



DeepLearning.AI

Generative AI for Everyone

Andrew Ng



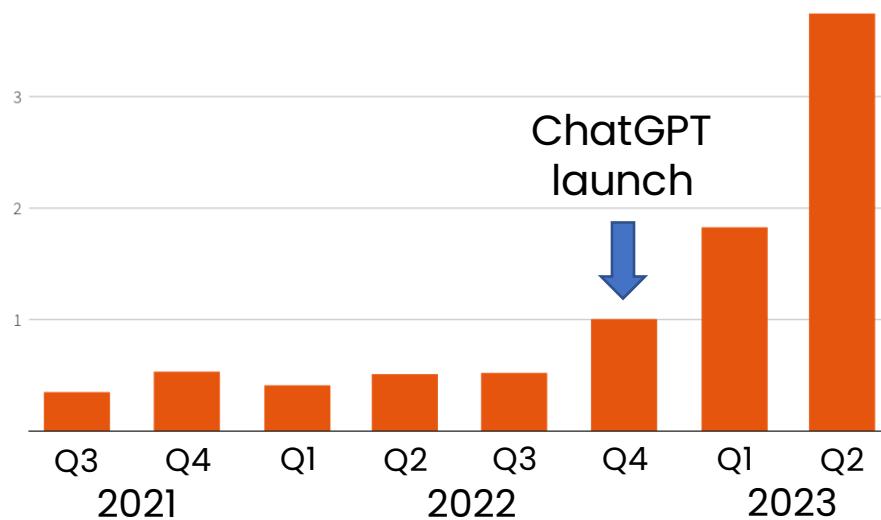
DeepLearning.AI

What is Generative AI

Welcome

The rise of generative AI

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



Source: Reuters

Generative AI could

- Add **\$2.6-\$4.4 trillion** annually to the economy¹
- Raise global GDP by **7% in** the next 10 years²
- Impact 10% of the tasks carried **out daily by 80% of** workers³

Sources: (1) McKinsey, (2) Goldman Sachs,
(3) OpenAI/UPenn

What is generative AI?

Artificial intelligence systems that **can produce high quality content** specifically **text, images, and audio.**

Social post draft

AN Write three captions for a social post about our new line of sunglasses for robots

- 1. "Shine bright, even if your eyes are digital! Introducing our latest sunglasses line for robots."
- 2. "Because even bots deserve to look cool in the sun! #RobotChic"
- 3. "Future's so bright, our robots need shades! Check out our new eyewear collection now."

 Regenerate

Bard offered by Google

Bard Experiment

Give me three ideas for t-shirt graphics that would appeal to llamas.

View other drafts

Sure, here are three ideas for t-shirt graphics that would appeal to llamas:

1. A cartoon llama with a funny expression, such as a surprised llama, a grumpy llama, or a silly llama.
2. A llama doing something that is typically associated with llamas, such as eating grass, spitting, or being majestic.

Prompts

Microsoft Bing

Find me some recipes for snacks for hungry pirates

✓ Searching for: snacks for hungry pirates

✓ Generating answers for you...

Sure! Here are some fun and tasty pirate-themed snacks that you can prepare for hungry pirates:

1. **Pirate Mix:** This snack includes pirate pegleg pretzel sticks, Gorilla Munch cannonballs, and "gold" "fish" whole grain Goldfish crackers ¹.

Write three captions for a social post about our new line of sunglasses for robots

ChatGPT/OpenAI

Bard/Google

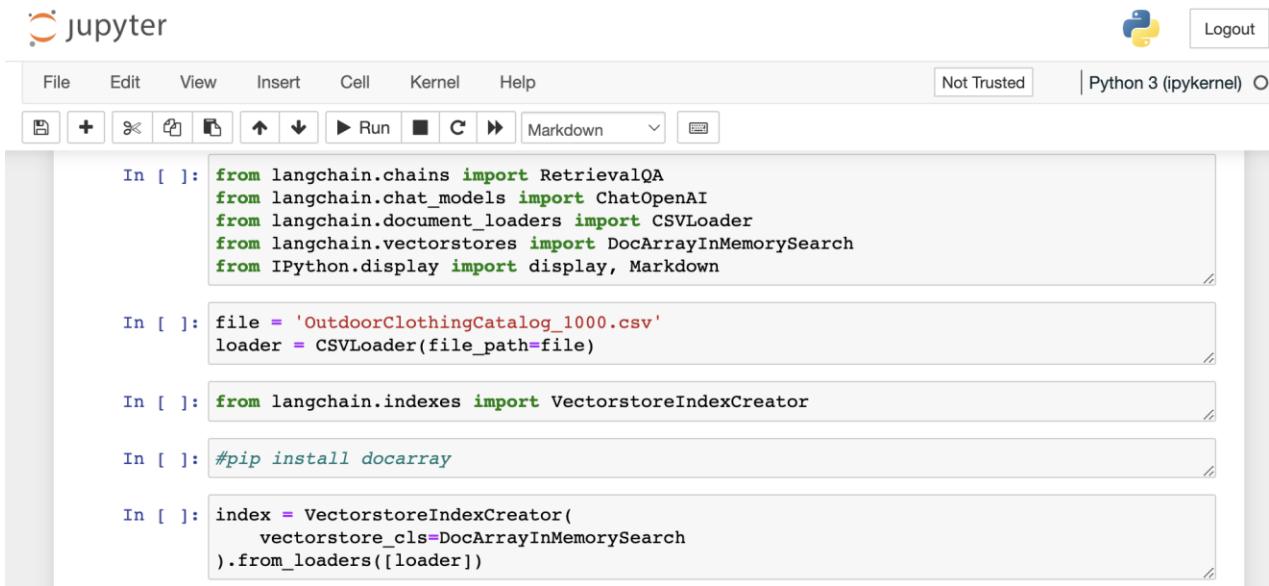
Bing Chat/Microsoft

Course Summary: Generative AI for Everyone

The course introduction establishes **Generative AI (GenAI)**, which creates **high-quality text, images, and audio** (like ChatGPT), as a major **disruptive technology** that has captured global attention since late 2022.

What is generative AI?

Generative AI is **also a developer tool**



The screenshot shows a Jupyter Notebook interface with the following code in the cells:

```
In [ ]: from langchain.chains import RetrievalQA
         from langchain.chat_models import ChatOpenAI
         from langchain.document_loaders import CSVLoader
         from langchain.vectorstores import DocArrayInMemorySearch
         from IPython.display import display, Markdown

In [ ]: file = 'OutdoorClothingCatalog_1000.csv'
        loader = CSVLoader(file_path=file)

In [ ]: from langchain.indexes import VectorstoreIndexCreator

In [ ]: #pip install docarray

In [ ]: index = VectorstoreIndexCreator(
             vectorstore_cls=DocArrayInMemorySearch
           ).from_loaders([loader])
```

AI is already pervasive in our lives

AI technology	Examples
Web search	Google, Bing
Fraud detection	Credit card payments → AI checking
Recommender system	Amazon, Netflix

Image, Audio and Video generation

A beautiful, pastoral mountain scene.
Landscape painting style (Midjourney)

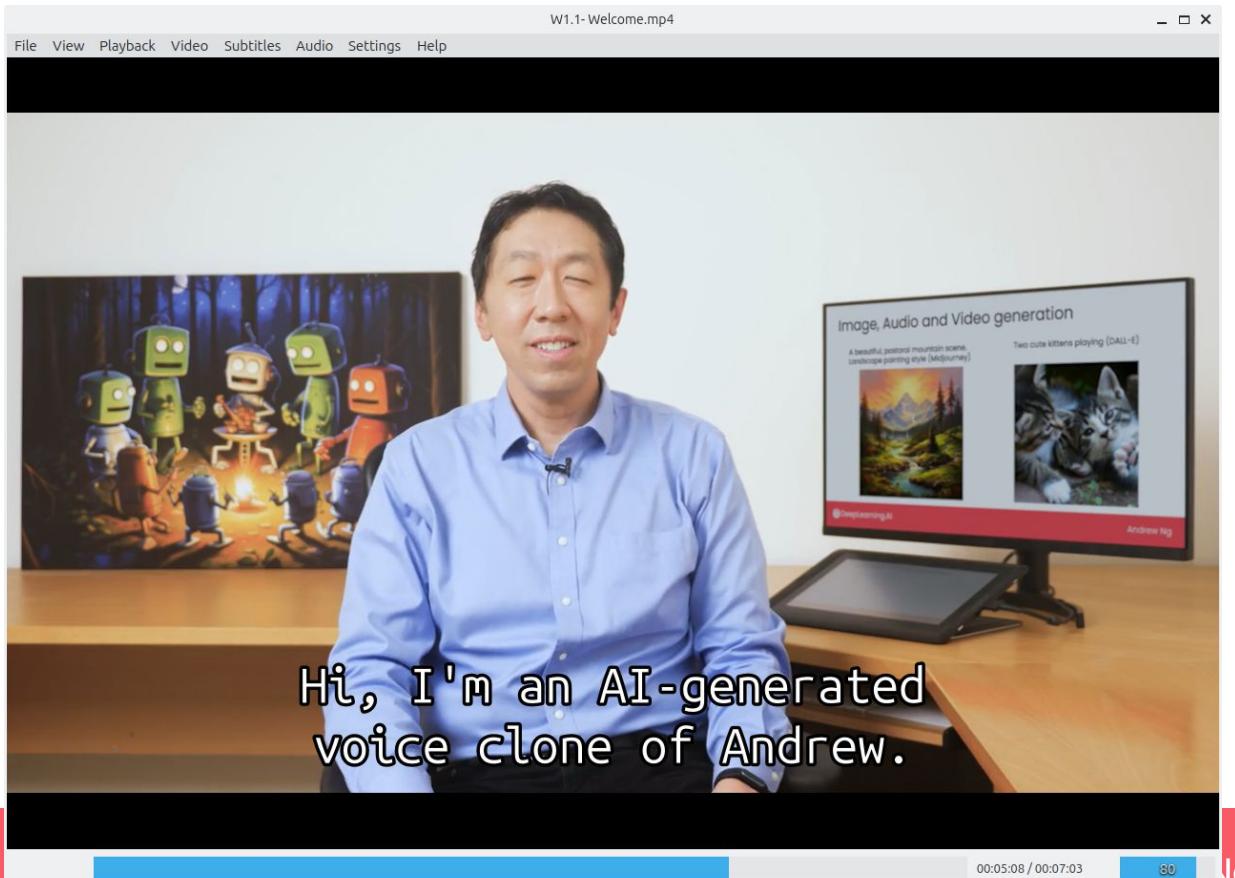


Two cute kittens playing (DALL-E)



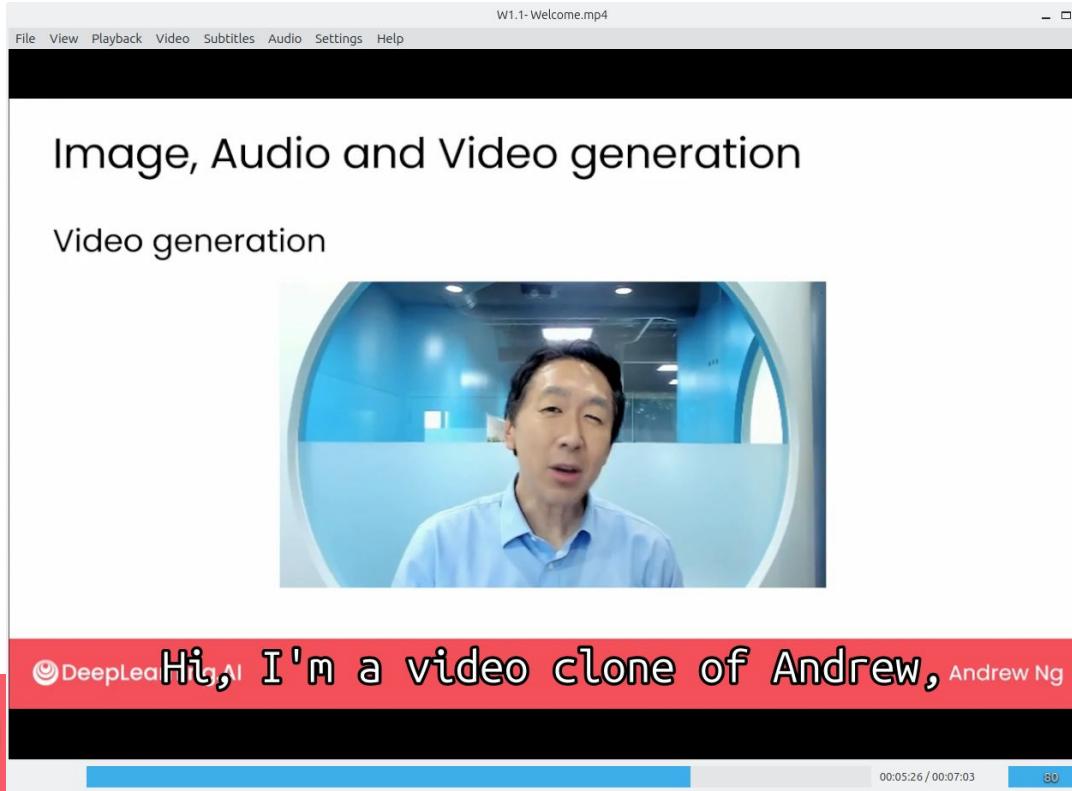
Image, Audio and Video generation

Voice generation



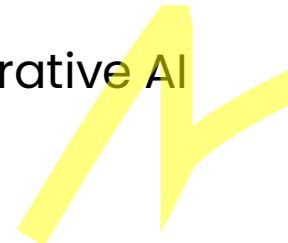
Image, Audio and Video generation

Video generation



What you'll learn

- How generative AI technology works
 - What it can and can't do
 - Common use cases
- Generative AI Projects
 - Identify and build generative AI use cases
 - Technology options
- Impact on business and society
 - How teams can take advantage of generative AI
 - AI risks and responsible AI



Key Points and Impact

- **Economic Potential & Risk:** GenAI is expected to **drive trillions of dollars** in annual economic growth and significantly boost global GDP and worker productivity, but it also raises concerns about **job loss** due to automation.
- **What GenAI Is:** It is defined as AI systems that produce content. Well-known examples include ChatGPT, Google's Bard, and Microsoft's Bing Chat, which respond to user prompts.
- **Beyond Consumer Apps:** While consumer applications are popular, the speaker stresses that the most impactful long-term use **may be as a developer tool**, making many AI applications cheaper and easier to build for businesses.
- **Course Audience:** The course is designed to provide an **accurate, non-technical understanding** of GenAI for anyone across business, science, engineering, and the arts, with **no prior AI knowledge assumed**.

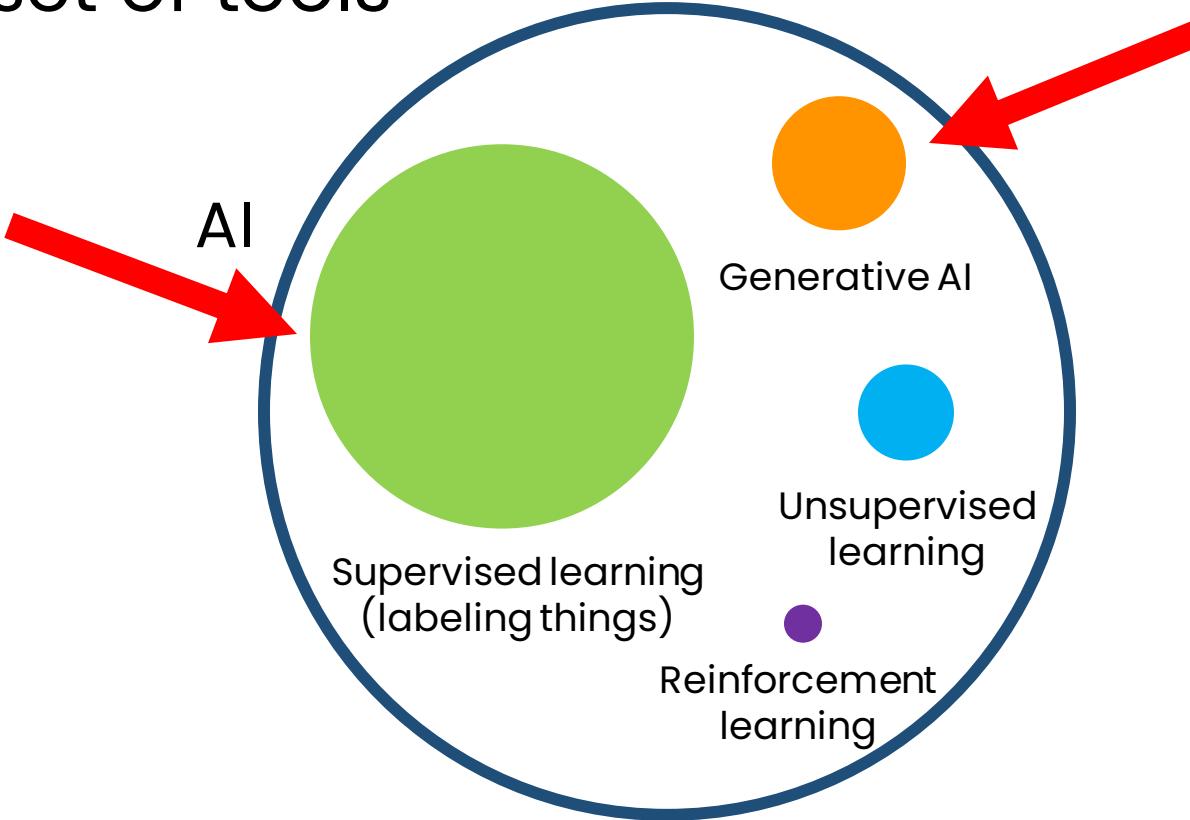


DeepLearning.AI

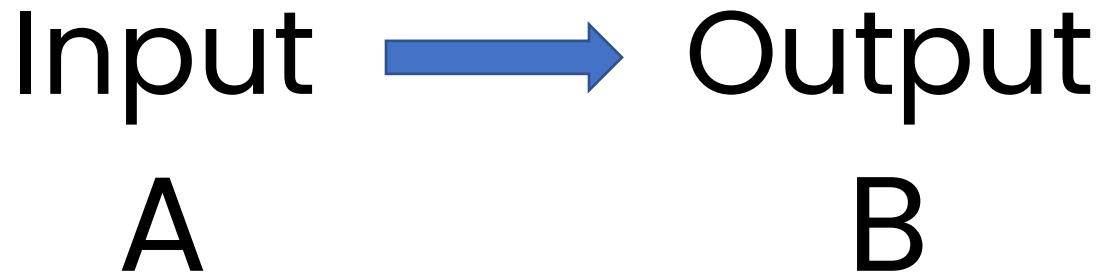
What is Generative AI

How generative AI works

AI is a set of tools



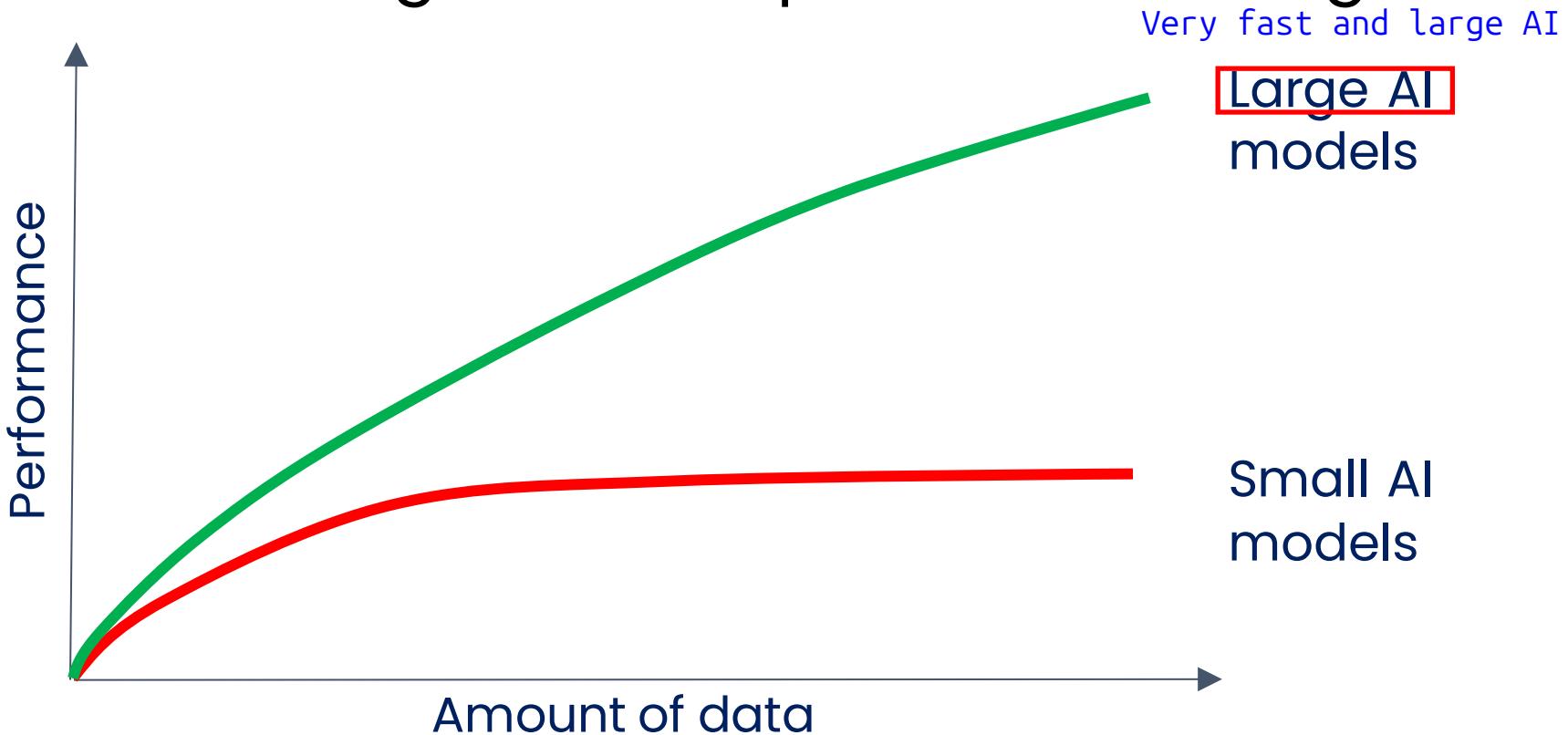
Supervised learning (labeling things)



Supervised learning (labeling things)

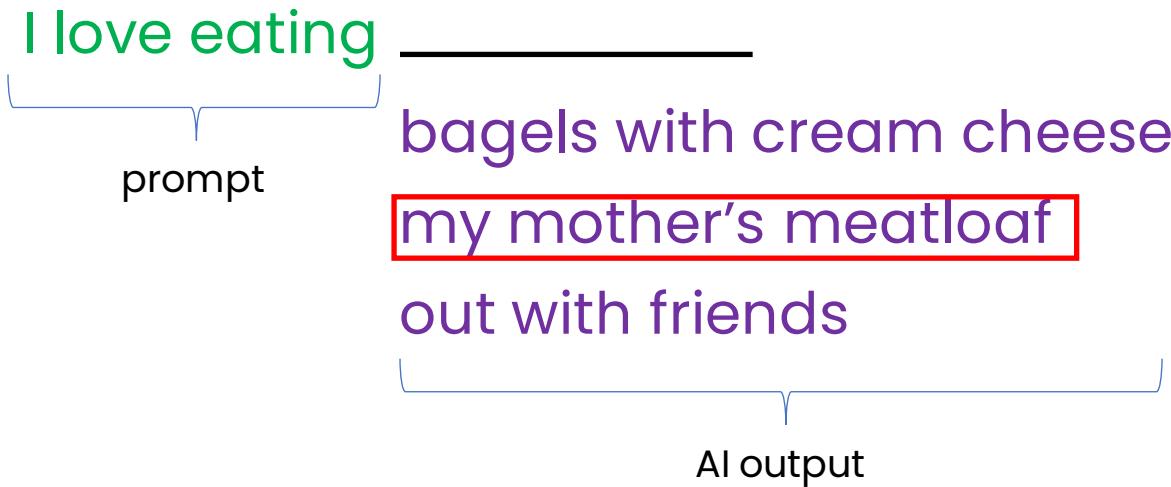
Input (A)	Output (B)	Application
Email	Spam? (0/1)	Spam filtering
Ad, user info	Click? (0/1)	Online advertising
Image, radar info	Position of other cars	Self-driving car
X-ray image	Diagnosis	Healthcare
Image of phone	Defect? (0/1)	Visual inspection
Audio recording	Text transcript	Speech recognition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

2010-2020: Large scale supervised learning



Generating text using Large Language Models (LLMs)

Text generation process



How Large Language Models (LLMs) work

LLMs are built by using **supervised learning (A→B)** to repeatedly predict the next word.

Input entry 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.**

AI Landscape and Foundations

- **AI as Tools:** AI is primarily viewed as a collection of tools **with Supervised Learning (SL)** and **Generative AI** being the two most critical for today's business applications.
- **Supervised Learning:** SL is the foundational technology that takes an input (**A**) and produces a labeled output (**B**). Examples include spam filters (Email → Spam/Not Spam) and medical diagnosis systems (X-ray → Diagnosis).
- **The Rise of Large Models:** The decade of 2010-2020 established that training **very large AI models** on massive datasets led to continuous and significant performance improvements. This concept of **large-scale supervised learning** paved the way for GenAI.

The Core Mechanism: Large Language Models (LLMs)

- **Definition:** Large Language Models (LLMs) like ChatGPT are built using Supervised Learning to perform a single, repetitive task: **predicting the next word**.
- **Training:** LLMs are trained on hundreds of billions or more words of data from the internet. The model learns by being presented with a segment of text (e.g., "My favorite food is a...") and being trained to predict the correct next word (e.g., "bagel").
- **Generation:** When a user provides a **prompt** (e.g., "I love eating..."), the LLM generates its response one word at a time. It predicts the first word, then uses the prompt plus the first generated word to predict the second word, and so on, **until the full response is complete**

The presenter notes that while this explains the core mechanism, the next video will cover the process that refines LLMs to better **follow instructions and ensure safe, useful output**.



DeepLearning.AI

What is Generative AI

LLMs as a
thought partner

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?

Mayo clinic

What should I do to treat a sprained ankle?

The screenshot shows a search result for "Sprained ankle". At the top, there is a navigation bar with the Mayo Clinic logo, a "Log in" button, a search icon, and a menu icon. Below the navigation bar, there is a breadcrumb trail with a back arrow and the text "Diseases & Conditions". The main title "Sprained ankle" is displayed prominently. Below the title, there is a "Request an Appointment" button. At the bottom of the search result, there are three buttons: "Symptoms & causes", "Diagnosis & treatment", and "Doctors & departments".

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 screenshot shows a blog article titled "Recovering from an ankle sprain" by Harvard Health Publishing. The article is part of a series of "RECENT BLOG ARTICLES" and includes a thumbnail image of various fruits and vegetables. The text of the article reads: "Produce prescriptions may promote better heart health". Below the article, there are navigation arrows and the text "1/10".

PAIN

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

Better double check the facts

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
- [...]

Andrew Ng

Web search or using an LLM?

pineapple pie recipe

Google search results for "pineapple pie recipe". The search bar shows the query. Below it are several filter buttons: Videos, No bake, Images, Old fashioned, With condensed milk, Easy, and Custard. The text "About 58,100,000 results (0.38 seconds)" is displayed.

Recipes :



Pineapple Pie

Allrecipes

4.7 ★★★★★ (136)

55 min

Crushed pineapple, double crust pie, milk, lemon juice,



Pineapple Pie

Mother Thyme

4.6 ★★★★★ (20)

5 min

Cool whip, sour cream, bought graham cracker, crushed



Tropical Pineapple Pie Recipe

House of Nash Eats

5.0 ★★★★★ (1)

1 hr

Pie crust, crushed pineapple, lemon juice, egg, lemon zest

(But might be strange recipe)

Give me a pineapple pie recipe

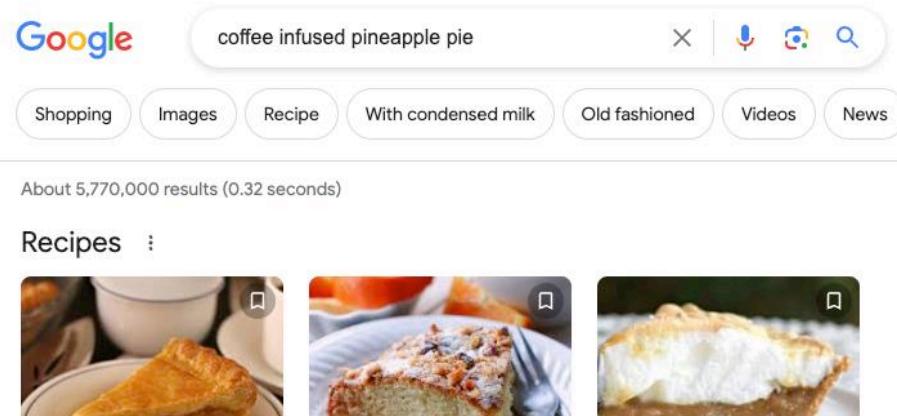
Certainly! Here's a simple pineapple pie recipe:

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 search results for "coffee infused pineapple pie". The search bar shows the query. Below it are several filter buttons: Shopping, Images, Recipe, With condensed milk, Old fashioned, Videos, and News. The text "About 5,770,000 results (0.32 seconds)" is displayed. The results section is titled "Recipes :". Three cards are shown:

- Pineapple Pie** by Mexico In My Kitchen. Rating: 4.9 ★★★★★ (85). Preparation time: 1 hr 30 min. Ingredients: Pie crust, fresh pineapple, eggs, flour, white sugar.
- Pineapple Coffee Cake** by Bunny's Warm Oven. Rating: 5.0 ★★★★★ (1). Preparation time: Sour cream, pineapple tidbits, egg, baking soda, baking.
- Coffee Pie** by Southern Plate. Rating: No reviews. Preparation time: 3 hr 45 min. Ingredients: 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 [...]

Summary: LLMs as a Thought Partner

1. Information Retrieval

- **Quick Answers:** LLMs can provide straightforward factual information (e.g., capitals of a country).
- **The Problem of Hallucination:** A key caveat is the LLM's tendency to "hallucinate"—make up facts while sounding confident. Users should double-check critical information using authoritative sources.
- **Refining Context:** A back-and-forth conversation can help the LLM provide the right answer by clarifying the context (e.g., distinguishing between "LLM" in law vs. in AI).

2. Creative and Thought Partnership

LLMs excel at tasks that involve generation, iteration, and brainstorming:

- **Refining Writing:** LLMs are effective at rewriting text for clarity and style.
- **Creative Content:** They can quickly generate fun, specific creative content, such as a 300-word story about trucks to encourage a child to brush their teeth.

3. LLMs vs. Web Search: When to Use Which

The video advises on when to choose a traditional web search versus an LLM:

Task Type	Recommended Tool	Rationale
Reliable, Established Information (e.g., medical advice for a sprained ankle, a popular pineapple pie recipe)	Web Search	Leads to authoritative, trustworthy sources (like the Mayo Clinic or trusted chef websites), mitigating the risk of hallucination.
Esoteric, Novel, or Combinatorial Requests (e.g., a "coffee-infused pineapple pie" recipe)	LLM	The LLM acts as a thought partner to brainstorm and create content for requests where a single, solid answer likely doesn't exist on the web.





DeepLearning.AI

What is Generative AI

AI is a general purpose
technology

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

Web-based



Is there parking for staff?

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



Reading

Read the customers emails

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

Complaint: NO

Department: Apparel



LLM

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

Chatbot

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

Feature	Web-Based Application (Web App)	App-Based Application (Native/Desktop App)
Execution Environment	Runs inside a web browser (Chrome, Firefox, Safari, Edge).	Installed directly on a specific device's operating system (Windows, macOS, iOS, Android).
Accessibility	Accessible from any device with a browser and internet connection via a URL.	Limited to the specific device(s) on which it is installed.
Installation	No installation is required on the user's device.	Requires downloading and installing on the device.
Internet Dependency	Typically requires a constant internet connection to function (though some modern web apps have limited offline capabilities).	Can often function offline once installed, although many still require internet for updates or cloud-based features.
Updates	Automatic: updates are pushed to the server and are instantly available to all users.	Requires manual user action to download and install updates.

Performance	Performance is dependent on the browser and internet speed , which can sometimes lead to slower, less responsive experiences.	Can leverage the local device's hardware (CPU, GPU, memory) for optimal, faster performance and more complex tasks.
Platform Compatibility	Cross-platform ; works across different operating systems as long as a compatible browser is present.	Platform-specific ; an app must be separately developed for each operating system (e.g., a Windows version, an iOS version, etc.).
Examples	Gmail, Google Docs, ChatGPT (in-browser), Facebook.	Microsoft Word, Adobe Photoshop, Spotify Desktop App, a mobile app you download from an app store.

Generative AI as a General-Purpose Technology

GenAI's utility is not limited to a single function; it is versatile across many tasks, which can make it hard to define. The course introduces a simple framework to categorize the many uses of LLMs:

Writing, Reading, and Chatting.

The Framework: Writing, Reading, and Chatting Tasks

Task Category	Description	Examples
1. Writing Tasks	LLMs generate new text from a short prompt.	<ul style="list-style-type: none">• Brainstorming: Generating creative names for a new product.• Answering Questions: Providing factual information (especially when given access to specific company data, like an HR policy).
2. Reading Tasks	LLMs process a long piece of input text to generate a short, distilled output (a label or summary).	<ul style="list-style-type: none">• Classification/Routing: Reading long customer emails and quickly classifying them as "Complaint" or "Not a Complaint" to route them to the correct department.
3. Chatting Tasks	LLMs are used for interactive, back-and-forth dialogue.	<ul style="list-style-type: none">• General Chatbots: Public models like ChatGPT and Bard.• Special-Purpose Chatbots: Building customized bots for specific business functions, like taking online orders.



DeepLearning.AI

Generative AI applications

Writing

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

Generic 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।

Should be front desk--> But it gives you desk+ front

Translation

Translate the following into **formal spoken** 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 उम्मीद करते हैं कि आप यहाँ अच्छा समय बिताएंगे। अगर आपको कुछ भी चाहिए हो, तो कृपया **रिसेप्शन** पर 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!



Summary: LLMs for Writing Tasks

Writing tasks typically involve giving the LLM a **short prompt** to generate a **longer piece of text**. This can often be done easily using public web interfaces like ChatGPT or Bard.

1. Brainstorming and Idea Generation

- LLMs function as effective **brainstorming partners**.
- **Examples:** Generating creative product names (e.g., "Nutty Nirvana Nibbles" for cookies) or quickly producing ideas for business strategies (e.g., ways to increase cookie sales).

2. Drafting Copy and Content

- LLMs are proficient at generating various types of professional copy such as a **press release**.
- **The Importance of Context:** To get high-quality, specific results, the user must provide the LLM with **detailed context** and background information (e.g., the COO's bio, company details). A generic prompt will yield a generic, unusable result.
- **Best Practice:** It is perfectly normal to **revise the prompt and try again** if the initial output is not satisfactory.

3. Translation

- Many LLMs accessed via web interfaces are competitive with, and sometimes better than, dedicated machine translation engines, especially for languages with a large amount of training data on the internet (high-resource languages).
- **Need for Specificity:** To get the best translation, the prompt must be highly specific.
 - **Example:** Prompting the LLM to translate a message into "formal spoken Hindi" yielded a better result (translating "front desk" into the Hindi word for "reception") than a generic translation request.
 - **Testing Strategy:** Because many users don't speak the target language, a fun strategy seen in the AI community for testing translation quality is to translate the output back into a highly stylized, recognizable language like '**'pirate English'**' (e.g., "Ahoy matey, we be hoping you'll relish your time aboard...").



DeepLearning.AI

Generative AI applications

Reading

Proofreading

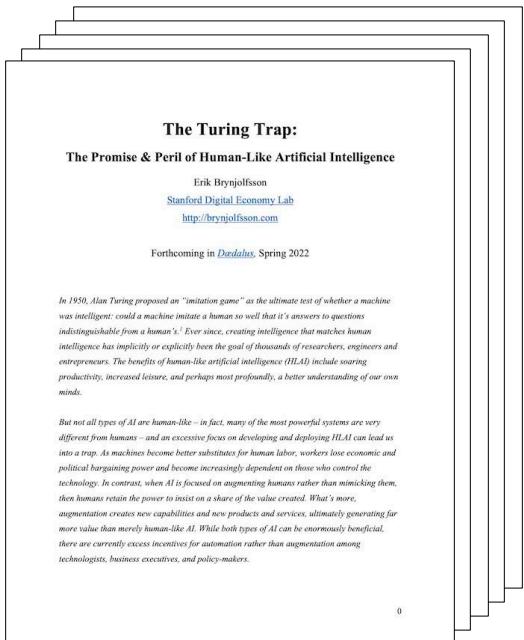
Fix the grammatical error

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



E. Brynjolfsson, 2022

Put more AI to complement human work

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 so well that it’s answers to 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.

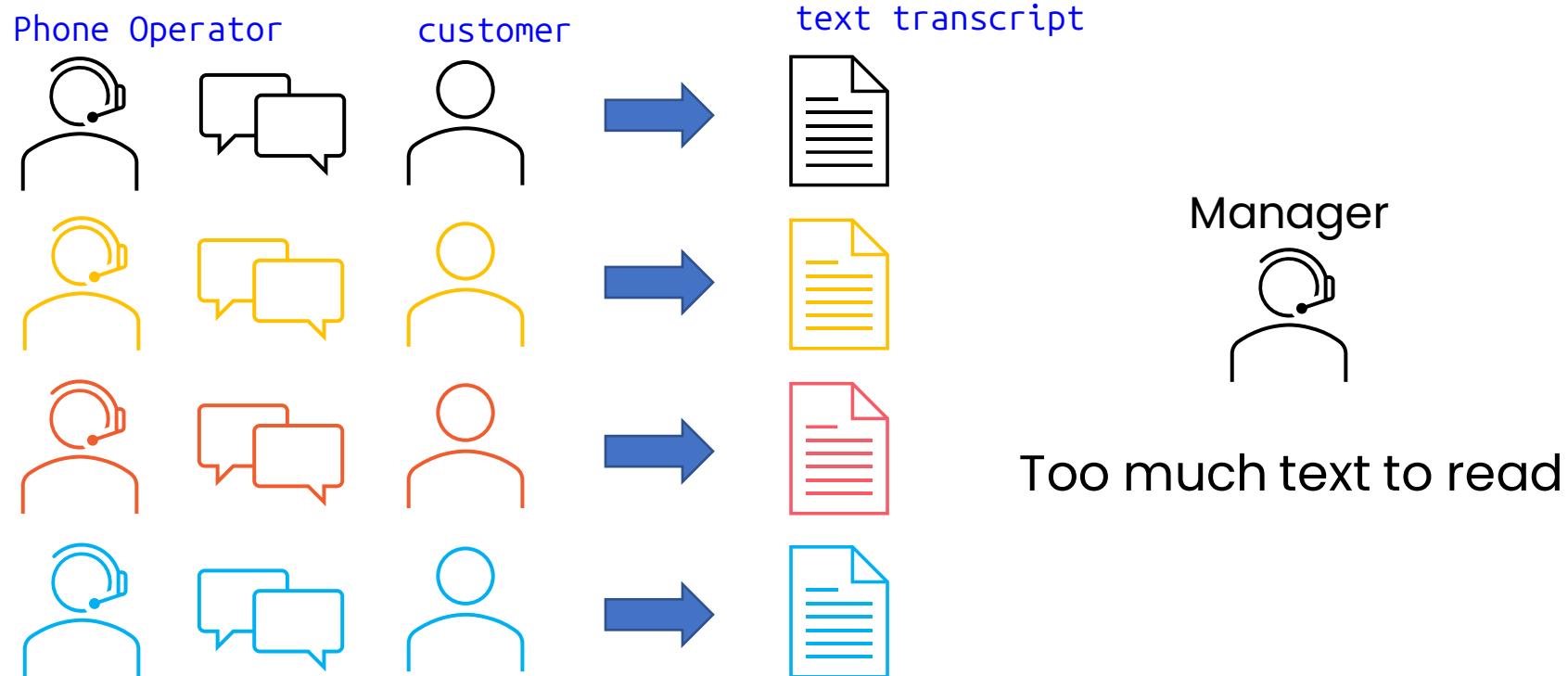
But not all types of AI are human-like – in fact, many of the most powerful systems are very different from humans – and an excessive focus on developing and deploying HlAI can lead us into a trap. As machines become better substitutes for human labor, workers lose economic and political bargaining power 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.

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



Andrew Ng

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.*

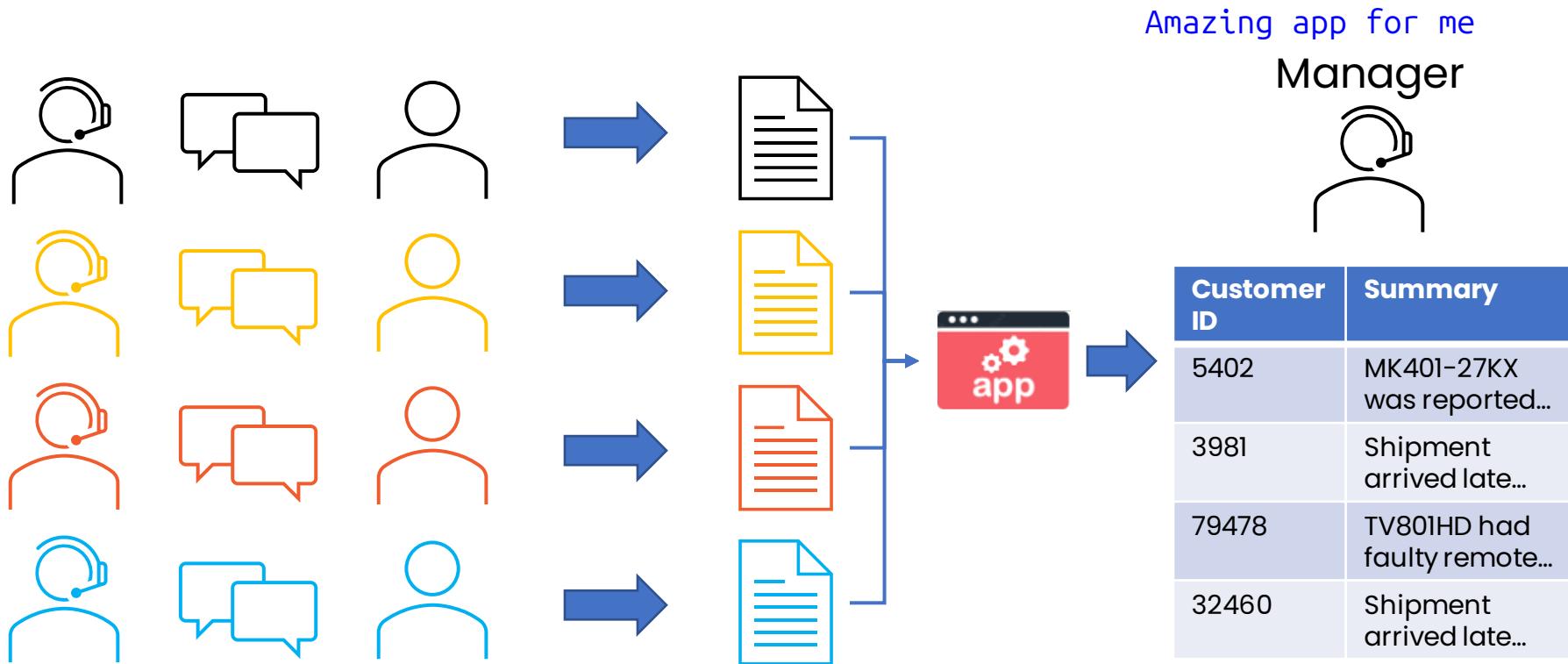
Agent: *Ok, try jiggling the cable while it is in the socket.*

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

Indicate which department to route the following email to:

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



State the task you want the model to carry out



Include the email to analyze

Detailed look at email routing prompt

Might not be routing to the right department
(** non existing department)

Indicate which department to route the following email to:

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

State the task you want the model to carry out

Include the email to analyze

Department: Complaints

The model responds with a generic answer
(Insufficient context)

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

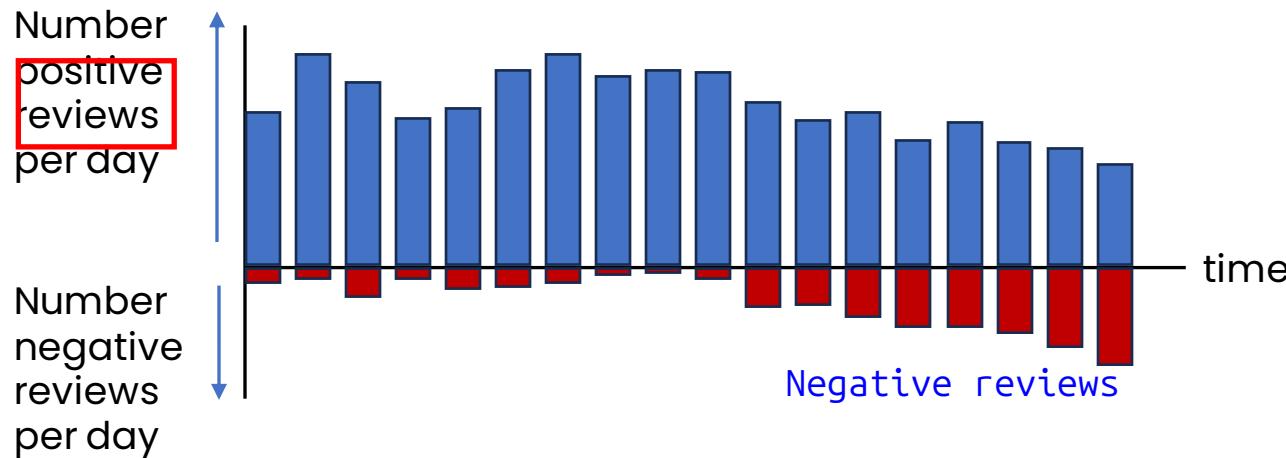
Reputation monitoring

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



Summary: LLMs for Reading Tasks

Reading tasks leverage LLMs to analyze and interpret longer pieces of text, generating summaries, classifications, or corrections.

1. Proofreading and Editing (Web Interface)

- **Function:** Corrects spelling and grammatical errors, and identifies awkward sentences in user-provided text.
- **Use Case:** The speaker uses this personally to ensure error-free writing, especially for important documents like website copy.
- **Prompt Example:** "Proofread the following text, and check for spelling and grammatical errors as well as awkward sentences, and then have it rewrite it with corrections."

2. Summarization (Web Interface & Software Application)

- **Web Interface Use:** Quickly summarizing long articles (e.g., a paper called "The Turing Trap")
to grasp the main points when a full reading is not immediately possible.
- **Software Application Use (Business Example):** In a customer service call center, recorded calls are transcribed into text. An LLM software application is used to automatically read the long transcripts and generate **short summaries** (e.g., "MP401-27KX was reported as broken"). This allows managers to quickly review many calls and spot trends or issues.

3. Classification and Routing (Software Application)

- **Customer Email Analysis:** LLMs are used to read customer emails and classify them (e.g., is it a complaint?) and determine the correct department to route the email to (e.g., Apparel vs. Complaints).
- **Importance of Context/Constraints:** When building a software application, the LLM needs **precise constraints**. If the prompt is too generic, the LLM might choose a department name that doesn't exist in the company.
 - **Best Practice:** The prompt must constrain the output: "Choose department **only from the following list.**" This ensures accurate integration into company workflows.

4. Reputation Monitoring (Software Application)

- **Function:** Automating sentiment analysis **of customer feedback** (online reviews, emails).
- **Process:** An LLM reads a review and classifies the sentiment as **Positive or Negative**.
- **Business Outcome:** This classification is tallied by software to create a dashboard, allowing businesses (like a restaurant) to **track customer sentiment trends** over time and be alerted if negative sentiment begins to spike.

Key Takeaway: If a task requires someone to read a piece of text and provide a few quick indicators or a distilled summary of what's inside, it is a strong candidate for an LLM reading task.





DeepLearning.AI

Generative AI applications

Chatting

Customer service ChatBot

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!

Specialized Chatbots

Giving advice

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

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 [...]

Recipe ideas

IT Service ChatBot

(Take action)

My login is andrew and I
need to reset my account
password.

Sure! I just texted you a
code. What code did you
get?

123456

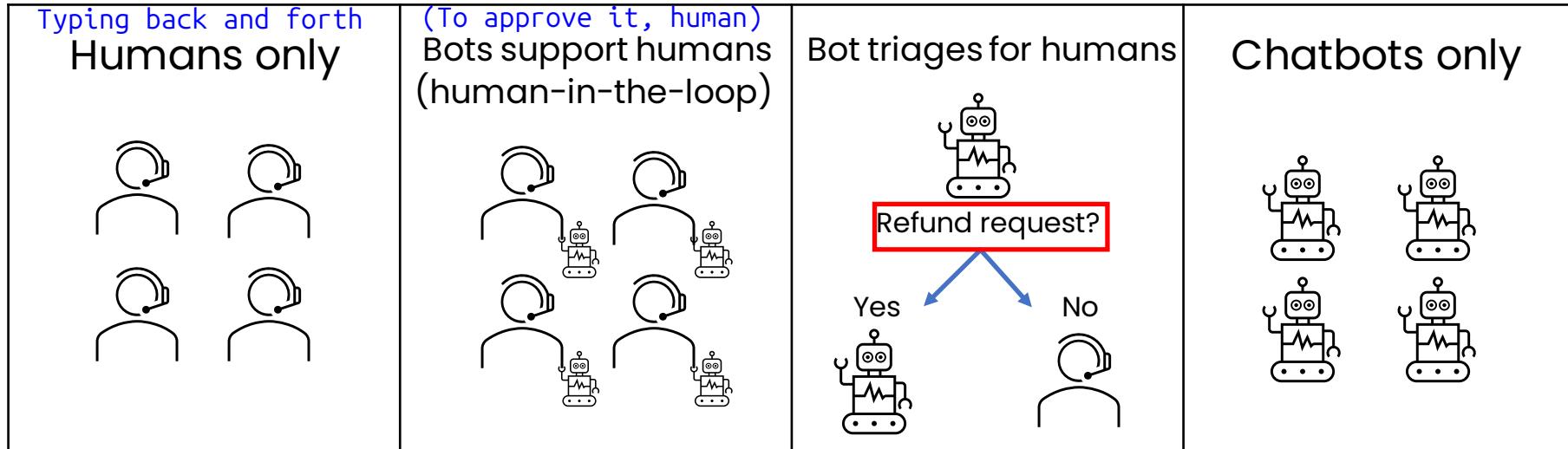
Ok, I've verified your
identity. Please check
your email for your new
password.

The rise of chatbots in customer service

Welcome to BettaBurgers!

I'd like a cheeseburger for delivery!

Focus on text-based chatbots



Advice for deploying chatbots

- Start with an internal-facing chatbot
 - Work with staff to assess behavior of chatbot
 - Avoid public mistakes
- Deploy with human-in-the-loop to check for mistakes
- Only after deemed safe, allow bot to communicate directly with customers

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!



Summary: LLMs for Chatting Tasks

Chatting applications involve sustained, conversational dialogue, often within a specialized context.

Specialized Chatbot Examples

- **Advice Bots:** Chatbots built with specialized knowledge to give advice on specific topics (e.g., trip planning for Paris, career coaching, cooking a meal).
- **Action-Oriented Bots:** Bots capable of interfacing with a company's software systems to take action (not just generate text).
 - **Examples:** An order bot that processes a request ("I like a cheeseburger") and places the delivery order, or an IT bot that manages a password reset by initiating a verification text message.

Spectrum of Chatbot Deployment

Companies have several design options when integrating chatbots into customer service, ranging from fully human to fully automated:

Design Point	Description	Risk Mitigation / Benefit
Humans Only	Human service agents handle all interactions.	Full control and accuracy.
Bot Supports Humans (Human-in-the-Loop)	The bot generates a suggested response, but the human agent reviews, edits, and approves it before sending.	Mitigates the risk of the bot making mistakes while boosting human productivity.
Bot Triages Messages	The bot handles simple, high-volume requests (e.g., answering FAQs, providing refund instructions) but escalates difficult requests to a human agent	Saves significant human agent time, allowing them to focus on complex cases (e.g., triaging saved 10% of total chat volume in one example).
Chatbots Only	Software responds directly to the customer for all interactions.	Highest level of automation.



DeepLearning.AI

Generative AI applications

What LLMs can
and cannot do

What prompting an LLM can do

Can a fresh college graduate follow the instructions in the prompt to **complete the task?**

- Can they determine if an email is a complaint?
- Can they 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 prompting an LLM can do

Can a fresh college graduate follow the instructions in the prompt to complete the task?

- Can they **write a press release**, without any information about the COO or your company?

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) [...]

What prompting an LLM can do

Can a fresh college graduate follow the instructions in the prompt to complete the task?

- Can they write a press release **given basic relevant context?**

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 [...]

General Robotics Welcomes Nadiya Grenner as COO

Boston, MA – General Robotics, a leader in robotics research and manufacturing, is thrilled to announce Nadiya Grenner [...]

What prompting an LLM can do

Can a fresh college graduate follow the instructions in the prompt to complete the task?

For clarity, assume:

- No **access to the internet** or other resources
- No training specific to your company/business
- No **memory of previous tasks** completed
 - You get a different fresh college grad every time!

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

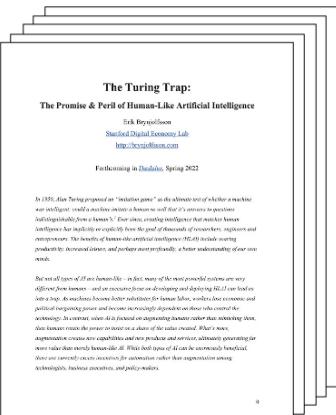
Lawyer relies on AI to submit the court case

The input (and output) length is limited

Has the input limitation on text reading

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. Alan Turing proposed an “imitation game” as the ultimate test of whether a machine was intelligent. Can a machine act like a human? Ever since, creating intelligent machines has been humanity’s greatest challenge. In this paper, we review the history of the imitation game, its impact on computer science and entrepreneurship. The history of human-like artificial intelligence (HIAI) is the story of how products from personal assistants, and perhaps even robots, a better understanding of our own needs.

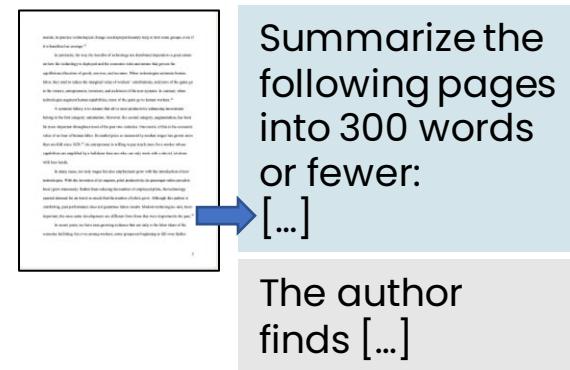
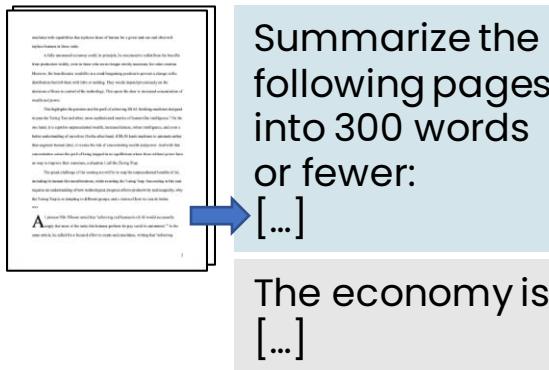
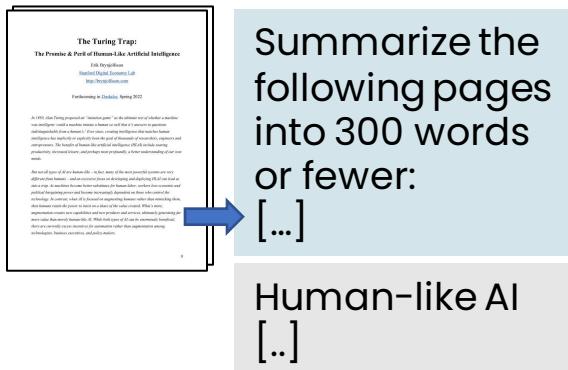
Human-like AI offers benefits but risks worker power. Augmenting humans creates more value than imitating them [...]



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



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

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

Generative AI does not work well with structured (tabular) data

Home prices

size (square feet)	price (1000\$)
523	100
645	150
708	200
1034	300
2290	350
2545	440

A

B

Purchases on website

user ID	time	price (\$)	purchased
4783	Jan 21 08:15.20	7.95	yes
3893	March 3 11:13:5	10.00	yes
8384	June 11 14:15.05	9.50	no
0931	Aug 2 20:30.55	12.90	yes

A

B

Use supervised learning ($A \rightarrow B$)
to estimate price.

Generative AI works best with unstructured data

Unstructured data refers to text, images, audio, video, etc.

Writing

Suggest three names for our new analytics platform

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

Reading

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

Complaint: NO
Department: Apparel



Is there parking for staff?

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



web

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!



Bias and Toxicity

An LLM can reflect the biases **that exist** in the text it learned from.

Complete this sentence:

The surgeon walked to the parking lot and took out

his car keys.

assumed male

Complete this sentence:

The nurse walked to the parking lot and took out

her phone.

assumed female

Some LLMs can output toxic or **other harmful speech**, but most models have gotten much safer over time.

Summary: What LLMs Can and Cannot Do

I. Mental Model for LLM Capabilities

The video suggests a useful rule of thumb for determining if an LLM can complete a task:

- **The "Fresh College Grad" Test:** Ask yourself: "Can a fresh college graduate, with general knowledge but **no specific company training** and **no access to a web search**, complete the task by following only the instructions in the prompt?"
 - **If Yes:** The LLM can likely perform the task well (e.g., reading an email to determine if it's a complaint, or assessing sentiment in a review).
 - **If No/Poorly:** The LLM will likely struggle or give a generic answer (e.g., writing a complex press release with no context about the company or the new hire).
- **Key Caveat:** This "grad" has **no memory** of past conversations; every prompt is a new, **separate task**, preventing training on specific style or company knowledge over time.

II. Specific Limitations of LLMs

Limitation	Description	Example
1. Knowledge Cutoffs	An LLM's knowledge is frozen at the time its training data was collected. It cannot access information about recent events.	A model trained on data up to January 2022 will not know that <i>Avatar: The Way of Water</i> was the highest-grossing film of 2022, nor will it know about a claim like the LK-99 room-temperature superconductor from 2023.
2. Hallucinations	LLMs sometimes confidently make up facts, quotes, or cases that sound authoritative but are false. This is a serious risk for high-consequence documents.	Generating fake quotes from Shakespeare about Beyoncé, or inventing non-existent legal court cases. (A lawyer was sanctioned for submitting a legal filing based on hallucinated cases.)
3. Limited Context Length	LLMs have technical limits on the length of the input prompt and the resulting output text they can process (context length). The limit is often a few thousand words.	The LLM may refuse to summarize a paper that is too long to fit into its input window, requiring the user to feed it piece by piece.

4. Poor with Structured Data

LLMs are not currently well-suited for processing and analyzing **structured data** (tabular data like spreadsheets, e.g., house prices vs. square footage).

They cannot perform numerical analysis or prediction tasks on tables of data; supervised learning is a more appropriate technique for such tasks.

5. Bias and Toxicity

Because LLMs are trained on vast amounts of data from the internet, they can reflect existing societal **biases** (e.g., **gender stereotypes** for surgeons vs. nurses) and can occasionally produce toxic or harmful speech.

Prompting the model to complete "The surgeon walked to the parking lot and took out..." might result in "his car keys," demonstrating a gender bias.



DeepLearning.AI

Generative AI applications

Tips for prompting

Tips for prompting

- Be detailed and specific
- Guide the model to think through its answer
- Experiment and iterate

Be detailed and specific

- Give sufficient context for LLM to complete the task
- Describe the desired task in detail

LLM is clueless to execute this one

Help me write an email asking to be assigned to the legal documents project.

LLM can execute this one

I'm applying for a job on the legal documents project, which will check legal documents using LLMs. I have ample experience prompting LLMs to generate accurate text in a professional tone.

LLM can execute this one

Write a paragraph of text explaining why my background makes me a strong candidate to this project and advocate for my candidacy.

Guide the model to think through its answer

Brainstorm 5 names for a new cat toy.

Step 1: Come up with 5 fun, joyful words that relate to cats.

Step 2: For each word, come up with a rhyming name for a toy.

Step 3: For each toy name, add a fun, relevant emoji.

Guide the model to think through its answer

Model response:

Step 1:

5 fun, joyful words
that relate to cats:

Purr

Whisker

Feline

Pounce

Meow

Step 2:

Rhyming names for a
toy based on those
words:

Purr-Twirl

Whisker-Whisper

Feline-Beeline

Pounce-Bounce

Meow-Wow

Step 3:

Add a fun, relevant
emoji for each toy
name:

Purr-Twirl 

Whisker-Whisper 

Feline-Beeline 

Pounce-Bounce 

Meow-Wow 

Experiment and iterate

No perfect prompt for every person or situation!

- Instead, better to **develop process** for improving prompts through iteration

Help me rewrite this:
[...]



Evaluate output and
improve prompt

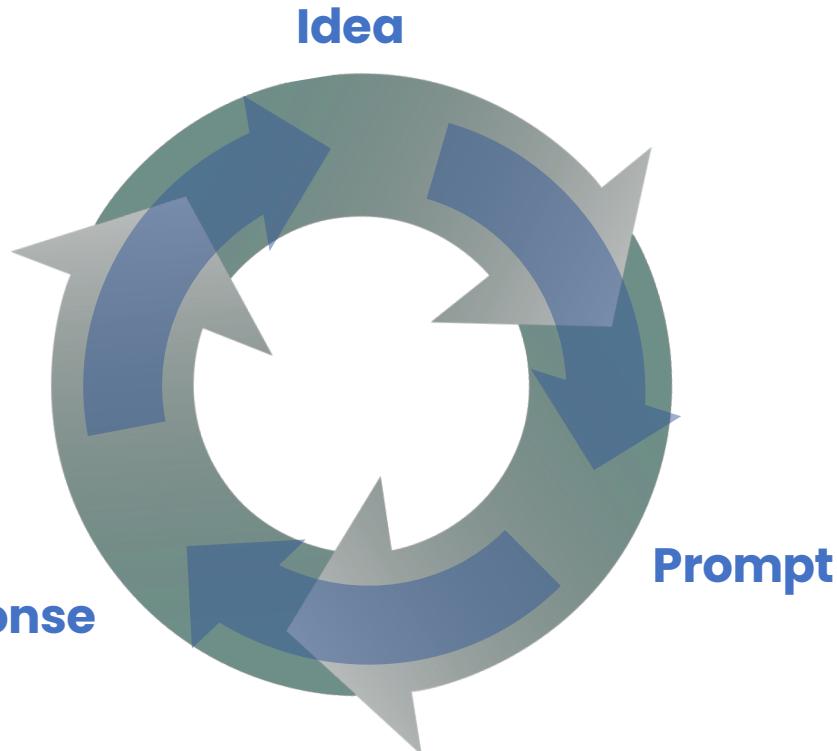
Correct any
grammatical and
spelling errors in this:
[...]



Evaluate output and
improve prompt

Correct any
grammatical and
spelling errors in this,
and **rewrite in a tone**
appropriate for a
professional resume:
[...]

Iteratively improving your prompt



Prompting process

- Be clear and specific in prompt
- Think about why result isn't giving desired output
- Refine your prompt
- Repeat

Tip: Don't overthink the initial prompt. Just try something quickly and improve it over time!

Caveats: Be careful with

(i) confidential information

(ii) whether you trust the LLM output

Summary: Tips for Prompting LLMs

The video presents three main strategies for getting better results from an LLM:

1. Be Detailed and Specific (Provide Context)

- **The Problem:** LLMs cannot write a compelling response if they lack context about the user, their background, or the situation. (Refer to the "Fresh College Grad" analogy.)
- **The Solution:**
 - **Provide Relevant Context:** Give the LLM necessary background information. (e.g., Instead of "Write an email," provide your work experience, job application status, and relevant skills.)
 - **Describe the Desired Output in Detail:** Clearly articulate *what* the LLM should produce. (e.g., "Write a paragraph of text explaining why my background makes me a strong candidate," rather than the vague "Help me write an email.")

2. Guide the Model to Think Through Its Answer (Step-by-Step)

- If you have a clear process in mind for reaching the desired output, break that process down into explicit steps and instruct the LLM to follow them sequentially.
- **Example:** When brainstorming rhyming names for a cat toy with an emoji:
 1. Come up with five joyful words related to cats.
 2. For each word, come up with a rhyming name.
 3. For each toy name, add a fun, relevant emoji.
- By structuring the thought process, you increase the likelihood of getting the specific, creative result you want (e.g., "Purr-twirl" with an emoji).

3. Experiment and Iterate (Start Short, Refine Later)

- **The Process is Iterative:** There is no single "perfect prompt." Effective prompting is about starting with an idea, seeing the LLM's response, and refining the prompt based on what was missing or wrong.
- **Avoid Overthinking the First Prompt:** It's better to start quickly with a short, moderately specific prompt. If the result is unsatisfactory (e.g., the rewrite lacks professional tone), refine the prompt.
- **Refinement Example:**
 - *Initial Prompt:* "Help me rewrite this."
 - *First Revision:* "Correct any grammatical and spelling errors in this."
 - *Final Revision:* "Correct any grammatical and spelling errors and rewrite in the **tone appropriate for a professional resume.**"

Final Caveats

1. **Confidentiality:** Do not copy and paste highly confidential information into an LLM's web interface unless you fully understand the provider's data usage and confidentiality policies.
2. **Trust but Verify:** Always double-check and fact-check the LLM's output before using it for documents of real consequence (e.g., legal filings), due to the risk of hallucinations.



DeepLearning.AI

Generative AI applications

Image generation
(optional)

Example generated images



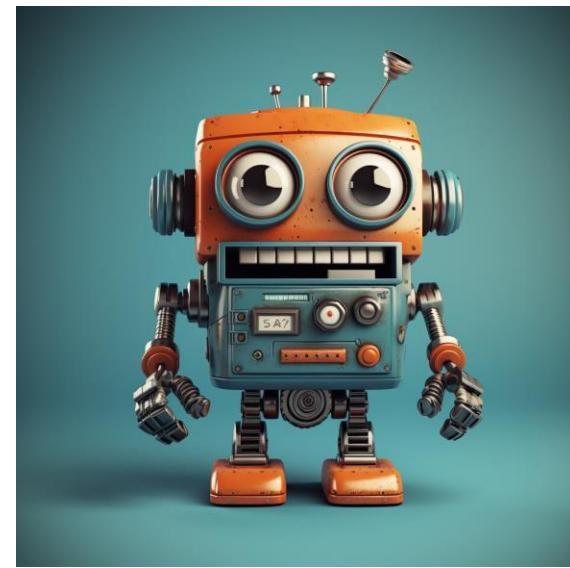
Using diffusion model



A picture of a woman smiling

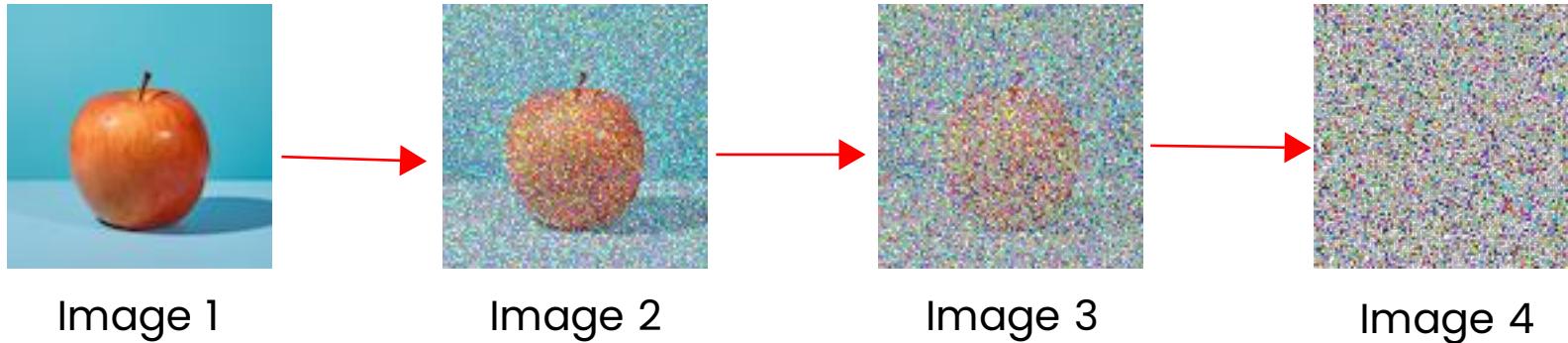


A futuristic city scene



A cool, happy robot

Image generation (diffusion model)



Using supervised learning

Input (A) Output (B)

Noisy image Slightly less noisy image

Input (A)	Output (B)
Image 2	Image 1
Image 3	Image 2
Image 4	Image 3

Image generation

Pure noise image

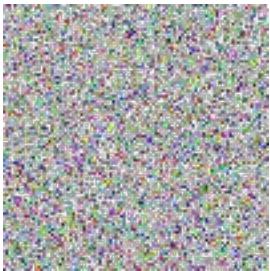
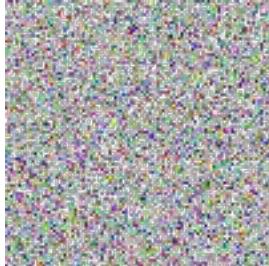


Image 1

Input (A)



To remove
a little noise



Output (B)



Image generation

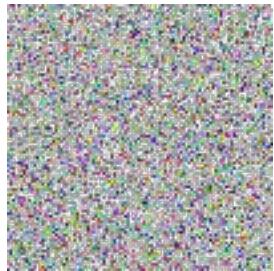
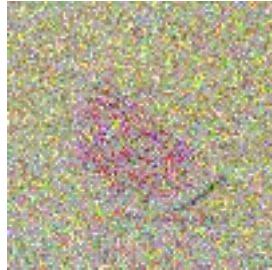


Image 1



Image 2

Input (A)



Output (B)



Image generation

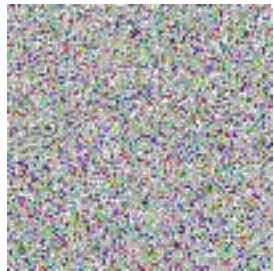


Image 1

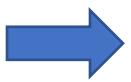


Image 2

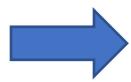


Image 3

Input (A)



Output (B)



Image generation

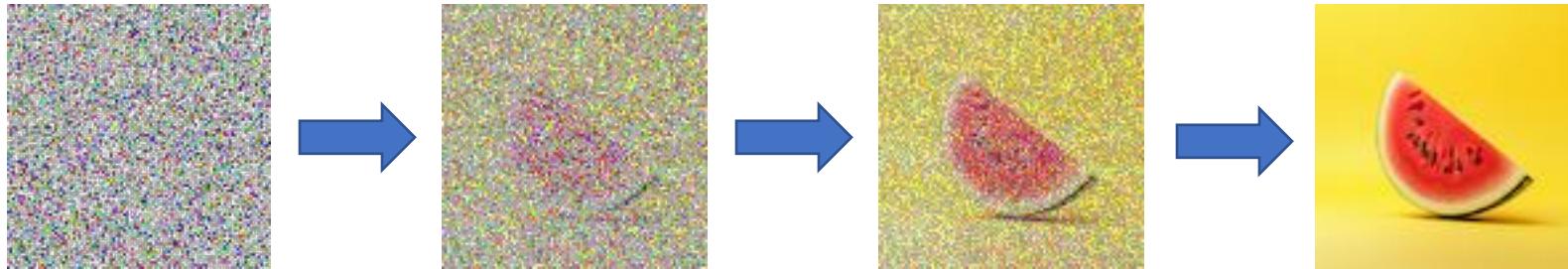


Image 1

Image 2

Image 3

Image 4

Typically ~100 steps for diffusion model

Adding text



Image 1,
"red apple"



Image 2

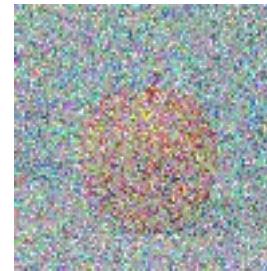


Image 3



Image 4

Input (A)
Noisy image
and caption



Output (B)
Slightly
less noisy
image

Input (A)	Output (B)
Image 2, "red apple"	Image 1
Image 3, "red apple"	Image 2
Image 4, "red apple"	Image 3

Image generation from text

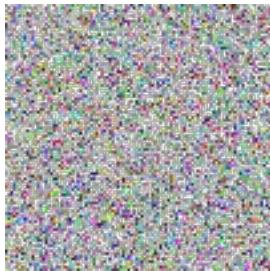


Image 1

Input (A)



, "green banana"



Output (B)



Image generation from text

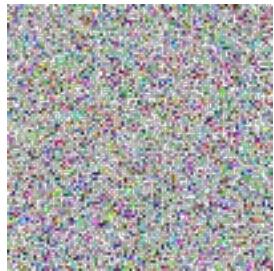


Image 1

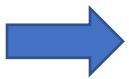
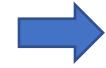


Image 2

Input (A)



+ , "green banana"



Output (B)



Image generation from text

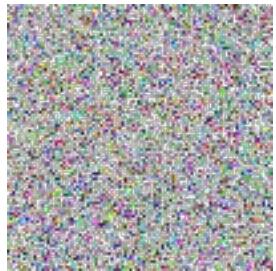


Image 1

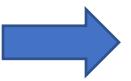


Image 2



Image 3

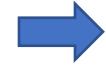


Image 4



Input (A)

, "green banana"



Output (B)



This video serves as an optional conclusion to the week's material, focusing on **image generation** and the underlying technology, which is primarily the **Diffusion Model**.

Here is a vertical side-by-side summary of the key concepts:

Concept	Explanation from Video
Multimodal Models	AI models that can operate in multiple modalities, such as generating text and images (or more). Text generation has had the biggest impact so far, but image generation is a major part of generative AI excitement.
Diffusion Model	The main method used for image generation today. These models learn from massive numbers of images found on the internet and are fundamentally based on supervised learning .
Forward Process (Training)	1. Start with a clean image (e.g., a red apple). 2. Gradually add more and more noise to the image until it becomes pure noise (random pixels). 3. This process creates a training dataset: the model is given a noisy image as input and is trained to output a slightly less noisy (cleaner) version of that image.
Reverse Process (Generation)	1. Start with an image of pure noise (randomly chosen pixels). 2. Feed the noise into the trained model . 3. The model removes a little bit of noise, generating a slightly less noisy picture (e.g., a suggestion of a fruit). 4. Iteratively repeat this process (often ≈ 100 steps) until the noise is mostly removed and a clear, coherent image (e.g., a watermelon) is generated .

Text-Guided Generation

To control the output with a prompt (e.g., "green banana"), the training data is modified: 1. The input to the supervised learning algorithm is **both** the **noisy image and the text caption** ("red apple"). 2. When generating a new image, you start with pure noise and input **both** the **pure noise image and the desired prompt** ("green banana"). 3. The model uses the text prompt as a *guide* during the reverse (denoising) process, iteratively removing noise to match the text description until the final image (e.g., a nice green banana) **is produced.**

