

Artificial Intelligence Tools: Responsible Use and Applications in Research and Academia

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Disclosure

Re-use conditions



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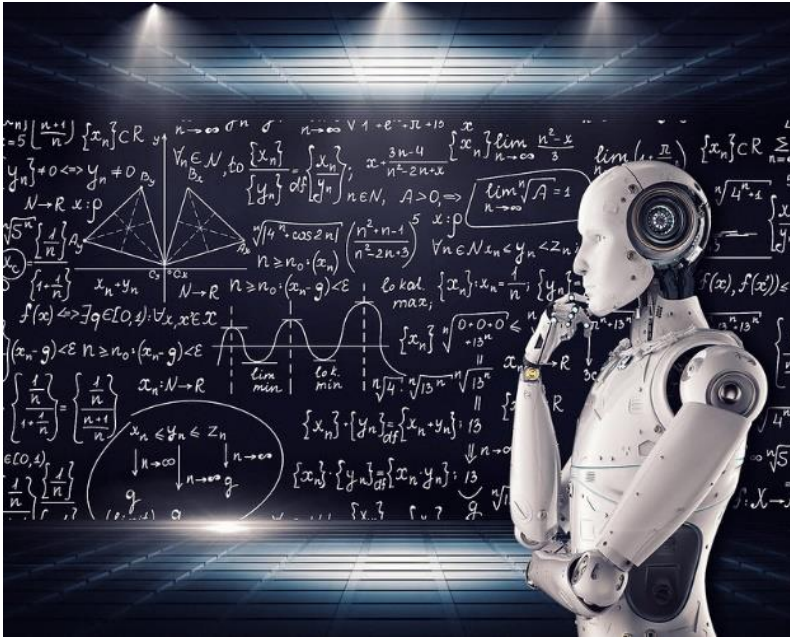
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Artificial Intelligence (AI) assistance

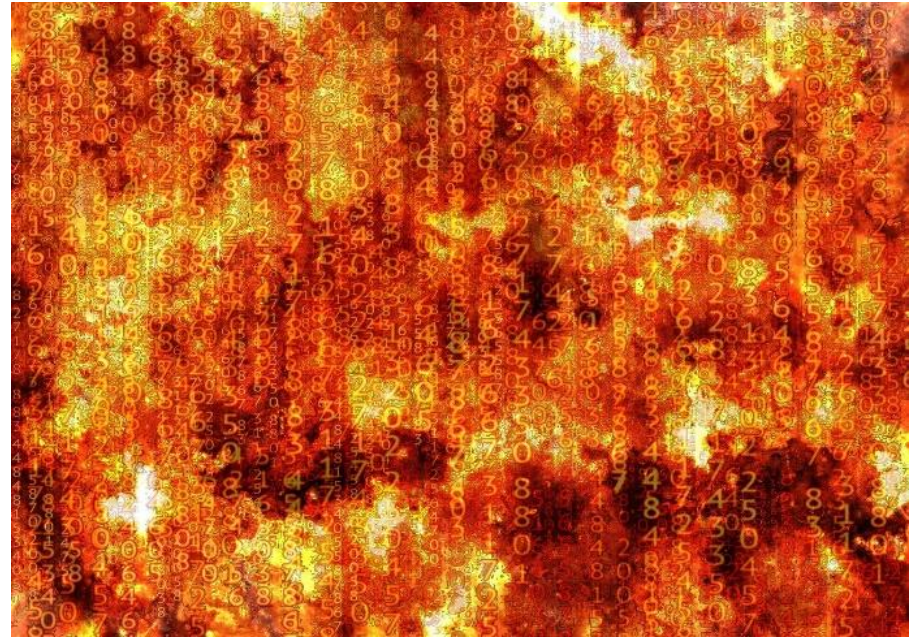
Parts of this workshop were developed with the assistance of ChatGPT/GPT-4 (e.g brainstorming guiding questions for exercises, refining exercise instructions and scenarios, providing feedback on slide content, suggesting/creating illustrations)



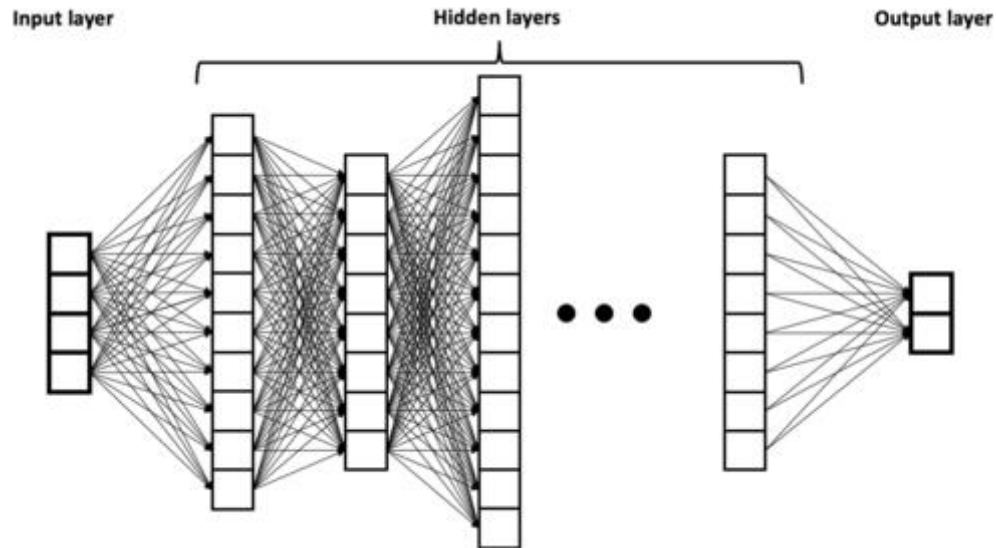
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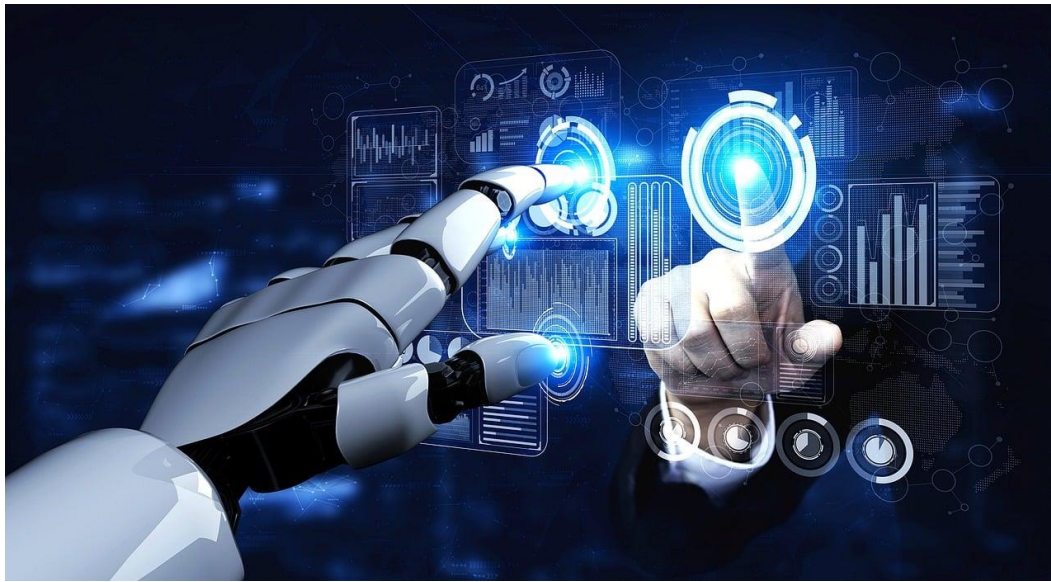
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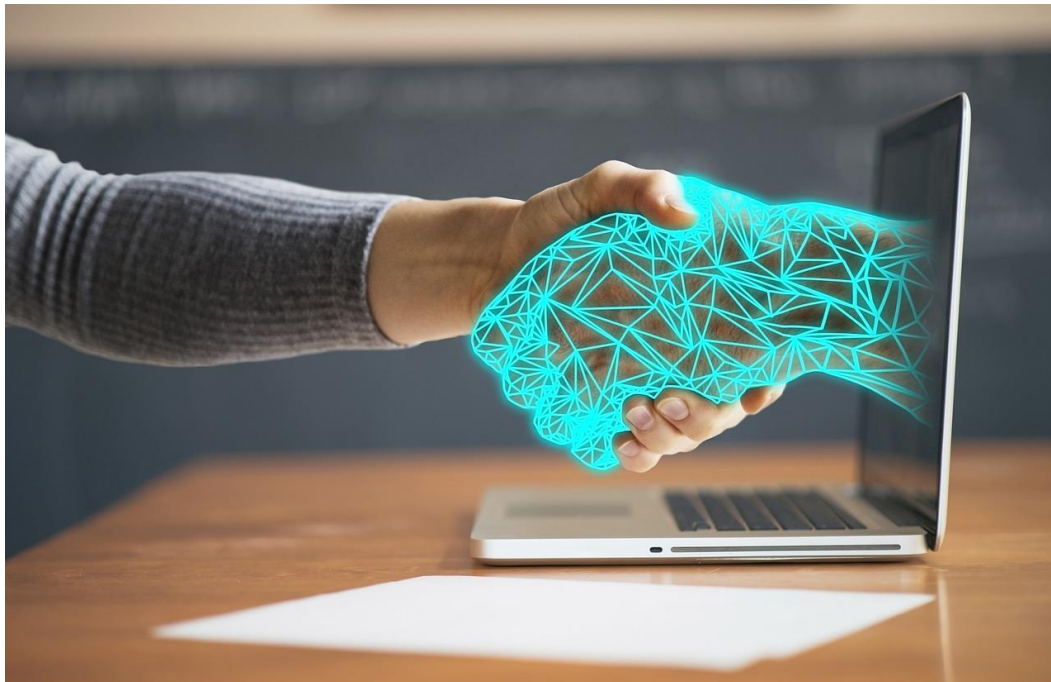
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Picture by Peggy_Marco on [Pixabay](#), available under a [Pixabay License](#).



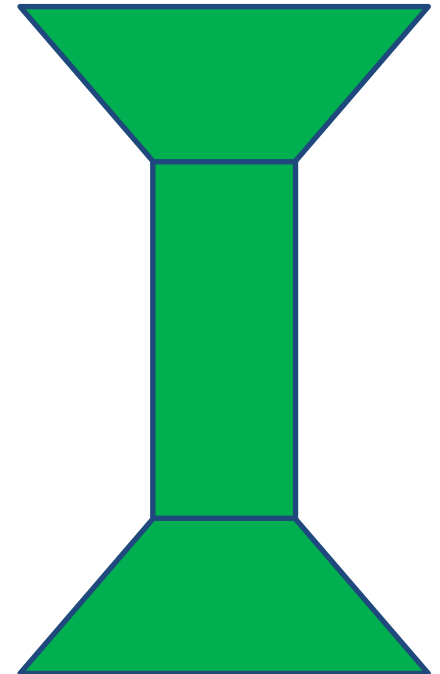
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Topics

- Introduction to AI with a focus on generative AI (e.g. ChatGPT/GPT-4)
- Ethical considerations and responsible use (e.g. data privacy, address biases, best practices)
- Guidelines from major journals and institutions on using AI-Tools in research and academia
- Crafting effective prompts for generative AI
- Practical applications of AI tools in research and academia, e.g.
 - Literature review assistance
 - Data analysis and interpretation
 - Manuscript, grant proposal and conference presentation support
 - Brainstorming research hypotheses
 - Preparing for defence or interviews
 - Developing training material
- Benefits and limitations of implementing AI tools in research and academia
- Future developments and possibilities



This Workshop is not...

... a tutorial on creating AI tools, nor an in-depth exploration of their theoretical foundations and mechanics

... an exhaustive overview of all AI tools available

Understand the importance of using AI in research and academia

Assess the benefits and risks of using AI in research and academia

Craft effective prompts for your research tasks

Develop strategies to integrate AI tools into your research workflow

Stay informed about and adapt to new developments in the field of AI

Learning Objectives



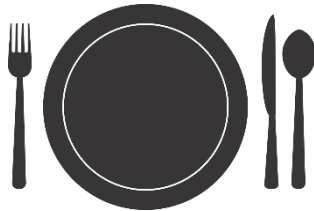
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9:00

10:15 - 10:30



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12:00-12:50

14:15-14:30



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15:45

Introduction to AI with a Focus on Generative AI (e.g. ChatGPT/GPT-4)

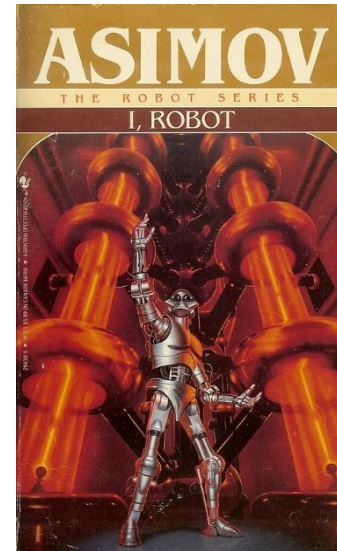
A Brief History of AI – Science Fiction

1942



<https://www.goodreads.com/book/show/48928553-runaround>

1950



Picture by RA.AZ on [flickr](#), available under a [CC BY 2.0 License](#).

“A robot may not injure a human being or, through inaction, allow a human being to come to harm”

“A robot must obey the orders given it by human beings except where such orders would conflict with the First Law”

“A robot must protect its own existence as long as such protection does not conflict with the First or Second Law”

A Brief History of AI – The Turing Test

VOL. LIX. No. 236.]

[October, 1950

M I N D
A QUARTERLY REVIEW
OF
PSYCHOLOGY AND PHILOSOPHY



I.—COMPUTING MACHINERY AND
INTELLIGENCE

BY A. M. TURING

*“Can machines
think?”*

([Turing, 1950](#))

A Brief History of AI – The Dartmouth Workshop

A PROPOSAL FOR THE
DARTMOUTH SUMMER RESEARCH PROJECT
ON ARTIFICIAL INTELLIGENCE

J. McCarthy, Dartmouth College
M. L. Minsky, Harvard University
N. Rochester, I.B.M. Corporation
C.E. Shannon, Bell Telephone Laboratories

([McCarthy, 1955](#))

A Brief History of AI – Deep Blue

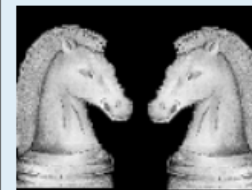
washingtonpost.com | home page | site index | search | help |

Kasparov Proves No Match for Computer

By Rajiv Chandrasekaran
Washington Post Staff Writer
Monday, May 12, 1997; Page A01

NEW YORK, May 11 -- In a stunning showdown between man and machine, the IBM supercomputer Deep Blue decisively beat world chess champion Garry Kasparov today, the first time a computer has been able to defeat the best human player in a match.

A visibly upset Kasparov stormed out of the small match room after only about an hour of play, effectively resigning the sixth -- and final -- game with a scant 19 moves played. Most chess experts here said Kasparov, who appeared frustrated from the start of today's game, likely would have been conquered by the computer within a few moves.



**KASPAROV
Vs
DEEP BLUE**

The Final Score:

Kasparov	Deep Blue
2.5	3.5

Replay the Games

Review each move on a graphical chess board:

- [Game 1](#): Kasparov
- [Game 2](#): Deep Blue
- [Game 3](#): Draw
- [Game 4](#): Draw
- [Game 5](#): Draw
- [Game 6](#): Deep Blue

([The Washington Post, 1997](#))

A Brief History of AI – AlphaGo

“In October 2015, AlphaGo played its first game against the reigning three-time European Champion, Fan Hui. AlphaGo won the first ever match between an AI system and Go professional, scoring 5-0”

([Google DeepMind](#))

A Brief History of AI – Generative AI and Large Language Models

Improving Language Understanding by Generative Pre-Training

Alec Radford Karthik Narasimhan Tim Salimans Ilya Sutskever
OpenAI OpenAI OpenAI OpenAI
alec@openai.com karthikn@openai.com tim@openai.com ilyasu@openai.com

Abstract

([Radford, 2018](#))

arXiv > cs > arXiv:2005.14165

Computer Science > Computation and Language

[Submitted on 28 May 2020 (v1), last revised 22 Jul 2020 (this version, v4)]

Language Models are Few-Shot Learners

([Brown, 2020](#))

November 30, 2022

Authors
[OpenAI](#) ↓

[Product, Announcements](#)

ChatGPT is a sibling model to [InstructGPT](#), which is trained to follow an instruction in a prompt and provide a detailed response.

We are excited to introduce ChatGPT to get users' feedback and learn about its strengths and weaknesses. During the research preview, usage of ChatGPT is free. Try it now at chat.openai.com.

<https://openai.com/blog/chatgpt>

AI Definition

“a system’s ability to interpret external data correctly, to learn from such data, and to use those learnings to achieve specific goals and tasks through flexible adaptation.”

(ESCP Europe Business School, Paris, France, as cited in [Haenlein, 2019](#))

Definitions in the AI Field

Artificial intelligence (AI)

“A broad discipline with the goal of creating intelligent machines, as opposed to the natural intelligence that is demonstrated by humans and animals”

Artificial general intelligence (AGI)

“A term used to describe future machines that could match and then exceed the full range of human cognitive ability across all economically valuable tasks”

Deep learning

“An approach to AI inspired by how neurons in the brain recognise complex patterns in data. The “deep” refers to the many layers of neurons in today’s models that help to learn rich representations of data to achieve better performance gains”

Generative AI

“A family of AI systems that are capable of generating new content (e.g. text, images, audio, or 3D assets) based on 'prompts’”

[\(State of AI report, 2023\)](#)

Definitions in the AI Field

Large Language model (LLM)

“A model trained on vast amounts of (often) textual data to predict the next word in a self-supervised manner. The term “LLM” is used to designate multi-billion parameter LMs, but this is a moving definition”

Machine learning

“A subset of AI that often uses statistical techniques to give machines the ability to “learn” from data without being explicitly given the instructions for how to do so. This process is known as “training” a “model” using a learning “algorithm” that progressively improves model performance on a specific task”

Natural language processing

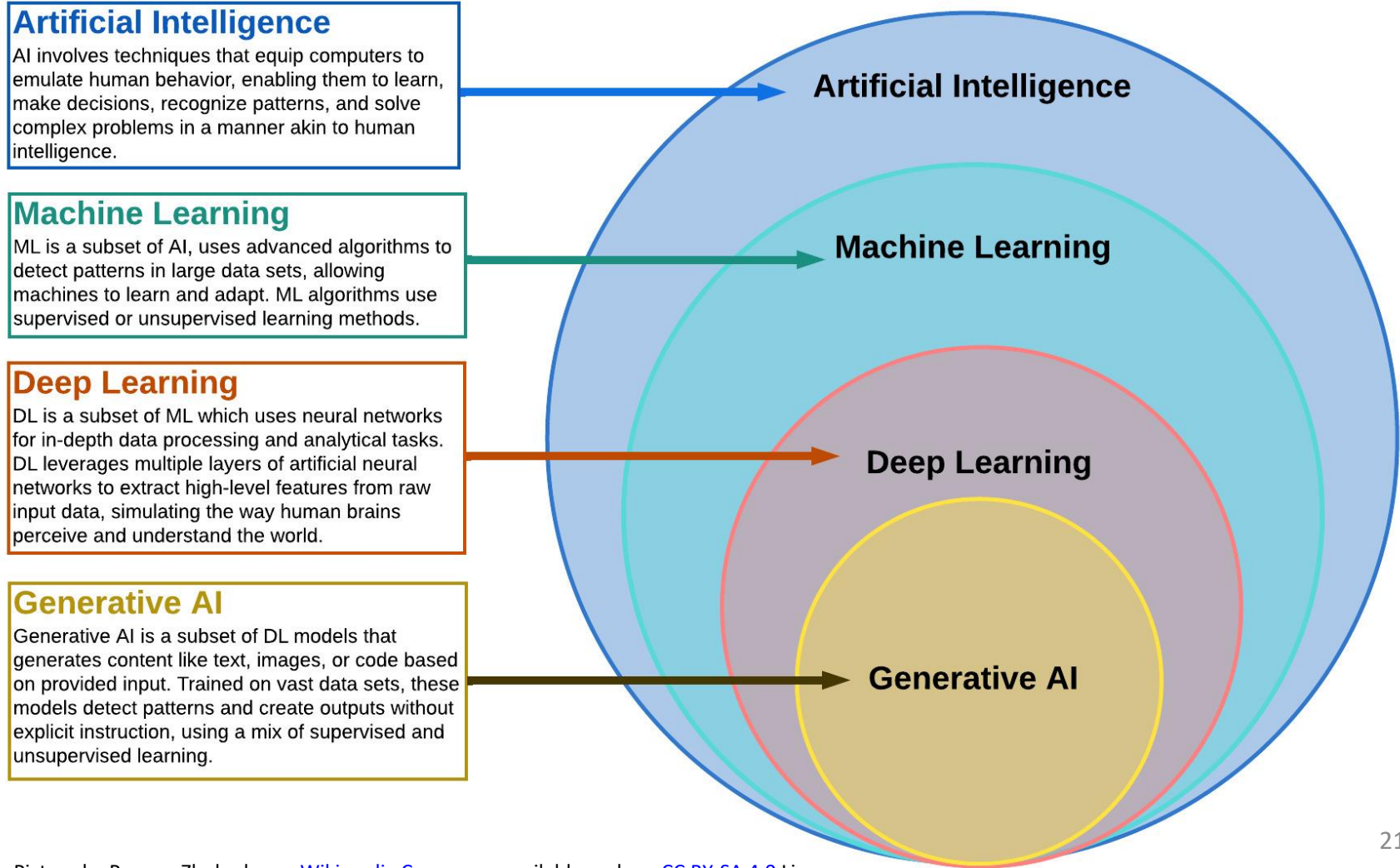
“The ability of a program to understand human language as it is spoken and written”

Prompt

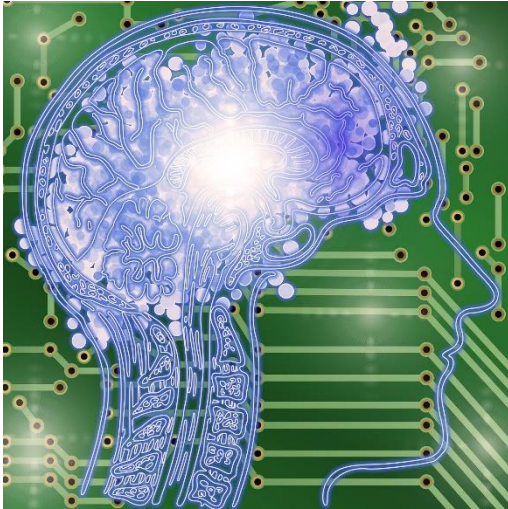
“A user input often written in natural language that is used to instruct an LLM to generate something or take action”

[\(State of AI report, 2023\)](#)

AI, Machine Learning, Deep learning and Generative AI



Main Features of (Generative) AI Useful in Research and Academia



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Understanding ChatGPT and LLMs

- Data-driven training
- Machine learning backbone
- Transformers
- Iterative improvements
- Text generation process

(UNESCO, [Guidance for generative AI in education and research](#), 2023)

Ethical Considerations and Responsible Use (e.g. Data Privacy, Address Biases, Best Practices)

Ethical Considerations and Responsible Use of AI Tools

Copying AI outputs,
original text/ideas

PLAGIARISM

Protect personal and
research data

DATA PRIVACY

Author vs. AI
contribution

AUTHORSHIP

Fairness in AI
developments
opportunities

EQUITY

Open disclosure of AI
use

TRANSPARENCY

Universal access to AI
tools and technologies

ACCESSIBILITY

Ethical Considerations and Responsible Use of AI Tools

Responsibility for AI outcomes and training data

ACCOUNTABILITY

Who own AI tools/outputs?

OWNERSHIP

Misuse of AI tools for harmful purposes

SECURITY, SAFETY

Upholding the standards of honesty and accuracy

ACADEMIC INTEGRITY

Respect of intellectual property rights when using (or training) AI

COPYRIGHT

Perpetuating societal prejudices in training data

BIASES

Examples of Guidelines on the Use of AI in Scholarly Publishing

Institutions, associations, committees

- [World Association of Medical Editors \(WAME\)](#)
- [Committee on Publication Ethics \(COPE\)](#)
- [International Committee of Medical Journal Editors \(ICMJE\)](#)
- [German Research Foundation \(DFG\)](#)
- [International Association of Scientific, Technical and Medical Publishers](#)
- [APA style: How to cite chatGPT](#)

Journals, publishers, preprint servers

- [Science](#)
- [Elsevier](#)
- [Elsevier: the use of AI, FAQ](#)
- [JAMA](#)
- [Nature](#)
- [Wiley](#)
- [arXiv](#)
- [Journal of Clinical Oncology](#)

Example of AI Usage Disclosure

Declaration of Generative AI and AI-assisted technologies in the writing process.

During the preparation of this work the authors used the OpenAI's large language model GPT-4 in order to improve the English language usage, clarity of text, readability, polishing the manuscript and overall manuscript editing. After using GPT-4, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

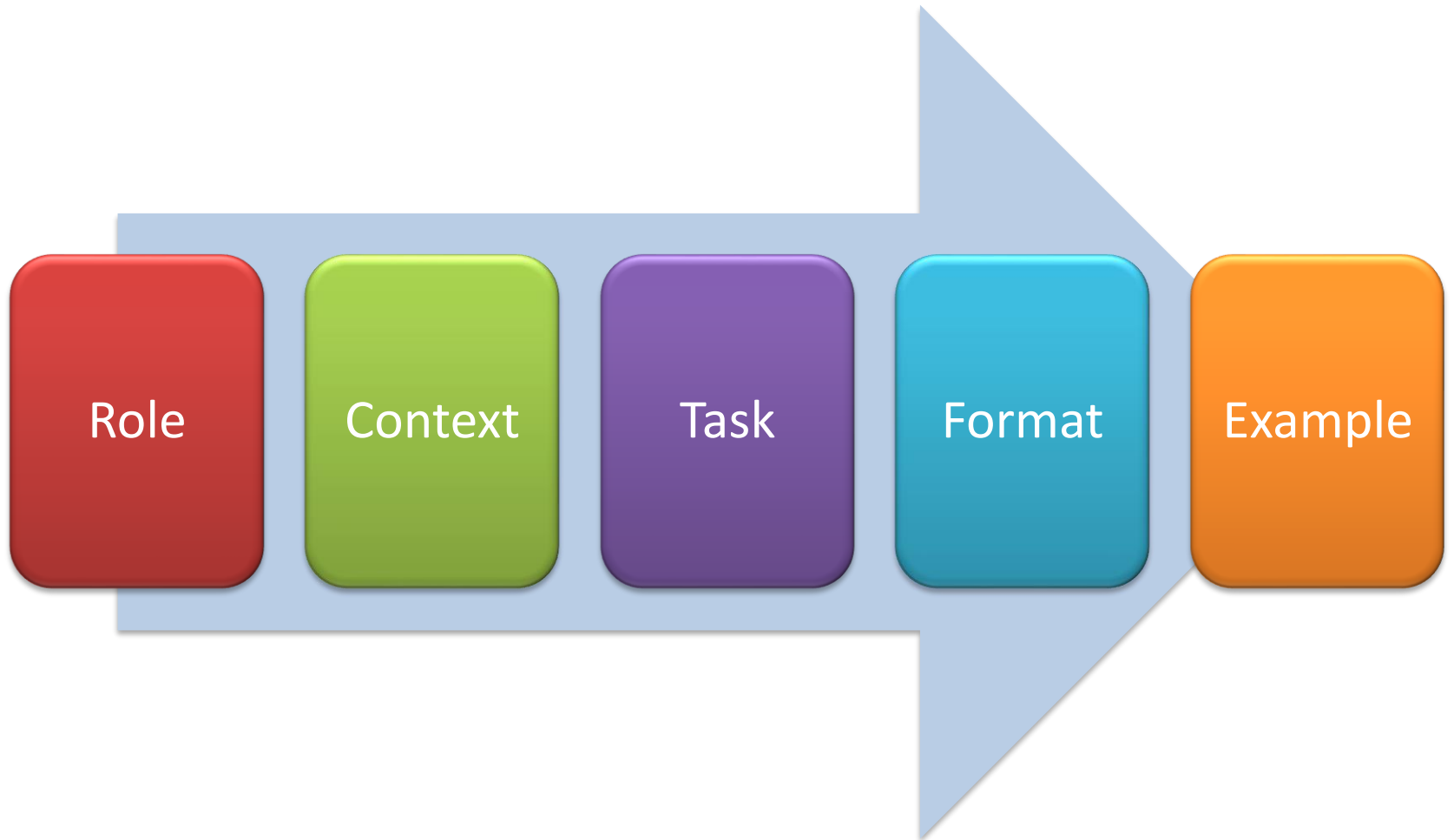
(Sanchini, 2024. Under Review)

Crafting Effective Prompts for Generative AI

Features of an Effective Prompt

Feature	Explanation
Simplicity	Use simple, clear, correct and direct language. Avoid complicate/confusing language
Context	Provide necessary background to generate more accurate responses
Example(s)	Include examples to illustrate the desired outcome, if relevant
Iteration	Refine, edit and iterate your prompt. Ask follow-up questions, ask to improve the prompt
Ethics	Create prompts that minimize biases or generate inappropriate/harmful responses
Role	Ask AI to take a specific role (e.g. senior researcher in the field of...), if relevant
Conciseness	Be brief, do not include unnecessary information that could “distract” the AI
Specificity	Include specific details which guide AI towards your desired response
Task	Define the task of the prompt, use “actionable” language (e.g. summarize, explain)
Format	Specify the required response format (e.g. summary, bullet points, table), if relevant
Style	Specify the tone and style of the response (e.g. professional, casual), if relevant
Target	Specify the target audience of the response, if relevant
Open-ended	Ask open-ended questions to gain a deeper understanding of the user’s situation, if relevant

Ideal Prompt Structure



([Smith, 2023](#))

Prompt Example

“In my PhD I am focusing on laboratory methods to detect drug resistance in Tuberculosis.

Can you provide 10 ideas for research topics or research gaps in this field?”

1. Novel Molecular Techniques for Rapid Detection:

Research and develop faster and more accurate molecular diagnostic tests to detect drug-resistant TB strains. This could involve exploring new genetic markers or leveraging CRISPR technology for quicker results.

2. Whole Genome Sequencing vs. Traditional Methods:

Compare the efficacy and cost-effectiveness of whole genome sequencing with traditional phenotypic drug susceptibility testing (DST) methods. This research could help streamline diagnostic processes in clinical settings.

3. Portable Diagnostic Tools for Low-resource Settings:

Develop and validate portable, low-cost diagnostic tools suitable for use in remote or resource-limited areas. These tools could use novel biosensor technologies or simplified molecular techniques.

4. Machine Learning Models to Predict Resistance Patterns:

Use artificial intelligence and machine learning to analyze large datasets of TB genomic information to predict resistance patterns and identify new resistance genes.

5. Impact of Genetic Diversity on Drug Resistance Detection:

Investigate how genetic diversity among TB strains affects the accuracy of current drug resistance tests. This could lead to the development of more universal or targeted diagnostic methods.

6. Pharmacogenomics in TB Treatment:

Explore the role of pharmacogenomics in TB treatment outcomes. Research how variations in human genes affect the response to drugs used in TB treatment, particularly in resistant cases.

7. Biomarkers for Rapid Detection of Multi-Drug Resistant TB:

Identify and validate new biomarkers that can be used to quickly diagnose multi-drug resistant TB. Focus on biomarkers that can be detected using non-invasive samples, like saliva or urine.

8. Comparative Studies of Line Probe Assays:

Conduct comparative studies to evaluate the effectiveness and limitations of various line probe assays used to detect drug-resistant TB. This could help refine the assays or develop better protocols.

9. Longitudinal Surveillance of Drug Resistance Patterns:

Set up a longitudinal study to monitor the evolution of drug resistance in TB in a certain population over time. This data could be crucial for public health planning and response strategies.

10. Evaluating the Impact of New Diagnostic Tests on Treatment Outcomes:

Assess how the introduction of new diagnostic tests affects treatment outcomes, including treatment duration, recovery rates, and incidence of drug resistance.

Prompt Example

Role

Act as a senior researcher specializing in Tuberculosis diagnostics

Context

My focus as a PhD candidate is on uncovering novel research directions specifically in detecting drug resistance

Task

Please generate a detailed list of 10 innovative research topics or critical gaps within this specialty, taking into account the latest methodologies, diagnostic challenges, and global health impacts

Format

List these topics in a structured, bulleted format for clarity


Example

Investigate the efficacy of current susceptibility tests against emerging resistance mutations

- 1. Development of Point-of-Care Diagnostic Tools for Multi-Drug Resistant TB (MDR-TB):** Investigate portable, rapid testing technologies that can be used in low-resource settings to detect MDR-TB, enhancing early detection and treatment.
- 2. Whole Genome Sequencing (WGS) for Real-Time Resistance Mapping:** Explore the feasibility of using WGS directly from clinical samples to map drug resistance patterns and predict treatment outcomes, focusing on reducing turnaround times and cost.
- 3. AI and Machine Learning Models to Predict Drug Resistance:** Design predictive models using existing data sets to forecast resistance pathways and outcomes, potentially identifying unknown resistance mechanisms before they become prevalent in the population.
- 4. High-Throughput Screening Methods for Novel Antituberculosis Agents:** Develop and validate high-throughput assays that can rapidly screen potential drug candidates against known and novel resistance mutations in TB bacteria.
- 5. Assessment of Non-Traditional Biomarkers for Drug-Resistant TB Detection:** Investigate the efficacy of detecting specific biomarkers (e.g., RNA, exosomes) in blood or urine that may indicate resistance, aiming to develop non-invasive testing methods.
- 6. Longitudinal Studies on the Impact of Socioeconomic Factors on TB Drug Resistance:** Conduct detailed cohort studies to understand how factors such as housing, nutrition, and healthcare access influence the evolution of drug-resistant TB strains.
- 7. Innovations in Molecular Diagnostics for Extensively Drug-Resistant TB (XDR-TB):** Explore new molecular diagnostic platforms that can detect XDR-TB more accurately and faster than current methods, with a focus on scalability and field deployment.
- 8. Impact of Pharmacogenomics on TB Treatment Regimens:** Study how individual genetic variations affect the metabolism and efficacy of TB drugs, which could lead to personalized treatment plans and reduce the occurrence of resistance.
- 9. Advanced Imaging Techniques for Assessing Drug Efficacy:** Utilize technologies such as PET, MRI, or CT scans to monitor the effectiveness of treatment regimens in real-time, particularly for patients with drug-resistant TB forms.
- 10. Integration of Diagnostic Data into Global Health Systems:** Research how diagnostic data can be better integrated into health information systems to track drug resistance trends globally, facilitate timely updates in treatment guidelines, and inform public health strategies.


Prompt Examples

Relatively vague, passive
or yes/no prompts



Did the authors of this article report diagnostic criteria?

Better, more active and
specific prompts



Did the authors of this article report diagnostic criteria such as sensitivity, specificity, turnaround time, length of treatment, etc.? If yes, list those results in detail

Prompt Examples

Relatively vague, passive
or yes/no prompts



Did the authors of this
article analyse limitations?

Better, more active and
specific prompts



Explain study
limitations or method
limitations in detail


Prompt Examples

Relatively vague, passive
or yes/no prompts



Prepare a cover letter for
this job offer

Better, more active and
specific prompts



Here is my CV; explain
how do I fits in the job offer.
Also, role-play as an
interviewer asking questions
for this job role. After each
question, wait for my
answer and then provide
feedback on its effectiveness

Prompt Examples

Relatively vague, passive
or yes/no prompts



Improve this sentence

Better, more active and
specific prompts



Can you offer suggestions for improving this sentence in terms of grammar, sentence structure, and overall clarity? Can you also identify any mistakes in the sentence? Explain your modifications

Prompt Examples

Relatively vague, passive
or yes/no prompts



Re-write this text

Better, more active and
specific prompts



Make this text more persuasive. Explain principles of persuasiveness in writing. Suggest techniques to write in a more persuasive way

Tips/Strategies to Optimize Your Prompts

For reasoning and for breaking down the answer:

“Let’s work this out in a step by step way to be sure we have the right answer”
([Hebenstreit, 2023](#))

Chain of Thought prompts, which requires the LLM to provide intermediate reasoning steps, significantly enhances performance ([State of AI report, 2023](#))

In case you are not satisfied with an answer:

“Please critique the above response. Then based on the critique, output the full improve response” ([Stapleton, 2023](#))
“Why was this wrong?” or “What can we improve in this answer?”
([Burns, 2023](#))

To reduce hallucinations:

*“Tell the AI to always start its answer with **my best guess is**”*
(Hamilton, 2023 as cited in [Burns, 2023](#))

Use AI to create and improve its own prompts:

“Welcome to the prompt engineering process. Your goal as a prompt engineer is to help me craft the best possible prompt ...” (the full prompt can be taken from [Stapleton, 2023](#))
(another full prompt creator can be taken from [ChainBrain AI, 2023](#))

Practical Applications of AI Tools in Research and Academia

Green Highlighted Tools:

These tools were demonstrated during the workshop.

They are either free of charge or offer a relatively generous free plan.

Yellow Highlighted Tools:

These tools are similar to those highlighted in green in terms of functionality but were not demonstrated during the workshop.

They are either free of charge or offer a relatively generous free plan.

Not Highlighted Tools:

These are additional tools that could be worth exploring. They were not demonstrated during the workshop but may offer useful features or capabilities.

Tip

Advantages of using several tools that perform similar functions:

1. it allows you to experiment with different algorithms, as each tool may operate slightly differently;
2. if you're utilizing free tools, which often have limited features, using multiple tools can provide access to a broader range of resources at no additional cost.

Search and Navigate the Literature

Part 1

Tool Name and Link	Suggested Use
ResearchRabbit https://researchrabbitapp.com	Visualize literature and relations between studies, select paper to read, integrate with Zotero
Connected Papers https://www.connectedpapers.com/	Visualize literature and relations between studies, select paper to read, see citation networks
Litmaps https://app.litmaps.com/	Visualize literature and relations between studies, select paper to read, see citation networks
Elicit https://elicit.com	Ask research questions, tabulate literature sources
SciSpace https://typeset.io/	Ask research questions, tabulate literature sources chat with literature sources
Semantic Scholar https://www.semanticscholar.org/	Provides AI-generated summaries and citation contexts, enhances search relevance through contextual understanding
Consensus https://consensus.app/search/	Ask about relationships between concepts or simple yes/no question

Search and Navigate the Literature

Part 2

Tool Name and Link	Suggested Use
Paper Digest https://www.paperdigest.org	Get a quick summary of ten papers in your field
Researcher.Life https://researcher.life/	Get literature recommendations and feeds in your field, smartphone app available, select your target journal
Inciteful https://inciteful.xyz/	Upload two papers and discover the literature connecting them together, build literature networks
EvidenceHunt https://evidencehunt.com/	Summarize evidence on a topics in clinical and biomedical research
Open Knowledge Maps https://openknowledgemaps.org	Place keywords and they will divide the results into clusters, by major literature topics
Lateral https://www.lateral.io/	Tabulate your documents, organize findings, suggests content within your documents
Researcher app https://www.researcher-app.com	Get literature recommendations and feeds in your field
Scite https://scite.ai	Find appropriate references and analyse citations
Keenious https://keenious.com/	Upload a PDF and discover similar papers or explore broader topics
Asreview.ai	Support the paper inclusion and exclusion for a systematic review

Explain, Summarize and Interact with Documents/Websites

Tool Name and Link	Suggested Use
SciSpace https://typeset.io/	Clarify complex/dense paper, interact/chat with AI, integrate with Zotero, extract information automatically
ChatPDF https://www.chatpdf.com/	Clarify complex/dense paper, interact/chat with AI, extract information automatically
Scholarcy Extension https://addons.mozilla.org/en-US/firefox/addon/scholarcy-browser-extension/	Summarize a paper and export the highlights in Word, use flashcards
TLDR this https://www.tldrthis.com/	Summarize papers, documents and website contents
ExplainPaper https://www.explainpaper.com	Explain papers for different audiences, ask follow up questions
Recall Extension https://www.getrecall.ai/	Summarize articles, YouTube videos, PDFs, podcasts etc.
Humata https://app.humata.ai/login	Clarify complex/dense paper, interact/chat with AI, extract information automatically
Resoomer https://resoomer.com/en/	Summarize papers/documents while preserving the original wording of the author
Sharli.ai https://app.sharly.ai/	Summarize papers, documents and website contents
FileGPT https://filegpt.app/chat	Chat/interact with several files simultaneously

Take Notes

Tool Name and Link	Suggested Use
Notion https://www.notion.so	Organize notes, manage projects, integrate with AI
Slite https://slite.com/	Organize notes, manage projects, integrate with AI

Text to Speech

Tool Name and Link	Suggested Use
NaturalReader https://www.naturalreaders.com/	Listen to documents, webpages, texts and images
Speechify https://app.speechify.com/	Listen to documents, webpages, texts and images
Audemic https://audemic.io/	Listen to papers highlights and summaries
Speechgen https://speechgen.io/	Listen to texts, download audio files
Listening https://www.listening.io/	Listen to academic papers on your smartphone

Speech to Text

Tool Name and Link	Suggested Use
Dictation https://dictation.io/	Transcribe your speech into text (Google Chrome)
Dragon Natural Speaking https://www.nuance.com/de-de/dragon.html	Transcribe your speech into text (software), can work offline

Support for Teaching

Tool Name and Link	Suggested Use
Doctrina AI https://app.doctrina.ai	Design quizzes about a topic or a book
Diffit https://beta.diffit.me/#topic	Upload texts, YouTube videos, links and PDF documents to get summary, definitions, quiz and open end questions
MagicSchool https://app.magicschool.ai/tools	Design teaching lessons and activities
Coursable https://coursable.io/	Suggest the outline, topics and resources for a course
Education Copilot https://educationcopilot.com/	Create lessons and other educational activities
Eduaide.AI https://www.eduaide.ai/app	Create lessons and other educational activities
Quizziz https://quizziz.com/admin	Create lessons and quizzes
Conker https://app.conker.ai/	Create several types of quizzes

Exercise

Try some of the AI-based tools to explore possible applications in your field. For example:

1. Visualize the key literature in your field, identify central themes, gaps and derivative works (e.g. [ResearchRabbit](#), [Litmaps](#))
2. Find 10-20 pivotal papers for your bibliography or manuscript (e.g. [Elicit](#), [Semantic Scholar](#))
3. Extract key data, information or concepts from research papers (or from a website). Or, summarize, interact and explain complex papers (e.g. [SciSpace](#), [ChatPDF](#))
4. Integrate notes from different sources (papers, speeches) into one document (e.g. [Notion](#))
5. Let AI read a paper/text aloud for you (e.g. [NaturalReader](#), [Speechify](#))
6. Let AI transcribe your speech (e.g. [Dictation](#) – on Chrome only)
7. Prepare training material, exercises, quizzes or interactive activities (e.g. [Coursable](#), [Diffit](#))

Create Presentations

Tool Name and Link	Suggested Use
Tome https://tome.app/	Suggest the outline and the covered topics for a presentation
Gamma.app https://gamma.app/	Suggest the outline and the covered topics for a presentation

Generate and Edit Images

Tool Name and Link	Suggested Use
Bing image creator https://www.bing.com/images/create	Generate general images
DALL E https://labs.openai.com/	Generate general images
Leonardo.ai https://app.leonardo.ai	Generate general images, improve prompts for image generation
Adobe Firefly https://firefly.adobe.com/	Generate and edit general images
Proofig https://www.proofig.com/pricing-page	Check image manipulation and duplication
Ideogram https://ideogram.ai/t/trending	Generate general images
Clipdrop https://clipdrop.co/stable-diffusion-turbo	Generate images in real-time

Generate Infographics, Illustrations, Graphs (not based on AI)

Tool Name and Link	Suggested Use
Biorender https://www.biorender.com	Create scientific illustrations and diagrams especially in biology and health science
Flourish https://app.flourish.studio	Visualize your data through charts, maps, etc.
Mind the Graph https://mindthegraph.com/	Create science figures, graphical abstracts, posters and infographics especially in medicine and biology
Visual Abstract https://www.visual-abstract.com/	Create interactive visual abstracts

Large Language Models

Tool Name and Link	Suggested Use
ChatGPT https://chat.openai.com/	Brainstorm ideas, outline/categorize information, receive feedback on text
Perplexity AI https://www.perplexity.ai/	Generate text, provide references
PI https://pi.ai/discover	Interact with a supportive and emphatic AI
Talk2us.ai https://www.talk2us.ai/chatroom	Seek mental health support
Claude https://claude.ai	Plausible alternative to ChatGPT, not yet available in Germany
Write Sonic https://app.writesonic.com	Generate text with a lot of available templates
Google Gemini https://gemini.google.com/app	Plausible alternative to ChatGPT
Microsoft Bing https://www.bing.com/	Plausible alternative to ChatGPT
Wisio https://www.wisio.app/	Facilitate the writing of a literature review, provide references
copy.ai https://app.copy.ai/	Plausible alternative to ChatGPT
Llama 2	Plausible alternative to ChatGPT, open source

Personal AI “Agent” on Your Data

Tool Name and Link	Suggested Use
Powerdrill https://powerdrill.ai	Use AI on your data/documents
Quivr https://www.quivr.app	Organize your documents in several “brains”, use AI on your documents
Iris.ai https://iris.ai/	Use AI on your data/documents
MirrorThink https://mirrorthink.ai/chat/	Perform several tasks relevant for researchers (e.g. lit review, fact checking, provide references)
Julius https://julius.ai/	Use AI on your data/documents
HeyGPT https://heygpt.chat/	Perform several tasks, use AI on your data/documents, websites
AgentGPT https://agentgpt.reworkd.ai/	Perform several tasks, use AI on your data/documents

Data Visualization

Tool Name and Link	Suggested Use
Tableau https://www.tableau.com	Analyze and visualize data, generate graphs
Power BI https://powerbi.microsoft.com/en-us/getting-started-with-power-bi/?culture=en-us&country=us	Analyze and visualize data, generate graphs

Generate Videos

Tool Name and Link	Suggested Use
Pictory https://pictory.ai	Generate and edit videos from text

Writing, Editing and Proofreading Assistant

Tool Name and Link	Suggested Use
Quillbot https://quillbot.com/	Paraphrase, re-write
Paperpal https://edit.paperpal.com	Paraphrase, summarize, make your text more “academic”
Grammarly https://www.grammarly.com/	Check grammar and spelling
Wordtune https://app.wordtune.com	Analyse text, extract summaries of each section of a paper in word, write, paraphrase
Jenny https://jenni.ai/?utm_source=jenny	Facilitate the writing of a literature review, provide references
Writefull https://www.writefull.com	Check the coherence, academic style, academic vocabulary, syntax and terminology
DeepL write https://www.deepl.com	Write using an academic tone
Language Tools https://languagetool.org	Check grammar and spelling in several languages
Hesse.ai https://write.hesse.ai	Write an essay, find relevant references
Smodin	Facilitate the writing of a research paper, provide references

Other Tools

Tool Name and Link	Suggested Use
mymap.ai https://www.mymap.ai/mindmap/	Generate mind maps
Goblin.tools https://goblin.tools/	Several tasks, e.g. break down a task into smaller ones
Looka https://looka.com/	Generate logos
Penelope.ai https://www.penelope.ai/	Check your manuscript prior to submission
parrot https://parrot.ai/	Record and transcribe online meetings
Heuristica https://www.heuristi.ca/	Generate concept maps vor learning a new field

ChatGPT/GPT-4 Extensions

Tool Name and Link	Suggested Use
WebChatGPT https://addons.mozilla.org/en-US/firefox/addon/web-chatgpt/	Use ChatGPT with internet access (also with ChatGPT 3.5)
YouTube summary with ChatGPT and Claude https://chromewebstore.google.com/detail/youtube-summary-with-chat/nmmicjeknamkfloonkhhcjmomieiodli	Summarize Youtube videos
Eightify https://chromewebstore.google.com/detail/eightify-ai-youtube-summa/cdcpabkolgalpgeingbdcebojebfelgb?pli=1	Summarize Youtube videos
ChatGPT for search engines https://addons.mozilla.org/en-US/firefox/addon/chatgpt-for-search-engines/	Use ChatGPT responses for search results
Voice Control for ChatGPT https://chromewebstore.google.com/detail/voice-control-for-chatgpt/eollffkcakegifhacjnlnegohfdlidhn	Have a voice conversation rather than a text conversation

ChatGPT/GPT-4 Useful GPTs – 1

Tool Name and Link	Suggested Use
Doc Maker	create documents, such as design docs, reports, proposals, resumes, and more
Prompt Perfect	Improve generative AI prompts for precision, accuracy, and clarity
Logo Creator	generate professional logos
Creative Writing Coach	Revise a text and improve creative writing skills
Convert Anything	file converter for images, audio, video, documents and more. It handles individual or batch uploads, supports ZIPs, and provides a download link
Deep Memory	Generate Flashcard to learn/memorize
ScholarAI	Search/analyze text, figures, and tables from 200M+ sources to generate new hypotheses. Formerly the ScholarAI Plugin
Canva	Generate illustrations, infographics
Diagrams: Show Me	Create diagrams, flow-charts, mind maps etc.
Screenshot To Code GPT	Upload a screenshot of a website and convert it to clean HTML/Tailwind/JS code.
Video Maker By invideo AI	Create videos with voiceovers

ChatGPT/GPT-4 Useful GPTs – 2

Tool Name and Link	Suggested Use
Consensus	Back up information with references
Whimsical Diagrams	Uses sequence diagrams, mind maps and flowcharts to illustrate and explain concepts.

Other Useful Tools for Generative AI

Tool Name and Link	Suggested Use
ChatGPT PROMPTS Splitter https://chatgpt-prompt-splitter.jjdiaz.dev/	Split a long prompt into multiple
Freshly.AI https://freshly.ai/what-a-prompt/	Enhance your prompts
PromptWise.AI https://www.promptwise.ai/	Enhance your prompts
Prompt Base https://promptbase.com/marketplace	Prompts store
Chain Brain AI https://www.chainbrainai.com/	A list of advanced prompts
FlowGPT https://flowgpt.com/	GPTs store
Text Blaze https://blaze.today/	Automate repetitive typing of prompts (Google Chrome)
Promptport https://promptport.ai/	Search for prompts
God of Prompt https://www.godofprompt.ai/	Improve your prompts, AI tools and GPTs database

Exercise

Try some of the AI-based tools to explore possible applications in your field. For example:

1. Create a presentation outline on your research project ([TOME](#), [Gamma.app](#))
2. Generate figures/images for your papers or presentations (e.g. [Leonardo.ai](#), [Bing Image Creator](#))
3. Ask complex research questions related to your field, then use AI to generate an answer with references (e.g. [Perplexity.ai](#))
4. Draft a short text/an abstract for a research paper (e.g. [ChatGPT](#), [Jenny.Ai](#), [Wordtune](#))
5. Revise a short text/an abstract for a research paper (e.g. [Grammarly](#), [ChatGPT](#))
6. Draw a mind map related to your research topic (e.g. [mymap.ai](#))
7. Engage in AI-mediated debate to argue both sides of a controversial topic in your field (e.g. [ChatGPT](#), [Google Gemini](#))
8. Simulate a difficult conversation with a supervisor/editor, practicing responses to criticism about your research project or ideas (e.g. [ChatGPT](#), [Google Gemini](#))

Benefits of Implementing AI Tools in Research and Academia

Productivity, Efficiency, Speed

RESEARCH ARTICLE | CHATGPT



Experimental evidence on the productivity effects of generative artificial intelligence

SHAKKED NOY AND WHITNEY ZHANG [Authors Info & Affiliations](#)

SCIENCE • 13 Jul 2023 • Vol 381, Issue 6654 • pp. 187-192 • DOI: [10.1126/science.adh2586](https://doi.org/10.1126/science.adh2586)

([Noy, 2023](#))

OSFPreprints DOI: <https://doi.org/10.31219/osf.io/pcrqf> License: CC-BY Attribution 4.0 International

Applying ChatGPT and AI-powered tools to accelerate evidence reviews

Kien Nguyen-Trung*, Alexander K Saeri, Stefan Kaufman

BehaviourWorks Australia, Monash Sustainable Development Institute, Monash University

([Nguyen-Trung, 2023](#))



Economics > General Economics

[Submitted on 23 Apr 2023]

Generative AI at Work

Erik Brynjolfsson, Danielle Li, Lindsey Raymond

([Brynjolfsson, 2023](#))

Special feature

Application ChatGPT in conducting systematic reviews and meta-analyses

[Simpy Amit Mahuli](#) , [Arpita Rai](#) , [Amit Vasant Mahuli](#) & [Ansul Kumar](#)

British Dental Journal **235**, 90–92 (2023) | [Cite this article](#)

([Mahuli, 2023](#))

Brainstorming, Thinking from Multiple Perspectives



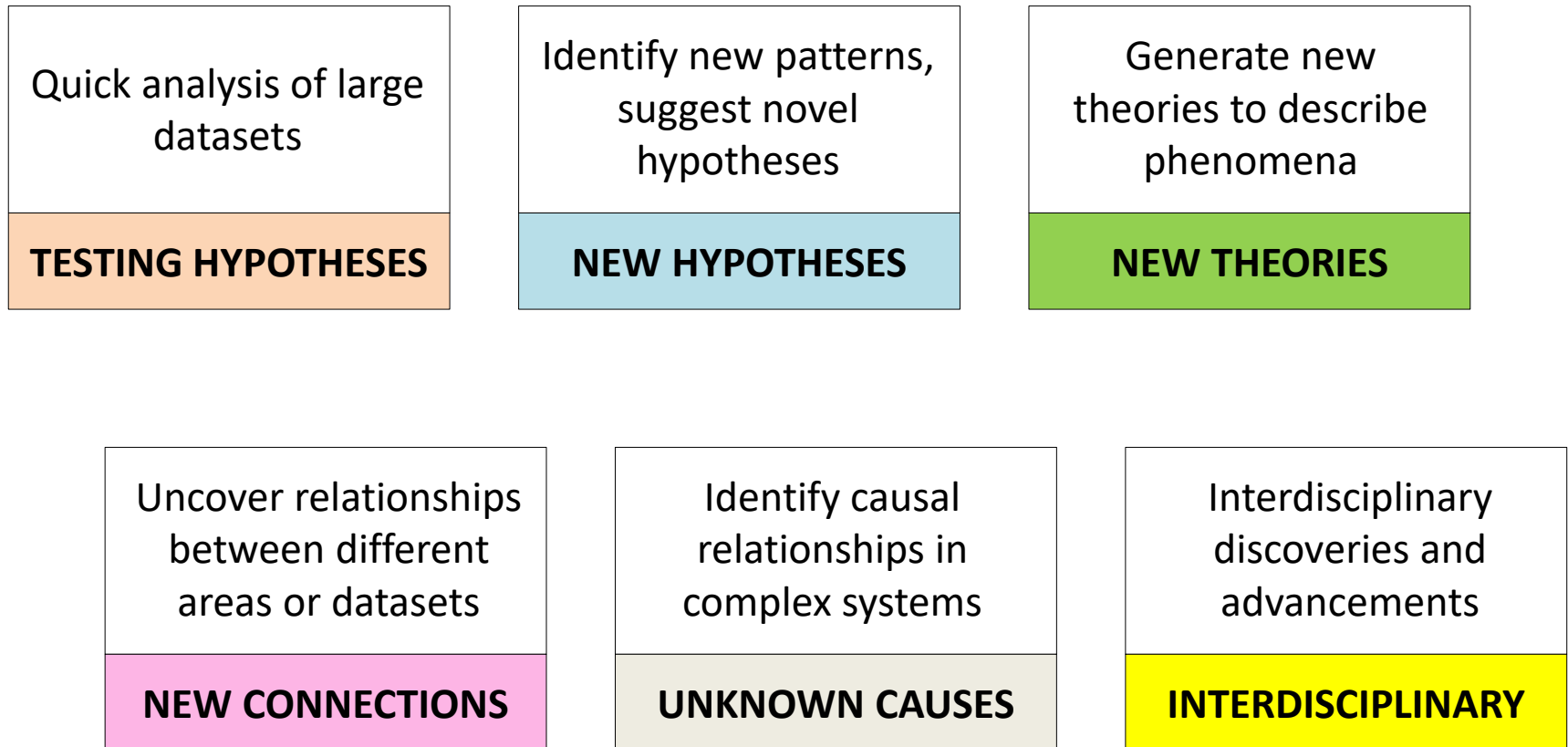
Picture by qimono on [Pixabay](#), available under a [Pixabay License](#).

([Chan, 2023](#); [Zhang, 2023a](#))



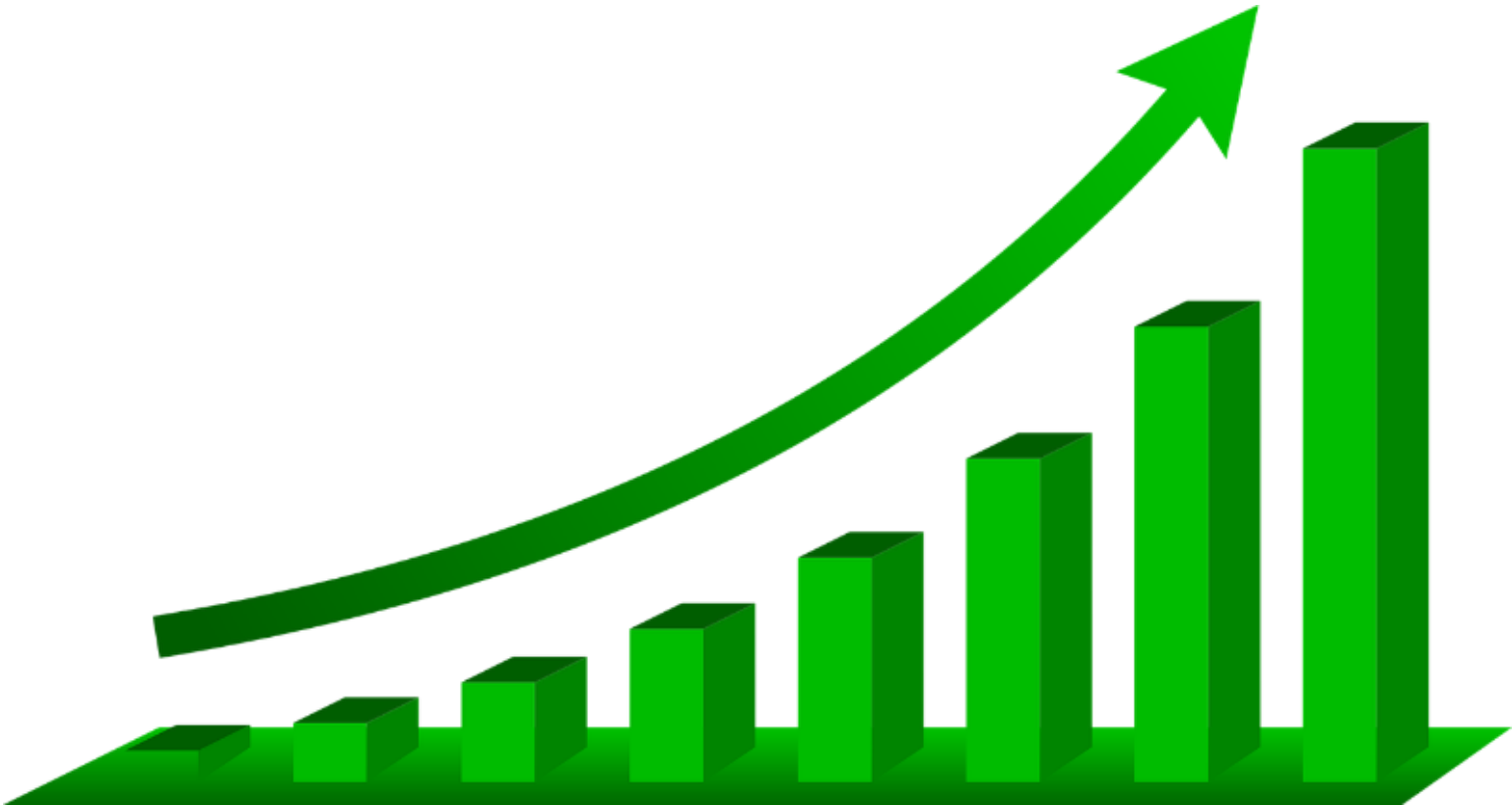
Picture by geraldton [Pixabay](#), available under a [Pixabay License](#).

Innovations, Smart Science



(STM. [AI Ethics in Scholarly Communication](#), 2021; [Bindra, 2023](#); [Zhang, 2023b](#))

Scalability



Picture by OpenClipart-Vectors on [Pixabay](https://pixabay.com/), available under a [Pixabay License](https://pixabay.com/en/licenses/).

Customization



Picture by karepet on [Pixabay](#), available under a [Pixabay License](#).

Education

Personalised tutoring
based on individual
needs

TAILORED TEACHING

Creation of interactive
learning materials

ENGAGEMENT

Learning systems that
adjust to learners
progress/performance

ADAPTIVE LEARNING

On learners
assessments or on
teachers materials

RAPID FEEDBACK

Facilitate training
content creation

TRAINING CREATION

([Baidoo-Anu, 2023](#); [Meyer, 2023](#); [Yusuf, 2024](#))

Coding, Programming

Learn coding

Write new codes

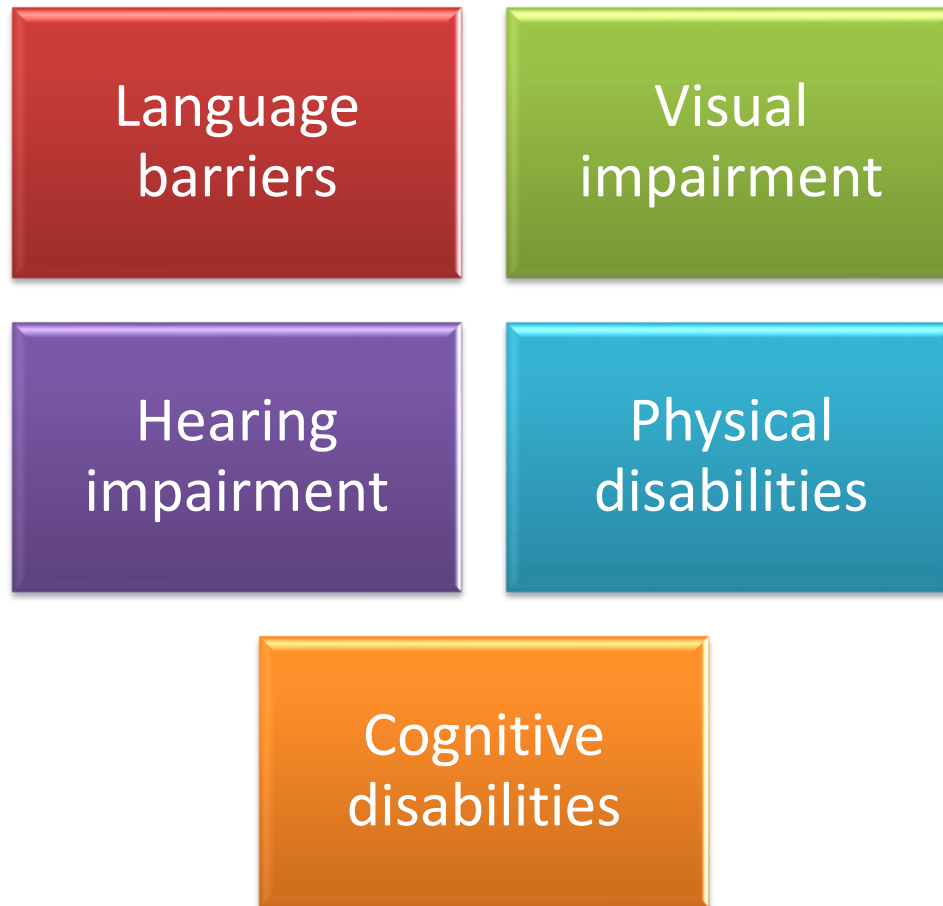
Intepret/debug
existing codes

Increase
compactness/
efficiency of code

Translate code from
one programming
language to another

([Meyer, 2023](#))

Breaking Down Barriers, Accessibility





([AIContentfy, 2023](#); [Heidt, 2024](#))

Limitations/Challenges of Implementing AI Tools in Research and Academia

(Un)Reliability, Lack of Understanding, Safety

[Cureus](#). 2023 Sep; 15(9): e44720.

Published online 2023 Sep 5. doi: [10.7759/cureus.44720](https://doi.org/10.7759/cureus.44720) 

PMCID: PMC10552880 

PMID: [37809168](https://pubmed.ncbi.nlm.nih.gov/37809168/)

A Call to Address AI “Hallucinations” and How Healthcare Professionals Can Mitigate Their Risks

Monitoring Editor: Alexander Muacevic and John R Adler

[Rami Hatem](#),¹ [Brianna Simmons](#),¹ and [Joseph E Thornton](#)^{OR}¹

([Hatem, 2023](#))

Computer Science > Computation and Language


[Submitted on 19 Feb 2024 (v1), last revised 22 Feb 2024 (this version, v2)]

ArtPrompt: ASCII Art-based Jailbreak Attacks against Aligned LLMs

[Fengqing Jiang](#), [Zhangchen Xu](#), [Luyao Niu](#), [Zhen Xiang](#), [Bhaskar Ramasubramanian](#), [Bo Li](#), [Radha Poovendran](#)

([Jiang, 2024](#))

[Schizophrenia \(Heidelb\)](#). 2023; 9(1): 52.

Published online 2023 Aug 19. doi: [10.1038/s41537-023-00379-4](https://doi.org/10.1038/s41537-023-00379-4) 

PMCID: PMC10439949 

PMID: [37598184](https://pubmed.ncbi.nlm.nih.gov/37598184/)

ChatGPT: these are not hallucinations – they’re fabrications and falsifications


[Robin Emsley](#)^{OR}

► [Author information](#) ► [Article notes](#) ► [Copyright and License information](#) ► [PMC Disclaimer](#)

([Emsley, 2023](#))

[Cureus](#). 2023 Aug; 15(8): e43313.

Published online 2023 Aug 10. doi: [10.7759/cureus.43313](https://doi.org/10.7759/cureus.43313) 

PMCID: PMC10492900 

PMID: [37700993](https://pubmed.ncbi.nlm.nih.gov/37700993/)

Artificial Hallucinations by Google Bard: Think Before You Leap

Monitoring Editor: Alexander Muacevic and John R Adler

[Mukesh Kumar](#),¹ [Utsav Anand Mani](#),^{OR}⁰¹ [Pranjal Tripathi](#),² [Mohd Saalim](#),¹ and [Sneha Roy](#)³

► [Author information](#) ► [Article notes](#) ► [Copyright and License information](#) ► [PMC Disclaimer](#)

([Kumar, 2023](#))

The Productivity Dilemma

“Speeding up to keep up”

([Chubb, 2022](#))

Worsening Inequalities

- Digital divide
- Data poverty
- Access to computing power and resources
- AI models predominantly trained in few institutions
- Fees for advanced AI tools

(UNESCO, [Guidance for generative AI in education and research](#), 2023; [Cazzaniga, 2024](#))

Bias

arXiv > cs > arXiv:2303.12712

Computer Science > Computation and Language

[Submitted on 22 Mar 2023 (v1), last revised 13 Apr 2023 (this version, v5)]

Sparks of Artificial General Intelligence: Early experiments with GPT-4


Sébastien Bubeck, Varun Chandrasekaran, Ronen Eldan, Johannes Gehrke, Eric Horvitz, Ece Kamar, Peter Lee,
([Bubeck, 2023](#))

ARTICLES | VOLUME 6, ISSUE 1, E12-E22, JANUARY 2024 [Download Full Issue](#)



Assessing the potential of GPT-4 to perpetuate racial and gender biases in health care: a model evaluation study

Travis Zack, PhD [†] • Eric Lehman, MSc [†] • Mirac Suzgun • Jorge A Rodriguez, MD • Prof Leo Anthony Celi, MD • Prof Judy Gichoya, MD • et al. [Show all authors](#) • [Show footnotes](#)

([Zack, 2024](#))

RESEARCH ARTICLE | PSYCHOLOGICAL AND COGNITIVE SCIENCES | 

Systematic testing of three Language Models reveals low language accuracy, absence of response stability, and a yes-response bias

Vittoria Dentella  , Fritz Günther , and Evelina Leivada  [Authors Info & Affiliations](#)

([Dentella, 2023](#))

arXiv > cs > arXiv:2402.02680

Computer Science > Computation and Language

[Submitted on 5 Feb 2024]

Large Language Models are Geographically Biased

Rohin Manvi, Samar Khanna, Marshall Burke, David Lobell, Stefano Ermon

([Manvi, 2024](#))

Bias

- Training data bias
- Data dependency
- Historical (predictability) bias
- Open end, instability
- Reducing the diversity of scientific opinions
- Further marginalization of already marginalized voices, views, theories, groups
- Research direction
- Harmful bias/stereotypes can be further amplified/ perpetuated
- Uniformity communication in scientific writing

([Baidoo-Anu, 2023](#); [Buriak, 2023](#); [Lin, 2023](#); UNESCO, [Guidance for generative AI in education and research](#), 2023; [Zhang, 2023a](#))

Copyright

Recent Trends in Generative Artificial Intelligence Litigation in the United States

by: Christopher J. Valente, Michael J. Stortz, Amy Wong, Michael W. Meredith of K&L Gates - *K&L Gates HUB*

([Valente, 2023](#))

The New York Times

The Times Sues OpenAI and Microsoft Over A.I. Use of Copyrighted Work

Millions of articles from The New York Times were used to train chatbots that now compete with it, the lawsuit said.

([Grynbaum, 2023](#))

'Impossible' to create AI tools like ChatGPT without copyrighted material, OpenAI says

Pressure grows on artificial intelligence firms over the content used to train their products

([The Guardian, 2024](#))

OPINION | ARTIFICIAL INTELLIGENCE

Generative AI Has a Visual Plagiarism Problem Experiments with Midjourney and DALL-E 3 show a copyright minefield

BY GARY MARCUS | REID SOUTHEN | 06 JAN 2024 | 19 MIN READ

([Marcus, 2024](#))

Privacy

 > cs > arXiv:2311.17035

Computer Science > Machine Learning

[Submitted on 28 Nov 2023]

Scalable Extraction of Training Data from (Production) Language Models

Milad Nasr, Nicholas Carlini, Jonathan Hayase, Matthew Jagielski, A. Feder Cooper, Daphne Ippolito, Christopher A. (Nasr, 2023)

You have the controls to manage your privacy

At the moment, you can submit only certain requests on this page. For instructions on how to access your ChatGPT data, read this [help center article](#). Other requests can be sent to dsar@openai.com.

Already submitted a request? **Verify your identity** to check its status.

I would like to:



Do not train on my content

Ask us to stop training on your content




Delete my OpenAI account

You can ask that we delete your personal data.


<https://privacy.openai.com/policies?modal=take-control>


Settings


- General
- Beta features
- Data controls**
- Builder profile

Chat history & training 

Save new chats on this browser to your history and allow them to be used to improve our models. Unsaved chats will be deleted from our systems within 30 days. This setting does not sync across browsers or devices. [Learn more](#)

Shared links 

Export data 

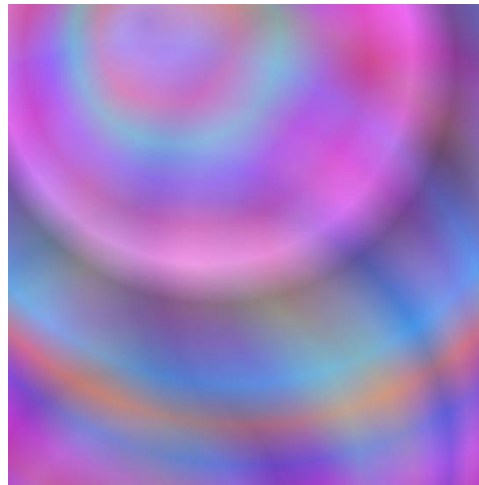
Delete account 

Opacity

Unclear how LLMs generate
outputs
([Zhang, 2023a](#))

The inner working of artificial
neural networks is not open for
inspection, not transparent and
not explainable

(UNESCO, [Guidance for generative AI in
education and research](#), 2023)



Picture by DavidZydd on [Pixabay](#), available under a [Pixabay License](#).

Continuing to use general-
purpose AI models with unclear
sources we risk “*rubbish in =
rubbish out*”
([Staiman, 2023](#))

*“You don’t know what the data
is. So you can’t improve it”*
([Sanderson, 2023](#))

Deepfake Research

Harmful
research

Paper mills

Results
falsification and
fabrication


Plagiarism

Images/videos
manipulation

Fake scientific
news, *AI-driven
infodemic*

(UNESCO, [Guidance for generative AI in education and research](#), 2023; [Zhang, 2023a](#); [De Angelis, 2023](#); [Loth, 2024](#))


Employment

> J Intell. 2023 Oct 9;11(10):194. doi: 10.3390/jintelligence11100194 .

Critical Thinking: Creating Job-Proof Skills for the Future of Work

Daniela Dumitru ^{1 2}, Diane F Halpern ³

([Dumitru, 2023](#))

arXiv > econ > arXiv:2303.10130 

Economics > General Economics

[Submitted on 17 Mar 2023 (v1), last revised 21 Aug 2023 (this version, v5)]

GPTs are GPTs: An Early Look at the Labor Market Impact Potential of Large Language Models

Tyna Eloundou, Sam Manning, Pamela Mishkin, Daniel Rock

([Eloundou, 2023](#))

“The goal is to automate us”

(Zuboff, “[The Age of Surveillance Capitalism](#)”, 2019)

“In advanced economies, about 60% of jobs are exposed to AI, due to prevalence of cognitive-task-oriented jobs”

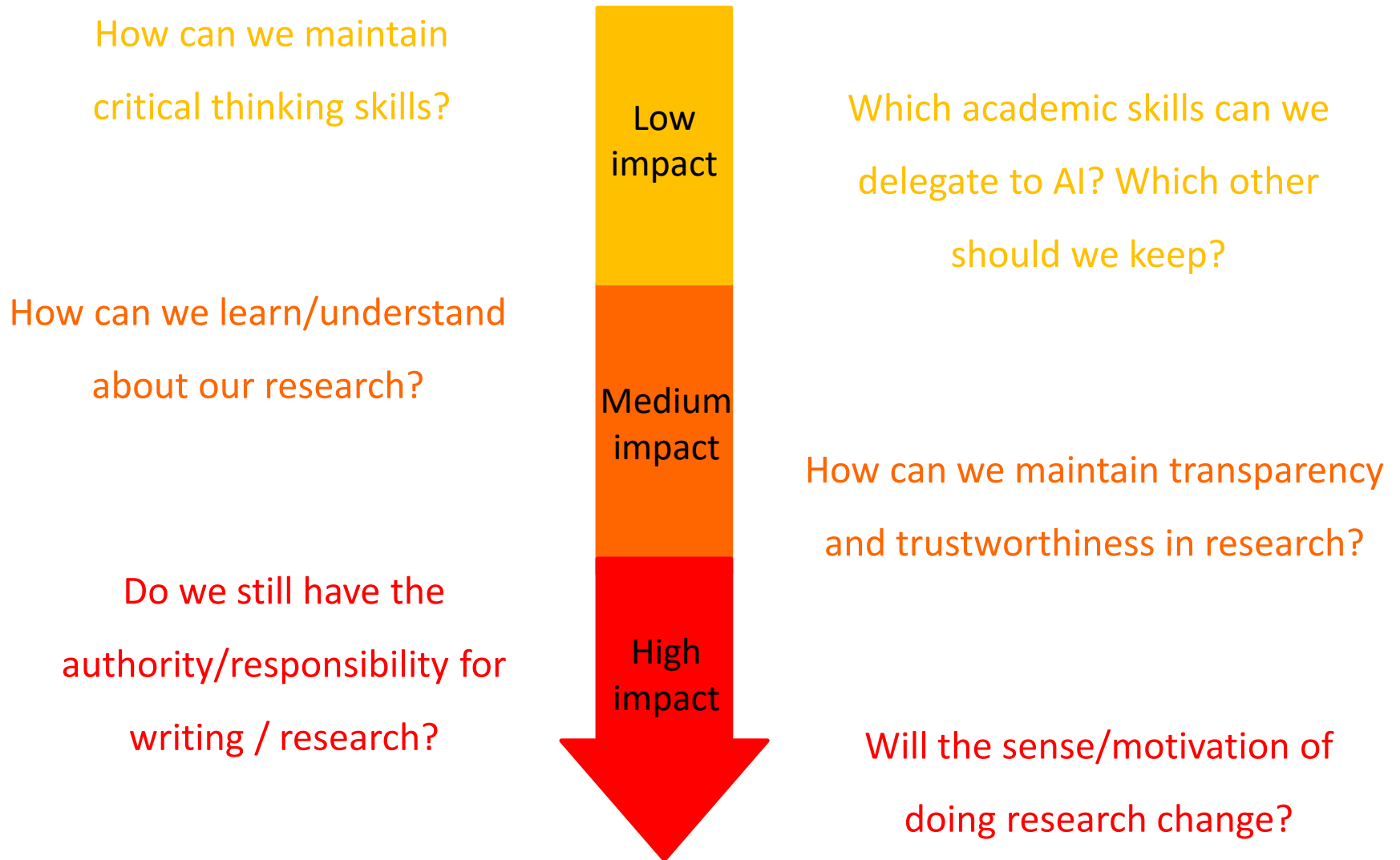
([Cazzaniga, 2024](#))

Loss of Skills, Overreliance



Picture by Only-shot on [Pixabay](#), available under a [Pixabay License](#).

If We over Rely on AI...



Sustainability

Making AI Less “Thirsty”: Uncovering and Addressing the Secret Water Footprint of AI Models

Pengfei Li
UC Riverside

Jianyi Yang
UC Riverside

Mohammad A. Islam
UT Arlington

Shaolei Ren[†]
UC Riverside

Abstract

([Li, 2023](#))

> *Int J Surg.* 2023 Nov 22. doi: 10.1097/JS9.0000000000000905 . Online ahead of print.

AI-enabled ChatGPT's carbon footprint and its use in the healthcare sector: A coin has two sides

Chiranjib Chakraborty¹, Soumen Pal², Manojit Bhattacharya³, Md Aminul Islam^{4 5}

([Chakraborty, 2023](#))

OCTOBER 13, 2023 | 5 MIN READ

The AI Boom Could Use a Shocking Amount of Electricity

Powering artificial intelligence models takes a lot of energy. A new analysis demonstrates just how big the problem could become

BY LAUREN LEFFER

([Leffer, 2023](#))

Future Developments and Possibilities

Stay Updated in the Field of AI:

AI Tools Databases

Link	Features
https://www.futurepedia.io/	Newsletter, user reviews
https://www.futuretools.io/	Newsletter, AI news
https://www.toolify.ai/de/	Newsletter, GPTs included, user reviews, available in German
https://theresanaiforthat.com/tasks/	Newsletter, large database, many tools' categories, user reviews
https://www.advanced-innovation.io/ki-tools	Available in German
https://aieducator.tools/	Newsletter, tools for teaching
https://www.hcilab.org/ai-tools-directory/	
https://aitoolsupdate.com/	
https://ditchthattextbook.com/ai-tools/	Tools for teaching
https://allthingsai.com/	Tools' reviews and tutorials
https://supertools.therundown.ai/	Newsletter, GPTs included
https://topai.tools/	
https://www.aistash.co/	Newsletter, many tools' categories
https://letsview.com/ai-tools#	
https://aitools.fyi/	Newsletter, many tools' categories
https://www.toolsforhumans.ai/	Newsletter, popular use cases

Stay Updated in the Field of AI: Other Resources

AI tools tutorials

Dr Amina Yonis

<https://www.youtube.com/@DrAminaYonis>

Andy Stapleton

<https://www.youtube.com/@DrAndyStapleton>

Science Grad School Coach

<https://www.youtube.com/@SciGradCoach>

Training, seminars, courses on AI

Virtuelles Kompetenzzentrum: Künstliche Intelligenz und wissenschaftliches Arbeiten

<https://www.vkkiwa.de/events-und-calls/>

AI Campus

<https://ki-campus.org/overview>

Books discussing AI and its more general impact

The Age of Surveillance Capitalism

<https://www.thalia.de/shop/home/artikeldetails/A1055042763>

The Coming Wave

<https://www.thalia.de/shop/home/artikeldetails/A1068285323>

Homo Deus

<https://www.thalia.de/shop/home/artikeldetails/A1041199815>

Ideal Regulatory Framework for AI in Research

- Rigorous data collection, storage and sharing policies
- Tools to detect plagiarism, image manipulation and AI-generated content
- Digital watermarking
- Transparency and Open Science (open data and materials)
- Rigorous peer review (open peer review, collaborative peer review)
- Policy for training/testing of AI models, potentially integrated with a guarantee system
- Ethical guidelines (institutions, journals) on the use of AI tools
- Education and awareness

Future Developments and Possibilities

Evolving roles of researchers

Less focus on writing and routine tasks, more focus on critical thinking and developing innovative studies ([Gandhi, 2023](#))

New jobs, new skills

Permanent training for emerging jobs and integrate AI advancements into one's professional practice ([Haenlein, 2019](#); [Grace, 2024](#))

AI in peer review

AI assisting peer review, hybrid human–machine editorial model, paper reviewed by AI prior to submission ([Bignami, 2023](#); [Hosseini, 2023](#); [Vincent, 2023](#))

Future Developments and Possibilities

Personal AI assistant

Personal AI assistants (e.g. GPTs) focused to your (your institution's) data; it executes tasks (AI with agency) ([OpenAI, 2024](#); [Aberystwyth University, 2023](#))

Acceleration of research

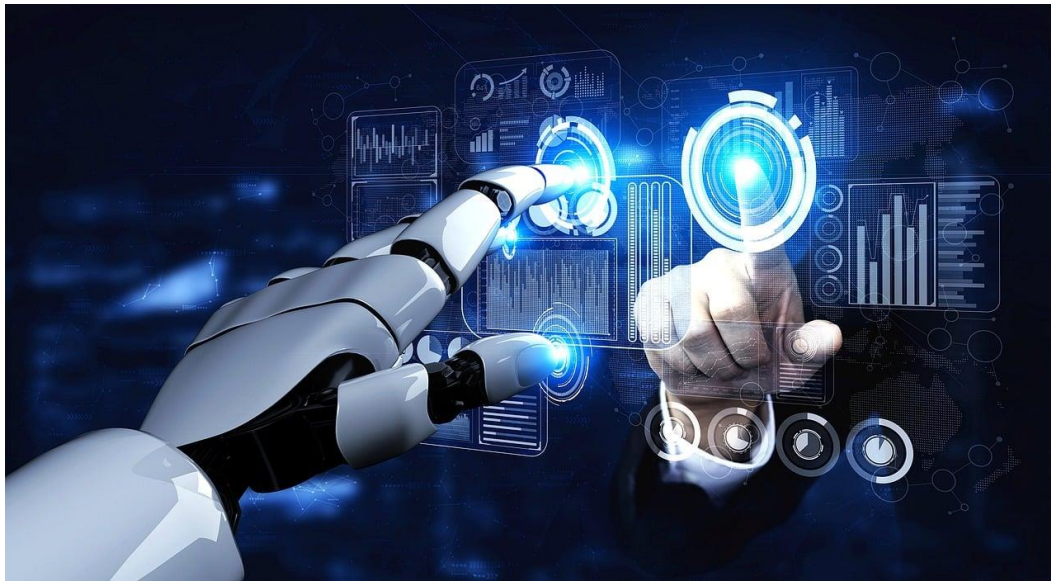
Acceleration in research and publication processes, hypothesis generation and testing, data-driven research ([Aberystwyth University, 2023](#); [Wang, 2023](#))

AGI

AGI outsmarting human researchers in several complex tasks, with autonomous decision-making skills and intrinsic motivation ([Bubeck, 2023](#))



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Picture by tungnguyen0905 on [Pixabay](#), available under a [Pixabay License](#).



Picture by kiquebg on [Pixabay](#), available under a [Pixabay License](#).

Understand the importance of using AI in research and academia

Assess the benefits and risks of using AI in research and academia

Craft effective prompts for your research tasks

Develop strategies to integrate AI tools into your research workflow

Stay informed about and adapt to new developments in the field of AI

Learning Objectives

References

- Aberystwyth University. (2023). Utilising AI in the Library: A Student's Guide: What is AI? Available at <https://libguides.aber.ac.uk/artificial-intelligence>
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