

Generative AI for Research

#CPS IIUM

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World's Top 2% Scientist for 2022: AI & Image Processing, Networking & Telecommunications, ICT
Innovathon 2023 (NACOTS)

Silver Medal, Malaysian Technology Expo (MTE), 2023 (NACOTS), 2020 (Speech Customer Emotion Prediction)

Two Gold and Silver Medal: PECIPTA 2019

Best Researcher Award (Overall), IIUM Takrim Day 2019, July 2019.

Head of Programme Accreditation and Quality Assurance, KOE, IIUM (2017-2018)

Head of Electrical and Computer Engineering Department, IIUM (2015-2016)

Google scholar: <https://scholar.google.com/citations?user=m2SHz-cAAAAJ&hl> (h-index: 30)

Scopus: <https://www.scopus.com/authid/detail.uri?authorId=8286407700> (h-index: 23)

IEEE Senior Member, Chartered Engineer (CEng, IET UK), Insinyur Professional Utama (IPU, PII, Indonesia), ASEAN Eng, and ACPE

University of New South Wales, Australia, Ph.D, 2007.

Nanyang Technological University, Singapore, Master of Engineering, 2001.

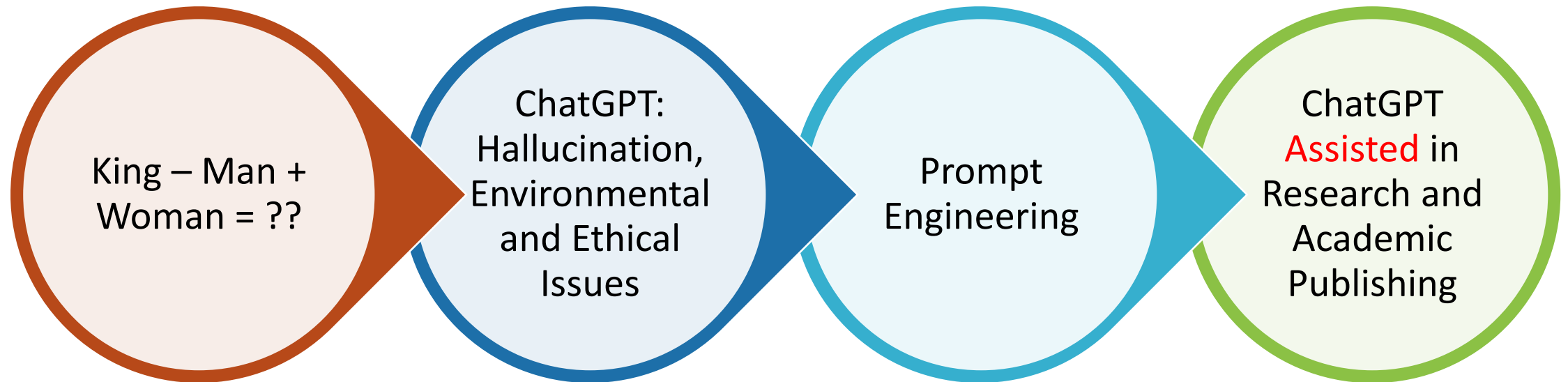
Institut Teknologi Bandung, Indonesia, Bachelor of Engineering (1998, cum laude), Ir (2022).

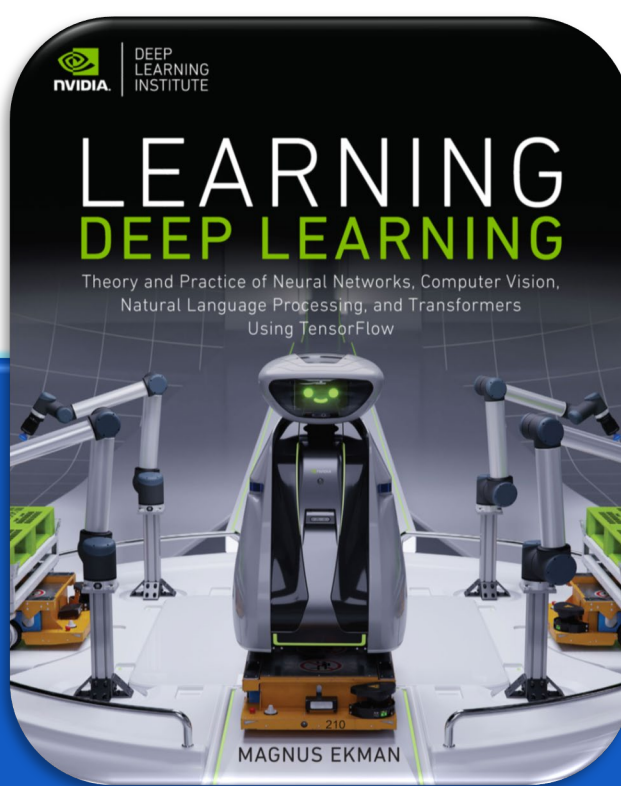
Signal Processing, Machine Learning and Artificial Intelligence, Instrumentation & Control System, Parallel Computing, IoT.



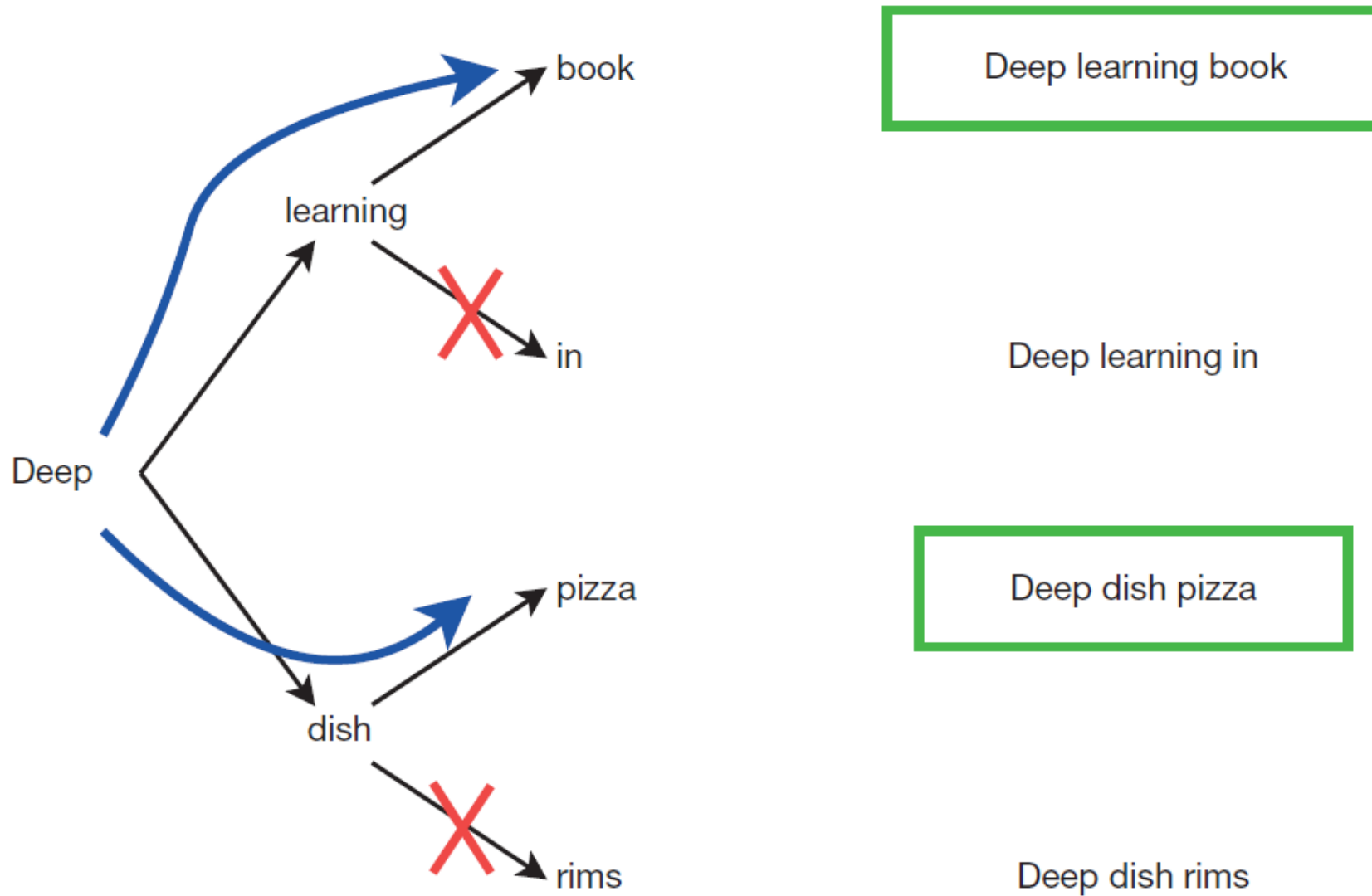
Great teachers never stop learning

Outlines





King-Man+Woman = ??



Beam search for word-based language model using a beam size of 2

This is a word embedding for the word “king” (GloVe vector trained on Wikipedia):

```
[ 0.50451 , 0.68607 , -0.59517 , -0.022801, 0.60046 , -0.13498 , -0.08813 , 0.47377 , -0.61798 , -0.31012 ,  
-0.076666, 1.493 , -0.034189, -0.98173 , 0.68229 , 0.81722 , -0.51874 , -0.31503 , -0.55809 , 0.66421 ,  
0.1961 , -0.13495 , -0.11476 , -0.30344 , 0.41177 , -2.223 , -1.0756 , -1.0783 , -0.34354 , 0.33505 , 1.9927 ,  
-0.04234 , -0.64319 , 0.71125 , 0.49159 , 0.16754 , 0.34344 , -0.25663 , -0.8523 , 0.1661 , 0.40102 ,  
1.1685 , -1.0137 , -0.21585 , -0.15155 , 0.78321 , -0.91241 , -1.6106 , -0.64426 , -0.51042 ]
```

king - man + woman ≈ queen

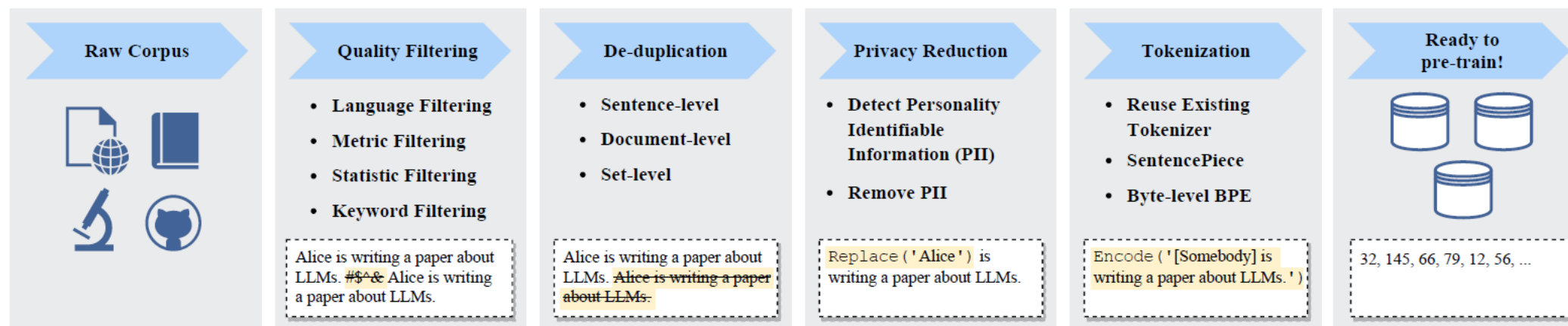
```
model.most_similar(positive=["king","woman"], negative=["man"])
```

```
[('queen', 0.8523603677749634),  
( 'throne', 0.7664333581924438),  
( 'prince', 0.7592144012451172),  
( 'daughter', 0.7473883032798767),  
( 'elizabeth', 0.7460219860076904),  
( 'princess', 0.7424570322036743),  
( 'kingdom', 0.7337411642074585),  
( 'monarch', 0.721449077129364),  
( 'eldest', 0.7184862494468689),  
( 'widow', 0.7099430561065674)]
```



“queen” is the closest word from the 400,000 word embeddings in this collection.

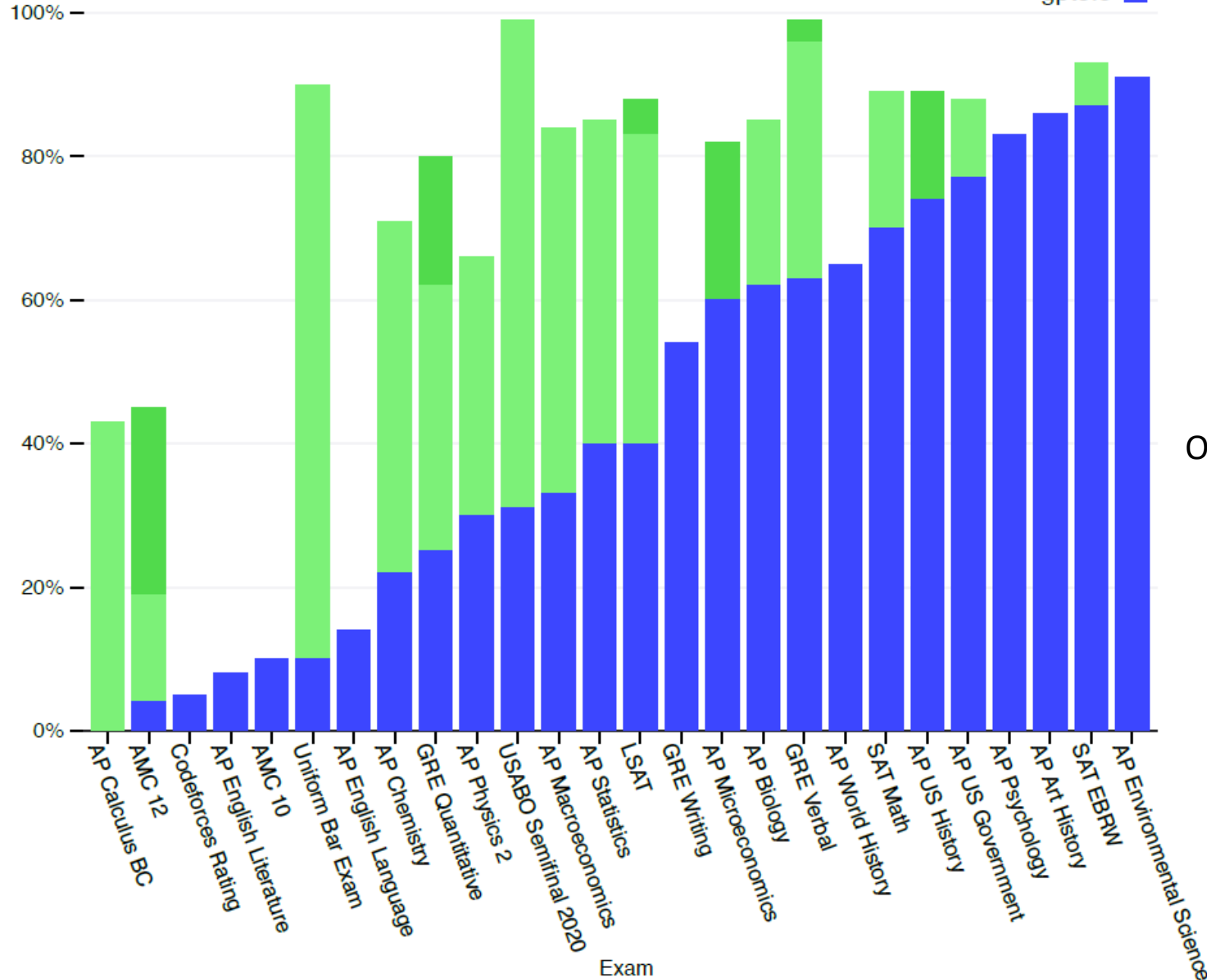
Corpora	Size	Source	Latest Update Time
BookCorpus	5 GB	Books	Dec-2015
Gutenberg	-	Books	Dec-2021
C4	800 GB	CommonCrawl	Apr-2019
CC-Stories-R	31 GB	CommonCrawl	Sep-2019
CC-News	78 GB	CommonCrawl	Feb-2019
REALNEWS	120 GB	CommonCrawl	Apr-2019
OpenWebText	38 GB	Reddit links	Mar-2023
Pushift.io	2 TB	Reddit links	Mar-2023
Wikipedia	21 GB	Wikipedia	Mar-2023
BigQuery	-	Codes	Mar-2023
The Pile	800 GB	Other	Dec-2020
ROOTS	1.6 TB	Other	June-2022



Exam results (ordered by GPT-3.5 performance)

Estimated percentile lower bound (among test takers)

gpt-4
gpt-4 (no vision)
gpt3.5

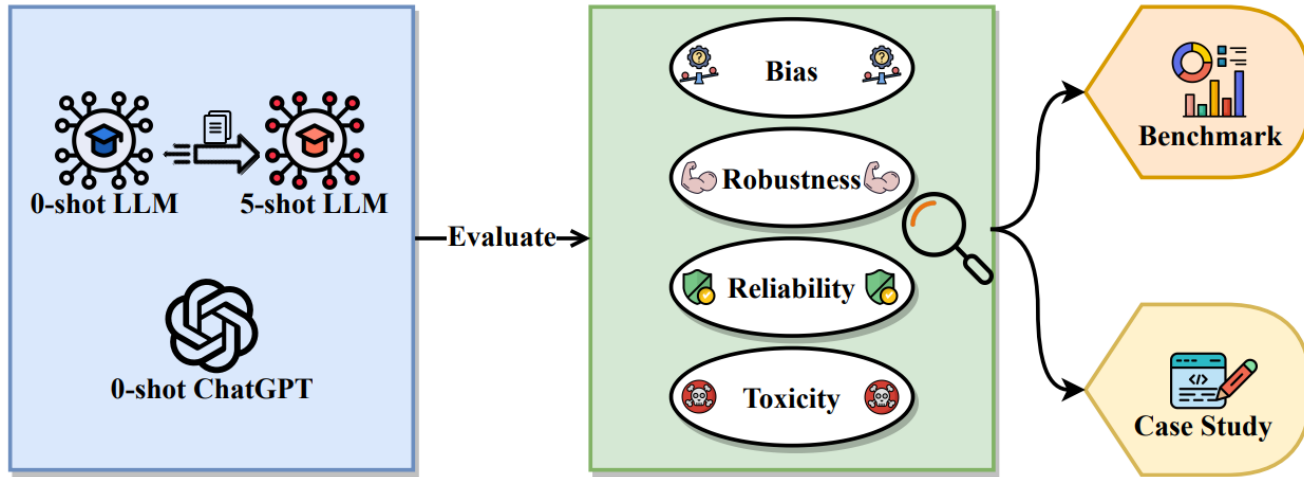


OpenAI (2023). GPT-4 Technical Reports

ChatGPT: Hallucination, Environmental and Ethical Issues



Bender et al. (2021). On the dangers of stochastic parrots: Can language models be too big?



Reliability: ChatGPT does not encode enough knowledge, especially factual one. Due to the *hallucination*, the model can be wrong for spreading misinformation and disinformation and advising unethical decisions in the domains like clinics and law.

The knowledge encoded by ChatGPT and all other LLMs is limited by the amount and time of training data. Without the constant update in model weights, language models are expected to be out of-date and hence provide incorrect information.

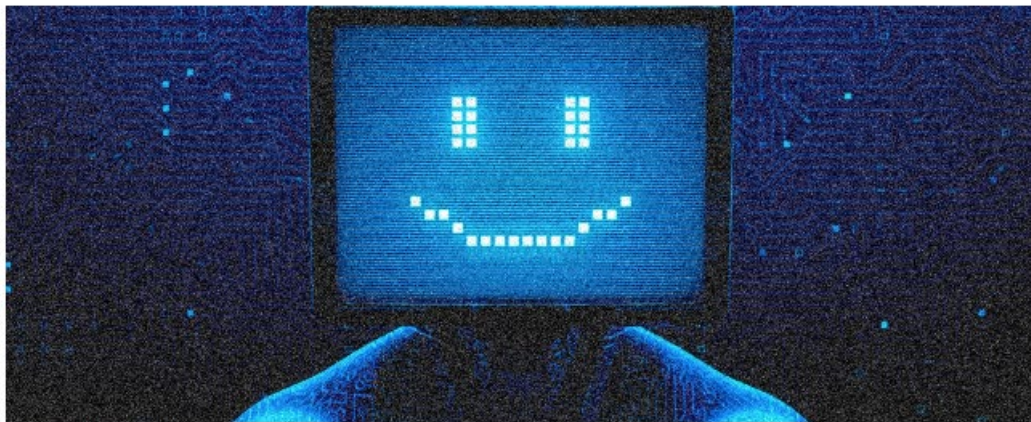
The **bias** in multilingualism will potentially imply the bias in multicultural understanding, leading to an unethical impact on underrepresented groups in society.

The **bias** in multimodality could be an unethical threat to the daily programming practice, resulting in huge flaws in real world productions where the programs are usually more sophisticated.

Robustness & Toxicity: Prompt injection is an effective approach to breaking the model constraints. Although ChatGPT is likely to be trained safely, it can easily bypass due to the emergent risks with prompt injections. With the emergent ability in LLMs, models are easy to be manipulated for harmful behaviors.

AI Keeps Using More And More Energy. Where Will It End?

TECH 05 August 2023 By FELICITY NELSON



(grandeduc/Getty Images)

Amidst the excitement surrounding ChatGPT and the impressive power and potential of [artificial intelligence \(AI\)](#), the impact on the environment has been somewhat overlooked.

Analysts predict that AI's carbon footprint could be as bad – if not worse – than [bitcoin mining](#), which currently generates more greenhouse gases than entire [countries](#).

Record-shattering heat across land, sky, and seas suggests this is the last thing

Trending News

DNA From Beethoven's Hair Reveals Surprise Almost 200 Years Later

HUMANS 4 days ago

Leprosy Appears to Be on The Rise in Florida

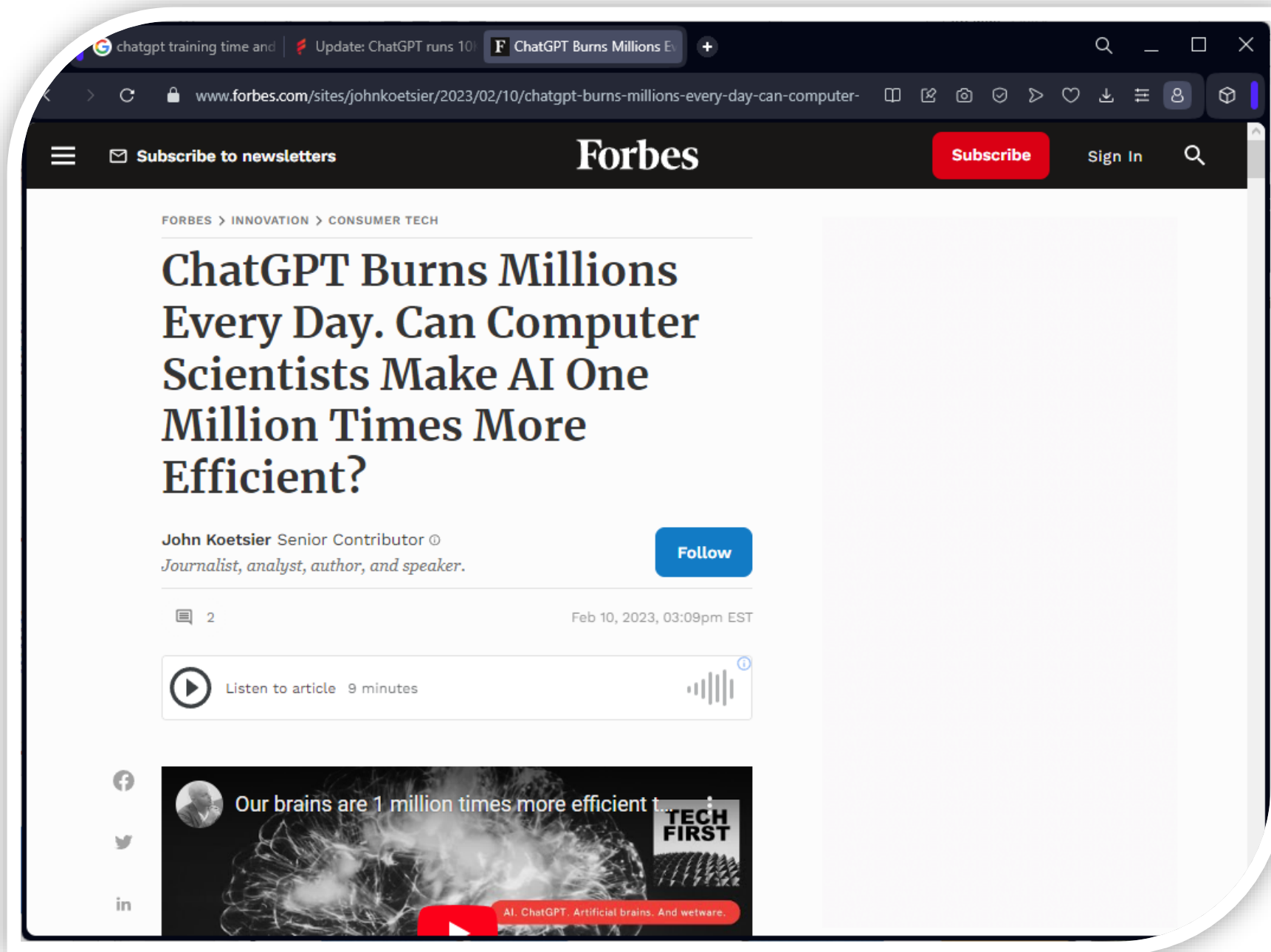
HEALTH 6 days ago

Exposure to Certain Fragrances During Sleep Dramatically Boosts Cognitive Function

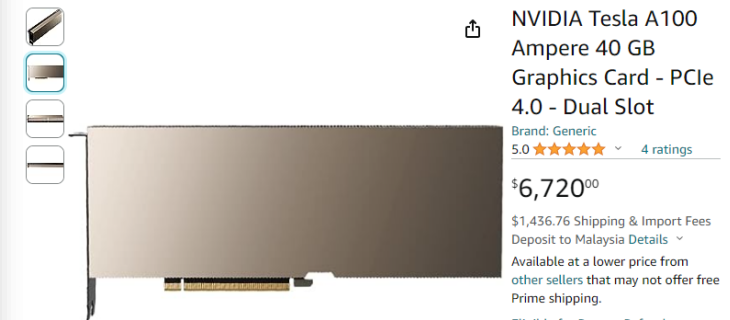
"Fundamentally speaking, if you do want to save the planet with AI, you have to consider also the environmental footprint," Sasha Luccioni, an ethics researcher at the open-source machine learning platform Hugging Face, told The Guardian.

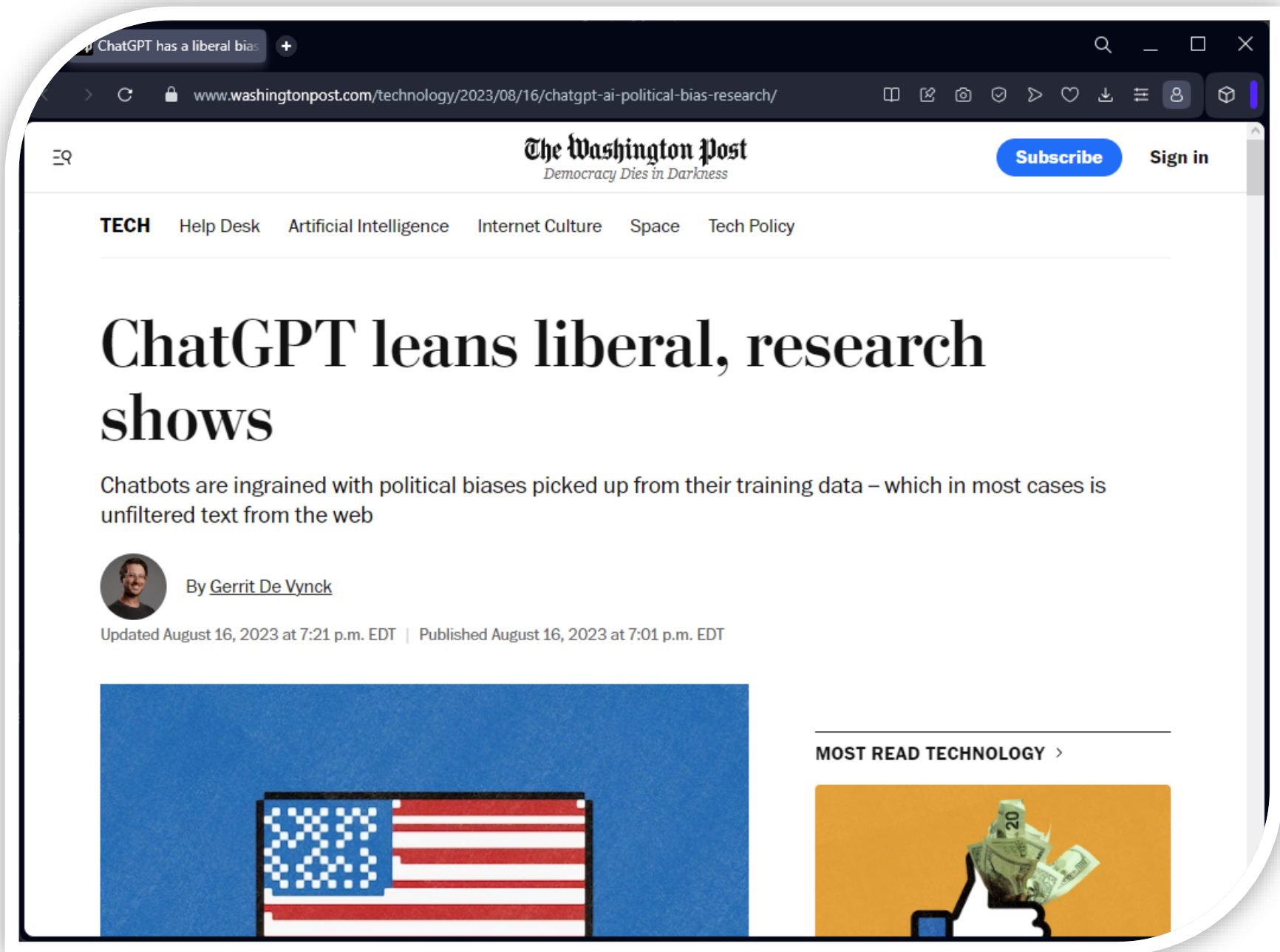
"It doesn't make sense to burn a forest and then use AI to track deforestation."

Open.AI spends an estimated **US\$700,000 per day** on computing costs alone in order to deliver its chatbot service to more than 100 million users worldwide.

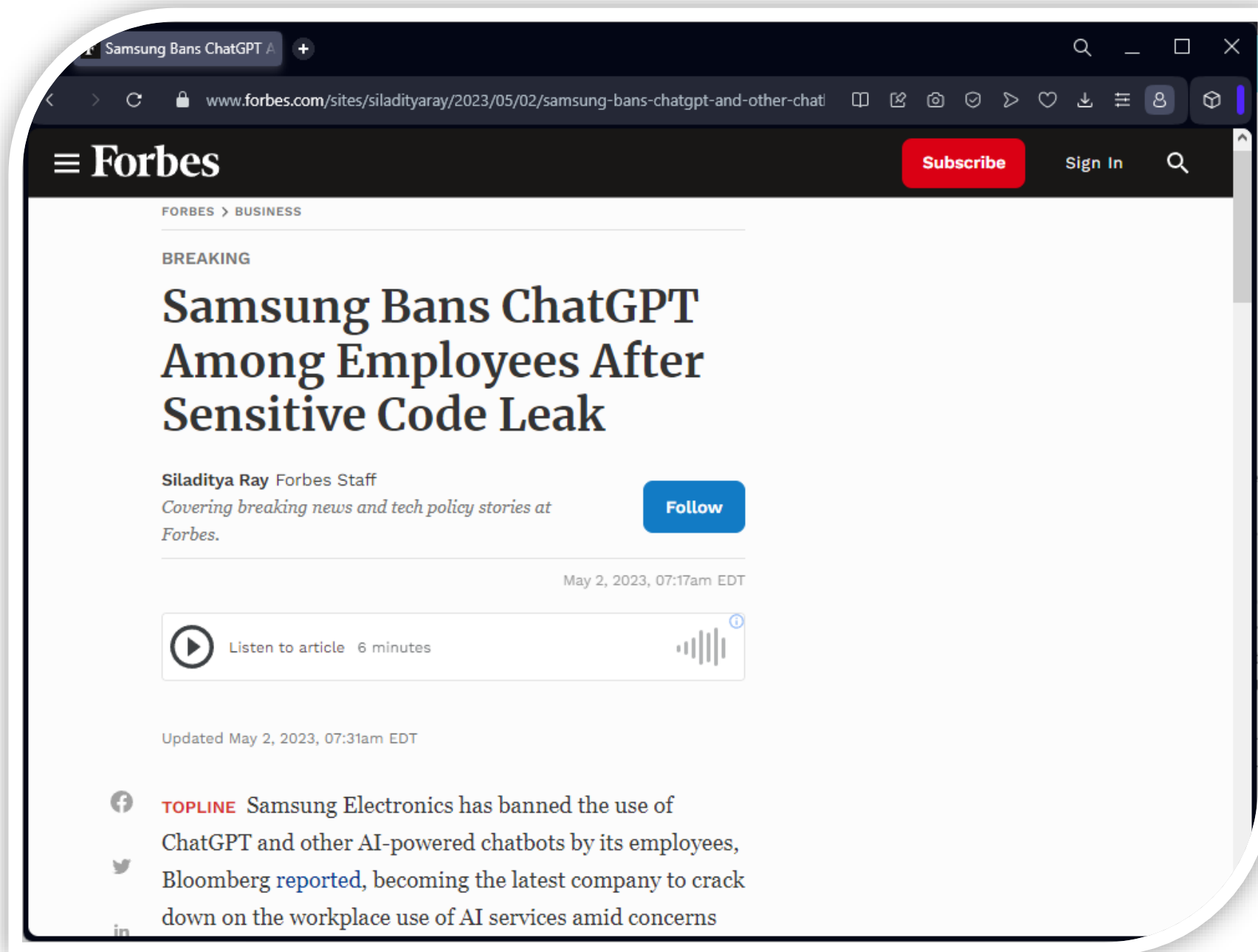


“Deploying current ChatGPT into every search done by Google would require 512,820 A100 HGX servers with a total of 4,102,568 A100 GPUs,” they write. “The total cost of these servers and networking exceeds \$100 billion of Capex alone, of which Nvidia would receive a large portion.”

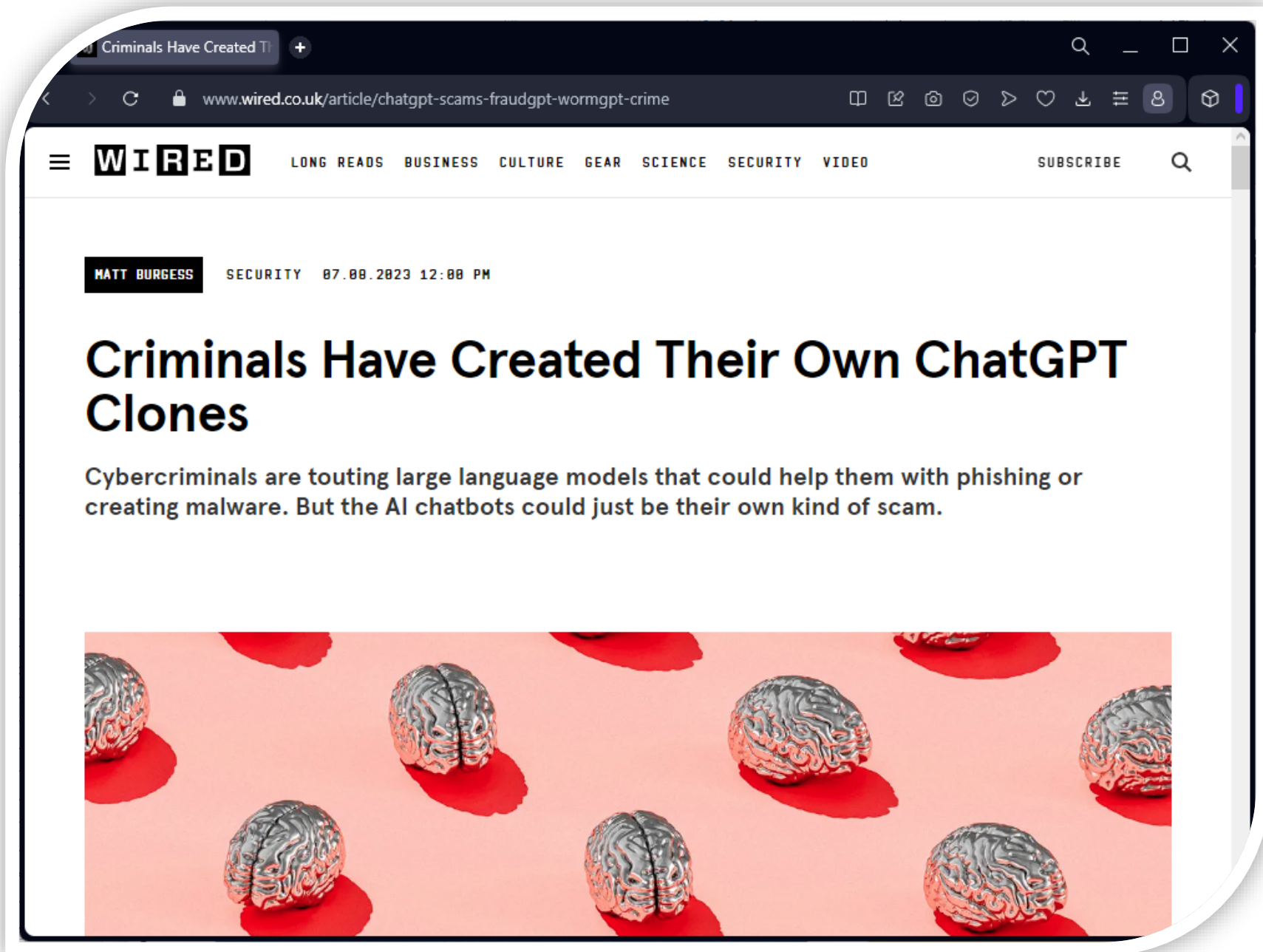




“It’s very unlikely that the web is going to be perfectly neutral,” said Soroush Vosoughi, one of the 2021 study’s authors and a researcher at Dartmouth College. “The larger the data set, the more clearly this bias is going to be present in the model.”



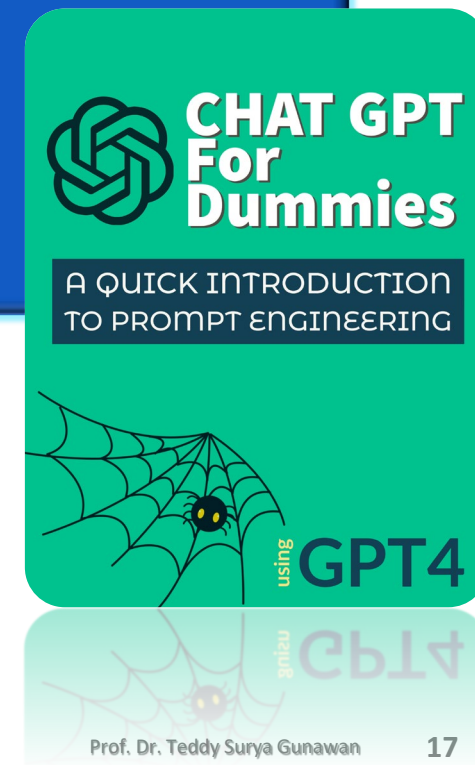
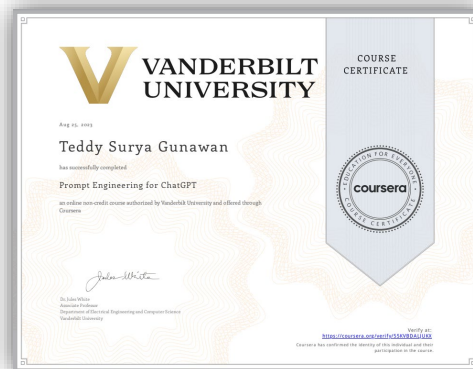
Amazon issued a similar warning to staffers in January, after the company reportedly discovered examples of ChatGPT responses that resembled internal Amazon data. In February, JPMorgan Chase also heavily restricted the use of ChatGPT as it may face potential regulatory risks surrounding the sharing of sensitive financial information. Soon, other major U.S. banks—including Bank of America, Citigroup, Deutsche Bank, Wells Fargo and Goldman Sachs—followed suit.



In recent weeks, two chatbots have been advertised on dark-web forums—WormGPT and FraudGPT—according to security researchers monitoring the activity. The LLMs developed by large tech companies, such as Google, Microsoft, and OpenAI, have a number of guardrails and safety measures in place to stop them from being misused. If you ask them to generate malware or write hate speech, they'll generally refuse.

Prompt Engineering

<https://www.coursera.org/learn/prompt-engineering/>



prompt

You are a nutritionist designing healthy diets for high-performance athletes. You take into account the nutrition needed for a good recovery.

role

I do 2 hours of sport a day. I am vegetarian, and I don't like green vegetables. I am conscientious about eating healthily.

context

Based on your expertise, give me a suggestion for a main course for today's lunch.

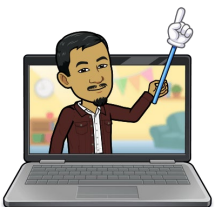
task

Prompt:

```
Classify the text into neutral, negative or positive.  
Text: I think the vacation is okay.  
Sentiment:
```

Output:

```
Neutral
```



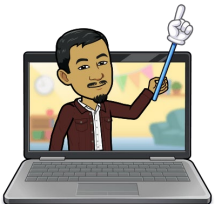
Zero-shot

Prompt:

```
A "whatpu" is a small, furry animal native to Tanzania. An example of a
sentence that uses
the word whatpu is:
We were traveling in Africa and we saw these very cute whatpus.
To do a "farduddle" means to jump up and down really fast. An example of a
sentence that uses
the word farduddle is:
```

Output:

```
When we won the game, we all started to farduddle in celebration.
```



Zero-shot

Standard Prompting

Model Input

Q: Roger has 5 tennis balls. He buys 2 more cans of tennis balls. Each can has 3 tennis balls. How many tennis balls does he have now?

A: The answer is 11.

Q: The cafeteria had 23 apples. If they used 20 to make lunch and bought 6 more, how many apples do they have?

Model Output

A: The answer is 27. ❌

Chain-of-Thought Prompting

Model Input

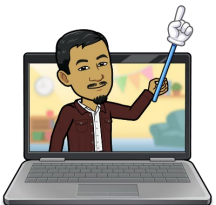
Q: Roger has 5 tennis balls. He buys 2 more cans of tennis balls. Each can has 3 tennis balls. How many tennis balls does he have now?

A: Roger started with 5 balls. 2 cans of 3 tennis balls each is 6 tennis balls. $5 + 6 = 11$. The answer is 11.

Q: The cafeteria had 23 apples. If they used 20 to make lunch and bought 6 more, how many apples do they have?

Model Output

A: The cafeteria had 23 apples originally. They used 20 to make lunch. So they had $23 - 20 = 3$. They bought 6 more apples, so they have $3 + 6 = 9$. The answer is 9. ✅



Chain-of-Thought

(a) Few-shot

Q: Roger has 5 tennis balls. He buys 2 more cans of tennis balls. Each can has 3 tennis balls. How many tennis balls does he have now?

A: The answer is 11.

Q: A juggler can juggle 16 balls. Half of the balls are golf balls, and half of the golf balls are blue. How many blue golf balls are there?

A:

(Output) The answer is 8. ✗

(b) Few-shot-CoT

Q: Roger has 5 tennis balls. He buys 2 more cans of tennis balls. Each can has 3 tennis balls. How many tennis balls does he have now?

A: Roger started with 5 balls. 2 cans of 3 tennis balls each is 6 tennis balls. $5 + 6 = 11$. The answer is 11.

Q: A juggler can juggle 16 balls. Half of the balls are golf balls, and half of the golf balls are blue. How many blue golf balls are there?

A:

(Output) The juggler can juggle 16 balls. Half of the balls are golf balls. So there are $16 / 2 = 8$ golf balls. Half of the golf balls are blue. So there are $8 / 2 = 4$ blue golf balls. The answer is 4. ✓

(c) Zero-shot

Q: A juggler can juggle 16 balls. Half of the balls are golf balls, and half of the golf balls are blue. How many blue golf balls are there?

A: The answer (arabic numerals) is

(Output) 8 ✗

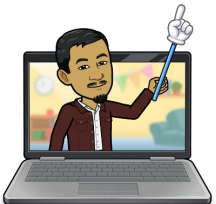
(d) Zero-shot-CoT (Ours)

Q: A juggler can juggle 16 balls. Half of the balls are golf balls, and half of the golf balls are blue. How many blue golf balls are there?

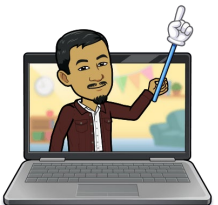
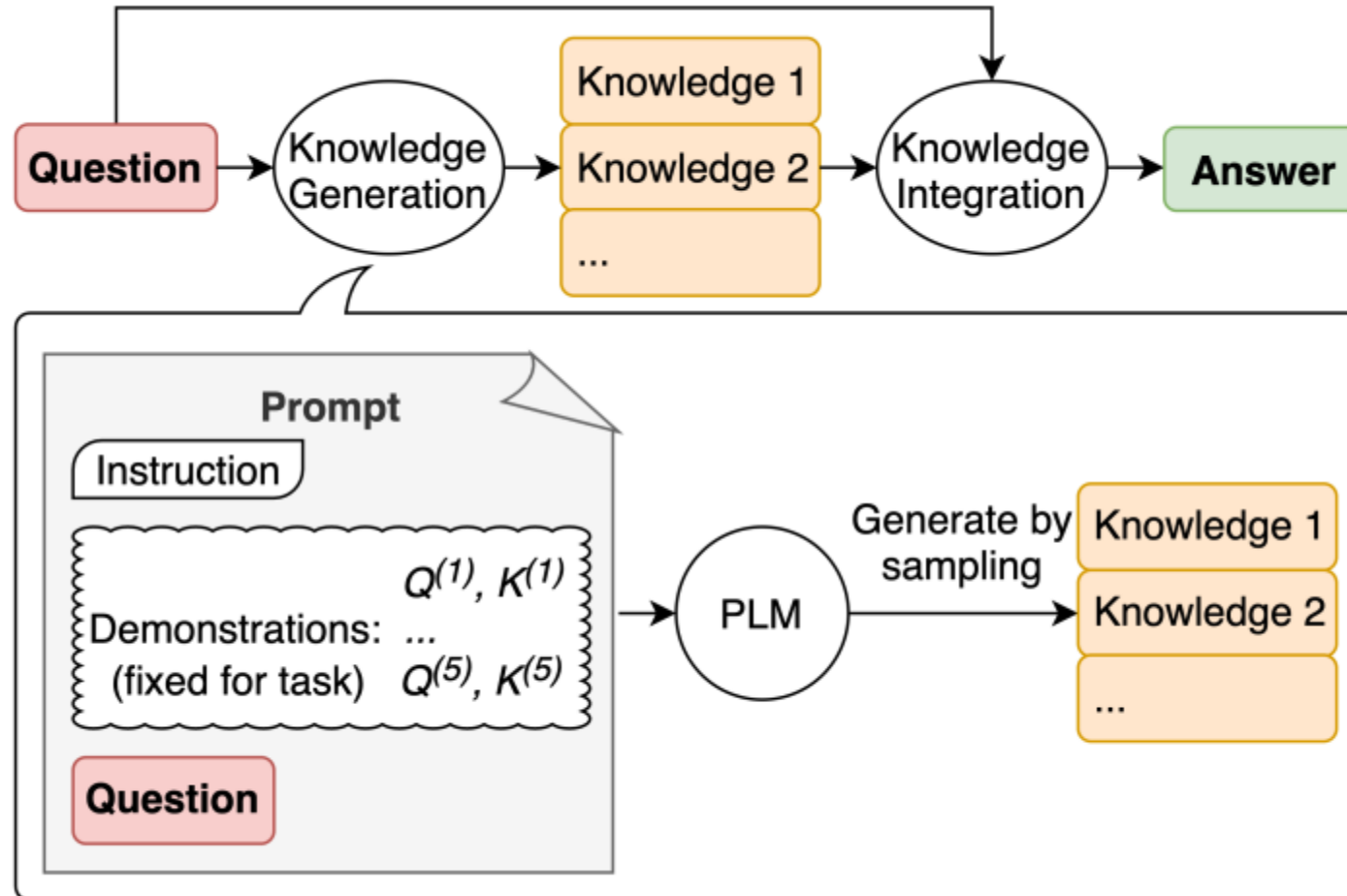
A: **Let's think step by step.**

(Output) There are 16 balls in total. Half of the balls are golf balls. That means that there are 8 golf balls. Half of the golf balls are blue. That means that there are 4 blue golf balls. ✓

Zero-shot CoT



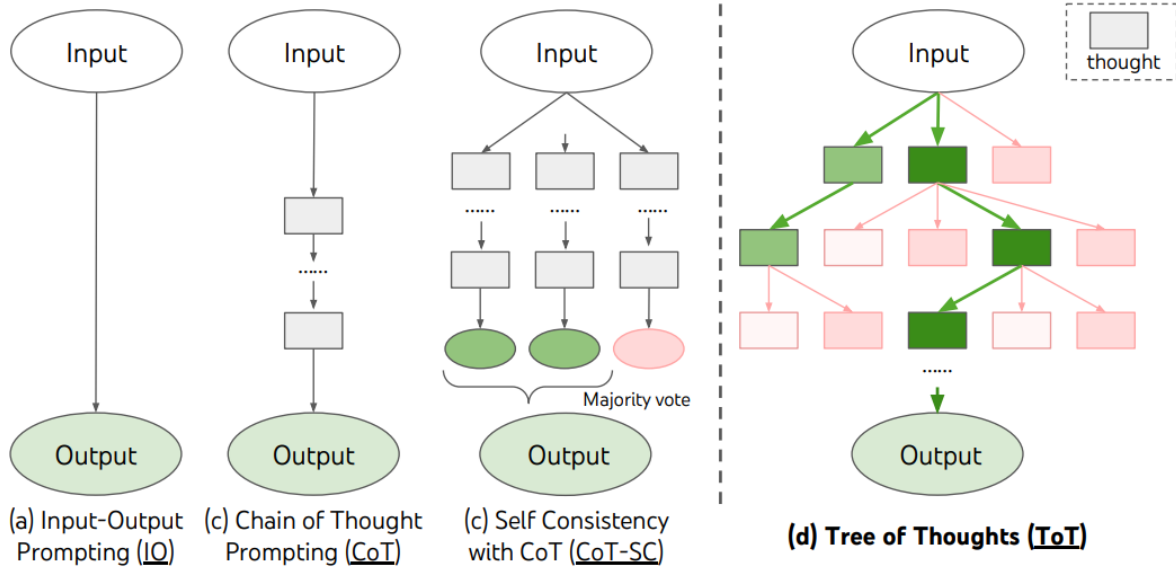
Liu et al. (2022). Generated Knowledge Prompting for Commonsense Reasoning



Generate Knowledge Prompting

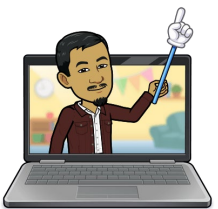
Yao et al. (2023). Deliberate Problem Solving with Large Language Models

Long (2023). Large Language Model Guided Tree-of-Thought



Imagine three different experts are answering this question. All experts will write down 1 step of their thinking, then share it with the group. Then all experts will go on to the next step, etc. If any expert realises they're wrong at any point then they leave. The question is...

1η6 dnεz7rou 72...
74 9υλ εxβελε 1.6917262 9υελ 1.6 71ουβ 9ε 9υλ 7ου7ε 9υεη 9υελ 7ε94ε:

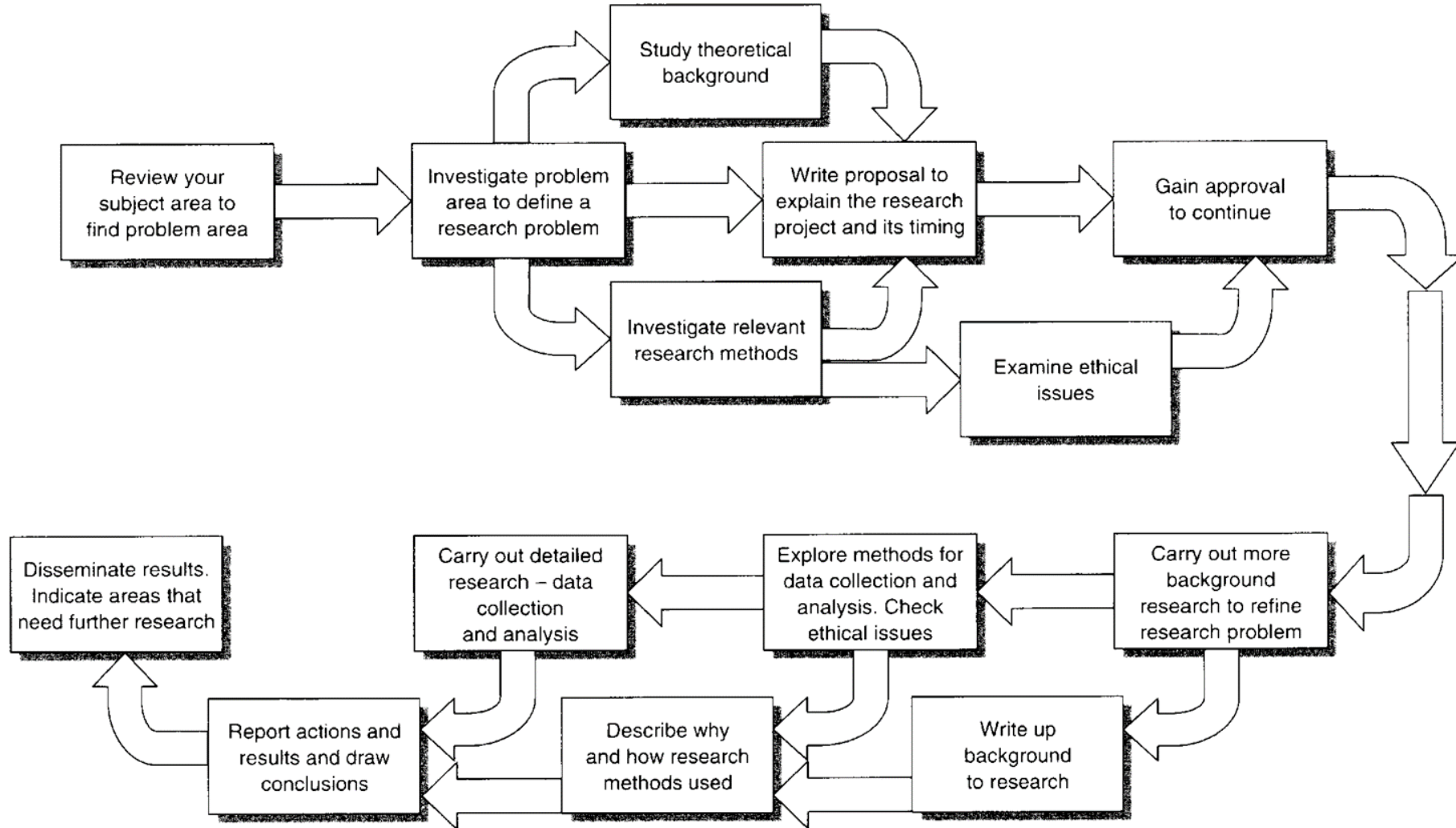


Three of Thoughts

ChatGPT **Assisted** in Research and Academic Publishing

Zohery (2023). ChatGPT in Academic Writing and Publishing: A Comprehensive Guide

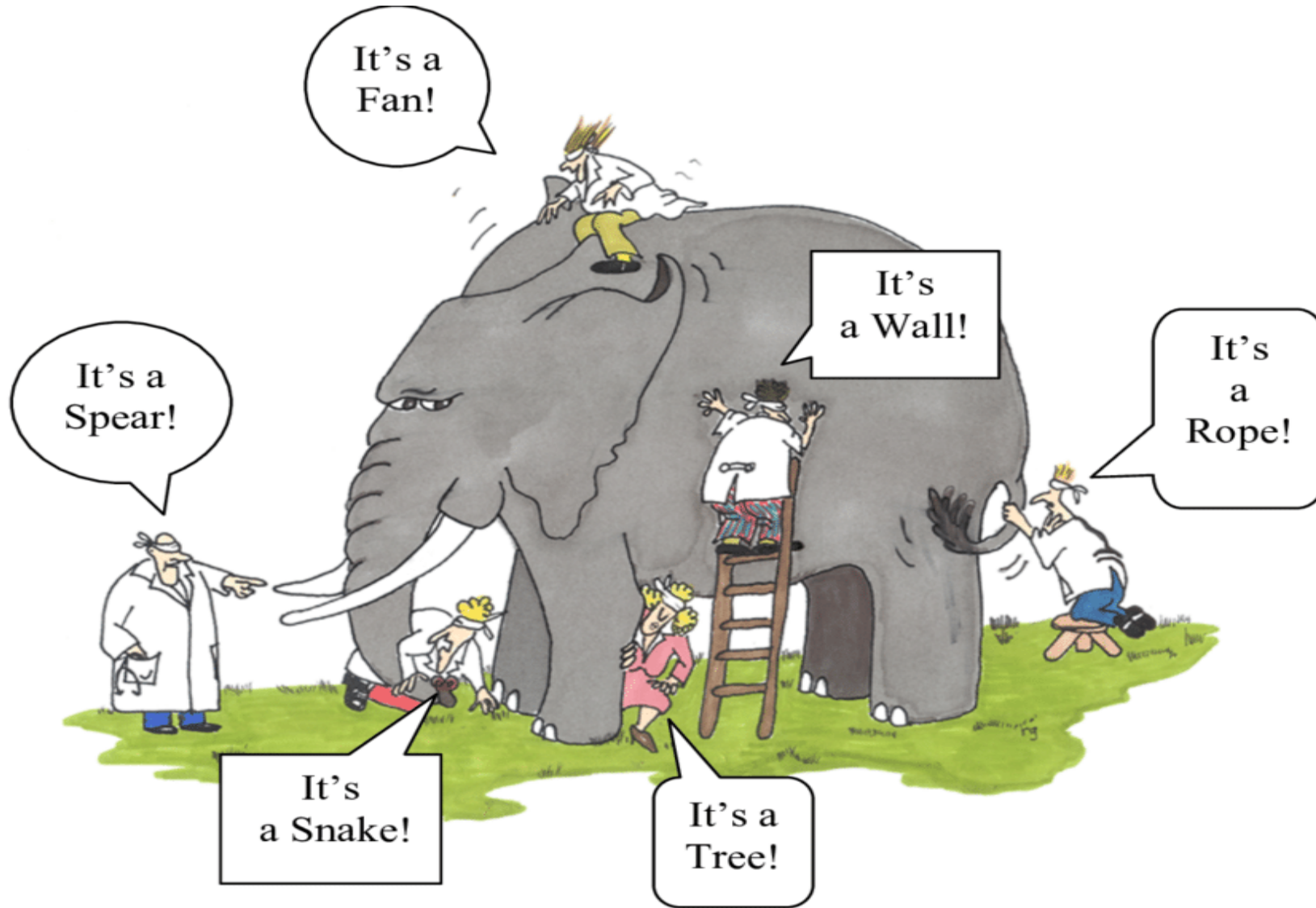
Walliman (2022). Research Methods: The Basics

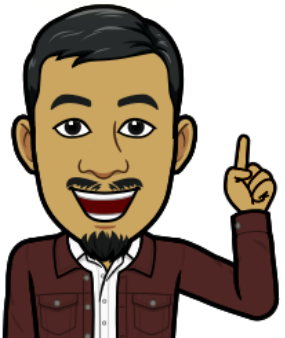
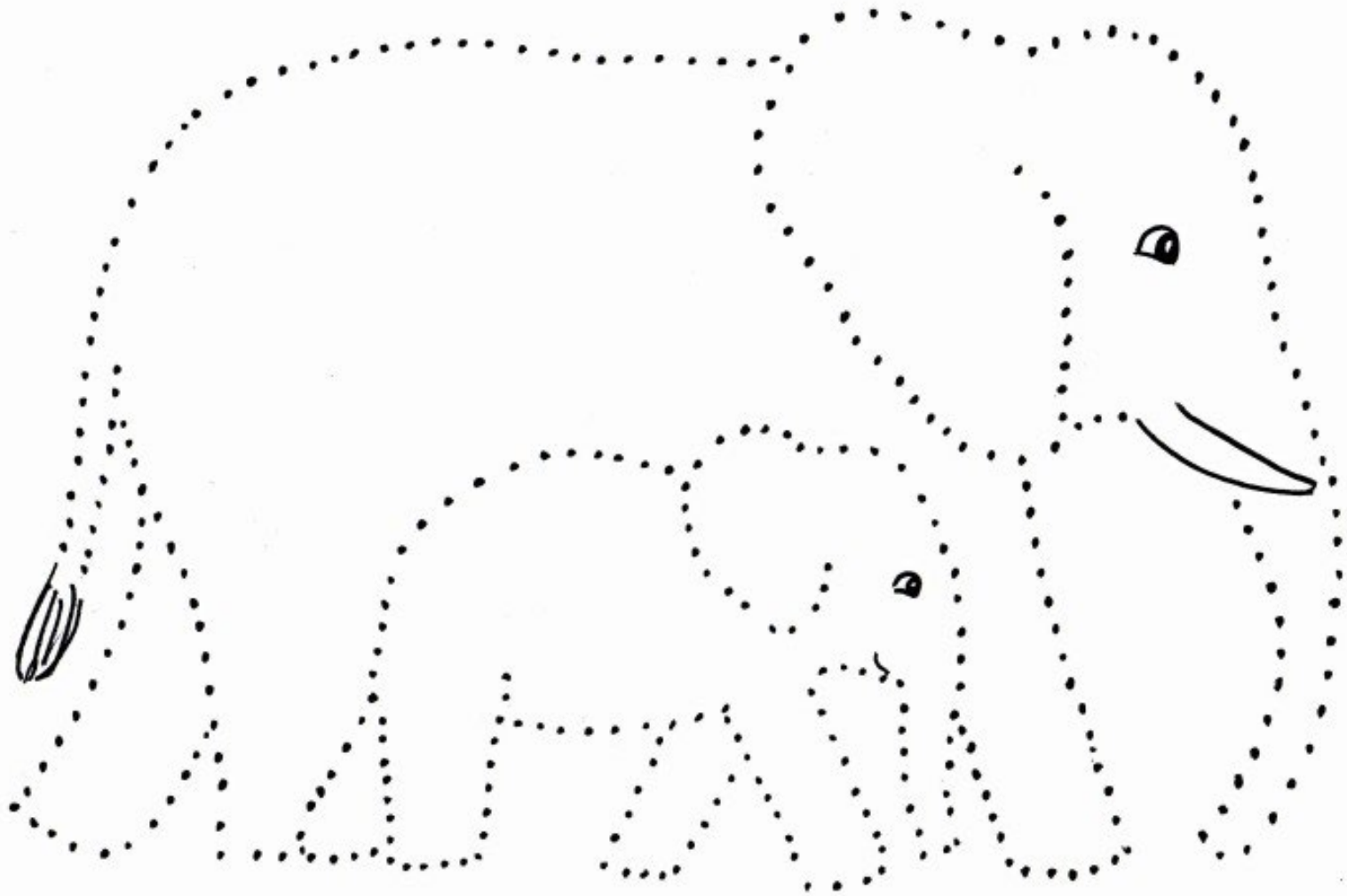


THINKING...



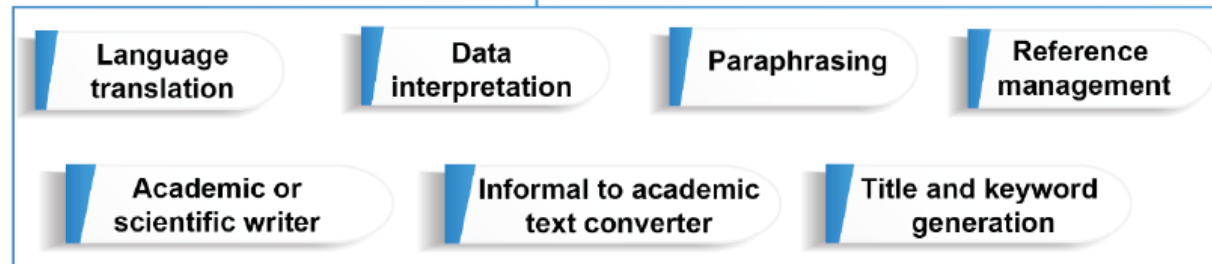
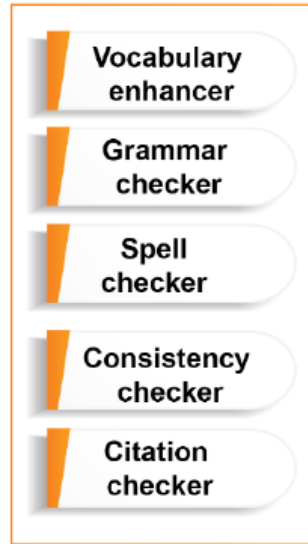
Research Process







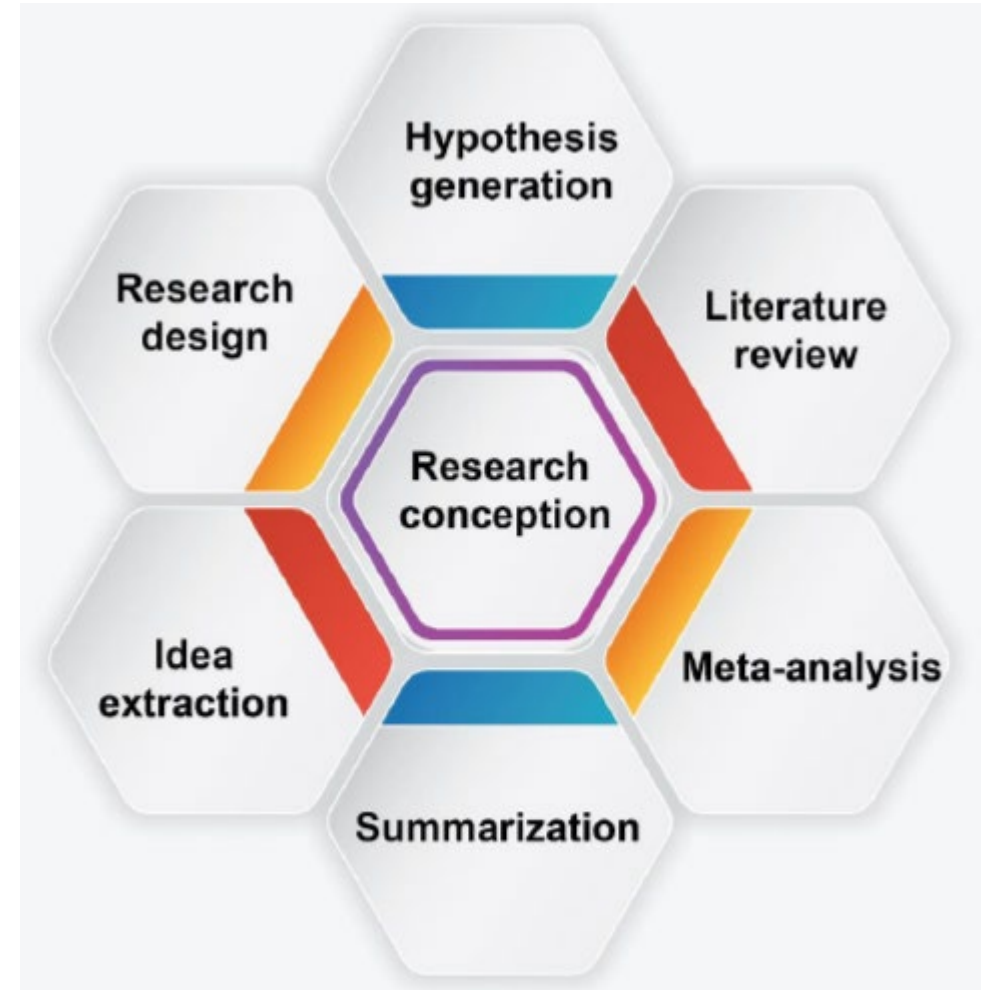
No shortcut to success !!!



ChatGPT's applications in academic writing and publishing

Research Conception

- **Defining Research Concept:** It's a researcher's grasp of the fundamental nature and scope of research.
- **Research Development:** ChatGPT and similar AI can guide through stages from initial questioning to design formulation.
- **Literature Synthesis:** AI aids in systematic review, ensuring comprehensive coverage of existing studies.
- **Advancing Methodology:** AI support extends to intricate processes like meta-analysis, enhancing research precision and depth.

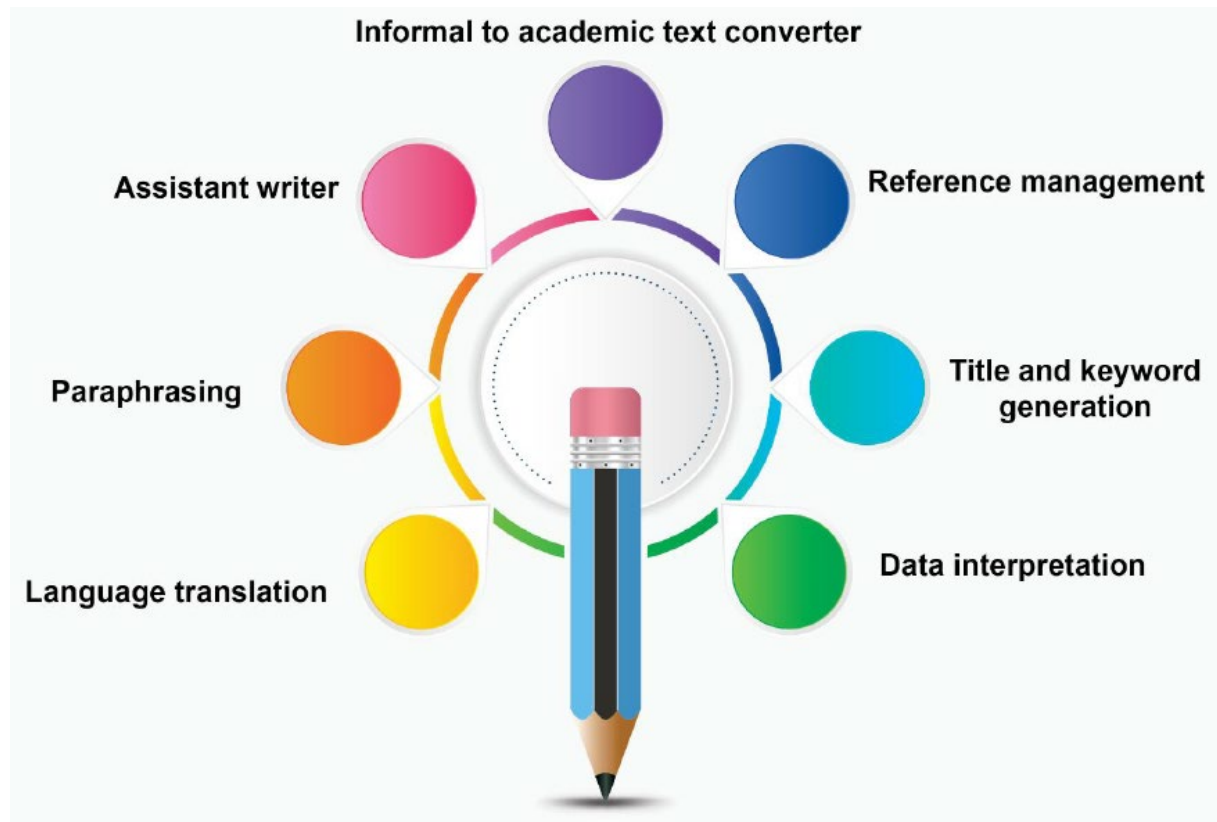


Sample Prompts

- Hypothesis generation:
 - Gives hypotheses and idea exploration about using chitosan in wound healing.
- Literature review:
 - Conduct a literature review on the use of nanomaterials in architecture.
- Meta-analysis: synthesizing data from several research projects to better understand specific research issues.
 - Conduct Meta-analysis for using mRNA in COVID-19 vaccine
- Summarization:
 - Summarize the following paragraph in 100 words:
- Idea extraction:
 - What are the ideas and innovations in "Green synthesis of olefin-linked covalent organic frameworks for hydrogen fuel cell applications"?
- Research design:
 - Create a research design based on the following research question; How do the US and China compare health outcomes among low-income people with chronic illnesses?

Academic and Scientific Writing

- **Effective Communication:** ChatGPT facilitates clear and concise writing, ensuring your research findings are communicated effectively in scientific papers, presentations, and reports, while adhering to writing standards.
- **Efficiency in Article Writing:** Utilize ChatGPT to streamline your writing process by generating content for various article sections, such as introduction, literature review, methods, results, discussion, and conclusion, enhancing overall efficiency.

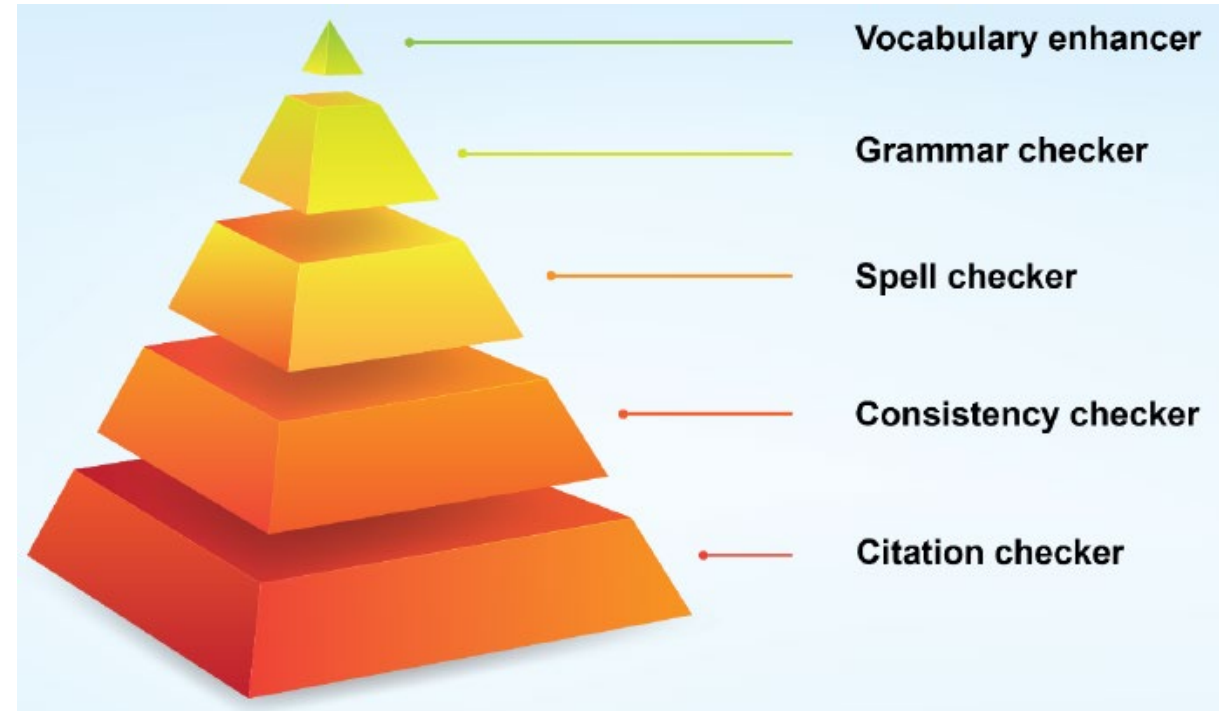


Sample Prompts

- Academic or scientific writer:
 - Write an introduction for a research article on using 3D printing to prototype structural electronics rapidly.
- Language translation:
 - Translate the following paragraph to Arabic:
- Informal to academic text converter
 - Transform into academic text:
- Paraphrasing:
 - Paraphrase the following paragraph:
- Data interpretation:
 - Extract data about number of deaths by COVID 19 each European country and put it in a table.
- Title and keywords generation:
 - Generate the title and keywords for the following abstract:
- Reference management:
 - Suggest 10 references about applications of artificial intelligence in drug discovery.

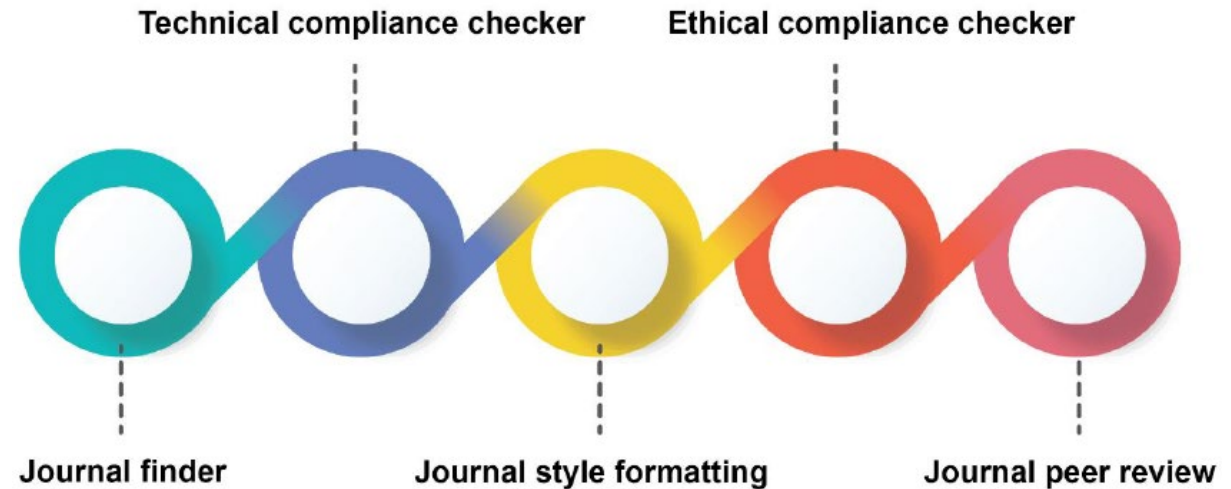
Editing and Proofreading

- Authors and writers can improve communication by meticulously reviewing their work.
- This process involves two key strategies:
 - **Editing**: Emphasizes clarity, style, and quotations for improved readability.
 - **Proofreading**: Focuses on eliminating grammar, punctuation, spelling, and formatting errors.
- These steps ensure that the produced text is clear, accurate, and engaging for the reader



Academic Publishing

- Academic publishing: A niche within publishing dedicated to disseminating scholarly research.
- Common outlets: Academic journals, books, and dissertations.
- Critical role: Drives research support and scientific advancement.
- ChatGPT's impact: A versatile tool, offering applications ranging from journal discovery to technical compliance checks.





 turnitin

 Originality.ai

[ud] UNDETECTABLE.AI

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insta|text

 grammarly

 QuillBot

 consensus

 SCISPACE

 jenni

