Generative AI: opening new doors in research, teaching, and administration

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About me, why this talk, why now

- Interest in computers and mathematics (randomness) since childhood
- Studied computer science, focus on algorithms
- PhD Aalto, MSC Fellow @ UGent, 2020–now Professor
- ’21–’23 academic advisor @ VAIA

- Early 2020s: Rise of foundation models & chat-based systems
- Impact increasing, lots of hype (?), ethical problems. Polarisation.

- Difficult to predict the future, challenging subject to give advice on
- Now sufficient information to make decisions what we *should* and *should not* do

Purpose of this talk

Is GenAI mostly hype and something to ban from our lives?

- There are many reasons to minimize use of current SotA systems

Should we be preparing for a post-AGI reality?

- AI is the most profound technology we have ever made

If neither, what is it then ?!

- Huge benefits to mastering this technology, for all knowledge workers
  - Education is mostly not knowledge work

The hype

February 24, 2023 Safety

Planning for AGI and beyond

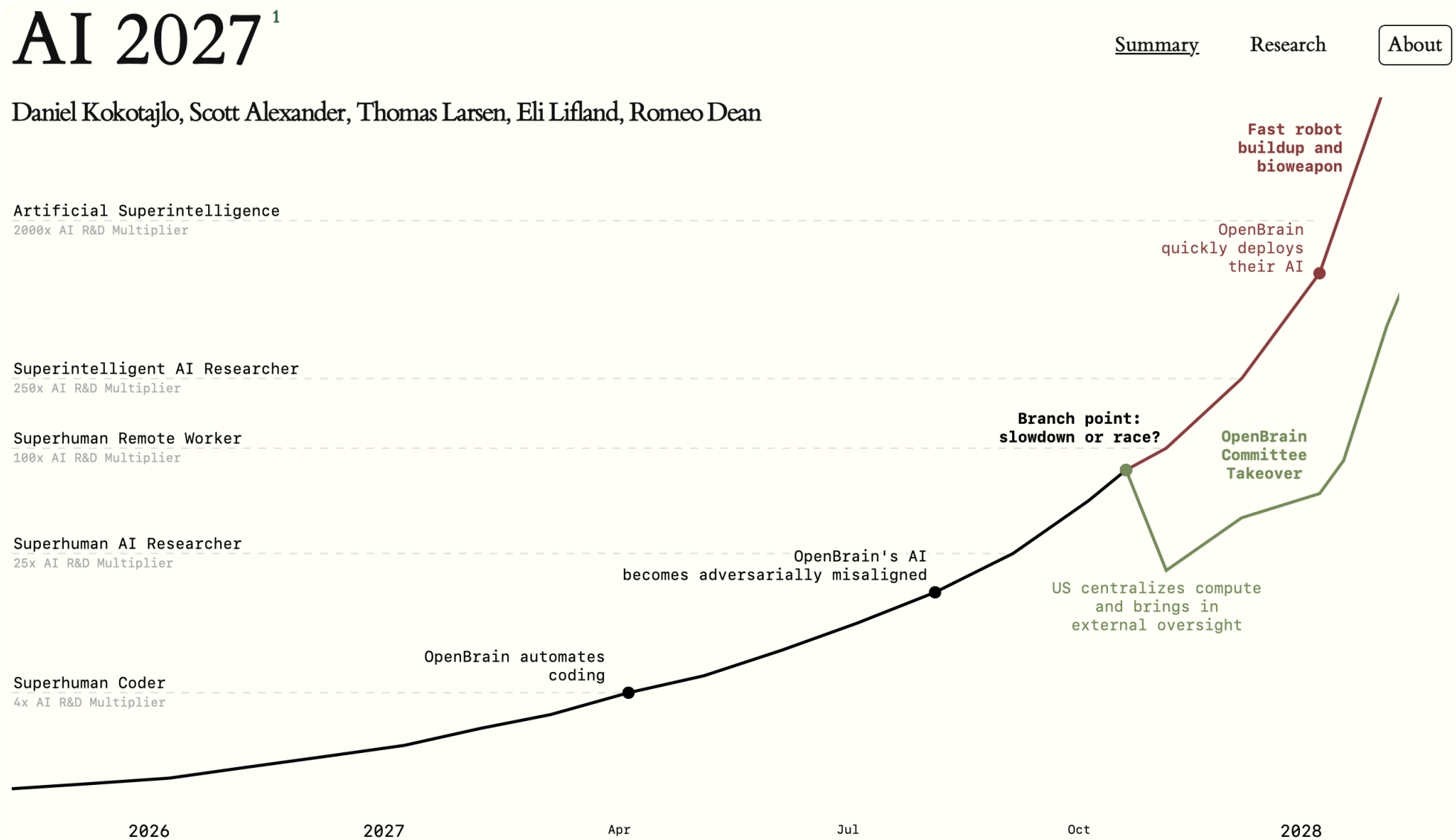
Our mission is to ensure that artificial general intelligence—AI systems that are generally smarter than humans—benefits all of humanity.

OpenAI

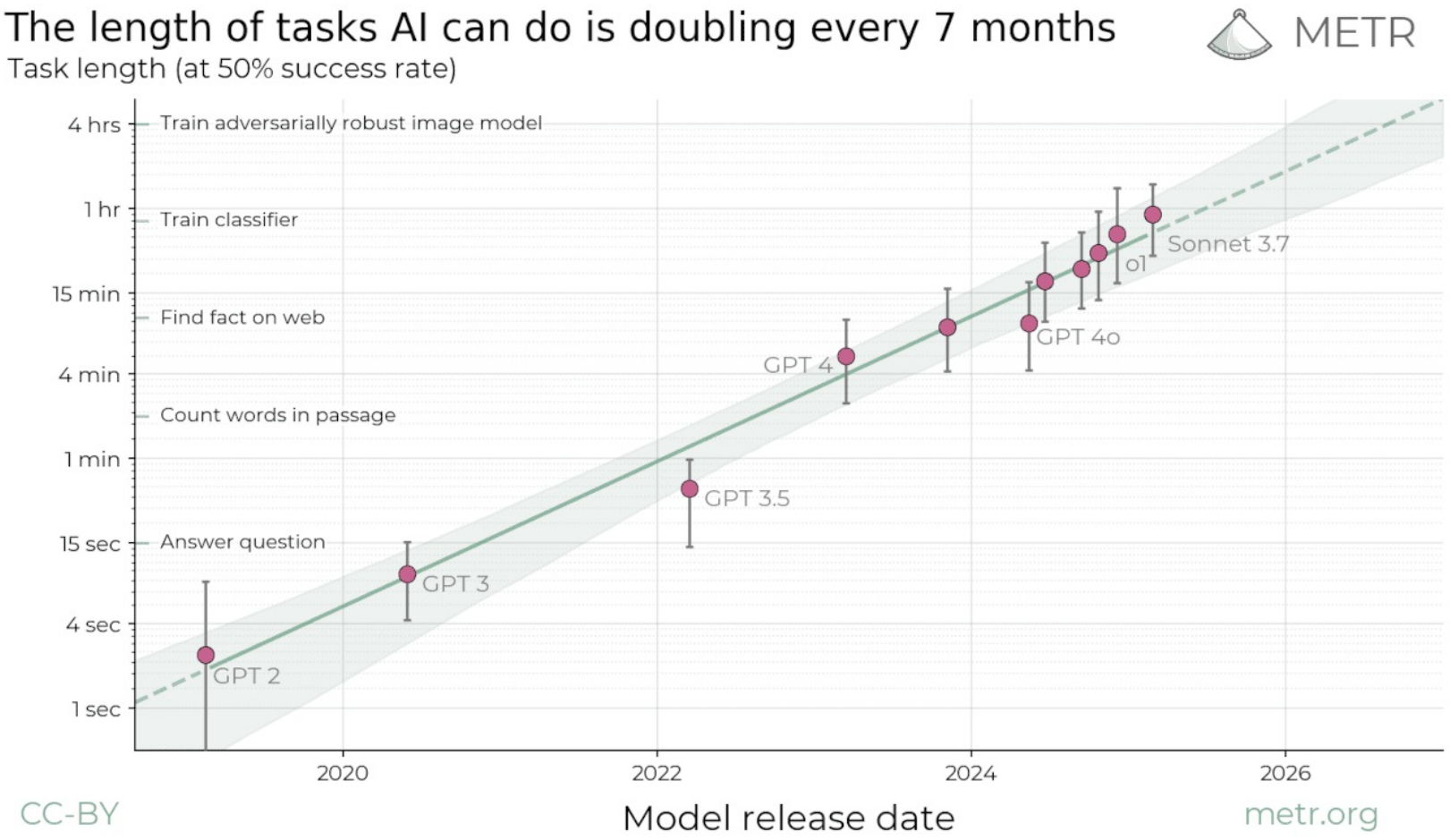
Author

Sam Altman

The hype


AI 2027 1
Summary
Research
About
Daniel Kokotajlo, Scott Alexander, Thomas Larsen, Eli Lifland, Romeo Dean
Fast robot buildup and bioweapon
Artificial Superintelligence
2000x AI R&D Multiplier
OpenBrain quickly deploys their AI
Superintelligent AI Researcher
250x AI R&D Multiplier
Branch point: slowdown or race?
Superhuman Remote Worker
100x AI R&D Multiplier
OpenBrain Committee Takeover
Superhuman AI Researcher
25x AI R&D Multiplier
OpenBrain's AI becomes adversarially misaligned
US centralizes compute and brings in external oversight
OpenBrain automates coding
Superhuman Coder
4x AI R&D Multiplier
2026
2027
Apr
Jul
Oct
2028

The hype



The length of tasks (measured by how long they take human professionals) that generalist frontier model agents can complete autonomously with 50% reliability has been doubling approximately every 7 months for the last 6 years. The shaded region represents 95% CI calculated by hierarchical bootstrap over task families, tasks, and task attempts.

The hype

Market Summary > NVIDIA Corp

177,10 USD

+177.06 (442,637.50%) ↑ all time

24 Sept, 15:20 GMT-4 • Disclaimer

+ Follow

1D | 5D | 1M | 6M | YTD | 1Y | 5Y | Max

Problems & risks GenAI/Chatbots

SotA providers ignored copyright & privacy
Data labelers in poor working conditions

High cost in energy & other resources

Unreliable (hallucination) & non-deterministic
Contains systematic biases
Increased risk of cutting corners
– Reduction in quality; alertness; learning
No ownership generated material

Diminishes social connections
Increases risk of mass manipulation
Increases inequality
…

Table 4: Hallucination evaluations

Dataset	Metric	o3	o4-mini	o1
SimpleQA	accuracy (higher is better)	0.49	0.20	0.47
	hallucination rate (lower is better)	0.51	0.79	0.44
PersonQA	accuracy (higher is better)	0.59	0.36	0.47
	hallucination rate (lower is better)	0.33	0.48	0.16

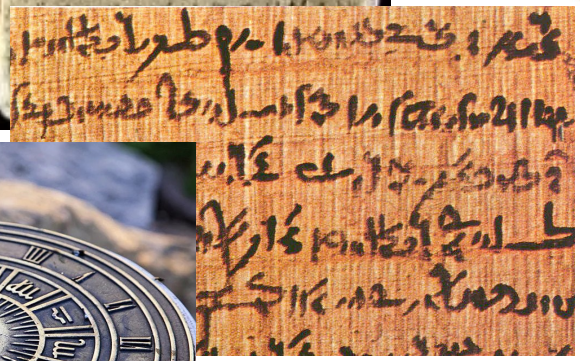
Will AI speed up literature reviews or derail them entirely?

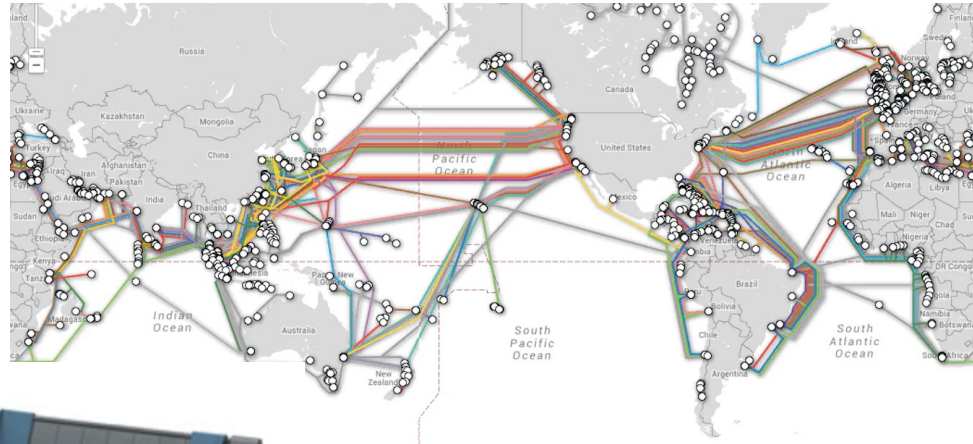
The publication of ever-larger numbers of problematic papers, including fake ones generated by artificial intelligence, represents an existential crisis for the established way of doing evidence synthesis. But with a new approach, AI might also save the day.

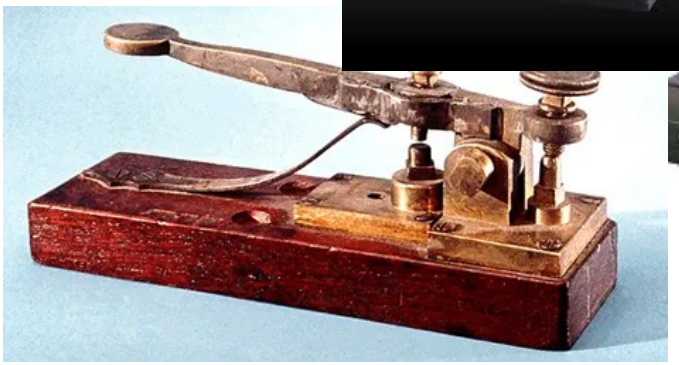
Supportive? Addictive? Abusive? How AI companions affect our mental health

Studies suggest benefits as well as harms from digital companion apps – but scientists worry about long-term dependency.

IT has shaped our society for millenia







Advance of information technology / augmented intelligence

- AI is not like crypto or quantum, it is both widely-applicable and present
- AI will redefine our relation to data, information, and knowledge
- We need this technology to make the ever-growing body of knowledge more accessible and useful
- Freedom to ‘know less about most topics’ enables further specialization
- Plainly the next step in the knowledge economy

Actual capabilities of current (and near-future) AI systems

Fuzzy database of most things ever written that you can query in natural language

– Every generation uses more training data

Systems don’t integrate formal logic / mathematics / reasoning

– Slowly emerging to use tools for this

Systems don’t learn actively

– Engineers retrain/update the models

No introspection: no explainability

No fundamental architectural innovations that can be brought to practice

- Capabilities will remain mostly the same
- Efficiency gains are fast

More elaborate use cases require development process

Are LLMs ready to help non-expert users to make charts of official statistics data?

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Belgium

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University of Amsterdam & CBS (Statistics Netherlands)
Netherlands

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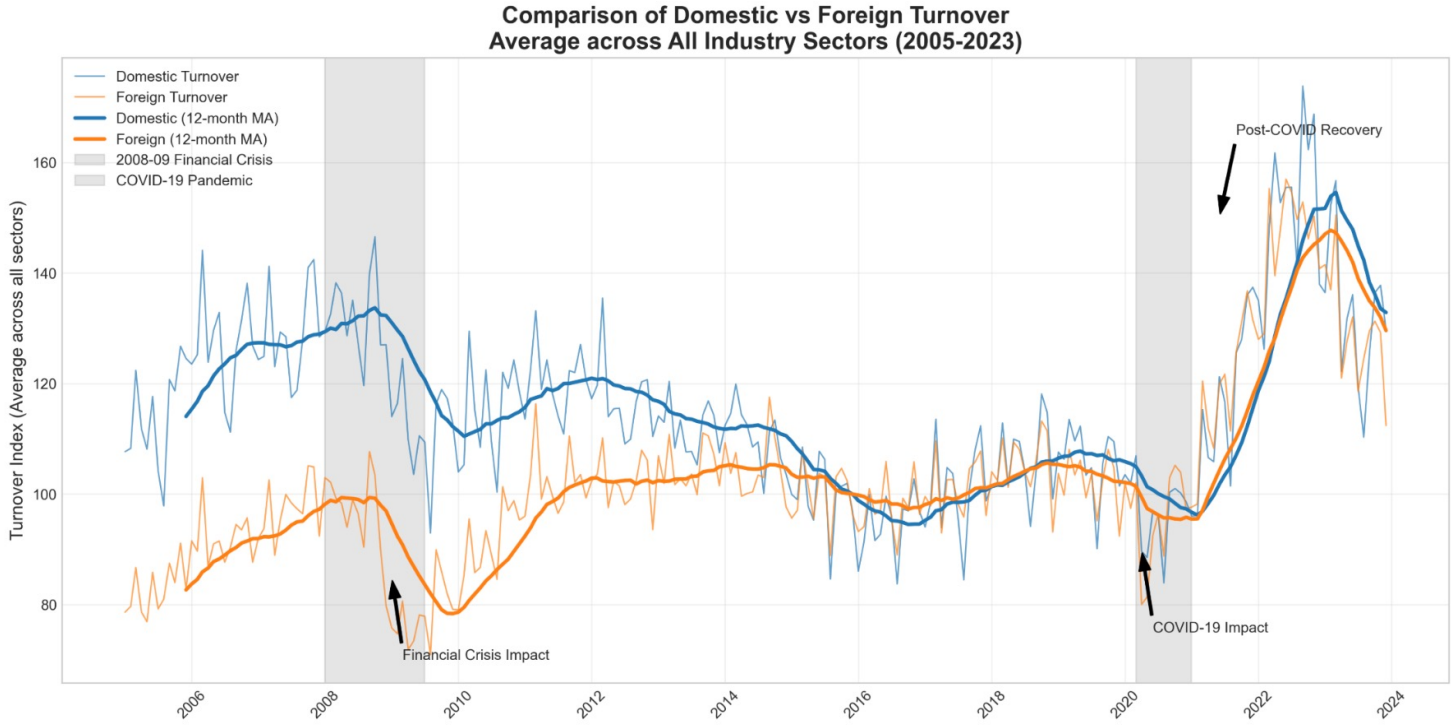

Figure 1: Sample visualization generated by Claude 3.7 using a modular prompt and a self-feedback loop (7 iterations), responding to the prompt: *"Plot and compare foreign and domestic turnover for All Sectors."* The chart compares domestic and foreign turnover indices from 2005 to 2023, averaged across all industry sectors, based on data from Statistics Netherlands. Raw monthly trends are shown with thin lines, while 12-month moving averages are overlaid with thicker curves to highlight longer-term patterns. Two key economic disruptions (the 2008–2009 Financial Crisis and the COVID-19 Pandemic) are marked with shaded regions. The visualization showcases use of reasoning, clear axis labeling, and appropriate use of smoothing and context. Sample figures are displayed as produced by the LLM system, without any post-processing. More results can be found at https://github.com/aida-ugent/llm_visualization_results

Table 2: Normalised evaluation scores (out of 10), averaged over the 25 prompts, for each model and configuration.

Model/Configuration	Visual	Code	Data
Llama3.1 (9B)	*5.95*	8.00	*4.86*
Gemma 2 (9B)	*5.55*	8.23	*4.91*
Qwen 2.5 (7B)	5.85	8.63	5.71
Claude 3.5	6.90	8.23	6.69
Deepseek-Chat	7.00	8.57	6.74
Gemini 2.0 Flash Thinking	7.05	7.77	6.00
GPT-4o	6.20	7.94	6.00
o1-High	7.50	**8.97**	**7.37**
o1-High + Context	**7.80**	8.91	7.03
Claude 3.7 + Feedback Loop	8.90	**9.83**	**9.43**
Claude 3.7 + Feedback + Context	**9.05**	9.71	**9.43**

My advice for education

Education: several immediate problems to address

- Validity of testing
- Loss of social engagement

Need to keep updated with changing skill needs

- E.g., need for education on (Gen)AI

Note that some use is high-risk!
E.g., evaluation

Generally useful for specific things only

- Admin, knowledge work (creation of material, tests, …)

My advice for operations

Many opportunities for efficiency gains

- Automation is faster, cheaper, more accessible than ever
- Possible to automate processes that were too complex before
- Requires (staff with) specific skills
- Need to uphold quality

Research: go all out, but deliberately

AI chatbots are already biasing research — we must establish guidelines for their use now

The academic community has looked at how artificial-intelligence tools help researchers to write papers, but not how they distort the literature scientists choose to cite.

Many opportunities to do things that were inconceivable before

- Gather & process immense data
- Enriching data analysis
- Connect research to literature more broadly than ever
- 10x speed to develop prototype code [not solid code]

Find new ways to deal with reduced trustworthiness of observations & content

- Reduction in reliability, but gain in capabilities will outweigh this

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