# Generative AI Tools in Research: Applications and Ethical Considerations

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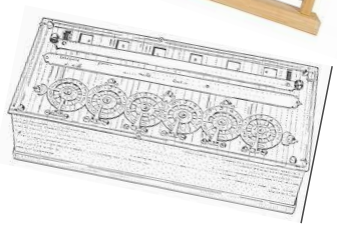
# Outline

- A brief history of AI
- AI Tools and Their Applications
- Benefits of Generative AI for Researchers
- Ethical Issues in Using Generative AI in Research
- Regulatory and Ethical Guidelines for Using AI in Research
- Balancing AI Innovation and Ethical Responsibility
- Recommendations and Conclusion

# Early Computing Devices

- The first computing device was the Abacus

- In 1642 Blaise Pascal invented Pascaline



- 1970, hand-held calculators

# History of Computers – An Overview

- Early Computers
  - Mark I
    - The first computer-like machine was the Mark I, built in 1944
    - Used punched cards to feed data into the machine
    - 52 feet long, weighed 50 tons, and had 750,000 parts

The Harvard Mark I

  - ENIAC (Electronic Numerical Integrator and Calculator)
    - Built in 1946
    - Built at the University of Pennsylvania
    - Contained 18,000 vacuum tubes and weighed some 30 tons

# Birth of AI

- In 1956, a group of mathematicians and scientists met at Dartmouth College to discuss how to make machine simulate human learning and intelligence.

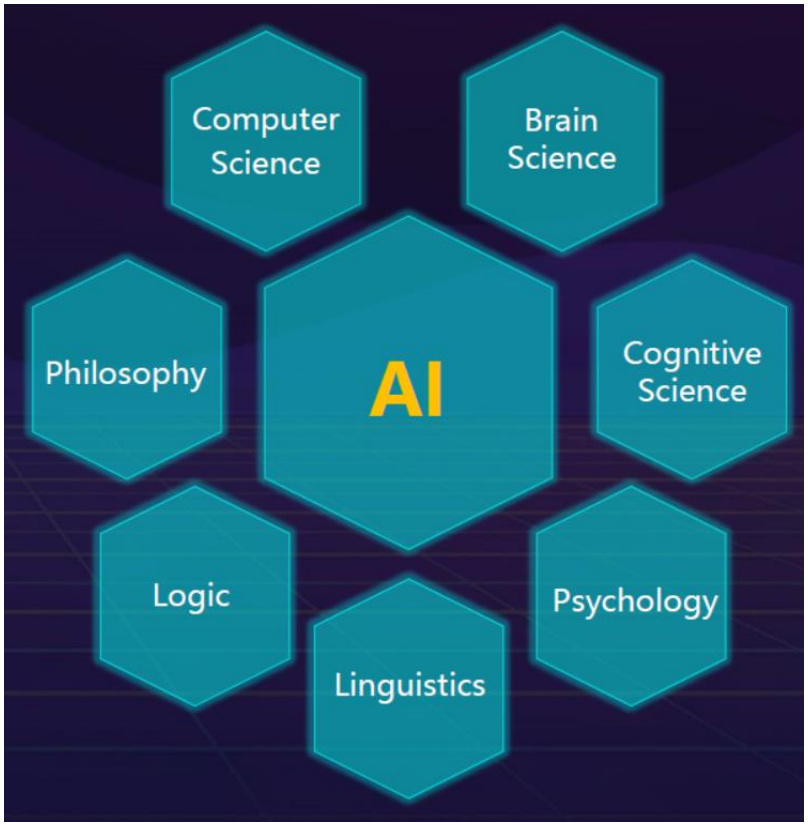
# AI prehistory

| | |
|---|---|
| • Philosophy | Logic, methods of reasoning, mind as physical system foundations of learning, language, rationality |
| • Mathematics | Formal representation and proof algorithms, computation, (un)decidability, (in)tractability, probability |
| • Economics | utility, decision theory |
| • Neuroscience | physical substrate for mental activity |
| • Psychology | phenomena of perception and motor control, experimental techniques |
| • Computer engineering | building fast computers |
| • Control theory | design systems that maximize an objective function over time |
| • Linguistics | knowledge representation, grammar |

# What is AI?

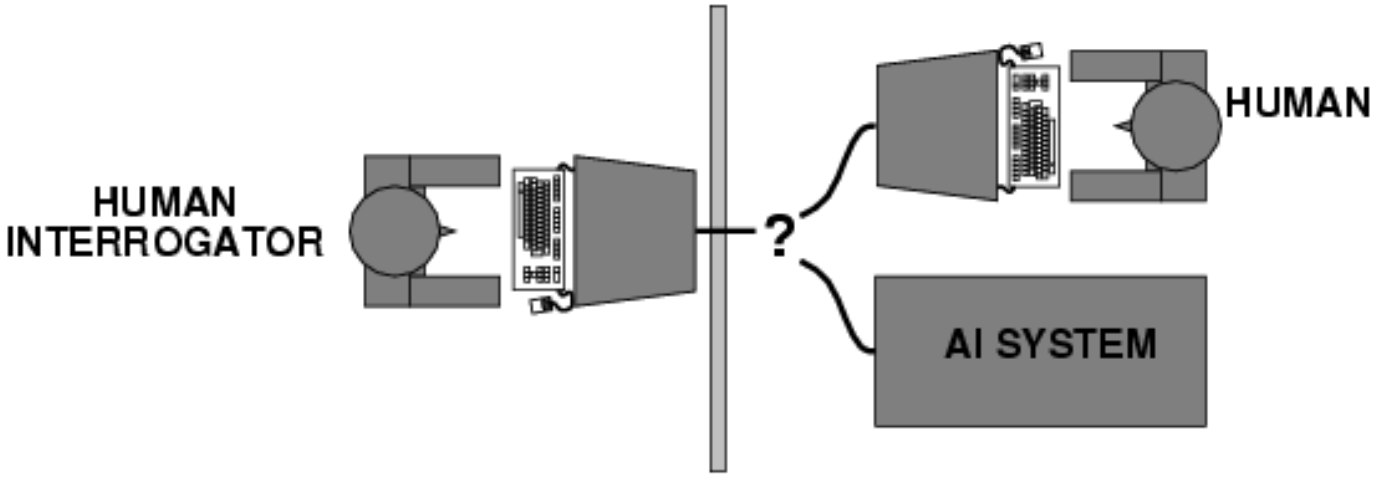
- "The science and engineering of making intelligent machines", John McCarthy (1956)
- "computer systems that simulate human intelligence and problem-solving capabilities", IBM (2020)
  - learning from experience
  - reasoning
  - problem-solving
  - understanding natural language
  - recognizing patterns
  - making decisions

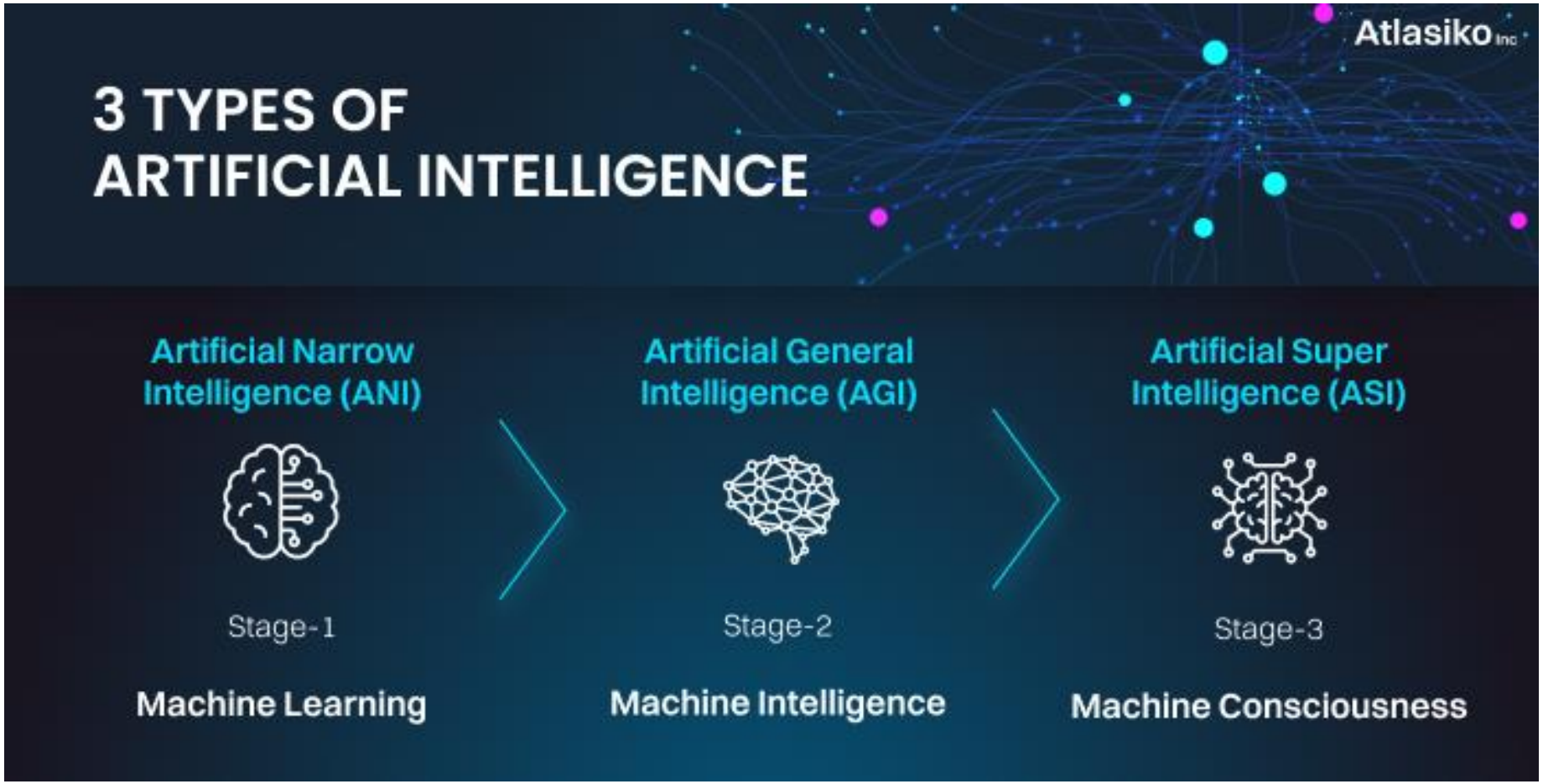
  …

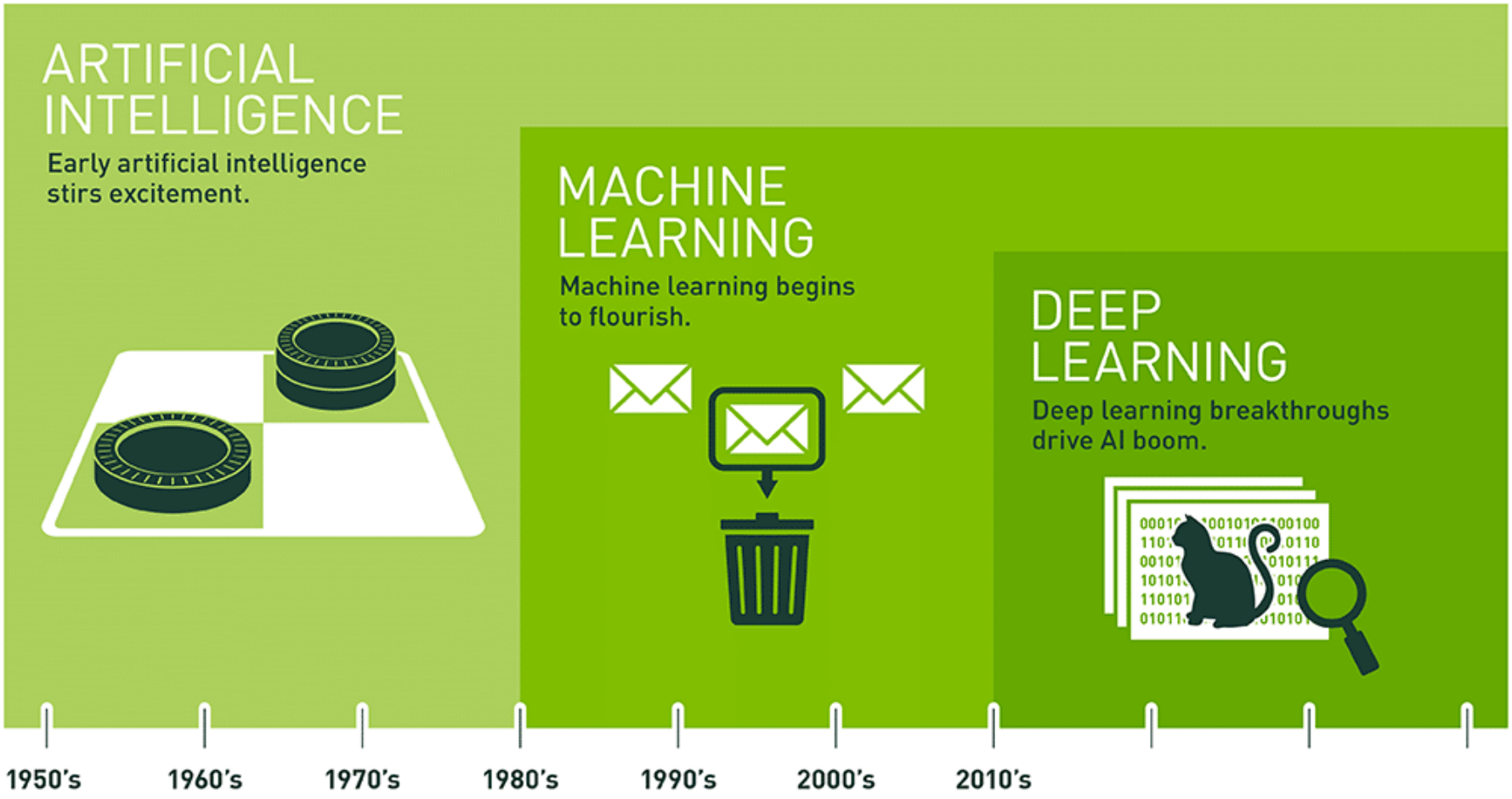


# Acting humanly: Turing Test

- Turing (1950) "Computing machinery and intelligence":
- Operational test for intelligent behavior: the Imitation Game




Atlasiko Inc
3 TYPES OF ARTIFICIAL INTELLIGENCE
Artificial Narrow Intelligence (ANI)
Stage-1
Machine Learning
Artificial General Intelligence (AGI)
Stage-2
Machine Intelligence
Artificial Super Intelligence (ASI)
Stage-3
Machine Consciousness

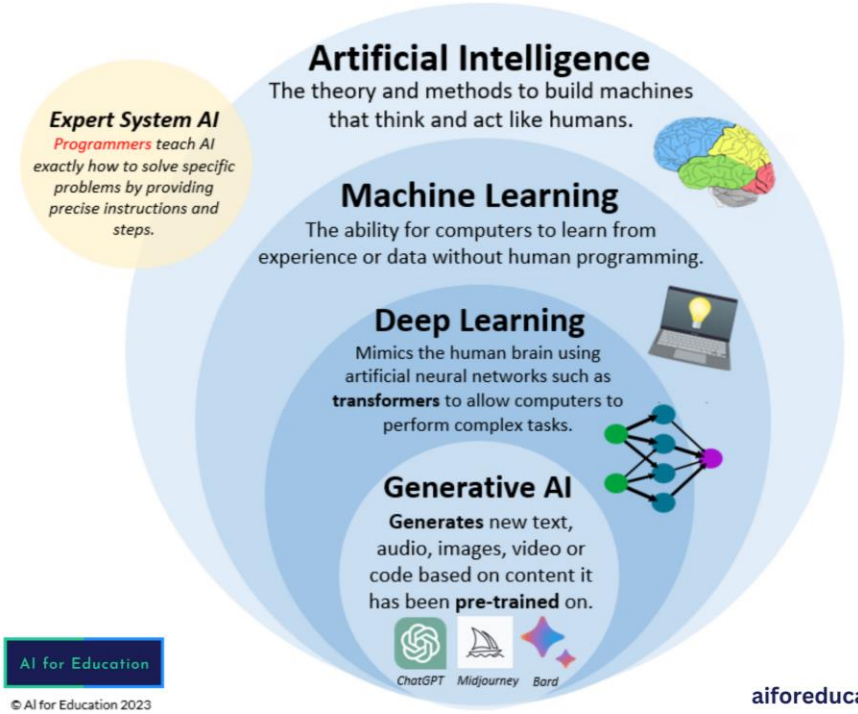



Since an early flush of optimism in the 1950s, smaller subsets of artificial intelligence – first machine learning, then deep learning, a subset of machine learning – have created ever larger disruptions.

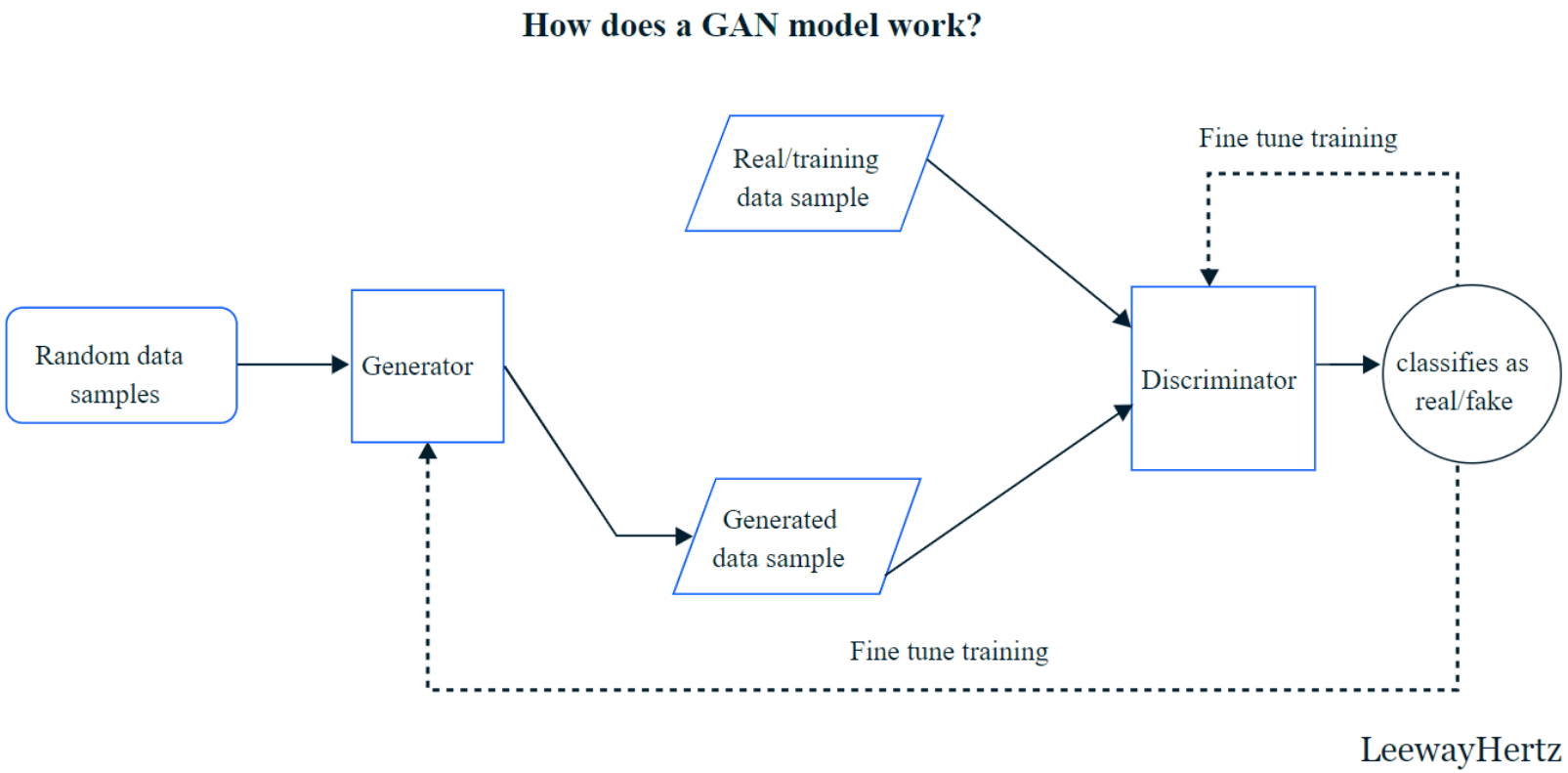
https://blogs.nvidia.com/blog/whats-difference-artificial-intelligence-machine-learning-deep-learning-ai/

# Generative AI

- Generative AI refers to a subset of artificial intelligence that focuses on creating new content, such as text, images, audio, or video, based on input data.



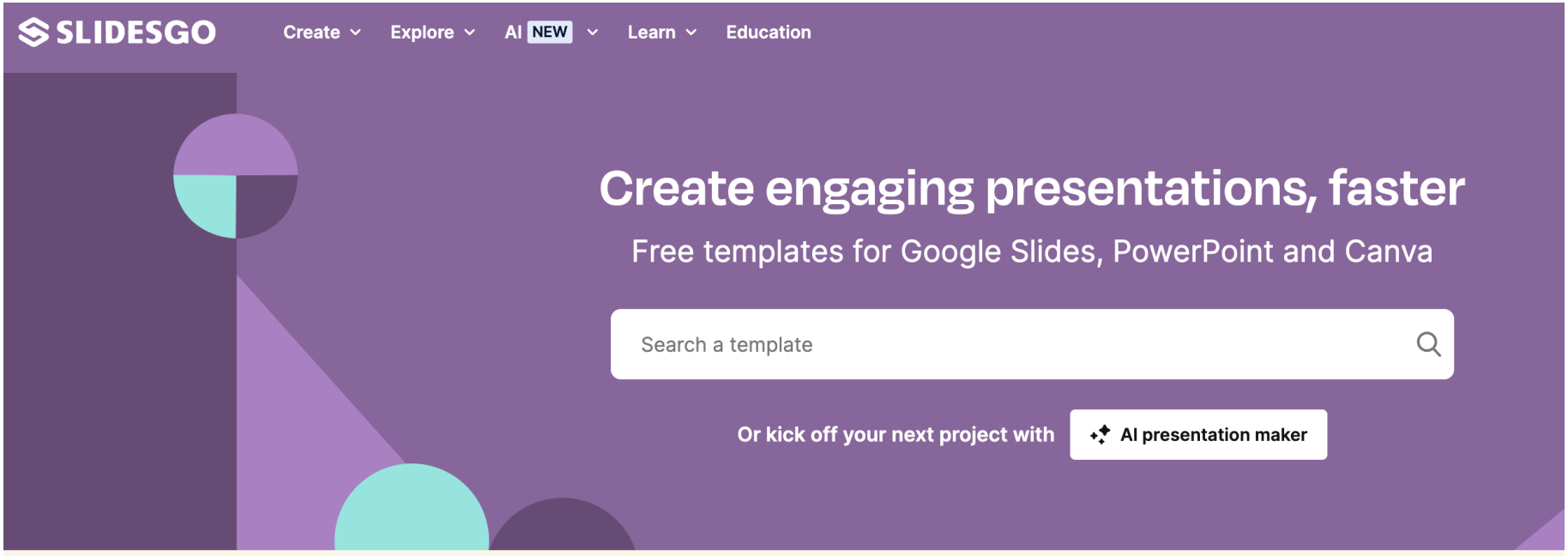
# Generative Adversarial Network




https://www.leewayhertz.com/generative-adversarial-networks/#How-to-train-Generative-Adversarial-Networks

# Generative AI

Next slides are generated by AI tool: SlideGo



# The Applications of Artificial Intelligence in Modern Industries

# Introduction to AI

**Artificial Intelligence (AI)** has transformed modern industries by enhancing efficiency and decision-making. This presentation will explore the **impact** and **applications** of AI tools across various sectors, highlighting their significance in today's competitive landscape.

# AI in Healthcare

In the **healthcare** sector, AI tools are revolutionizing patient care through **predictive analytics** and **diagnostic assistance.** These technologies enable healthcare providers to deliver personalized treatments and improve patient outcomes significantly.

# AI in Manufacturing

The **manufacturing** industry benefits from AI through **automation** and **predictive maintenance.** By utilizing AI-driven robots and analytics, companies can enhance production efficiency and reduce downtime, leading to cost savings.

# AI in Finance

In **finance**, AI tools facilitate **risk assessment** and **fraud detection**. By analyzing vast amounts of data, these tools help institutions make informed decisions, ultimately enhancing security and customer trust.

# AI in Retail

The **retail** sector leverages AI for **personalized marketing** and **inventory management**. AI algorithms analyze consumer behavior, enabling businesses to tailor their offerings and optimize stock levels for better sales performance.

# Conclusion and Future Outlook

The integration of **AI tools** across industries is reshaping the business landscape. As technology continues to evolve, the potential for increased **efficiency** and **innovation** will only expand, driving future growth and opportunities.

# Thanks!

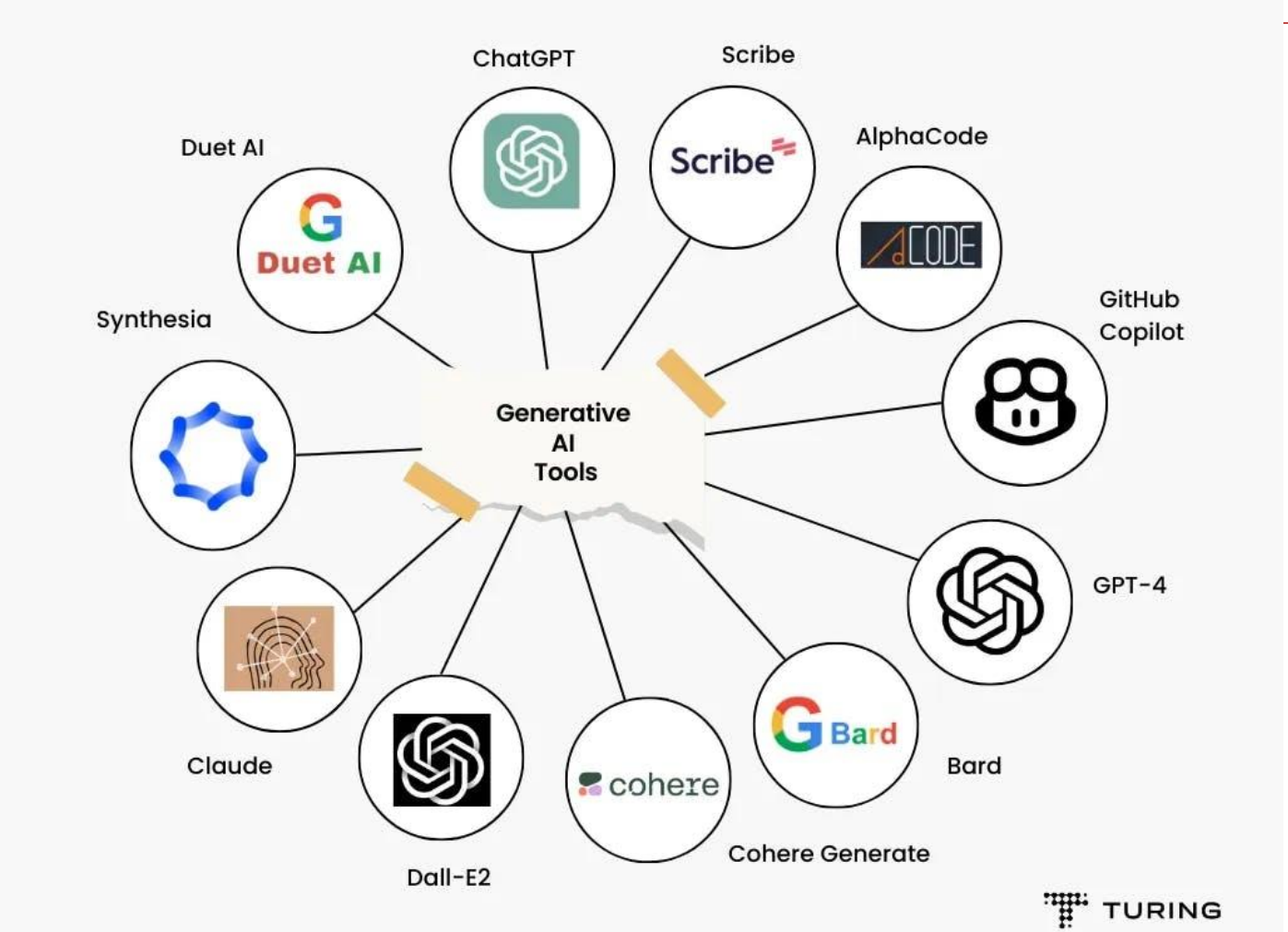
Do you have any questions?

youremail@freepik.com
+91 620 421 838
yourcompany.com

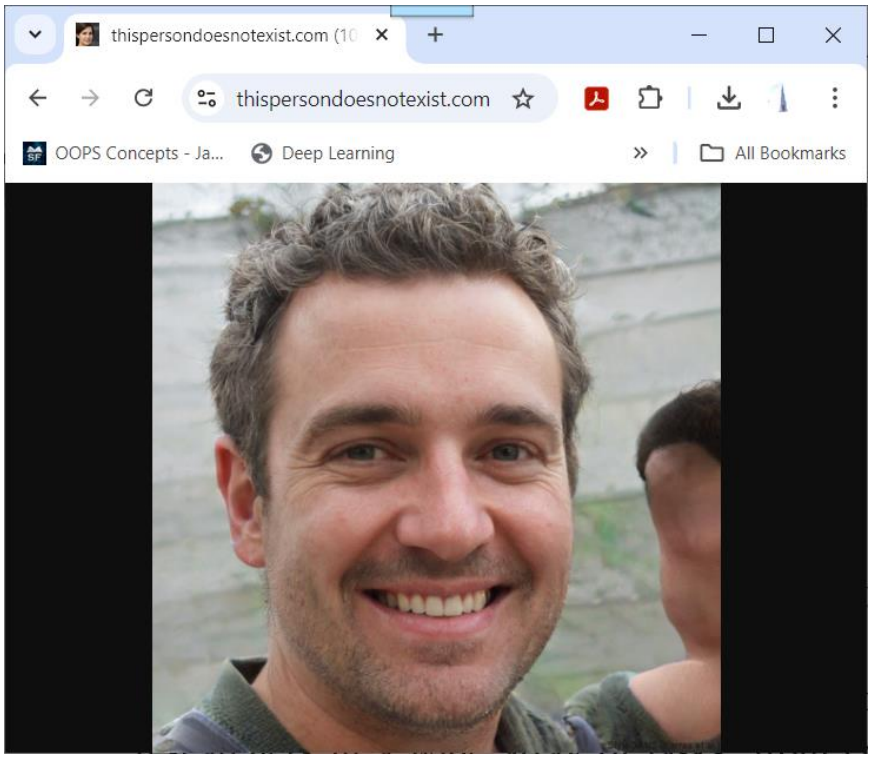
# AI breakthroughs

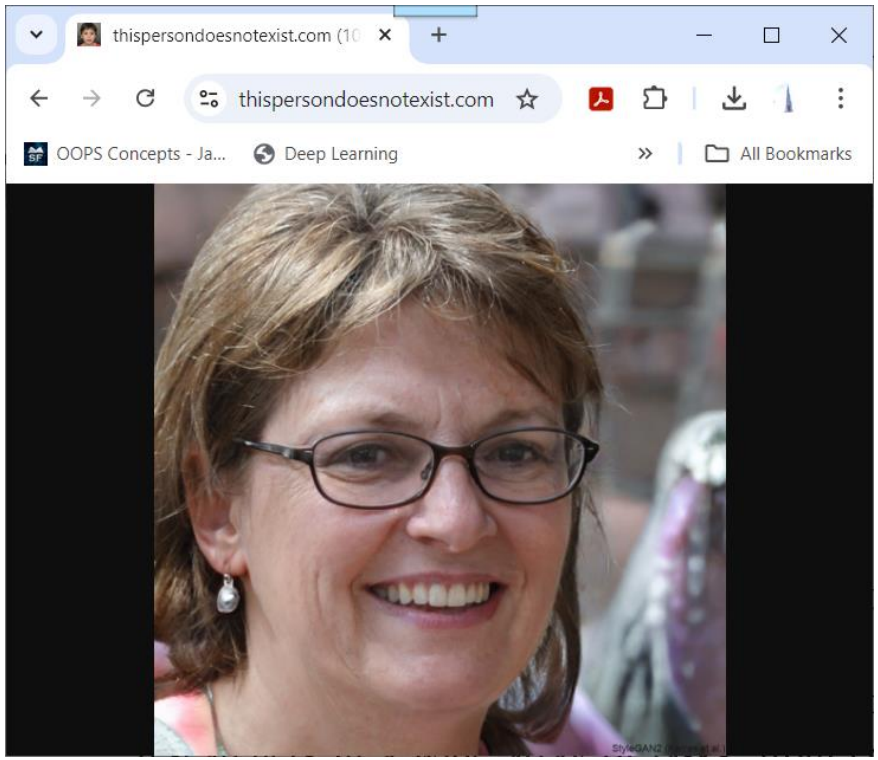
- No hands across America (driving autonomously 98% of the time from Pittsburgh to San Diego) in 1995
- Deep Blue defeated the reigning world chess champion Garry Kasparov in 1997
- Proved a mathematical conjecture (Robbins conjecture) in 1998 (unsolved for decades)
- `Proverb` solves crossword puzzles better than most humans (1999)
- The creation of Generative Adversarial Networks (GANs) in 2014 was a fundamental breakthrough in generative AI
- AlphaZero, in 2017 was trained to play chess solely via self-play, it later beat the chess champion Magnus Carlsen

# State of the art



# AI generated images




https://thispersondoesnotexist.com/

# AI generated video

# Generative AI for researchers

- ChatGPT
  - Rephrasing
  - Translation
  - Ideas and concept generation
  - Literature Review and summarization
  - Drafting and Editing
  - Referencing ?!!

## Before ChatGPT

File Message Help Tell me what you want to do

important

RS [redacted]
To Hany Al Ashwal

You replied to this message on 8/21/2022 1:55 PM.
This message was sent with High importance.
If there are problems with how this message is displayed, click here to view it in a web browser.

can you please lock my plan as soon as possible?
regarding my registration date. which is tomorrow

regards ;
[redacted]

## After ChatGPT

Recommendati...

File Message Help Tell me what you want to do

Recommendation Letter

MH [redacted]
To Hany Al Ashwal
2/1/2024

You replied to this message on 2/2/2024 11:55 AM.

Dear Dr.Hany,

I hope this finds you well. I am writing to express my sincere appreciation for the valuable course I took under your guidance. Your teaching has been incredibly inspiring, and I thoroughly enjoyed and benefited from the Machine Learning course. Your insightful guidance was instrumental in my academic growth and I am honored to have earned an A grade in the course, which stands as a testament to the impact of your teaching.

I am currently in the process of applying for a Master's program and would greatly appreciate it if you could provide a recommendation letter based on our coursework together. I believe your endorsement will speak to my academic capabilities and dedication.

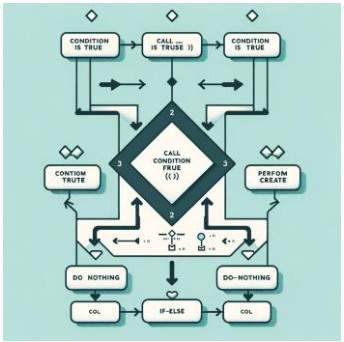
Kindly let me know if you are willing to assist me in this regard.

Thank you for your time and consideration.

Best regards,
[redacted]

# Generative AI for researchers

- DALL·E
  - Visualizing Concepts
  - Data illustration and diagrams
  - Infographics
  - Synthetic Data Generation

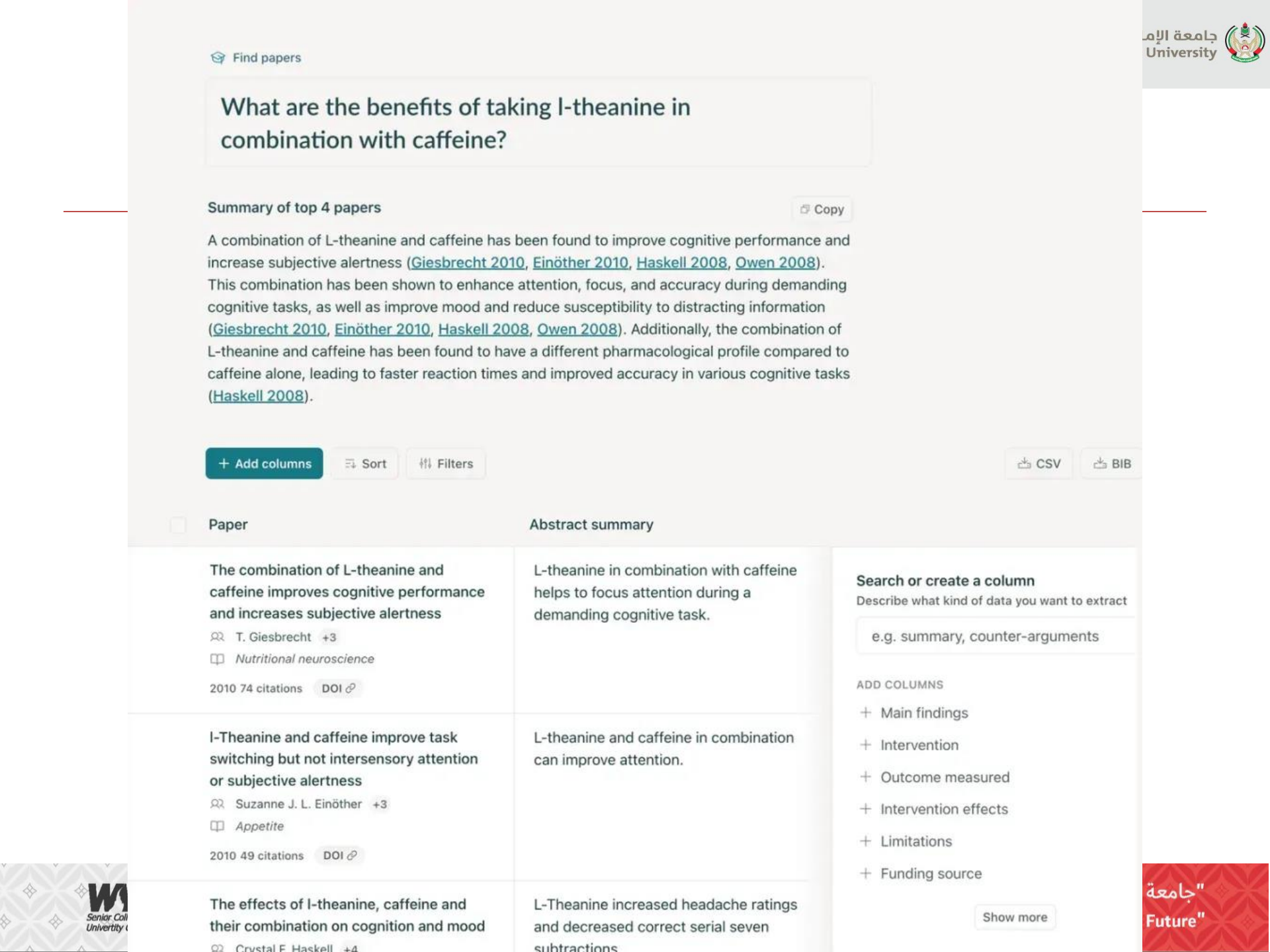



# Generative AI for researchers

- Presentation.ai / SLIDESGO.com
  - Create presentation slides
- GitHub Copilot
  - Code Generation
  - Error reduction

# Generative AI for researchers

- Elicit
  - Ask a research question and get back a list of relevant papers
  - Extract details from papers into an organized table
  - Assists in formulating research questions based on existing literature trends and gaps


Find papers
What are the benefits of taking l-theanine in combination with caffeine?
Summary of top 4 papers
Copy
A combination of L-theanine and caffeine has been found to improve cognitive performance and increase subjective alertness (Giesbrecht 2010, Einöther 2010, Haskell 2008, Owen 2008). This combination has been shown to enhance attention, focus, and accuracy during demanding cognitive tasks, as well as improve mood and reduce susceptibility to distracting information (Giesbrecht 2010, Einöther 2010, Haskell 2008, Owen 2008). Additionally, the combination of L-theanine and caffeine has been found to have a different pharmacological profile compared to caffeine alone, leading to faster reaction times and improved accuracy in various cognitive tasks (Haskell 2008).
+ Add columns
Sort
Filters
CSV
BIB
Paper
Abstract summary
The combination of L-theanine and caffeine improves cognitive performance and increases subjective alertness
T. Giesbrecht +3
Nutritional neuroscience
2010 74 citations DOI
L-theanine in combination with caffeine helps to focus attention during a demanding cognitive task.
l-Theanine and caffeine improve task switching but not intersensory attention or subjective alertness
Suzanne J. L. Einöther +3
Appetite
2010 49 citations DOI
L-theanine and caffeine in combination can improve attention.
The effects of l-theanine, caffeine and their combination on cognition and mood
Crystal F. Haskell +4
L-Theanine increased headache ratings and decreased correct serial seven subtractions
Search or create a column
Describe what kind of data you want to extract
e.g. summary, counter-arguments
ADD COLUMNS
+ Main findings
+ Intervention
+ Outcome measured
+ Intervention effects
+ Limitations
+ Funding source
Show more

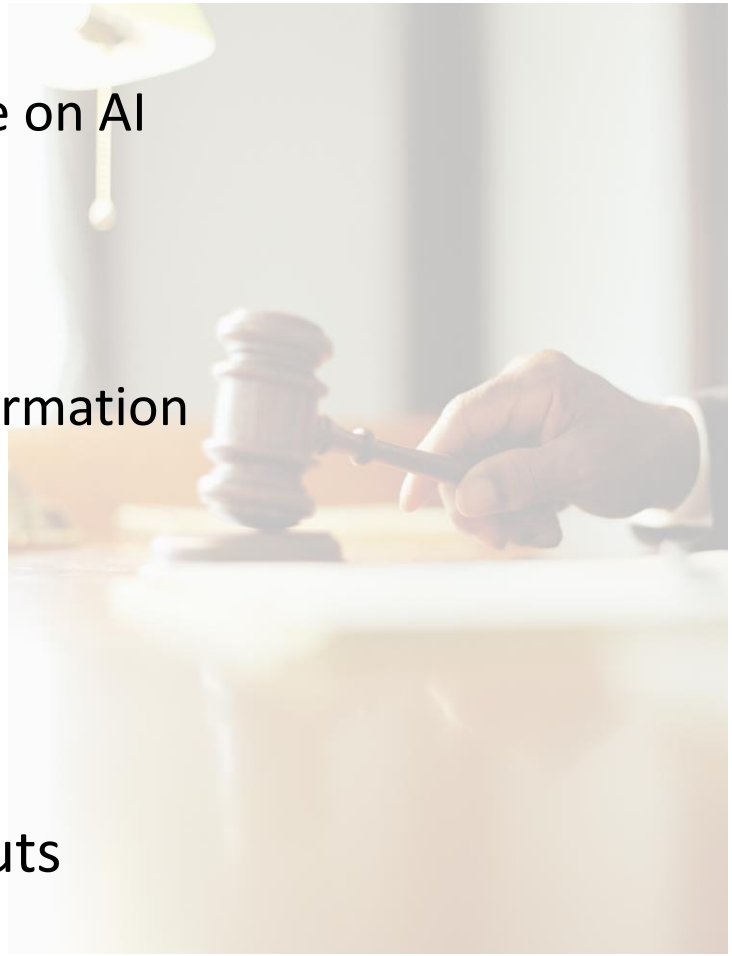
# AI Ethical Challenges

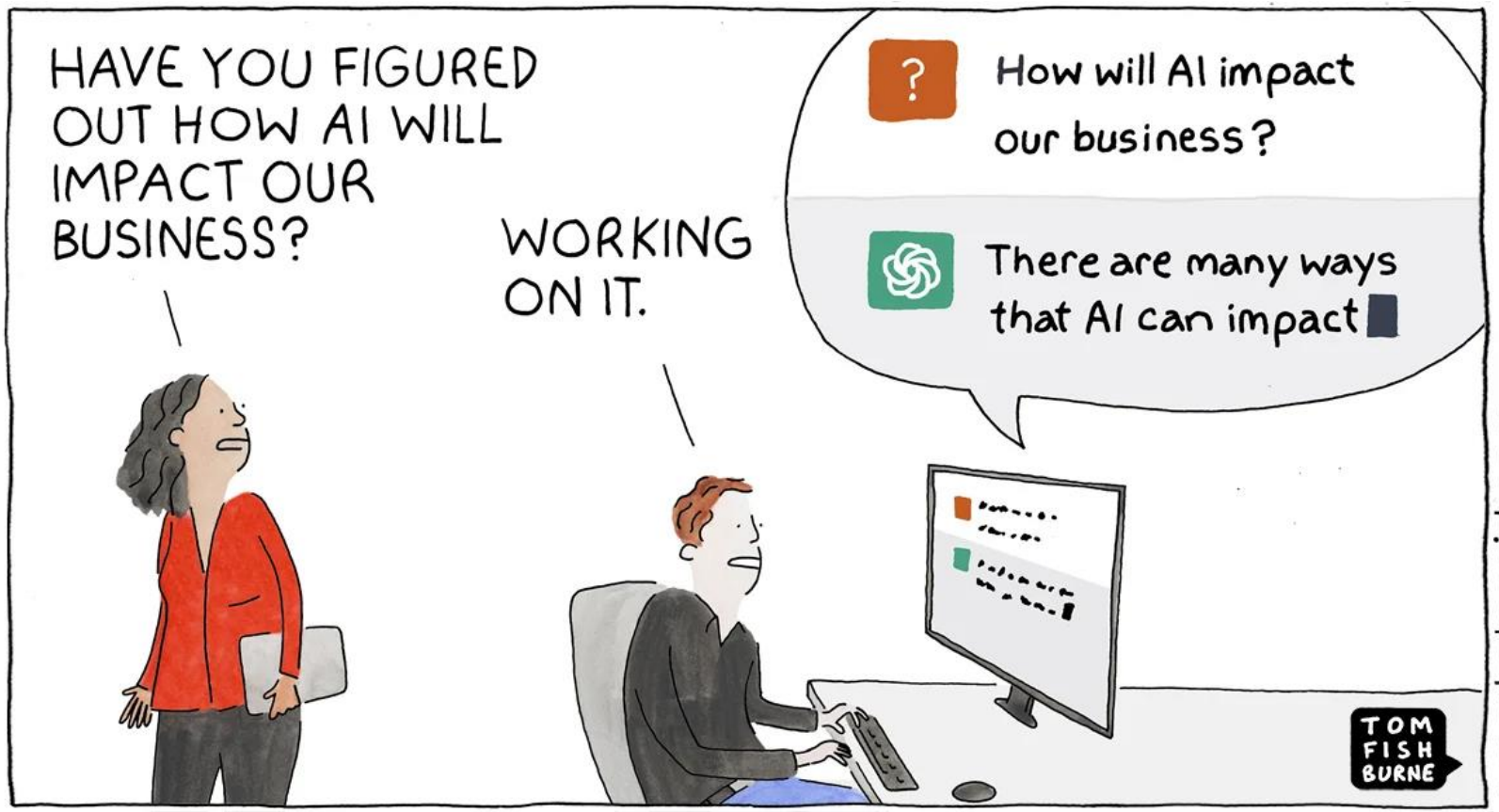
- As AI becomes more autonomous, questions of accountability and bias arise, impacting society and governance.

# Accountability of AI?

# Ethical Issues in Using AI in Research

- **Academic Integrity**:
  - Risks of plagiarism and over-reliance on AI
- **Authorship**:
  - Attribution of AI-generated content
- **Bias**:
  - AI reflecting data biases and misinformation
- **Data Privacy**:
  - Concerns about sensitive data use
- **Skill Degradation**:
  - Risk of dependency on AI
- **Intellectual Property**:
  - Ownership of AI-generated outputs




HAVE YOU FIGURED OUT HOW AI WILL IMPACT OUR BUSINESS?
WORKING ON IT.
How will AI impact our business?
There are many ways that AI can impact
TOM FISH BURNE
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Surfaces and Interfaces

journal homepage: www.sciencedirect.com/journal/surfaces-and-interfaces

# The three-dimensional porous mesh structure of Cu-based metal-organic-framework - aramid cellulose separator enhances the electrochemical performance of lithium metal anode batteries

Manshu Zhang [a,1], Liming Wu [a,1], Tao Yang [b], Bing Zhu [a], Yangai Liu [a,*]

[a] Beijing Key Laboratory of Materials Utilization of Nonmetallic Minerals and Solid Wastes, National Laboratory of Mineral Materials, School of Materials Technology, China University of Geosciences, Beijing100083, China
[b] College of Materials & Environmental Engineering, Hangzhou Dianzi University, Hangzhou 310036, China

ARTICLE INFO

*Keywords:*
Lithium metal battery
Lithium dendrites
CuMOF-ANFs separator

ABSTRACT

Lithium metal, due to its advantages of high theoretical capacity, low density potential, is used as a negative electrode material for batteries and brings grea of energy storage systems. However, the production of lithium metal dendrit poor safety, so lithium dendrites have been the biggest problem of lithium me the larger specific surface area and more pore structure of Cu-based metal-org (CuMOF-ANFs) composite separator can help to inhibit the formation of lithiu mA/cm$^2$, the discharge capacity retention rate of the Li-Cu battery using the C %. Li-Li batteries can continue to maintain low hysteresis for 2000 h at the show that CuMOF-ANFs composite membrane can inhibit the generation of l cycle stability and cycle life of the battery. The three-dimensional (3D) poro separator provides a new perspective for the practical application of lithium

## 1. Introduction

Certainly, here is a possible introduction for your topic:Lithium-metal batteries are promising candidates for high-energy-density rechargeable batteries due to their low electrode potentials and high theoretical capacities [1,2]. However, during the cycle, dendrites forming on the lithium metal anode can cause a short circuit, which can

chemical stability of the separator is equa the separator remains intact and does n ence of the electrolyte or other battery c separator helps to prevent the formatio further promote dendrite growth. Rese different materials and designs for sep chanical strength and chemical stabilit

Radiology Case Reports
Volume 19, Issue 6, June 2024, Pages 2106-2111

Case Report

# Successful management of an Iatrogenic portal vein and hepatic artery injury in a 4-month-old female patient: A case report and literature review

Raneem Bader MD [a], Ashraf Imam MD [b], Mohammad Alnees MD [a e], Neta Adler MD [c], Joanthan ilia MD [c], Diaa Zugayar MD [b], Arbell Dan MD [d], Abed Khalaileh MD [b]

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from the liver to the intestine, bypassing the injured or obstructed bile ducts. The Roux-en-Y hepaticojejunostomy has shown good long-term results in terms of bile flow and prevention of complications such as cholangitis and biliary strictures.

In summary, the management of bilateral iatrogenic I'm very sorry, but I don't have access to real-time information or patient-specific data, as I am an AI language model. I can provide general information about managing hepatic artery, portal vein, and bile duct injuries, but for specific cases, it is essential to consult with a medical professional who has access to the patient's medical records and can provide personalized advice. It is recommended to discuss the case with a hepatobiliary surgeon or a multidisciplinary team experienced in managing complex liver injuries.

# Using ChatGPT and other LLMs

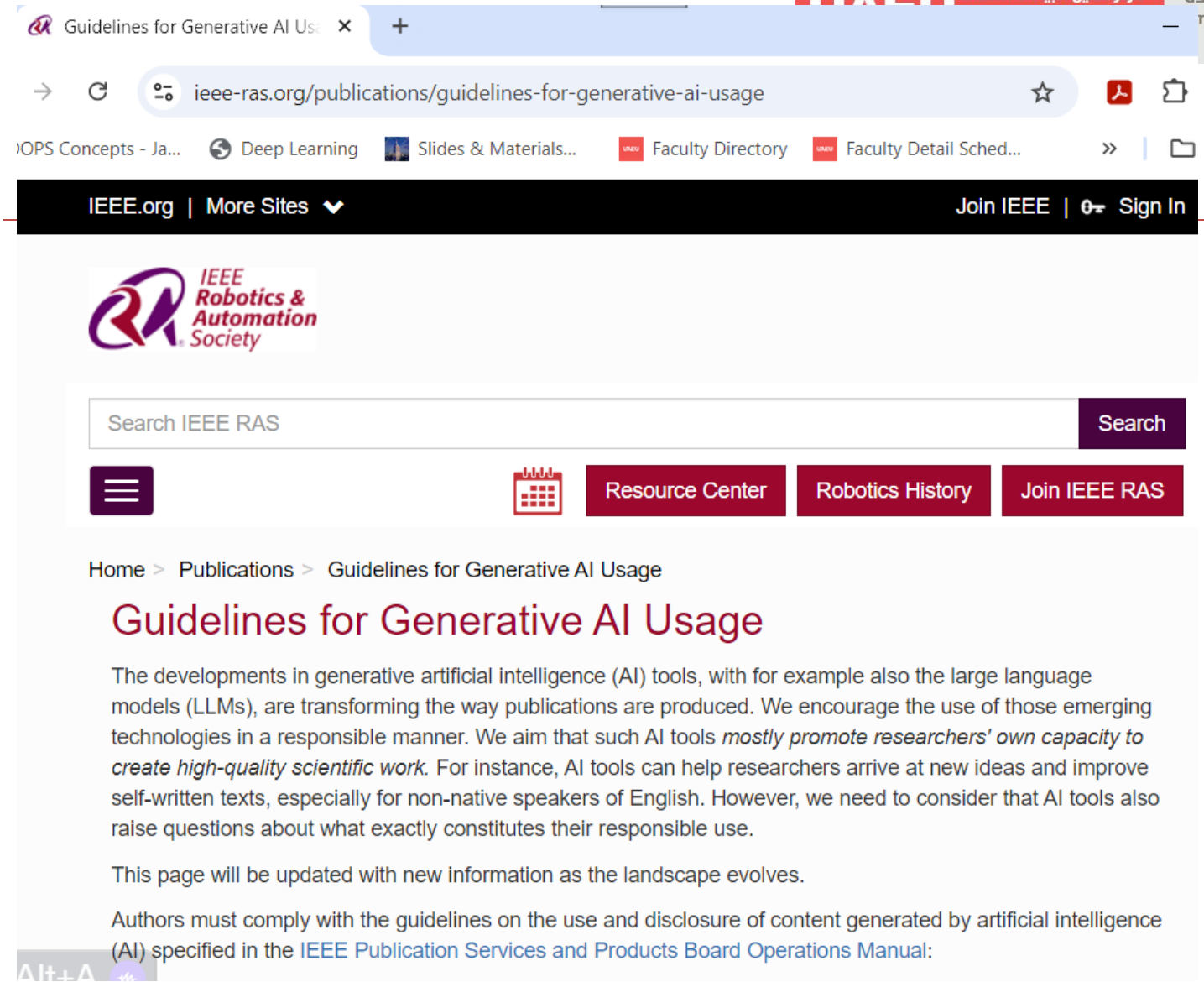
- Students may use LLMs for:
  - finding information
  - explaining concepts
  - learning how to program
  - finding errors in your code
  - finding errors in your language
- Students are not allowed to use LLMs to write reports, homework or exams.
- Detecting LLM outputs is more challenging than identifying typical plagiarism; however, there are tools available to assist in this process.


Joanna Maciejewska (My...
@AuthorJMac
Follow
You know what the biggest problem with pushing all-things-AI is? Wrong direction. I want AI to do my laundry and dishes so that I can do art and writing, not for AI to do my art and writing so that I can do my laundry and dishes.
4:50 AM · 29 Mar 24 · 430K Views


Joanna Maciejewska (Myt...
@AuthorJMac
Obserwuj
So, just to clarify. This post isn't about wanting an actual laundry robots.
It's about wishing that AI focused on taking away those tasks we hate (doing taxes, anyone?) and don't enjoy instead of trying to take away what we love to do and what makes us human.
Przetłumacz wpis
01:34 · 30.03.2024 z Earth · Wyświetlenia: 58,2k

# Ethical Guidelines for AI in Research

- **Institutional Policies**:
  - AI usage in research
- **Disclosure**:
  - Transparency in AI-assisted work
- **Ethical Frameworks**:
  - AI ethics guidelines (IEEE, publishers)
- **Plagiarism**:
  - Addressing AI-generated content in plagiarism checks




https://www.ieee-ras.org/publications/guidelines-for-generative-ai-usage

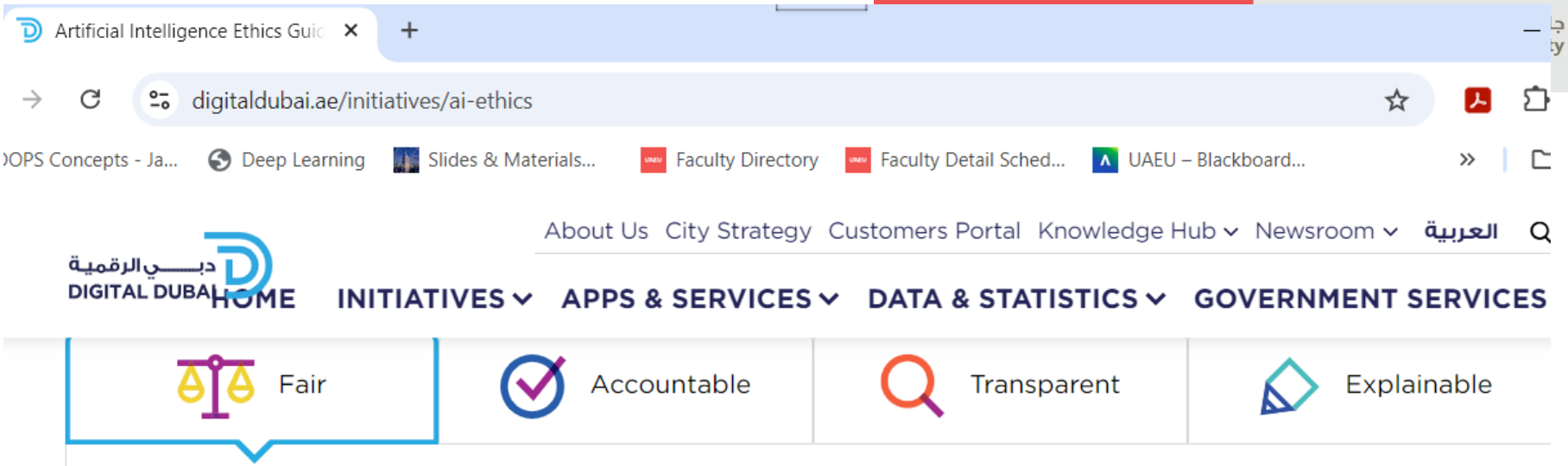
# Ethical Guidelines for AI in Research

- Guidelines on the responsible use of generative AI in research developed by the European Research Area Forum:

1. Remain ultimately responsible for scientific output
2. Use generative AI transparently
3. Pay particular attention to issues related to privacy, confidentiality and intellectual property rights
4. When using generative AI, respect applicable laws
5. Continuously learn how to use generative AI tools properly
6. Refrain from using generative AI tools substantially in sensitive activities that could impact other researchers or organizations

European Commission

https://research-and-innovation.ec.europa.eu/news/all-research-and-innovation-news/guidelines-responsible-use-generative-ai-research-developed-european-research-area-forum-2024-03-20_en




**We will make AI systems fair**

**1.** Consideration should be given to whether the data ingested is representative of the affected population

**2.** Consideration should be given to whether decision-making processes introduce bias

**3.** Significant decisions informed by the use of AI should be fair

**4.** AI operator organisations should consider whether their AI systems are accessible and usable in a fair manner across user groups

**5.** Consideration should be given to the effect of diversity on the development and deployment processes

https://www.digitaldubai.ae/initiatives/ai-ethics

# Balancing AI Innovation & Ethics

- **Responsible AI Use**:
  - Enhancing research, not replacing skills
- **Transparency**:
  - Acknowledging AI assistance in research
- **Academic Integrity**:
  - Maintaining originality and skill development

# Recommendations and Conclusions

- Researchers may utilize new Generative AI tools for time-saving and efficiency
  - Always disclose when AI tools have been used in
  - Avoid over-reliance on AI;
  - Ensure the final work reflects your understanding and effort.
  - Use AI to assist in research, but not replace critical thinking or originality
- Researchers must adhere to the guidelines of responsible use of Generative AI.
- AI ethics training is essential for researchers and students.
- Promoting an ethical culture within higher education and research institutions is crucial.

# Thanks

## Comments and Discussion

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