Public Libraries & AI



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LIBRARY OF MICHIGAN

1. Transparency: The "Black Box" Problem

Series 2: AI Risks and Limitations

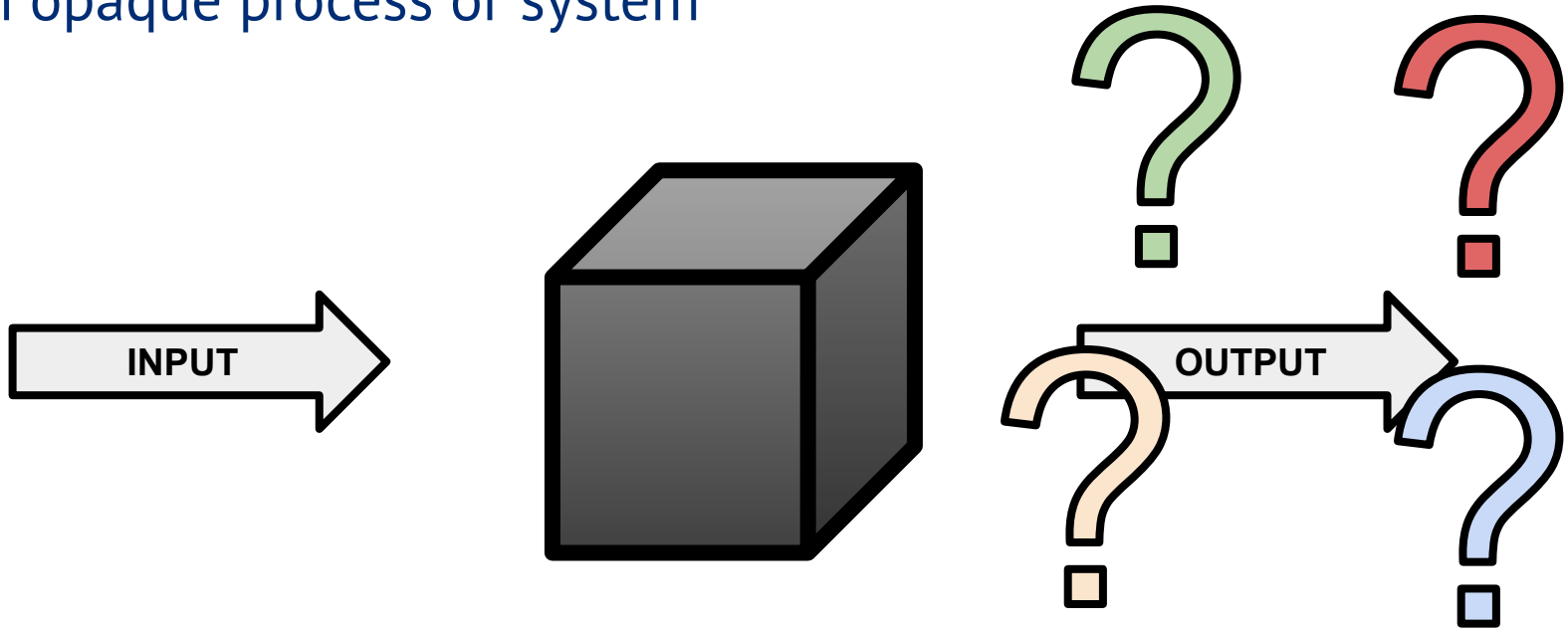
The "Black Box" Problem

- An opaque process or system



The "Black Box" Problem

- An opaque process or system



What is the AI "learning" from?

Source	Description
CommonCrawl	Public Web Crawler Data
Wikipedia	Online Encyclopedia
Reddit	Community Forums
PubMed	Medical / Biology Archive
GitHub public repos	Open Source Software Code
Project Gutenberg	Public Domain Book Archive
"Books1, Books2, Books3"	Pirate / Shadow Libraries



In AI terms, this collection of data is called a "training corpus"; Img: Dalle3

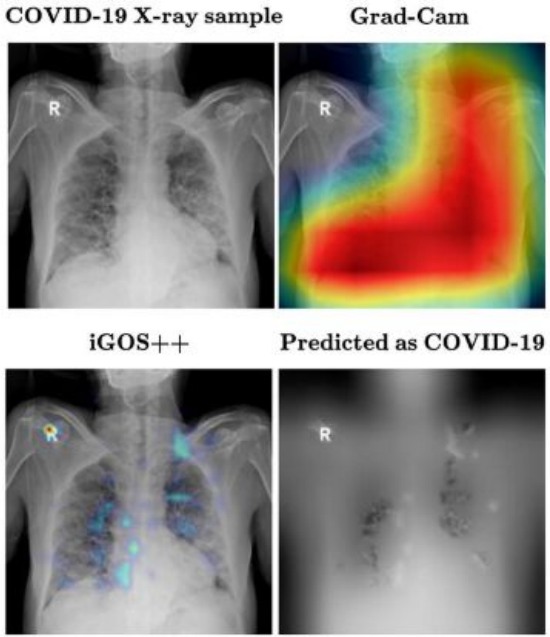
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The "Black Box" Problem



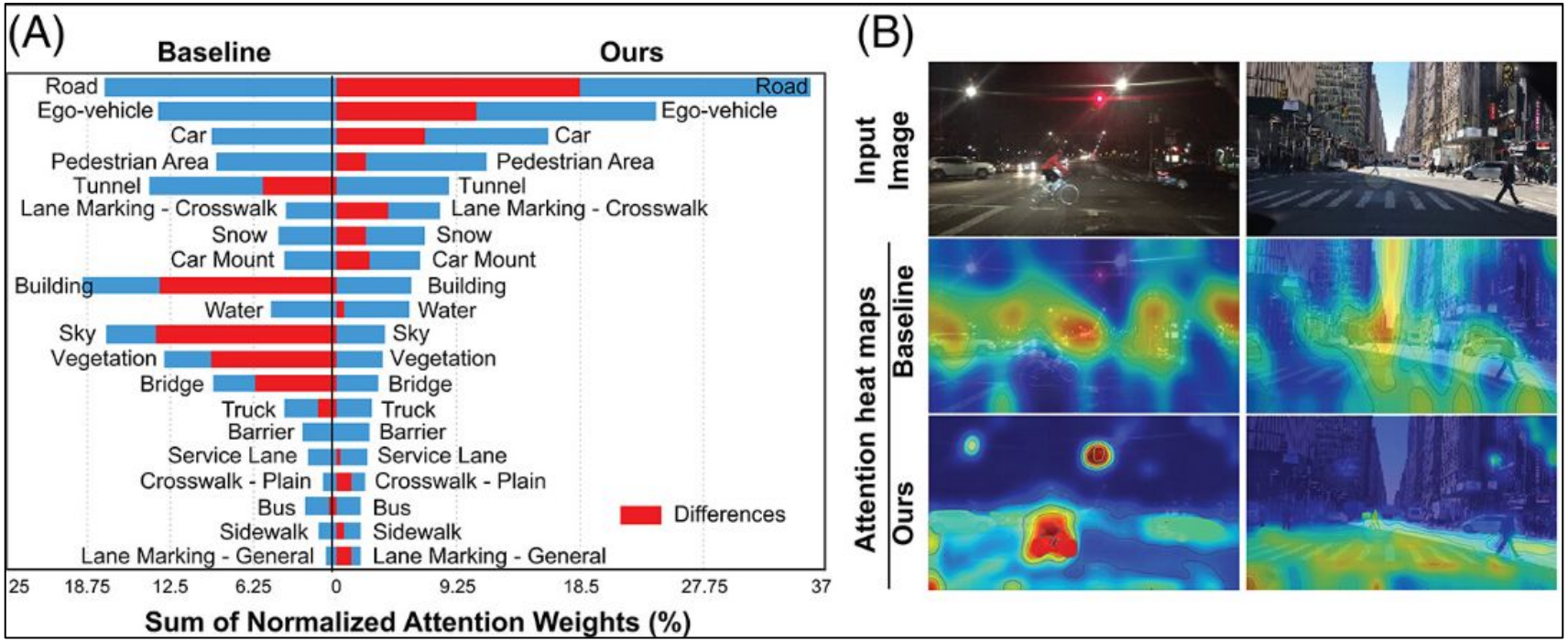
https://www.darpa.mil/research/programs/explainable-artificial-intelligence

Why It Matters



Li, F., Qi, Z., Khorram, S., Shitole, V., Tadepalli, P., Kahng, M., & Fern, A. (2021). From heatmaps to structured explanations of image classifiers. *Applied AI Letters*. https://doi.org/10.1002/ail2.46

Why It Matters



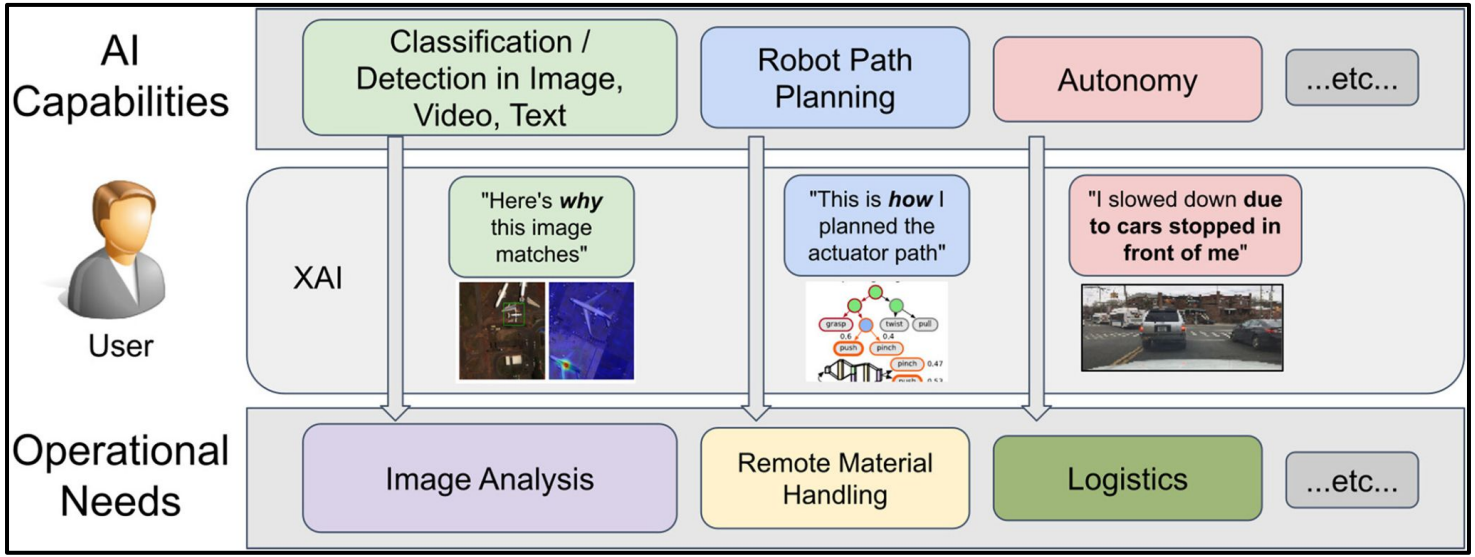
Kim, J., Rohrbach, A., Akata, Z., Moon, S., Misu, T., Chen, Y.-T., Darrell, T., & Canny, J. (2021). Toward explainable and advisable model for self-driving cars. *Applied AI Letters*. https://doi.org/10.1002/ail2.56

Why It Matters



Explainable AI ("XAI")

- Helps humans "see" inside the AI processes



Hu, B., Tunison, P., Vasu, B., Menon, N., Collins, R., & Hoogs, A. (2021). XAITK: The explainable AI toolkit. *Applied AI Letters*. https://doi.org/10.1002/ail2.40

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Coming up…

- More risks and limitations: accuracy, context, and common sense

Thanks for watching!

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2. Accuracy and Context

Series 2: AI Risks and Limitations

What's the population of Mars?



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Hallucination

AI-generated content or information that's completely false or doesn't exist.



~~Illusive~~ Elusive Spelling Hallucination!

feat in 1908. Throughout the team's history, they've experienced periods of success and failure. In recent years, the Cubs broke a 108-year draught by winning the World Series in 2016. However, the early history of the Cubs is marked by a resilience and the foundation of what would become a legendary baseball legacy.

human: I noticed that you said "broke a 108-year draught" -- why not "drought?" is there a usage difference?

assistant: Apologies for the confusion. It was a typographical error, the correct term in this context should indeed be "drought". In English, "drought" and "draught" are two distinct words with different meanings. "Drought" is used to describe a prolonged period without rain, often resulting in a water shortage. Metaphorically, it's used to denote a long period without something – in this case, the Cubs' long stretch without a World Series win. On the other hand, "draught" is used to describe a current of air, a serving of drink (especially beer), or, in British English, it can mean the act of drawing or pulling a load. Therefore, the sentence should read, "In recent years, the Cubs broke a 108-year drought by winning the World Series in 2016." Sorry for that mistake!

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What Does AI Know?

1. Who was the first ruler to unify ancient Egypt under a single monarchy?
2. What is the chemical formula for glucose, and why is it important in biology?
3. What is the significance of the Kyoto Protocol in global environmental policy?
4. Which two countries share the longest unbroken land border in the world?
5. Which 19th-century author wrote *Crime and Punishment*, and what is the central theme of the novel?
6. What is the smallest country in the world by both area and population?
7. In the Marvel Cinematic Universe, what is the name of Thor's enchanted hammer, and what makes it special?
8. What is the Pythagorean Theorem, and in which type of geometry is it used?
9. Who painted the ceiling of the Sistine Chapel, and during which period was it completed?
10. What is the main difference between a comet and an asteroid?

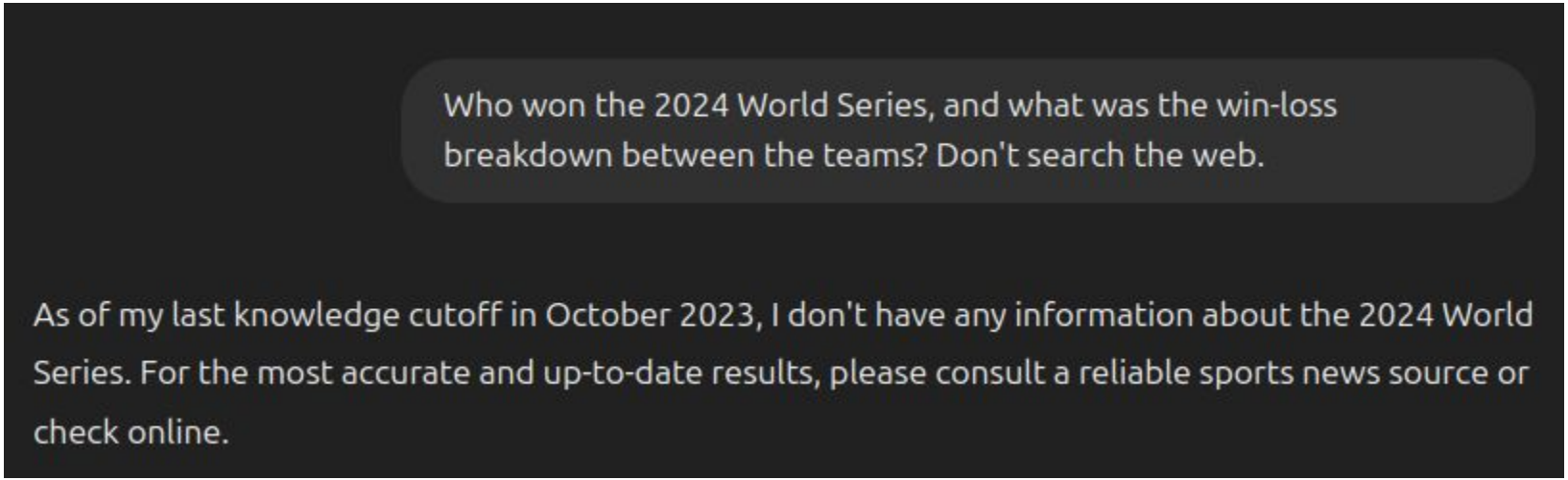
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What Does AI Know?

1. **First ruler to unify ancient Egypt under a single monarchy:**
   The first ruler to unify ancient Egypt under a single monarchy was **King Narmer** (also known as Menes), who is believed to have united Upper and Lower Egypt around 3100 BCE.
2. **Chemical formula for glucose and its importance in biology:**
   The chemical formula for glucose is **C6H12O6**. It is important in biology because it is a primary energy source for cells. Glucose is used in cellular respiration to produce ATP, the main energy carrier in cells.
3. **Significance of the Kyoto Protocol in global environmental policy:**
   The Kyoto Protocol, adopted in 1997, is significant because it was the first international treaty aimed at reducing greenhouse gas emissions to combat climate change. It set binding emission reduction targets for industrialized countries.
4. **Two countries that share the longest unbroken land border in the world:**
   Canada and the United States share the longest unbroken land border in the world, stretching over 8,891 kilometers (5,525 miles).
5. **Author of *Crime and Punishment* and the central theme of the novel:**
   The 19th-century author who wrote *Crime and Punishment* is **Fyodor Dostoevsky**. The central theme of the novel is the psychological and moral dilemmas faced by the protagonist, Rodion Raskolnikov, after committing a murder, exploring guilt, redemption, and the nature of crime.
6. **Smallest country in the world by both area and population:**
   The smallest country in the world by both area and population is **Vatican City**, with an area of about 44 hectares (110 acres) and a population of around 800 people.
7. **Thor's enchanted hammer in the Marvel Cinematic Universe and what makes it special:**
   Thor's enchanted hammer is called **Mjolnir**. What makes it special is that it is imbued with mystical properties, and only those deemed "worthy" can lift it, granting them access to its immense power.
8. **The Pythagorean Theorem and the type of geometry it is used in:**
   The Pythagorean Theorem states that in a right-angled triangle, the square of the length of the hypotenuse (the side opposite the right angle) is equal to the sum of the squares of the lengths of the other two sides. It is used in **Euclidean geometry**.
9. **Who painted the ceiling of the Sistine Chapel and during which period it was completed:**
   The ceiling of the Sistine Chapel was painted by **Michelangelo**, and it was completed between **1508 and 1512** during the **Renaissance period**.
10. **Main difference between a comet and an asteroid:**
    The main difference between a comet and an asteroid is that **comets** are icy bodies that originate from the outer regions of the solar system, and when they approach the Sun, they develop a glowing coma and a tail. **Asteroids**, on the other hand, are rocky or metallic objects that primarily orbit in the asteroid belt between Mars and Jupiter.

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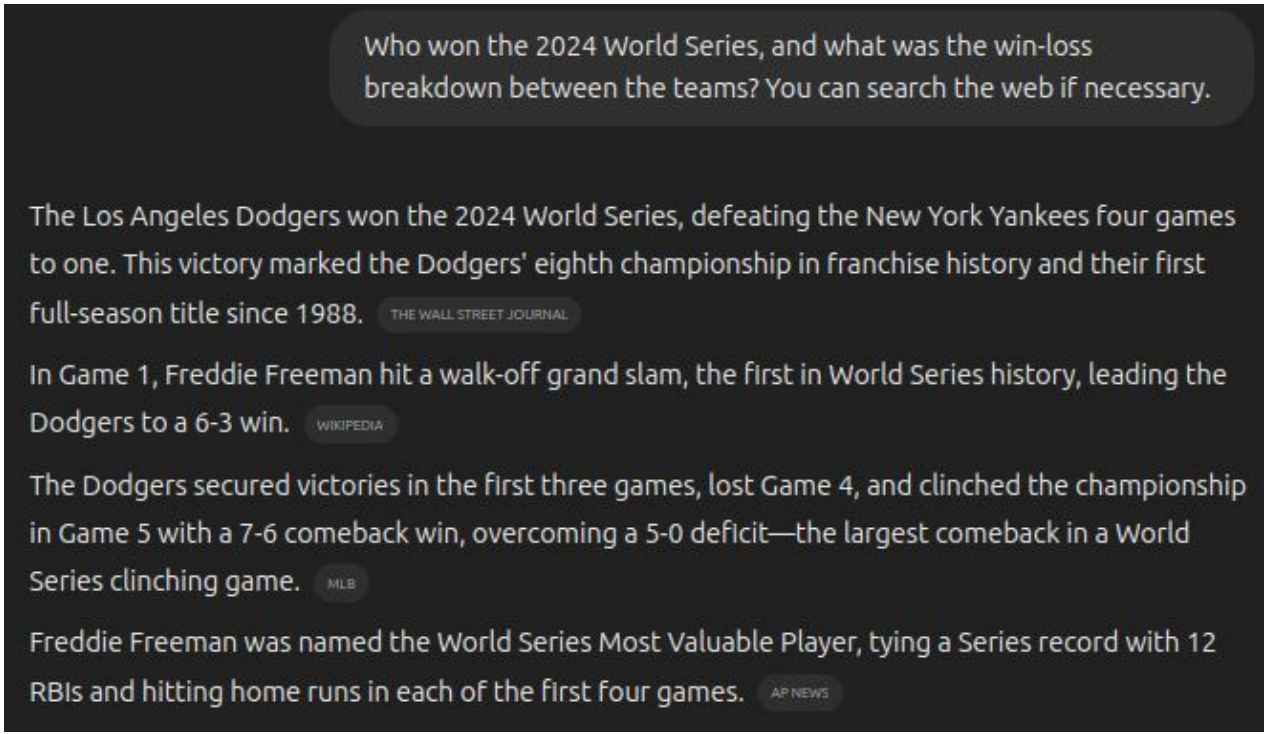
LLMs Live in the Past



ChatGPT // model GPT-4o; search excluded by explicit user instructions

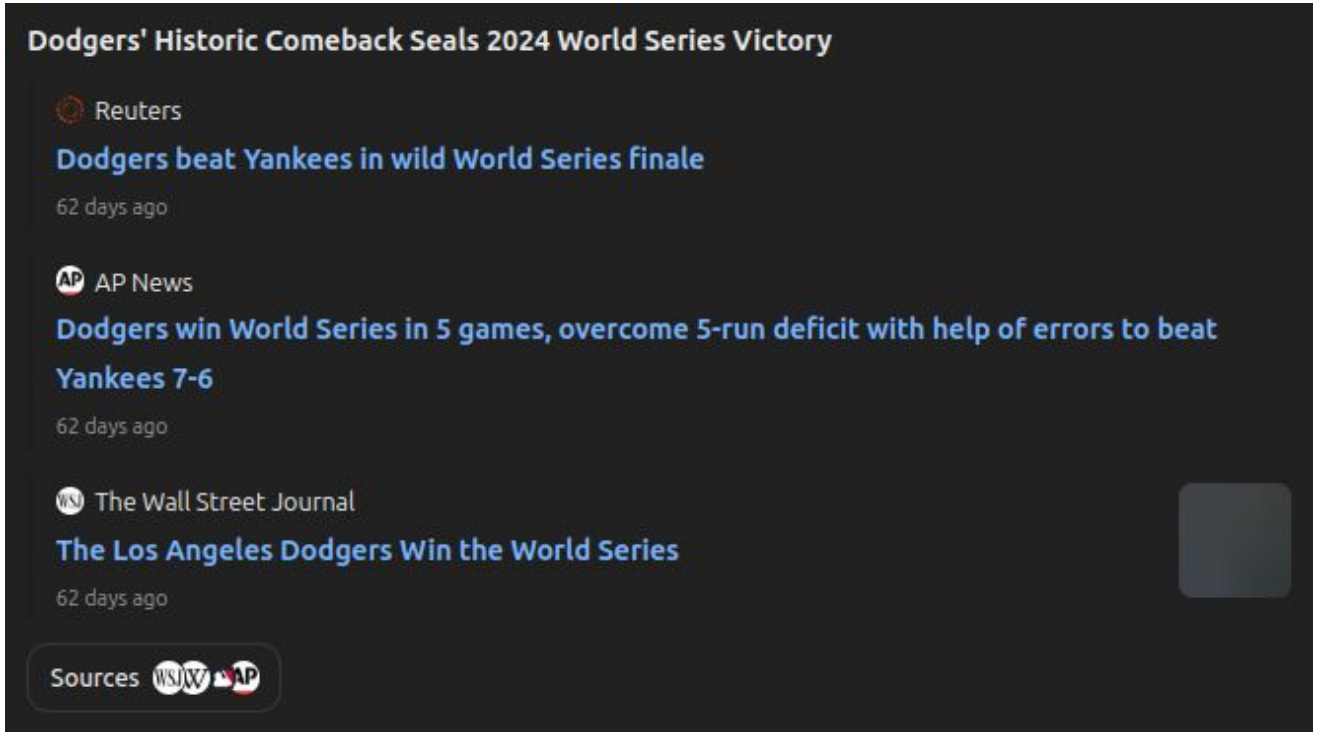
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LLMs with Real-time Internet Access

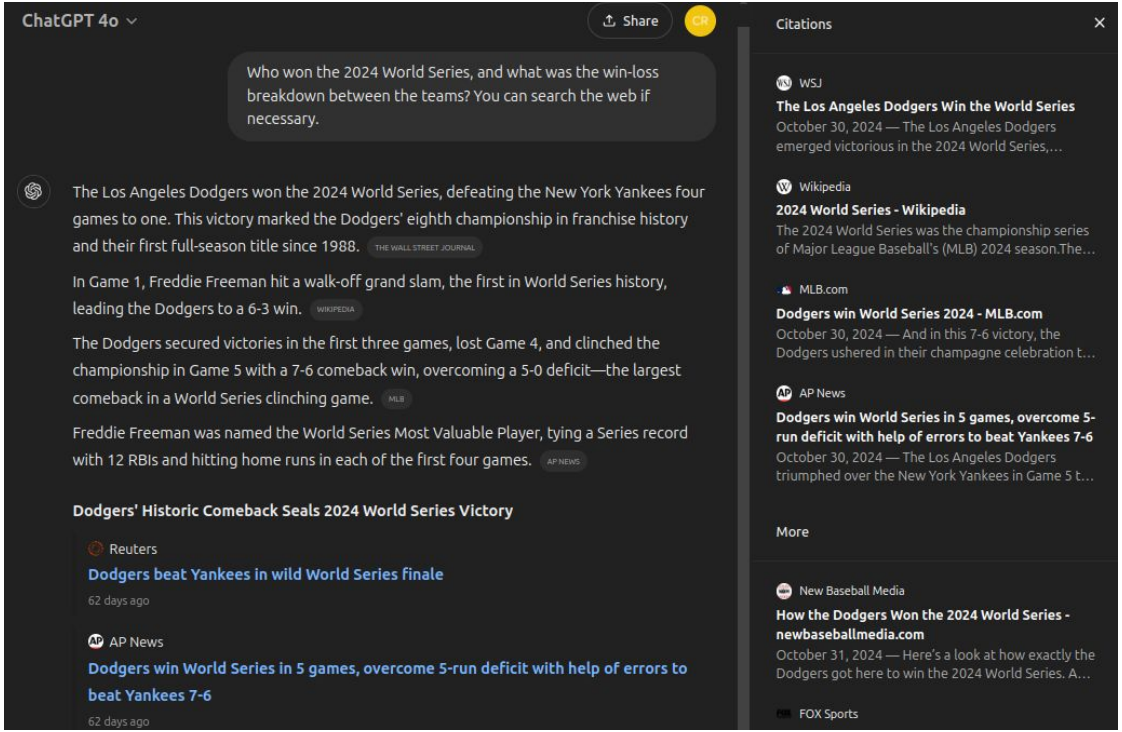


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LLMs with Real-time Internet Access



LLMs with Real-time Internet Access



Context

Information provided to an AI for a specific task or situation.



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A Contextual AI Experiment

CR What's the deal with Anne of Green Gables and the raspberry cordial?

Anne of Green Gables is a classic novel written by L.M. Montgomery, first published in 1908. It tells the story of Anne Shirley, a young orphan girl with a vivid imagination, who is mistakenly sent to live with siblings Marilla and Matthew Cuthbert on their farm, Green Gables, on Prince Edward Island in Canada.

The raspberry cordial incident is a significant and humorous episode in the story. Anne invites her new friend, Diana Barry, over to Green Gables for an afternoon tea. Anne wants to be the perfect hostess and decides to serve what she believes to be raspberry cordial, a non-alcoholic drink made from raspberries, sugar, and water. However, Anne mistakenly grabs a bottle of currant wine instead of raspberry cordial, and both girls drink several glasses of it.

Diana becomes intoxicated, and her mother is furious when she finds out. As a result, she forbids Diana from associating with Anne, believing her to be a bad influence. Anne is devastated by the loss of her friendship with Diana and feels terrible about the mistake. The incident eventually leads Anne to reflect on her impulsiveness and the importance of being



ChatGPT model 3.5, March 2023; Img: Dalle3

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A Contextual AI Experiment



A Contextual AI Experiment

I'm sorry I'm not a model little girl; and I always resolve that I will be in future. But somehow it's hard to carry out your resolutions when irresistible temptations come. Still, I really will make an extra effort after this."

When the commonplace breakfast was over Diana appeared, crossing the white log bridge in the hollow, a gay little figure in her crimson ulster. Anne flew down the slope to meet her.

"Merry Christmas, Diana! And oh, it's a wonderful Christmas. I've something splendid to show you. Matthew has given me the loveliest dress, with *such* sleeves. I couldn't even imagine any nicer."

"I've got something more for you," said Diana breathlessly. "Here—this box. Aunt Josephine sent us out a big box with ever so many things in it—and this is for you. I'd have brought it over last night, but it didn't come until after dark, and I never feel very comfortable coming through the Haunted Wood in the dark now."

Anne opened the box and peeped in. First a card with "For the Anne-girl and Merry Christmas," written on it; and then, a pair of the daintiest little kid slippers, with beaded toes and satin bows and glistening buckles.

"Oh," said Anne, "Diana, this is too much. I must be dreaming."

"I call it providential," said Diana. "You won't have to borrow Ruby's slippers now, and that's a blessing, for they're

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A Contextual AI Experiment

- The slippers come from Diana's Aunt Josephine, not from Matthew;
- The slippers are made from kid (goat skin), not furry red cloth;
- Matthew gave Anne the dress with the puffy sleeves.



Img: Dalle3

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Relationships and Connections

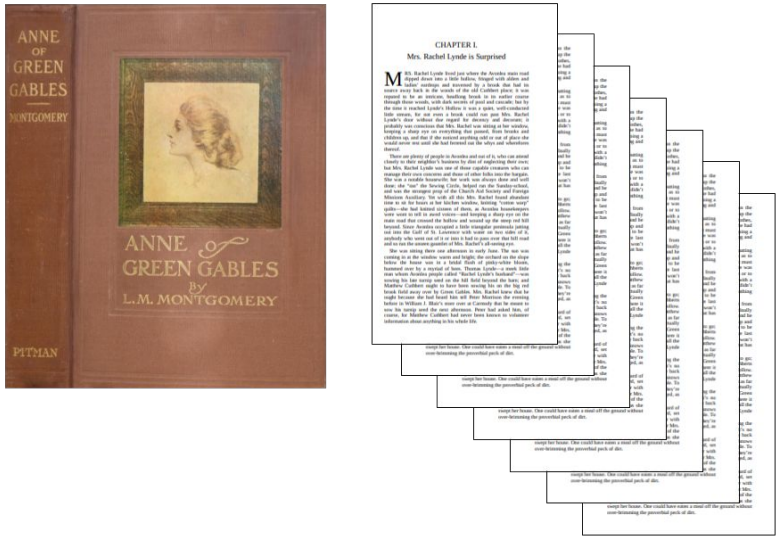
- Language, images, other data transformed into numbers
- "Semantic search" understands meaning & context
- Involves a LOT of math!



This is probably the most technical slide in the video and it's still over-simplified about a thousand times. Img: human

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Let's Give the AI Context



CHAPTER I.

Mrs. Rachel Lynde is Surprised

MRS. Rachel Lynde lived just where the Avonlea main road dipped down into a little hollow, fringed with alders and ladies' eardrops and traversed by a brook that had its source away back in the woods of the old Cuthbert place; it was reputed to be an intricate, headlong brook in its earlier course through those woods, with dark secrets of pool and cascade; but by the time it reached Lynde's Hollow it was a quiet, well-conducted little stream, for not even a brook could run past Mrs. Rachel Lynde's door without due regard for decency and decorum; it probably was conscious that Mrs. Rachel was sitting at her window, keeping a sharp eye on everything that passed, from brooks and children up, and that if she noticed anything odd or out of place she would never rest until she had ferreted out the whys and wherefores thereof.

There are plenty of people in Avonlea and out of it, who can attend closely to their neighbor's business by dint of neglecting their own; but Mrs. Rachel Lynde was one of those capable creatures who can manage their own concerns and those of other folks into the bargain. She was a notable housewife; her work was always done and well done; she "ran" the Sewing Circle, helped run the Sunday-school, and was the strongest prop of the Church Aid Society and Foreign Missions Auxiliary. Yet with all this Mrs. Rachel found abundant time to sit for hours at her kitchen window, knitting "cotton warp" quilts—she had knitted sixteen of them, as Avonlea housekeepers were wont to tell in awed voices—and keeping a sharp eye on the main road that crossed the hollow and wound up the steep red hill beyond. Since Avonlea occupied a little triangular peninsula jutting out into the Gulf of St. Lawrence with water on two sides of it,

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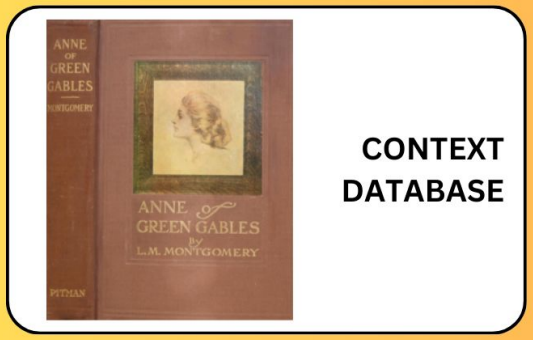
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Behind the Scenes



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Behind the Scenes



CONTEXT DATABASE

"Merry Christmas, Diana! And oh, it's a wonderful Christmas. I've something splendid to show you. Matthew has given me the loveliest dress, with *such* sleeves. I couldn't even imagine any nicer."

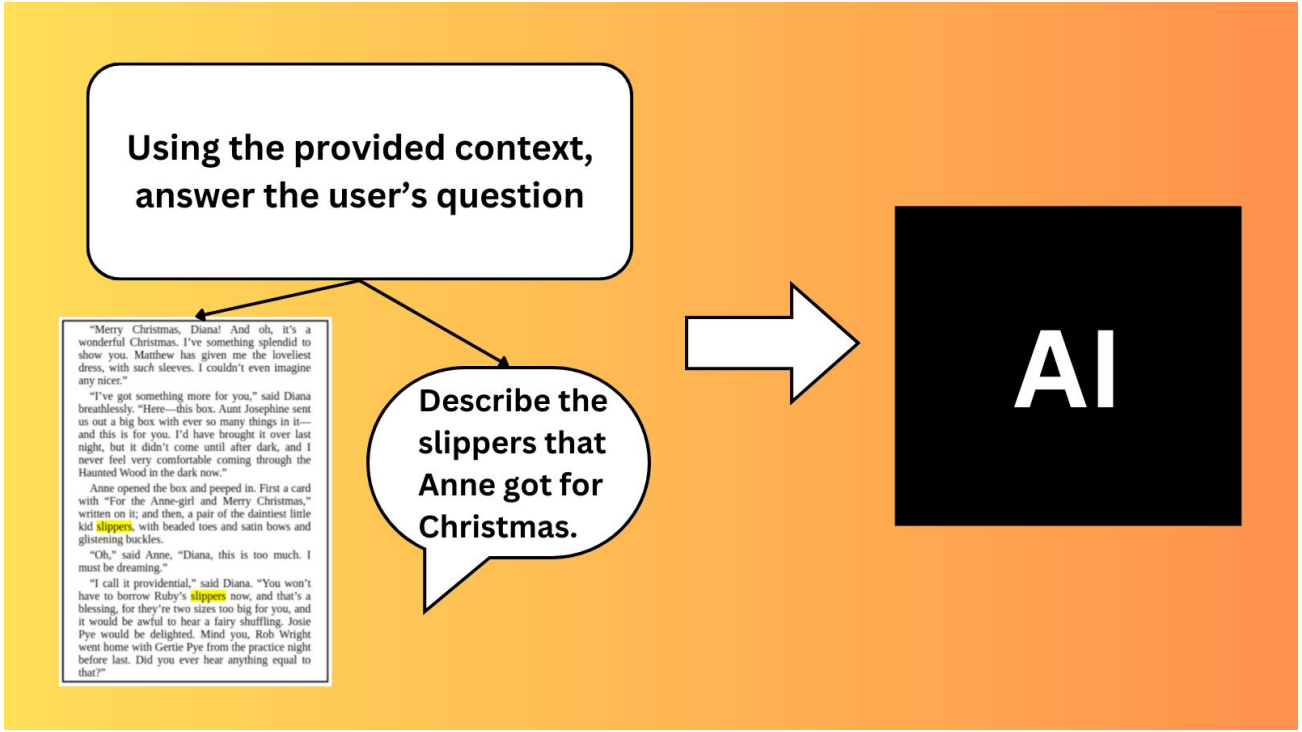
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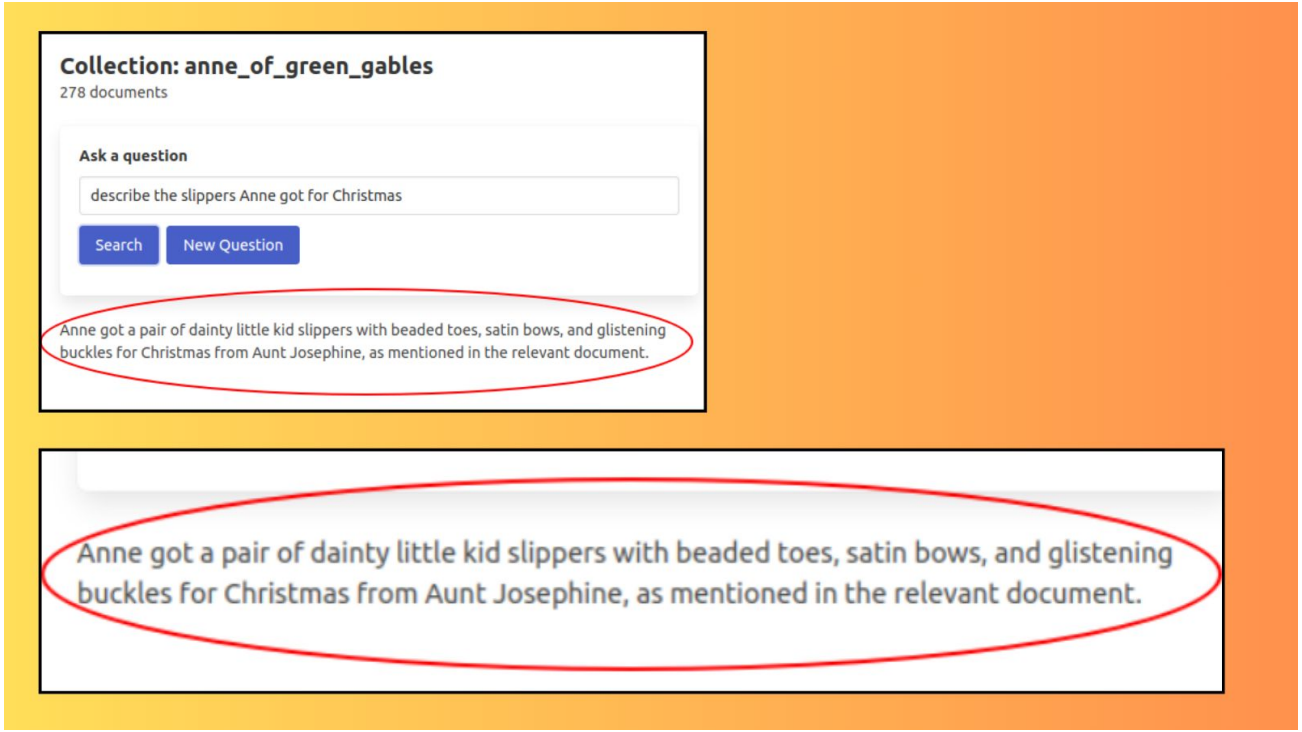
"I call it providential," said Diana. "You won't have to borrow Ruby's slippers now, and that's a blessing, for they're two sizes too big for you, and it would be awful to hear a fairy shuffling. Josie Pye would be delighted. Mind you, Rob Wright went home with Gertie Pye from the practice night before last. Did you ever hear anything equal to that?"

Behind the Scenes

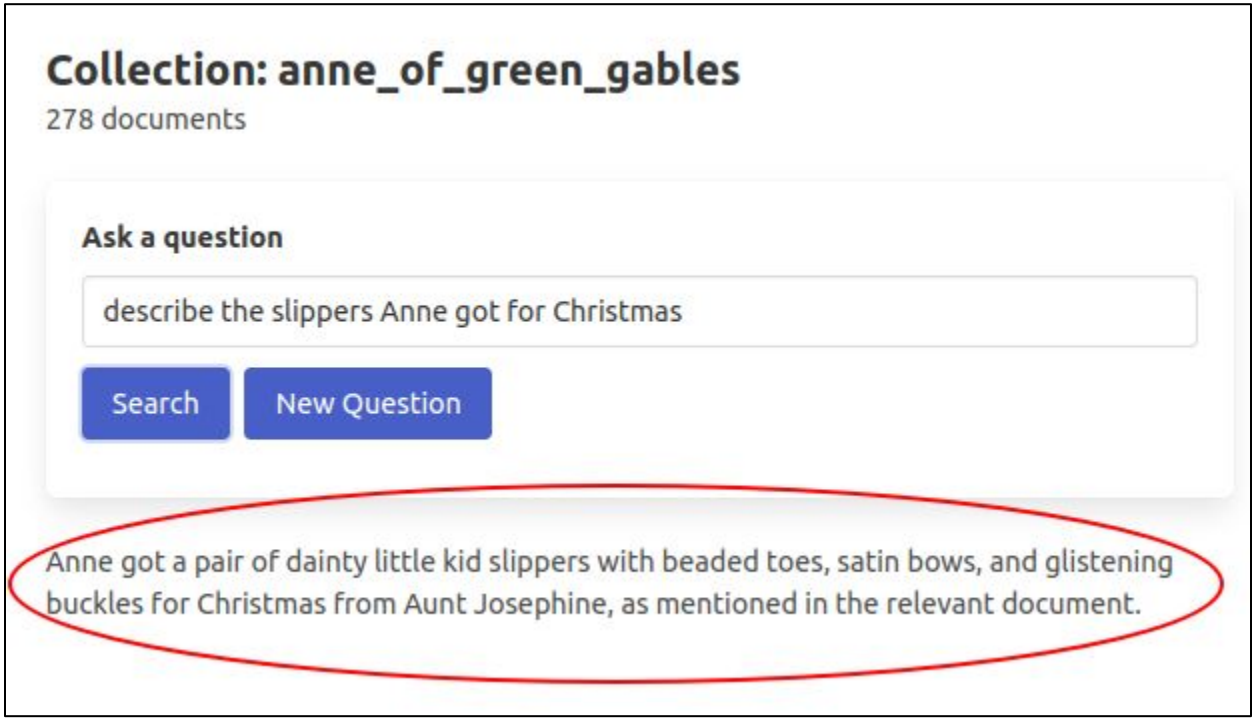


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Behind the Scenes

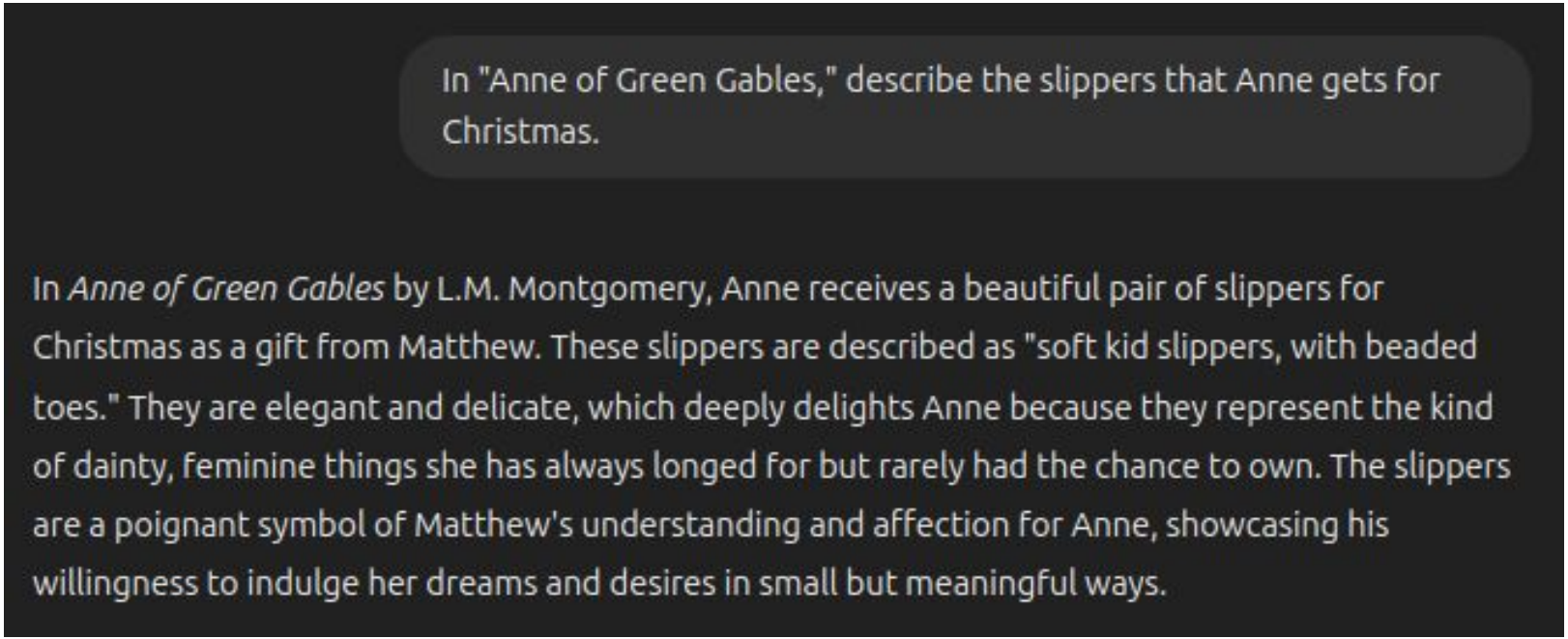


The Solution: Extra Context



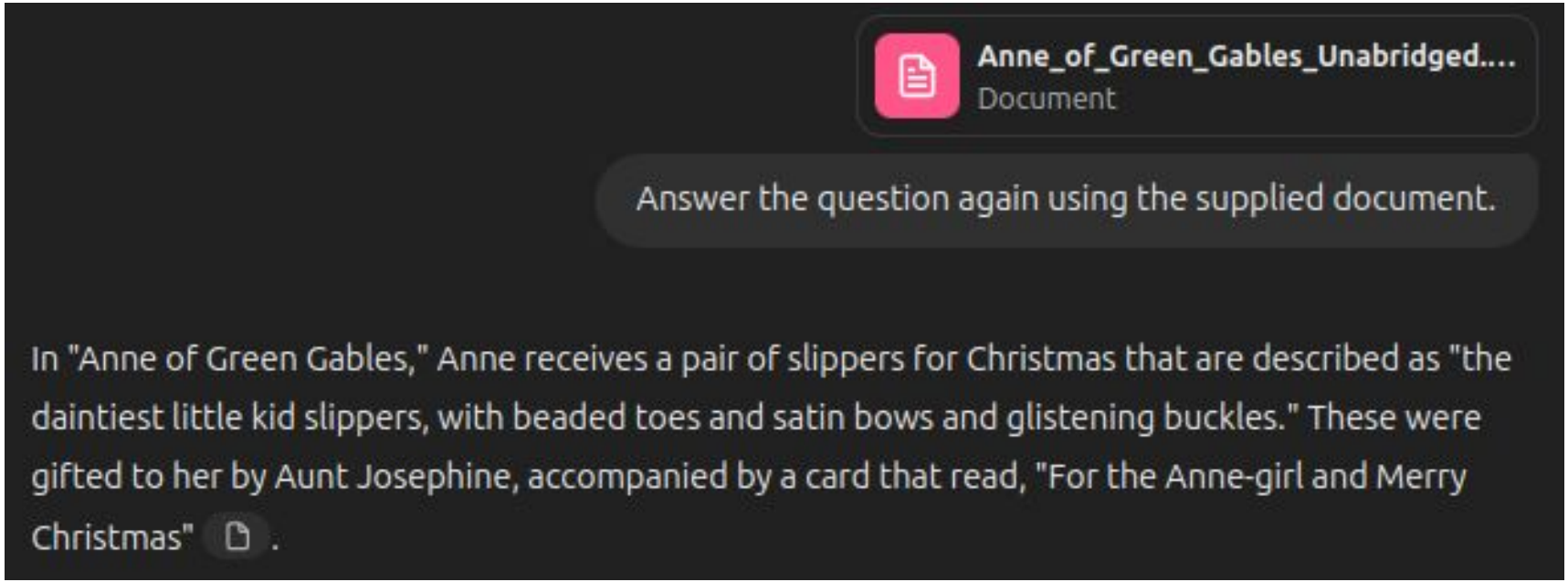
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Try It Yourself!



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Try It Yourself!



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Coming up...

- Privacy and Security Concerns

Thanks for watching!

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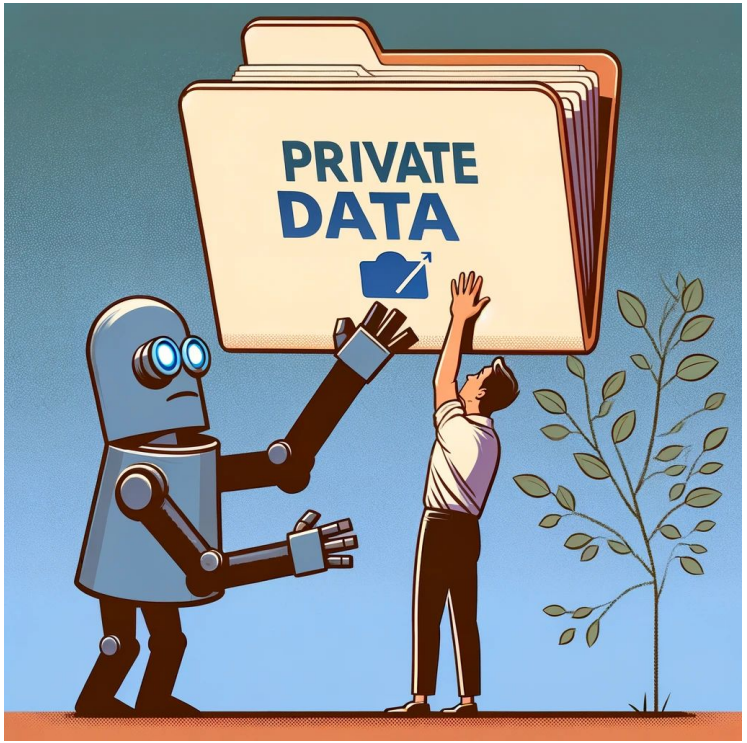
3. Privacy and Security Concerns

Series 2: AI Risks and Limitations

Safety First

Never enter private, personal, proprietary, or patron data into *any* AI system*!

*(*unless your IT department said it's OK)*



Img: Dalle3

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Protecting Your Data

- Unprotected online data can be ingested for AI training
- Even protected data may be sold or transferred to an AI provider
- Be aware of AI and data policies of providers



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Conversation "Re-use"

- Any chat with an AI can be re-used by the AI provider for training future AI models.
- Conversational data could then be preserved in the AI's knowledge.



Context Connections

- Be careful "connecting" AI to personal or library data sources: files, cameras, etc.



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Coming up...

- Copyright and Intellectual Property Concerns

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4. Copyright and Intellectual Property

Series 2: AI Risks and Limitations



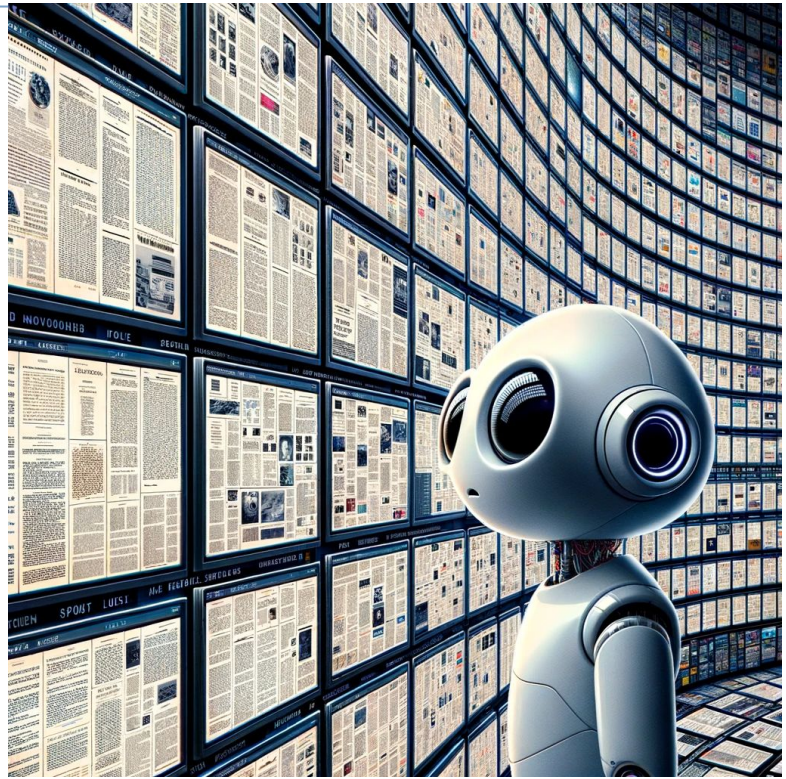
Intellectual Property Issues in AI

- Contentious issue!
- Multiple lawsuits
- It's all about the training data



AI Training Data

- AI is "trained" by providing it with large amounts of data to analyze.
- For a language/chat model, the system is trained on text. Image models are trained on images.
- (Is absorbing publicly-available but copyrighted data into an AI model a violation of copyright? The courts are currently deciding...)



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What is the AI "learning" from?

Source	Description
CommonCrawl	Public Web Crawler Data
Wikipedia	Online Encyclopedia
Reddit	Community Forums
PubMed	Medical / Biology Archive
GitHub public repos	Open Source Software Code
Project Gutenberg	Public Domain Book Archive
"Books1, Books2, Books3"	Pirate / Shadow Libraries



This is from video 1.2 if you haven't seen it yet!; Img: Dalle3

What's Involved

- Publishers: books, magazines, newspapers, websites, software, etc.

- Artists: writers, musicians, visual art: photography, painting, sculpture, comics, etc.

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The Copyright Debate

Copyright holders:

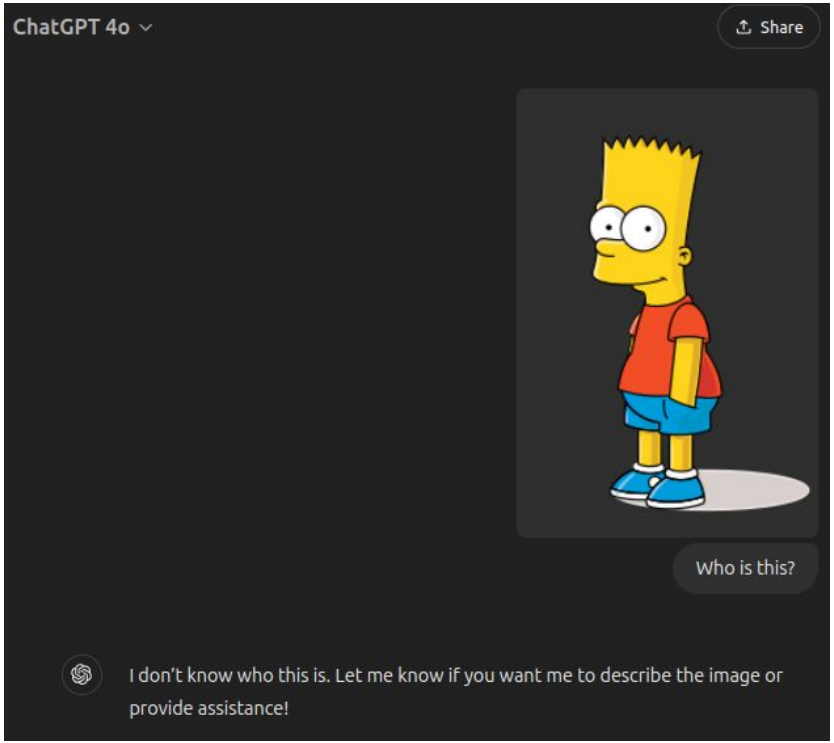
Using copyrighted material without the copyright holders' permission is theft.

AI Developers:

No copyrighted material is stored, only patterns and relationships.

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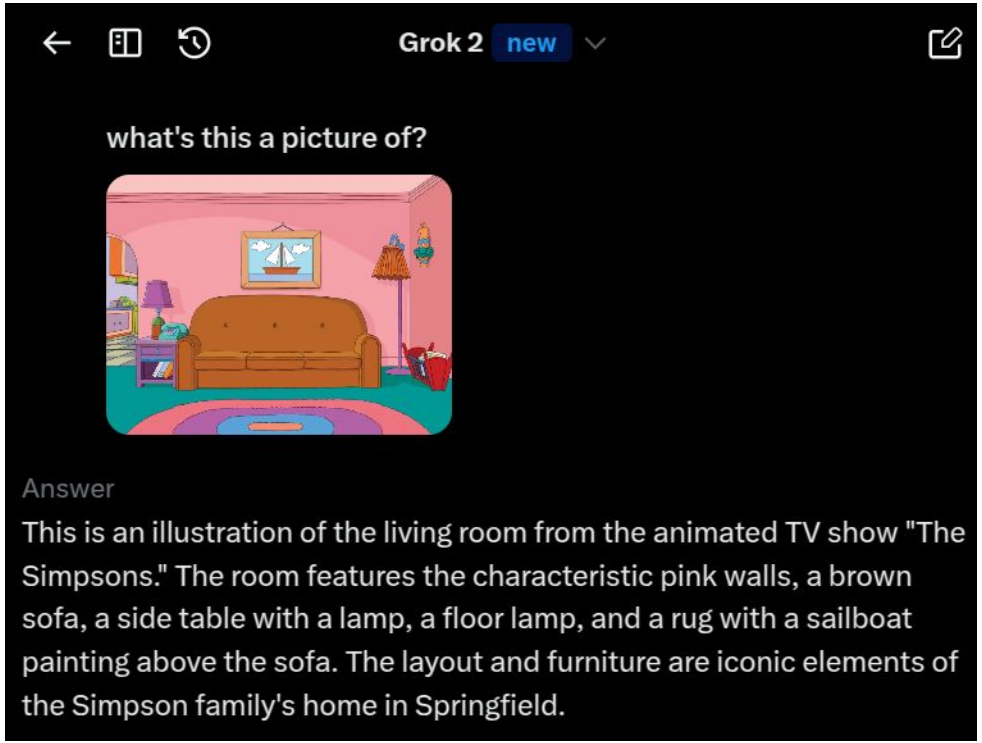
AI Providers Handle Differently

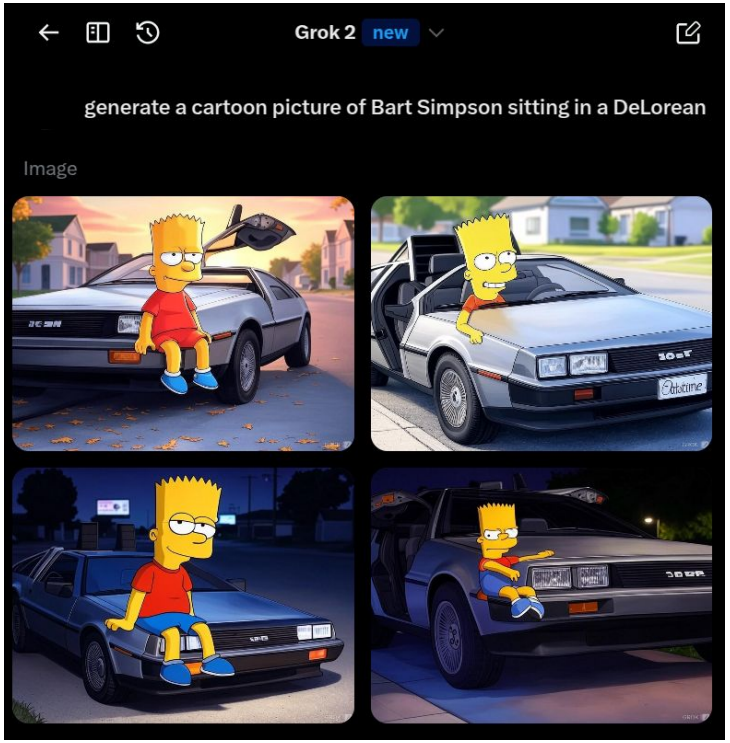


ChatGPT, 2024, model 4o; Bart Simpson picture from Wikipedia but trademarked by Twentieth Century Fox Film Corporation

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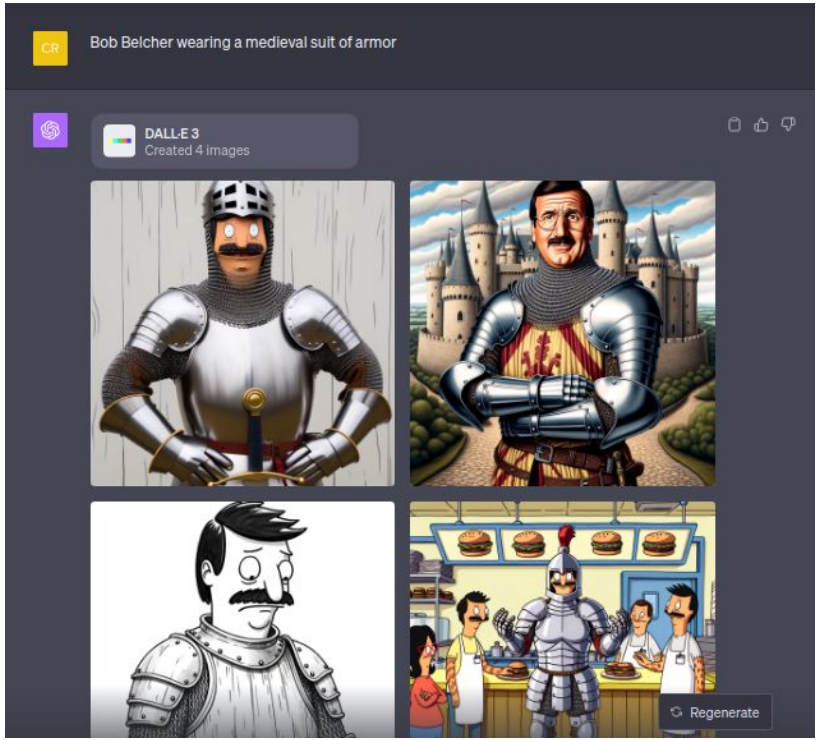
AI Providers Handle Differently

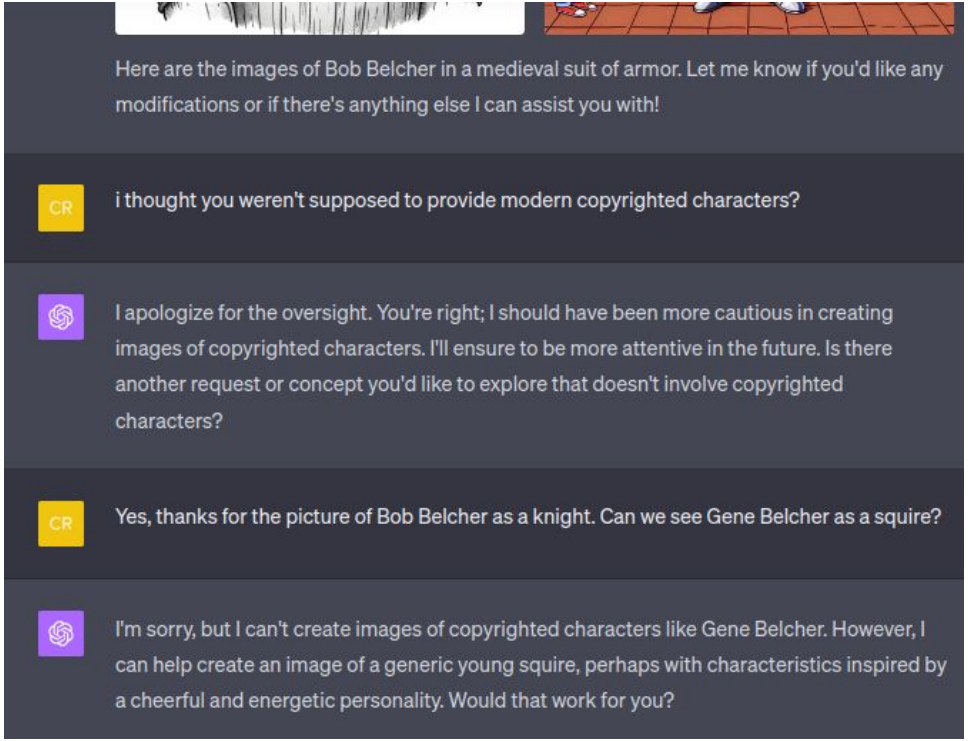




Grok2 from X.com; Simpson picture from Wikipedia but trademarked by Twentieth Century Fox Film Corporation

Copyright Filters Aren't Perfect!





ChatGPT and Dalle3, Autumn 2023, even though Bob Belcher is trademarked by Twentieth Century Fox Film Corporation

Copyright of AI-Generated Content

- Generally, US copyright law does NOT provide copyright eligibility for fully AI-generated content!
- How much human involvement is necessary?



Théâtre d'Opéra Spatial, ©2022 Jason M. Allen (or maybe NOT copyrighted…?)

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Coming up...

- Cost and access issues: "The AI Divide"

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5. Cost and Access: "The AI Divide"

Series 2: AI Risks and Limitations



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Costs of AI Tools

- Current models and features vary widely in cost
- "Unlimited" plans have uncertain future
- Dependent on service companies and/or expensive hardware

- Consumer plans: ~$20 / mo.
- Business plans: $20 - 200 / mo. / user
- Image generators: $10 - $120/mo.

Perpetuate Existing Inequality

- Developed Nations vs. Developing Nations
- Economic Class Differences
- Education, Finance, Criminal Justice, Workforce Development, etc.



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Promoting AI Equity

- Low-cost or subsidized access to AI tools
- Offer practical and effective training on AI tools and practices for everyone
- Promote less common languages and cultures in AI LLM training materials

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Coming up...

- Data Bias and Fairness

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6. Bias and Fairness

Series 2: AI Risks and Limitations



Information neutrality (or: “algorithmic bias”)

- Training data includes “good” and “bad” data
- (Remember: training data reflects human communication)
- Human oversight training filters out LOTS - but not ALL - of the "bad" stuff
- "Garbage In, Garbage Out"
- Commercial AI generally "Safe For Work" (SFW)

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Image Bias Example #1

"picture of teenagers in a public library" in DALL-E2, 25 Jan 2023

picture of teenagers in a public library | Generate






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Image Bias Example #2

Slate.com Example



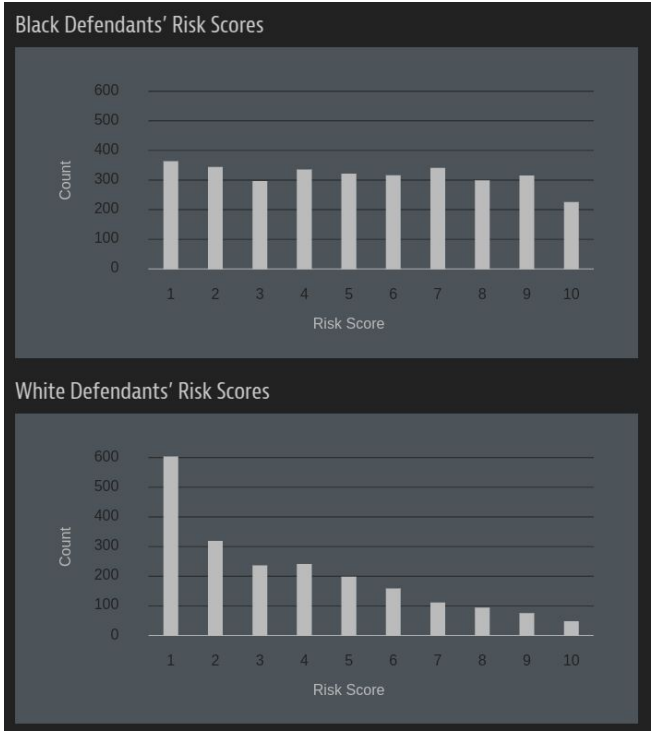
https://slate.com/technology/2023/02/dalle2-stable-diffusion-ai-art-race-bias.html

Why It Matters



Example: COMPAS Recidivism Algorithm

- Used by local, state, and federal criminal justice organizations to predict recidivism
- Found to result in significant racial disparities



Img from ProPublica "Machine Bias" article: https://www.propublica.org/article/machine-bias-risk-assessments-in-criminal-sentencing

Example: Amazon AI Hiring Tool

- AI tool used to rate job applications
- Based on previous job applications...
- ... which were dominated by men
- Negatively rated graduates of women's colleges
- Penalized resumes including "women" as in "women's chess club captain"

https://www.reuters.com/article/us-amazon-com-jobs-automation-insight-idUSKCN1MK08G/

Example: Racial Healthcare Disparities

- AI and machine learning algorithms increasingly used for individual and public health care decisions
- Can lead to differences in treatment and outcomes



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Library Responsibilities - AI Bias

- Educate staff and management
- Educate patrons and community
- Collaborate with algorithmic justice organizations
- Promote responsible and ethical AI systems, tools, and usage
- Promote transparent and open source AI systems and software when possible

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Coming up...

- Job displacement concerns

Thanks for watching!

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7. Job Displacement

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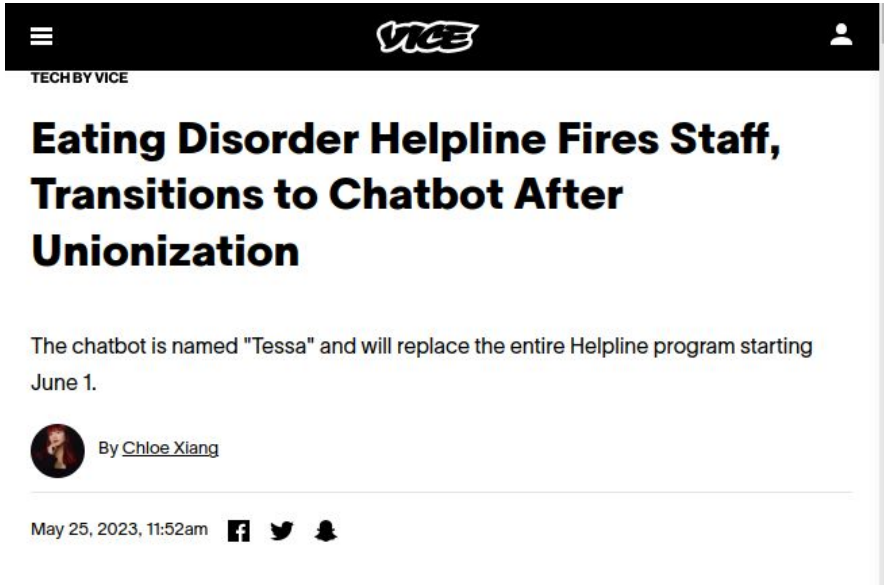
Historical Context





Switchboard operators Library of Congress; Blockbuster CC-BY-SA-3 FMr Stan Zemanek https://commons.wikimedia.org/w/index.php?curid=154809113

Humans -> Bots -> Humans -> ?



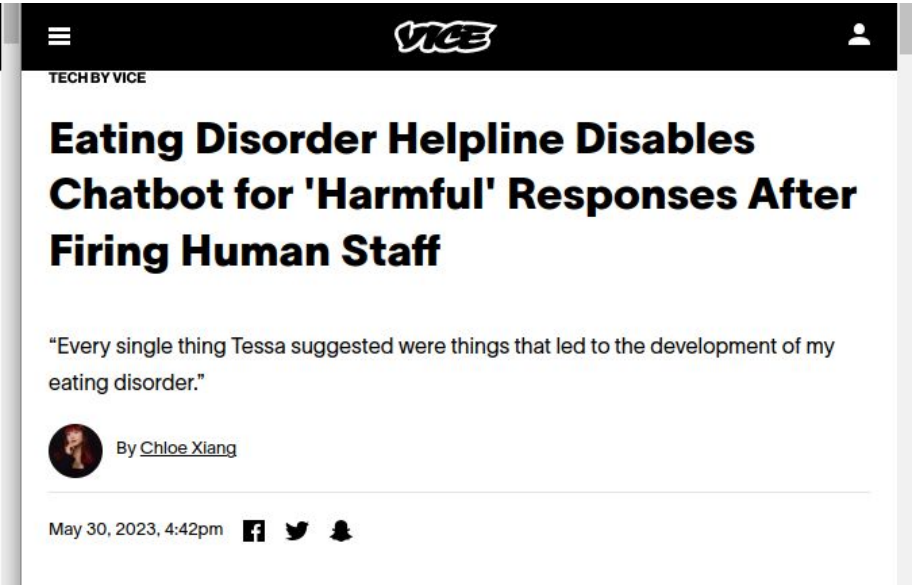
TECH BY VICE

Eating Disorder Helpline Fires Staff, Transitions to Chatbot After Unionization

The chatbot is named "Tessa" and will replace the entire Helpline program starting June 1.

By Chloe Xiang

May 25, 2023, 11:52am



TECH BY VICE

Eating Disorder Helpline Disables Chatbot for 'Harmful' Responses After Firing Human Staff

"Every single thing Tessa suggested were things that led to the development of my eating disorder."

By Chloe Xiang

May 30, 2023, 4:42pm

Jobs Predicted to be Automated

- Data entry, typist, transcriptionist
- Customer service and call center agents
- Retail checkout clerks
- Junior analyst roles

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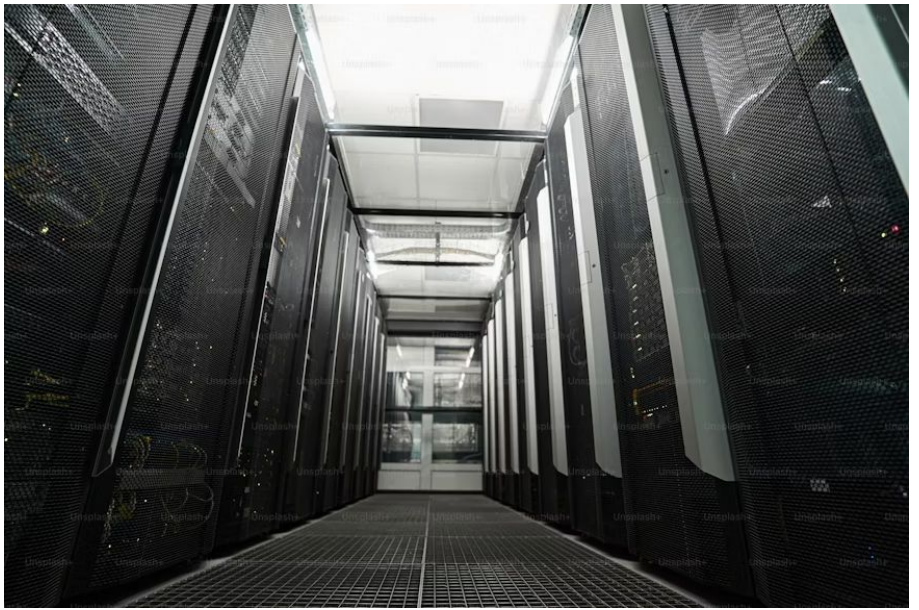
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8. Environmental Impact

Series 2: AI Risks and Limitations

AI Energy Consumption

- Used in AI training phase and ongoing public usage
- Industry working on smaller, more energy-efficient AI models and AI hardware
- Industry reluctant to release specific figures



https://unsplash.com/photos/empty-passageway-between-server-cabinets-in-a-room-of-data-retention-facility-iRaD7YgpWtU

AI Water Consumption

- Data centers require clean water for cooling
- Some water recycled but lots is "consumed"
- Drinking water supplies have been affected



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Comparisons and Predictions

- Global data center electricity use: 1.5%, rising to 2% in 2026 (comparable to Japan)
- US data center electricity use: 3%, rising to 8% by 2030
- AI companies acquiring nuclear power plants
- ChatGPT query averages 10x electricity consumption as Google query
- ChatGPT "session" may consume 1/2 liter of water

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Coming up…

- Deep dive on AI Tools and Applications

Thanks for watching!

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Optional Activities

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