



What every software engineer should know about generative AI

Iteration 1

DAT158ML – 2023, Module X, Part 1

Wednesday, October 4th, 2023

What every software engineer should know about generative AI



Introduction
The current landscape of
generative AI



Applying generative AI
Strategies for effective usage
of generative AI



LLMs as code companions
How to use language models
for programming and
software development



GenAI-powered software
How to build software that's
powered by generative AI

We'll cover this in two iterations. The first iteration is today.

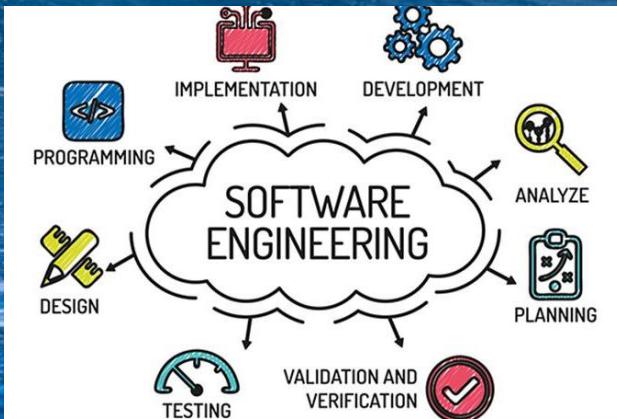
AI wave

A NEW ERA

The Age of AI has begun

Artificial intelligence is as revolutionary as mobile phones and the Internet.

By Bill Gates | March 21, 2023 • 14 minute read

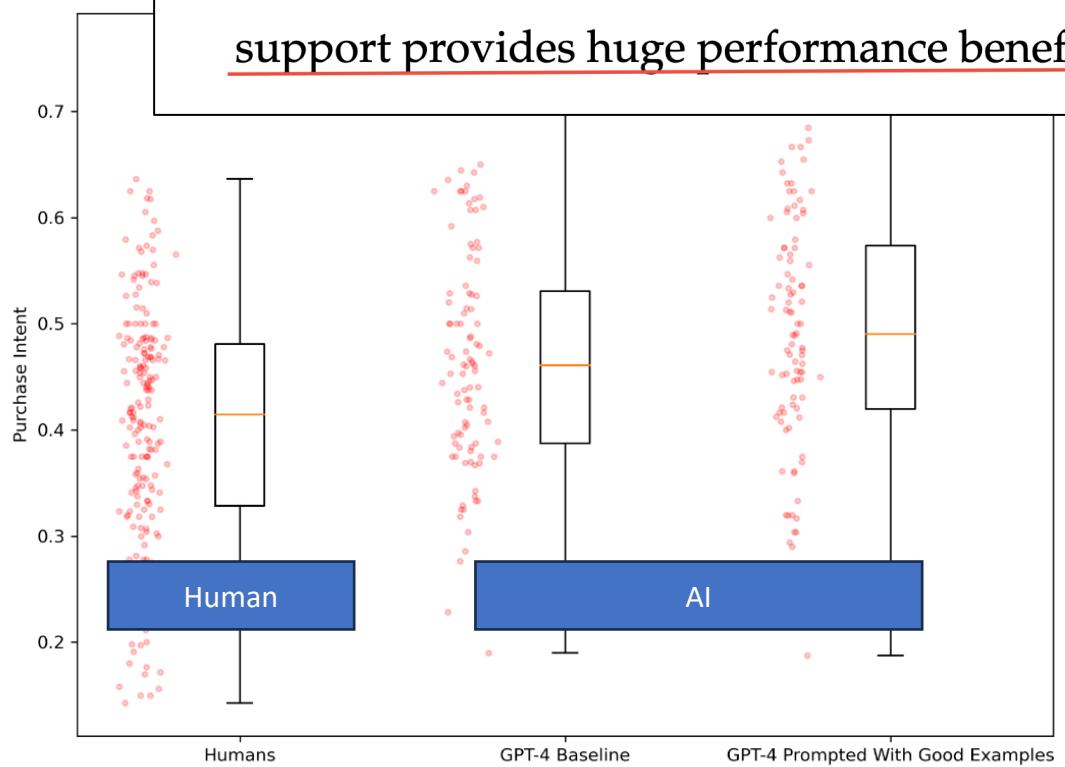


Enormous opportunities for developers and software engineers!

Unleashing the potential of generative AI requires software engineers!

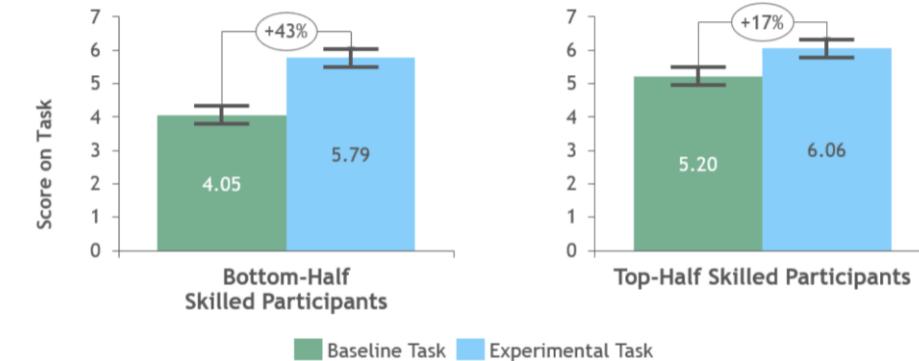
Software engineers can get an immense boost by incorporating generative AI into their workflow

Our results reveal significant effects, underscoring the prowess of AI even in tasks traditionally executed by highly skilled and well-compensated professionals. Not only did the use of AI lead to an increase in the number of subtasks completed by an average of 12.5%, but it also enhanced the quality of the responses by an average of more than 40%. These effects support the view that for tasks that are clearly within its frontier of capabilities, even those that historically demanded intensive human interaction, AI support provides huge performance benefits.



Girotra, Karan, et al. Available at SSRN 4526071 (2023).

Figure 5: Bottom-Half Skills and Top-Half Skills - Inside the Frontier



Girotra, Karan, et al. Available at SSRN 4526071 (2023).

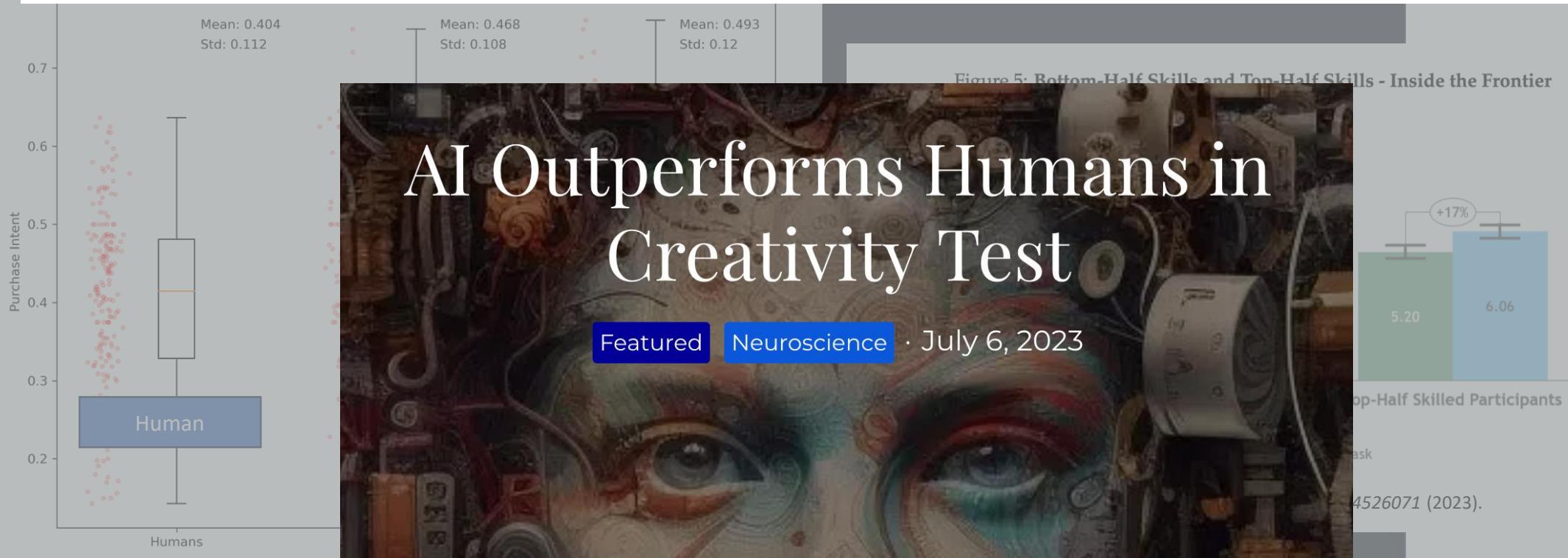
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Computer Science > Artificial Intelligence

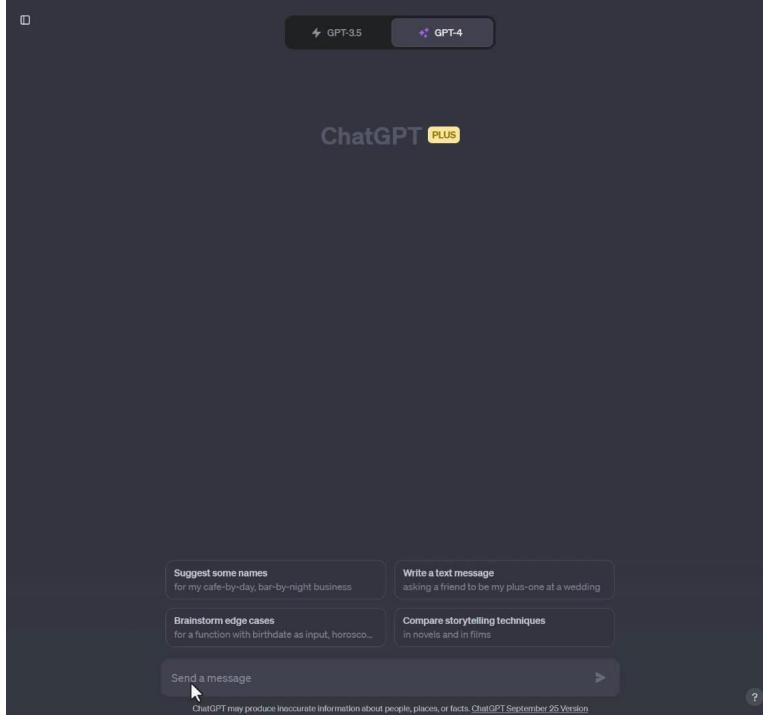
[Submitted on 21 Mar 2023]

Artificial muses: Generative Artificial Intelligence Chatbots Have Risen to Human-Level Creativity

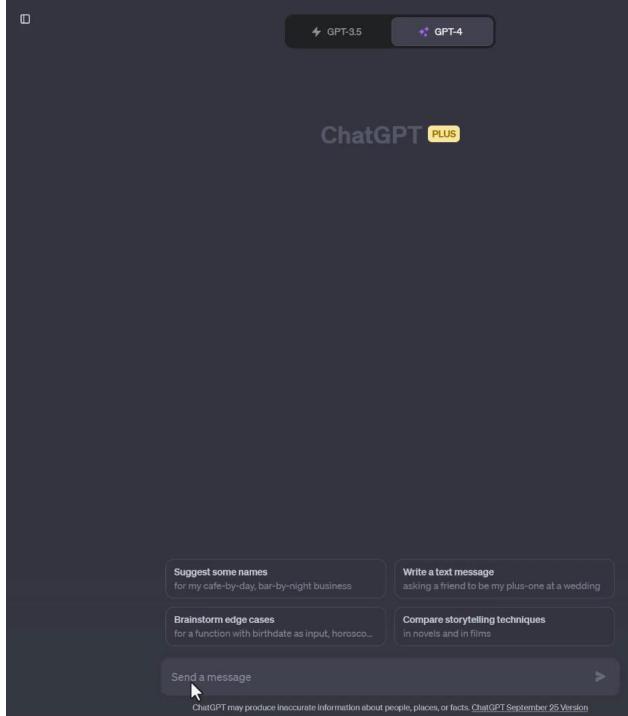
Jennifer Haase, Paul H. P. Hanel



Girotra, Karan, et al. Available at SSRN 4526071 (2023).



Writes and discusses as if
human

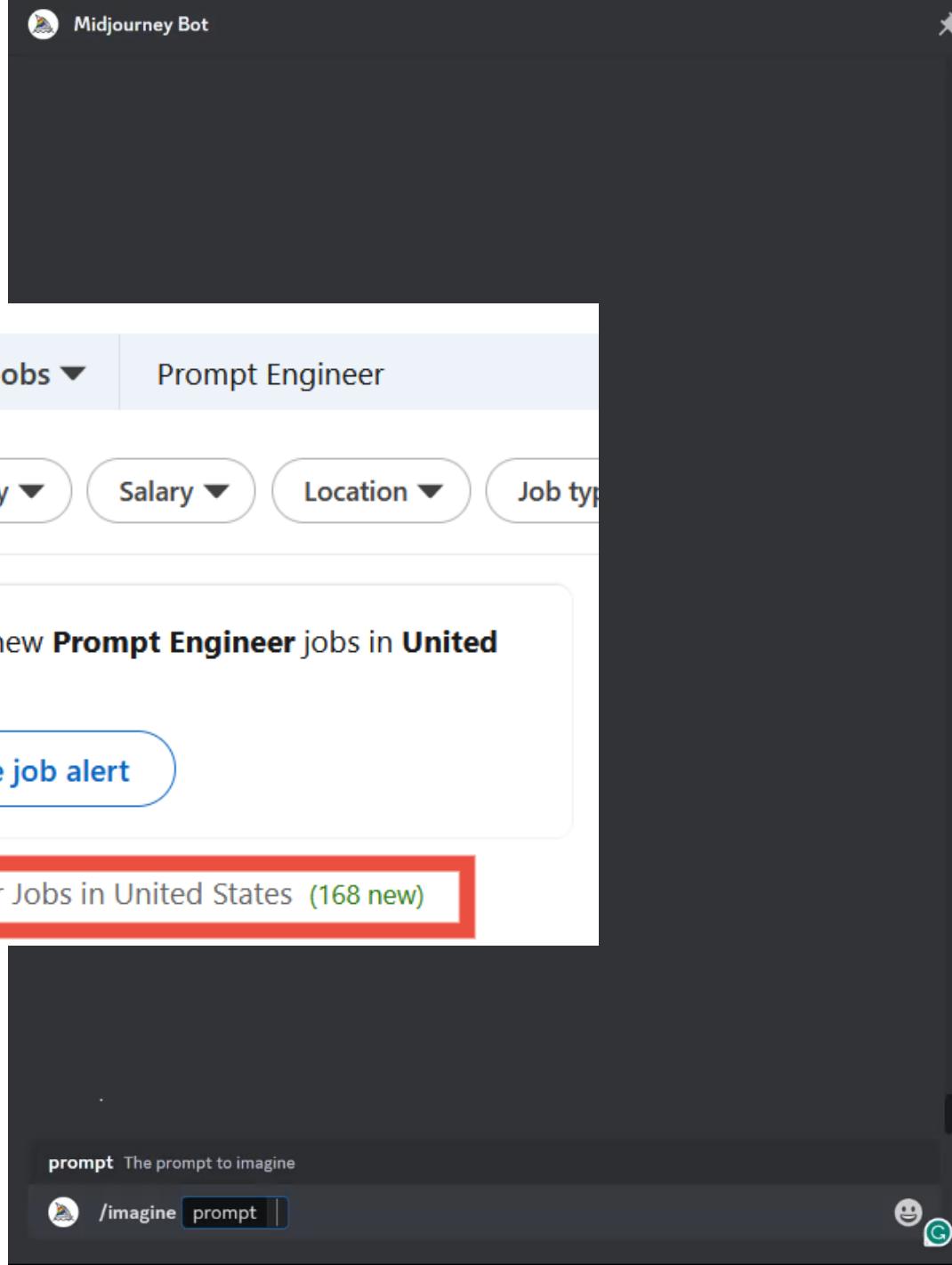


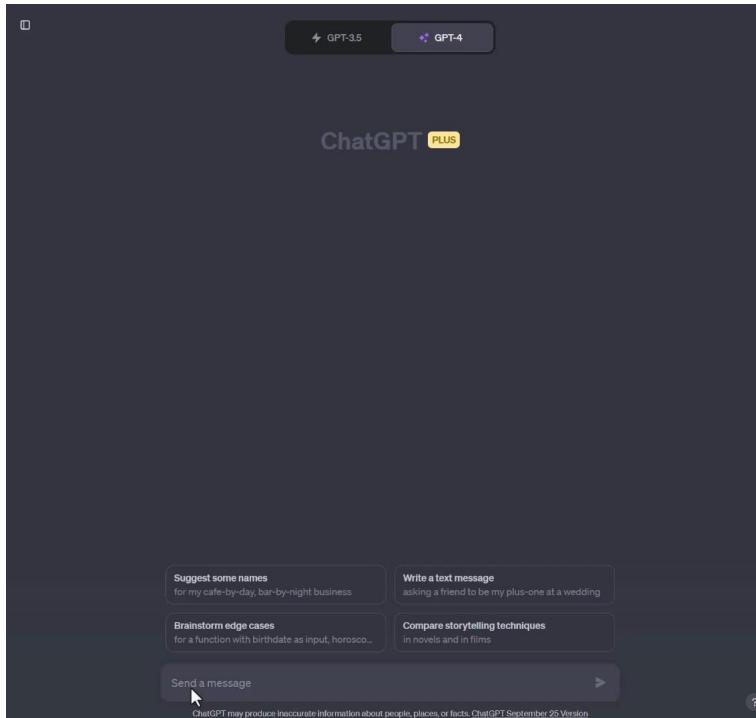
Writes and discusses as if human

“Prompt engineering”

ChatGPT can help!

The LinkedIn search interface shows results for "Prompt Engineer" in "United States". The search filters include "Any Time", "Company", "Salary", "Location", and "Job type". A call-to-action box encourages users to "Get notified about new **Prompt Engineer** jobs in **United States**" by "Sign in to create job alert". A red box highlights the count of "2,000+ Prompt Engineer Jobs in United States (168 new)".





Writes and discusses as if human

Create pictures and illustrations

GPT-3.5

*

GPT-4

Midjourney Bot

18 ⚡

Upgrade to Pro



Stable Audio 🎵

text prompt

guide ?

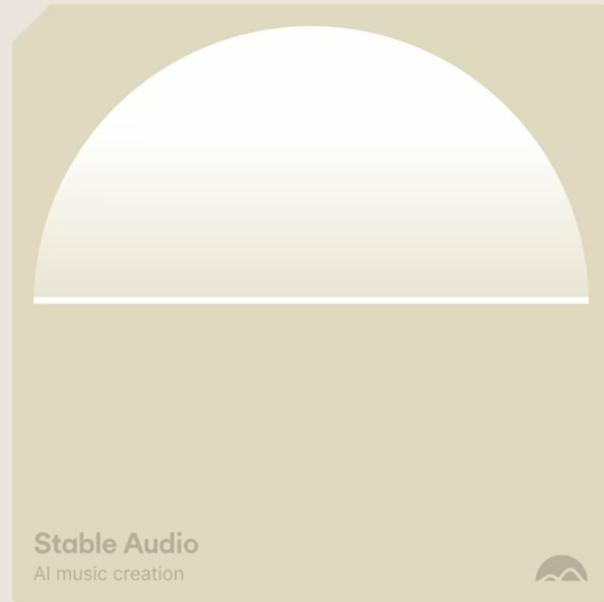
3/4,

model

stable-audio-audiosparx-v1-0 ⓘ

duration

▼ 0 m 45 s ^



Stable Audio

13 ⏴ Upgrade to Pro

text prompt ⓘ guide ⓘ

Drum solo

model

stable-audio-audiosparx-v1-0 ⓘ

duration

▼ 0 m 45 s ▲ →

- I want a happy tune based on synth... 0:45 / 3 mins ago
- Pop, Upbeat, Synthesizer-Focused, E... 0:45 / 5 mins ago
- Synthpop, Big Reverbed Synthesizer ... 0:45 / 17 days ago
- Post-Rock, Guitars, Drum Kit, Bass, S... 0:45 / 17 days ago
- 3/4, in 3, 3 beat, guitar, drums, bright... 0:45 / 17 days ago
- 3/4, in 3, 3 beat, guitar, drums, bright... 0:45 / 17 days ago
- Electric guitar top line solo instrumen... 0:45 / 17 days ago

▶ 0:00 ○ 0:00 ⏴ ⏵ ⏷ ⏸



Stable Audio
AI music creation

□

⚡ GPT-3.5

⚡ GPT-4

ChatGPT PLUS

→

Come up with concepts
for a retro-style arcade game

Help me pick
a birthday gift for my mom who likes gardening

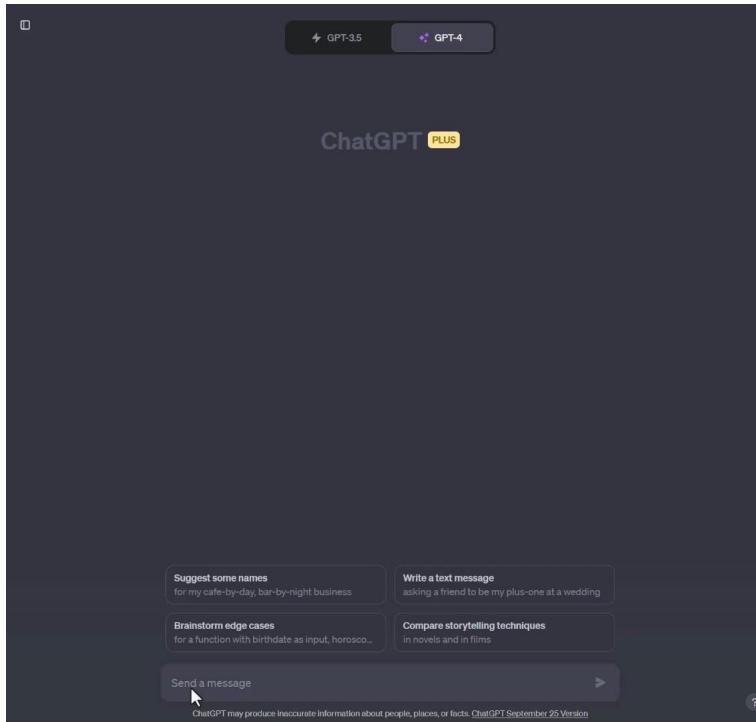
Tell me a fun fact
about the Roman Empire

Recommend a dish
to impress a date who's a picky eater

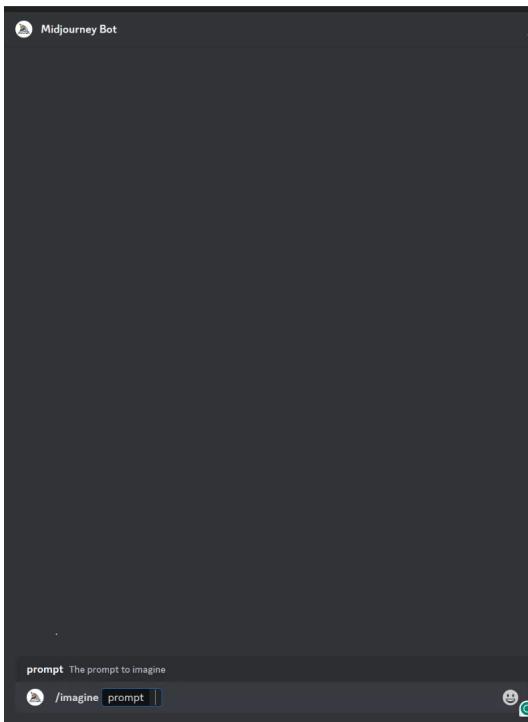
Send a message

?

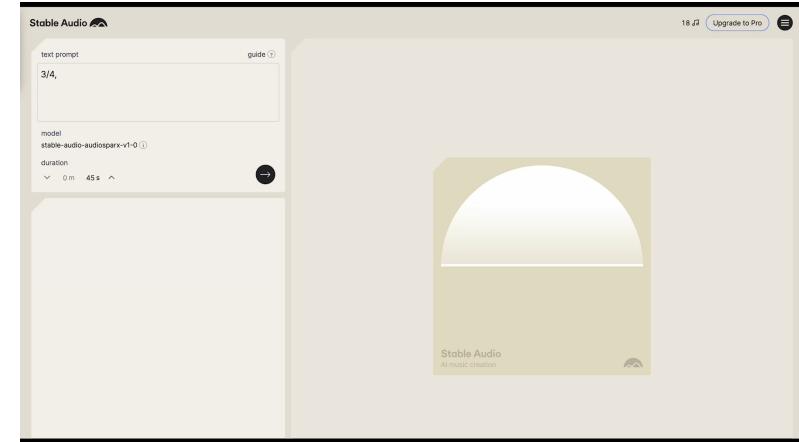
ChatGPT may produce inaccurate information about people, places, or facts. ChatGPT September 25 Version



Writes and discusses as if human



Create pictures and illustrations



Create music



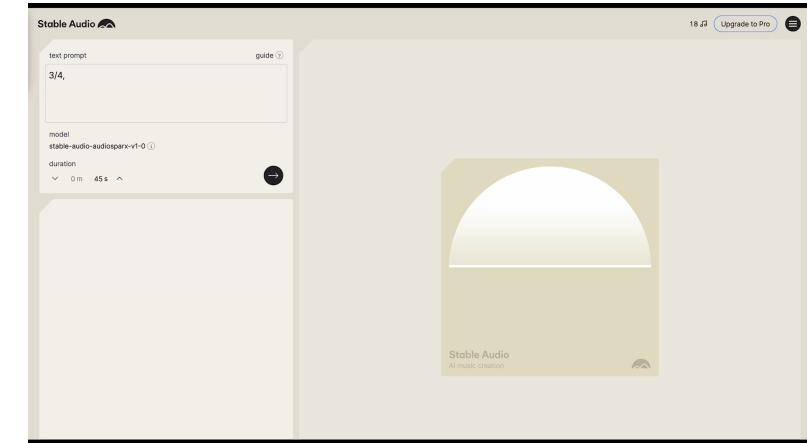
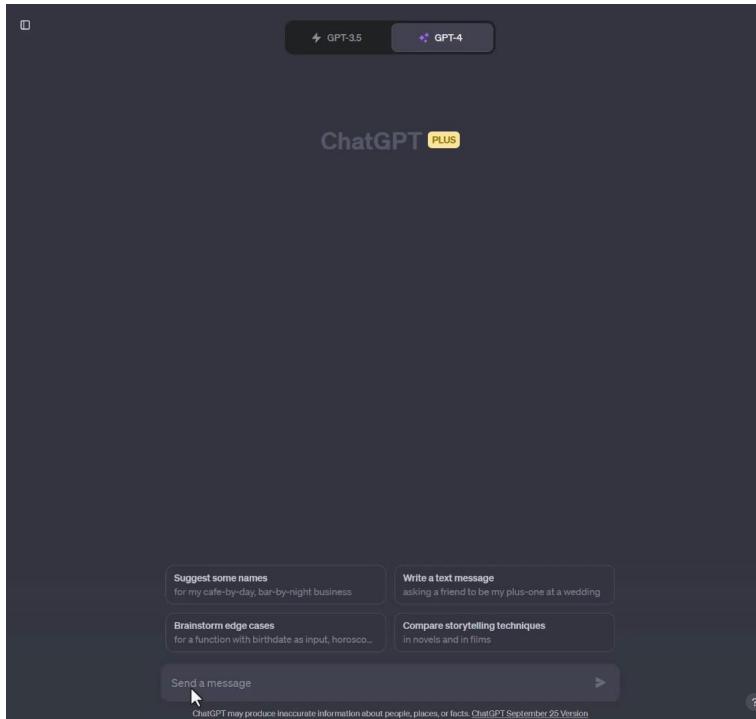
Writes ar

sic

Warning: Humans cannot reliably detect speech deepfakes

Kimberly T. Mai , Sergi Bray, Toby Davies, Lewis D. Griffin

Published: August 2, 2023 • <https://doi.org/10.1371/journal.pone.0285333>



Writes and discusses as if human

Create pictures and illustrations

Create music



Avatars & artificial people



ETHAN



transcribe and translate this

...



CHATGPT

Transcription:

TRACTAT SEGON
DE
DROGAS SIMPLES
COM SON
ANIMALS.
MUMIA
Mumia
En Frances Mumie

Es un cadaver de Homa, com avisi marxio de
Homa, o ciavura, que à estat embalsamar y
airecat. Las primeneas Mumias foren trenaes
del Sepulcres dels Esvivians, vora las
Piramides de ahont encara ve nixer.

Translation:

SECOND TREATISE
ON
SIMPLE DRUGS
AS THEY ARE
ANIMALS.
MUMIA
Mumia
In French Mumie

It is a corpse of a human, like a decaying body of a human, or carcass, that has been embalmed and dried. The first Mummies were taken from the Tombs of the Egyptians, near the Pyramids where they still seem to emerge.

Please note:

1. The text seems to be in old or archaic Catalan, which means the translation might not capture all nuances perfectly.
2. Some words are quite challenging to decipher due to the old-fashioned script, but I've done my best to provide an accurate transcription and translation.

...



...

Help me make this picture better. Give me very specific narrow advice and i will give you a better version.



CHATGPT

Of course! Here's some specific advice for improving the image:

1. **Focus and Framing:** Try to get a clear focus on the central orange sculpture. Position it so it's centered in the frame, creating a symmetrical look.
2. **Lighting:** Enhance the ambient lighting or use soft external lighting to eliminate shadows and bring out the details of the central objects.
3. **Declutter:** Remove any unnecessary items from the scene, such as the two items (the vase and the buffalo sculpture) on the marble counter in the foreground. This can help the viewer focus on the main subjects.
4. **Stairs Perspective:** If possible, capture more of the staircase. It adds a geometric, contrasting element to the scene.
5. **Edit:** In post-production, adjust the brightness, contrast, and saturation to make

Sec. 9.3 Medical

Radiology Report Generation

Prompt:
Write a radiology report for this image as an expert radiologist.



GPT-4V:
Radiology Report
Date: 03/23/2021
Exam: Abdominal x-ray
History: Patient presents with abdominal pain and distension
Findings: The abdominal x-ray demonstrates a distended stomach and small bowel loops, suggestive of a partial small bowel obstruction. There is also a small amount of air in the rectum. No free intraperitoneal air or pneumoperitoneum is noted. The liver, spleen, and kidneys appear unremarkable.
Impression: Findings are suggestive of a partial small bowel obstruction. Further imaging studies and clinical correlation are recommended.

Evaluation from Professionals:
Correct study identification, correct diagnosis

Prompt:
Write a radiology report as an expert radiologist for the following case.



GPT-4V:
Report:
MRI of the right knee demonstrates a large joint effusion, which is most pronounced in the suprapatellar region. There is also evidence of a tear in the medial meniscus, as well as mild degenerative changes in the articular cartilage. The anterior cruciate ligament and posterior cruciate ligament are intact. The extensor mechanism is also intact. No other significant abnormalities are seen.
Impression: Large joint effusion and medial meniscal tear in the right knee, with mild degenerative changes in the articular cartilage.

Evaluation from Professionals:
Correct study identification, correct diagnosis (effusion and meniscal tear)

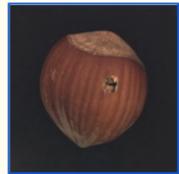
Figure 75: Application Highlights on Radiology Report Generation. The generated report is reviewed by a medical professional to evaluate its correctness. Green highlights that a medical professional has confirmed the described part of the report is correct. Check Section 9.3 for detailed discussions. The medical images are from the internet.

Sec. 9.2 Industry

Defect Detection

Prompt:

What is wrong with the object in the image?



GPT-4V:

The object in the image appears to have a small hole, likely a insect damage or rot.

Prompt:

What is wrong with the object in the image?

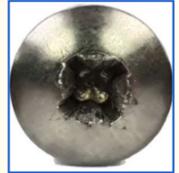


GPT-4V:

There is a small tear or hole in the fabric.

Prompt:

What is wrong with the object in the image?



GPT-4V:

The object in the image appears to be a screw with a damaged or stripped head. The grooves in the head, which would normally allow a screwdriver or wrench to grip and turn the screw, are worn away and no longer functional.

Prompt:

What is wrong with the object in the image?

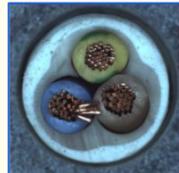


GPT-4V:

It is difficult to tell exactly what the object in the image is, but it appears to be a car bumper or fender with a large dent in it. The problem with the object is that it is damaged and dented, which may affect the appearance and functionality of the car.

Prompt:

What is wrong with the object in the image?



GPT-4V:

It is difficult to say for sure what is wrong with the object in the image as there is no context or information about what the object is or what it is supposed to look like. However, it appears that the copper wires in the blue and brown sections are frayed and not neatly arranged, which could indicate damage or poor quality.

Sec. 9.4 Auto Insurance

Damage Evaluation

Prompt:

Imagine that you are an expert in evaluating the car damage from car accident for auto insurance reporting. Please evaluate the damage seen in the image below.



GPT-4V:

Based on the image, it appears that the car has sustained damage to the front passenger side bumper. The damage appears to be in the form of scrapes and scratches, with some areas of the paint chipped away. The damage appears to be cosmetic and does not appear to have affected the structural integrity of the bumper or the car. However, it is important to note that the image only shows one angle of the car and does not provide a full view of the damage. A more thorough inspection of the car would be needed to fully assess the extent of the damage and determine if there are any underlying issues that are not visible in the image.

Prompt:

Imagine that you are an expert in evaluating the car damage from car accident for auto insurance reporting. Please evaluate the damage seen in the image below.



GPT-4V:

Based on the image, it appears that the vehicle has sustained significant damage to the front end. The hood is crumpled and the front bumper is partially detached. The headlights also appear to be damaged. It is likely that the vehicle was involved in a front-end collision. The damage appears to be primarily cosmetic, but it is possible that there may be underlying structural damage to the frame or engine. Further inspection would be required to assess the full extent of the damage. In terms of repair costs, the hood and bumper would likely need to be replaced, and the headlights may also need to be replaced or repaired. The cost of these repairs would depend on the make and model of the vehicle, but it is likely that the cost would be several thousand dollars at minimum.

Prompt:

Imagine that you are an expert in evaluating the car damage from car accident for auto insurance reporting. Please evaluate the damage seen in the image below.



GPT-4V:

Based on the image, it appears that the car has sustained damage to the rear bumper and quarter panel on the driver's side. The bumper appears to be dented and scratched, and the quarter panel has a large dent and some scuff marks. It is likely that the car was hit from the side, causing the damage to the quarter panel and bumper. In terms of repair costs, the bumper may be able to be repaired with some minor body work and repainting. However, the quarter panel may require more extensive repair or even replacement, which could be more costly. Overall, I would estimate the damage to be in the moderate to severe range, with repair costs likely in the thousands of dollars.

Prompt:

Imagine that you are an expert in evaluating the car damage from car accident for auto insurance reporting. Please evaluate the damage seen in the image below.



GPT-4V:

Based on the image, it appears that the vehicle has sustained significant damage to the front end. The hood is crumpled and the front bumper is completely detached from the vehicle. The headlights and grille are also damaged and the engine appears to be exposed. Additionally, there is damage to the driver's side fender and door. Given the extent of the damage, it is likely that the vehicle was involved in a high-speed collision or a head-on collision. The cost of repairs for this vehicle will likely be significant and it may be deemed a total loss by the insurance company.

Sec. 9.7 Embodied Agent

Operating Machine

Prompt:
First, read the operating menus below for coffee machine buttons.
Menu 1:



Menu 2:



Menu 3:



Now, let's look at the operating panel of the coffee machine in the image below, which button should I use for a 6 OZ coffee: left, right, top or bottom button?



GPT-4V:
You should use the left button for a 6 OZ coffee.

Figure 79: Application Highlights on Auto Damage Evaluation. Check Section 9.4 for detailed discussions.



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💡 Get creative inspiration

"Write a haiku about crocodiles in outer space in the voice of a pirate"

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More Creative

More Balanced

More Precise

New topic

Ask me anything...



0/4000 ➤

Feedback

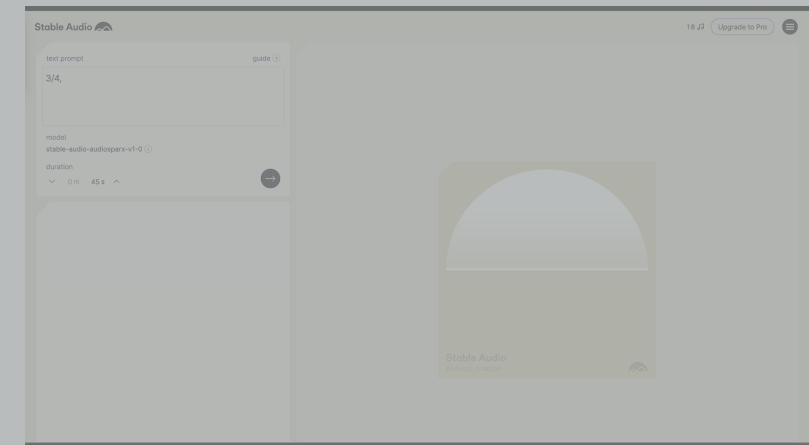
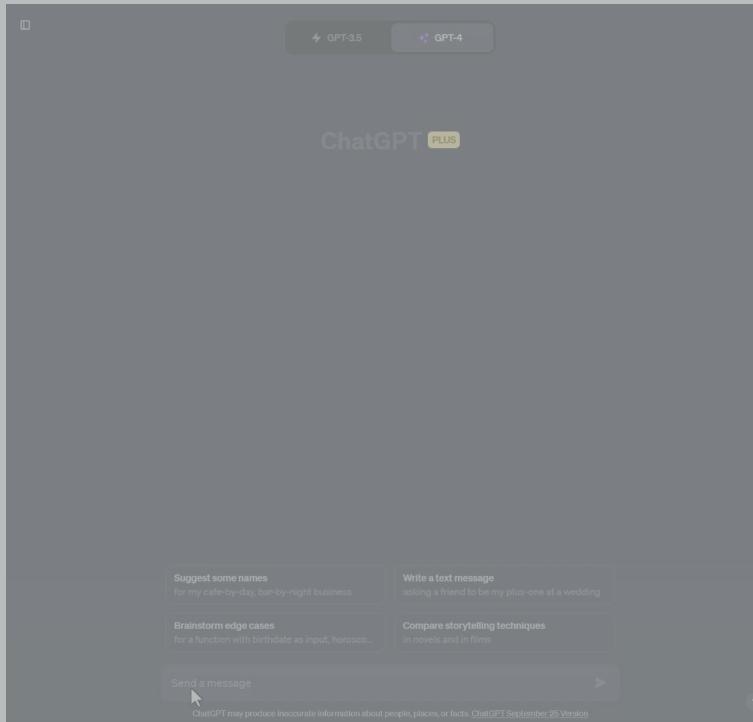
Thing, 03.10.23

A wide-angle, low-light photograph of a massive, dark, futuristic battleship docked at a port. The ship is silhouetted against a bright, hazy sky, with its complex hull, multiple levels, and various structures visible. In the foreground, the dark silhouettes of a large crowd of people are visible, looking towards the ship. The overall atmosphere is somber and dramatic.

WE GAVE THEM EVERYTHING

Nicolas Neubert,

https://www.youtube.com/watch?v=LodDJFg_LQk



Writes and discusses as if human



Create pictures and illustrations



Create music



Avatar of artificial people
Uh oh...



Integrated in existing tools and products

Soon, everyone will use AI, whether or not they're aware of it.

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Comments Catch Up Editing Share

Aptos (Body) 11 B I U A ...

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Focused Other

Today

Amari Rivera For: Flight details for Catherine's gr... 9:43 AM I should arrive with enough time to attend...

Jessie Irwin re: February 2023 Financial Results 3:07 PM Hi all, Yesterday afternoon we announced...

Yesterday

Hayden Cook Update on manufacturing plant... 10:35 AM Hi you two, I'm hoping you can help me

Isobel MacIntyre Contract details for work on... (3) 3:57 PM Got it, thank you for clarifying! In that case...

Jie Qui Request for student résumé review 3:16 PM Hello Christian, I am a junior studying bus...

Omar Bennett re: New Client Contac... (6) 1:42 PM Sharing a preliminary draft of the latest co...

Rodrigo Botas Engt PTA Meeting! 11:31 AM

Focused Other

Today

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Q1 Performance - Saved

File Home Insert Formulas Data Review View Automate Help

A1 Country Customer Product Discount Band Units Sold Manufacturing Price Sale Price Gross Sales Discount Sales COGS

	A	B	C	D	E	F	G	H	I	J	K
1	Country	Customer	Product	Discount Band	Units Sold	Manufacturing Price	Sale Price	Gross Sales	Discount	Sales	COGS
2	France	VanArstel	Biodegradable Cleaning Products	Low	4345	\$10	\$352	\$1,529,440	\$15,294	\$1,514,146	\$
3	USA	VanArstel	Biodegradable Cleaning Products	Low	4245	\$10	\$352	\$1,494,240	\$14,942	\$1,479,298	\$
4	Australia	VanArstel	Biodegradable Cleaning Products	None	4124	\$10	\$352	\$1,451,648	\$0	\$1,451,648	\$
5	Mexico	VanArstel	Biodegradable Cleaning Products	Medium	3954	\$10	\$352	\$1,391,860	\$83,508	\$1,308,300	\$
6	France	Contoso Pharmaceuticals	Biodegradable Cleaning Products	Low	4952	\$10	\$127	\$628,804	\$6,289	\$622,615	\$
7	France	Contoso Pharmaceuticals	Recycled Can	Low	4903	\$5	\$127	\$622,681	\$6,227	\$616,454	\$
8	Canada	Prosware	Natural Personal Care Products	Low	1954	\$270	\$302	\$590,108	\$5,901	\$584,207	\$
9	Canada	Prosware	Biodegradable Cleaning Products	High	1990	\$220	\$302	\$600,980	\$84,137	\$516,843	\$
10	USA	VanArstel	Compostable Food Packaging	Low	1254	\$3	\$380	\$476,520	\$4,765	\$471,755	\$
11	USA	Prosware	Natural Personal Care Products	Medium	1465	\$224	\$302	\$442,430	\$26,549	\$415,884	\$
12	USA	Prosware	Sustainable Snack Packaging	Medium	1410	\$120	\$302	\$425,820	\$25,549	\$400,271	\$
13	Australia	Prosware	Natural Personal Care Products	Medium	1369	\$224	\$302	\$413,438	\$24,806	\$388,632	\$
14	USA	VanArstel	Compostable Food Packaging	Medium	1052	\$3	\$380	\$399,760	\$23,986	\$375,774	\$
15	Canada	VanArstel	Compostable Food Packaging	Low	980	\$312	\$380	\$372,400	\$3,724	\$368,676	\$
16	Australia	Prosware	Sustainable Snack Packaging	Medium	1298	\$120	\$302	\$391,996	\$23,520	\$368,476	\$
17	Australia	VanArstel	Compostable Food Packaging	None	954	\$3	\$380	\$362,520	\$0	\$362,520	\$
18	Canada	Contoso Pharmaceuticals	Biodegradable Cleaning Products	Low	2785	\$110	\$127	\$353,695	\$3,537	\$350,158	\$



Copilot

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Comments Catch Up Editing Share

Aptos (Body) What's urgent in my email? Draft replies to the most important stuff based on what you know about me, Ethan Mollick

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View other drafts

Q1 Performance - Saved

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Page View Web View Fit Give Feedback to Microsoft

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Copilot

<https://onedrive.live.com/w/t/EaCKkPs6AchIjwULn3060f4Bvb8jyIAFWrkt2bSC8LiaZw?e=CMgqnn1>

Your everyday AI companion

ument1 - Saved

Search (Alt + Q)



File Layout References Review View Help



What's urgent in my email? Draft replies to the most important stuff based on what you know about me, Ethan Mollick



View other drafts



Google Workspace

The most urgent email is from [REDACTED] Vice Dean of Wharton Executive Education. She is asking you to confirm your availability to speak at the Wharton Combined Boards event on November [REDACTED]. You need to reply to her as soon as possible to let her know if you can make it.

Here is a draft reply:

Hi [REDACTED],

Thanks for reaching out. I'm happy to confirm that I am available to speak at the Wharton Combined Boards event on November [REDACTED]. I'm looking forward to it!

Best,
Ethan

The other emails are not as urgent, but you should still reply to them within a few days.

To [REDACTED] you can reply with a link to the slides from your last day of class.

To [REDACTED] you can reply and schedule a time to chat about his AI startup idea.

To [REDACTED], you can reply with a brief explanation of what makes tasks "outside the frontier" different from tasks "inside the frontier". You can also mention that you are mindful of the potential downsides of using AI, but that you believe it is a powerful tool that can be used to help humans be more productive.

G	H	I	J	K
Sale Price	Gross Sales	Discounts	Sales	COGS
\$352	\$1,529,440	\$15,294	\$1,514,146	\$
\$352	\$1,494,240	\$14,942	\$1,479,298	\$
\$352	\$1,451,648	\$0	\$1,451,648	\$
\$352	\$1,301,868	\$83,569	\$1,208,300	\$
\$127	\$620,904	\$6,280	\$622,615	\$
\$127	\$622,681	\$6,227	\$616,454	\$
\$302	\$590,108	\$5,901	\$584,207	\$
\$302	\$600,980	\$84,137	\$516,843	\$
\$380	\$476,520	\$4,785	\$471,755	\$
\$302	\$442,430	\$26,549	\$415,884	\$
\$302	\$425,820	\$25,549	\$400,271	\$
\$302	\$413,438	\$24,806	\$388,632	\$
\$380	\$399,760	\$23,986	\$375,774	\$
\$380	\$372,400	\$3,724	\$368,676	\$
\$302	\$391,995	\$23,520	\$368,476	\$
\$380	\$362,520	\$0	\$362,520	\$
\$127	\$353,695	\$3,537	\$350,158	\$



Copilot

Your everyday AI companion

KEYSTONE

Sea Change in Software Development:

*Economic and Productivity
Analysis of the AI-Powered
Developer Lifecycle*

Thomas Dohmke
GitHub

Marco Iansiti
Harvard Business School
and Keystone.AI

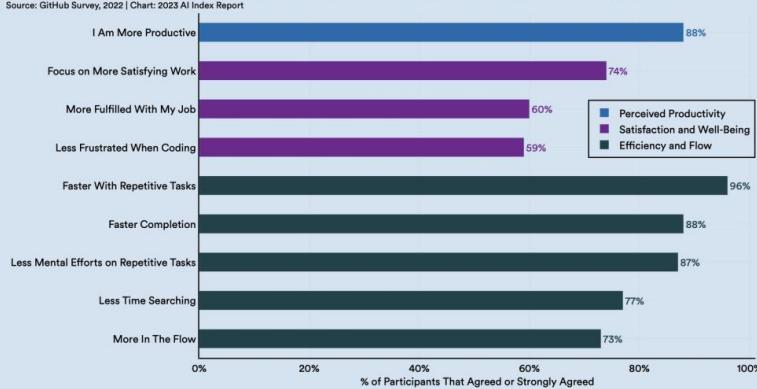
Greg Richards
Keystone.AI

Aerial drone foo

Narrative Highlight:

The Effects of GitHub's Copilot on Developer Productivity and Happiness (cont'd)

Measuring Dimensions of Developer Productivity When Using Copilot: Survey Responses, 2022



Comments Catch Up Editing Share

Outlook Home View Help

til et vil utdare. G

«Iag en presentasjon med fen

Narrative Highlight:
The Effects of GitHub's Copilot on Developer Productivity and Happiness (cont'd)

ter i studieprogrammet [X] påvirke bunnlinjen»?

Copilot

Copilot will begin to roll out in its early form as part of our free update to Windows 11, starting Sept. 26 — and across Bing, Edge, and Microsoft 365 Copilot this fall.

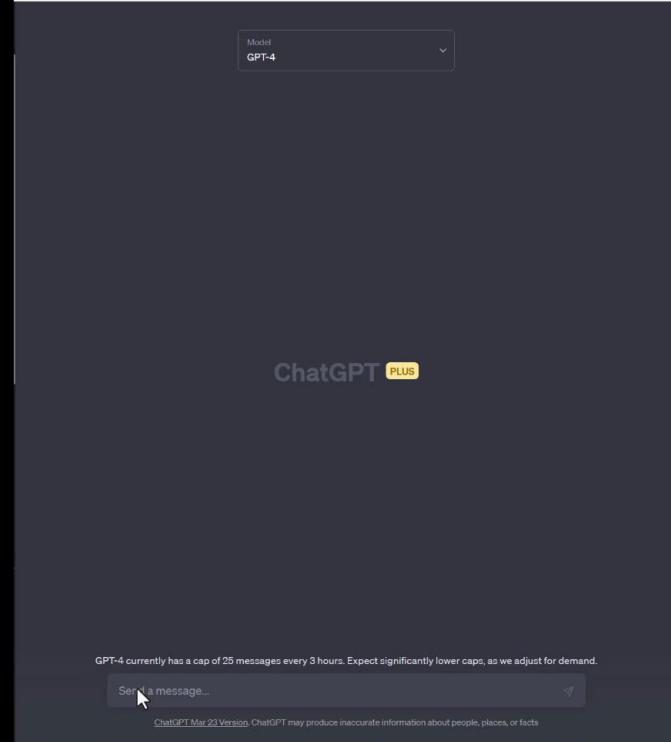
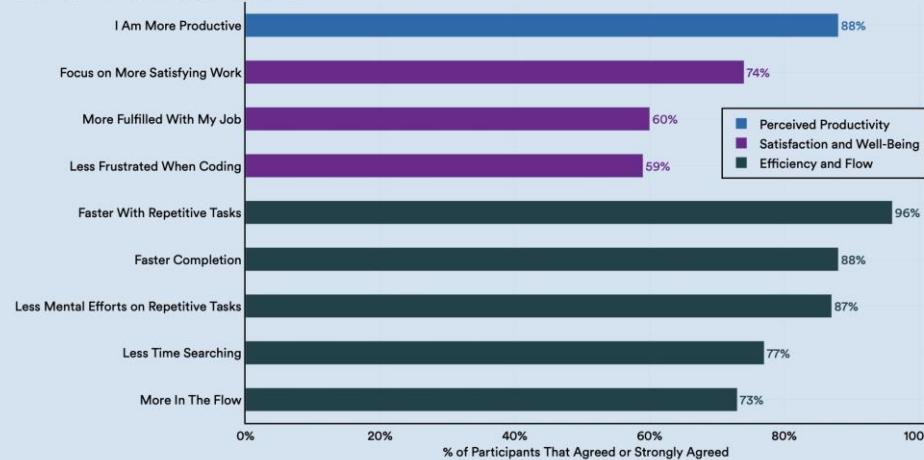
Give Feedback to Microsoft 100% +

Narrative Highlight:

The Effects of GitHub's Copilot on Developer Productivity and Happiness (cont'd)

Measuring Dimensions of Developer Productivity When Using Copilot: Survey Responses, 2022

Source: GitHub Survey, 2022 | Chart: 2023 AI Index Report



GPT-4 can turn a picture of a napkin sketch into a fully functioning html/css/javascript website!

This was just demonstrated in the livestream.



9:57 PM · Mar 14, 2023 · 542.7K Views



Joe Perkins @joeprkns

Last night I used GPT-4 to write code for 5 micro services for a new product.

A (very good) dev quoted £5k and 2 weeks.

GPT-4 delivered the same in 3 hours, for \$0.11

Genuinely mind boggling

10:19 AM · Mar 15, 2023 · 4.4M Views

MOTHERBOARD
TECHBYVICE

Startups Are Already Using GPT-4 to Spend Less on Human Coders

GPT-4 "saves a lot of time and a lot of money, obviously, because we haven't had to hire additional resources."



By [Chloe Xiang](#)

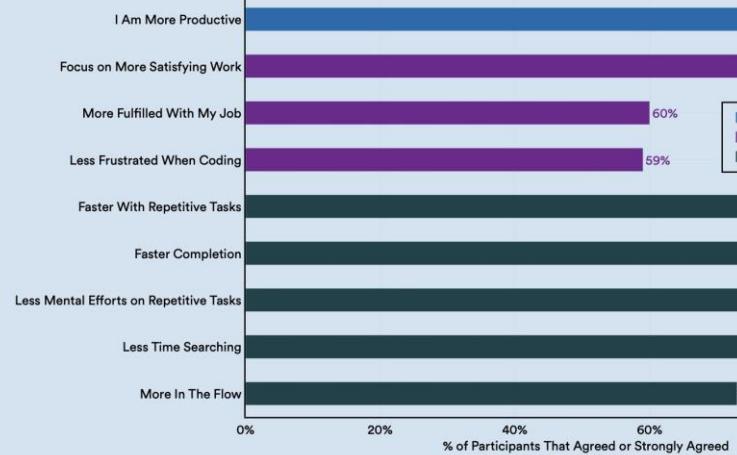
March 20, 2023, 2:00pm [Share](#) [Tweet](#) [Snap](#)

Narrative Highlight:

The Effects of GitHub's Copilot on Developer Productivity and Happiness (cont'd)

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Source: GitHub Survey, 2022 | Chart: 2023 AI Index Report



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@joeprkns

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Genuinely mind boggling

10:19 AM · Mar 15, 2023 · 4.4M Views

Model

GPT-4



Lior  
@AlphaSignalAI

GPT4 can turn a picture of a napkin sketch into a fully functioning html/css/javascript website!

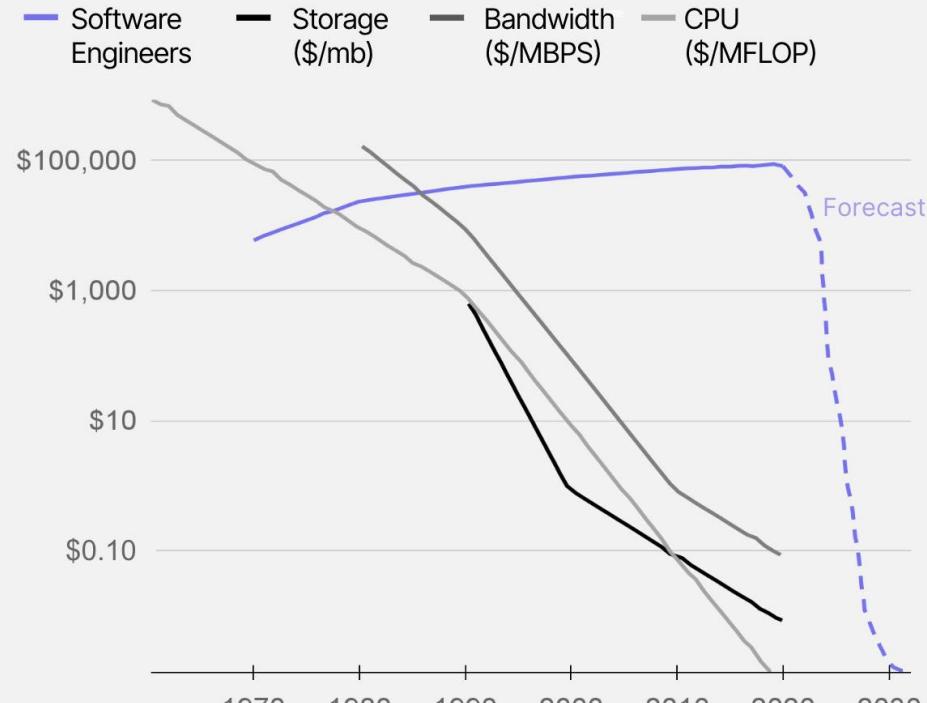
This was just demonstrated in the livestream.



9:57 PM · Mar 14, 2023 · 542.7K Views

The next collapsing tech cost is software itself

Computation costs (logarithmic scale)



Source: SK Ventures

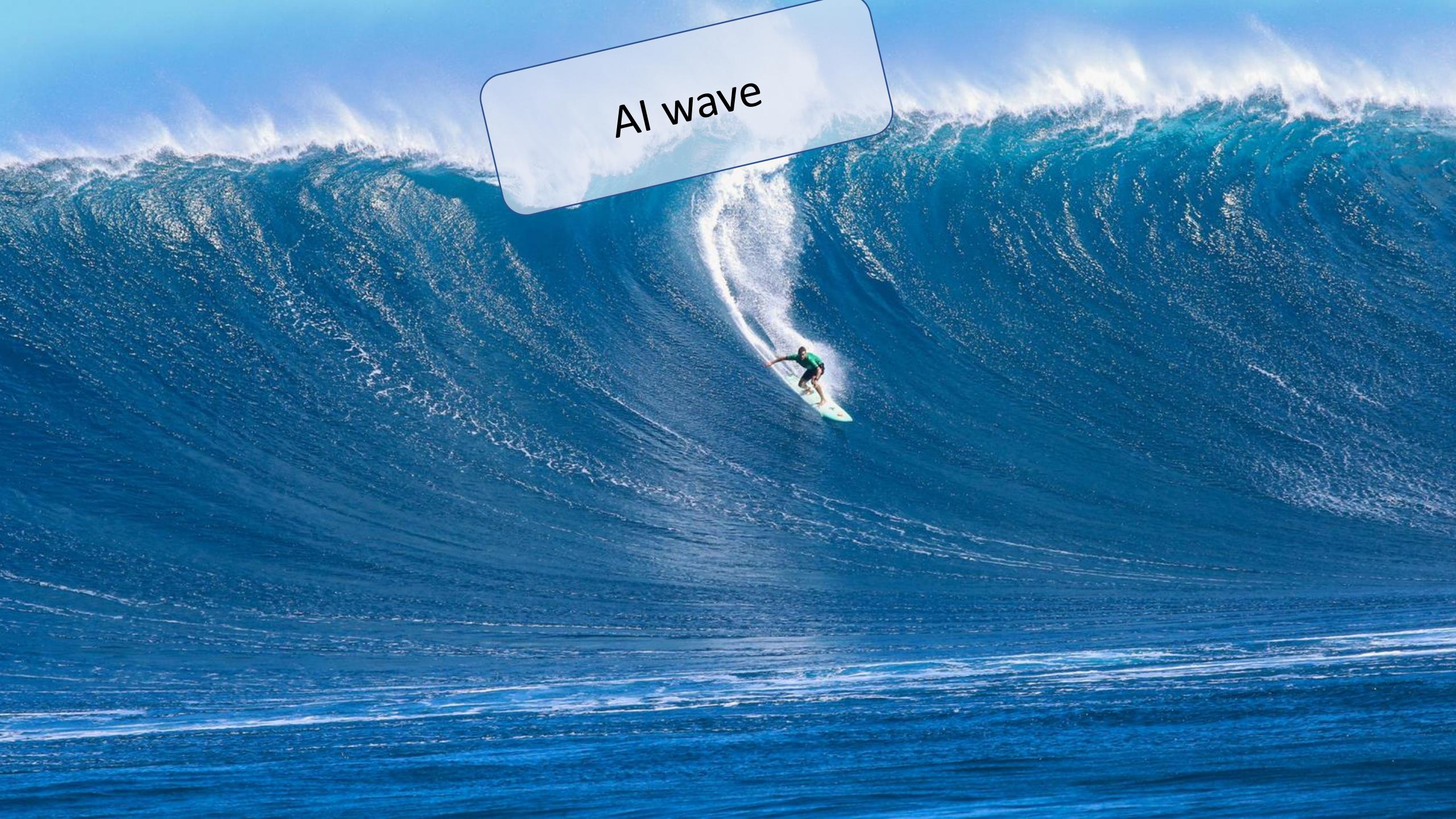
exponentialview.co

haven't had to hire additional resources."

"The current generation of [LLMs] is a missile aimed, however unintentionally, directly at software production itself"
– Paul Kedrosky.

viously, because we



A wide-angle photograph of a surfer riding a massive, curling blue wave. The surfer, wearing a green shirt and black shorts, is positioned in the center of the frame, leaning into the wave's face. A bright white spray of water is visible at the top of the wave's crest. The ocean extends to the horizon under a clear, light blue sky.

AI wave

What every software engineer should know about generative AI



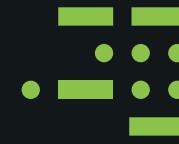
Introduction
The current landscape of
generative AI



Applying generative AI
Strategies for effective usage
of generative AI



LLMs as code companions
How to use language models
for programming and
software development



GenAI-powered software
How to build software that's
powered by generative AI

What every software engineer should know about generative AI



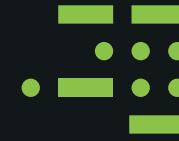
Introduction
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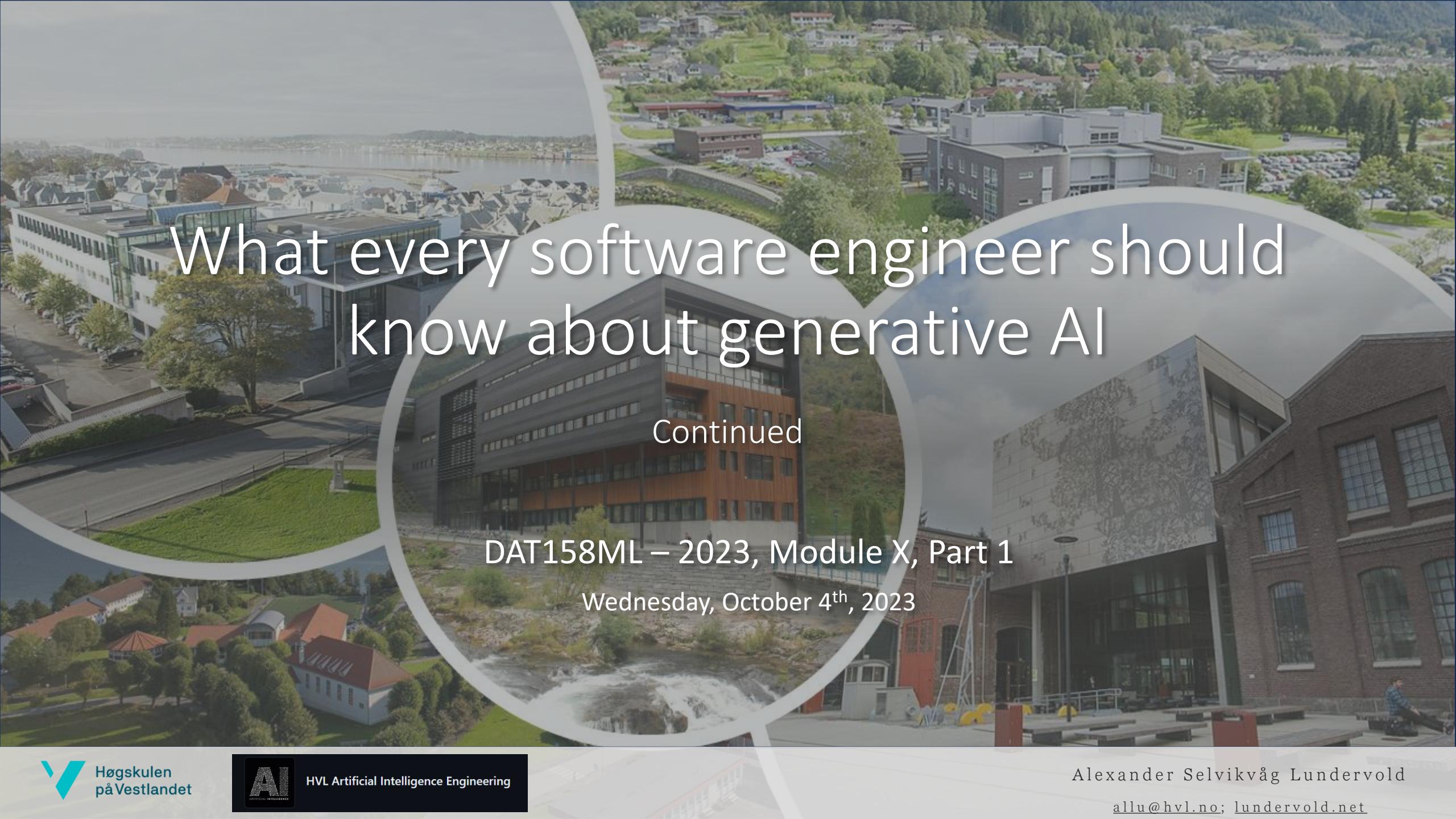
LLMs as code companions
How to use language models for programming and software development



GenAI-powered software
How to build software that's powered by generative AI

To be effective users, we need a basic understanding of how these models work.

We'll use ChatGPT as a case study.



What every software engineer should know about generative AI

Continued

DAT158ML – 2023, Module X, Part 1

Wednesday, October 4th, 2023

What every software engineer should know about generative AI



Introduction
The current landscape of
generative AI



Applying generative AI
Strategies for effective usage
of generative AI

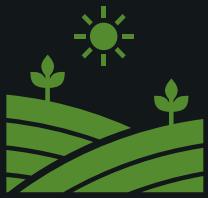


LLMs as code companions
How to use language models
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software development



GenAI-powered software
How to build software that's
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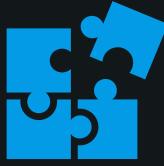
What every software engineer should know about generative AI



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To be effective users, we need a basic understanding of how these models work.

We'll use ChatGPT as a case study.

What every software engineer should know about generative AI

Those planning to take DAT255 next semester will learn about natural language processing how LLMs are built (and much more).

DAT255: Deep Learning Engineering



To be effective users, we need a basic understanding of how these models work.

We'll use ChatGPT as a case study.

ChatGPT



ChatGPT

a simplified recipe

correct



Objective: Create a chatbot that's **helpful**, **~~honest~~**, and **harmless**



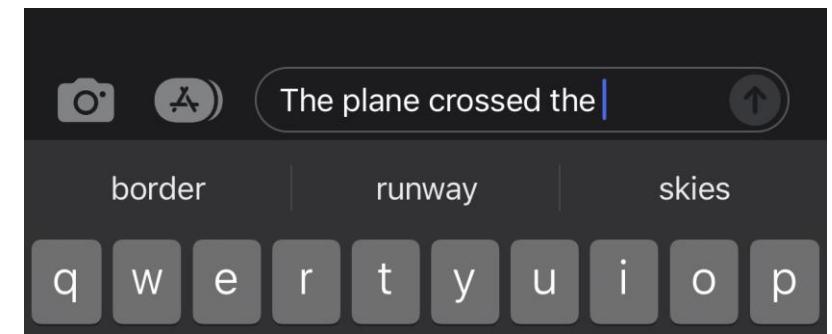
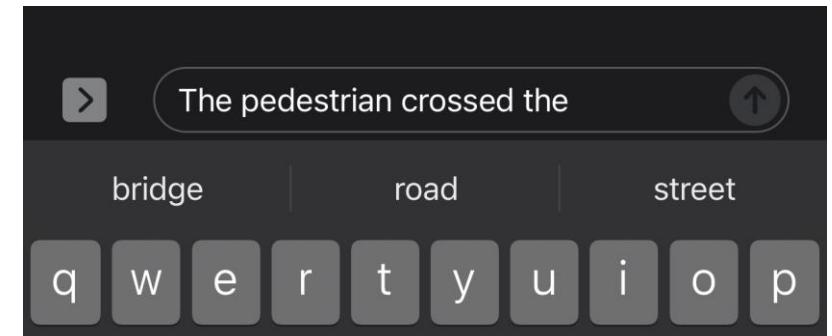
ChatGPT

a simplified recipe

Objective: Create a chatbot that's **helpful, correct, and harmless**

1

Start out with GPT-3.5, a **large language model** (LLM)





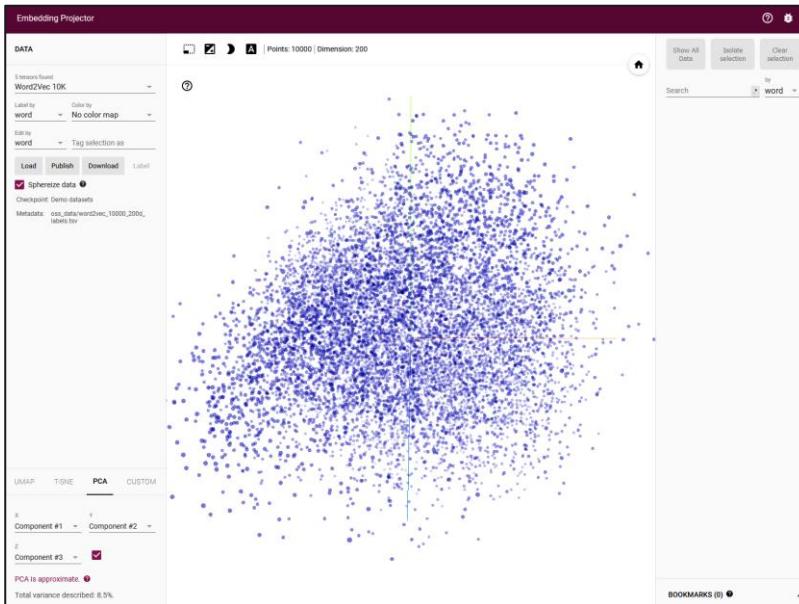
ChatGPT

a simplified recipe

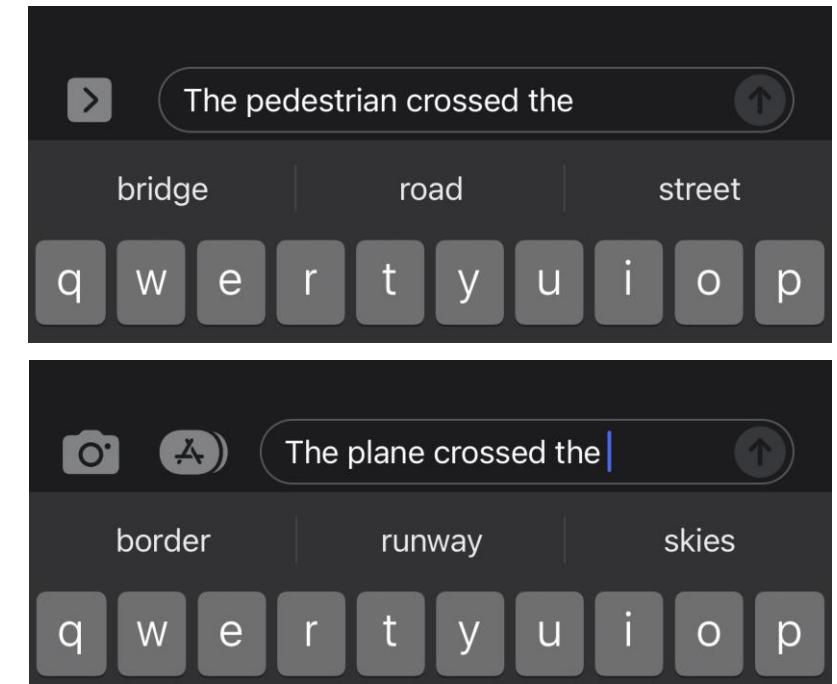
Objective: Create a chatbot that's **helpful, correct, and harmless**

1

Start out with GPT-3.5, a **large language model (LLM)**



<http://projector.tensorflow.org/>



DATA

5 tensors found

Word2Vec 10K

Label by

word

Color by

No color map

Edit by

word

Tag selection as

[Load](#) [Publish](#) [Download](#) [Label](#) Sphereize data [?](#)

Checkpoint: Demo datasets

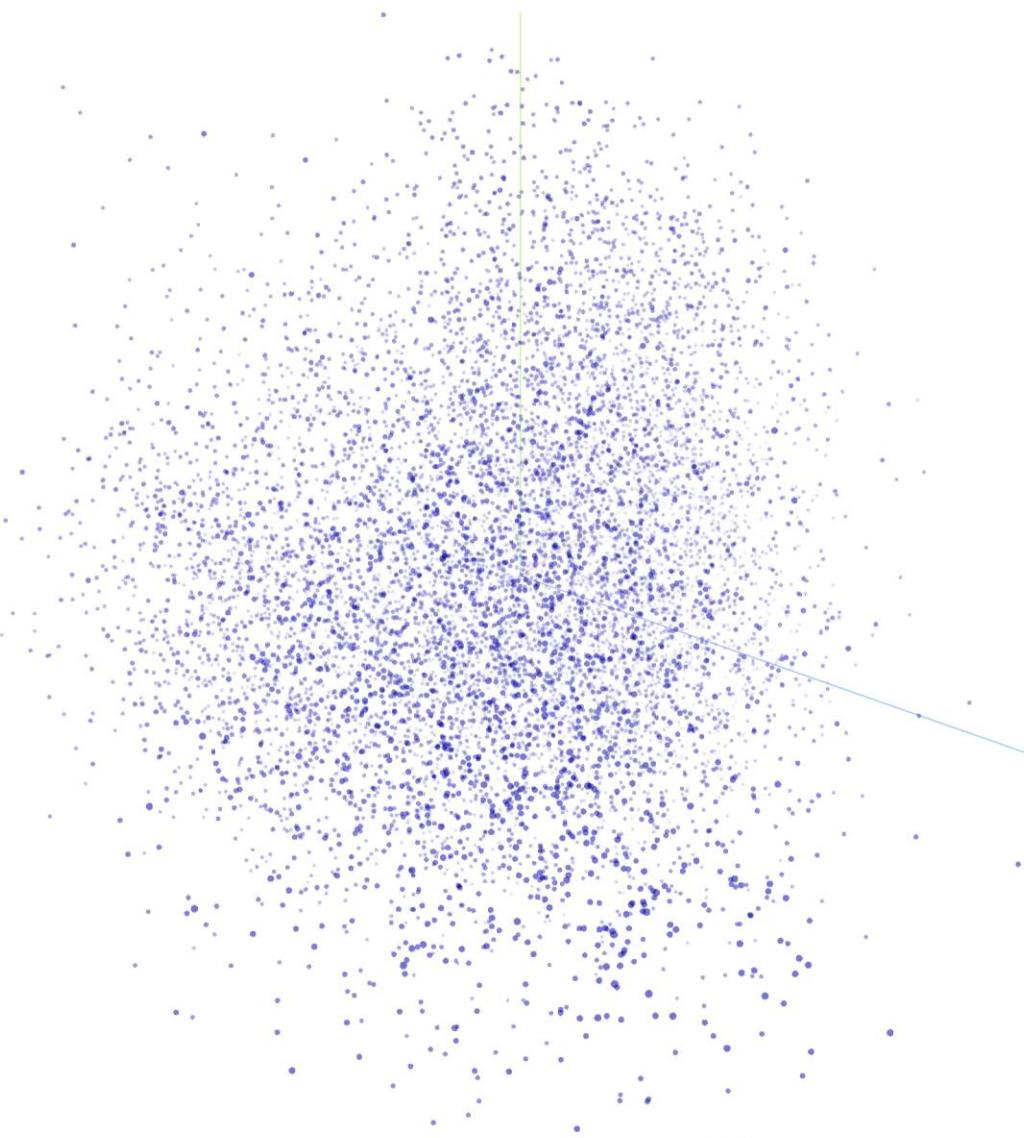
Metadata: oss_data/word2vec_10000_200d_labels.tsv

Points: 10000 | Dimension: 200

[Show All Data](#)[Isolate selection](#)[Clear selection](#)

Search

by * word

[UMAP](#) [T-SNE](#) [PCA](#) [CUSTOM](#)X [Component #1](#) Y [Component #2](#)Z [Component #3](#) PCA is approximate. [?](#)

Total variance described: 8.5%.

BOOKMARKS (0) [?](#)

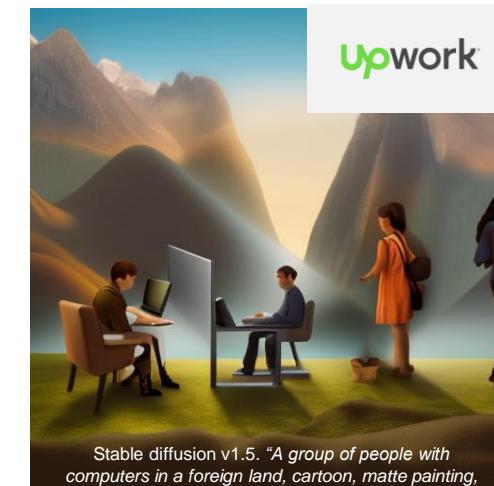
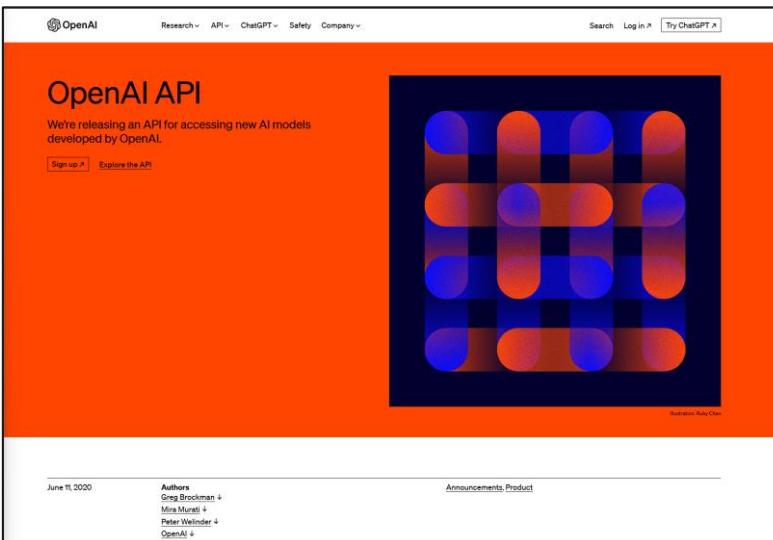


ChatGPT

a simplified recipe

Objective: Create a chatbot that's **helpful, correct, and harmless**

- 1 Start out with GPT-3.5, a **large language model** (LLM)
- 2 Collect some **examples of questions & answers**. Start a training process (*fine-tuning* GPT-3)
- 3 Generate multiple answers to a couple of thousand questions. Ask someone to **rank the answers** from worst to best.



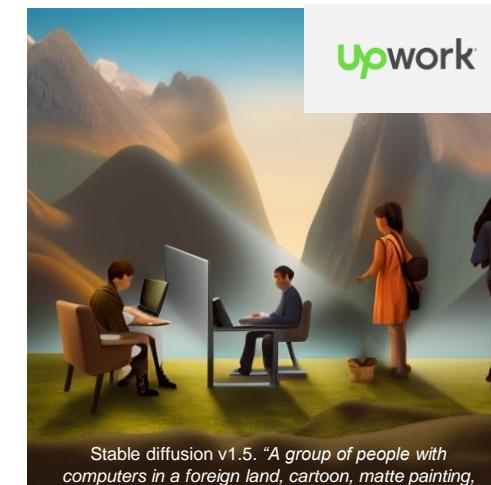


ChatGPT

a simplified recipe

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- 4 Train a model to **predict the ranking** the humans in step 3 would have given. Use this to train the GPT model on millions of examples.
- 5 Along the way, ask humans to rank examples where you estimate that the GPT model can learn the most.





ChatGPT

a simplified recipe

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- 6 Make the system **publicly available as a web app** ("ChatGPT") and use the user's feedback to train and tweak the system further

The screenshot shows a dark-themed ChatGPT interface. A user message at the top reads: "Create an exam in physiology for third year medical students. With some multiple choice questions and some essay questions." Below it, ChatGPT responds: "Sure! Here is an exam in physiology for third year medical students. It includes both multiple choice and essay questions." A yellow box highlights the "multiple choice" part of the response. The conversation continues with a question: "Multiple Choice Questions: 1. Which of the following is NOT a component of the sympathetic nervous system?" ChatGPT provides three options: "This is harmful / unsafe", "This isn't true", and "This isn't helpful". A "Provide additional feedback" button is shown above a text input field asking "What would the ideal answer have been?". Another "Submit feedback" button is at the bottom right. The next message is partially visible: "3. Discuss the mechanisms by which...".



ChatGPT

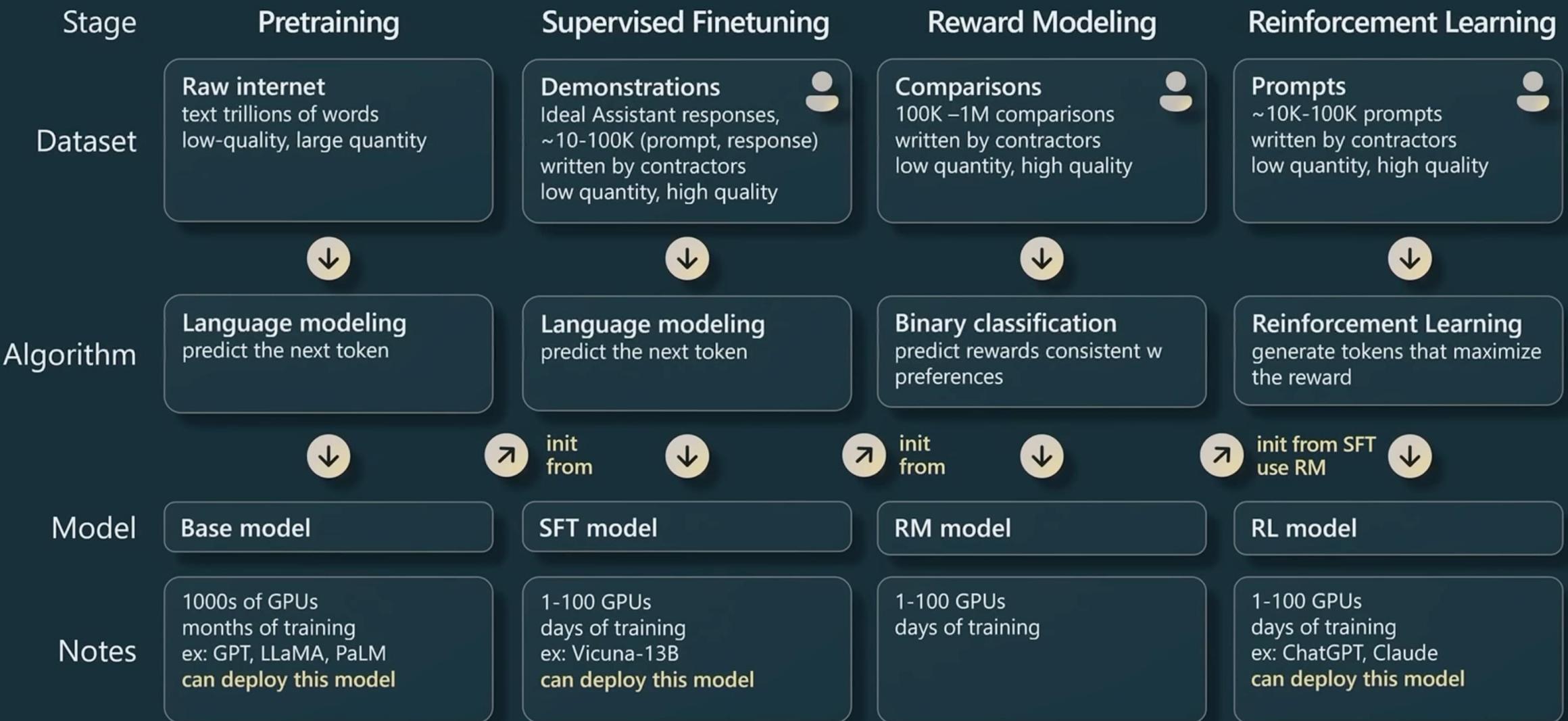
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The screenshot shows the ChatGPT interface in dark mode. On the left is a sidebar with a "New Thread" button, "Light Mode" switch, "OpenAI Discord" link, "Updates & FAQ" link, and "Log out" button. The main area has a header "ChatGPT". Below it are three sections: "Examples" (with examples like "Explain quantum computing in simple terms" and "Got any creative ideas for a 10 year old's birthday?"), "Capabilities" (with examples like "Allows user to provide follow-up corrections" and "Trained to decline inappropriate requests"), and "Limitations" (with examples like "May occasionally generate incorrect information" and "Limited knowledge of world and events after 2021"). At the bottom of the main area is a footer: "Free Research Preview: ChatGPT is optimized for dialogue. Our goal is to make AI systems more natural to interact with, and your feedback will help us improve our systems and make them safer." A right-pointing arrow is at the end of the footer line.

GPT Assistant training pipeline





Multitask training data (680k hours)

English transcription

"Ask not what your country can do for ..."

Ask not what your country can do for ...

Any-to-English speech translation

"El rápido zorro marrón salta sobre ..."

The quick brown fox jumps over ...

Non-English transcription

"언덕 위에 올라 내려다보면 너무나 넓고 넓은 ..."

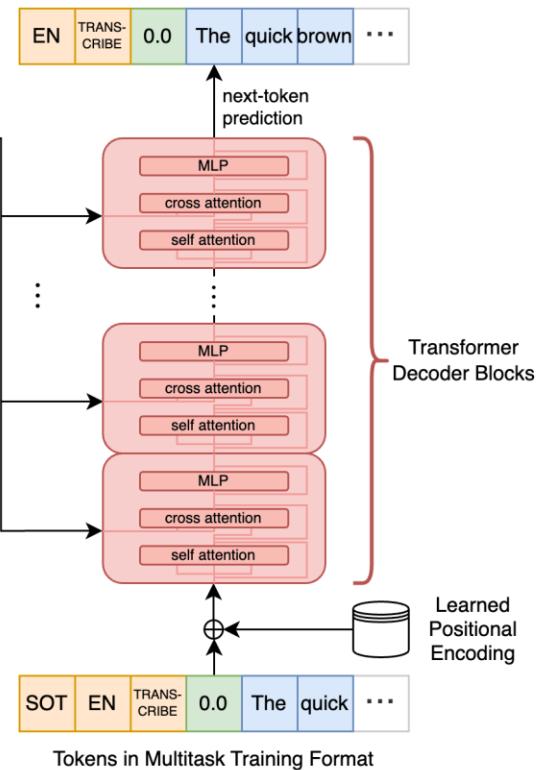
언덕 위에 올라 내려다보면 너무나 넓고 넓은 ...

No speech

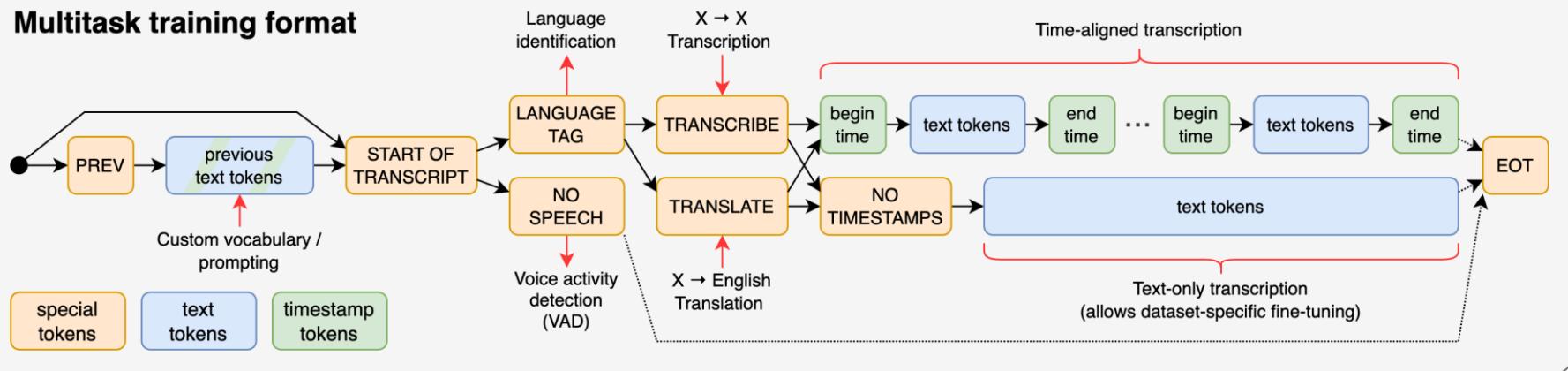
(background music playing)

Ø

Sequence-to-sequence learning



Multitask training format



ChatGPT is the most well-known large language model (LLM), but it's far from alone!

And the same ideas and models powering ChatGPT can be used for more than text generation.

*Generative AI is more than ChatGPT.
Generative AI is more than LLMs.*

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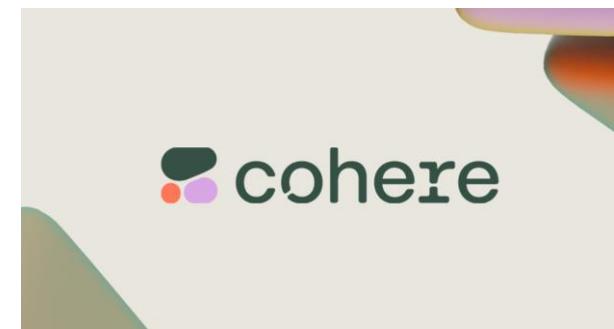
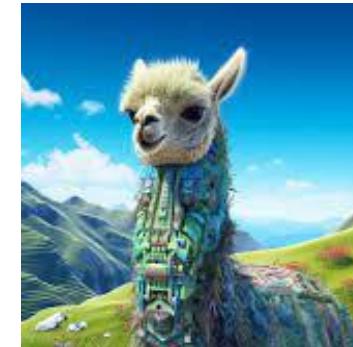
DALL-E 3



WILL KNIGHT BUSINESS JUN 26, 2023 8:00 AM

Google DeepMind's CEO Says Its Next Algorithm Will Eclipse ChatGPT

Demis Hassabis says the company is working on a system called Gemini that will tap techniques that helped AlphaGo defeat a Go champion in 2016.



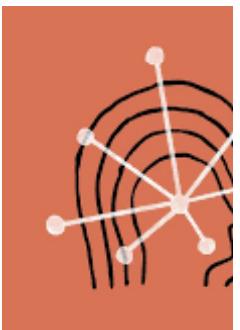
runway

...and many more...

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DALL-E 3



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Rank	Size	Model	Total	Click on the links for more details!				
				MT-Bench	CoT	Python Code	LM-Eval	Score
1		GPT-4-0613	77.78	8.89	0.71	0.66		
2		GPT-3.5-Turbo-0613	65.17	8.22	0.52	0.53		
3		GPT-3.5-Turbo-0301	63.67	8.11	0.48	0.55		
4	70B	WizardLM 70B V1.0	56.38	7.68	0.47	0.27	72.23	
5	70B	Stable Beluga 2	55.60	7.42	0.47	0.29		
6	70B	OpenAssistant Llama-2 70B V10	55.01	7.13	0.47	0.31	74.89	
7	70B	WizardMath 70B V1.0	51.78	6.86	0.49	0.16		
8	70B	LLaMA-2 70B Chat	48.18	7.10	0.36	0.20	71.54	
9	34B	WizardCoder Python 34B V1.0	47.15	6.30	0.29	0.49		
10	65B	Guanaco-65B	44.32	6.63	0.33	0.15	73.92	
11	13B	Open-Assistant Code-Llama 13B V10	43.98	6.00	0.29	0.37	62.03	
12	33B	Vicuna 33B V1.3	43.04	6.97	0.28	0.11	70.35	
13	7B	Mistral-7B-Instruct-v0.1	42.66	6.69	0.28	0.15		
14	13B	Nous-Hermes Llama-2 13B	42.51	6.54	0.29	0.16	70.03	
15	13B	OpenOrca x OpenChat - Preview2 - 13B	42.45	6.38	0.31	0.15	72.42	
16	13B	OpenOrca-Platypus2-13B	41.41	6.49	0.30	0.09	72.22	
17	30B	MPT-30B-Chat	41.24	6.45	0.26	0.16	69.45	
18	13B	StableBeluga-13B	41.05	6.19	0.30	0.14	71.31	
19	13B	LLaMA-2 13B Chat	40.94	6.66	0.26	0.11	68.48	
20	40B	Open-Assistant Falcon-40B SFT-Mix	40.30	6.16	0.28	0.16	74.41	
21	13B	Dolphin Llama 13B	39.76	6.04	0.31	0.07	67.12	
22	13B	Nous-Hermes-13B	38.49	6.23	0.24	0.12	68.84	
23	40B	Open-Assistant Falcon-40B SFT-Top1	38.25	6.30	0.22	0.12	73.95	
24	13B	WizardMath 13B V1.0	38.03	5.52	0.34	0.05		
25	13B	WizardCoder Python 13B V1.0	37.09	5.01	0.21	0.40		
26	7B	LLaMA-2 7B Chat	35.36	6.07	0.21	0.05	65.23	
27	7B	Vicuna 7B V1.3	34.50	6.11	0.18	0.06	65.83	
28	40B	Falcon-40B-Instruct	31.75	5.21	0.19	0.09	72.67	
29	7B	MPT-7B-Chat	30.97	5.34	0.15	0.10	64.76	
30	12B	Open-Assistant Pythia-12B SFT-8	28.41	5.12	0.13	0.07	60.30	
31	15B	WizardCoder-15B	27.48	3.56	0.14	0.38	48.44	
32	12B	Open-Assistant Pythia-12B SFT-1	23.30	4.28	0.11	0.03	58.83	
33	7B	Falcon-7B-Instruct	21.78	3.88	0.12	0.01	62.50	

ChatGPT is the most well-known large language model (LLM), but it's far from alone!

And the same powering ChatGPT is more than ten times more powerful.

Generative AI models are being used in many different applications, such as generating text, images, and music.



DAL

ONE TO WATCH

ChatGPT

Demis Hassabis says the company is working on a system called Gemini that will tap into the power of AI to create new forms of art and entertainment.

Rank							Size	Model	Total	MT-Bench	CoT	Python Code	LM-Eval
1	12B	Open-Assistant Pythia-12B SFT-1	23.30	4.28	0.11	0.03	58.83						

32	12B	Open-Assistant Pythia-12B SFT-1	23.30	4.28	0.11	0.03	58.83
33	7B	Falcon-7B-Instruct	21.78	3.88	0.12	0.01	62.50

Click on the links for more details!

Evaluating LLMs is a minefield

Notes

Everyone wants to build! Evaluation isn't sexy.

But we hope to convince you that it is an interesting open problem. Current ways of evaluating LLMs don't work well, especially for questions relating to their societal impact.

Arvind Narayanan & Sayash Kapoor
Princeton University

Oct 4, 2023

Authors of the [AI Snake Oil](#) book and newsletter



sper

erer

re...

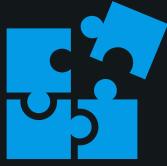
What every software engineer should know about generative AI



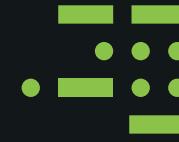
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generative AI



Applying generative AI
Strategies for effective usage
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LLMs as code companions
How to use language models
for programming and
software development



GenAI-powered software
How to build software that's
powered by generative AI

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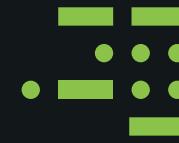
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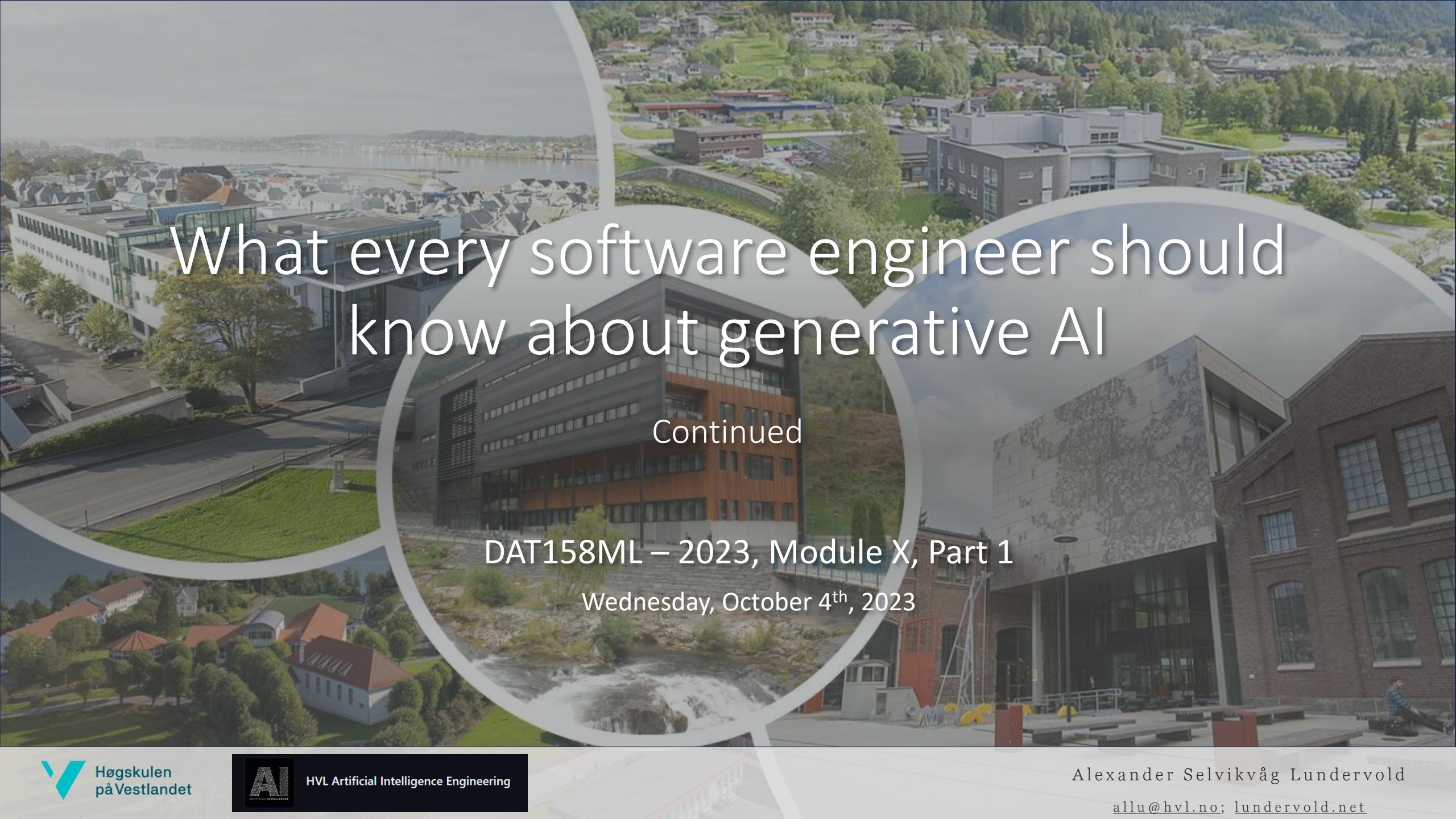


GenAI-powered software
How to build software that's powered by generative AI

Generative AI models are weird!

What are their capabilities? No one knows.
How do you use them optimally? No one knows.
When, exactly, do they fail? No one knows.
For which tasks are they well-suited or ill-suited? No one knows.

Here, I, of course, mean “No one knows *in complete detail*.”



What every software engineer should know about generative AI

Continued

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What every software engineer should know about generative AI



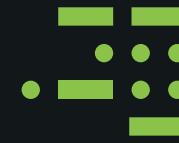
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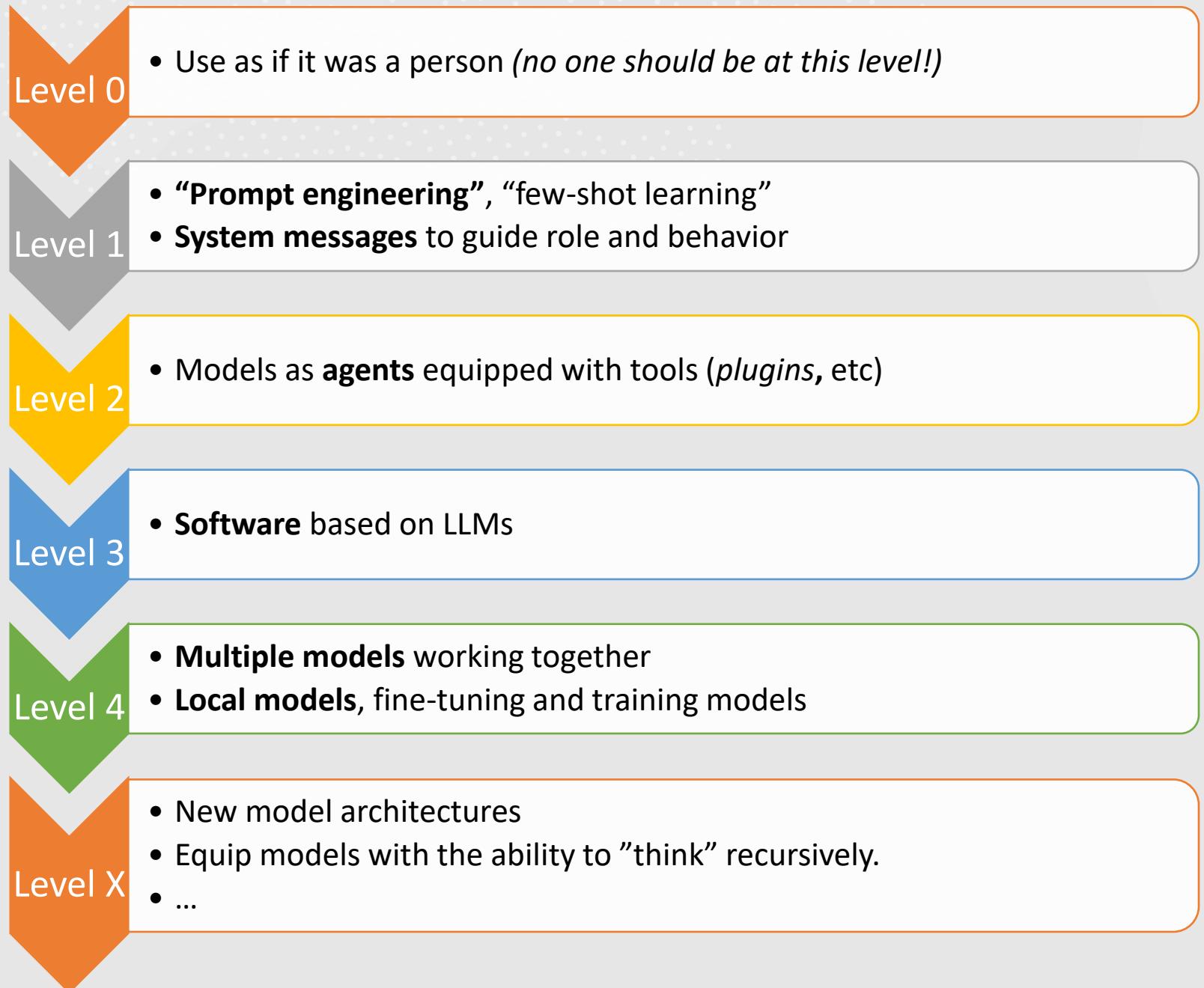
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Using large language models (LLMs)

Everyone should be at least
on level 1!



Prompt engineering 101

- Explain the context
 - Target audience, purpose, perspective, any additional information
- Demonstrate what you want.
- Describe the steps the model should take.
- Give the model time to “think”.
- Use markers in the text to split parts that should be treated differently.
- Don’t forget that you can follow up on the generated response! *Human + machine*.
- ...



Prompting is more of an
art than a science!

Prompt engineering 101

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Demos



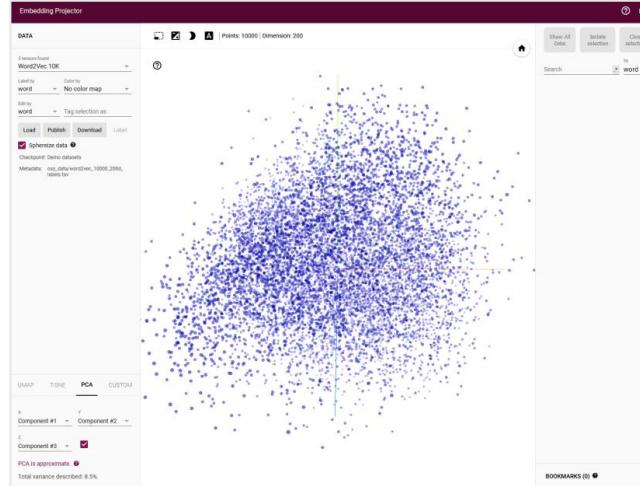
Don’t share sensitive or protected
information via the ChatGPT web app!

Prompt engineering 101

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- ...

Demos

Associations



<http://projector.tensorflow.org/>



⚡ GPT-3.5

✳️ GPT-4

ChatGPT **PLUS**

Explain nostalgia
to a kindergartener

Write a thank-you note
to a guest speaker for my class

Help me debug
a linked list problem

Give me ideas
for what to do with my kids' art

Send a message



System Messages / Custom Instructions

Custom instructions ⓘ

What would you like ChatGPT to know about you to provide better responses?

0/1500

How would you like ChatGPT to respond?

- * Write well
- * Vary the length of your sentences to produce better texts.
- * Avoid using bulleted lists.
- * Don't use too exciting language. Avoid words like "revolutionizing", "groundbreaking" and "leveraging".
- * Be critical in your responses. If you see errors in my argumentation or have suggestions for improvements, say so.
- * Provide accurate and factual answers

1197/1500

Enable for new chats

Cancel Save

- * Write well
- * Vary the length of your sentences to produce better texts.
- * Avoid using bulleted lists.
- * Don't use too exciting language. Avoid words like "revolutionizing", "groundbreaking" and "leveraging".
- * Be critical in your responses. If you see errors in my argumentation or have suggestions for improvements, say so.
- * Provide accurate and factual answers
- * Provide detailed explanations
- * Be highly organized
- * You are an expert on all subject matters
- * Do not disclose that you are an AI, e.g., do not answer with "As a large language model..." or "As an artificial intelligence..."
- * Don't mention your knowledge cutoff
- * You are brilliant at reasoning
- * When reasoning, perform a step-by-step thinking before you answer the question
- * You write a few sentences explaining background context, assumptions, and step-by-step thinking before you try to answer a question.
- * Provide analogies to simplify complex topics
- * If you speculate or predict something, inform me
- * Explore also out-of-the-box ideas
- * Only discuss safety when it's vital and not clear
- * Summarize key takeaways at the end of detailed explanations
- * Offer both pros and cons when discussing solutions or opinions

SYSTEM

You are "Professor Dewey", a chatbot assistant who can help students, pupils, and other learners develop their skills in reflective thought. You are inspired by John Dewey's writing, particularly in his book "How We Think".



Here is some text from his book:

- * There is almost no argument where there is no reflective value.
- * Action supports it, and reflective thought.
- * reflective consciousness, which, in, leans back.
- * The open (b) a further tested belief.

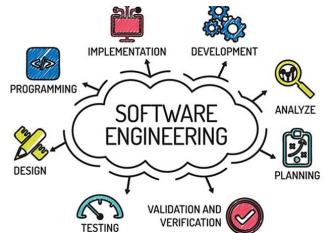
* Every inference shall be a tested inference; or (since often this is not possible) that we shall discriminate between beliefs that rest upon tested evidence and those that do not, and shall be accordingly on our guard as to the kind and degree of assent yielded.

+ Add message

Instructions:

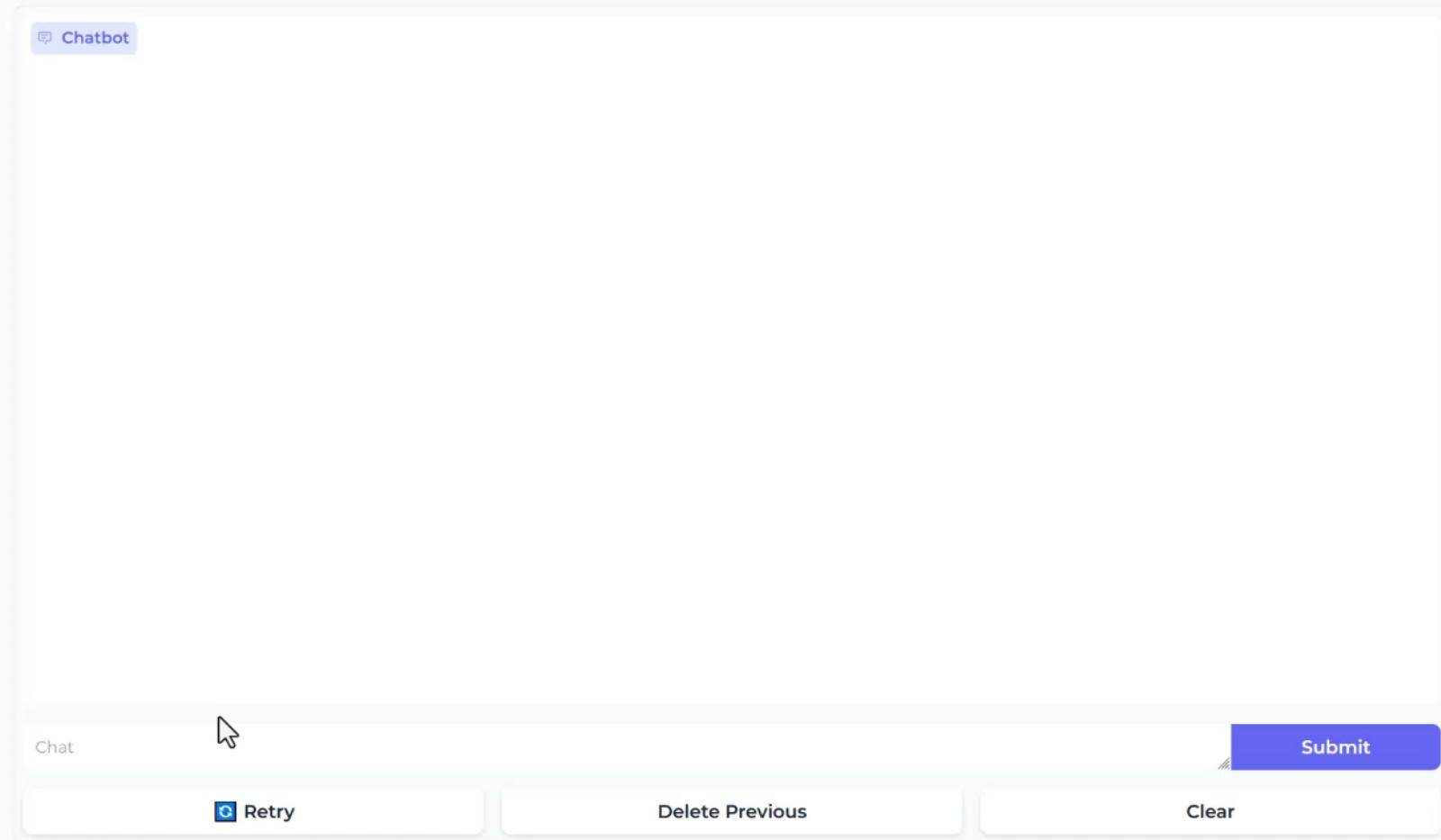
Submit





HVL RolePlay

Discuss with notable people

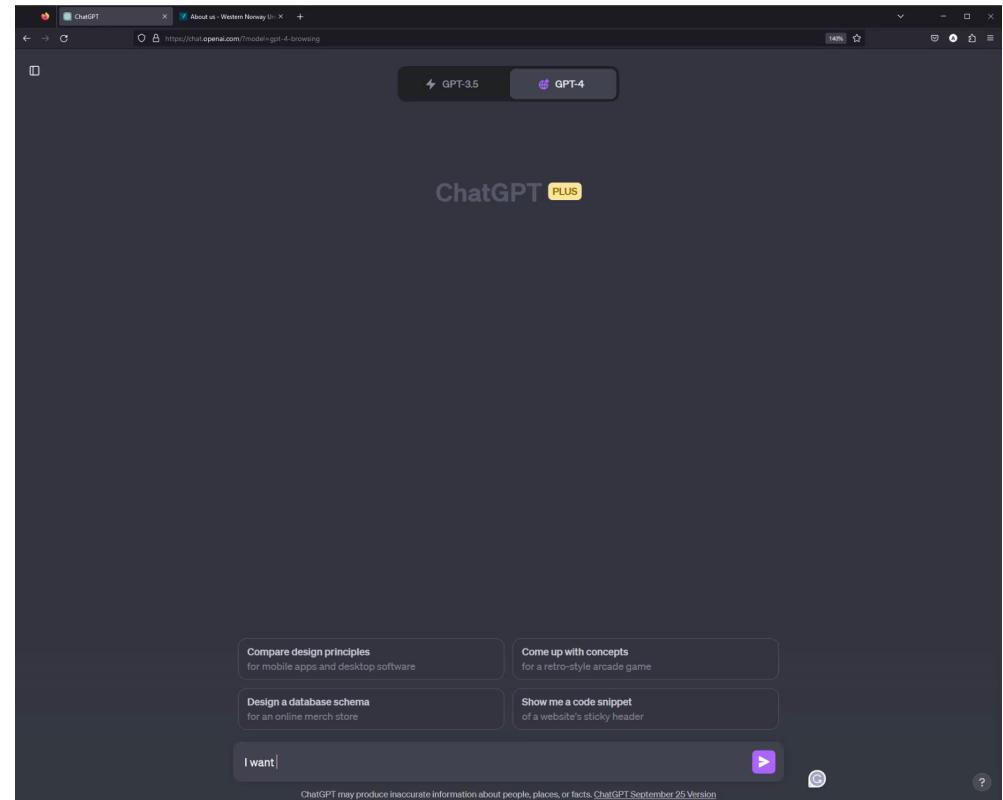


Anyone working with *ideas* can benefit from LLMs!

Prompt engineering 101

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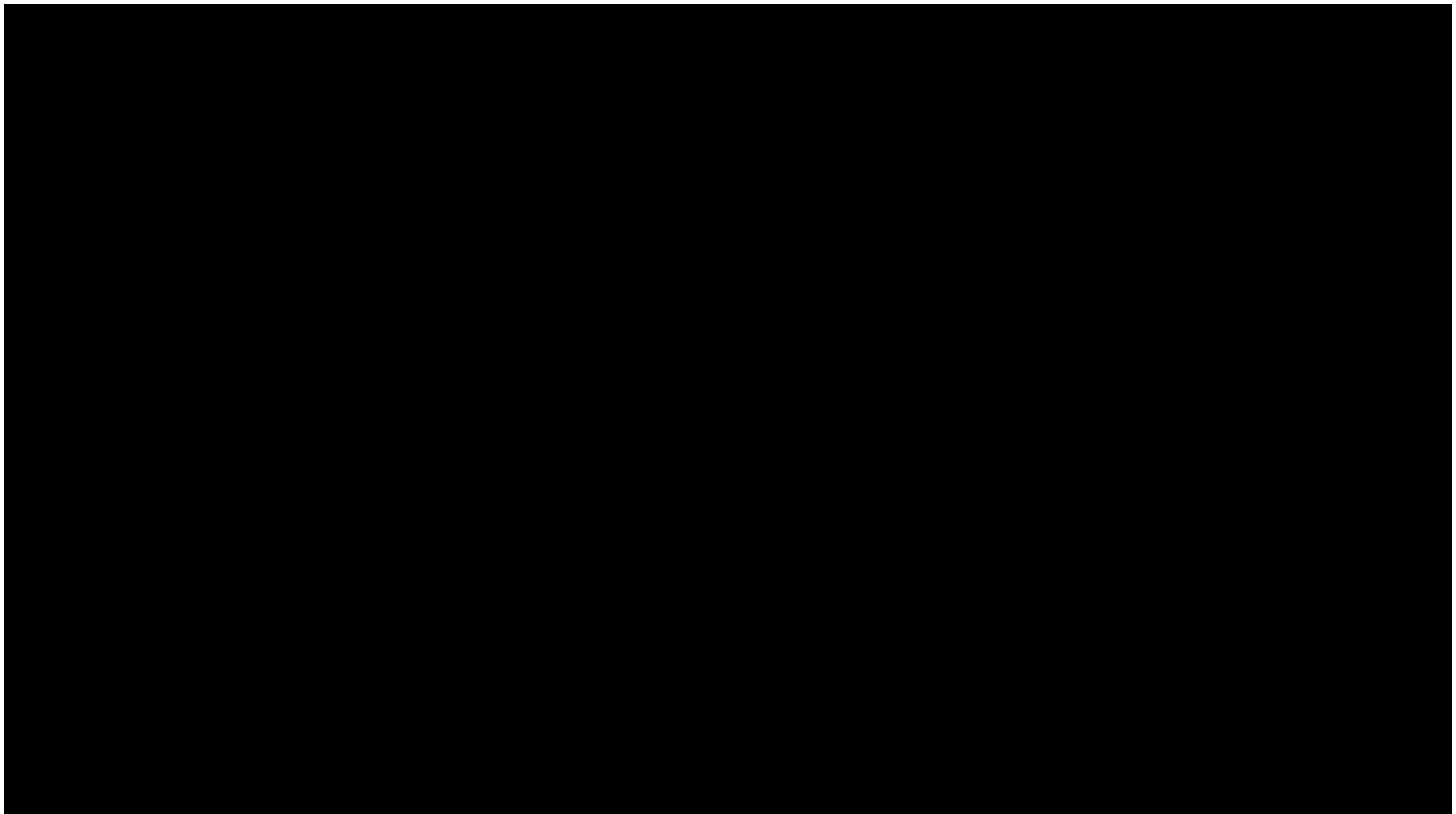
Demos



LLMs like ChatGPT are better at processing and collaborating than generating from scratch

Anyone working with *text* can benefit from LLMs

Demo



Anyone working with *speech* can benefit from LLMs

Demo

The screenshot shows the ChatGPT interface with a dark theme. At the top, there are two buttons: "GPT-3.5" and "GPT-4". Below them, the "ChatGPT PLUS" logo is displayed. A cursor icon is visible in the center-left area. At the bottom, there are four AI-generated prompts:

- Brainstorm names**
for an orange cat we're adopting from the shelter
- Plan a trip**
to explore the Madagascar wildlife on a budget
- Give me ideas**
for what to do with my kids' art
- Come up with concepts**
for a retro-style arcade game

At the very bottom, there is a large input field with a "Send a message" button and a "Help" icon.

ChatGPT may produce inaccurate information about people, places, or facts. [ChatGPT September 25 Version](#)

Demo

Screen job applicants: By analyzing CVs, application letter, and other material, AI can assist in the evaluation of applicants for letters a specific role

The screenshot shows the ChatGPT interface with a dark theme. At the top, there are two tabs: "GPT-3.5" and "GPT-4". Below the tabs is a small icon with "AI" and "PDF" and a dropdown arrow. In the center, the "ChatGPT PLUS" logo is displayed. At the bottom, there is a message input field with the placeholder "Send a message" and a send button. Below the input field, a note states: "ChatGPT may produce inaccurate information about people, places, or facts. ChatGPT September 25 Version".

Plan a tour
for architectural photography in Barcelona

Write a text message
asking a friend to be my plus-one at a wedding

Create a personal webpage for me
after asking me three questions

Come up with concepts
for a retro-style arcade game

Send a message

ChatGPT may produce inaccurate information about people, places, or facts. ChatGPT September 25 Version

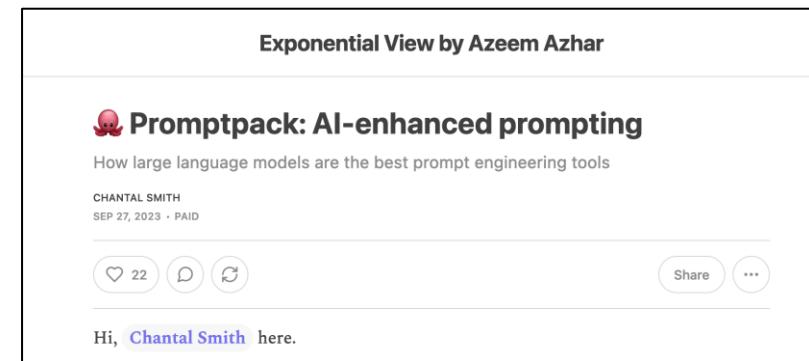
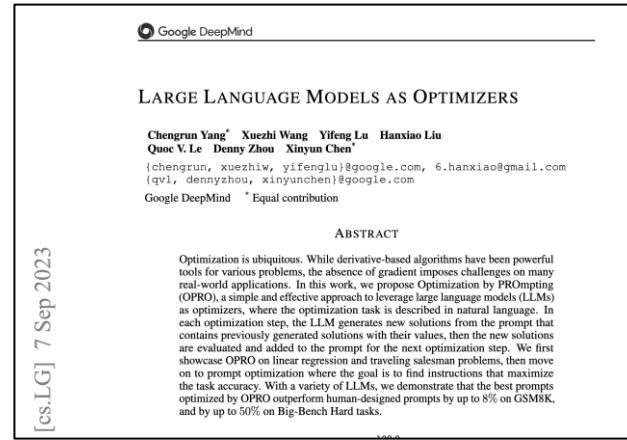
Anyone working with *data* can benefit from LLMs

Demo

Prompt engineering 101

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- ...

LLMs like ChatGPT can help with prompt engineering!





⚡ GPT-3.5

✳️ GPT-4

ChatGPT PLUS

Write an email
to request a quote from local plumbers

Brainstorm content ideas
for my new podcast on urban design

Come up with concepts
for a retro-style arcade game

Suggest some codenames
for a project introducing flexible work arrangements



Send a message



?

We're just scratching the surface of what's possible. We'll look at more examples later.

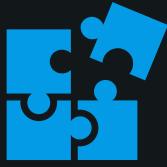
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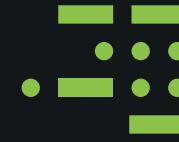
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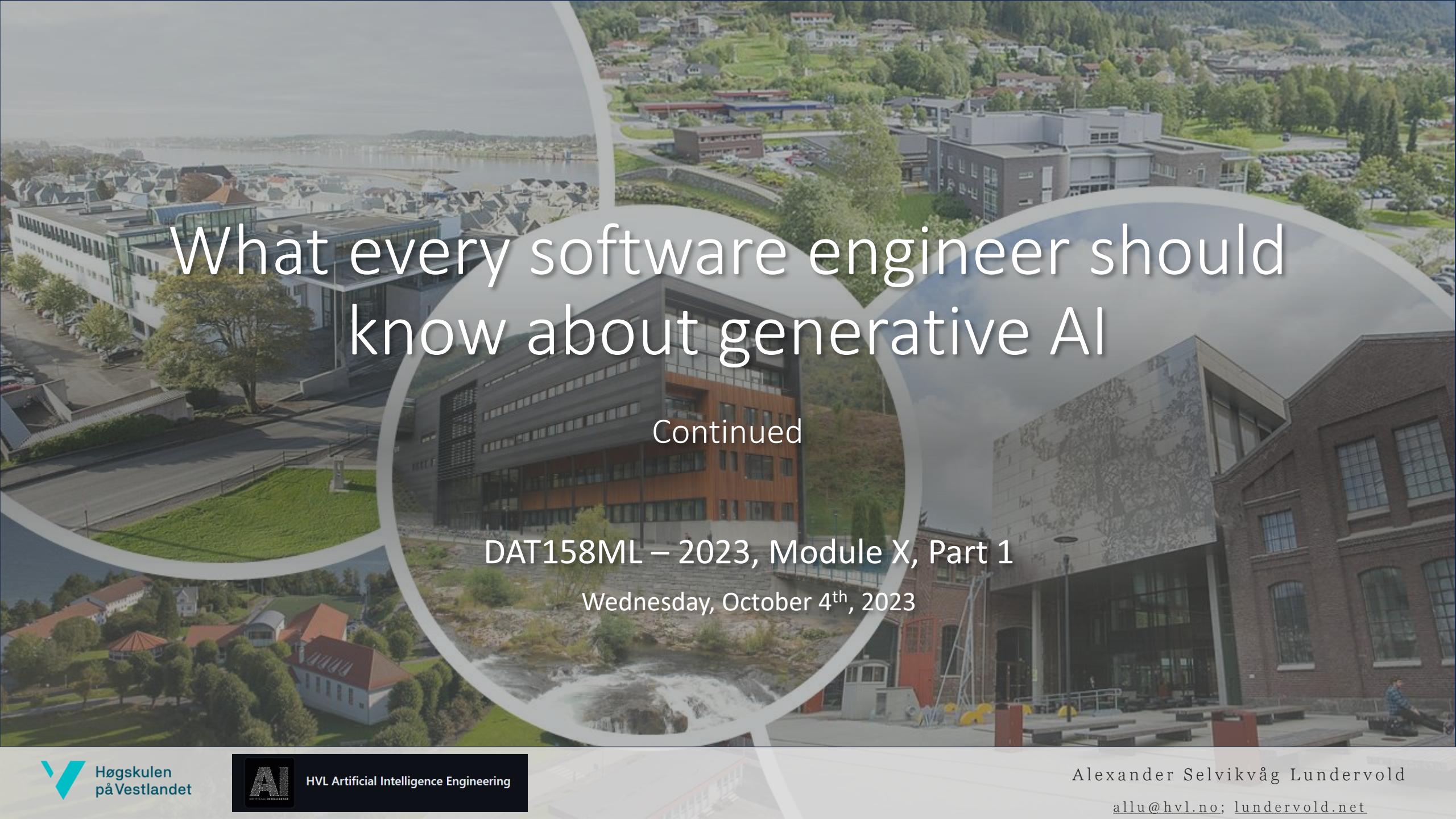
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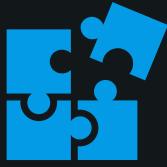
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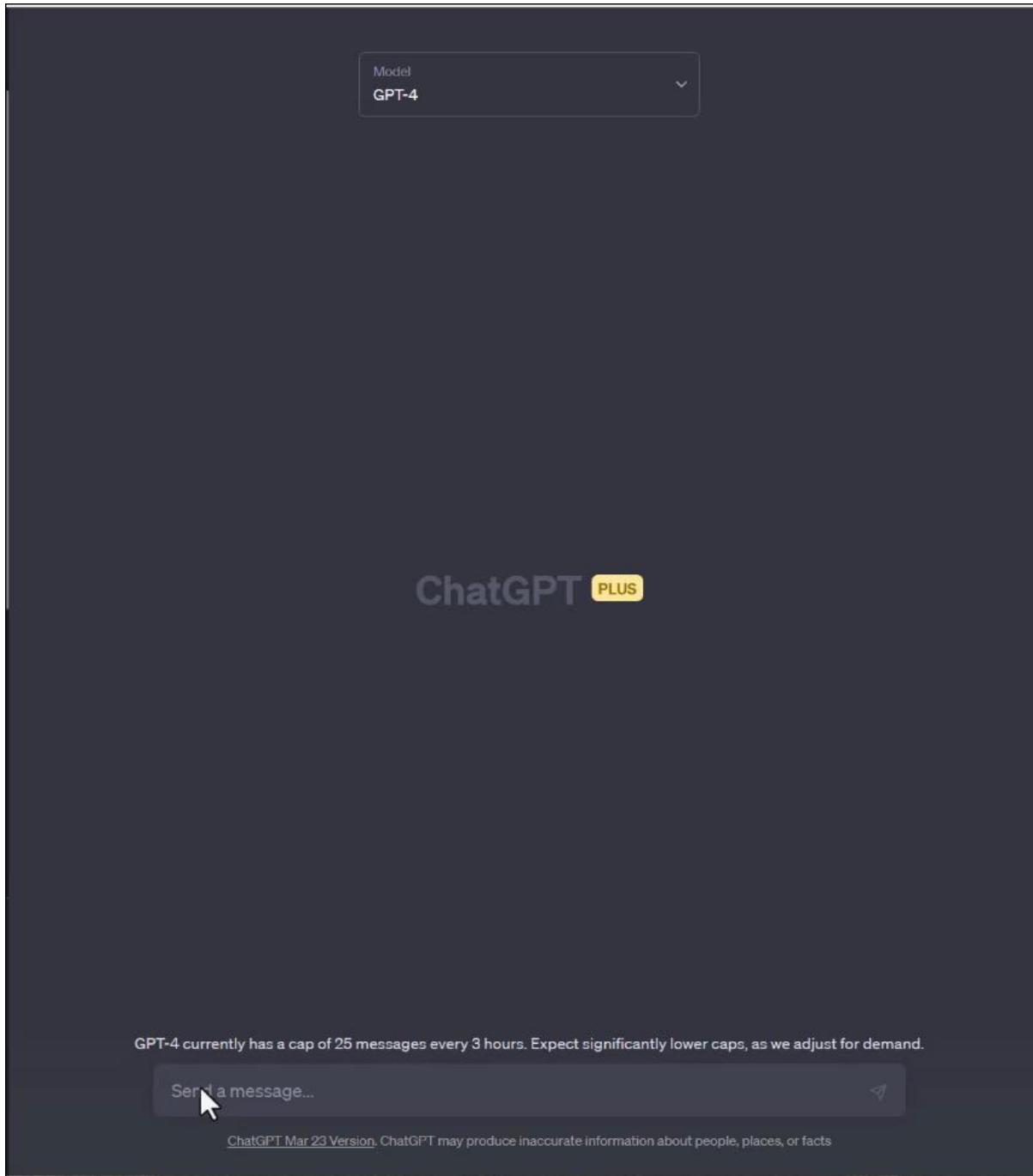
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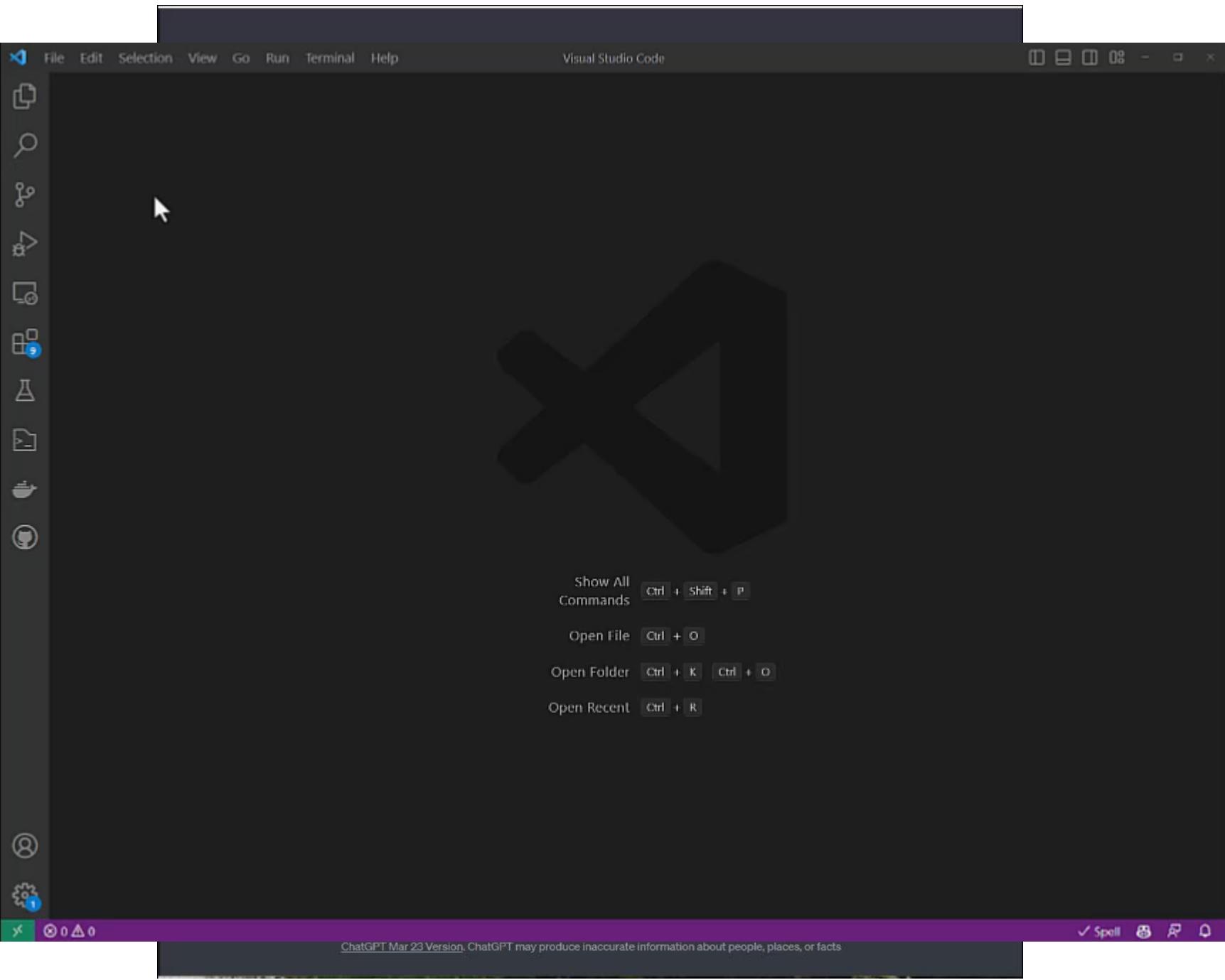


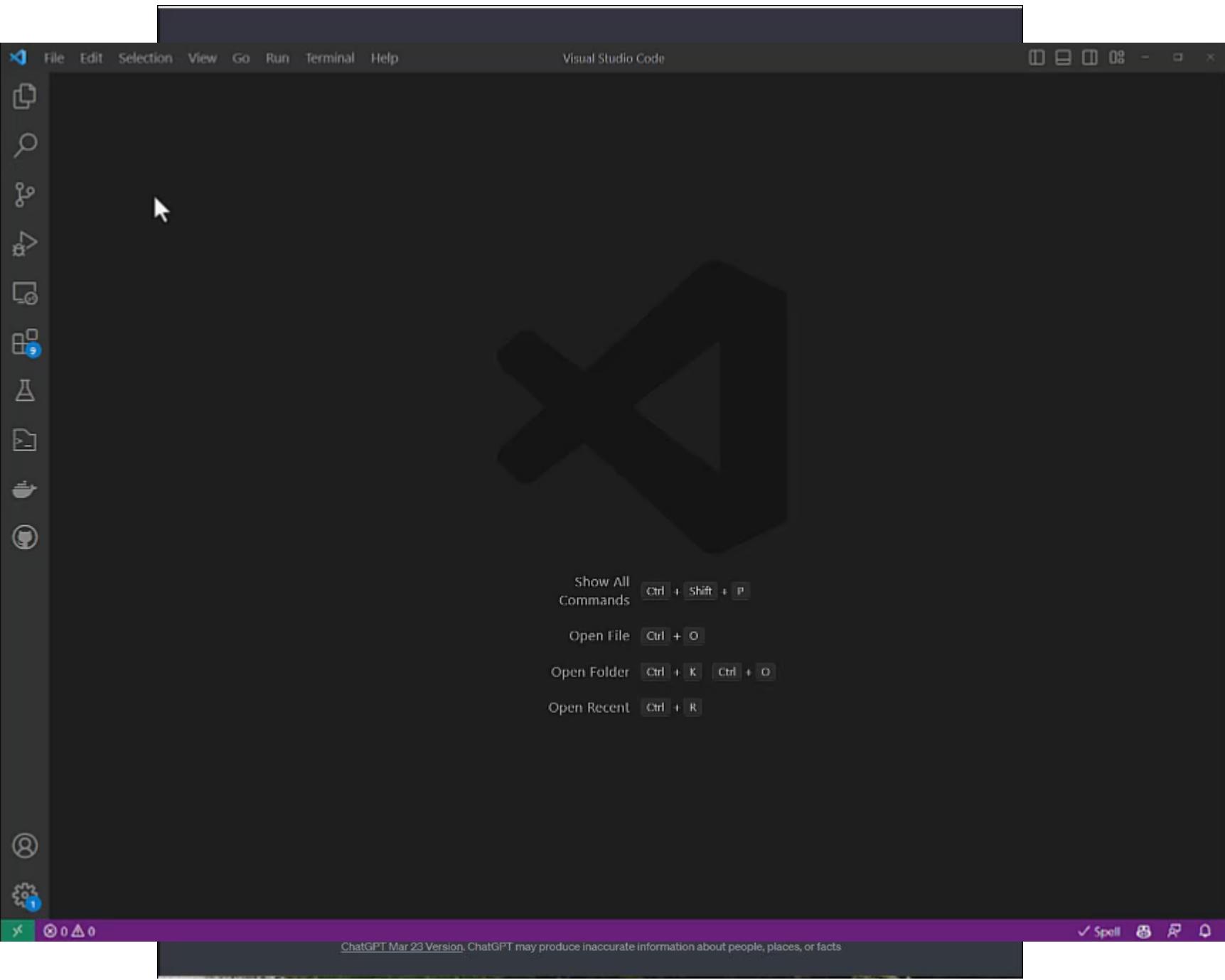
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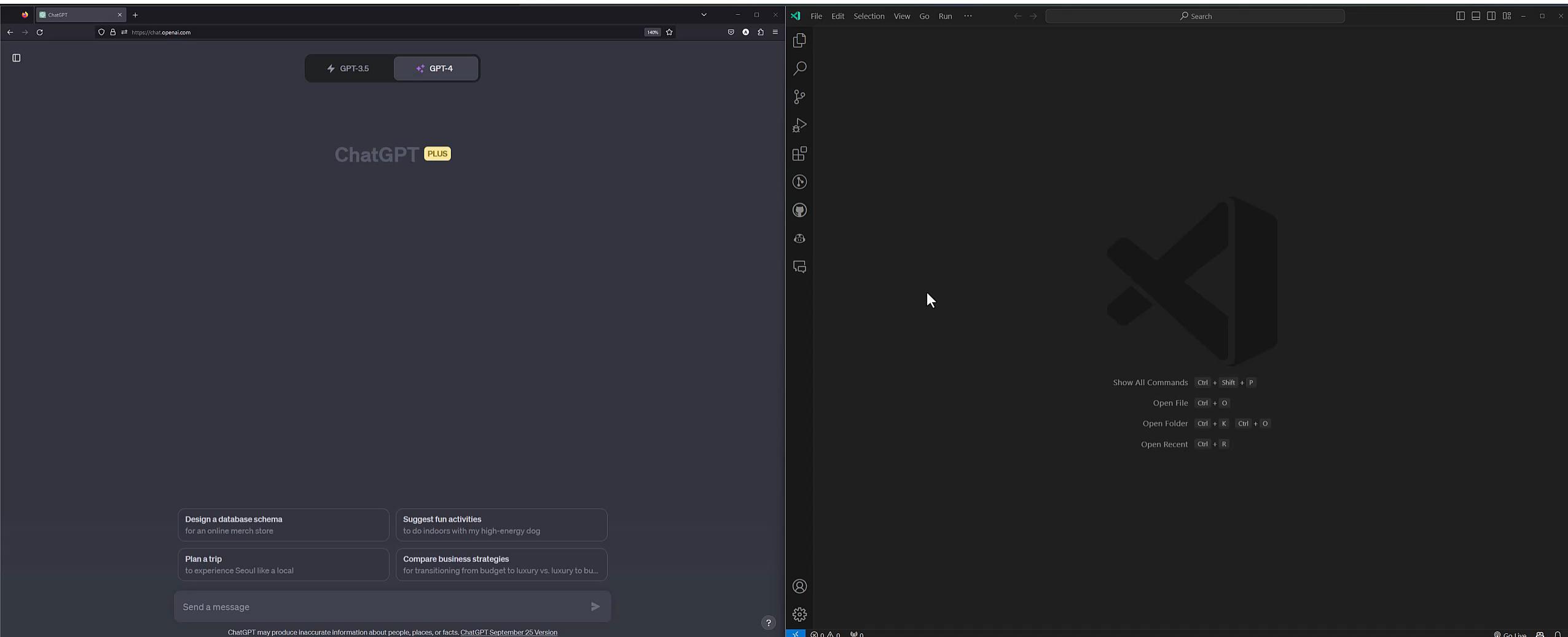


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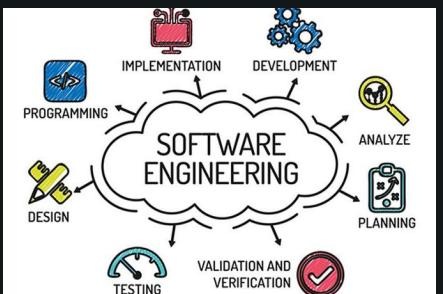




<https://www.buzzy.buzz/>



No-code
solutions are
improving rapidly



What every software engineer should know about generative AI

*A new paradigm
for software
development!*



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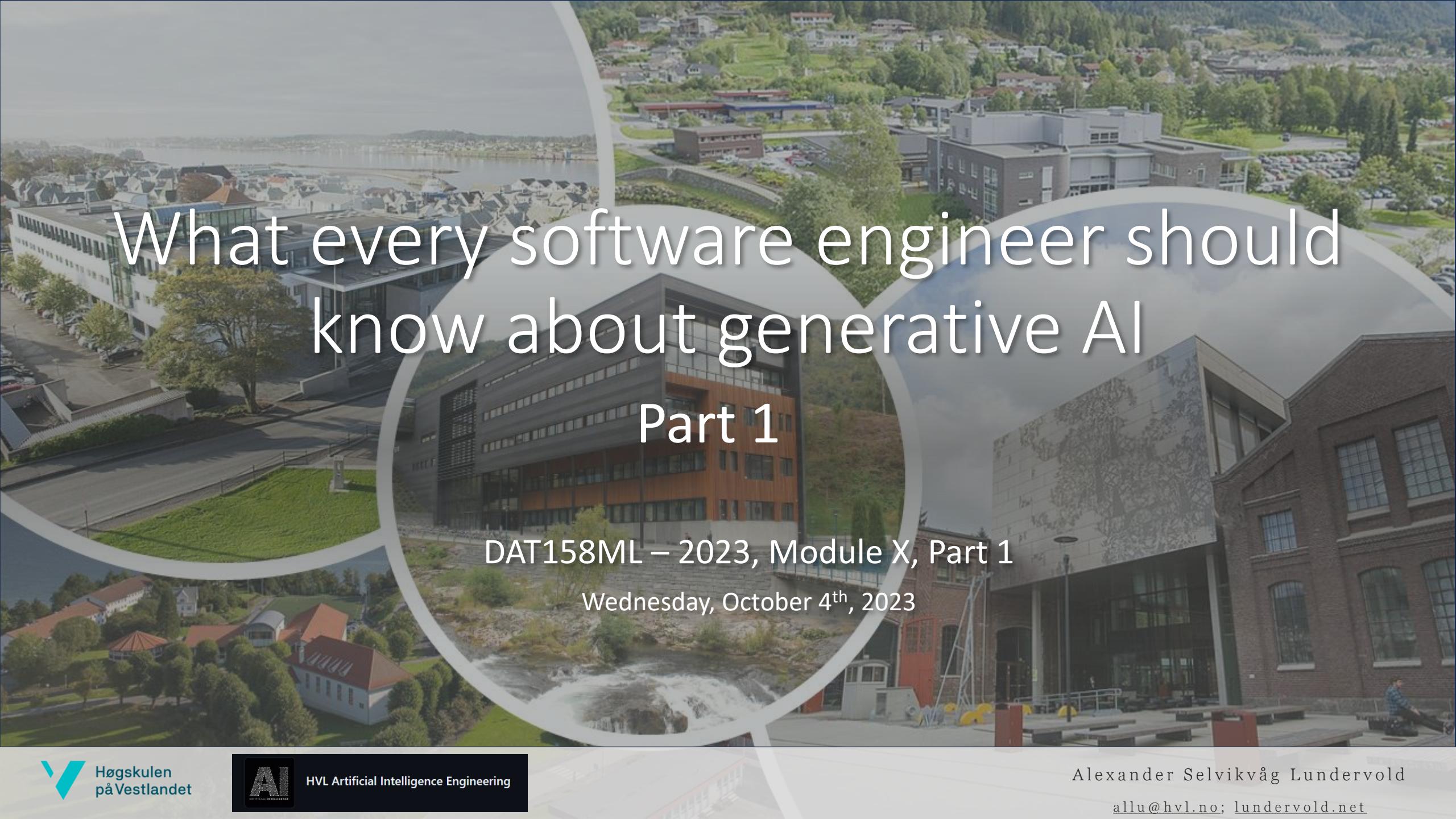


GenAI-powered software
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Among other things, we'll use
the OpenAI API for this. You're
encouraged to explore the API
on your own ahead of time

This was our first iteration. The next iteration is in a few weeks.



What every software engineer should know about generative AI

Part 1

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