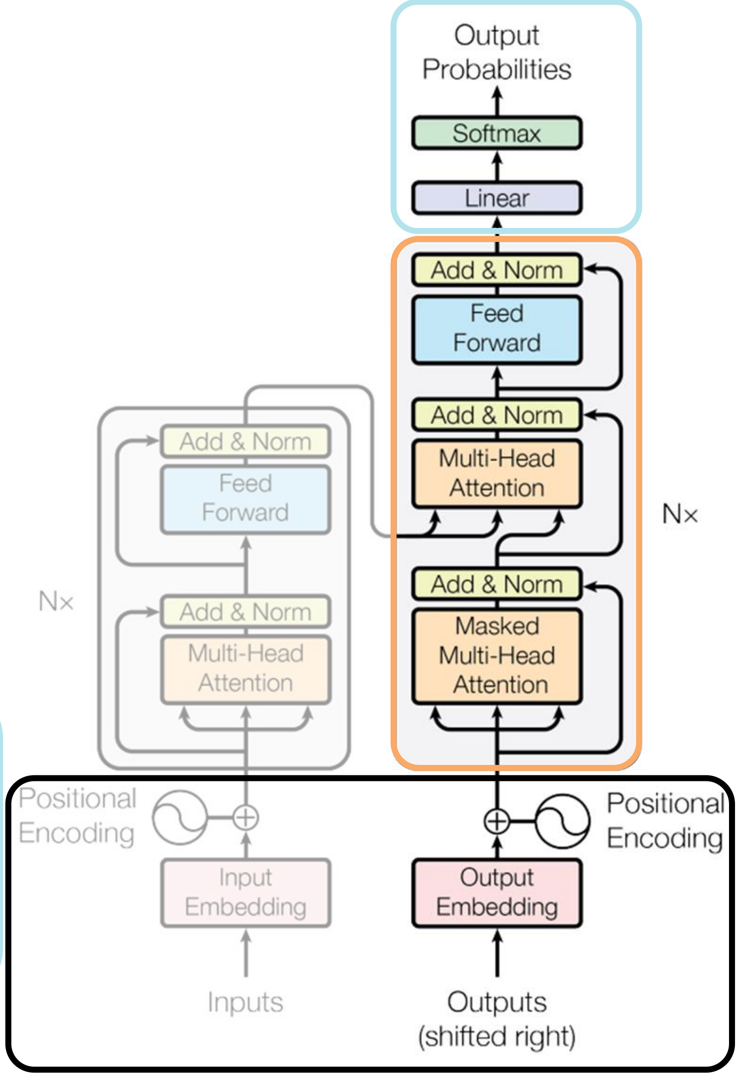
Output Generation

- **Vocabulary Distribution**: net output is a distribution over the vocabulary
- **Sampling Techniques**: top-k, top-p sampling for token selections
- **Iterative process**: Selected token is fed back to generate the next one



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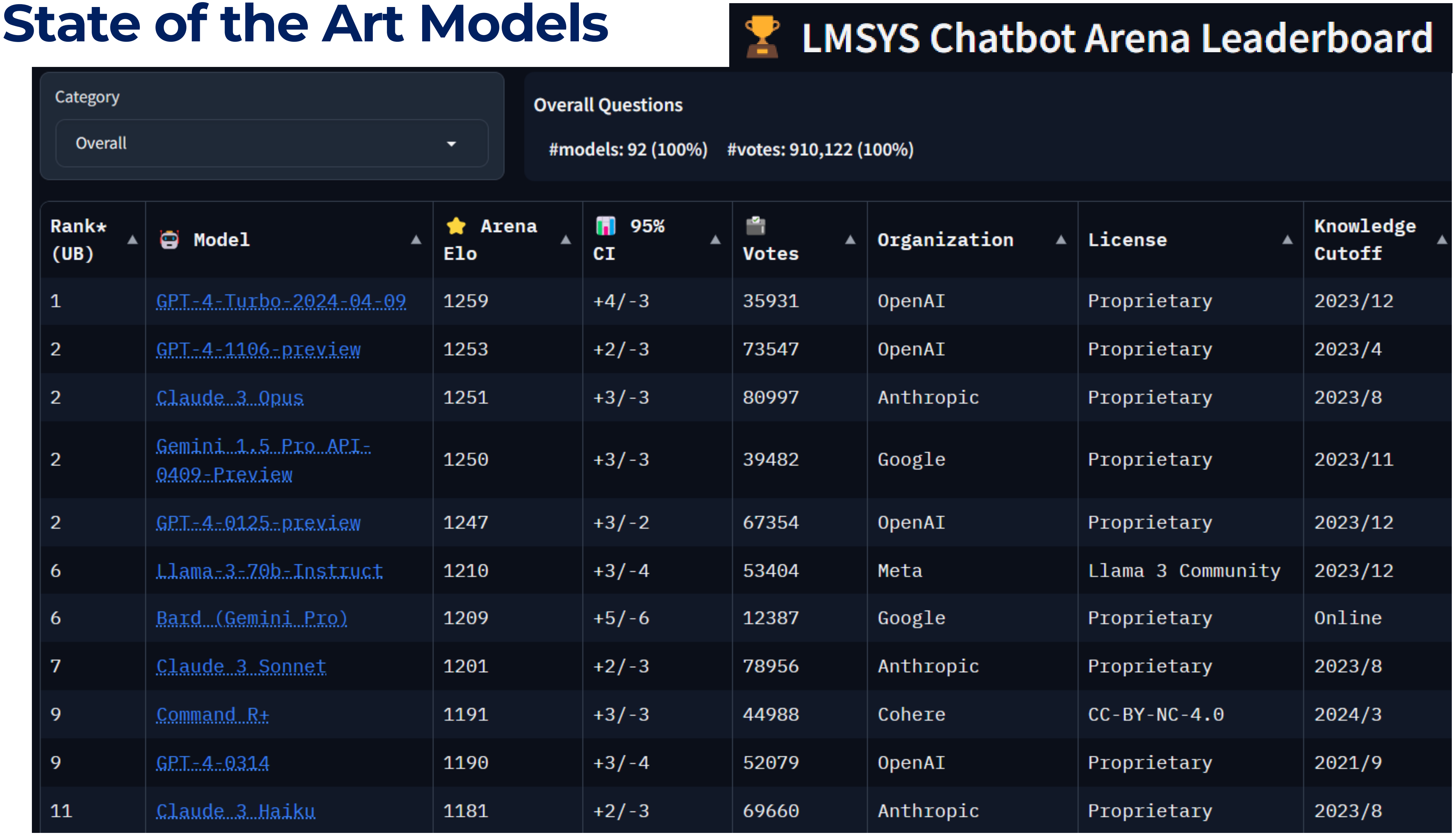
State of the Art Models



LMSYS Chatbot Arena Leaderboard

Category

Overall

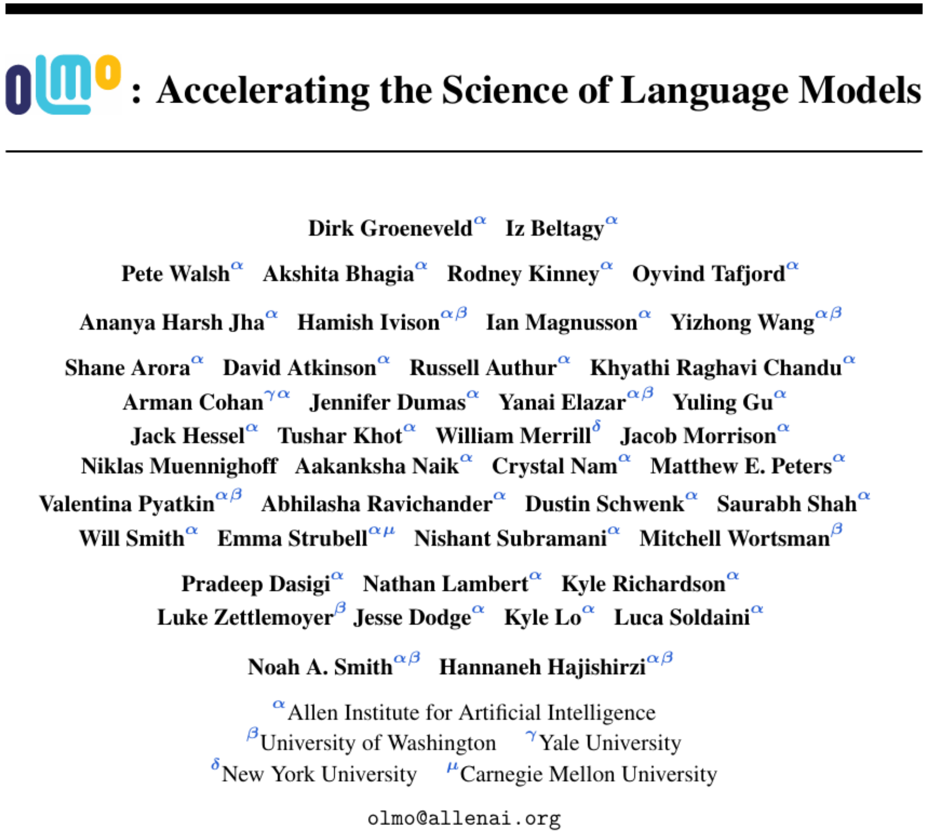
Overall Questions

#models: 92 (100%) #votes: 910,122 (100%)

Rank* (UB)	Model	Arena Elo	95% CI	Votes	Organization	License	Knowledge Cutoff
1	GPT-4-Turbo-2024-04-09	1259	+4/-3	35931	OpenAI	Proprietary	2023/12
2	GPT-4-1106-preview	1253	+2/-3	73547	OpenAI	Proprietary	2023/4
2	Claude 3 Opus	1251	+3/-3	80997	Anthropic	Proprietary	2023/8
2	Gemini 1.5 Pro API-0409-Preview	1250	+3/-3	39482	Google	Proprietary	2023/11
2	GPT-4-0125-preview	1247	+3/-2	67354	OpenAI	Proprietary	2023/12
6	Llama-3-70b-Instruct	1210	+3/-4	53404	Meta	Llama 3 Community	2023/12
6	Bard (Gemini Pro)	1209	+5/-6	12387	Google	Proprietary	Online
7	Claude 3 Sonnet	1201	+2/-3	78956	Anthropic	Proprietary	2023/8
9	Command R+	1191	+3/-3	44988	Cohere	CC-BY-NC-4.0	2024/3
9	GPT-4-0314	1190	+3/-4	52079	OpenAI	Proprietary	2021/9
11	Claude 3 Haiku	1181	+2/-3	69660	Anthropic	Proprietary	2023/8

Image from: arena.lmsys.org

Open Source vs Open Weights



OLMo: Accelerating the Science of Language Models

Dirk Groeneveld[α] Iz Beltagy[α]

Pete Walsh[α] Akshita Bhagia[α] Rodney Kinney[α] Oyvind Tafjord[α]

Ananya Harsh Jha[α] Hamish Ivison[αβ] Ian Magnusson[α] Yizhong Wang[αβ]

Shane Arora[α] David Atkinson[α] Russell Authur[α] Khyathi Raghavi Chandu[α]
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Jack Hessel[α] Tushar Khot[α] William Merrill[δ] Jacob Morrison[α]
Niklas Muennighoff Aakanksha Naik[α] Crystal Nam[α] Matthew E. Peters[α]
Valentina Pyatkin[αβ] Abhilasha Ravichander[α] Dustin Schwenk[α] Saurabh Shah[α]
Will Smith[α] Emma Strubell[αμ] Nishant Subramani[α] Mitchell Wortsman[β]

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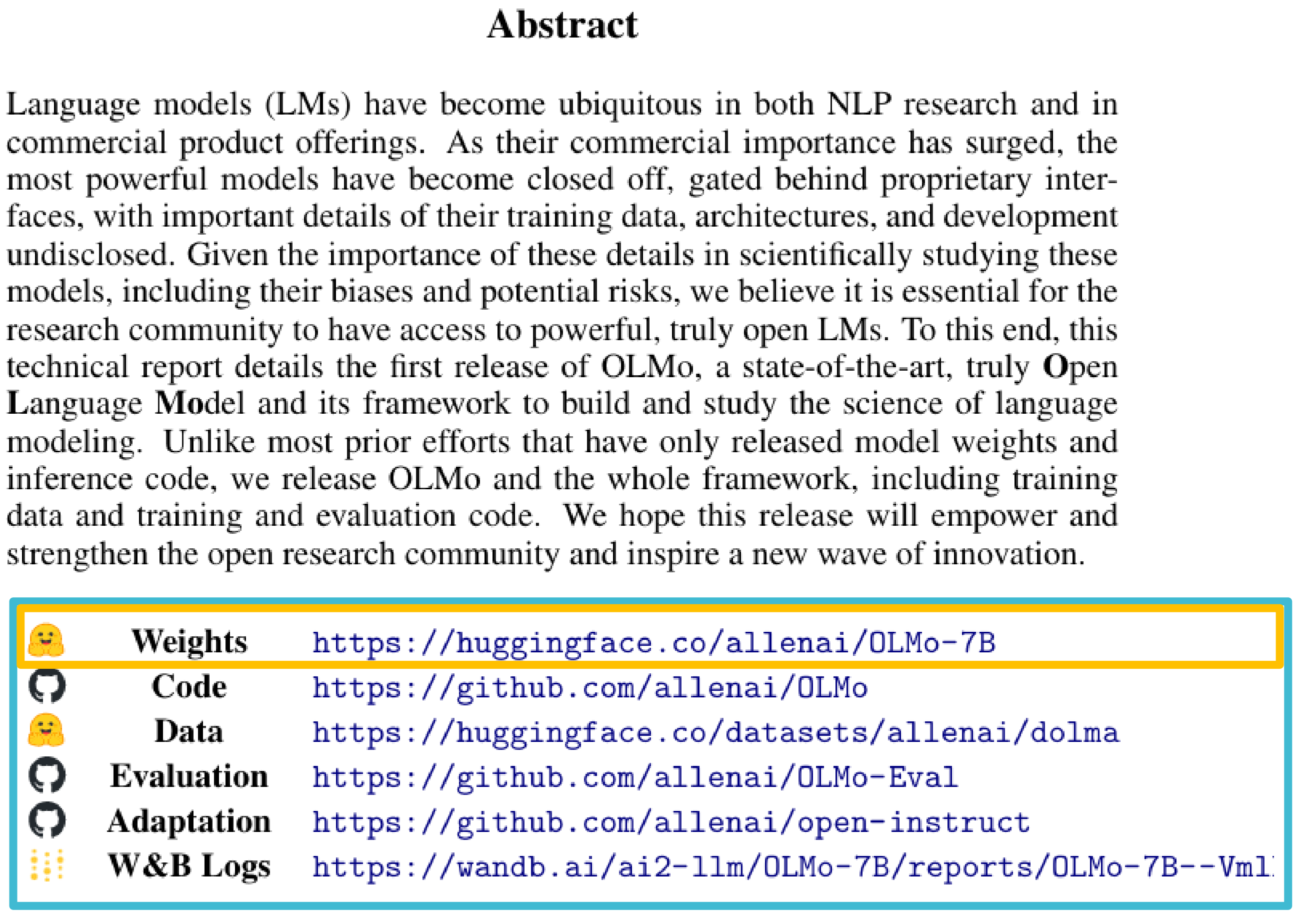


Abstract

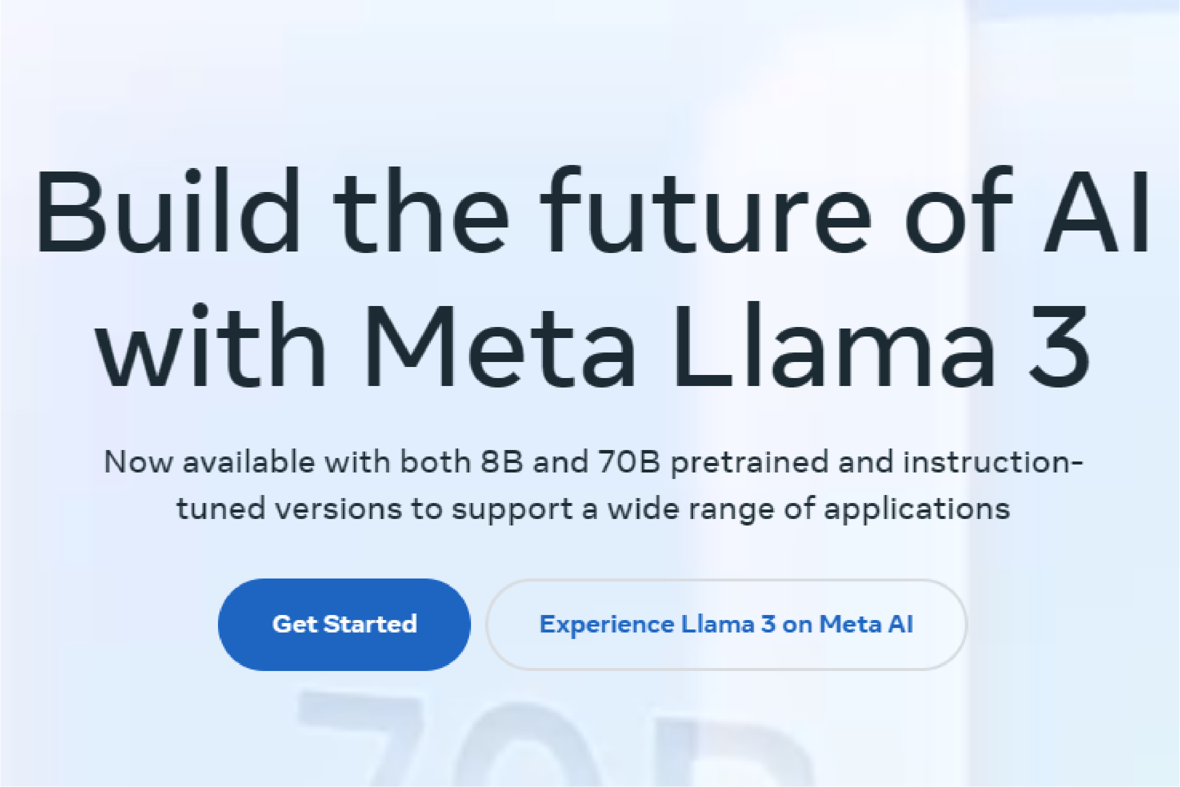
Language models (LMs) have become ubiquitous in both NLP research and in commercial product offerings. As their commercial importance has surged, the most powerful models have become closed off, gated behind proprietary interfaces, with important details of their training data, architectures, and development undisclosed. Given the importance of these details in scientifically studying these models, including their biases and potential risks, we believe it is essential for the research community to have access to powerful, truly open LMs. To this end, this technical report details the first release of OLMo, a state-of-the-art, truly **O**pen **L**anguage **Mo**del and its framework to build and study the science of language modeling. Unlike most prior efforts that have only released model weights and inference code, we release OLMo and the whole framework, including training data and training and evaluation code. We hope this release will empower and strengthen the open research community and inspire a new wave of innovation.

🤗	**Weights**	https://huggingface.co/allenai/OLMo-7B
	Code	https://github.com/allenai/OLMo
🤗	**Data**	https://huggingface.co/datasets/allenai/dolma
	Evaluation	https://github.com/allenai/OLMo-Eval
	Adaptation	https://github.com/allenai/open-instruct
	W&B Logs	https://wandb.ai/ai2-llm/OLMo-7B/reports/OLMo-7B--Vml

New entry within Open Weights LLMs by Meta

Latest release:

- **Llama 3** released on April 18th 8B and 70B Models
- **400B Model** currently **under training**, planned weight release
- LLaMa 3 **license** is **royalty free** if:
  - monthly active users < 700M
  - not use to improve other LLMs

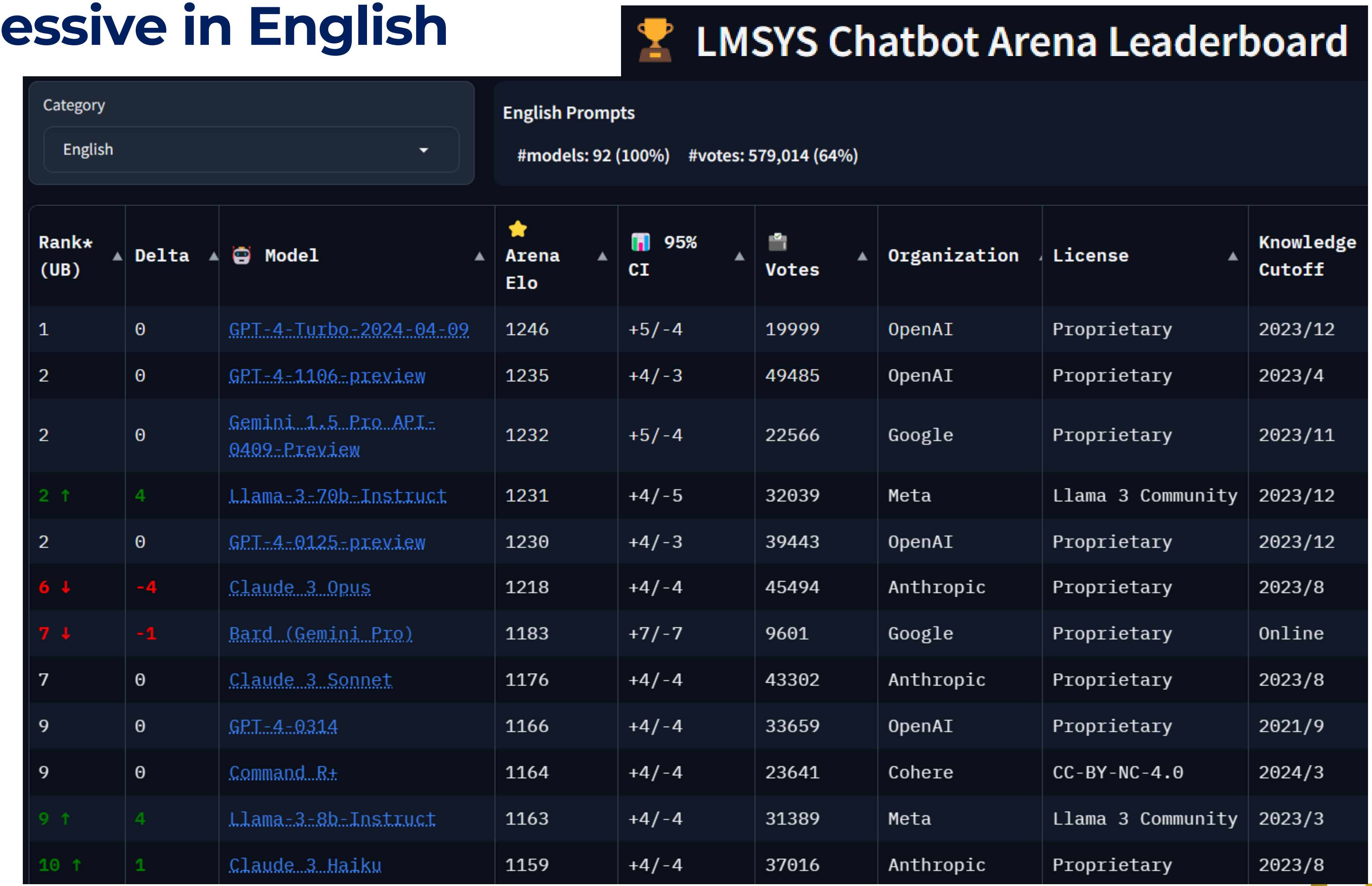


Build the future of AI with Meta Llama 3

Now available with both 8B and 70B pretrained and instruction-tuned versions to support a wide range of applications

Image from: llama.meta.com/llama3/

Impressive in English



LMSYS Chatbot Arena Leaderboard

Category: English

English Prompts

#models: 92 (100%) #votes: 579,014 (64%)

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2 ↑	4	Llama-3-70b-Instruct	1231	+4/-5	32039	Meta	Llama 3 Community	2023/12
2	0	GPT-4-0125-preview	1230	+4/-3	39443	OpenAI	Proprietary	2023/12
6 ↓	-4	Claude 3 Opus	1218	+4/-4	45494	Anthropic	Proprietary	2023/8
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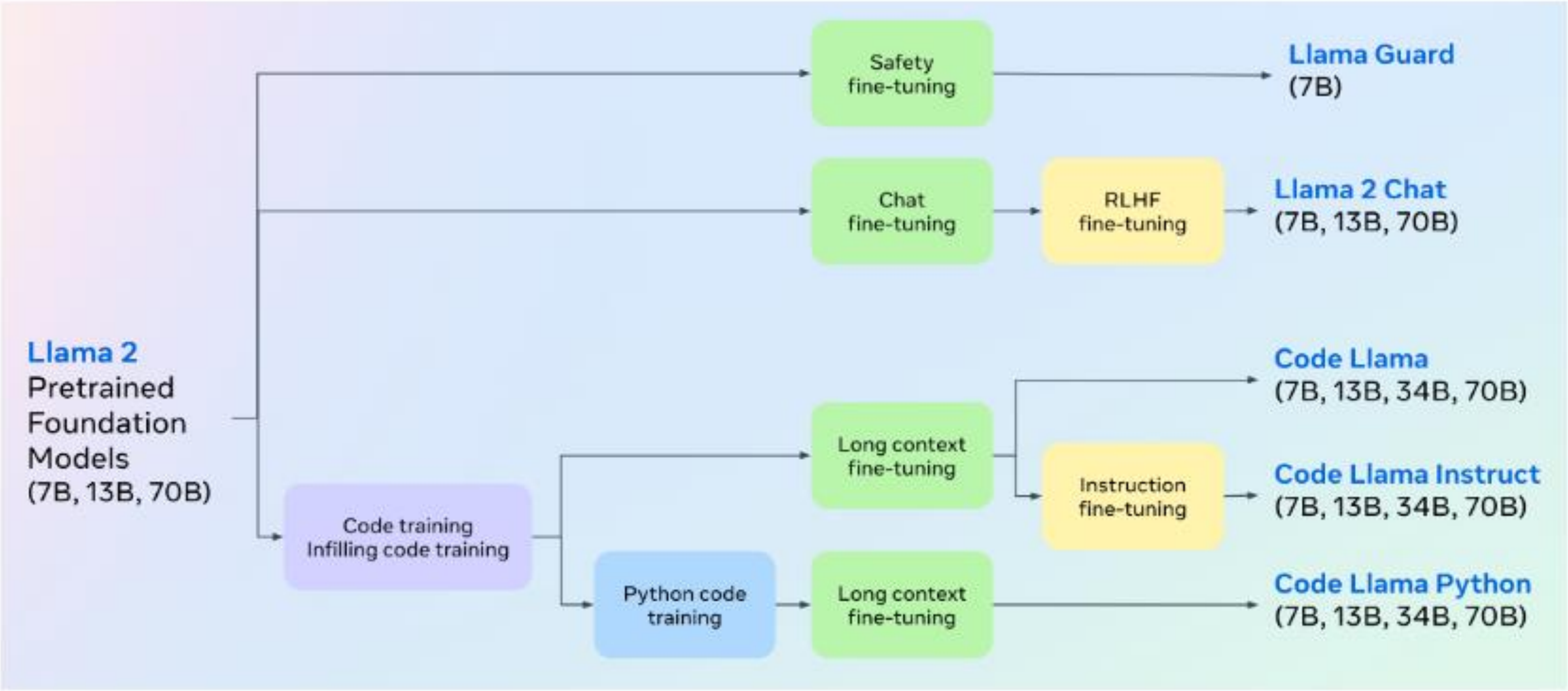
7	0	Claude 3 Sonnet	1176	+4/-4	43302	Anthropic	Proprietary	2023/8
9	0	GPT-4-0314	1166	+4/-4	33659	OpenAI	Proprietary	2021/9
9	0	Command R+	1164	+4/-4	23641	Cohere	CC-BY-NC-4.0	2024/3
9 ↑	4	Llama-3-8b-Instruct	1163	+4/-4	31389	Meta	Llama 3 Community	2023/3
10 ↑	1	Claude 3 Haiku	1159	+4/-4	37016	Anthropic	Proprietary	2023/8

Image from: arena.lmsys.org

Which Llama2?



- Llama 2: Foundation model (good at text completion)
- Llama2 – chat: Good at question answering (like ChatGPT!)
- CodeLlama – Instruct : Good for safer deployment
- LlamaGuard: input-output safeguard model

image from llama.meta.com/llama2/

Llama 2 Training

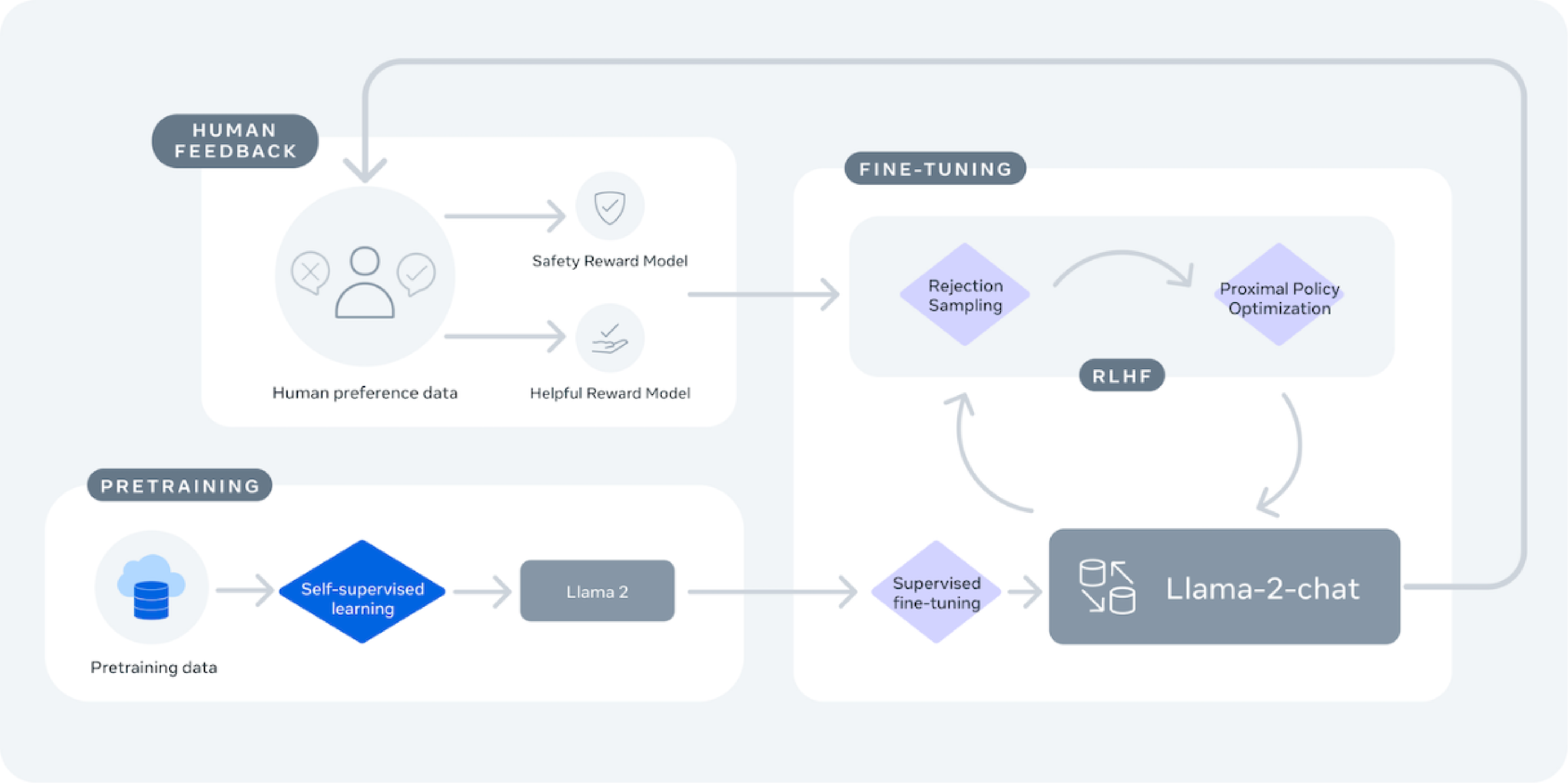


image from llama.meta.com/llama2/

Training != Inference

image from llama.meta.com/llama2/

Let’s continue the discussion!

If you want to talk more about LLMs
feel free to add me
on the event website or Linkedin or
just come say hi in the next days :)

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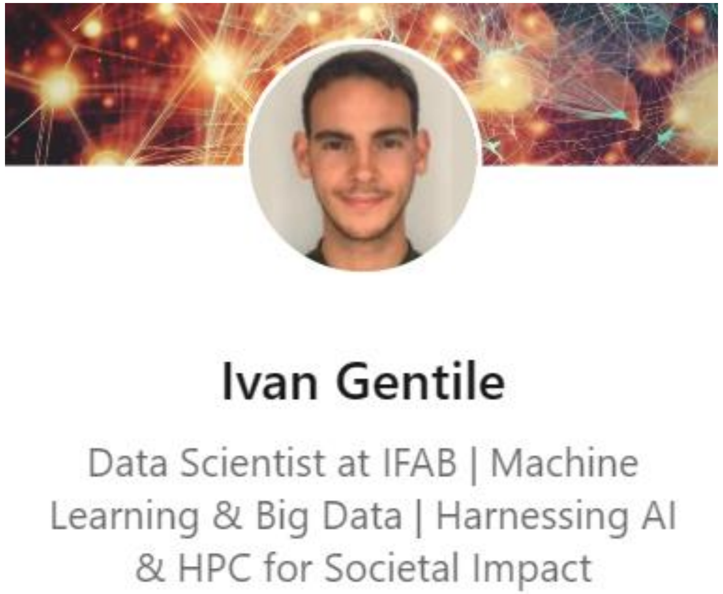

Ivan Gentile

Data Scientist at IFAB | Machine Learning & Big Data | Harnessing AI & HPC for Societal Impact

Acknowledgements

Funded by the European Union. This work has received funding from the European High Performance Computing Joint Undertaking (JU) and Germany, Bulgaria, Austria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Greece, Hungary, Ireland, Italy, Lithuania, Latvia, Poland, Portugal, Romania, Slovenia, Spain, Sweden, France, Netherlands, Belgium, Luxembourg, Slovakia, Norway, Türkiye, Republic of North Macedonia, Iceland, Montenegro, Serbia under grant agreement No 101101903.

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