

Short Course in Artificial Intelligence

20st June 2024

Lecture 3: Generative AI

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Generative AI for Everyone

Andrew Ng

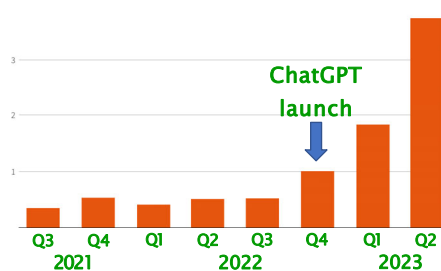
Many slides are borrowed from a course by Andrew Ng

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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

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What is generative AI?

- ◆ Artificial intelligence systems that can produce high quality content, specifically text, images, and audio

ChatGPT/OpenAI

Prompt: Write three captions for a social post about our line of sunglasses for robots.

Response:

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! Introducing our new eyewear collection now."

Bard/Google

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

Response:

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.

Bing Chat/Microsoft

Prompt: Find me some recipes for snacks for hungry pirates.

Response:

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.

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Generative Artificial Intelligence

- Generating complex and **realistic** data
- Recent progress
- Generative Adversarial Networks (Goodfellow)



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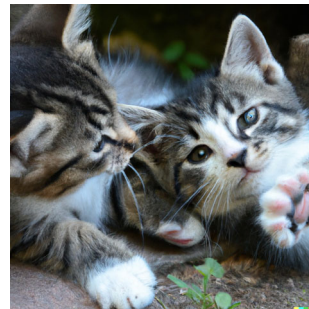
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Image, Audio and Video generation

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



Two cute kittens playing (DALL-E)



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What is generative AI?

◆ Generative AI is also a developer tool

```
jupyter L4-QnA (unsaved changes) Logout
File Edit View Insert Cell Kernel Help Not Trusted Python 3 (ipykernel) O
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)

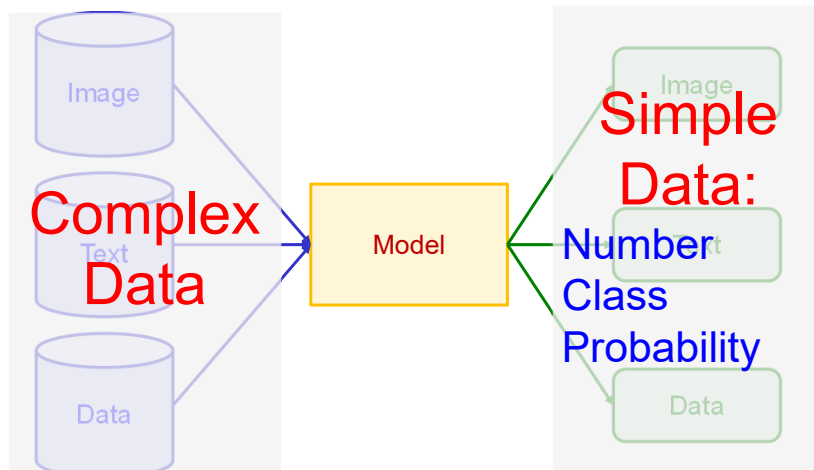
In [ ]: from langchain.indexes import VectorstoreIndexCreator

In [ ]: #pip install docarray

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

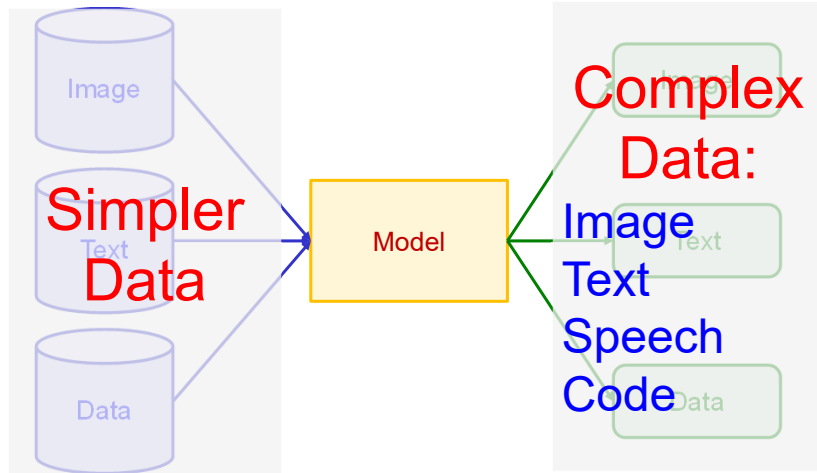
Generative Artificial Intelligence

➤ Discriminative AI



Generative AI

Generative AI



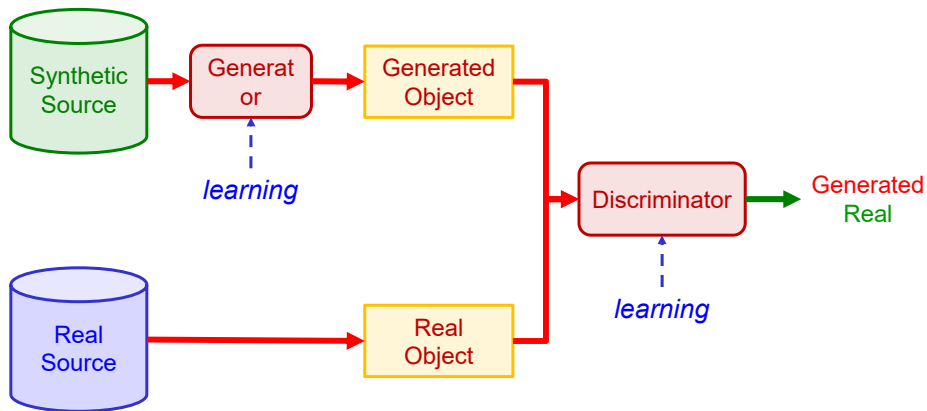
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Generative AI

Generative Adversarial Networks GAN

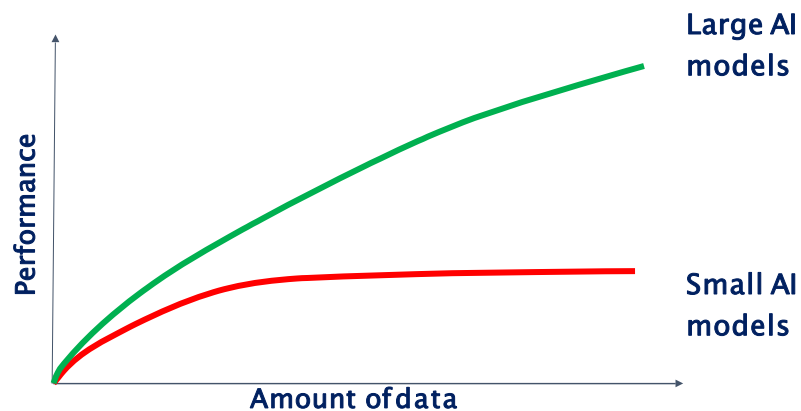


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2010-2020: Large scale supervised learning



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Generative AI

◆ ChatGPT

- chatbot, article writer, code writer by OpenAI
- one of the most famous LLM (Large Language Model)
- 175,000,000,000 parameters
- Trained on 570 GB of data
- Cost of training: 65M US\$
- Number of users:
 - December 2022 – 1 Million
 - January 2023 – 57 Million
 - February 2023 – 100 Million
 - June 2023 – 1.6 Billion

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How Large Language Models (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.

How Large Language Models (LLMs) work

Learning is done on:

- ◆ text
- ◆ questions/answers
- ◆ text/summary
- ◆ text/translation
- ◆ computer code
- ◆ ...

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 [...]

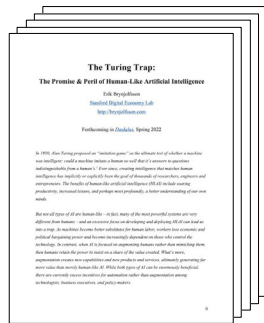
Translation

◆ 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 फ्रंटडेस्क से संपर्क करें।

Summarizing an article



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 [...]

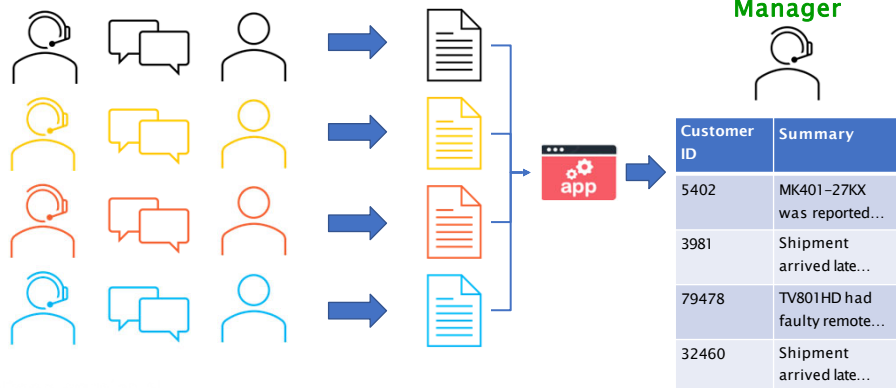
Human-like AI offers benefits but risks worker power. Augmenting humans creates more value than imitating them [...]

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Summarizing call center conversations



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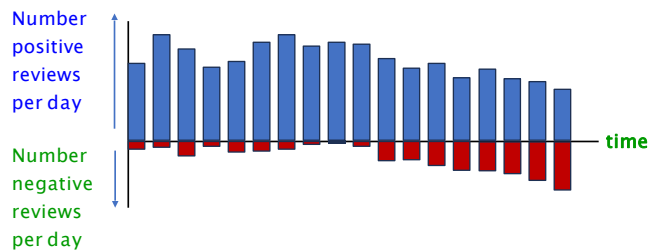
Reputation monitoring

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



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 [...]

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 [...]

Generative AI

◆ New skill: prompt design

“Introduction to prompt design

Prompt design is the process of creating prompts that elicit the desired response from language models. Writing well structured prompts is an essential part of ensuring accurate, high quality responses from a language model. This page introduces some basic concepts, strategies, and best practices to get you started in designing prompts.

Prompts can include one or more of the following types of content:

- ◆ Input (required)
- ◆ Context (optional)
- ◆ Examples (optional)

Tips for prompting

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

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:
[...]

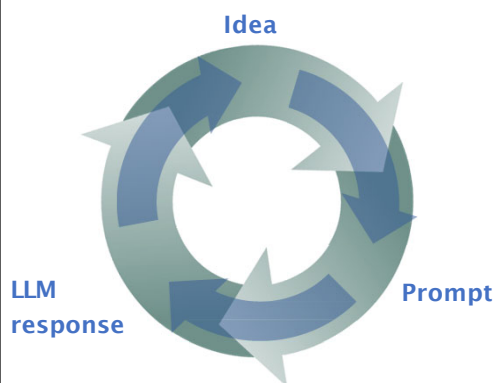
Evaluate output and
improve prompt

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

Making things up: Hallucinations

- ◆ Give me three quotes that Shakespeare wrote about Beyonce

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

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.

Dimensions of responsible AI

- ◆ **Fairness:** Ensuring AI does not perpetuate or amplify biases
- ◆ **Transparency:** Making AI systems and their decisions understandable to stakeholders impacted
- ◆ **Privacy:** Protecting user data and ensure confidentiality
- ◆ **Security:** Safeguard AI systems from malicious attacks
- ◆ **Ethical Use:** Ensuring AI is used for beneficial purposes

Practice 3: Generative AI

- ◆ Free online LLM without login:
 - <https://chat.lmsys.org/>
 - <https://sdk.vercel.ai/>
 - <https://huggingface.co/chat/>
 - <https://playground.ai.cloudflare.com/>
- ◆ Free online LLM with login
 - <https://poe.com/login>
 - <https://accounts.nat.dev/sign-in>
- ◆ Free Local LLM (requires installation on your machine)
 - <https://gpt4all.io/index.html>
 - <https://github.com/nat/openplayground>

Practice 3: Generative AI

- ◆ Give prompt to generate code
- ◆ generate code to insert a semicolon between each character of a string
- ◆ generate code to convert a number into words (choose the language)
- ◆ generate code to ... *your own ideas*

Practice 3: Generative AI

- ◆ Add comments to existing code
- ◆ Generate test units for existing code
- ◆ Find bugs in existing code
 - you can get some inspiration from bug examples such as:
<https://medium.com/@ababyprogrammer/python-programming-language-buggy-code-b0c3b3c25db8>