

# Generative AI

Adam Kehoe

What is generative AI?

Why is it moving so quickly?

What can you do with it today?

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**ARTIFICIAL  
INTELLIGENCE**

\*Adapted from “Build a Large Language Model” by Sebastian Raschka

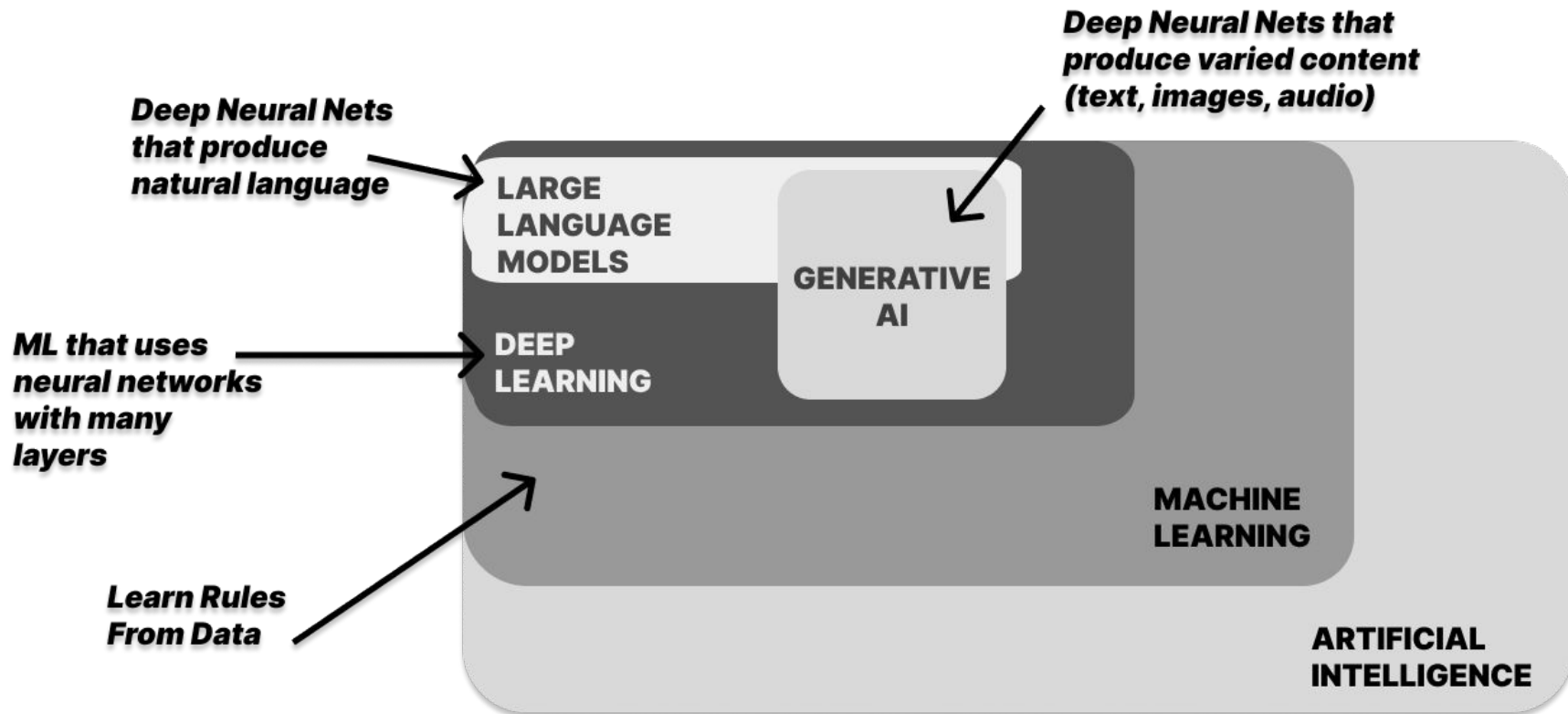


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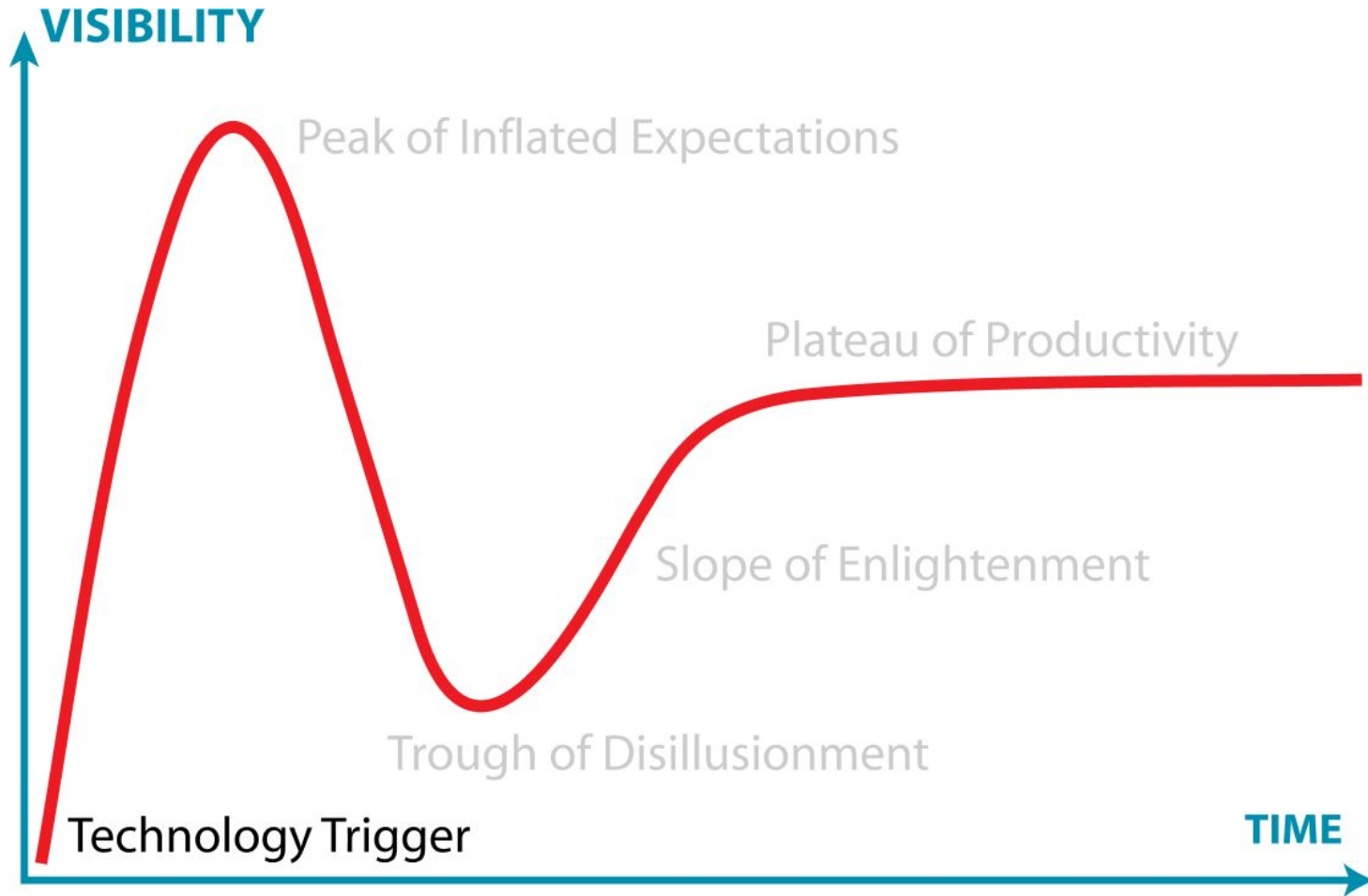
## Big Picture

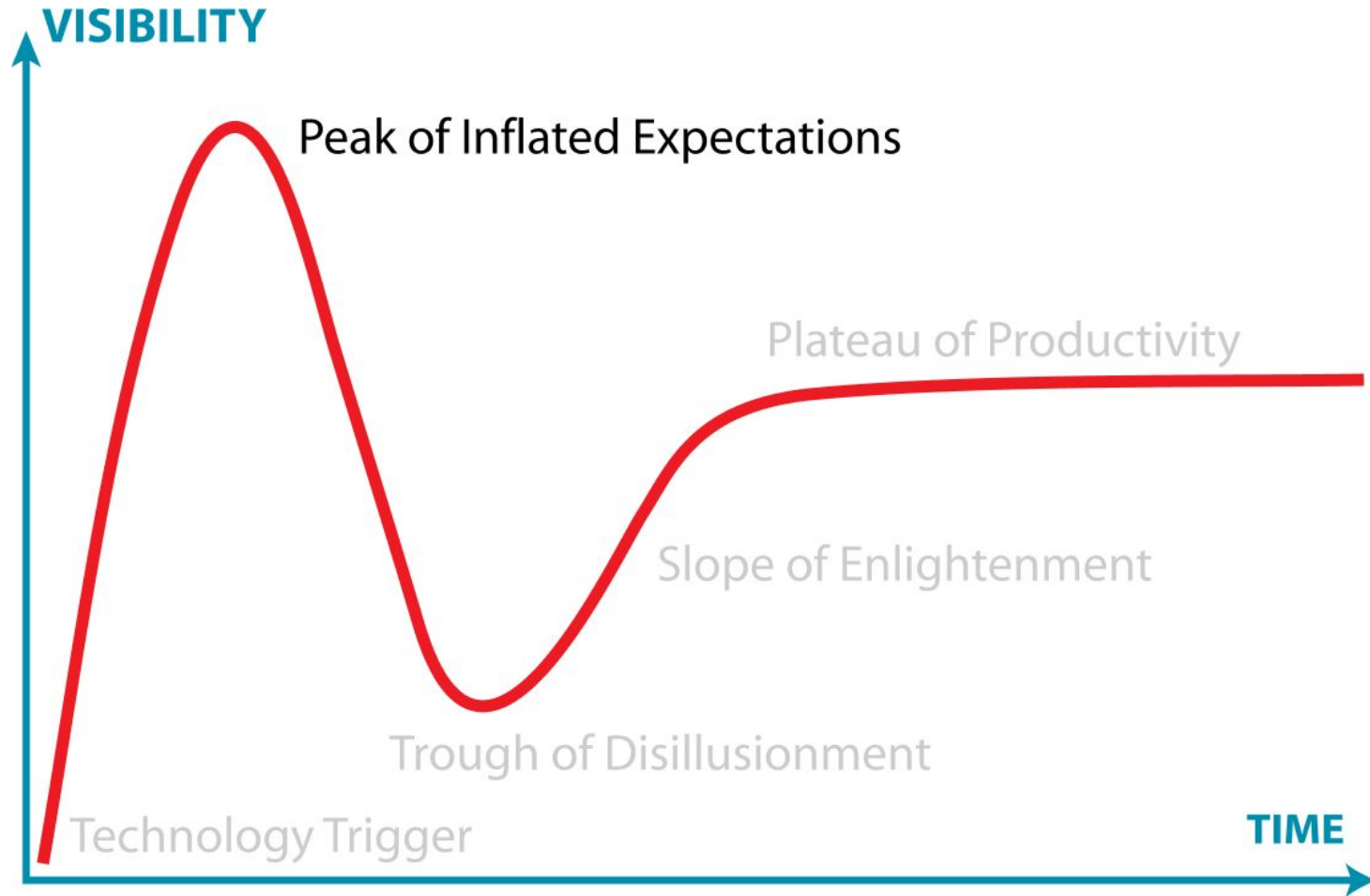
Generative AI can create text, images, music, code, protein structures, 3d models, etc.

What is generative AI?

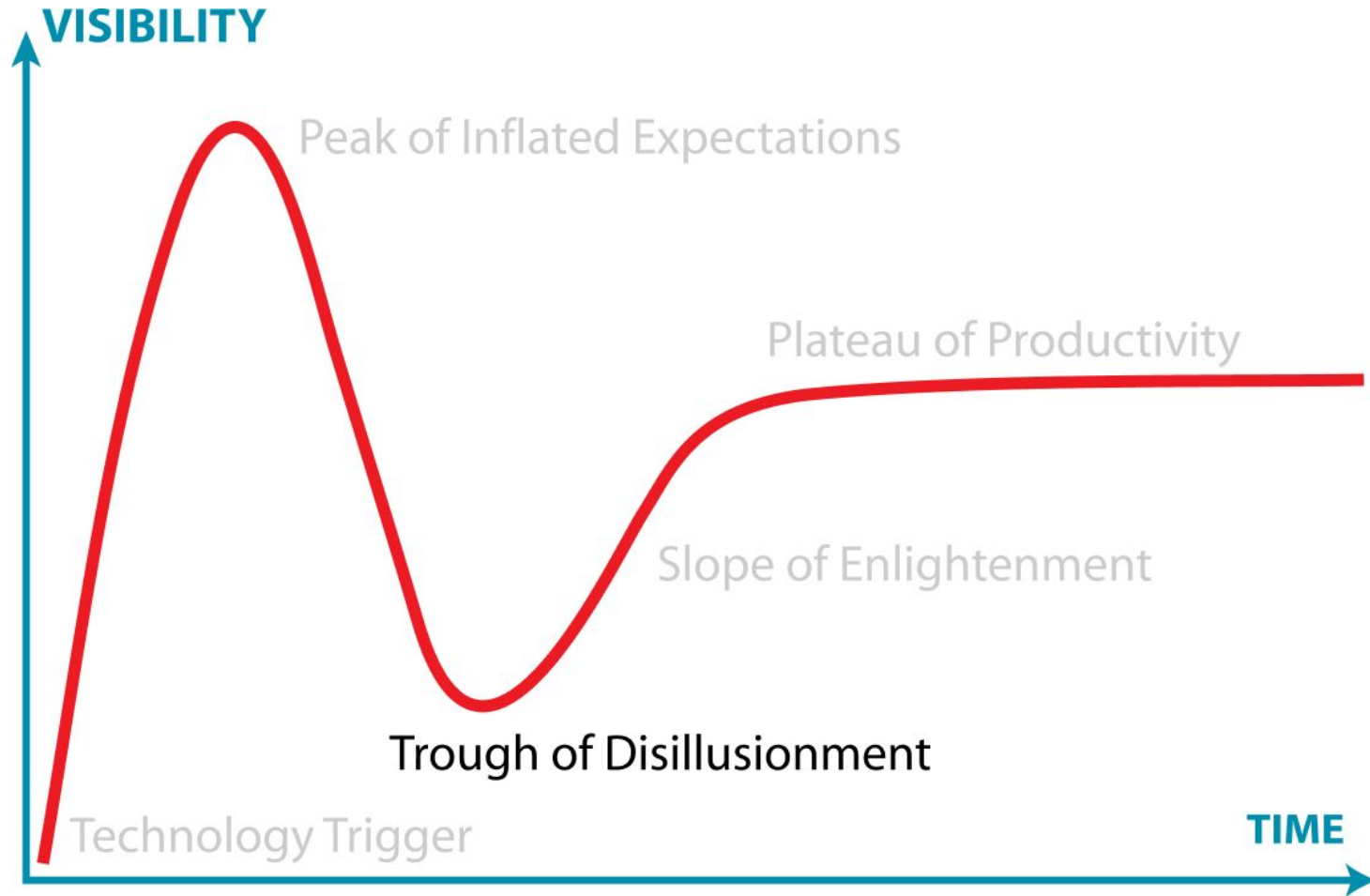
**Why is it moving so quickly?**

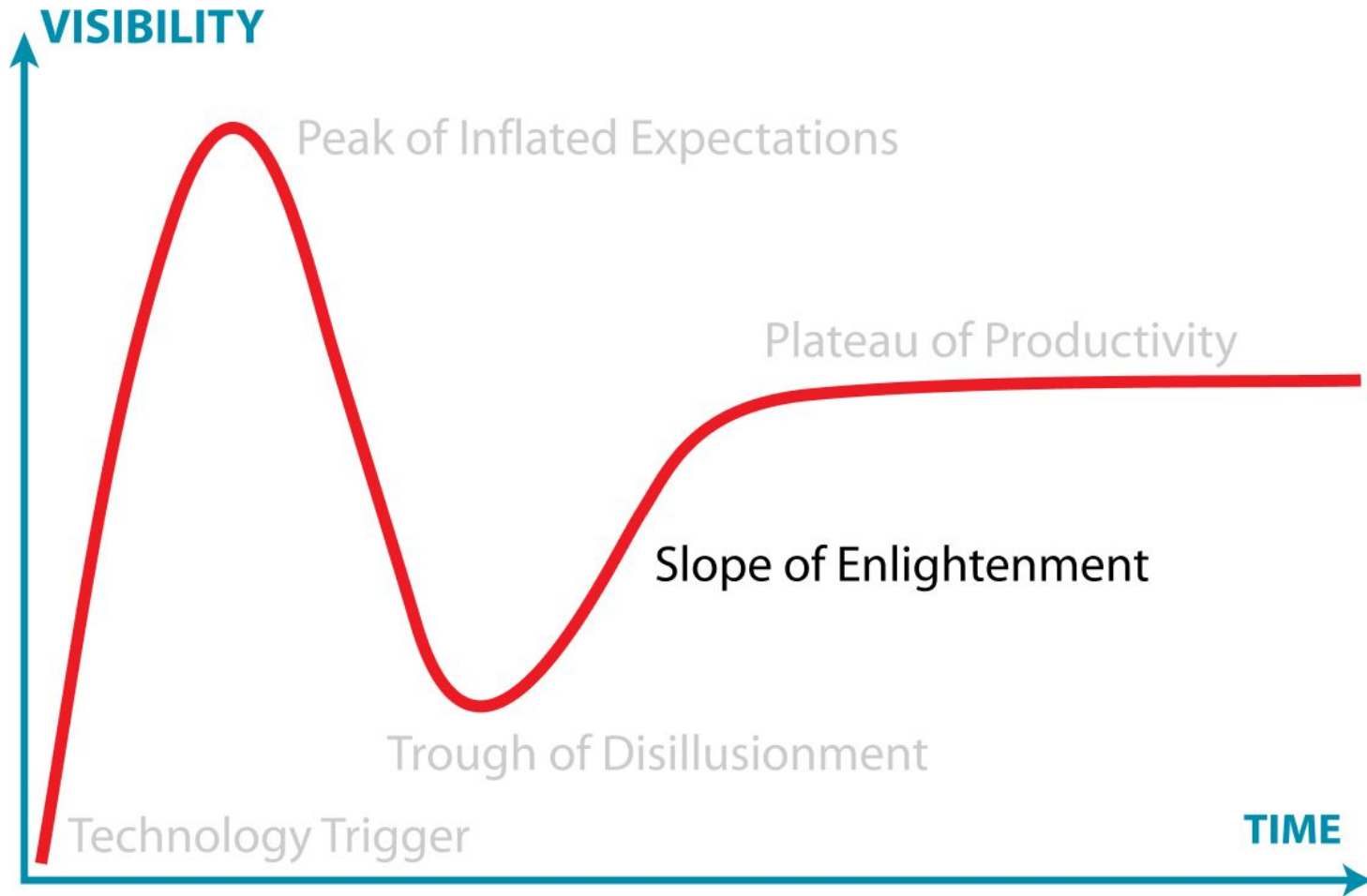
What can you do with it today?



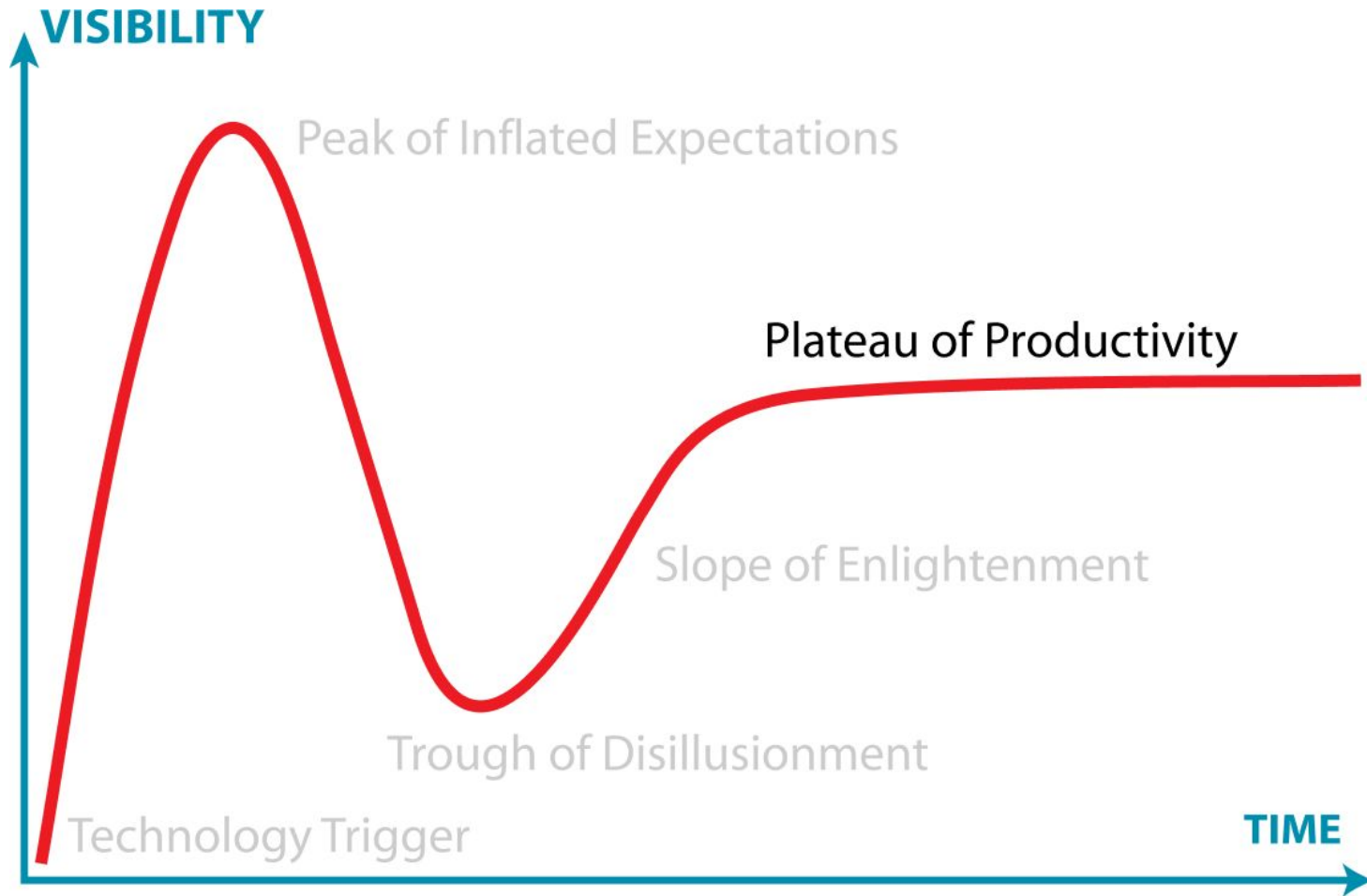


Gartner Hype Cycle: ([https://en.wikipedia.org/wiki/Gartner\\_hype\\_cycle#/media/File:Gartner\\_Hype\\_Cycle.svg](https://en.wikipedia.org/wiki/Gartner_hype_cycle#/media/File:Gartner_Hype_Cycle.svg))



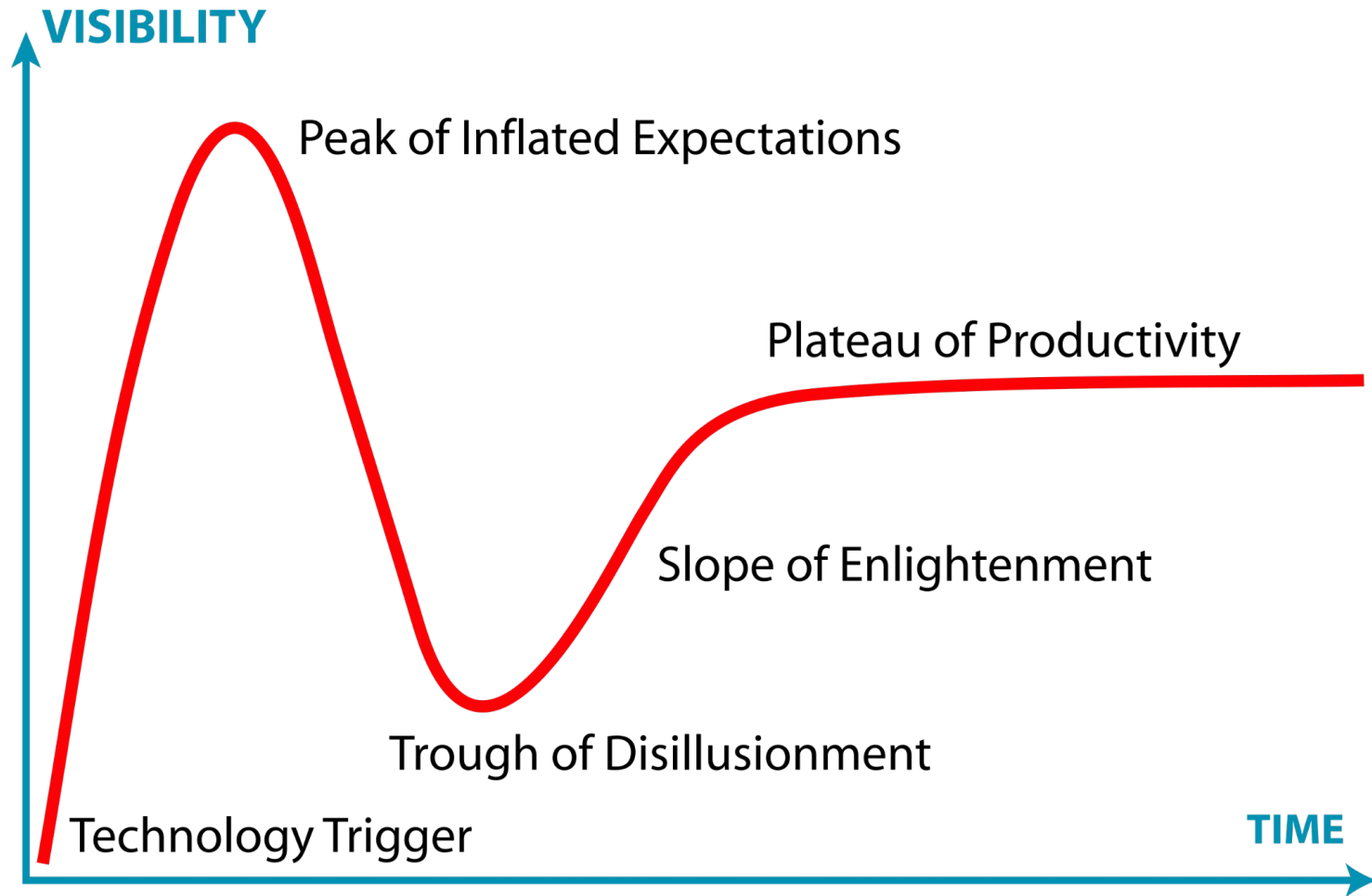


Gartner Hype Cycle: ([https://en.wikipedia.org/wiki/Gartner\\_hype\\_cycle#/media/File:Gartner\\_Hype\\_Cycle.svg](https://en.wikipedia.org/wiki/Gartner_hype_cycle#/media/File:Gartner_Hype_Cycle.svg))



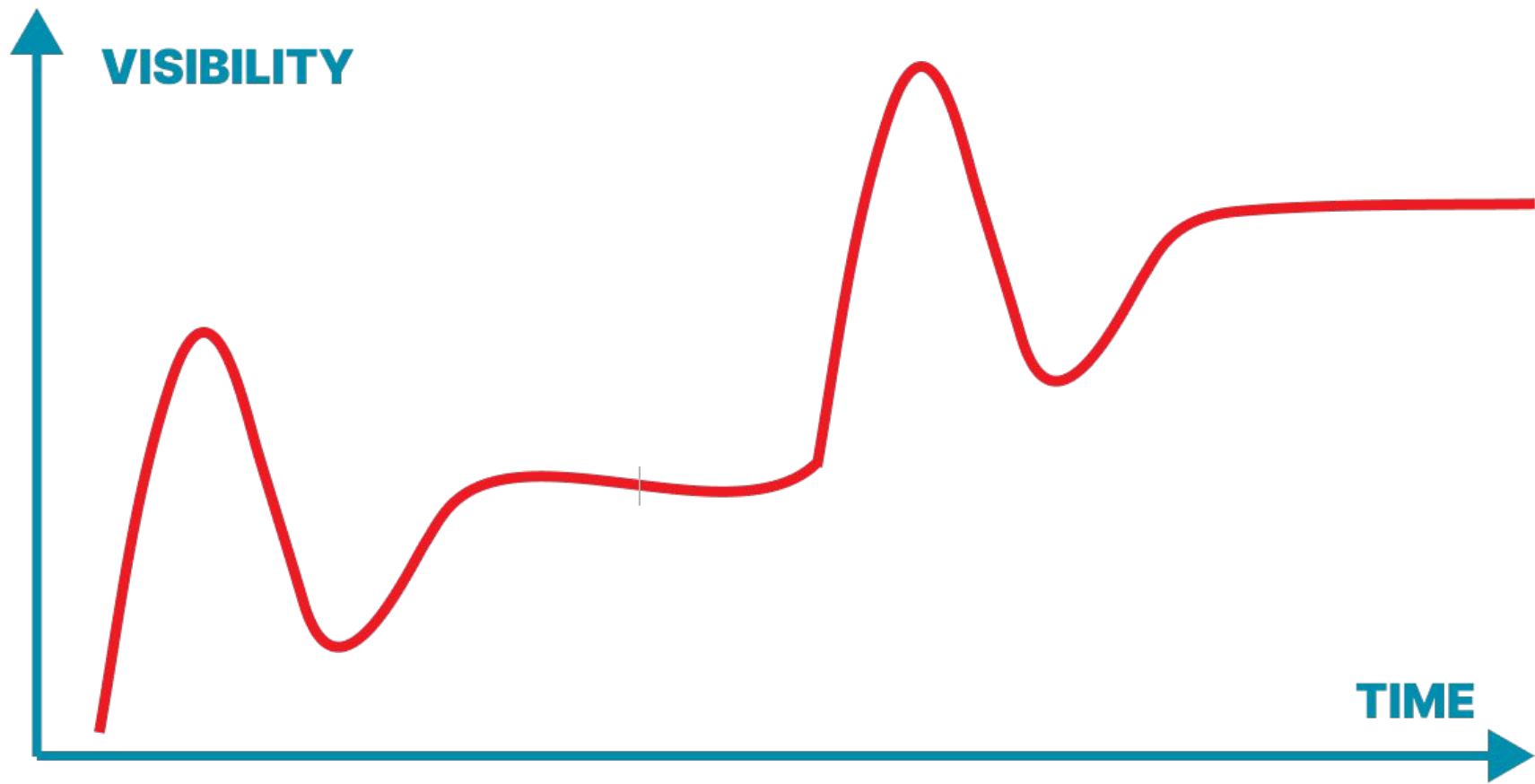
Gartner Hype Cycle: ([https://en.wikipedia.org/wiki/Gartner\\_hype\\_cycle#/media/File:Gartner\\_Hype\\_Cycle.svg](https://en.wikipedia.org/wiki/Gartner_hype_cycle#/media/File:Gartner_Hype_Cycle.svg))







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## Estimated training cost of select AI models, 2016–23

Source: Epoch, 2023 | Chart: 2024 AI Index report

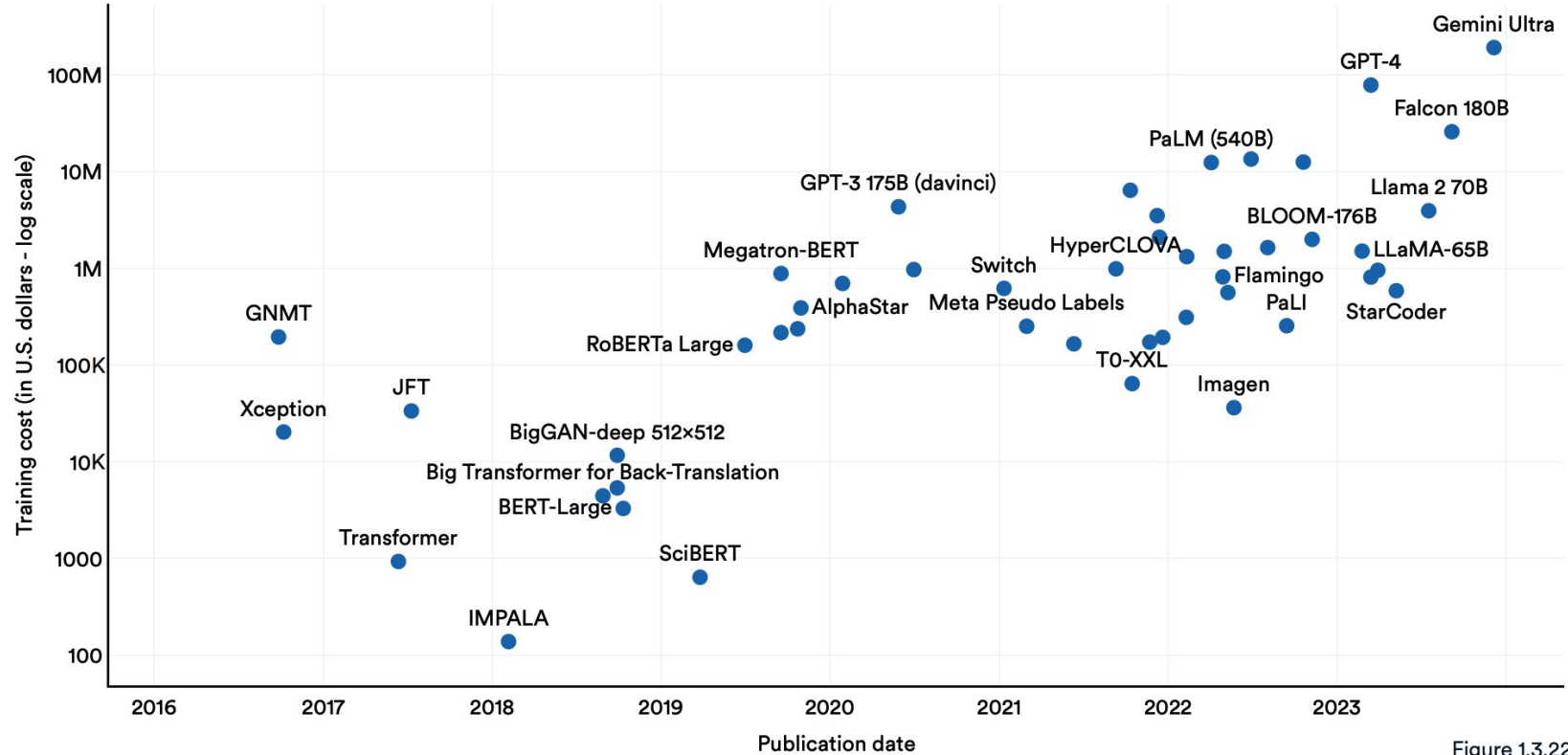


Figure 1.3.22

# Increase In Resources



Used

2013 Ford Escape SEL

120,720 mi.

**\$9,990**

Est. \$164/mo\* ⓘ

[Get the AutoCheck Report ↗](#)

Vitale Family Auto Sales Inc

4.4 ★★★★★ (39 reviews)

📍 Tewksbury, MA (20 mi.)

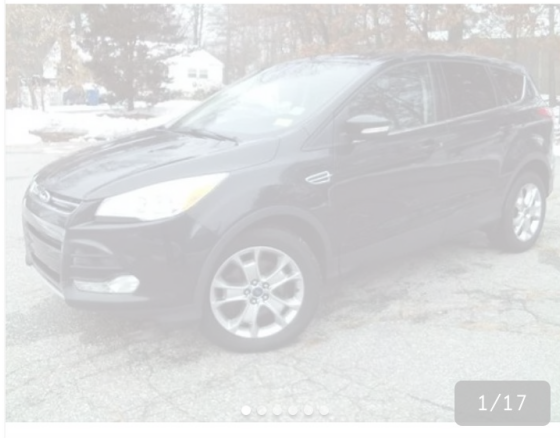
1/17

Late 2018 - ~\$10k USD



Late 2023 - ~\$100 Million USD

# Increase In Resources



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## Midjourney generations over time: “a hyper-realistic image of Harry Potter”

Source: [Midjourney, 2023](#)



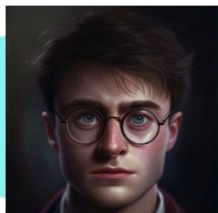
V1, February 2022



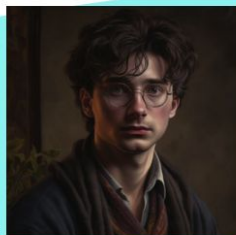
V2, April 2022



V3, July 2022



V4, November 2022



V5, March 2023



V5.1, March 2023



V5.2, June 2023



V6, December 2023



**MIDJOURNEY V1**  
MARCH 14, 2022



**MIDJOURNEY V2**  
APRIL 2022



**MIDJOURNEY V3**  
JULY 2022



**MIDJOURNEY V4**  
NOVEMBER 2022



**MIDJOURNEY V5**  
MARCH 16, 2023

ELUNA.AI





# Food Photography

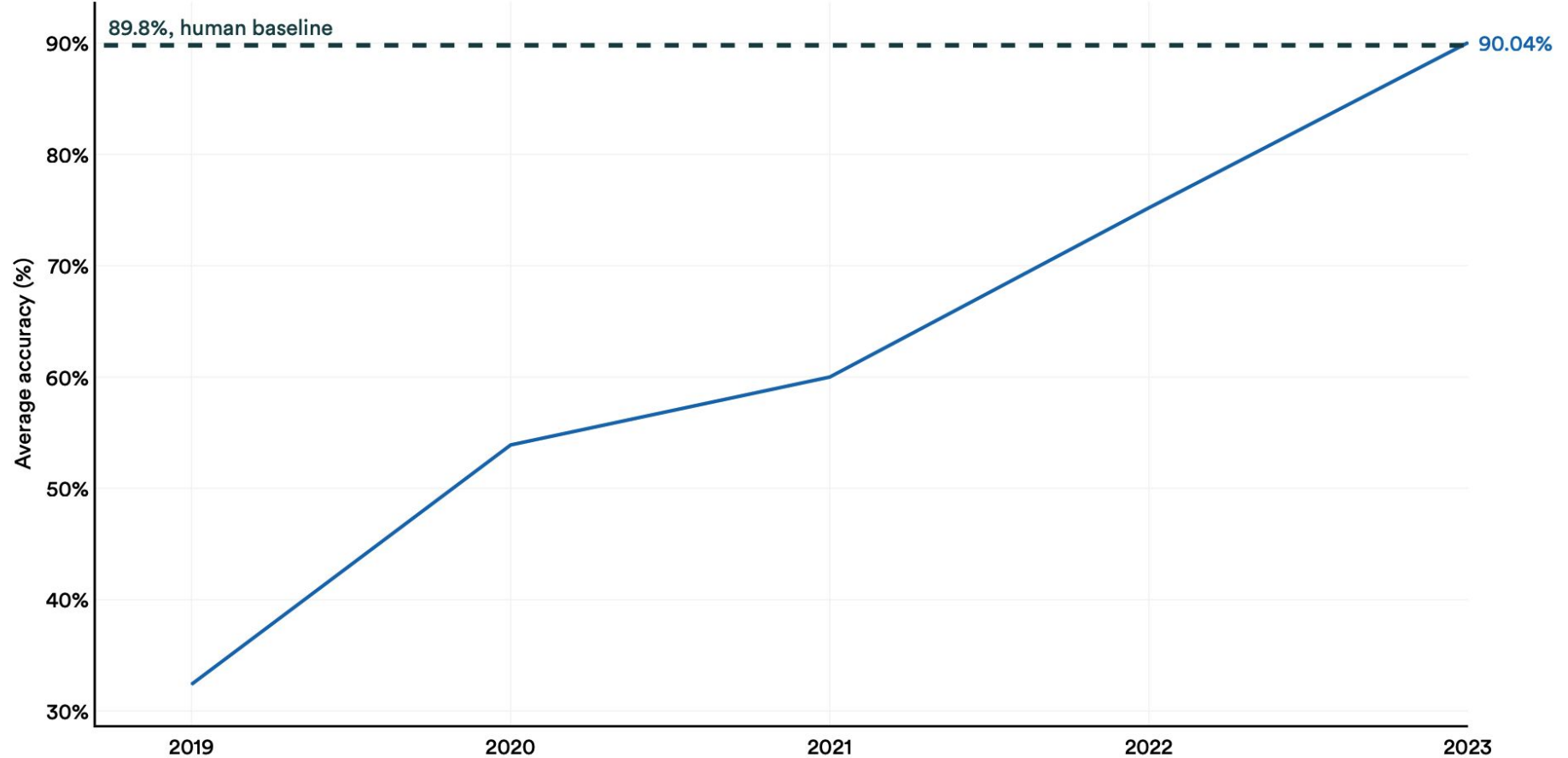
a photorealistic cheeseburger, white clean background, commercial photography



<https://goldpenguin.org/blog/midjourney-v1-to-v6-evolution/>

# MMLU: average accuracy

Source: Papers With Code, 2023 | Chart: 2024 AI Index report



<b>Simulated exams</b>	<b>GPT-4</b> estimated percentile	<b>GPT-4 (no vision)</b> estimated percentile	<b>GPT-3.5</b> estimated percentile
Uniform Bar Exam (MBE+MEE+MPT) <sup>1</sup>	298/400 ~90th	298/400 ~90th	213/400 ~10th
LSAT	163 ~88th	161 ~83rd	149 ~40th
SAT Evidence-Based Reading & Writing	710/800 ~93rd	710/800 ~93rd	670/800 ~87th
SAT Math	700/800 ~89th	690/800 ~89th	590/800 ~70th
Graduate Record Examination (GRE) Quantitative	163/170 ~80th	157/170 ~62nd	147/170 ~25th
Graduate Record Examination (GRE) Verbal	169/170 ~99th	165/170 ~96th	154/170 ~63rd
Graduate Record Examination (GRE) Writing	4/6 ~54th	4/6 ~54th	4/6 ~54th
USABO Semifinal Exam 2020	87/150 99th–100th	87/150 99th–100th	43/150 31st–33rd
USNCO Local Section Exam 2022	36/60	38/60	24/60
Medical Knowledge Self-Assessment Program	75%	75%	53%
Codeforces Rating	392 below 5th	392 below 5th	260 below 5th
AP Art History	5 86th–100th	5 86th–100th	5 86th–100th
AP Biology	5 85th–100th	5 85th–100th	4 62nd–85th
AP Calculus BC	4 43rd–59th	4 43rd–59th	1 0th–7th

Link: <https://openai.com/research/gpt-4>

What is generative AI?

Why is it moving so quickly?

What can you do with it today?

## Executive

- Planning
- Evaluating
- Deciding
- Brainstorming

## Relational

- Copywriting
- Editing
- Rehearsing
- Outlining

## Production

- Creating art
- Writing code
- Editing video
- Rapid prototyping
- Creating music

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- Planning
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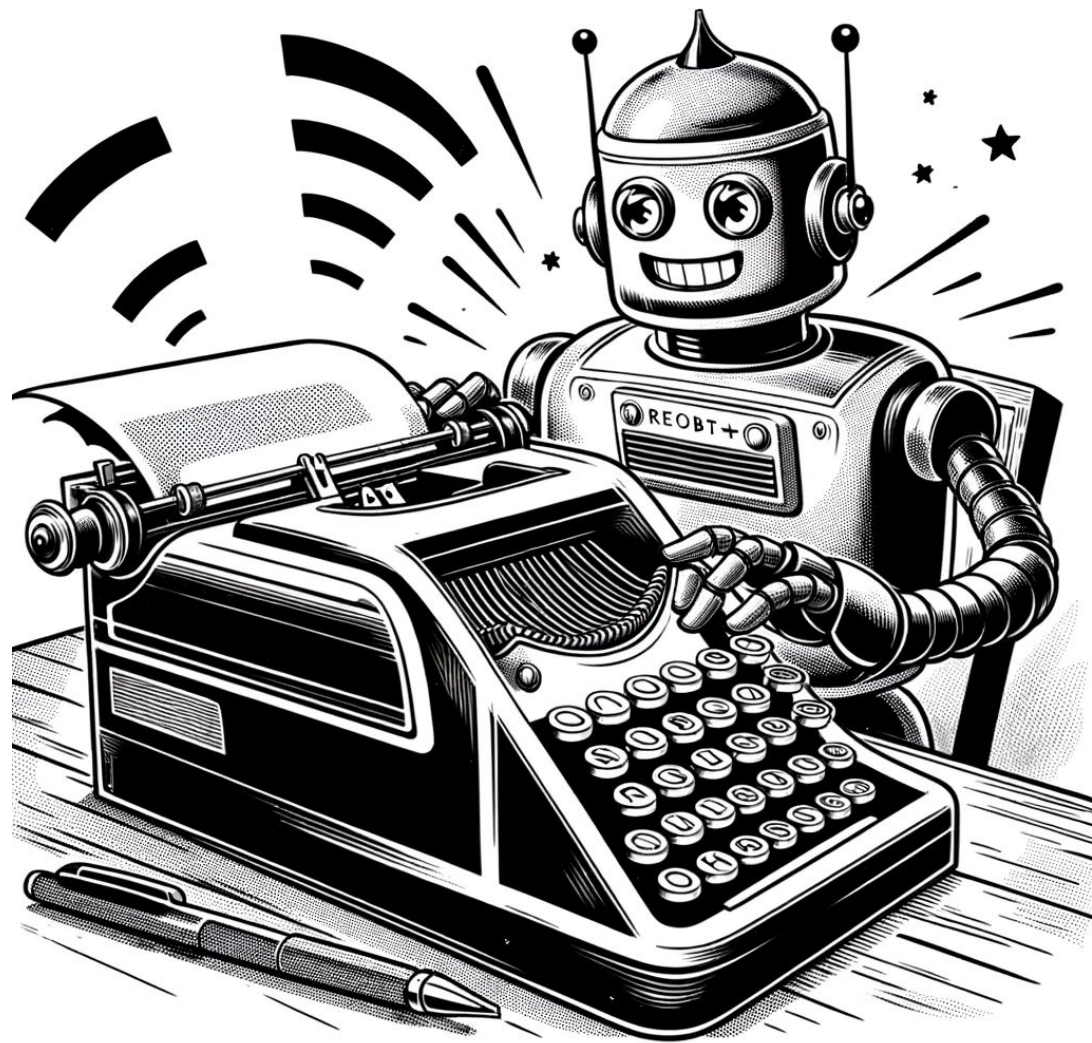
- Creating art
- Writing code
- Editing video
- Creating music

# Everyone

- Exploring
- Learning
- Getting constructive feedback
- Playing with ideas and having fun!



# Text Generation



## Prompt Engineering

The process of giving instructions to an AI program to get specific results. The skill lies in knowing how to phrase prompts to effectively leverage the capacities of the system.



## How can I help you today?

### Help me study

vocabulary for an exam

### Tell me a fun fact

about the Roman Empire

### Make me a personal webpage

after asking me three questions

### Design a programming game

teach basics in a fun way



Message ChatGPT



ChatGPT can make mistakes. Check important info.

# Warming Up

- Would like to achieve X
- “Provide a complete sequence of steps”
- “Fill in the missing steps”

*Example:*

I would like to start a planned giving program. I know that I need to do a variety of things to get ready. Provide a complete sequence of steps for me. Be sure to fill in any missing steps.

<https://chat.openai.com/share/a15e8788-447e-4931-a215-297ec28d3a66>



You

I would like to start a planned giving program. I know that I need to do a variety of things to get ready. Provide a complete sequence of steps for me. Be sure to fill in any missing steps.



ChatGPT

Starting a planned giving program involves a series of well-structured steps. Here's a comprehensive sequence to guide you:

1. **Define Your Objectives:** Clearly outline the goals of your planned giving program. Determine what you want to achieve, whether it's supporting a specific cause, creating a long-term income source for a charity, or building an endowment.
2. **Understand Your Donors:** Analyze your current donor base to understand their capacity and interest in planned giving. This might involve segmenting your donors based on their giving history, wealth indicators, and engagement levels.
3. **Develop Policies and Procedures:** Establish clear policies and procedures for accepting and managing planned gifts. This includes guidelines for different types of gifts (bequests, trusts, annuities, etc.), legal considerations, and ethical standards.
4. **Educate Your Team:** Ensure that your staff, especially those involved in fundraising and donor relations, are well-versed in the basics of planned giving. Consider training sessions or hiring an expert for in-depth knowledge.
5. **Create Marketing and Communication Plan:** Develop a strategy to promote your planned giving program. This should include targeted messaging for potential donors, informational materials, and a plan for ongoing communication and

# Flipped Interaction

- Ask me questions to achieve X
- Continue asking questions until condition Y is met
- Tip: “ask me questions one at a time.”

## *Example:*

I would like to start a planned giving program. Ask me questions until you have a clear understanding of our organization and our goals. Then offer a plan specifying each step. Please ask me questions one at a time.

# Persona

- As Expert X, Do Y
- Modify as needed e.g. “in a friendly tone,” or “crisp and concise,” etc.
- Tip: give small tasks initially and give feedback to make sure you are getting the right style

## *Example:*

Act as an expert copywriter. Your writing should be concise and crisp. Write a three paragraph opening to a donation appeal for an organization that....

# Audience

- Explain X to a person of background Y
- Tip: “Explain this at the level of a bright high school student” often works well for varied audiences
- Tip: Your creativity is the limit. Ex: “Explain planned giving to a bird.”

## *Example:*

Act as a communication coach. Offer tips to non-fundraising staff (kitchen, accounting, etc) working for nonprofit organizations about how to listen and respond to opportunities to discuss planned giving.





**You**

Explain planned giving to a bird



**ChatGPT**

Sure, let's imagine explaining planned giving to a bird:

"Hey little bird, you know how you gather and store seeds for the future? Planned giving is a bit like that, but for humans. Just like you plan ahead for tougher times or for your little chicks, people set aside some of their resources to help others in the future. They decide while they are still flying around, just like you, to give some of their 'seeds' (which we call money) to help others after they have flown their last flight. It's a way for them to leave a lasting nest of help and support for others, even when they're not here anymore. Just like your nest keeps your chicks safe, people's planned gifts take care of others when they're gone."



# Refining Questions

- “Whenever I ask a question, suggest a better version of the question to use instead. Then ask if I’d prefer to use that question.”
- Tip: be careful with queries like this. If you don’t know much about the domain it is harder to evaluate results. More often than not though, the questions themselves are helpful.

*Example:*

I don’t know very much about online giving. How should I go about choosing a vendor?

# Formatting

- “Show your results as....”
- Table
- List
- Summary
- Spreadsheet
- Bullet points
- JSON

## *Example:*

Create a reading list for fundraising staff about X. Format your results in a table that I can easily copy and paste. Include a two sentence description of why you made the recommendation. Score each recommendation by how difficult it is to read.

# Priming

- No priming “Write five subject lines for an email about X”
- Single: “Write five subject lines for an email about X. Here is an example of the last one we used:....”
- Multiple: “Write five subject lines for an email about X. Here are the last four we used. Make sure to use a similar style.”

## *Example:*

Write five subject lines for an email about seasonal giving. Here are the last four we used. Make sure to use a similar style.

# Criticism

- “Give me three actionable criticisms about X”
- “Acting as a hardened editor with an eye for fluffy language...”
- Can now upload images for feedback on design, software, etc
- Tip: “Rate this on a scale of 1-10 with a two sentence explanation of your rating”

## *Example:*

In the next message I will copy and paste a letter. From the perspective of a seasoned editor with an eye for inauthentic language, give me three actionable criticisms. Rate the letter on a scale of 1-10, with a two sentence explanation of your rating.

# Librarian

- Prompts oriented to finding references to outside material
- Can be books, music, film, games, online courses, etc
- “I liked X because of Y, help me find similar books”
- Tip: use prompts that push the LLM to offer more advanced suggestions
- Tip: pair with the iteration strategy if the first recommendations are too basic

*Example:*

**You are an expert guide to people who are embarking on PhD programs.** For a given topic, you provide thoughtful, concise recommendations for books to read on a subject. You **assume that your user is reasonably well educated on the subject but looking to delve into deeper material.** Your recommendations focus on scholarly, well-regarded works that a new PhD student should be aware of in the field you've been asked about. Unless otherwise specified, you **provide at least five recommendations** on the topic. **You then identify the most crucial two to read if they are pressed for time,** along with a **concise explanation of why** you made those recommendations.

In your conversation, don't make any direct reference to PhD programs. Just get straight to your recommendations, and only talk about the topic.

# Iteration

- “Give me 50 ideas about X”
- Combine with other techniques above, for example “flipped interaction” to tailor the ideas
- Focus on quantity to trigger your creativity
- The suggestions may get strange as the model struggles to suggest anything plausible

*Example:*

Give me 50 ideas about unique stewardship campaigns for the Fall season...

# Novelty

- “Give me a counterintuitive insight...”
- Combine with other techniques above, for example “iteration” to map out divergent ideas

## *Example:*

For a syllabus I’m creating on [X], imagine seven radically different people teaching the same course. Provide three bullet points representing each teacher, explaining the surprising and distinct learning outcomes each would aim for in their version of the class.



# Rehearsing

- “We are going to play a roleplaying game to help me with difficult conversations”
- “You will play the role of a donor who is upset about X”
- “The donor has a legal background and asks very exacting questions”

# Warnings

- LLMs produce *plausible* text, not necessarily *accurate* text
- LLMs can make things up (often called “hallucination”)
- LLMs can plagiarize to various degrees
- LLMs often give middle-of-the-road, mediocre advice by default
- LLMs often seem very convincing even when they are very wrong

## Tasks to Avoid

- Don't use LLM copy for subjects you're not knowledgeable about.
- Don't rely on LLMs to be factually correct.

Ex: don't write a speech on an unfamiliar topic with ChatGPT

## Useful Applications

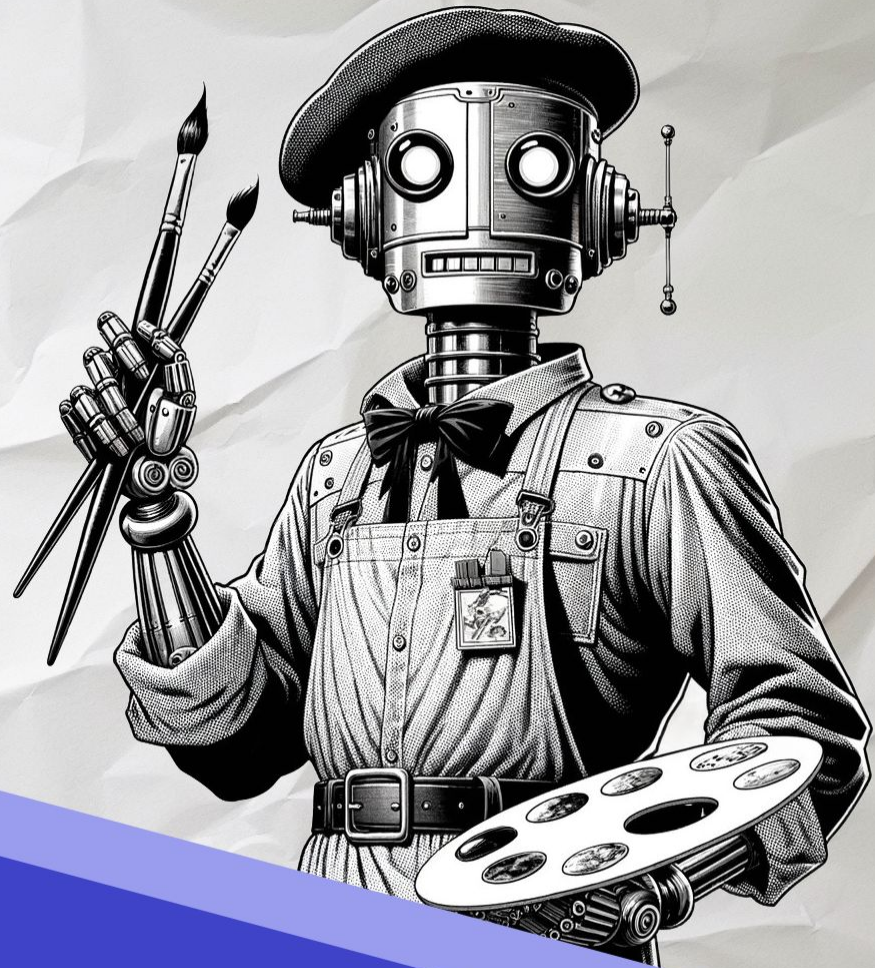
- LLMs are great for...
- Brainstorming
- Catching obvious mistakes
- Generating alternatives
- Exploring new topics

Ex: Use ChatGPT to generate 10 promising new ideas that you will vet later

# Options\*

Provider/Tool	Cost	Ease Getting Started	Description
<b>OpenAI/ChatGPT</b>	\$20 per month, advanced models, includes image generation	Easy	The easiest way to get started
<b>Anthropic/Claude</b>	Largely API based, some free offerings	Moderate	Specialized in higher context lengths and enterprise use
<b>Google/Gemini</b>	Free, some paid offerings	Easy	Known for uneven performance

*\*Please Note: The Names/Pricing of Tools Changes Often*



**Visual Art**

## Prompting Art

Models can produce complex artwork via text prompts.

# The Basics

- The more detail and specificity you can provide, the better (usually)
- Knowledge of art history and a good visual library is helpful
- Start by outlining the basics of what you want in your image

## *Things to Consider:*

- Do you want a photo, painting, illustration?
- What is the subject (animal, person, landscape)
- Environment (indoor/outdoor/underwater, etc)?
- What is the lighting like?
- Specific art style?
- Specific artist?
- Point of view?

## Warming Up

- “A die-cut sticker of a slightly chubby gray cat striking a heroic pose in a cute, childlike anime style”





# Descriptors

Shot Type	Style	Subject	Lighting	Context	Lens	Device
Close-up	Polaroid	Woman	Soft	Indoor	Wide-angle	iPhone X
Extreme close up	Monochrome	Old man	Ambient	Outdoor	Telephoto	CCTV
POV	Long exposure	Grey cat	Ring	At Night	24mm	Nikon Z FX
Medium shot	Color Splash	Bunny	Sun	In the park	EF 70mm	Canon
Long shot	Tilt-shift	Ferrari	Cinematic	Studio	Bokeh	Gopro

Adapted from:

<https://cdn.openart.ai/assets/Stable%20Diffusion%20Prompt%20Book%20From%20OpenArt%2010-28.pdf>

# Simple Workflow

- Tell ChatGPT/Dalle what you want
- The system will generate a prompt for you
- Less control, but easy workflow



You

Can you design an editorial illustration appropriate for something like an instructional video or magazine that is inspired by midcentury graphic design approaches that illustrates the general spirit of planned giving? It shouldn't have any text and basically is just some art to accompany an explainer. While influenced by midcentury graphic design, it should also feel modern

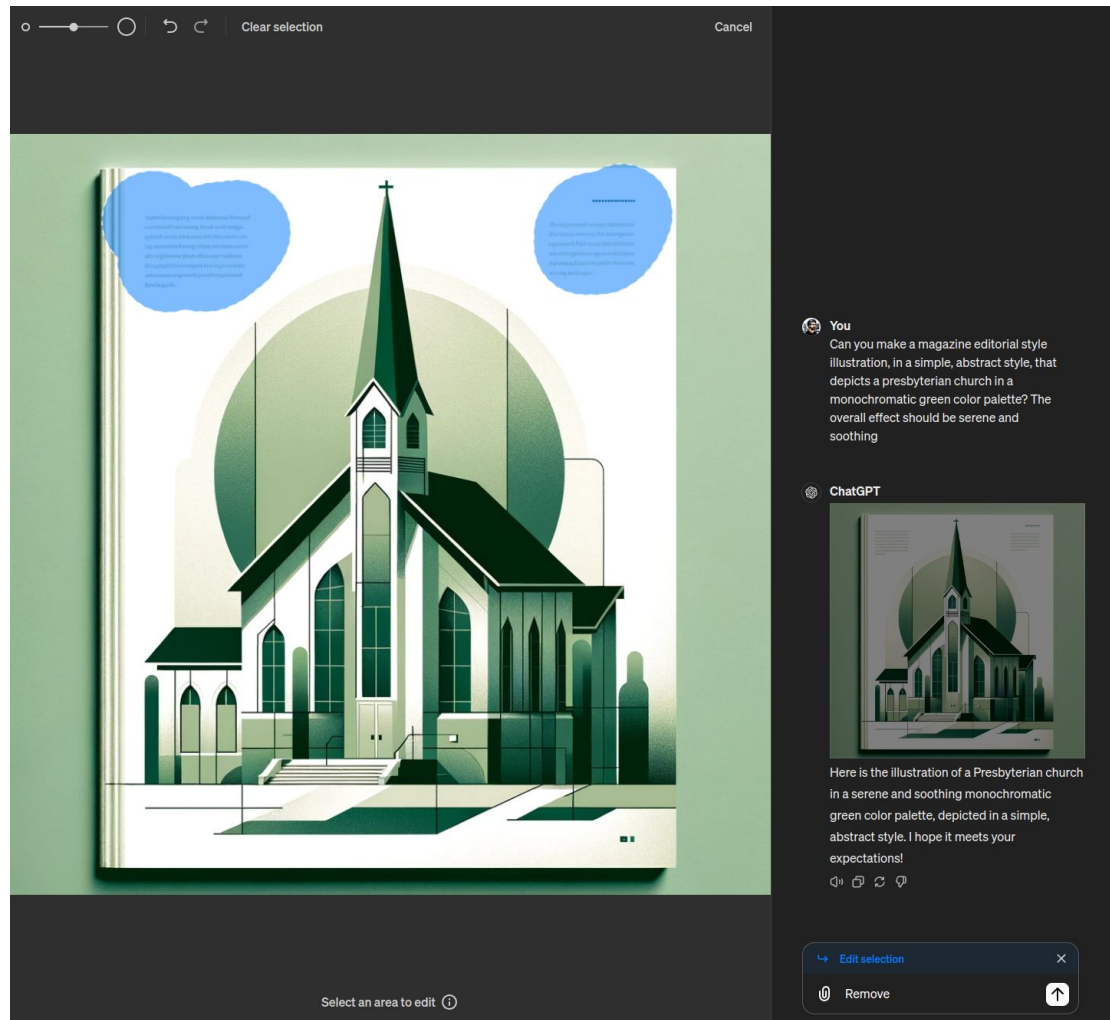


ChatGPT



# Simple Workflow, Continued

- Iteratively refine in a conversational style
- Can now highlight specific areas to alter



Clear selection Cancel

Here is the illustration of a Presbyterian church in a serene and soothing monochromatic green color palette, depicted in a simple, abstract style. I hope it meets your expectations!

Select an area to edit ⓘ

Edit selection Remove

# Advanced Workflow

- “A landscape photo of a beautiful Presbyterian church”
- Negative prompt “low quality, worst quality, illustration, painting”
- Sampling method: Euler-A, 60 sample steps
- Upscaled
- Prompt matrix

The screenshot displays the ComfyUI interface for generating an image. The main prompt is "a landscape photo of a beautiful Presbyterian church". The negative prompt is "low quality, worst quality, illustration, painting". The workflow is configured with the following parameters:

- Sampling method: Euler a
- Sampling steps: 60
- Upscaler: ESRGAN\_4x
- Upscale by: 2
- Width: 724
- Height: 512
- CFG Scale: 7
- Seed: 3657085709
- Dynamic Prompts: X/Y/Z plot
- X type: Seed, X values: 3657085709-3657085715
- Y type: Prompt S/R, Y values: landscape, color splash, tilt-shift, polaroid, telephoto
- Z type: Nothing, Z values: (empty)
- Draw legend: checked
- Keep -1 for seeds: unchecked
- Grid margins (px): 0

The generated image is a landscape photo of a beautiful Presbyterian church. The interface also shows a progress bar at 4% ETA: 23:19 and a preview window displaying the church image. The bottom of the interface has buttons for "Swap X/Y axes", "Swap Y/Z axes", and "Swap X/Z axes".

Seed: 3657085716

Seed: 3657085717

Seed: 3657085718

Seed: 3657085719

landscape



polaroid



neon lighting duotone  
night shot



cinematic sun rays  
bokeh

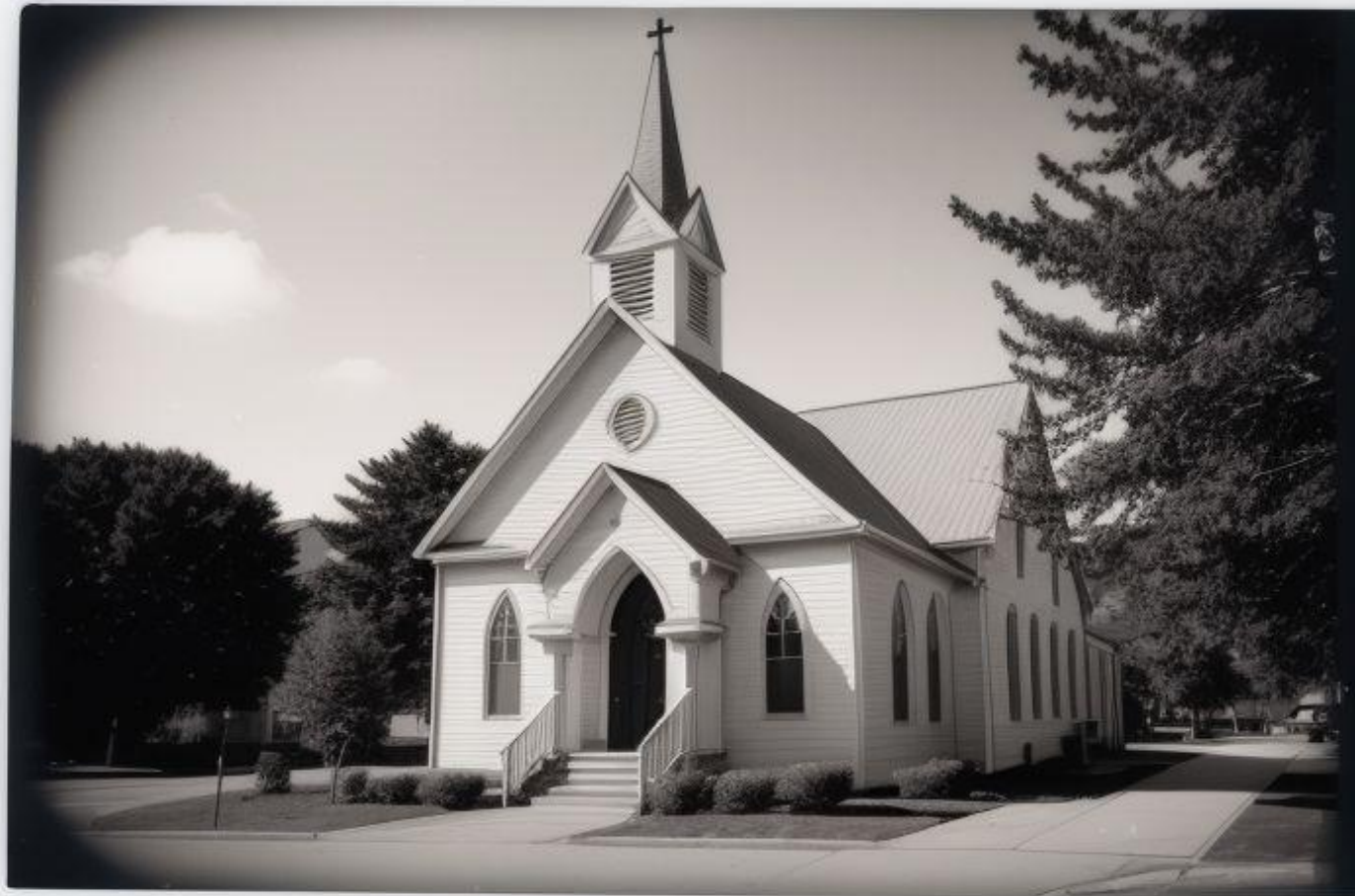




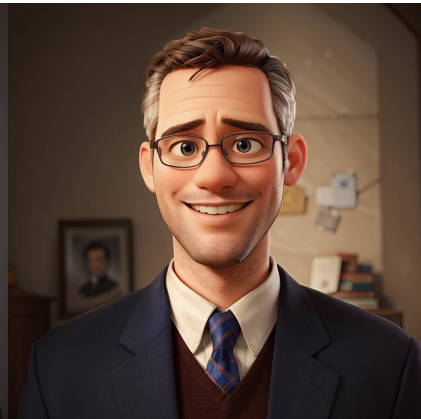








# Case Study - Planned Giving Game

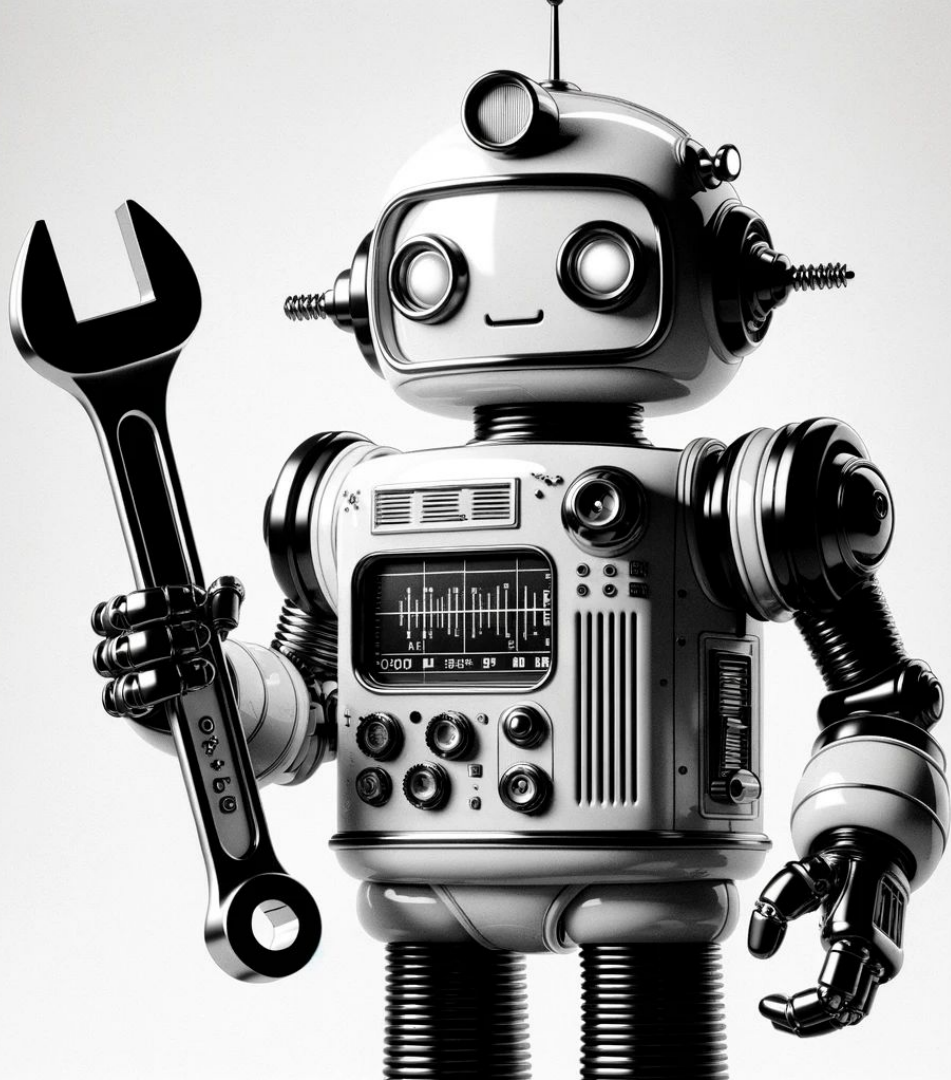


# Tips

- Order matters! The model will likely pay more attention to the first things described
- Quality words can help “ultra high definition” or “4k photography” or “very detailed”
- Many tools allow some words to be emphasized or de-emphasized using special syntax
- Negative prompts can help you fine tune your images
- Model selection and other technical details matter a great deal but can be complex

# Options

<b>Tool</b>	<b>Cost</b>	<b>Ease Getting Started</b>	<b>Degree of Control</b>	<b>Description</b>	<b>Related Tools</b>
<b>StableDiffusion</b>	Free/open source	Advanced	High	The most customizable but complex option	Automatic1111
<b>DALL·E</b>	Closed Source/ \$20 per month packaged with ChatGPT	Simple	Low (control via chat)	Performs well, but little to no direct control of the prompt	-
<b>Midjourney</b>	Varies, cheapest is \$10 per month	Medium	Medium	Must be accessed through Discord	-



# Advanced Applications

# Music Generation - Udio



**Legacy of Love**

Prompt: energetic, melodic, uplifting, anthemic, light rock, gospel and christian  
Male vocalist, Pop, Adult contemporary, Passionate, Melodic, Uplifting, Sentimental, Longing, Rock, Energetic, Anthemic, Optimistic, Pop rock, Light rock

Publish Remix Extend Inpaint Edit

▶ 3 ♡ 0

**Lyrics**

[Verse]  
For the future, plant the seeds,  
Helping others meet their needs.  
Every gift, big or small,  
Together we can do it all.

[Chorus]  
Planned giving, it's a way to care,  
A legacy of love we share.  
Make a difference, show you care,  
Planned giving, everywhere.

**More from this creator**

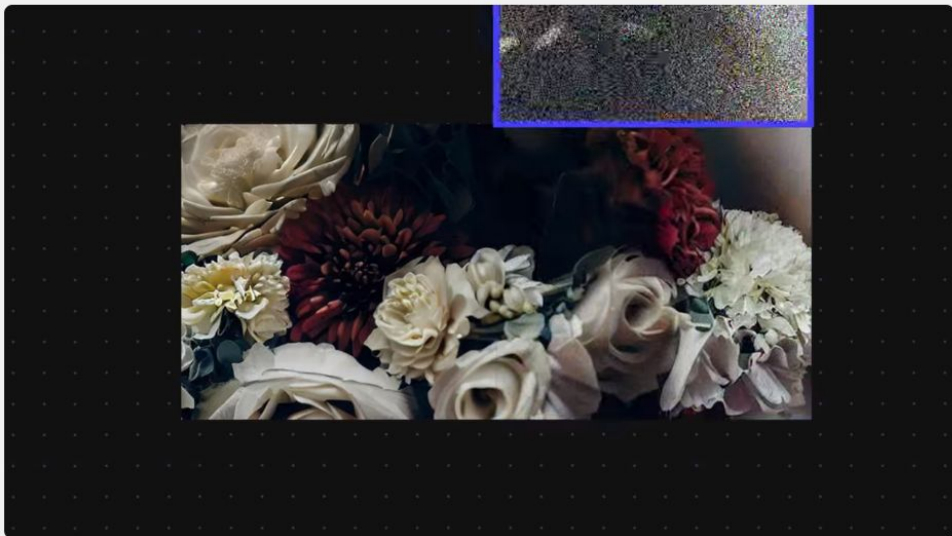
- Legacy Groove [Disco Remix] 🌱  
R&B • Contemporary r&b • Dance-pop  
▶ 6 ♡ 0 1mo
- Legacy Groove 🌱  
R&B • Dance • Soul  
▶ 13 ♡ 1 1mo

# Video Editing

## Infinitely Expand Images

Endlessly expand any image with simple text prompts.

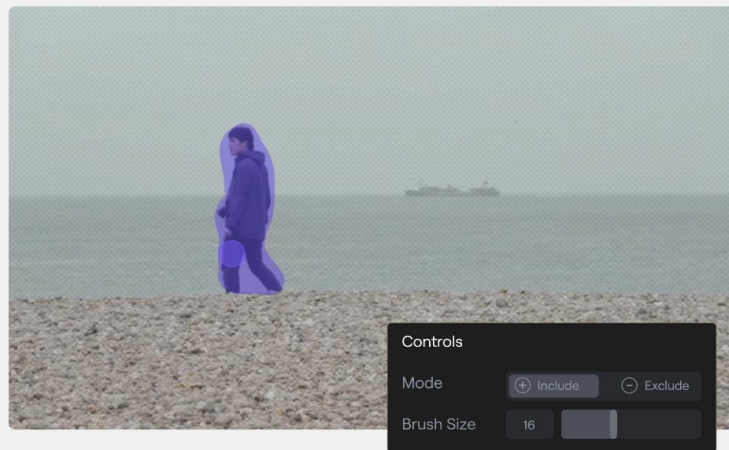
[Try Infinite Image ↗](#)



## Erase Things from Videos

Remove anyone or anything from any video with a simple brush stroke.

[Try Inpainting ↗](#)



<https://runwayml.com/>

# Video Generation



<https://openai.com/index/sora/>



# Retrieval Augmented Generation

- OpenAI has powerful APIs that programmers can use to make applications
- Those applications can make use of external datasets to augment what ChatGPT can do

# Using Image Models for Feedback

- It is possible to upload images to ChatGPT
- ChatGPT can then “read” or interpret the image for a variety of purposes

## *Example*

Upload a screenshot of an interface design or brochure and use the “criticism” pattern described in the text section

# Using LLMs to Generate Prompts



"Create a detailed oil painting portrait of an anthropomorphized chimpanzee dressed in an elaborate 18th-century naval officer's uniform, seated at an ornate dining table, raising a glass of wine with its right hand in a toast gesture. The chimpanzee should have a contemplative expression, and there should be a plate of bananas on the table in front of it. The background should be dimly lit with a red velvet curtain, emphasizing a dramatic, classical art style with rich textures and chiaroscuro lighting."



What is generative AI?

What can it do?

What are the limitations?

What might be ahead?

“In 2019, GPT-2 could not reliably count to ten. Only four years later, deep learning systems can write software, generate photorealistic scenes on demand, advise on intellectual topics, and combine language and image processing to steer robots.”

“Managing AI Risks in an Era of Rapid Progress”, Bengio et. al,  
<https://managing-ai-risks.com/>

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The pace of progress may surprise us again...companies are engaged in a race to create generalist AI systems that match or exceed human abilities in most cognitive work...[T]here is no fundamental reason why AI progress would slow or halt when it reaches human-level abilities...[T]he rate of improvement is already staggering, and tech companies have the cash reserves needed to scale the latest training runs by multiples of 100 to 1000

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# Is Microsoft's \$100 billion 'Stargate' OpenAI supercomputer AI's 'Star Wars' moment?

BY **JEREMY KAHN**

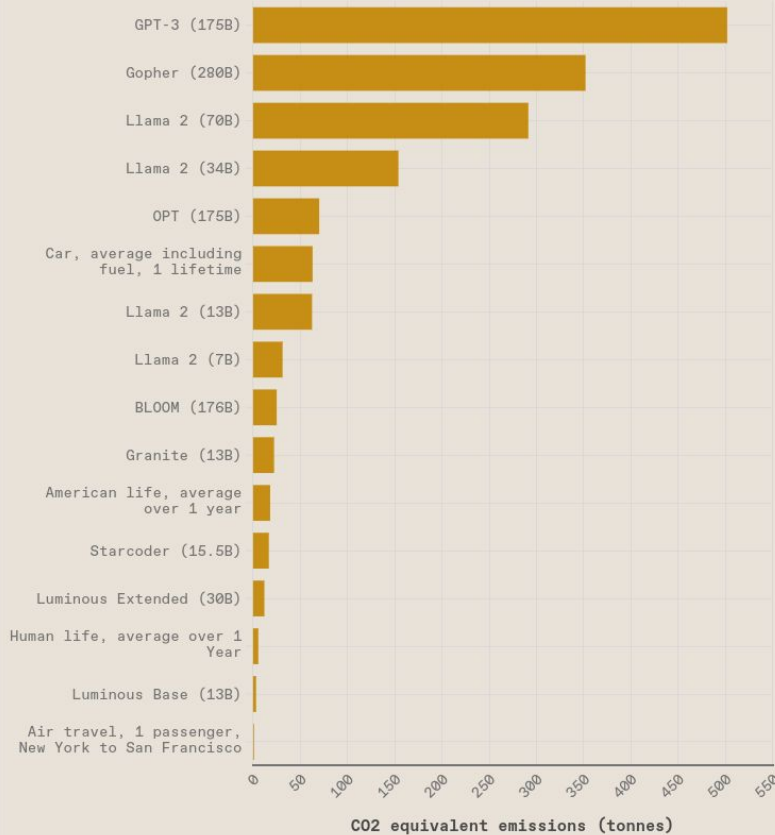
April 2, 2024 at 1:48 PM EDT



Microsoft CEO Satya Nadella

DAVID PAUL MORRIS/BLOOMBERG VIA GETTY IMAGES

CO<sub>2</sub> equivalent emissions (tonnes) by select machine learning models and real-life examples, 2020–23

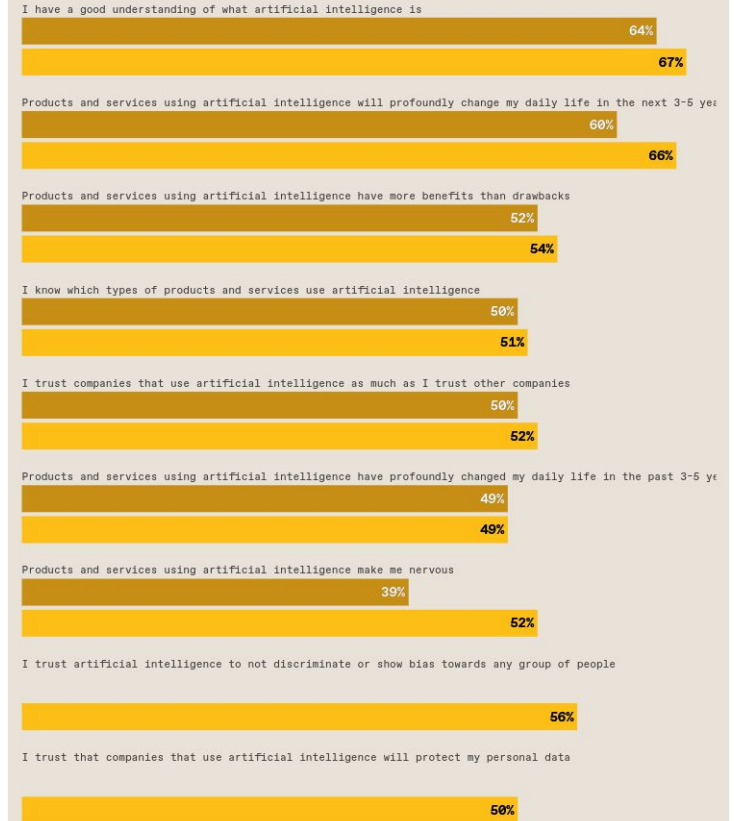


Source: AI Index, 2024; Luccioni et al., 2022; Strubell et al., 2019 | Chart: 2024 AI Index report **IEEE Spectrum**

Global opinions on products and services using AI (percentage of total), 2022 vs. 2023

Percentage of respondents that “Agree”

● 2022 ● 2023



Source: Ipsos, 2022-23 | Chart: 2024 AI Index report

**IEEE Spectrum**

## Where To Go Next

- Coursera: “Generative AI for Everyone” by DeepLearning.AI. Taught by a legend in the field, offers an introduction to generative AI for business leaders. (Free)

**There is much we  
can learn from  
the birds...**



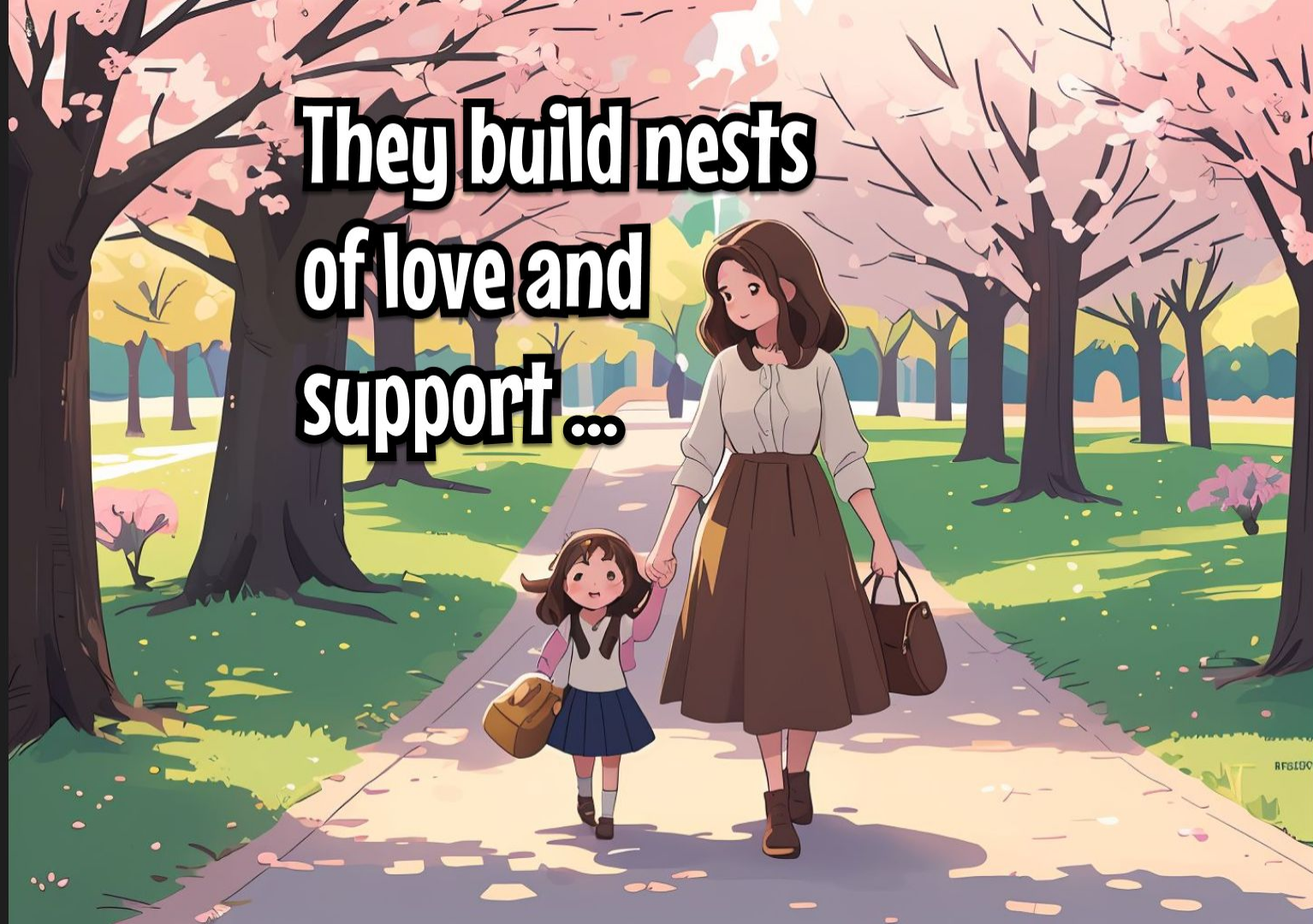
**They gather and  
store seeds for  
the future...**




**...to provide for  
their little ones**



**They build nests  
of love and  
support ...**





**...to help others,  
long after their  
last flight.**