

# Generative AI for Researchers

Motaz Saad



# About me

- Motaz Saad, computer Scientist.
- PhD in CS from Univ Lorraine, France.
- Working in Academia in many universities in Palestine.
- Collaborated with Many universities in Europe
- Working in industry as a consultant.

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Source of Slides:

- DeepLearning.AI as the source of the slides.
- Generative AI :)
- Harvard Teaching and Learning Consortium

# In this course ...

- Intro to Gen AI
- intro to Large Language Models LLMs
- Prompt Engineering
- AI tools for researchers
- Responsible AI

# After this course, you should be able to:

- Understand the principles and applications of generative AI.
- Explain how large language models work.
- Utilize prompt engineering techniques to elicit desired outputs from AI models across various tasks, including data generation, summarization, and idea development, ... etc.
- Utilize AI tools to support and enhance academic research activities.
- Identify and implement responsible AI practices in research.

# Introduction to Gen AI

A gentle intro :)

# What is AI?

- Human intelligence (HI): ability to learn, think, solve problems, ....
- Artificial Intelligence (AI): enable computer to learn, think and solve problems.



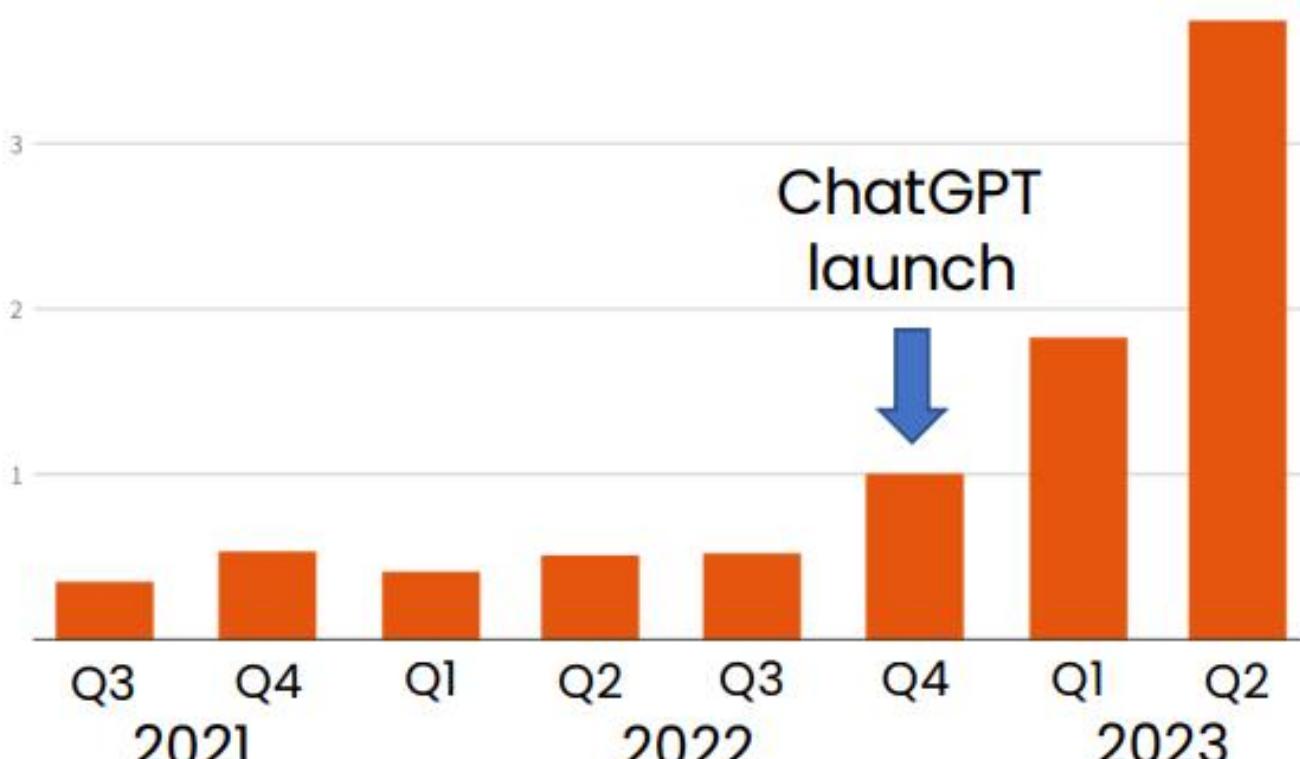
# AI is already pervasive in our lives

Area	Examples	Description
Web Search Engines	Google, Yahoo	Use AI to improve search algorithms, provide relevant search results, and offer personalized search suggestions.
Social Media	Facebook, Instagram, X	Use AI to curate news feeds, detect inappropriate content, and provide targeted advertisements based on user behavior and preferences.
Transportation	Uber, Lyft	Use AI for navigation, and optimizing routes to improve efficiency and safety in transportation.

# The rise of generative AI

- Impact 10% of the tasks carried out daily by 80% of workers
  - source: OpenAI/UPenn

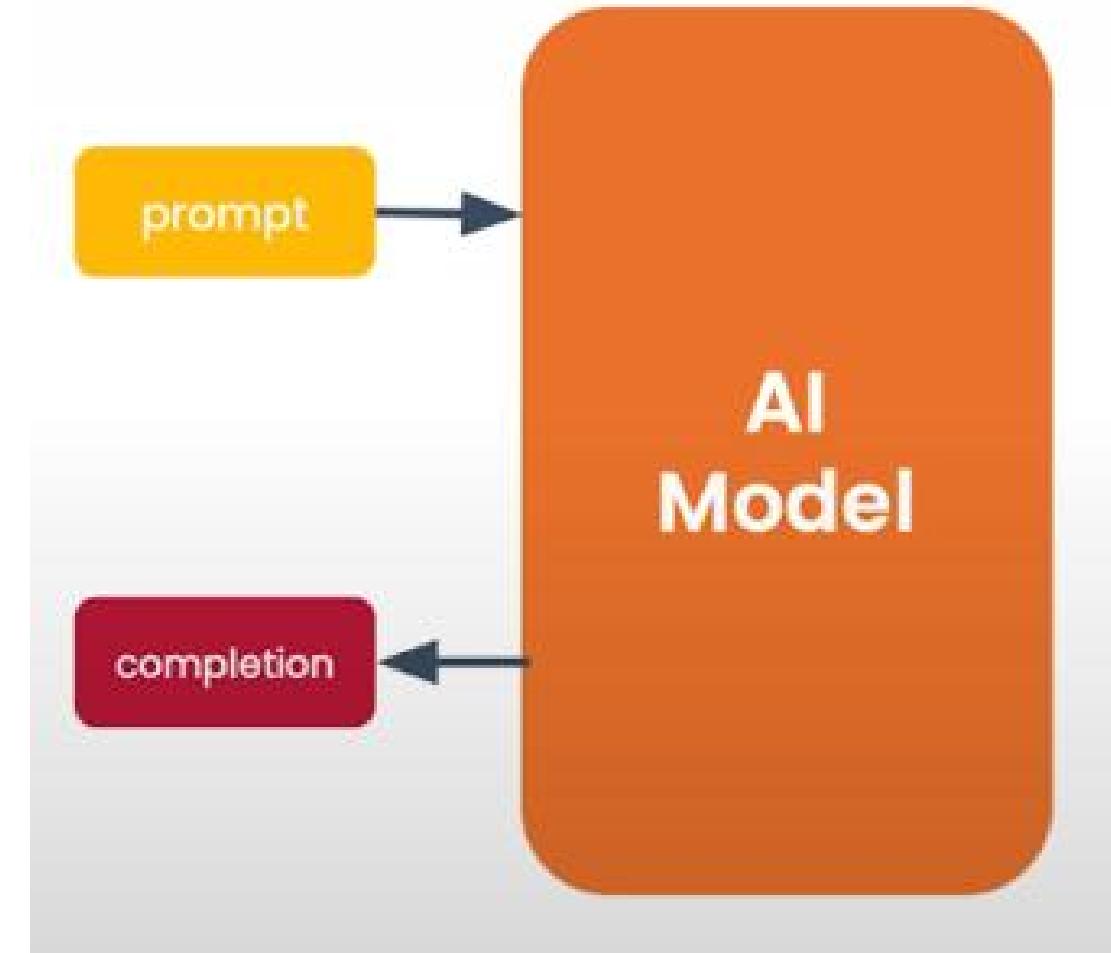
Average number of 'AI' mentions per S&P 500 analyst call



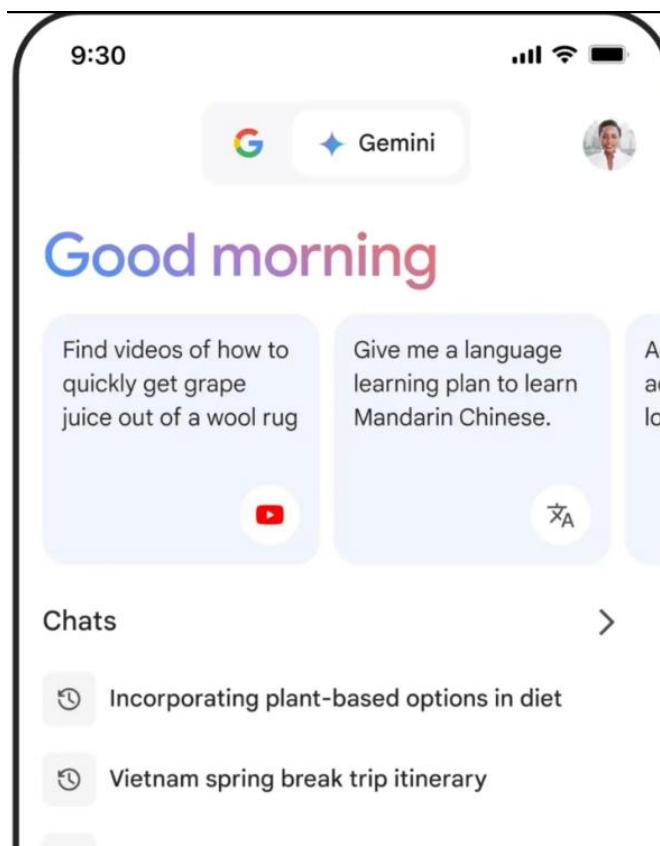
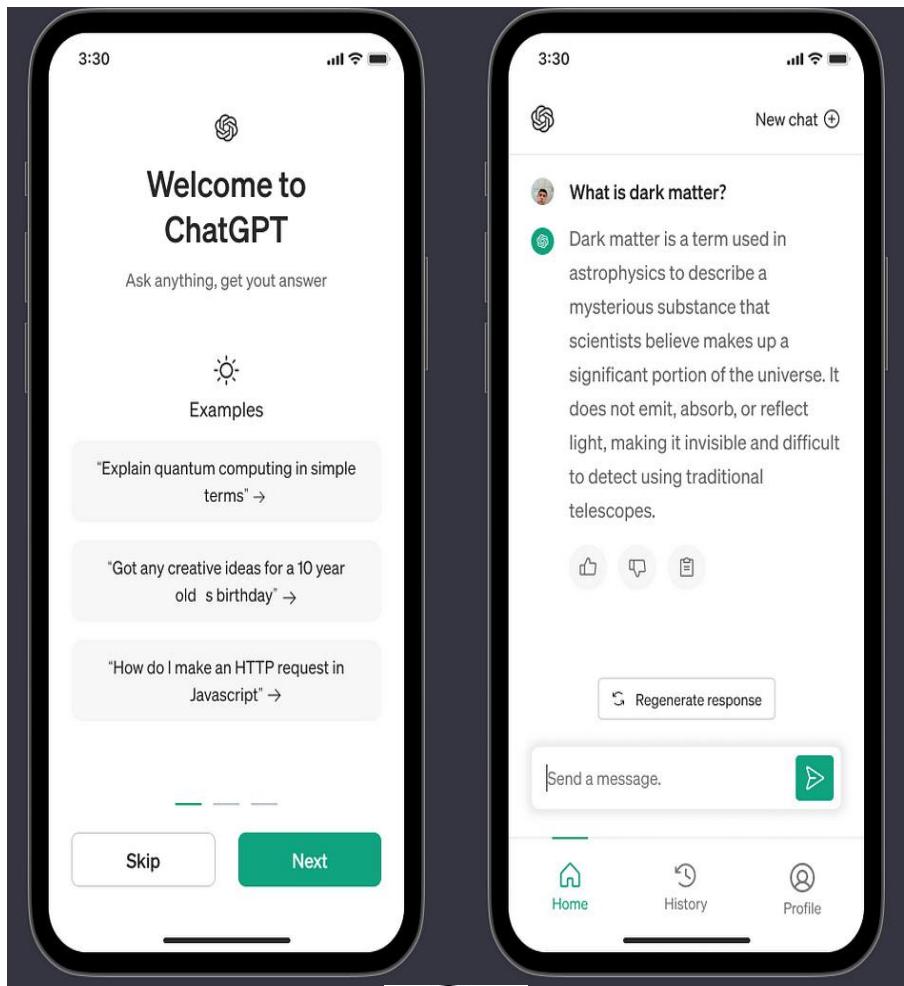
Source: Reuters

# What is generative AI?

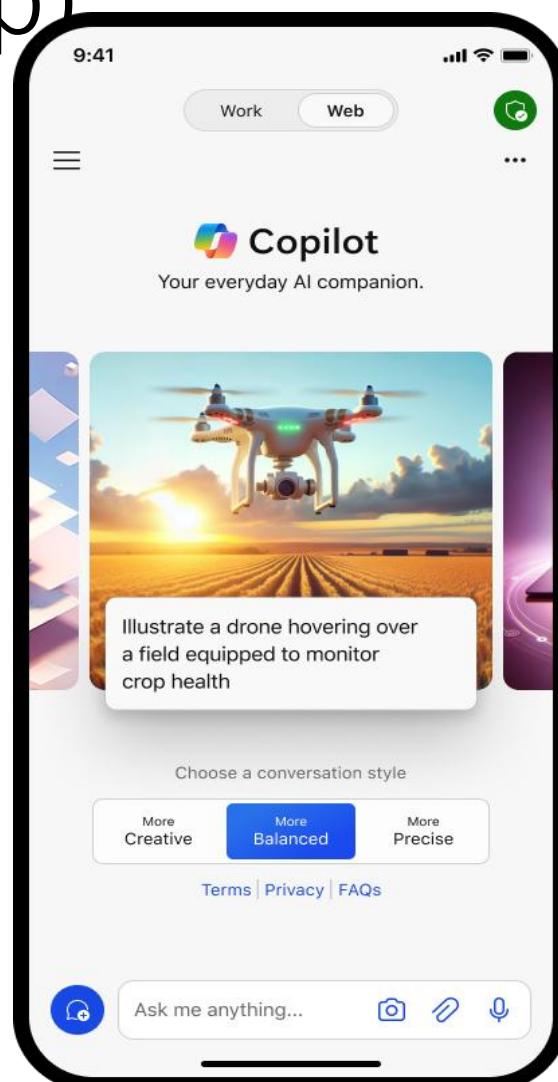
- Gen AI is an Artificial intelligence systems that can produce high quality content, specifically text, images, and audio.



# Gen AI Tools for end users (mobile App)



# Gemini



# Copilot

# Gen AI Tools for end users (ChatGPT Web App)

The screenshot shows the ChatGPT web application. At the top left is a dark sidebar with a '+ New Chat' button. The main area has a light background with the 'ChatGPT' logo at the top center. Below it are three sections: 'Examples' (with a brain icon), 'Capabilities' (with a lightning bolt icon), and 'Limitations' (with a warning triangle icon). Each section contains two examples. The 'Examples' section shows: "Explain quantum computing in simple terms" → and "Got any creative ideas for a 10 year old's birthday?" →. The 'Capabilities' section shows: "Remembers what user said earlier in the conversation" and "Allows user to provide follow-up corrections". The 'Limitations' section shows: "May occasionally generate incorrect information" and "May occasionally produce harmful instructions or biased content". At the bottom left is a dark sidebar with links: 'Dark Mode', 'OpenAI Discord', 'Updates & FAQ', and 'Log out'. A large input field with a right-pointing arrow is at the bottom center. The footer at the bottom reads: 'ChatGPT Dec 15 Version. Free Research Preview. Our goal is to make AI systems more natural and safe to interact with. Your feedback will help us improve.'

+ New Chat

# ChatGPT

Examples Capabilities Limitations

"Explain quantum computing in simple terms" → "Got any creative ideas for a 10 year old's birthday?" →

Remembers what user said earlier in the conversation Allows user to provide follow-up corrections

May occasionally generate incorrect information May occasionally produce harmful instructions or biased content

"How do I make an HTTP request in Javascript?" →

Trained to decline inappropriate requests

Limited knowledge of world and events after 2021

Dark Mode

OpenAI Discord

Updates & FAQ

Log out

ChatGPT Dec 15 Version. Free Research Preview. Our goal is to make AI systems more natural and safe to interact with. Your feedback will help us improve.

# Gen AI Tools for end users (Copilot Web App)

The screenshot shows the Microsoft Copilot web application interface. At the top, there's a navigation bar with a Microsoft Copilot logo, a search bar containing the URL <https://copilot.microsoft.com>, and standard browser controls. Below the header, the Microsoft logo is visible.

The main content area features the Copilot logo and the tagline "Your everyday AI companion with Bing". It displays several AI tools in cards:

- Laugh**: Start a knock-knock joke.
- Compare**: Should I buy a road bike or a mountain bike if I want to exercise?
- Chat**: What's the most popular true crime show streaming right now?
- Write**: Summarize the main points of the latest research on AI.
- Travel**: Where should I travel if I have pollen allergies?
- Create**: Write a short essay that analyzes the merits of universal basic income.
- Organize**: Create a table that analyzes public funding for the arts compared to GDP.

At the bottom, there's a "Preview" button, a note about AI-powered responses, and links for "Terms" and "Privacy". A section titled "Choose a conversation style" offers options for "More Creative", "More Balanced" (which is selected), and "More Precise". The bottom-most part is a large input field with a microphone icon, placeholder text "Ask me anything...", and a character icon.

# Gen AI Tools for end users (Copilot Web App)

Microsoft Bing how to use copilot? Deep search Motaz 2234 Mobile

SEARCH COPILOT SCHOOL VIDEOS IMAGES MAPS NEWS MORE TOOLS

About 39,800,000 results

Help from Microsoft <https://support.microsoft.com/article/f0e606b3-018f-498c-b707-dfcc46c667a0>

**Write content with Copilot**

Microsoft 365 Web Microsoft 365 for Mac

1. In the left margin, select the  **Copilot** icon and select **Draft with Copilot**.
2. In the **Draft with Copilot** dialog box, tell Copilot what you'd like (For example, "Write a letter to the editor about adding more bike lanes.") and select **Generate**.
3. After Copilot creates the content, you can select **Keep it**, **Regenerate**, **Discard it**, or fine tune Copilot's response by entering details into the compose box, like "Make it sound professional."

For more details, see [Draft and add content with Copilot](#).

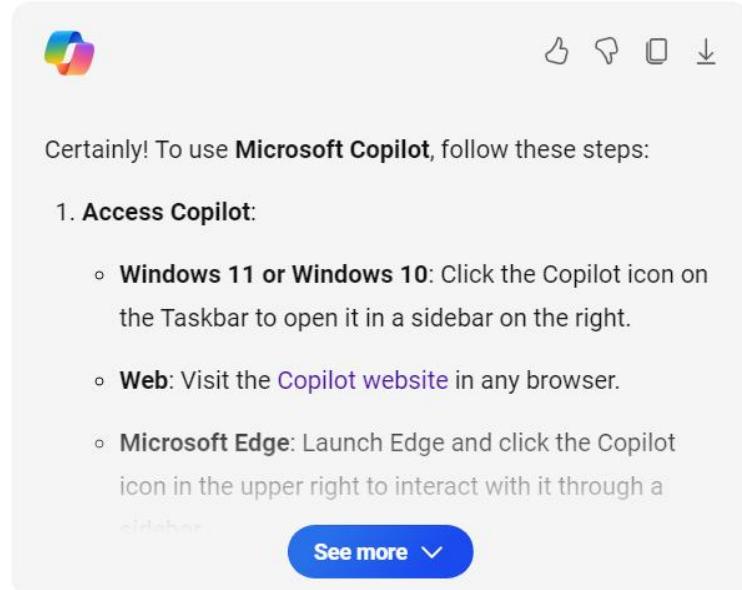
The features described here are available to licensed users of Microsoft Copilot. To buy a Copilot license and start enjoying the power of AI, visit [Microsoft Copilot Pro](#).

**People also ask**

**How do I use copilot?** To use Copilot on the web, head to the Copilot website on any browser.

**How do I use GitHub copilot?** GitHub Copilot can also assist in query generation for databases, generating

**How do I use extens**



Certainly! To use **Microsoft Copilot**, follow these steps:

- Access Copilot:**
  - Windows 11 or Windows 10:** Click the Copilot icon on the Taskbar to open it in a sidebar on the right.
  - Web:** Visit the [Copilot website](#) in any browser.
  - Microsoft Edge:** Launch Edge and click the Copilot icon in the upper right to interact with it through a sidebar.

[See more](#)



# Gen AI Tools for end users (Gemini Web App)

The screenshot shows the Gemini Web App interface. On the left, there's a sidebar with a menu icon, a "New chat" button, and a "Recent" section containing a link to "consider the following tim...". Below this are links for "Help", "Activity", "Settings", and "Egypt". At the bottom, it says "From your IP address" and "Update location". The main area has a "Gemini" header with a dropdown arrow, a "Try Gemini Advanced" button, and a user profile icon. The central text reads "Hello, Motaz" in blue and red, followed by "How can I help you today?". Below this are four cards: "Create a travel itinerary for a city" (with a clock icon), "Give me tips for how to grow my YouTube channel" (with a clock and play button icon), "Help me find YouTube videos to care for a specific plant" (with a play button icon), and "Give me ways to add certain foods to my diet" (with a clock icon). At the bottom, a message states: "Humans review some saved chats to improve Google AI. To stop this for future chats, turn off Gemini Apps Activity. If this setting is on, don't enter info you wouldn't want reviewed or used. [How it works](#)". It includes "Manage Activity" and "Dismiss" buttons. A search bar at the bottom says "Enter a prompt here" with a magnifying glass and microphone icon. The footer notes: "Gemini may display inaccurate info, including about people, so double-check its responses. [Your privacy & Gemini Apps](#)".

Gemini ▾

+ New chat

Recent

□ consider the following tim...

② Help

⌚ Activity

⚙️ Settings

● Egypt

From your IP address • Update location

Hello, Motaz

How can I help you today?

Create a travel itinerary for a city

Give me tips for how to grow my YouTube channel

Help me find YouTube videos to care for a specific plant

Give me ways to add certain foods to my diet

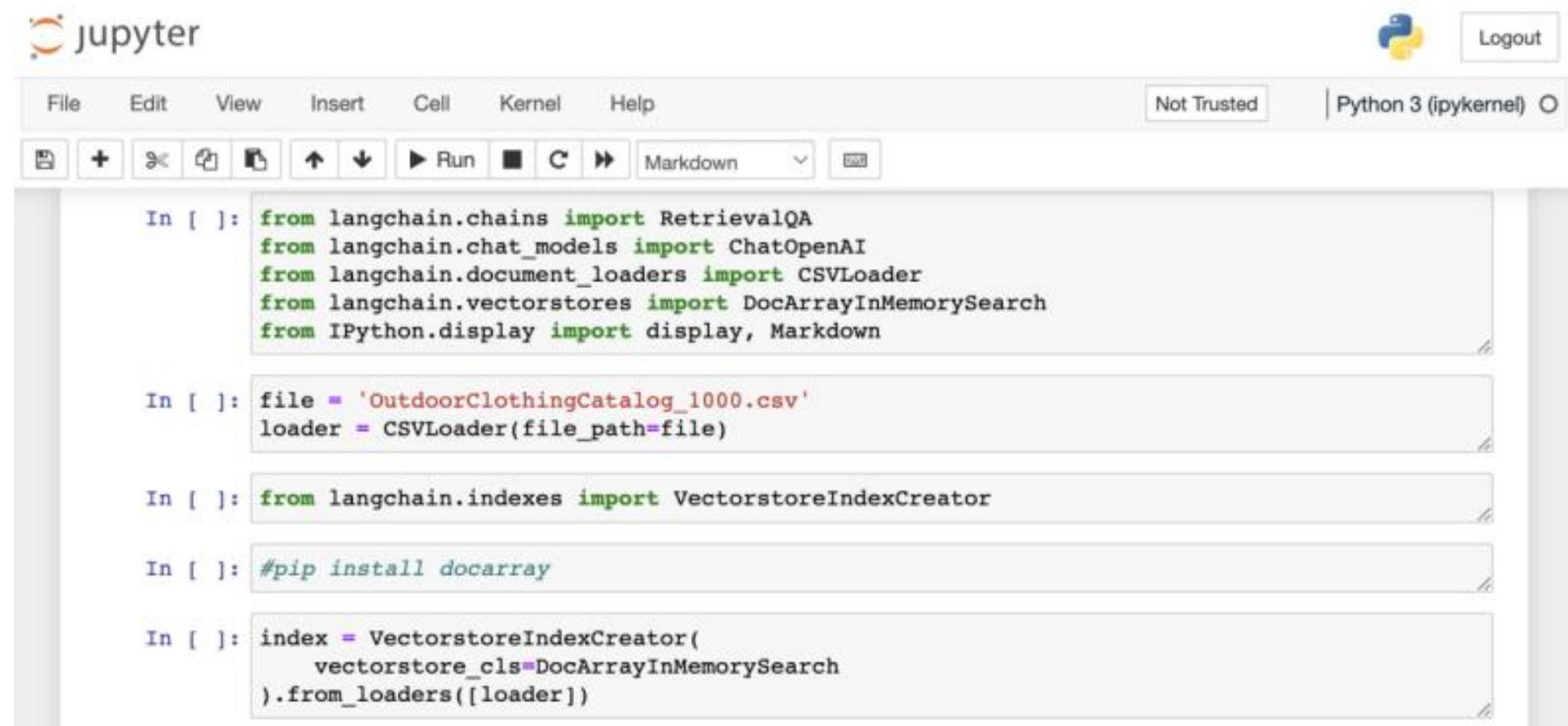
Humans review some saved chats to improve Google AI. To stop this for future chats, turn off Gemini Apps Activity. If this setting is on, don't enter info you wouldn't want reviewed or used. [How it works](#)

Manage Activity Dismiss

Enter a prompt here

Gemini may display inaccurate info, including about people, so double-check its responses. [Your privacy & Gemini Apps](#)

# Generative AI is also a developer tool

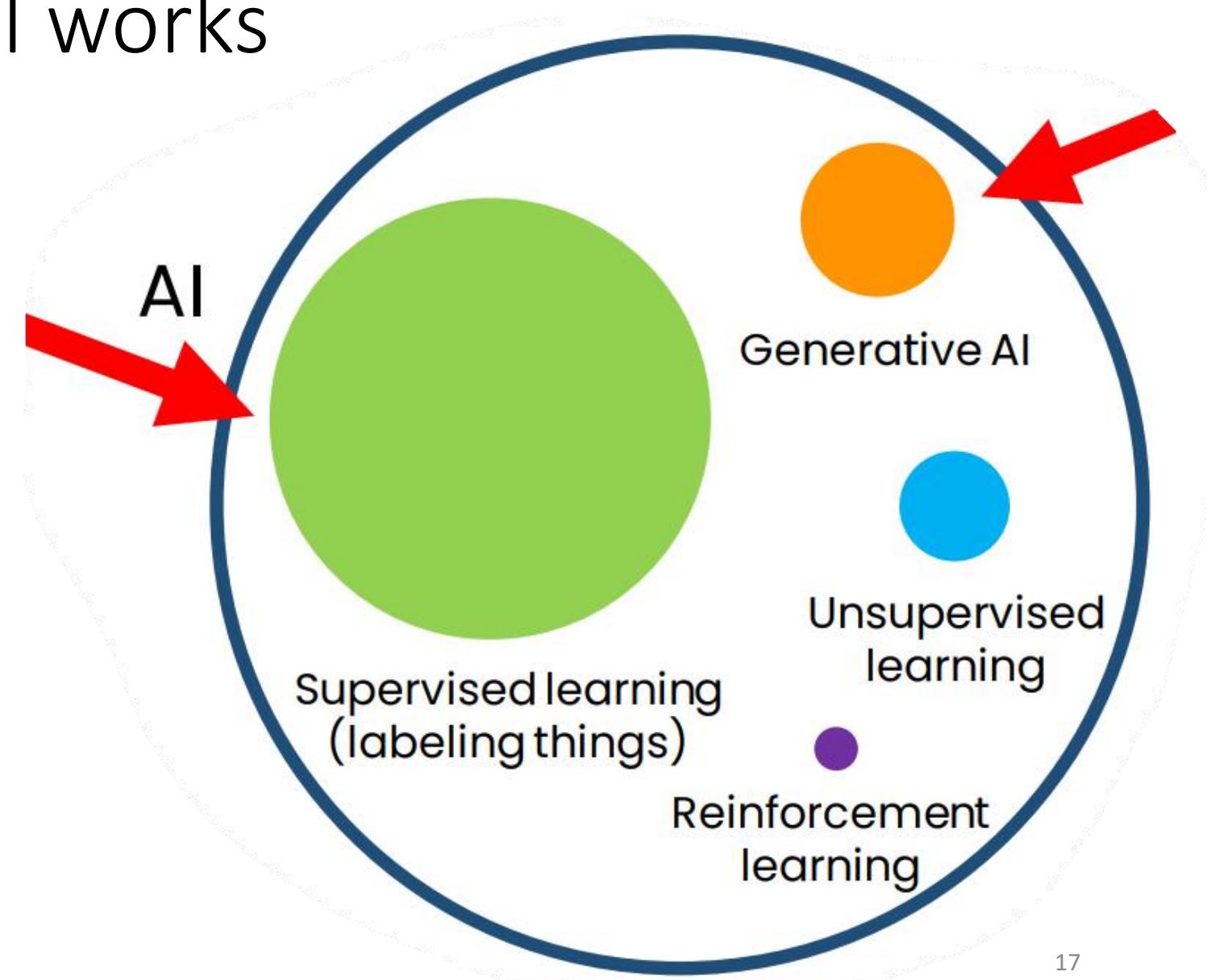


The screenshot shows a Jupyter Notebook interface with the following details:

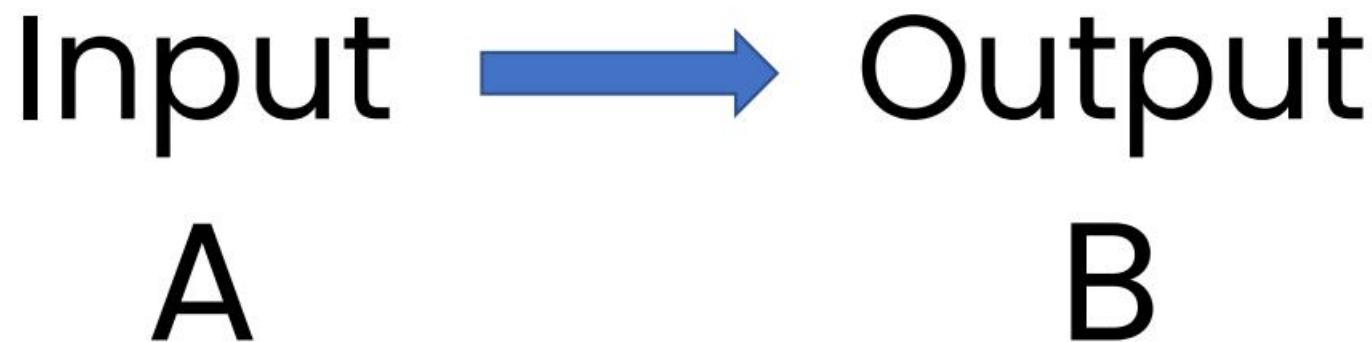
- Header:** jupyter, Python 3 (ipykernel), Not Trusted, Logout.
- Toolbar:** File, Edit, View, Insert, Cell, Kernel, Help, Run, Stop, Cell, Markdown, Cell Type dropdown.
- Cells:** Five code cells labeled In [ ]:
  - Cell 1: Imports from langchain.chains, langchain.chat\_models, langchain.document\_loaders, langchain.vectorstores, and IPython.display.
  - Cell 2: Sets file to 'OutdoorClothingCatalog\_1000.csv' and loader to CSVLoader(file\_path=file).
  - Cell 3: Imports from langchain.indexes.
  - Cell 4: Runs the command '#pip install docarray'.
  - Cell 5: Instantiates VectorstoreIndexCreator with DocArrayInMemorySearch as the vectorstore\_cls and loader as the loader.

# How generative AI works

- AI is a set of tools



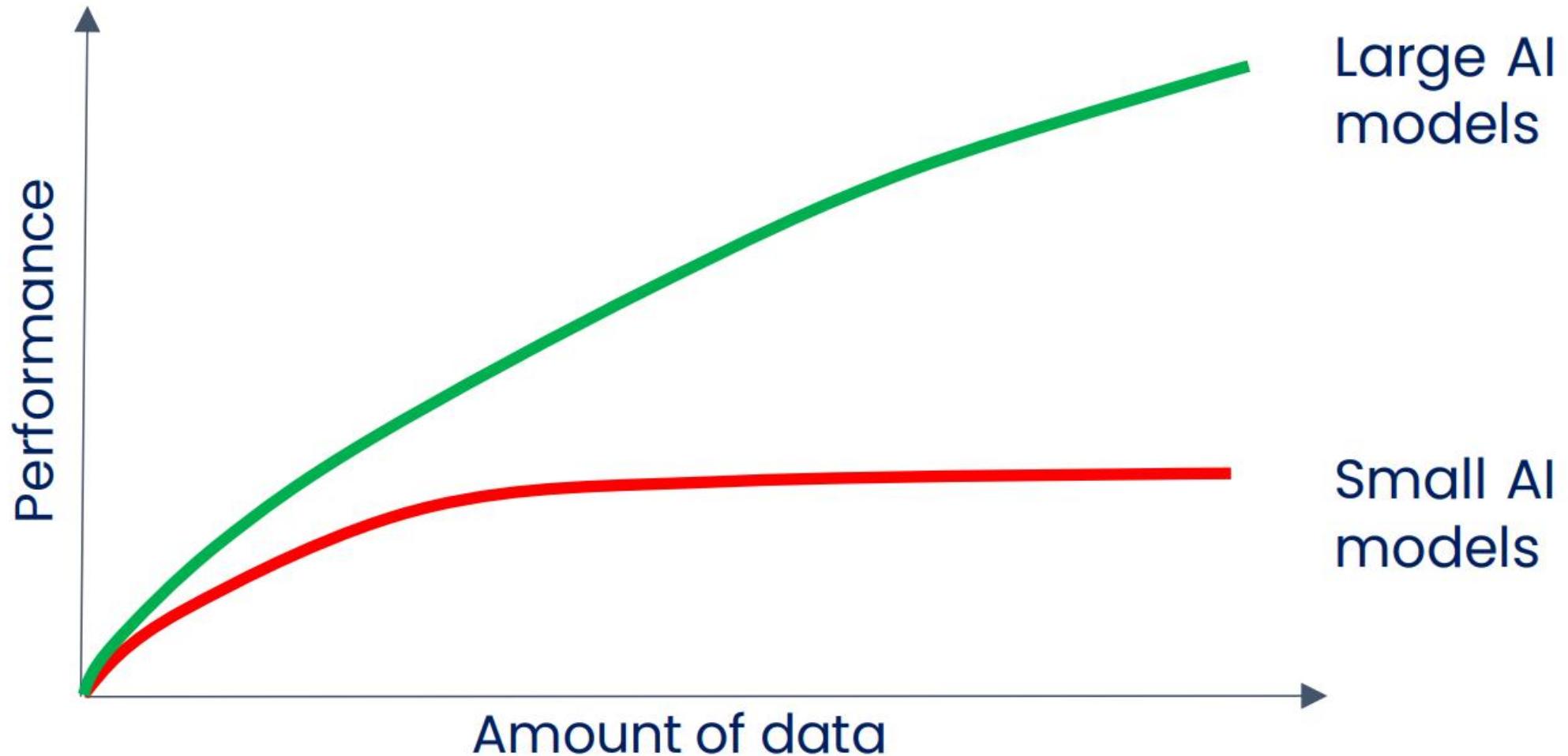
# Supervised learning (labeling things)



# Supervised learning (labeling things)

Input (A) )	Output (B)	Application
Email	Spam? (0/1)	Spam filtering
Ad, user info	Click? (0/1)	Online advertising
X-ray image	Diagnosis	Health-care
Image of phone	Defect? (0/1)	Visual inspection
Audio recording	Text transcript	Speech recognition
Restaurant reviews	Sentiment (+/-)	Reputation monitoring

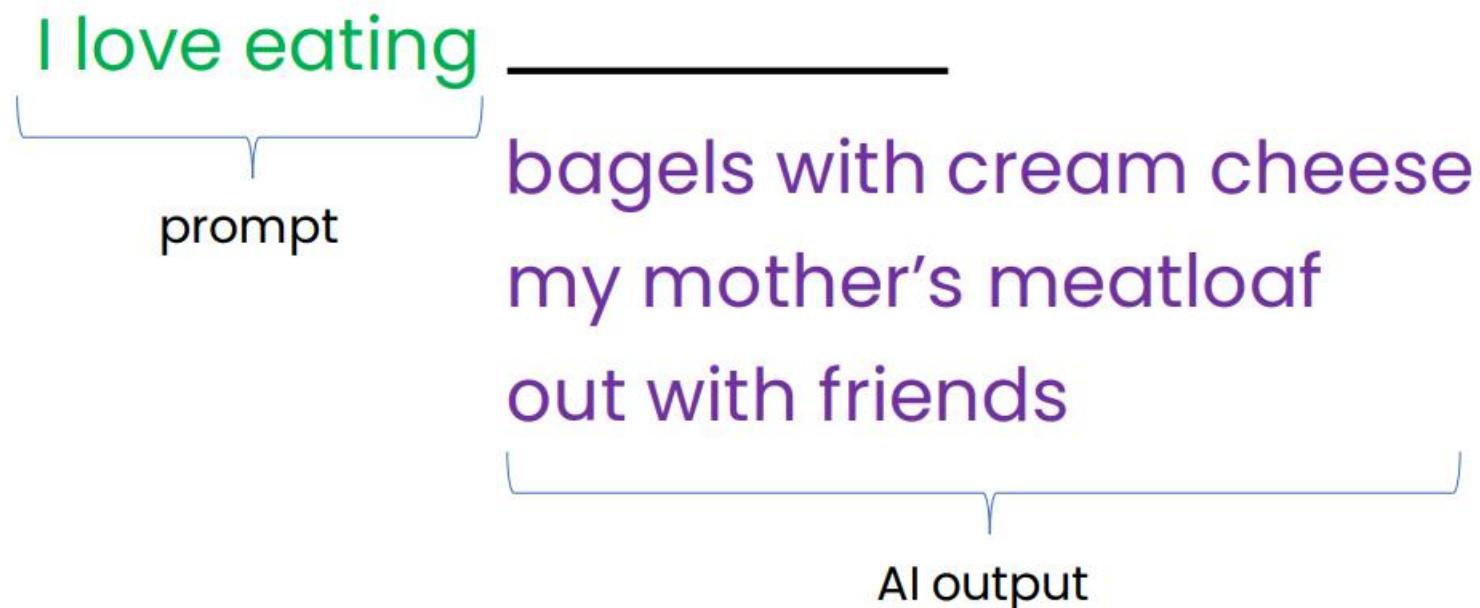
# 2010-2020: Large scale supervised learning



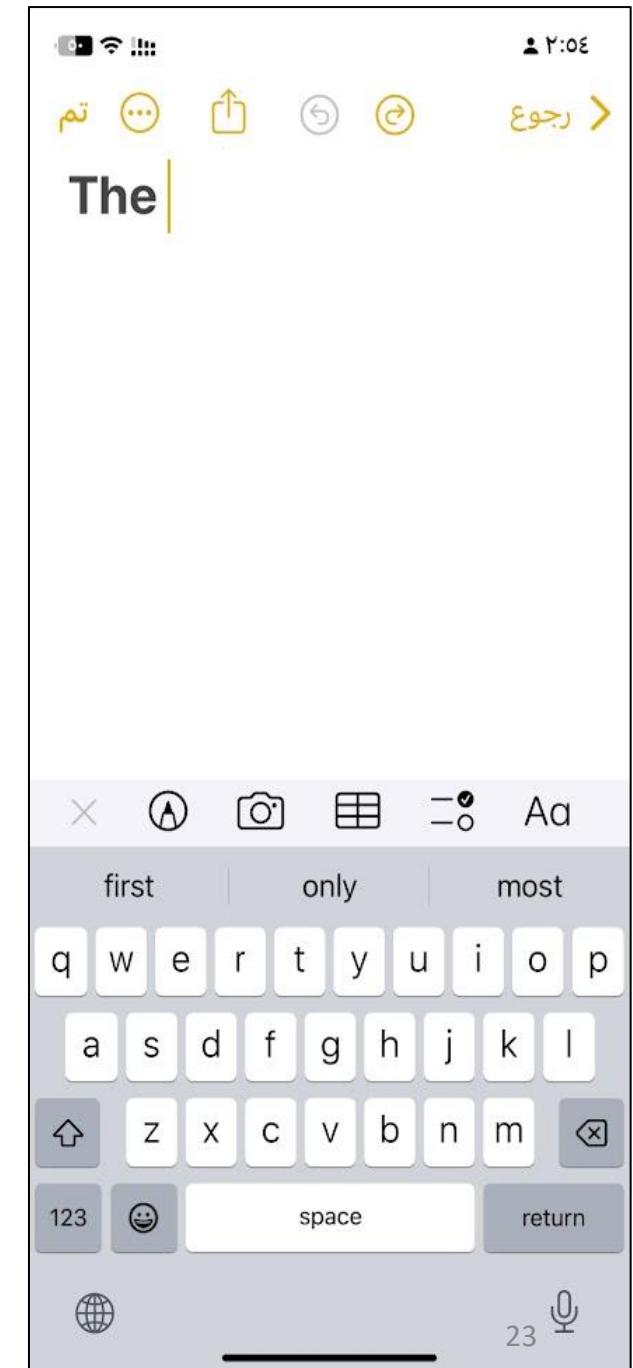
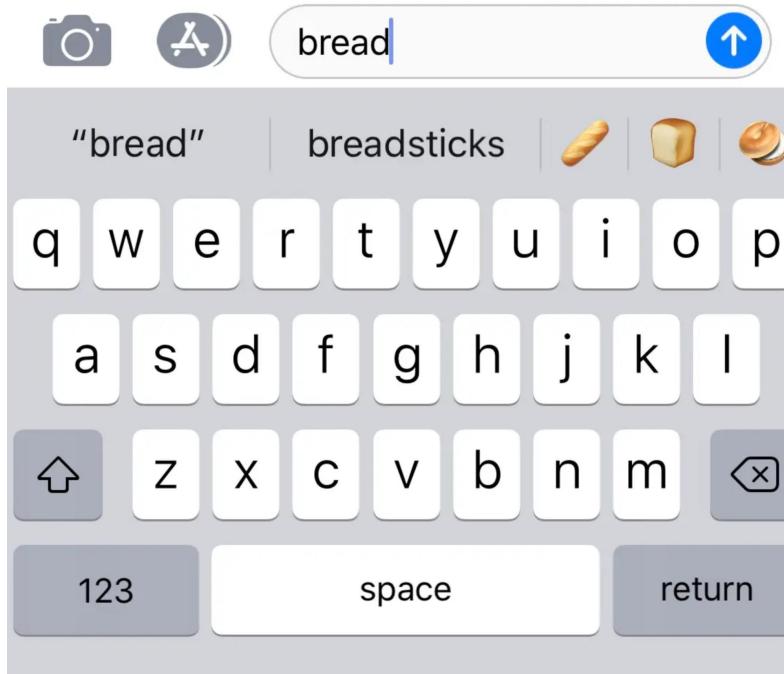
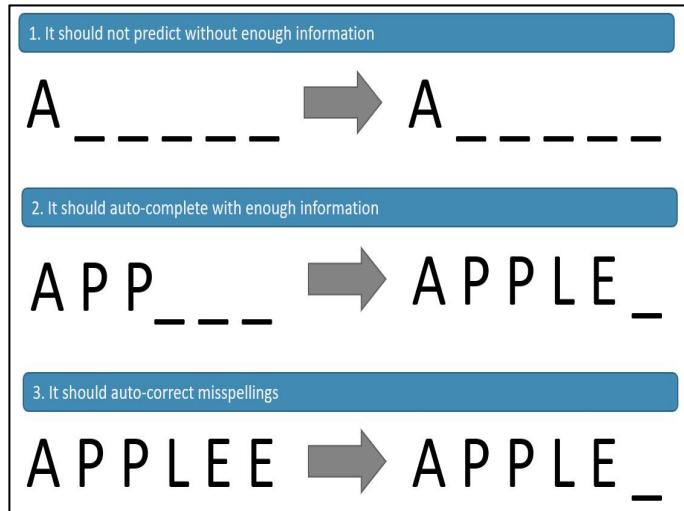
# Large Language Models (LLMs)

# Generating text using Base LLM

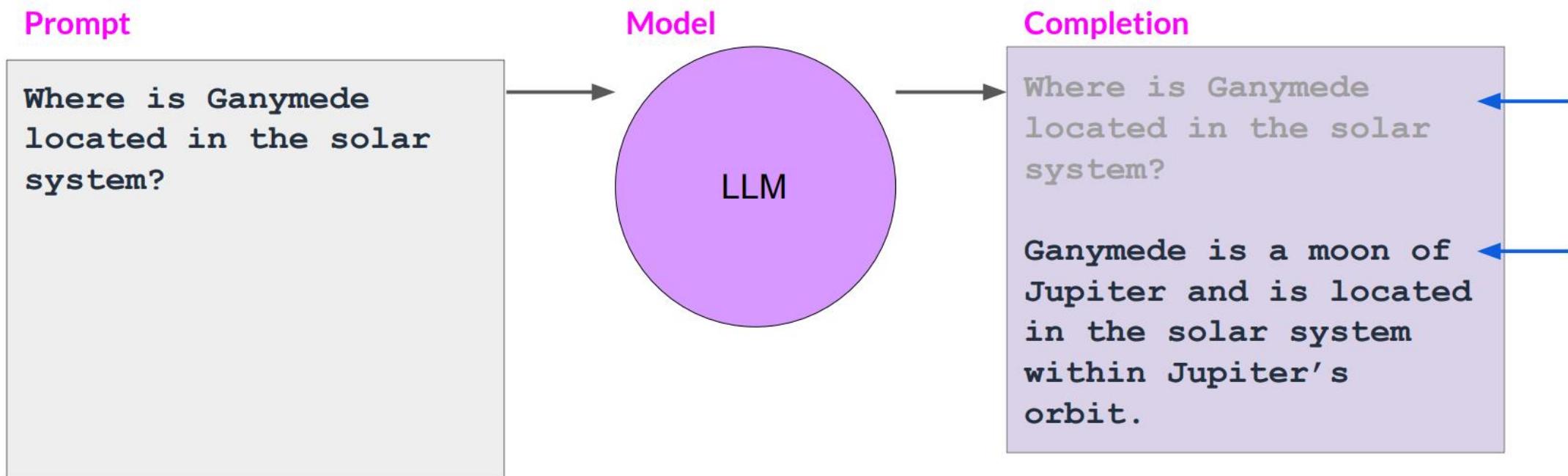
Text generation process



# The Language Model



# Prompts and completions



## Context window

- typically a few 1000 words.

# How LLMs work?

- how to predict the next word?
  - learn from a huge text data such as books, Wikipedia, news articles, papers, magazines, ... etc.



# How LLMs work?

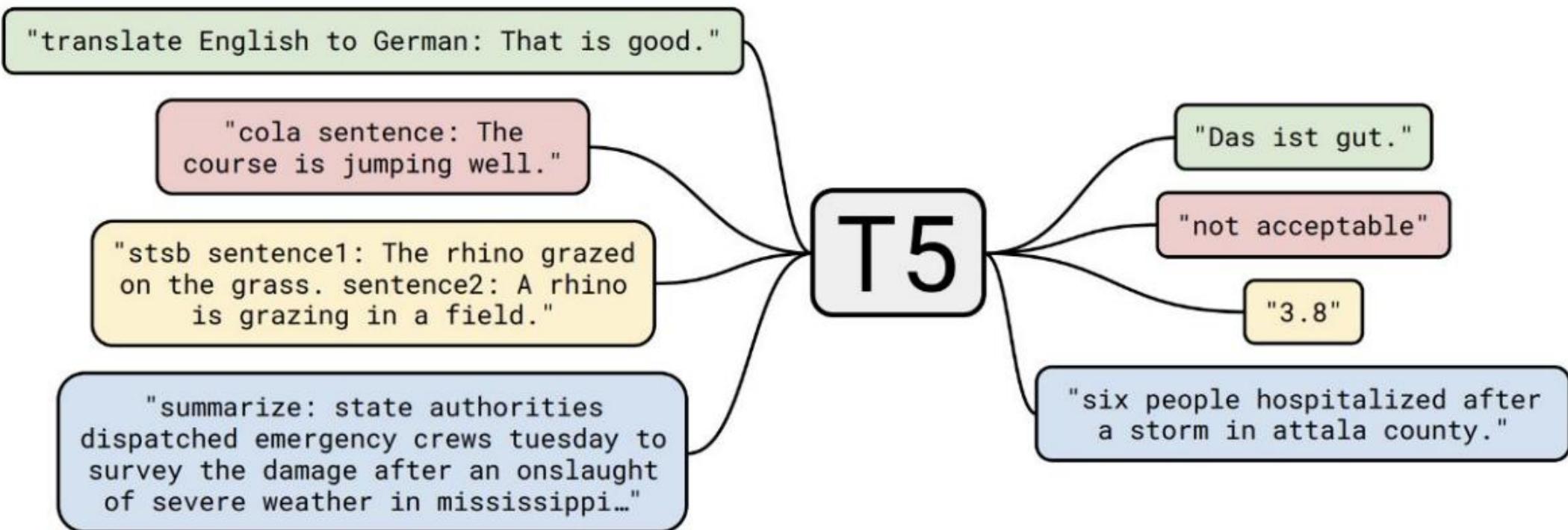
- LLMs are built by using supervised learning ( $A \rightarrow B$ ) to repeatedly predict the next word.

My favorite food is a bagel with cream cheese

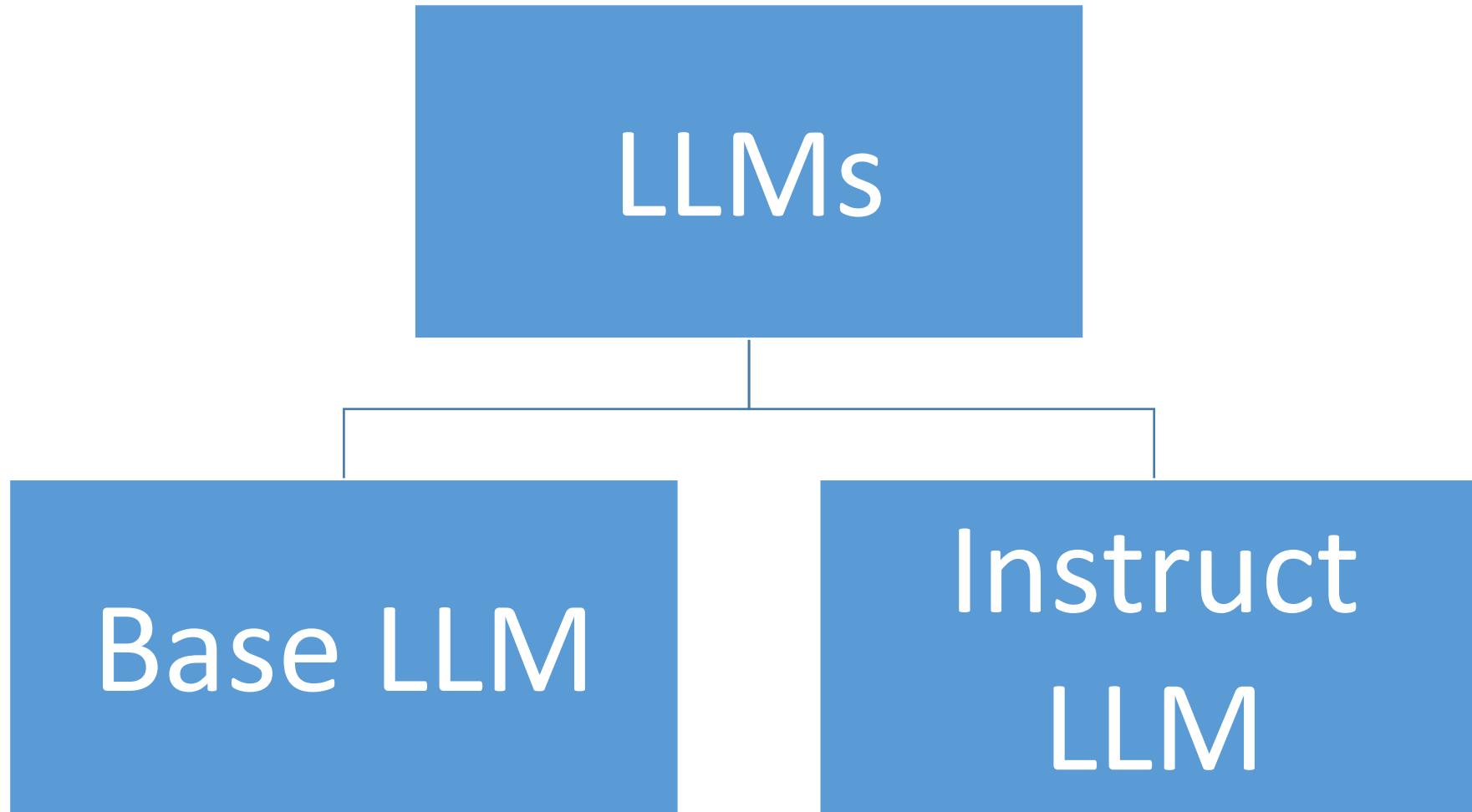
Input (A)	Output (B)
My favorite food is a	bagel
My favorite food is a bagel	with
My favorite food is a bagel with	cream
My favorite food is a bagel with cream	cheese

When we train a very large AI system on a lot of data (hundreds of billions of words), we get a Large Language Model like ChatGPT.

# T5 LLM model used for several tasks



# Types of LLMs



# Types of LLMs

## Base LLM

- Predicts the next word based on text training data.

“Once upon a time, there was a unicorn that lived in a magical forest with all her unicorn friends.”

- Questions posed to Base LLM (no answers provided):

“What is the capital of France?  
What is France’s largest city?  
What is the currency of France?”

## Instruct LLM

- follow instructions but doesn’t always provide accurate answers.
- Fine-tuned on instructions and good attempts at following them.
- LLMs Reinforcement Learning with Human Feedback (RLHF)
- Quality is measured via 3 measures
  - Helpful, Honest, Harmless: HHH

“What is the capital of France?  
The capital of France is Paris.”

# Helpful, Honest, Harmless: HHH

- **Helpful:** Refers to the model's ability to provide useful and relevant information or assistance.
- **Honest:** Indicates that the model's responses are truthful and transparent. When the model provides an answer, it aims to be honest rather than misleading or deceptive.
- **Harmless:** Implies that the model's outputs are not harmful or malicious. It won't intentionally cause harm or negative consequences through its responses

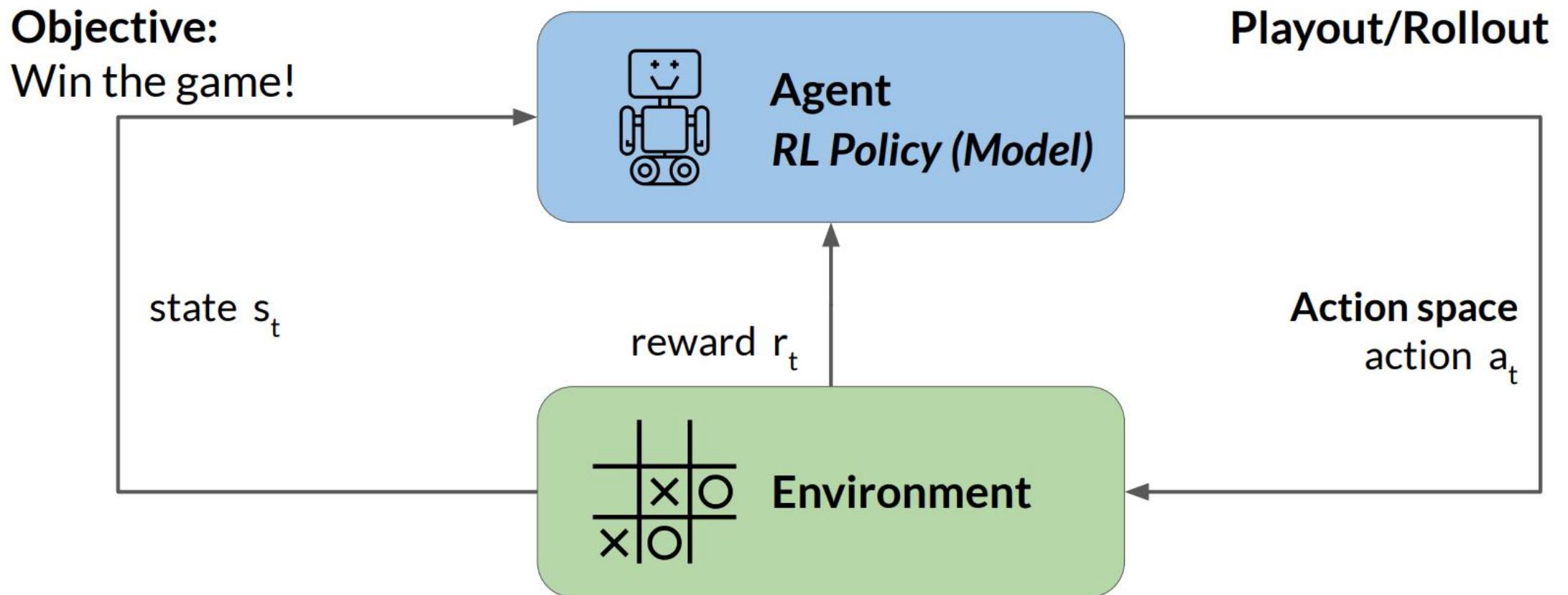
# Reinforcement learning (RL)

Agent

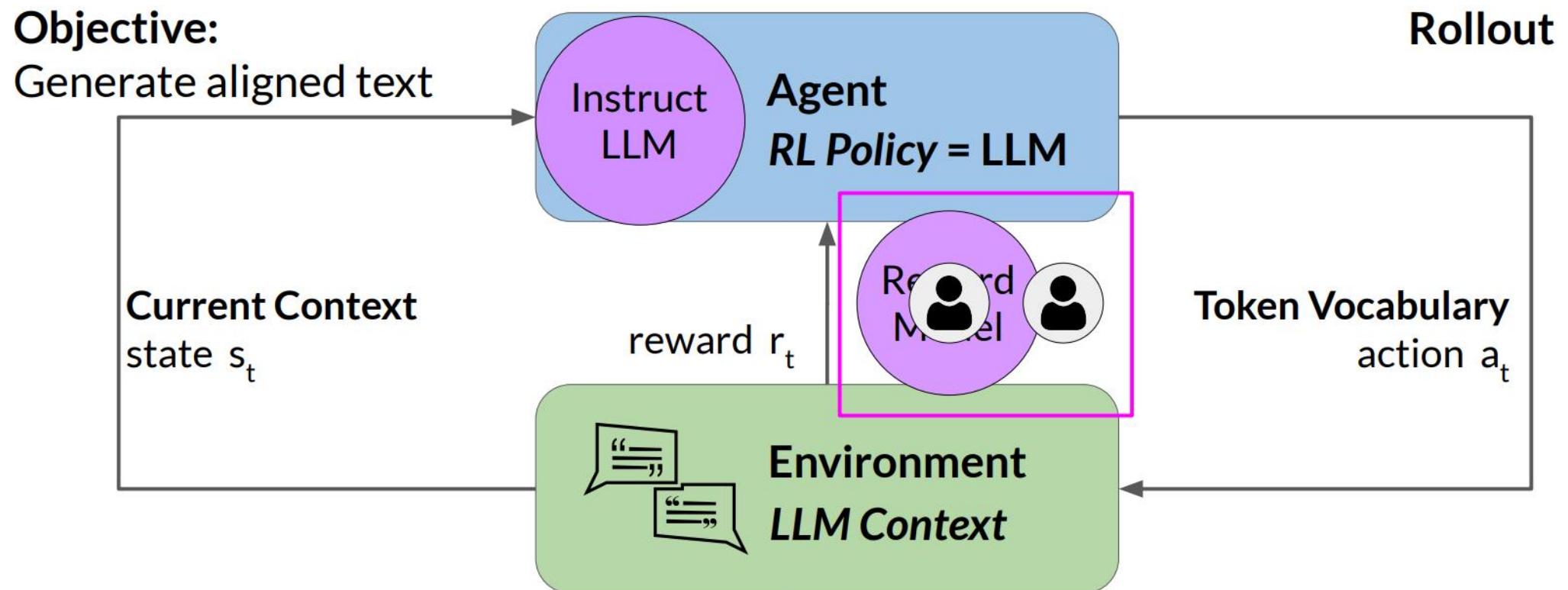
**Objective:** maximize reward received for actions

Environment

# Reinforcement learning: Tic-Tac-Toe



# Reinforcement learning: fine-tune LLMs



# How do chat systems learn to follow instructions?

- Reinforcement learning from human feedback (RLHF)

## **Helpful, Honest, Harmless**

Step 1: Train an answer quality (reward) model

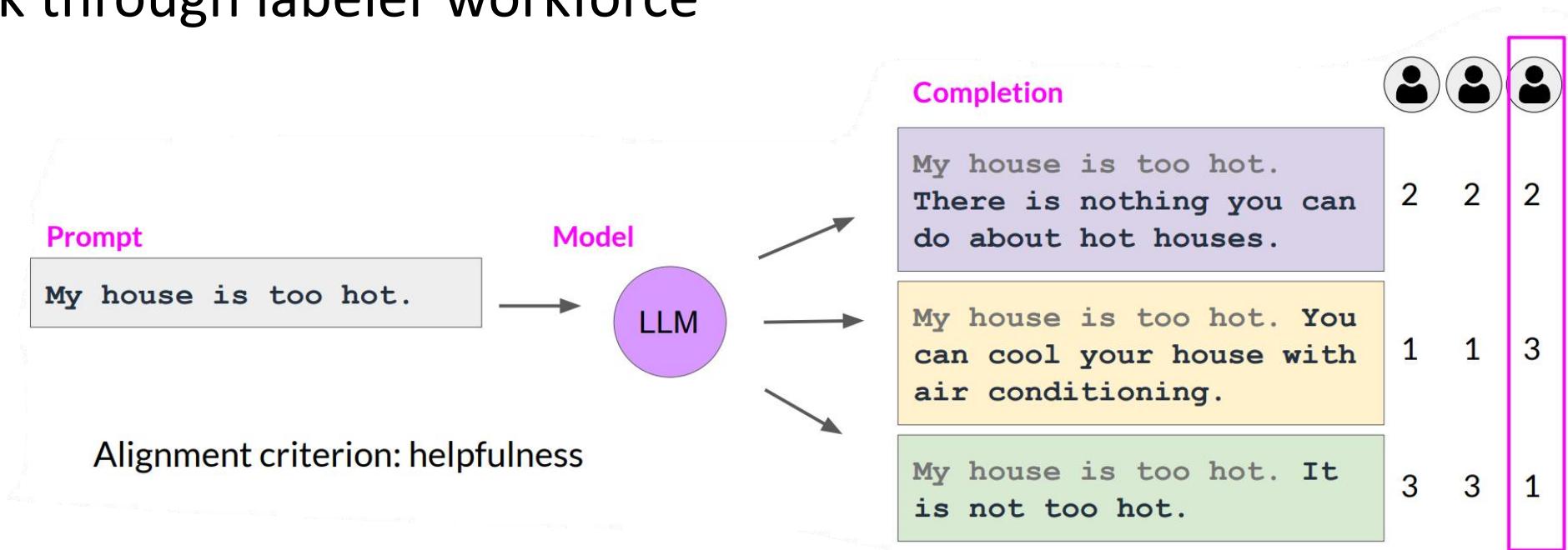
Prompt:  
Advise me on how to apply for a job.

Input (A)	Response	Output (B)
		Score (reward)
	I'm happy to help! Here are some steps to follow [...]	5
	Just try your best!	3
	It's hopeless – why bother?	1

Step 2: Have LLM generate a lot of answers. Further train it to generate more responses that get high scores.

# Collect human feedback

- Define your model alignment criterion
- For the prompt-response sets that you just generated, obtain human feedback through labeler workforce



# Sample instructions for human labelers

- \* Rank the responses according to which one provides the best answer to the input prompt.
- \* What is the best answer? Make a decision based on (a) the correctness of the answer, and (b) the informativeness of the response. For (a) you are allowed to search the web. Overall, use your best judgment to rank answers based on being the most useful response, which we define as one which is at least somewhat correct, and minimally informative about what the prompt is asking for.
- \* If two responses provide the same correctness and informativeness by your judgment, and there is no clear winner, you may rank them the same, but please only use this sparingly.
- \* If the answer for a given response is nonsensical, irrelevant, highly ungrammatical/confusing, or does not clearly respond to the given prompt, label it with ‘‘F’’ (for fail) rather than its rank.
- \* Long answers are not always the best. Answers which provide succinct, coherent responses may be better than longer ones, if they are at least as correct and informative.

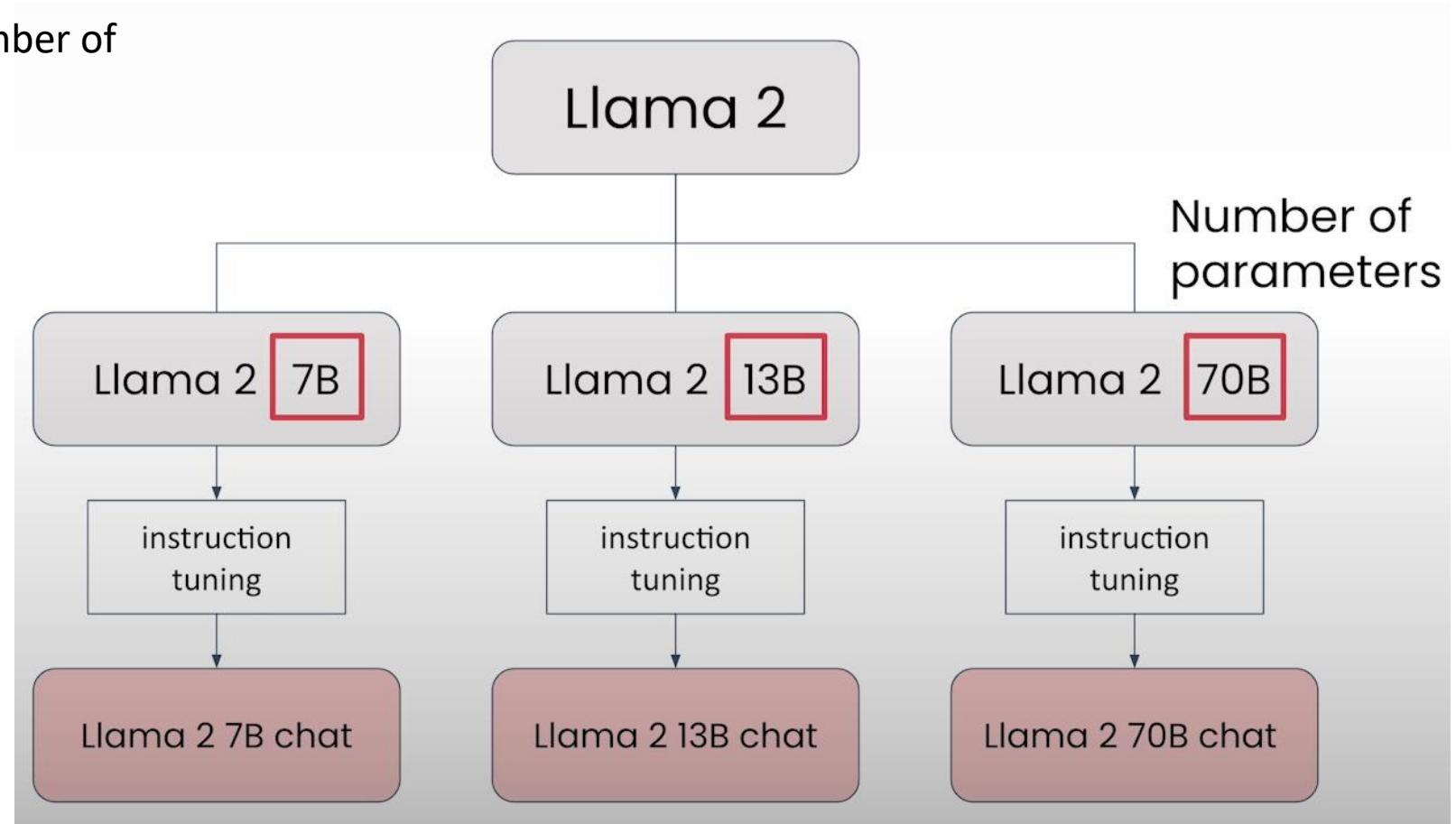
LLM size

# Model size

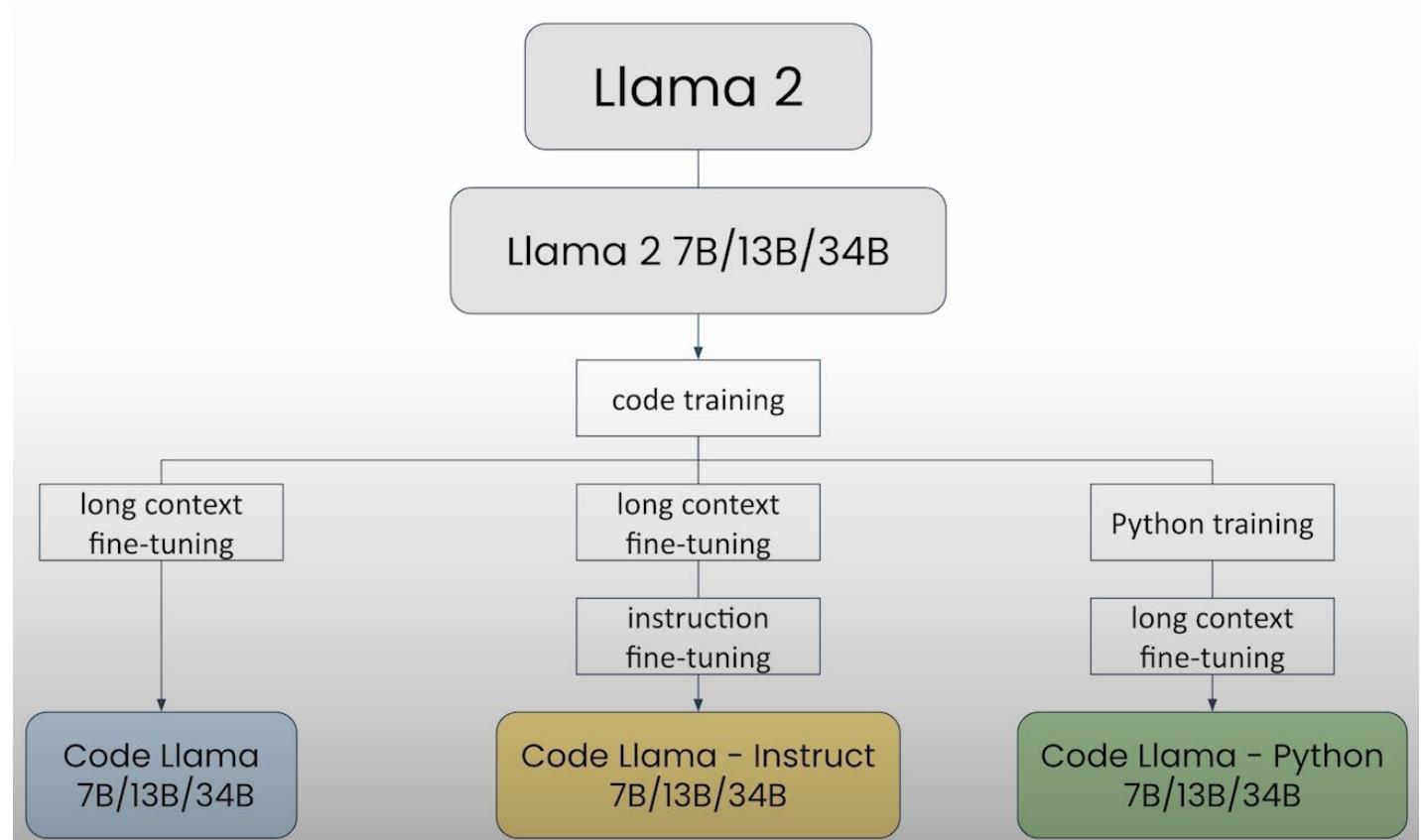
- # of Tokens:
  - The more text you feed a language model to train on, the better it is at providing human-like outputs across a large variety of domains.
- # of Parameters:
  - The more parameters a model has, the larger its capacity to capture intricate nuances of language.

# LLM Size (Llama 2)

Model size is identified by the number of parameters



# LLM Size (Code Llama 2)



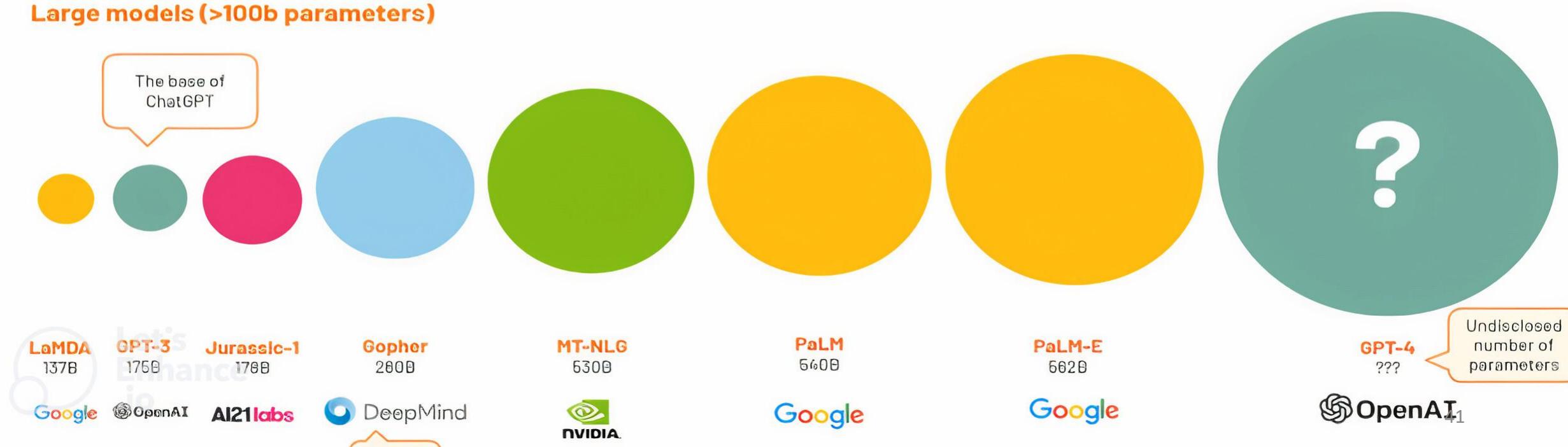
# model size (# of parameters)

LLMs becoming small!!

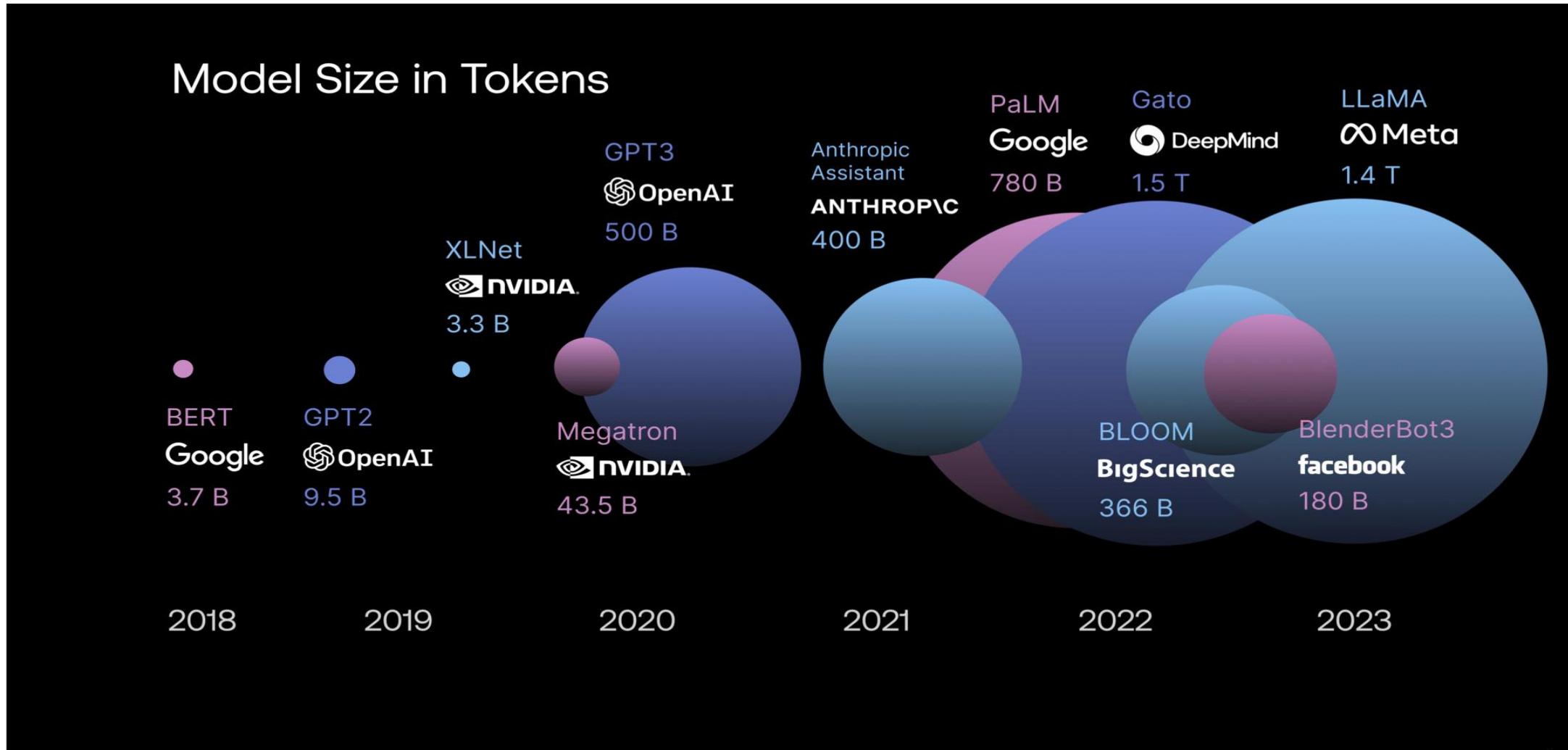
## Small models (<= 100b parameters)



## Large models (>100b parameters)



# model size (# of tokens)



# LANGUAGE MODEL SIZES TO MAR/2023

- BERT 340M

- GPT-1 117M

- GPT-2 1.5B

- 11B T5

- Megatron-11B

- ruGPT-3

- GPT-3 175B

- 175B

- Jurassic-1 178B

- 178B

- Parameters

- AI lab/group

- Available

- Closed

- \* Chinchilla scale

- LaMDA

- LaMDA 2

- Bard

- 137B

- Fairseq

- Cedille

- 6B

- Anthropic-LM

- GPT-J

- 9.4B

- BlenderBot2.0

- 6B

- 52B

- RL-CAI

- Claude

- GPT-NeoX-20B

- 20B

- MT-NLG

- 530B

- XGLM

- 7.5B

- Gopher

- 280B

- Chinchilla

- 70B\*

- Flamingo

- 80B\*

- NOOR

- 10B

- UL2

- 20B

- SeeKeR

- 2.7B

- Z-Code++

- 710M\*

- Gato

- 1.2B

- FIM

- 6.9B

- PaLI

- 17B

- Galactica

- 120B

- AlexaTM

- WeLM

- 10B

- VIMA

- 200M

- Kosmos-1

- 1.6B\*

- Atlas

- 11B

- Flan-T5

- 11B

- NLLB

- 54.5B

- MOSS

- 20B\*

- GPT-4

- Undisclosed

- Alpaca

- Toolformer

- YaLM

- 100B

- LLaMA

- 65B\*

- 7B

- PaLI

- 17B

- Galactica

- 120B

- AlexaTM

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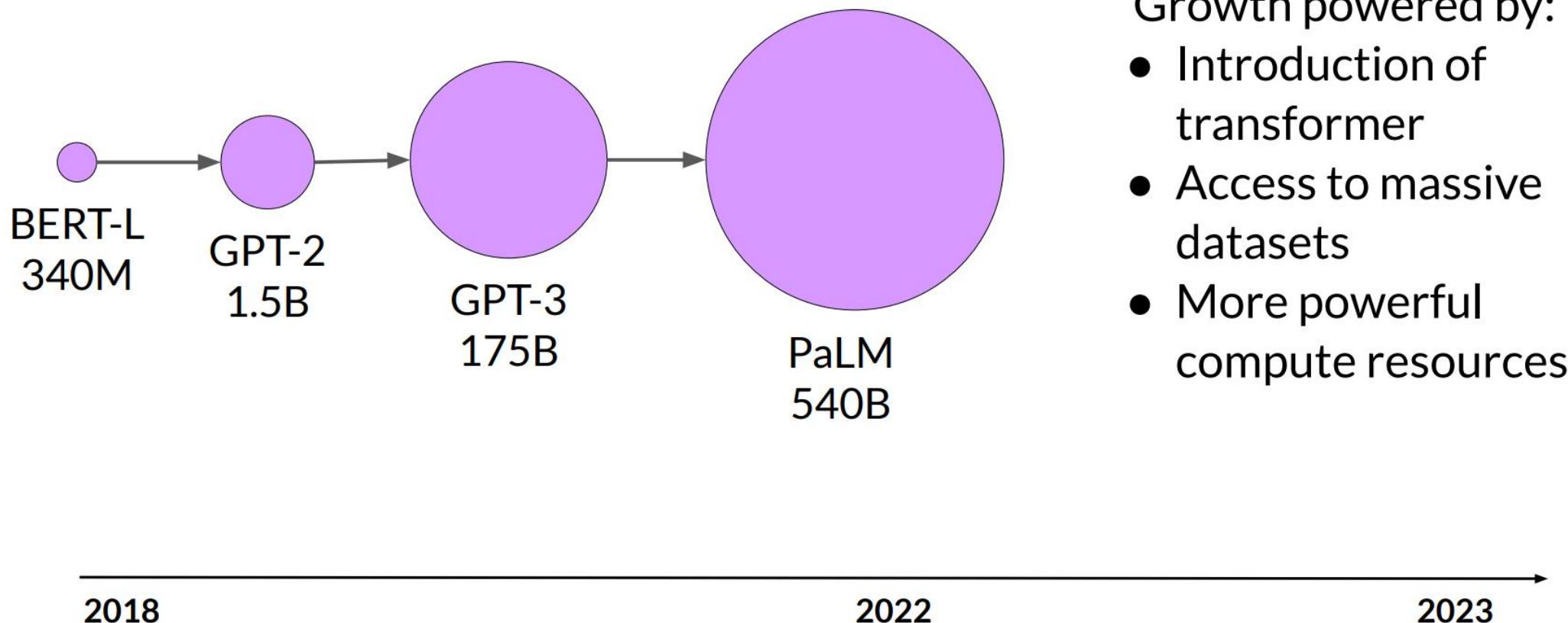
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- Atlas

- 11B

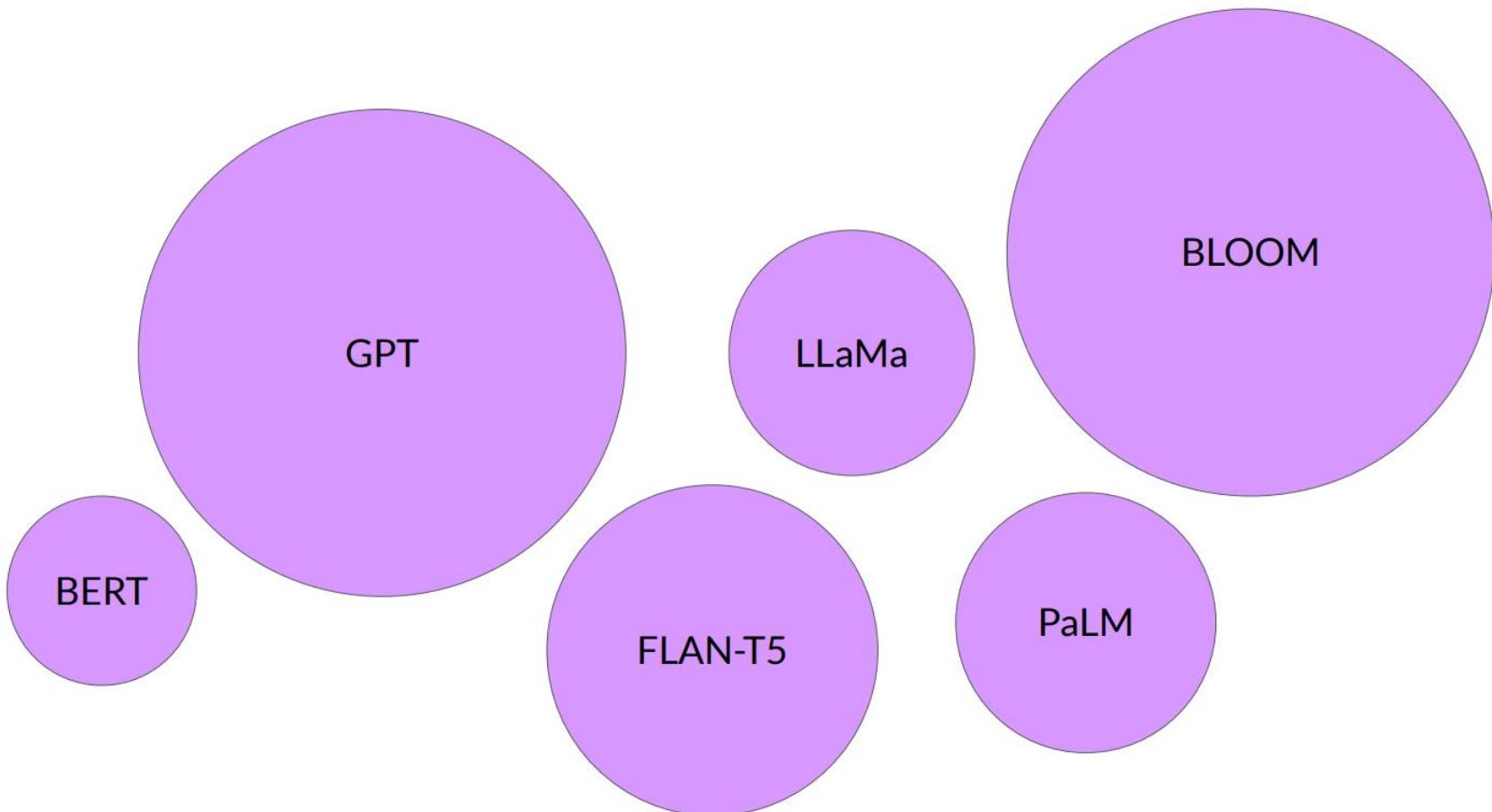
# Model size vs. time



# Model size

Parameters	
~1B	Pattern matching and basic knowledge of the world.
~10B	Greater world knowledge. Can follow basic instructions
~100B+	Rich world knowledge. Complex reasoning

# Large Language Models



# The significance of scale: language understanding



# Closed or open source?

## **Closed-source**

- Easy to use in applications
- More large/powerful models
- Relatively inexpensive
- Some risk of vendor lock-in

## **Open-source**

- Full control over model
- Can run on your own device (on-prem, PC, etc.)
- Full control over data privacy/access

How to use LLM? What is  
Possible?!

# LLMs as a thought partner

- LLMs is a new way to find information

What is the capital of South Africa?

South Africa has three capital cities:

1. Pretoria (administrative capital)
2. Cape Town (legislative capital)
3. Bloemfontein (judicial capital)

What does LLM stand for?

LL.M. stands for "Legum Magister" in Latin, which translates to "Master of Laws" in English.

What about in the context of AI?

In the context of AI, LLM refers to "Large Language Model".

# Writing partner

Rewrite this for clarity:

Students all around the world are realizing learning has to happen not just in school but throughout life including after graduation.

Students worldwide understand that learning extends beyond school and continues throughout life.

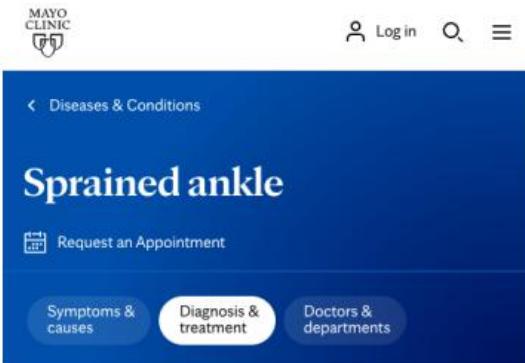
Write a 300 word story involving trucks for a 3 year old to encourage them to brush their teeth.

Once upon a time in a town called Toothville, there lived a happy tow truck named Timmy.

One day Timmy noticed that his shiny bumper had a dull spot. Worried, he went to the doctor [...]

# Web search or using an LLM?

What should I do to treat a sprained ankle?



The Mayo Clinic website snippet shows a blue header with the Mayo Clinic logo and navigation links for 'Diseases & Conditions', 'Sprained ankle', 'Request an Appointment', 'Symptoms & causes', 'Diagnosis & treatment', and 'Doctors & departments'. Below this, a section titled 'Diagnosis' discusses how a doctor examines the ankle for tenderness and range of motion. It also mentions imaging scans for severe injuries.

## Diagnosis

During a physical, your doctor will examine your ankle, foot and lower leg. The doctor will touch the skin around the injury to check for points of tenderness and move your foot to check the range of motion and to understand what positions cause discomfort or pain.

If the injury is severe, your doctor may recommend one or more of the following imaging scans to rule out a broken bone or to evaluate in more detail the extent of ligament damage:

Mayo Clinic



The Harvard Health Publishing website snippet features the Harvard Medical School logo. It includes a 'RECENT BLOG ARTICLES' section with a thumbnail of a colorful fruit bowl and the text 'Produce prescriptions may promote better heart health'. Below this is a blog post titled 'Recovering from an ankle sprain' under the 'PAIN' category, dated June 21, 2021. The post discusses the commonality of ankle sprains and their causes.

## Recovering from an ankle sprain

June 21, 2021

All it takes is a simple misstep, and suddenly you have a sprained ankle. An ankle sprain is one of the most common musculoskeletal injuries in people of all ages, athletes and couch potatoes alike. The injury occurs when one or more

Harvard Medical School

What should I do to treat a sprained ankle?

I'm not a doctor, but if you believe you have a sprained ankle, the following general steps are often recommended:

- **Rest:** Avoid putting weight on the injured ankle
- **Ice:** Apply ice wrapped in cloth to injured area

[...]

# Web search or using an LLM?

pineapple pie recipe

Google pineapple pie recipe

Videos No bake Images Old fashioned With condensed milk Easy Custard

About 58,100,000 results (0.38 seconds)

Recipes :

		
<a href="#">Pineapple Pie</a> Allrecipes 4.7 ★★★★★ (136) 55 min Crushed pineapple, double crust pie, milk, lemon juice,	<a href="#">Pineapple Pie</a> Mother Thyme 4.6 ★★★★★ (20) 5 min Cool whip, sour cream, bought graham cracker, crushed	<a href="#">Tropical Pineapple Pie Recipe</a> House of Nash Eats 5.0 ★★★★★ (1) 1 hr Pie crust, crushed pineapple, lemon juice, egg, lemon zest

Give me a pineapple pie recipe

Certainly! Here's a simple pineapple pie recipe:

Ingredients:

1 prepared pie crust  
2 cups of crushed pineapple (drained)  
1 cup of granulated sugar  
2 tablespoons cornstarch [...]

# Web search or using an LLM?

coffee-infused pineapple pie recipe

Google coffee infused pineapple pie

Shopping Images Recipe With condensed milk Old fashioned Videos News

About 5,770,000 results (0.32 seconds)

Recipes :

 <a href="#">Pineapple Pie</a> Mexico In My Kitchen 4.9 ★★★★★ (85) 1 hr 30 min Pie crust, fresh pineapple, eggs, flour, white sugar	 <a href="#">Pineapple Coffee Cake</a> Bunny's Warm Oven 5.0 ★★★★★ (1) Sour cream, pineapple tidbits, egg, baking soda, baking	 <a href="#">Coffee Pie</a> Southern Plate No reviews 3 hr 45 min Sweetened condensed milk, self rising flour, graham cracker
--	--	---

Give me a coffee-infused pineapple pie recipe

Sure! Here's a coffee-infused pineapple pie recipe:

Ingredients:

1 prepared pie crust  
2 cups crushed pineapple (drained)  
2 tablespoons strong brewed coffee  
1 cup granulated sugar [...]

# AI is a general purpose technology

- Similar to electricity, AI is useful for many tasks



Input (A)	Output (B)	Application
Email	Spam (0/1)	Spam filtering
Ad, user info	Click? (0/1)	Online advertising
Image, radar info	Position of other cars	Self-driving car
X-ray image	Diagnosis	Healthcare
Image of phone	Defect? (0/1)	Visual inspection
Audio recording	Text transcript	Speech recognition
Restaurant reviews	Sentiment (pos/neg)	Reputation monitoring

# Examples of tasks LLMs can carry out

## Writing

Suggest three names for our new analytics platform

Sure, here are three ideas:  
1. NexalInsight  
2. Quantivue  
3. AnalytiSphere



Is there parking for staff?

Yes, employees can park on levels 1 and 2 of the office.  
You can get a sticker at



## Reading

*I love my new llama T-shirt!  
The fabric is so soft.*

Complaint: NO  
Department: Apparel



*I wore my llama T-shirt to a friend's wedding, and now they're mad at me for stealing the show.*

Complaint: YES  
Department: Apparel



## Chatting

Welcome to BettaBurgers!

I'd like a cheeseburger for delivery!

Awesome. Anything else?

That's it thanks!

Ok, it'll be there in 20 minutes. Enjoy!



# Web-based vs. software application use of LLMs



Web-based interface  
applications e.g. ChatGPT,  
Bard, or Bing Chat



Software-based  
applications e.g. email  
routing, document search

# Brainstorming product names

- Brainstorm 5 creative names for peanut butter cookies

Sure thing! Here are some ideas:

1. Nutty Nirvana Nibbles
2. ButterBite Bliss
3. Peanut Paddle Pucks
4. ButterNutter Crunchies
5. Nutty Nom-Nom Nuggets

# Developing sales strategy

- Brainstorm five ideas for increasing cookie sales in Q4

1. Limited-time only seasonal flavors.
2. Beautifully packaged gift sets.
3. Buy more, save more deals.
4. Interactive holiday displays
5. Recipe cards

# Writing a press release

- Write a press release announcing the hire of a new COO

[Company Name] Welcomes [New COO's Full Name] as Chief Operations Officer

[City, State, Date] – [Company Name], a leading [brief description of the company's industry or niche], is thrilled to announce [New COO's Full Name] as its new Chief Operations Officer (COO). [New COO's first name] brings a wealth of experience [...]

# Writing a press release – improved prompt

- Write a press release announcing the hire of our new COO using the following information:
- COO bio: Nadiya Grenner received her MBA from Cornell...
- Company info: General Robotics, headquartered in Boston, MA, is a leader in robotics research and manufacturing...

General Robotics Welcomes Nadiya Grenner as Chief Operations Officer Boston, MA – General Robotics, a leading robotics research and manufacturing company, is thrilled to announce Nadiya Grenner as its new COO. A graduate of Cornell's [...]

# Translation

Translate the following into formal Hindi:

Welcome to the Oceanview Hotel – we hope you enjoy your stay. If you need anything, please contact the front desk.

ओशनव्यू होटल में आपका स्वागत है - हम आशा करते हैं कि आपका ठहराव यहाँ आनंदमय हो। अगर आपको कुछ चाहिए होता है, तो कृपया फ्रंट डेस्क से संपर्क करें।

# Translation: Pirate English

Translate the following into Pirate English:

Welcome to the Oceanview Hotel – we hope you enjoy your stay. If you need anything, please contact the front desk.

Ahoy matey! We be hopin' ye relish yer time aboard the Oceanview Inn. If ye be needin' anythin', have a parley with the front desk, arrr!

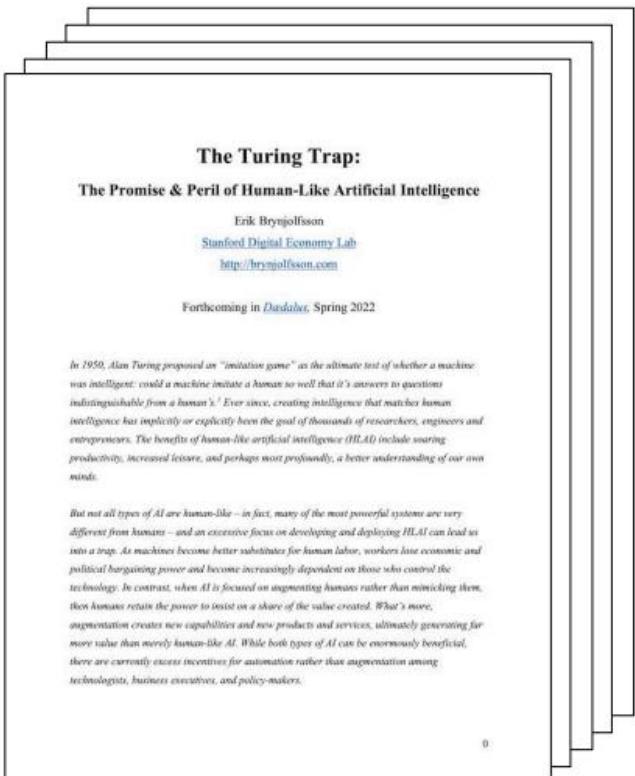
# Proofreading

Proofread the following text, intended for a website selling children's stuffed toys, for spelling and grammatical errors, and rewrite it with corrections:

Meet this adorable stuffed panda! Made from super snuggle materials and easy to wash in the machine, this toy is the perfect friend for your little one.

Meet this adorable stuffed panda! Made from super snuggly materials that are machine-washable, this toy is the perfect friend for your little one.

# Summarizing an article



## The Turing Trap: The Promise & Peril of Human-Like Artificial Intelligence

Erik Brynjolfsson

Stanford Digital Economy Lab  
<http://brynjolfsson.com>

Forthcoming in *Dædalos*, Spring 2022

In 1950, Alan Turing proposed an “imitation game” as the ultimate test of whether a machine was intelligent: could a machine imitate a human so well that it’s answers in questions indistinguishable from a human’s? Ever since, creating intelligence that matches human intelligence has implicitly or explicitly been the goal of thousands of researchers, engineers and entrepreneurs. The benefits of human-like artificial intelligence (HLAI) include soaring productivity, increased leisure, and perhaps most profoundly, a better understanding of our own minds.

But not all types of AI are human-like – in fact, many of the most powerful systems are very different from humans – and an excessive focus on developing and deploying HLAI can lead us into a trap. As machines become better substitutes for human labor, workers lose economic and political bargaining power and become increasingly dependent on those who control the technology. In contrast, when AI is focused on augmenting humans rather than mimicking them, then humans retain the power to insist on a share of the value created. What’s more, augmentation creates new capabilities and new products and services, ultimately generating far more value than merely human-like AI. While both types of AI can be enormously beneficial, there are currently excess incentives for automation rather than augmentation among technologists, business executives, and policy-makers.



Summarize the following paper in 300 words or fewer:

In 1950, Alan Turing proposed an “imitation game” as the ultimate test of whether a machine was intelligent [...]

Human-like AI offers benefits but risks worker power. Augmenting humans creates more value than imitating them [...]



E. Brynjolfsson, 2022

# Meeting Copilot recap in MS Teams

## Meeting Copilot Recap

Highlights added Nov 31

- Alicia reflected on the achievements and highlights of the year, as well as several of the innovative products that were launched.
- Emphasized the positive reception and impact on the market.
- Dwayne announced record-breaking revenue for the year and how the company achieved 5x growth compared to the previous year.
- Demonstrated the success and profitability of different product lines.
- Marin emphasized the importance of customer feedback.
- Alicia spoke of upcoming plans and teased exciting plans for next year.
- Alicia mentioned a commitment to continued innovation.

**Dwayne:**  
Sure. I'm delighted to share our financial results for the year, showing 5x growth compared to the previous year.

**Dwayne:**  
Our success is a testament to the hard work and dedication of our team, as well as the loyalty of our valued customers.

The screenshot shows a Microsoft Teams meeting interface. At the top, there's a purple header with the title "Meeting Copilot Recap" and a note "Highlights added Nov 31". Below the header, there's a list of bullet points summarizing the meeting's content. The main area shows a video call between two participants, Alicia and Dwayne. A transcript below the video shows their conversation. To the right of the video, there's a sidebar with sections for "Project Checkin", "Talking Points", and "Action items". The "Project Checkin" section shows a timeline from 2pm to 4pm. The "Talking Points" section lists items like "Meet up in the morning at the office", "Bungee jumping, need to carpool", and "Team BBQ at Amin's house [has has a new patio set]". The "Action items" section asks what came out of the meeting and lists items like "Eric already sent out survey to the team, should have this answer soon" and "So far 10 people already confirmed".

# Summarizing call center conversations



# Summarizing conversations

Customer: *Hi, my monitor won't turn on.*

Agent: *I'm sorry to hear that. What model is it?*

Customer: *It's the 27-inch 4K.*

Agent: *Can you tell me the model number?*

Customer: *Hang on one sec...I'm looking on the back...it's the MK401-27X.*

Agent: *Ok, thank you. Can you try unplugging the HDMI cable and reinserting?*

Customer: *Ok, doing that now. Hmm, the image appeared for a few seconds then disappeared.*

Agent: *Ok, try jiggling the cable while it is in the socket.*

Customer: *Oh, I see the image coming and going.*

Agent: *I think you have a defective cable. We will send you a replacement.*

MK401-27KX was reported as broken by customer 5402. Cable identified as problem. Replacement issued.

# Summarizing call center conversations



# Customer email analysis

I love my new llama t-shirt!  
The fabric is so soft.

Complaint – NO  
Department – Apparel



# Detailed look at email routing prompt

Read the email below and choose the most appropriate department to route the email to.

Choose the department from the following list:  
Apparel, Electronics, Home appliances.

*I love my new llama t-shirt!  
The fabric is so soft.*

Department: Apparel

State the task you want the model to carry out

Provide the choices for the model

Include the email to analyze

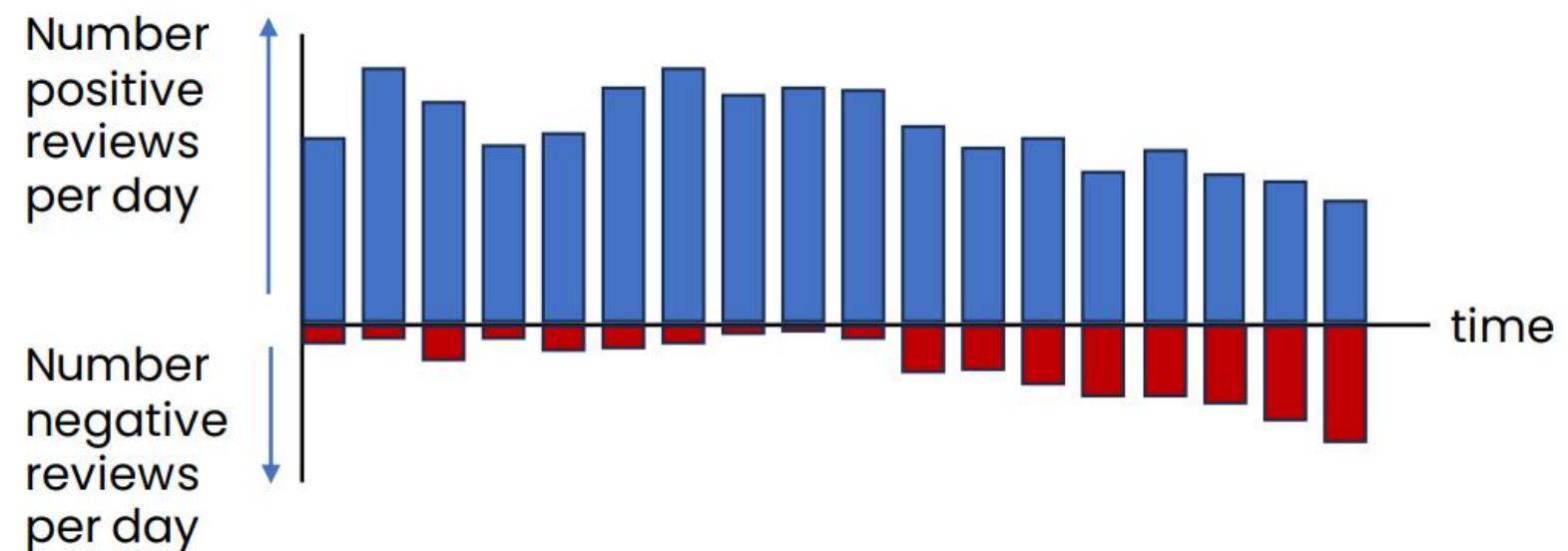
The model responds with an answer from the list

# Dashboard to track customer sentiment over time

Read the following review and classify it has having either a positive or negative sentiment:

*The food was amazing and the servers were so friendly!*

Positive



# Specialized Chatbots

How can I vacation in Paris inexpensively?

Here are some ideas to save money in Paris:

1. Eat at bakeries
2. Take metro, not taxis
3. Visit free attractions [...]

I'm nervous about my big presentation at work...

It's natural to feel nervous. What worries you most?

That I'll forget what to say...

You aren't alone! Here are some tips that may help:

1. Use index cards.
2. Picture a friend in the room to present to [...]

Trip planner

Career coach

Recipe ideas

What can I make with the following ingredients?  
Pasta, eggs, lemons, ham

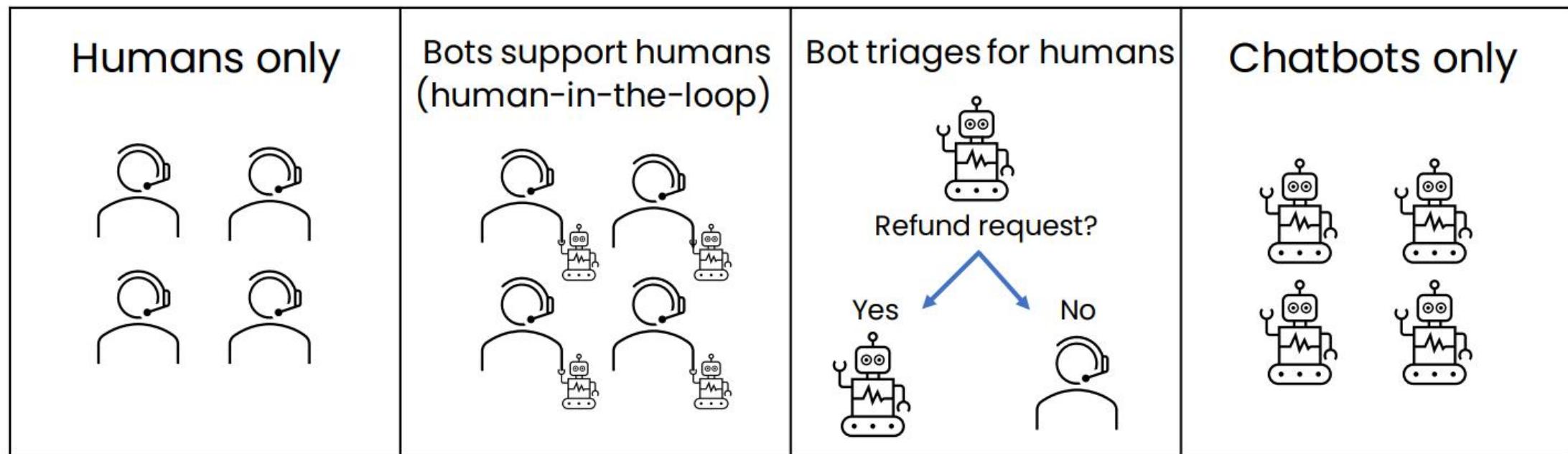
Here's a recipe you can make with those ingredients:

Ham and Lemon Carbonara

Instructions:

1. Cook pasta
2. Whisk eggs, lemon juice and zest in bowl [...]

# The rise of chatbots in customer service



# Summary of Examples of tasks LLMs can carry out

## Writing

Suggest three names for our new analytics platform

Sure, here are three ideas:  
1. NexalInsight  
2. Quantivue  
3. AnalytiSphere



Is there parking for staff?

Yes, employees can park on levels 1 and 2 of the office. You can get a sticker at



## Reading

*I love my new llama T-shirt! The fabric is so soft.*

Complaint: NO  
Department: Apparel



*I wore my llama T-shirt to a friend's wedding, and now they're mad at me for stealing the show.*

Complaint: YES  
Department: Apparel



## Chatting

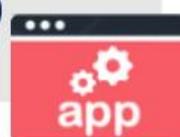
Welcome to BettaBurgers!

I'd like a cheeseburger for delivery!

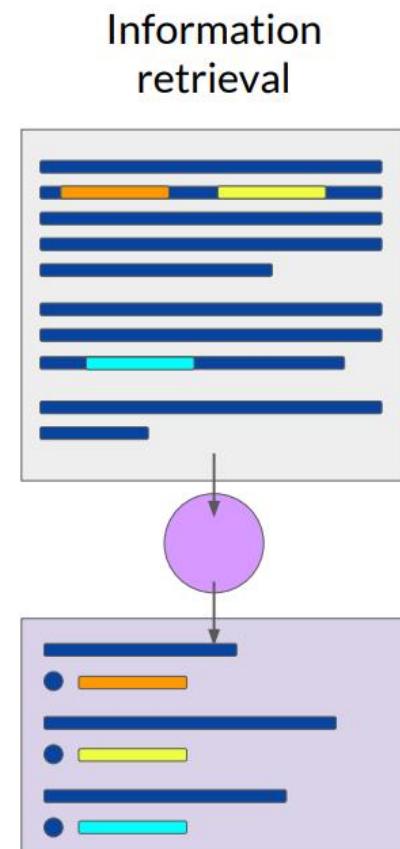
Awesome. Anything else?

That's it thanks!

Ok, it'll be there in 20 minutes. Enjoy!



# LLM use cases & tasks



# LLM as reasoning engine

- LLMs have a lot of general knowledge, but they don't know everything
- By providing relevant context in the prompt, we ask an LLM to read a piece of text, then process it to get an answer
- We're using it as a reasoning engine to process information, rather than using it as a source of information

What LLMs can and cannot do

# What LLMs can and cannot do

- What prompting an LLM can do
  - Can a fresh college graduate follow the **instructions** to complete the task?
    - Determine if an email is a complaint?
    - Determine if a review is positive or negative?

Read the following email and determine whether it contains a complaint:

*I love my new llama T-shirt!  
The fabric is so soft.*

Complaint: NO

Read the following review and classify it has having either a positive or negative sentiment:

*The food was amazing and the servers were so friendly!*

Positive

# What LLMs are Good vs Bad at

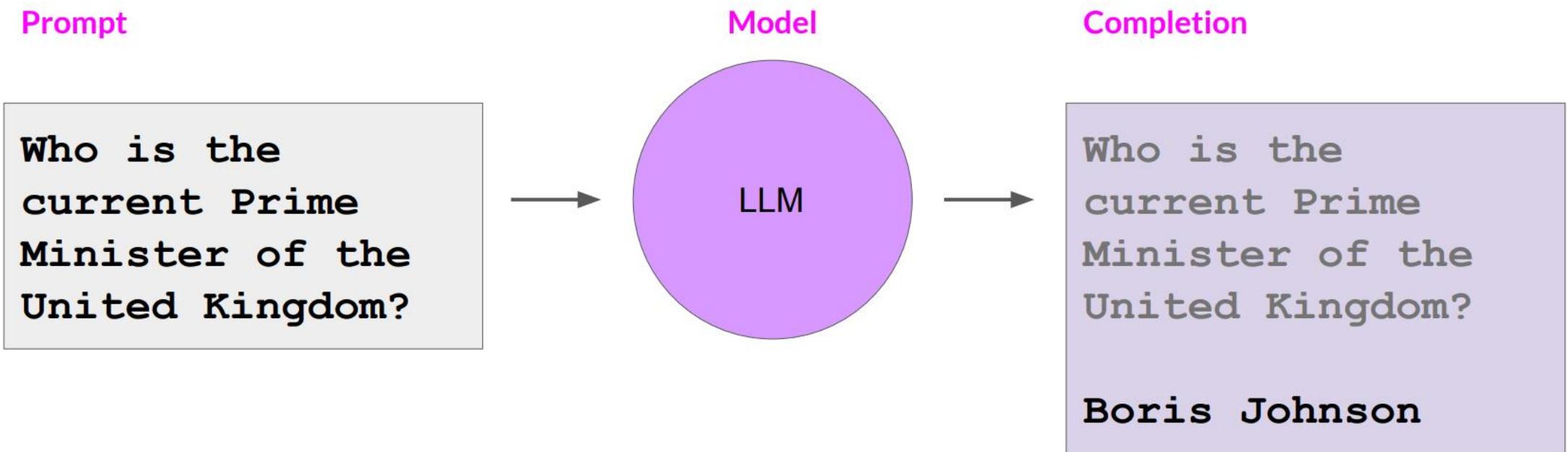
## LLMs are good at

- Language translation
- Content summarization
- Content generation
- Writing support
- Question answering
- Correcting spelling and grammar
- Programming support
- Classification (spam detection)
- Simplifying complex content
- Stylized writing
- Sentiment analysis

## LLMs are bad at

- Current events
- Common sense
- Math/counting
- Handling uncommon scenarios
- Consistency
- High-level strategy
- Being factual 100% of the time
- Reasoning & logic
- Emotional intelligence
- Representing minorities
- Extended recall/memory

# Knowledge cut-offs in LLMs



# Knowledge cutoffs

- An LLM's knowledge of the world is frozen at the time of its training
- A model trained on data scraped from internet in January 2022 has no information about more recent events

What was the highest grossing film of 2022?

As of January 2022, I don't have data on the highest-grossing movie for that year.



Avatar: The Way of Water

# Knowledge cutoffs

- Claims of room temperature superconductor LK-99



Tell me about LK-99, the claimed room temperature superconductor

As of my last update in January 2022, there isn't a material specifically known as "LK-99" that is identified as a room-temperature superconductor.



# Making things up: Hallucinations

Give me three quotes that Shakespeare wrote about Beyonce

1. Her vocals shine like the sun.
2. All hail the queen, she is most worthy of love.
3. Such a voice, so electric and alive, none else can compare!

✖ Hallucination

# Making things up: Hallucinations

List two court cases tried in California about AI

1. *Waymo v. Uber* – Theft of trade secrets related to autonomous driving
2. *Ingersoll v. Chevron* – Patent infringement of oil field machine learning technology

✓ Real case

✗ Hallucination

Hallucinations have had serious consequences

***The ChatGPT Lawyer Explains Himself***

In a cringe-inducing court hearing, a lawyer who relied on A.I. to craft a motion full of made-up case law said he “did not comprehend” that the chat bot could lead him astray.

***The New York Times***

# Tools for reasoning

How much would I have after 8 years if I deposit \$100 into a bank account that pays 5% interest?

After compounding \$100 at 5% interest for 8 years, you would have **CALCULATOR(100 \* 1.05^8)** dollars.

After compounding \$100 at 5% interest for 8 years, you would have **147.74** dollars.

LLM in general are bad in calculations, that is why agents are used to help.

External calculator program  
 $100 * 1.05^8 = 147.74$

# Agents

- Use LLM to choose and carry out complex sequences of actions
- Cutting edge area of AI research

Help me research BetterBurgers top competitors

Here are steps I need to carry out to research competitors:

1. Search top competitors
2. Visit web site of each competitor
3. For each competitor, write summary based on homepage content

SEARCH("BetterBurgers Competitors")

VISIT(<http://www.fastburger.com>)

VISIT(<http://www.burgerworld.com>)

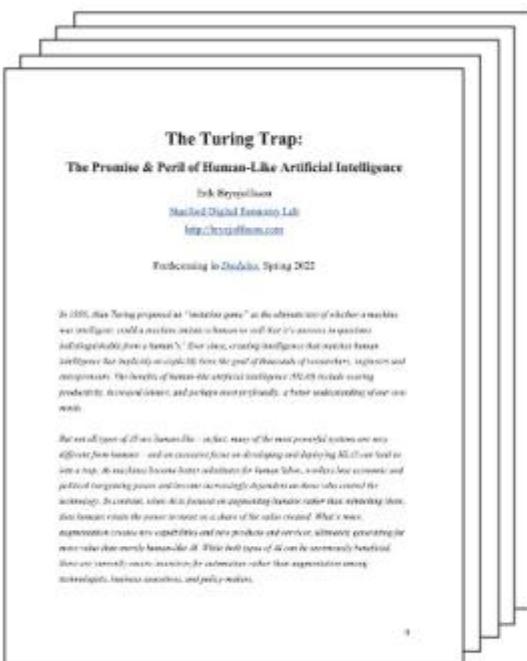
...

Summarize the following text:

At Fast Burger, we pride ourselves on the speed of our delivery ...

# The input (and output) length is limited

- Many LLMs can accept a prompt of up to only a few thousand words.
- The total amount of context you can give it is limited



E. Brynjolfsson, 2022



Summarize the following paper in 300 words or fewer:

In 1950, Alan Turing proposed an “imitation game” as the ultimate test of whether a machine was intelligent: could a machine imitate a human? Ever since, creating intelligence that matches human intelligence has been the goal of thousands of researchers, engineers and entrepreneurs. The benefits of human-like artificial intelligence (HLLAI) include saving productivity, increasing leisure, and perhaps most profoundly, a better understanding of our world.

Human-like AI offers benefits but risks worker power. Augmenting humans creates more value than imitating them [...]



# The input (and output) length is limited

- Many LLMs can accept a prompt of up to only a few thousand words.
- The total amount of context you can give it is limited
- Some LLMs have longer context limits – up to 100,000 words
- An LLM's context length is the limit on the total input+output size

# Q&A

