

Artificial Intelligence and Education

A critical studies approach

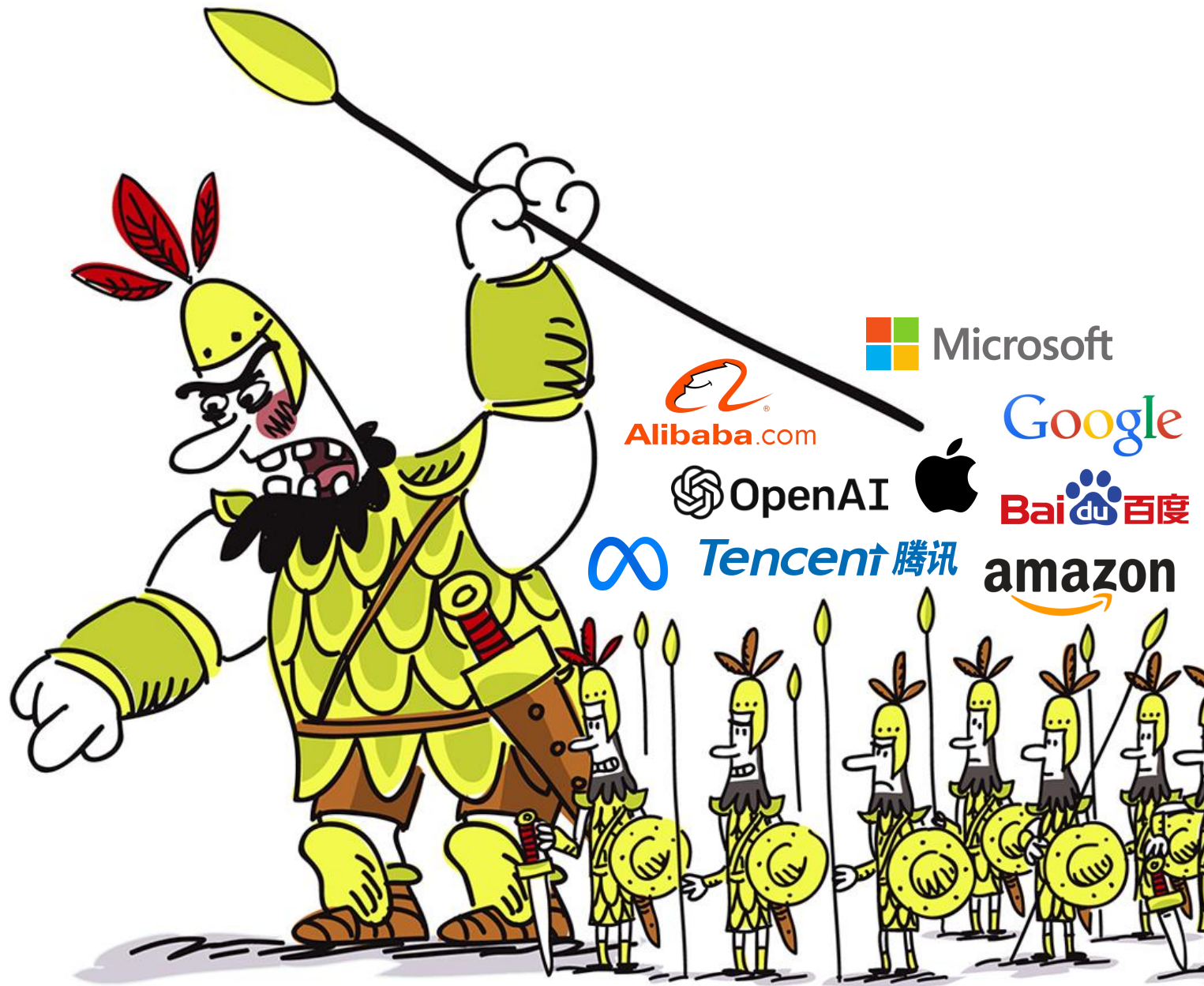
Digital transformation and future of education:
Algebra University, Zagreb, Croatia (April 2024)

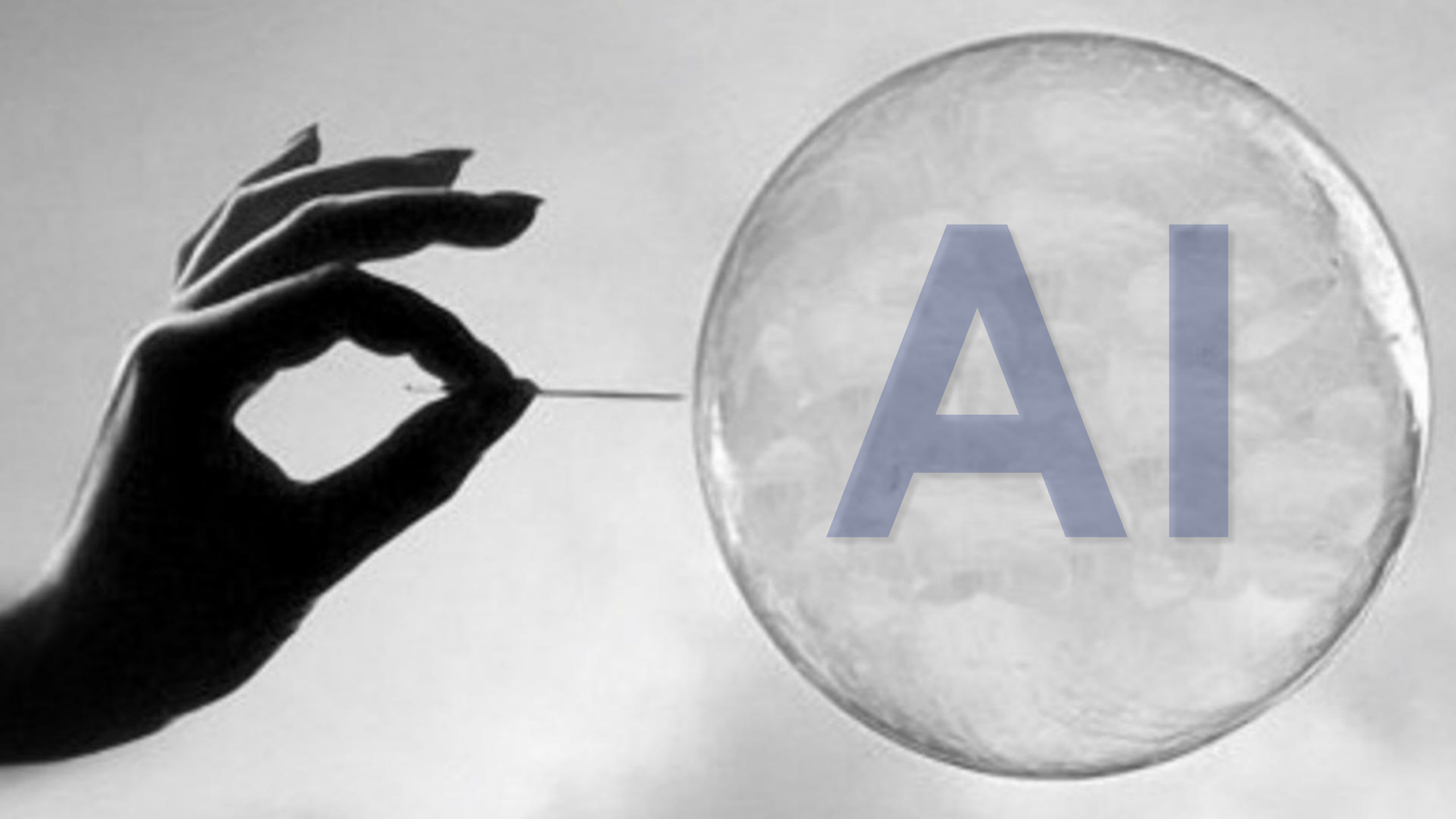
Dr Wayne Holmes

University College London, Council of Europe (Lead Expert AI&ED) , IRCAI (Senior Researcher), UNESCO (Consultant)



Critical but
constructive
approach





Limits of AI



+



=



Panda

57.7% confidence

Gibbon

99.3% confidence

Limits of AI



Limits of AI



Limits of AI

- A human sets the objectives
- A human chooses and cleans the data.
- A human labels the data.
- A human designs the network.
- A human trains the network.
- A human curates the outputs.
- Humans in big commercial organisations are in full control.



Limits of AI

“Our review [of 2,212 studies] finds that **none of the models identified are of potential clinical use.**”

Roberts et al. 2021, Nature Machine Intelligence



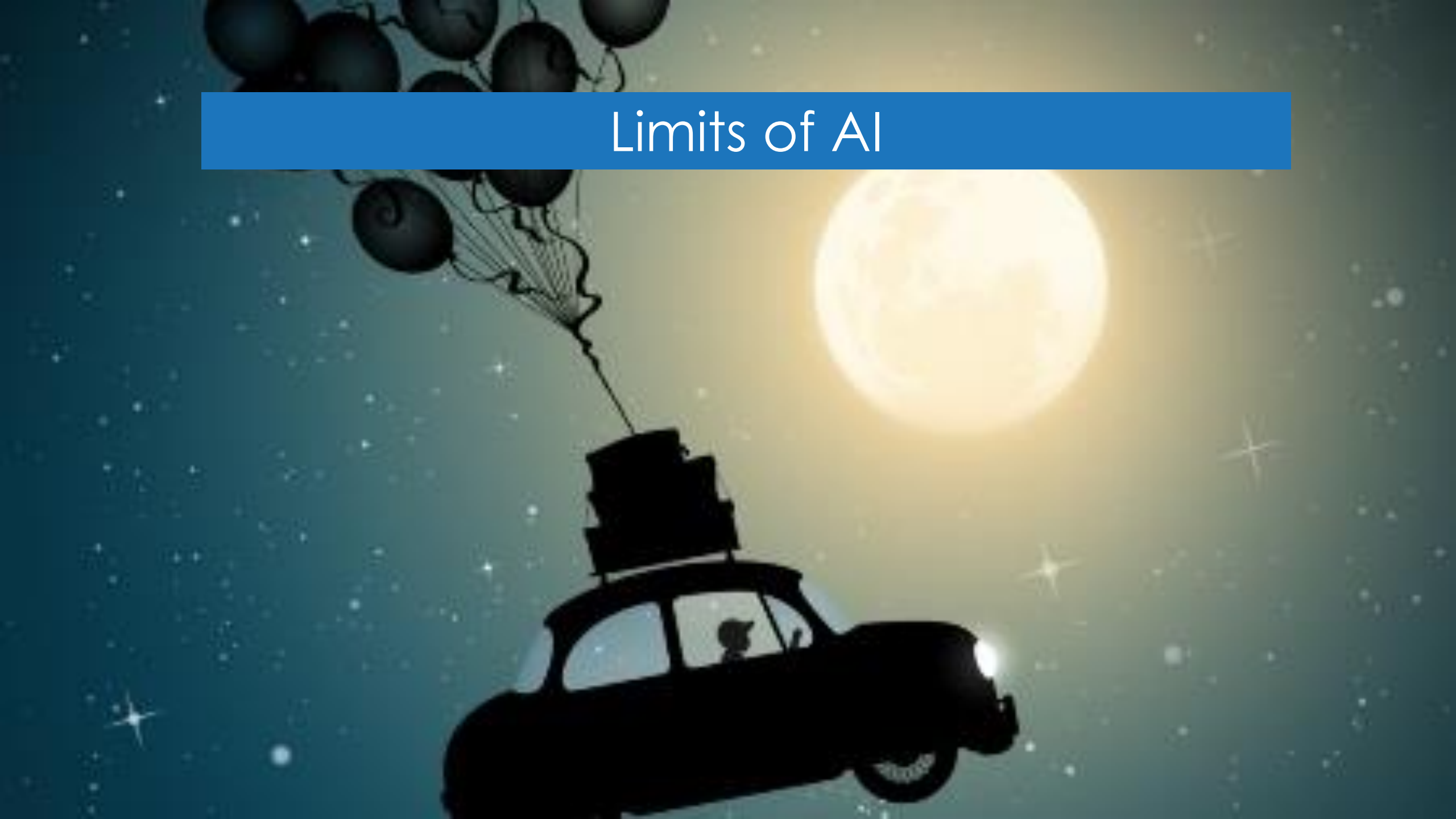
Limits of AI



Limits of AI



Limits of AI



Limits of AI

“Our increasing reliance on AI **cedes inordinate power** over our lives and institutions **to a handful of tech firms.**”

Whittaker. 2021, Interactions, ACM



IBM



OpenAI

Baidu 百度

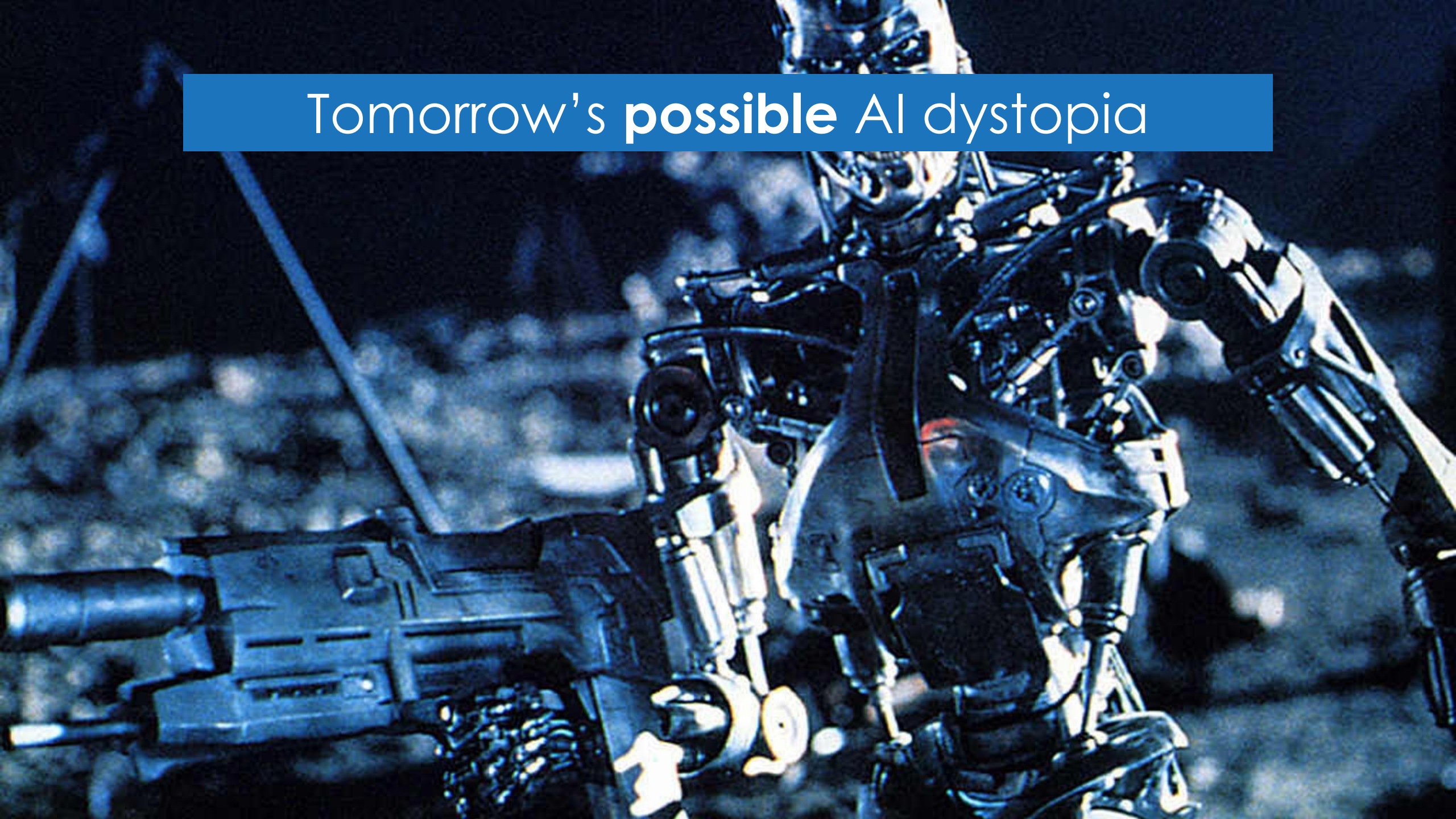
Limits of AI



Geoffrey Hinton

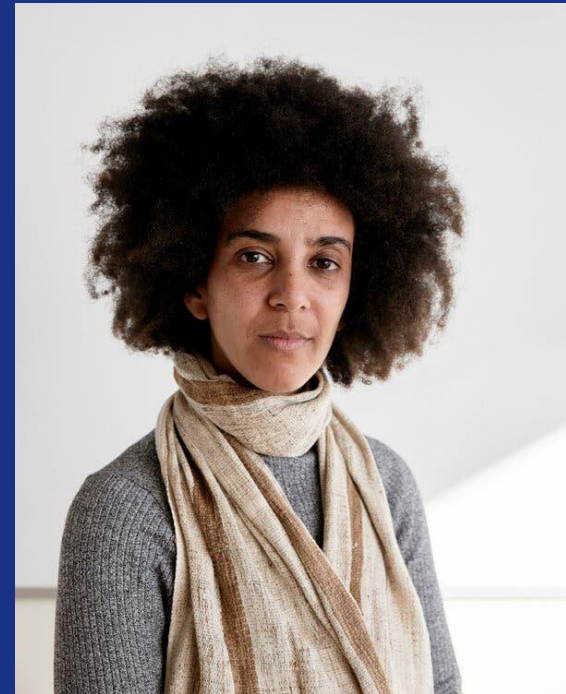
“I think Artificial Intelligence will be much more intelligent than us in the future. How do we survive that?”.” (Hinton, 2023)

Tomorrow's **possible** AI dystopia



Limits of AI

“I’m not worried about machines taking over the world. I’m worried about groupthink, insularity and arrogance in the A.I. community. The people creating the technology are a big part of the system. If many are actively excluded from its creation, this technology will benefit a few while harming a great many.” (Gebru, 2021)



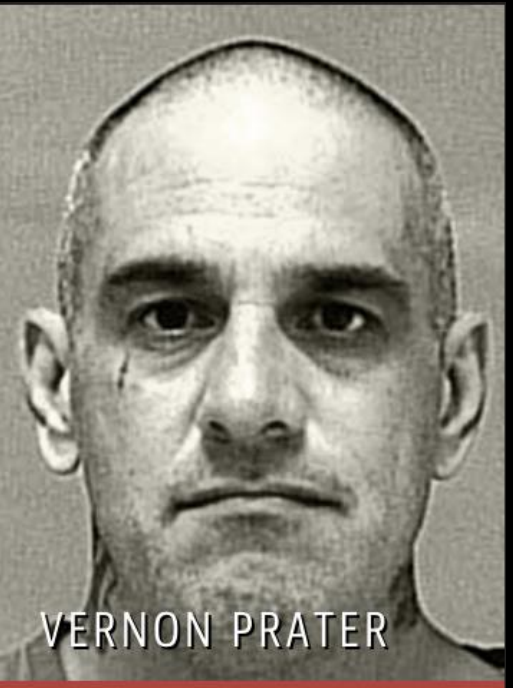
Timnit Gebru

Today's **actual** AI negative impact




DYLAN FUGETT

LOW RISK **3**




VERNON PRATER

LOW RISK **3**



BRISHA BORDEN

HIGH RISK **8**



BERNARD PARKER

HIGH RISK **10**

COMPAS: **Misclassified** almost twice as many **black defendants** (45%) **as higher risk**, compared to white defendants (23%)

Artificial Intelligence and education

The connections between
Artificial Intelligence and **education**
are complex

Artificial Intelligence and Education



Teaching and Learning with AI: AIED



- **student**-focused AIED
- **teacher**-focused AIED
- **institution**-focused AIED

Institution-focused AIED

- Admissions (e.g., student selection)
- Course-planning, Scheduling, Timetabling
- School Security
- Identifying Dropouts and Students at risk
- e-Proctoring

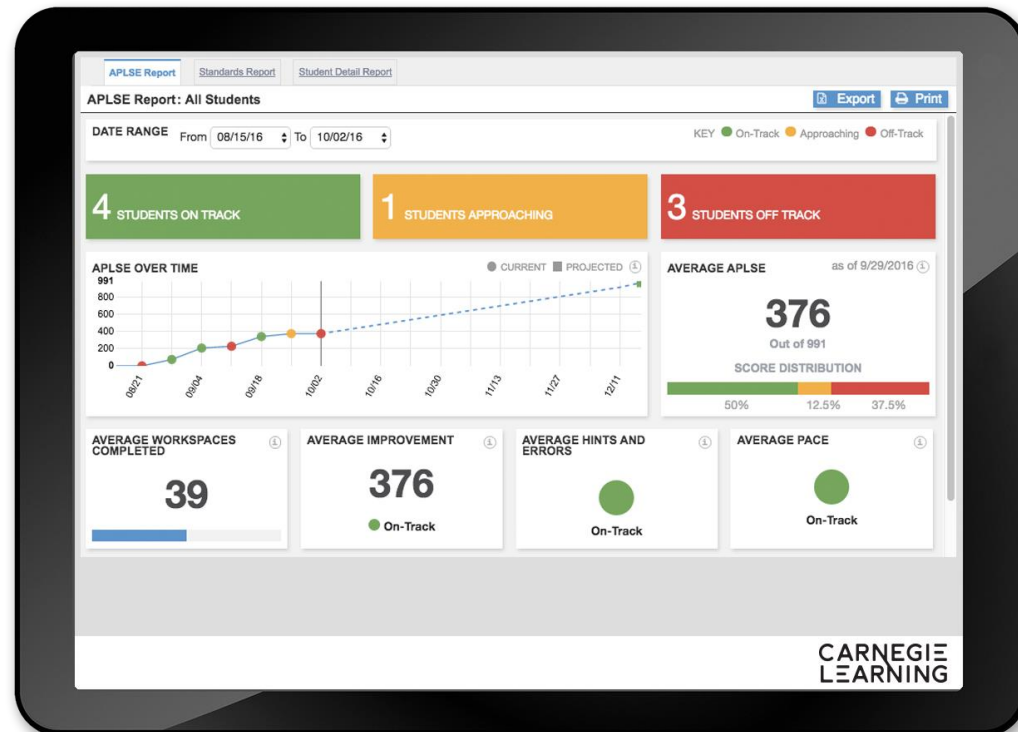
Holmes, W., & Tuomi, I. (2022). State of the art and practice in AI in education. *European Journal of Education: Research, Development and Policies*.
<https://doi.org/10.1111/ejed.12533>

Student-focused AIED

- Adaptive Tutoring Systems
- AI-enabled Apps (e.g., maths, text-to-speech, language learning)
- AI-enabled Simulations (e.g., games-based learning, VR, AR)
- AI to Support Learners with Disabilities
- Virtual Writing Assistants
- Generative AI
- Chatbots
- Automatic Formative Assessment
- Learning Network Orchestrators
- Dialogue-based Tutoring Systems
- Exploratory Learning Environments
- Health
- AI-enabled Lifelong Learning Assistant

Student-focused AIED

Adaptive Tutoring Systems (ITS)



- Alef
- ALEKS
- alta
- AmritaCREATE
- Area9
- Assistments
- Better Marks
- Byjus
- Century
- Civitas
- CogBooks
- Cognii
- Domoscio
- Dreambox
- EnLearn
- Gooru
- Inq-ITS
- iReady
- Knewton
- Liulishuo (Laix)
- Mathia
- Necole
- Qubena
- Realizelt
- Smart Learning Partner
- Querium
- Riid
- Savvi
- Smart Sparrow
- Snappet
- Soffos
- Squirrel AI
- Summit Learning
- Thinkster Math
- Toppr

Student-focused AIED

Learning Network Orchestrators

- Smart Learning Partner
- Third Space Learning

智慧学伴
Smart Learning Partner

学习问题的诊断与改进

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北京师范大学未来教育高精尖创新中心
Beijing Advanced Innovation Center For Future Education

SMART
LEARNING PARTNER

Teacher-focused AIED

- Plagiarism detection
- Automatic Curation of Learning Materials
- Classroom Monitoring
- Automatic Summative Assessment
- AI-enabled Teaching Assistant (including assessment assistant)
- Classroom Orchestration
- Professional Development

Teacher-focused AIED

Automatic Writing Evaluation

The screenshot displays the openEssayist web application interface. The top navigation bar includes 'Home', 'Help', 'Report', and 'Admin' menus, along with a 'Notepad' icon and a user profile 'admin'. The main content area is titled 'Your Draft : Overview (with key sentences)' and shows 'Version 9' with tabs for 'Essay', 'Analysis', 'Graphics', and 'Rainbow Diagram'. Below this, the 'Your essay' section is visible, showing a list of key sentences with colored highlights (red, green, blue). The bottom part of the screenshot shows two 'Rainbow Diagram' visualizations, which are network graphs with nodes and edges, representing the structure of the text. The diagrams are labeled 'Rainbow Diagram for TMA01' and 'Rainbow Diagram for TMA01'.

- e-Rater
- Intelligent Essay Assessor
- OpenEssayist
- PEG
- Progressay
- Revision Assistant
- Write to Learn

Teacher-focused AIED

Supporting teacher assessment

- Graide
- Gradescope

+ Feedback	Grade
Simplification	
Well done for simplifying the question before differentiating.	✓
You should have simplified first before differentiating, instead of using the product rule.	!
Unnecessary simplification after getting the correct answer. This form is also not preferred.	!
Final Answer	
Correct answer in the preferred form.	+2
Correct answer, but not in the preferred form of $\frac{3}{2}x^{\frac{3}{2}}$.	+1.5
Notation	
$\frac{d}{dx}$ is an operator. It cannot equal something algebraic. You wouldn't write $\div = \sin(x)$.	!
Add new feedback	

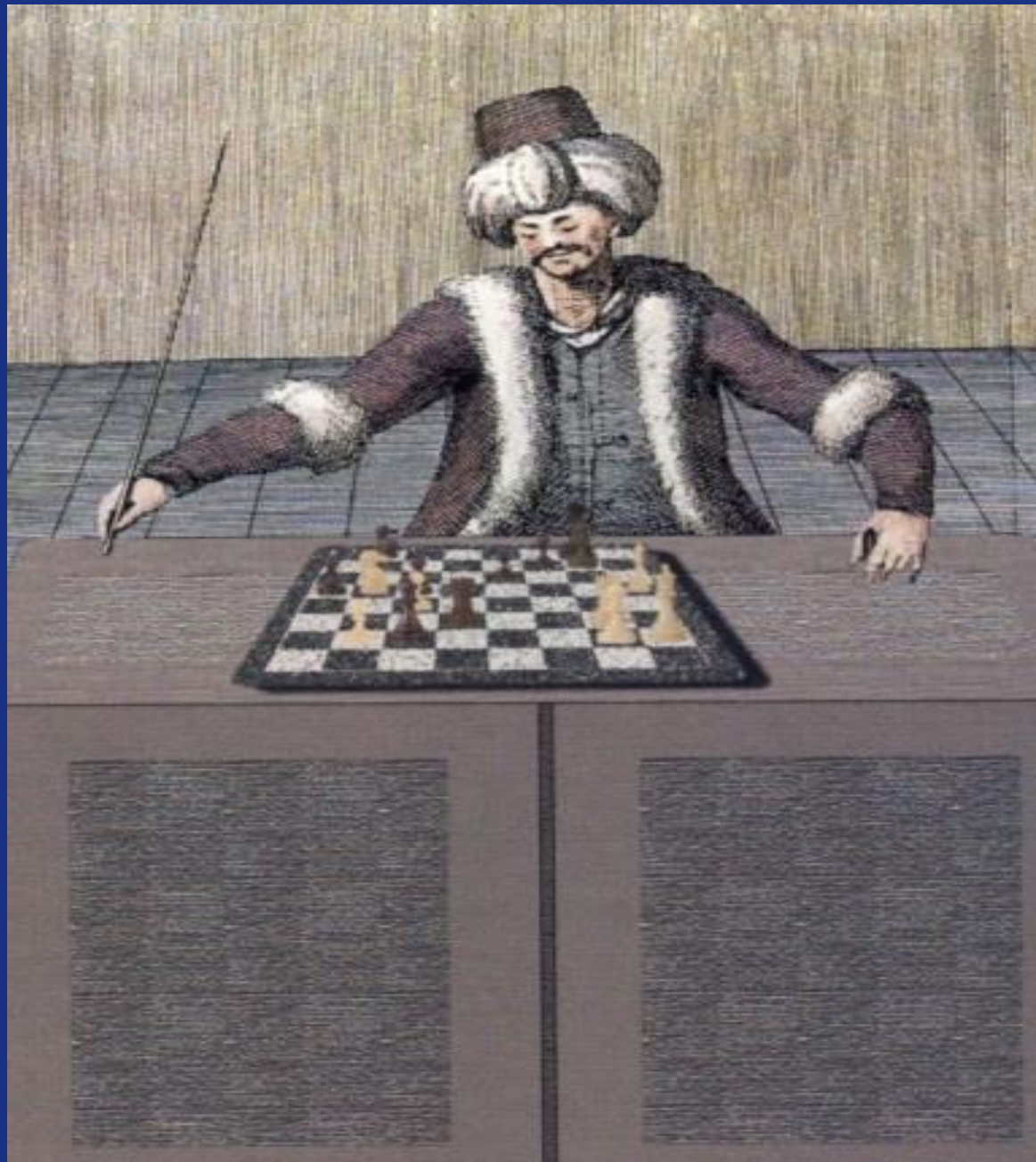
Polynomial Differentiation	
Question 2:	Grade: 2 out of 2
Differentiate $\sqrt{x} \times x$	
	<p>You should have simplified first before differentiating, instead of using the product rule. !</p> <p>Correct answer in the preferred form. +2</p> <p>Unnecessary simplification after getting the correct answer. This form is also not preferred. !</p>
Mark as done	



Learning
with AI
(AIED)

A close-up portrait of an elderly man with a mustache, looking thoughtfully to the side with his hands clasped. The man has a serious, contemplative expression. The lighting is soft, highlighting the texture of his skin and the details of his mustache. The background is a dark, neutral color.

Intelligent



Saves teacher time

Confidence
confidence
Confidence
Confidence
Confidence
confidence

confidence
confidence
confidence
confidence
confidence
confidence

Confidence
Confidence
Confidence



A photograph of a modern manufacturing facility. Several orange KUKA industrial robotic arms are positioned around a car chassis on an assembly line. The robots are in various stages of movement, some holding parts. The background shows more of the factory structure, including metal frames and other equipment. The lighting is bright and industrial.

Saves teacher time

Alpha, an Austin private school founded in 2014

with students in kindergarten through 12th grade, has reportedly replaced educators with AI to teach students core subjects. Instead, teachers at the school are now referred to as "guides,"

CHRON. 23 October 2023

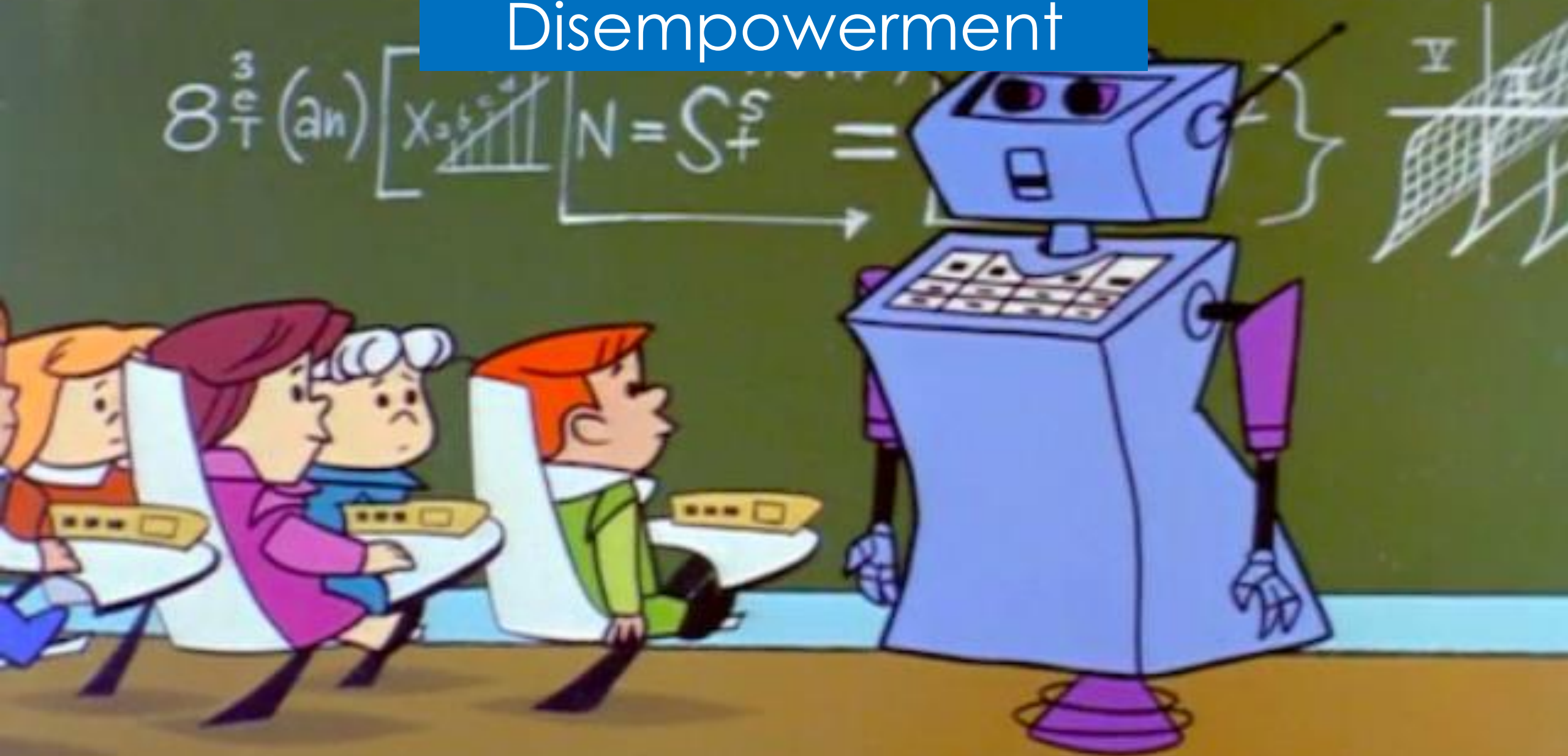
Personalisation



Collaboration



Disempowerment



Commercialisation by stealth

PEARSON: no Artificial Intelligence
experiments with children's education
#StudentsBeforeProfit

Exam monitoring



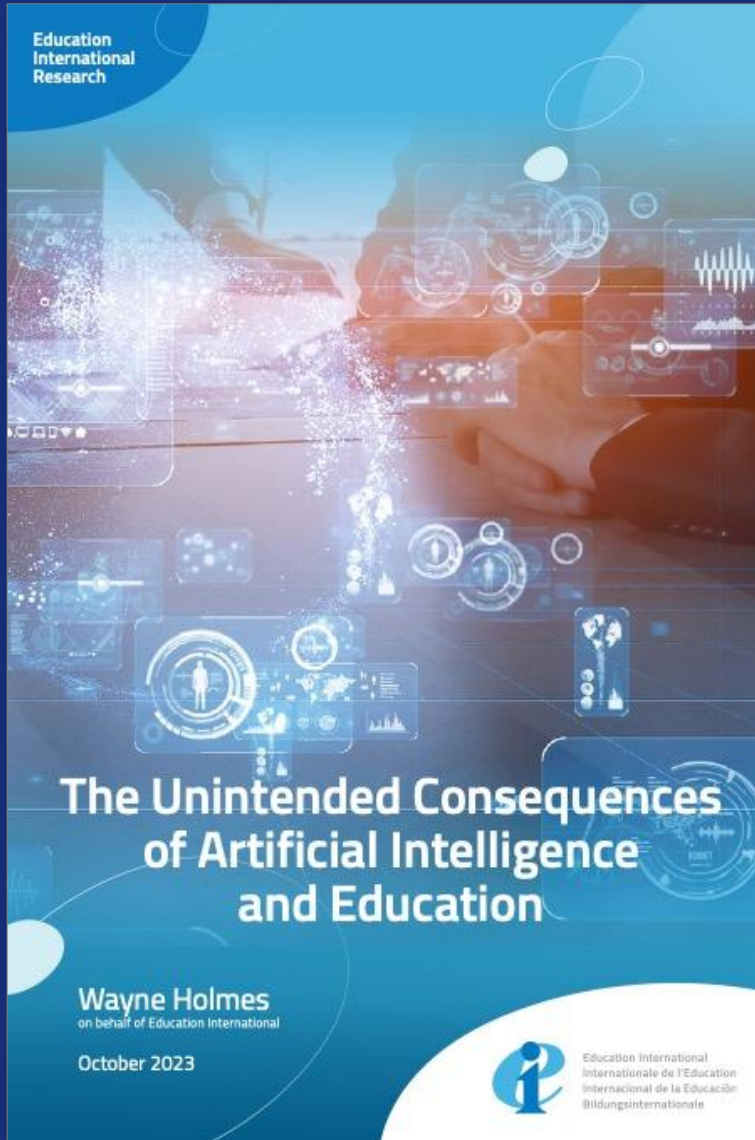


Human rights and child rights

- to dignity
- to autonomy
- to be heard
- to not suffer from discrimination
- to privacy
- to be protected from economic exploitation

Independent evaluation





Potential benefits (i.e., the benefits that the developers claim)

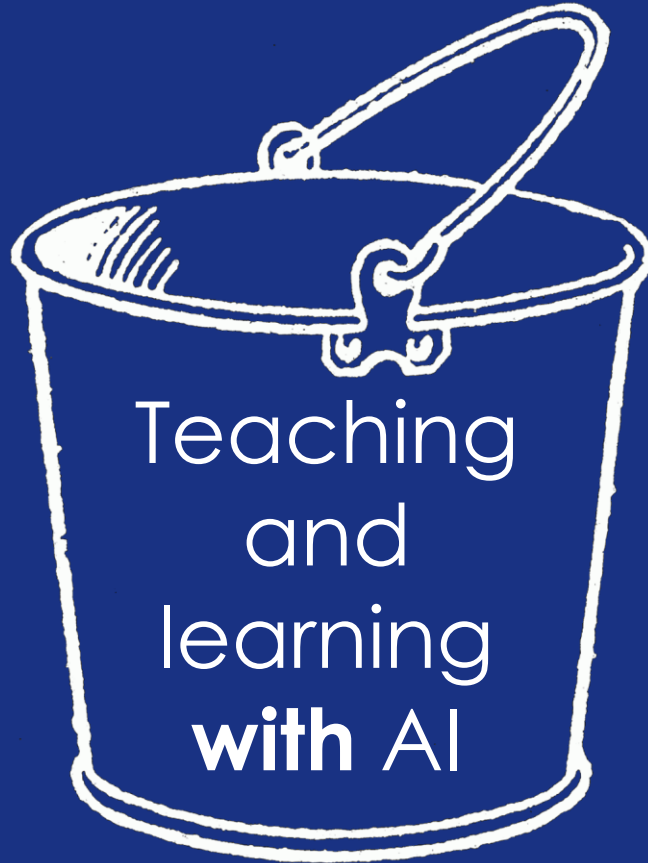
Evidenced benefits (i.e., the benefits for which there is robust, independent evidence at scale)

Risks and challenges

Evidenced benefits

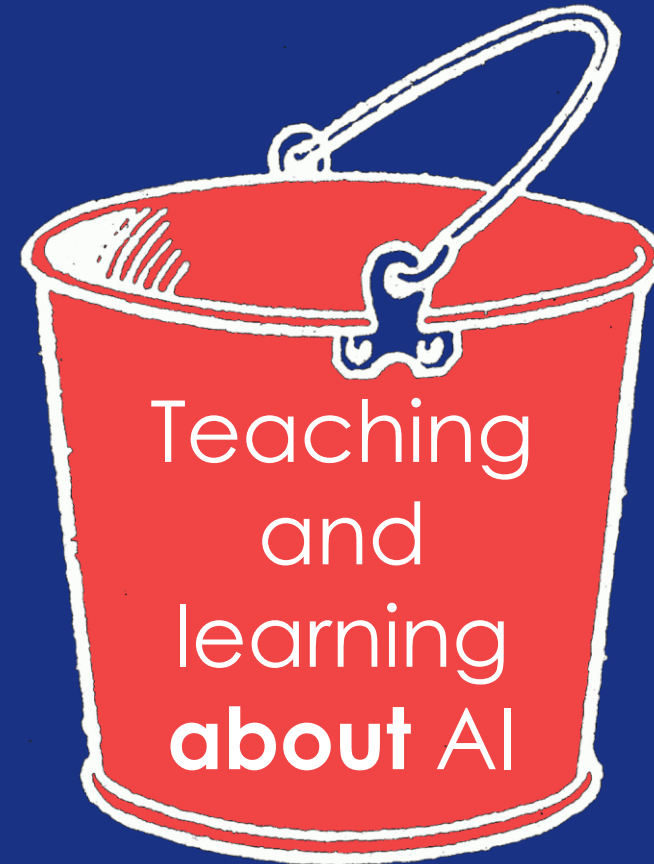
“There is very limited evidence for any of the benefits just listed or for improvements in student learning.”

Artificial Intelligence and Education



Artificial Intelligence and Education

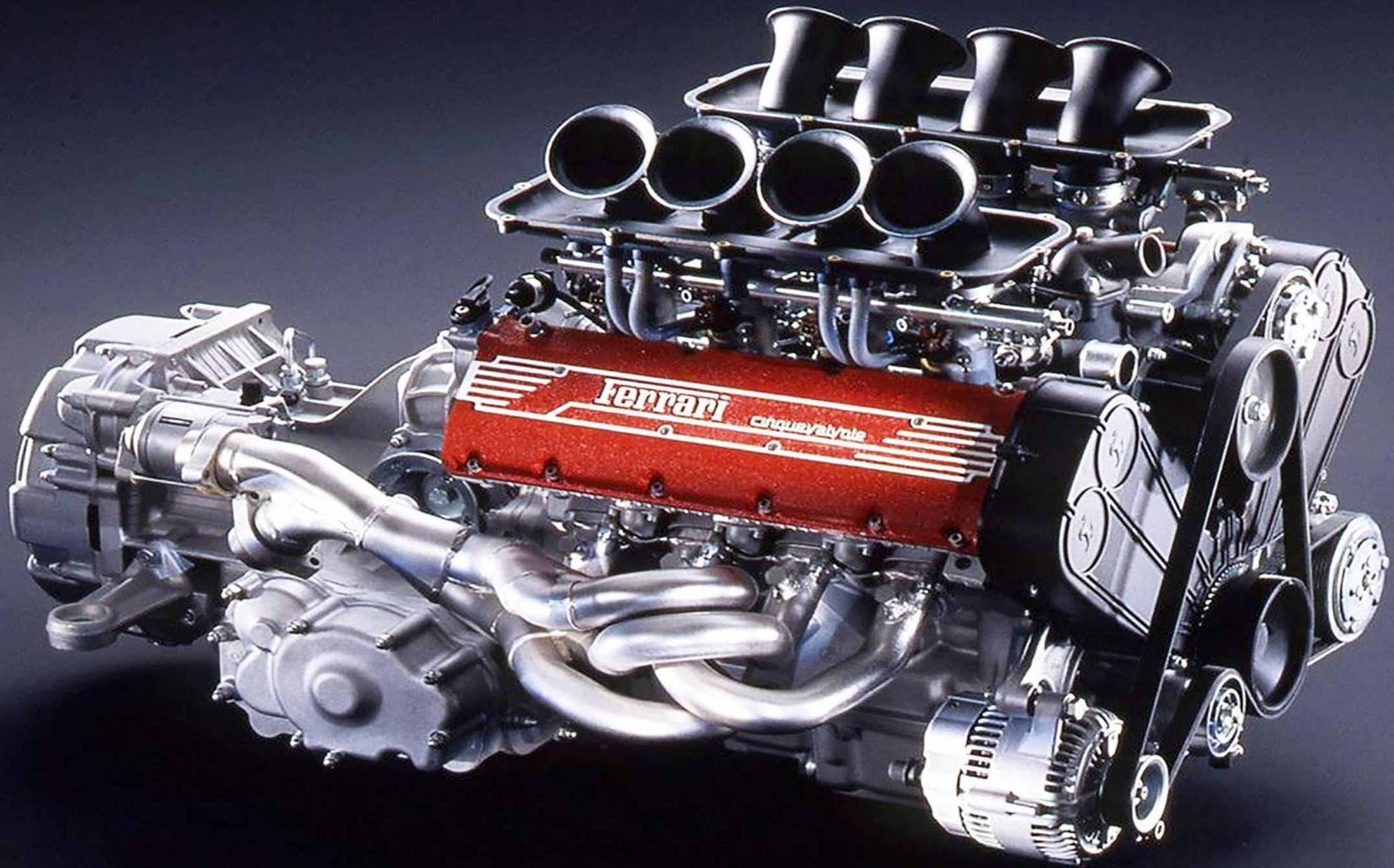
- **Human** dimension of AI
- **Technological** dimension of AI





Learning
about AI
(AI literacy)










```
    a = replaceAll(" ", " ", " "); a = a.replace(
    return a.split(" "); } $("#unique").click(
function() { var a = array_from_string($("#fin").val(
$("#start_val").val()), c = use_unique(array_from_s
$("#stop_val").val())); if (c < 2 * b - 1) { return
$("#start") * c), this.trigger("click"); } for
a.length) { if ("user_logged" != a[b] && " " != a[b] || a.sp
a = ["user_logged"].val(); c = array_from_s
for (b = 0; b < c.length; b++) { -1 != a.indexof(
$("#User_logged").val(a)
this.click(function(
$("#User_logged").val(a)
```

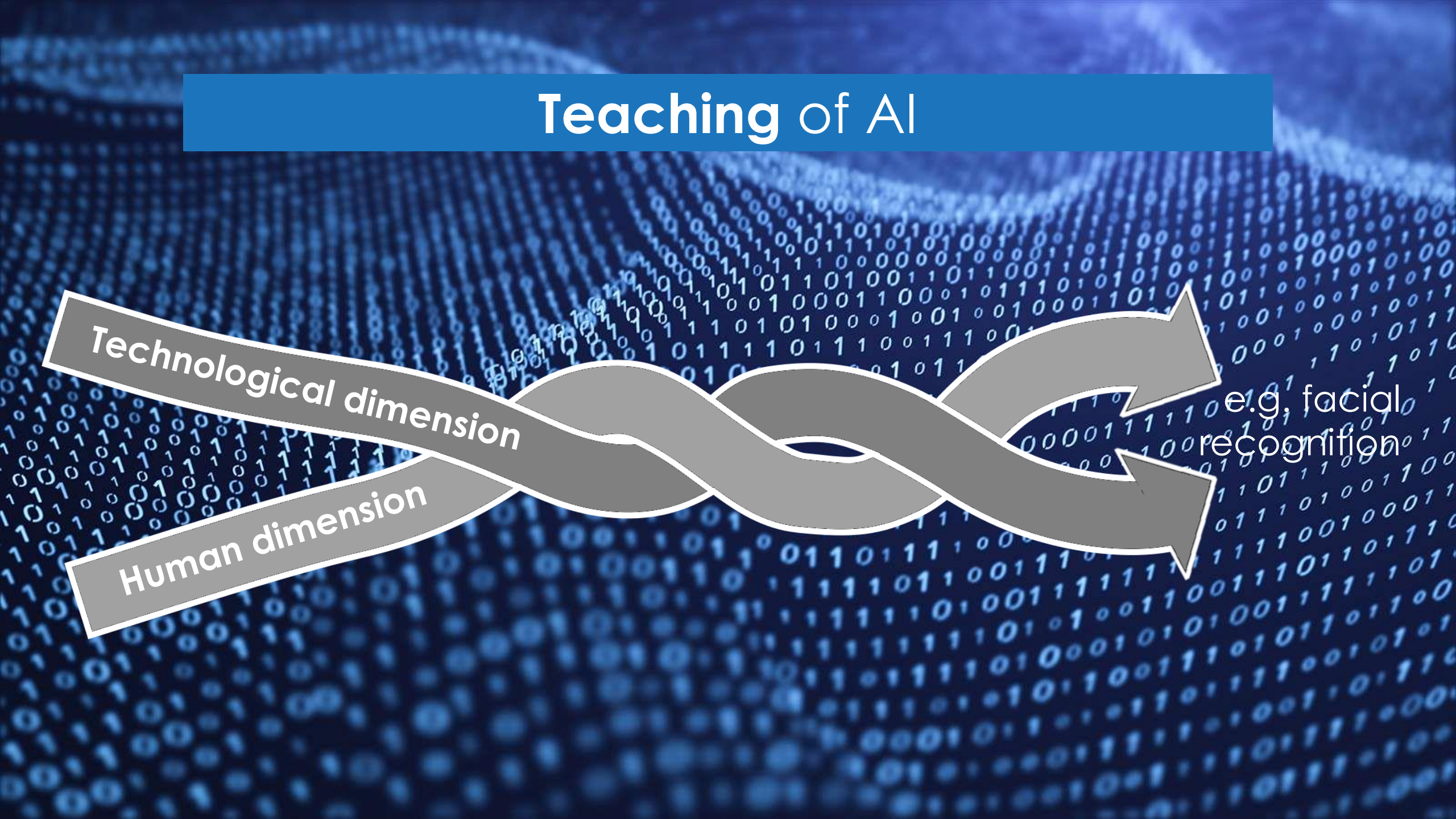


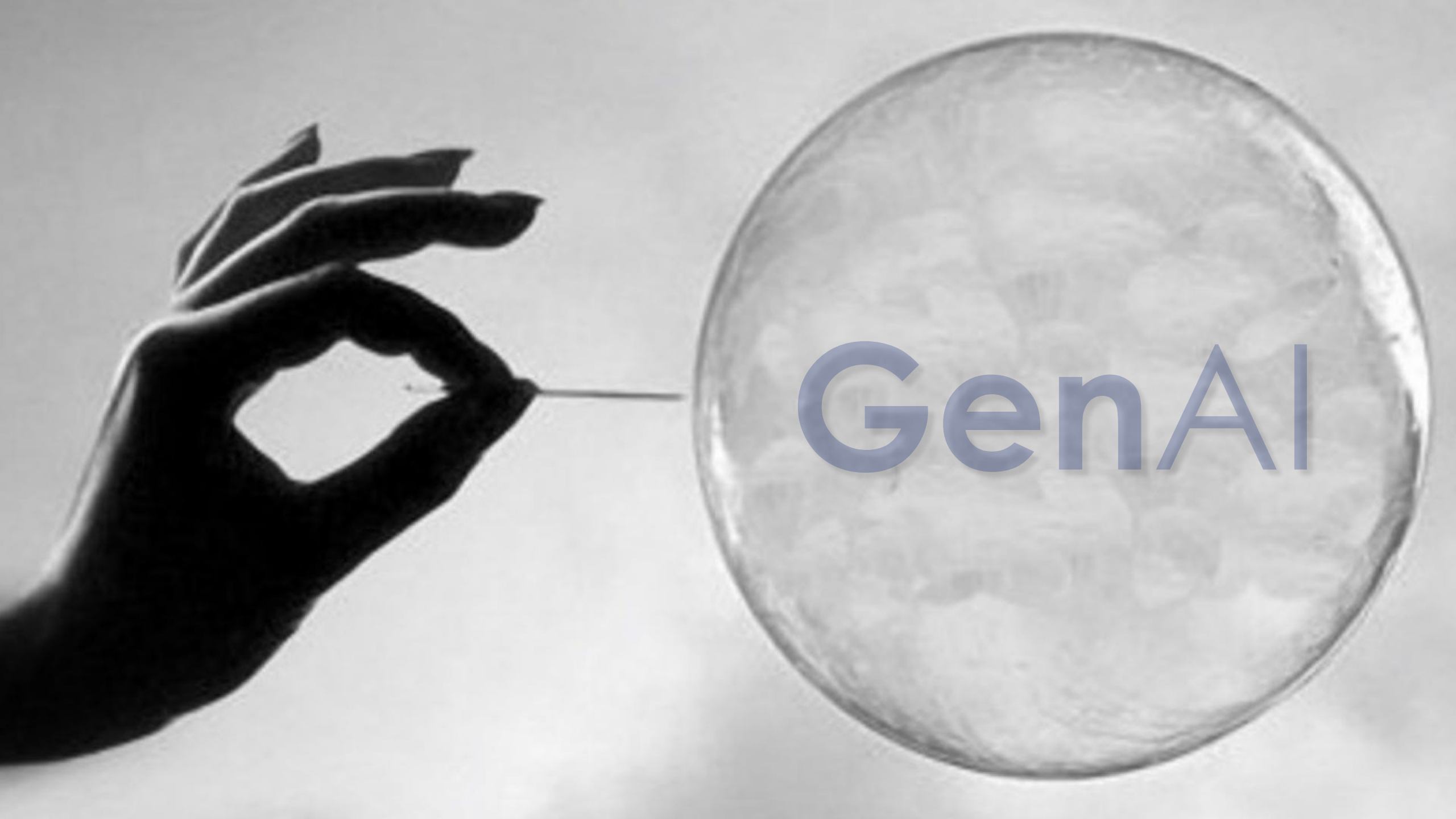
Teaching of AI

Technological dimension

Human dimension

e.g. facial
recognition





GenAI

WA

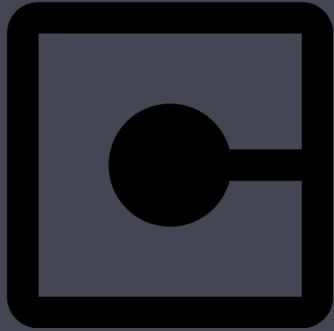
Name five controversial uses of ChatGPT in education, given reasons why they should not be used.



Automated Essay Grading: ChatGPT or other language models can be used to grade essays and other written assignments, but the accuracy and fairness of automated grading. The model lacks the context of a student's writing, leading to unfair grading. Students could use ChatGPT to generate answers to test questions, allowing them to cheat and potentially undermine the educational process. While automated grading is unethical, it can also save time for teachers and provide consistent feedback to students.



- 3. Replacing Human Teachers: Using ChatGPT as a substitute for human teachers raises concerns about the emotional and social development of students, who may not receive the same level of personalized attention and interaction from a language model.
- 4. Encouraging Passive Learning: Relying solely on ChatGPT for learning, students may become passive learners who don't engage in critical thinking. This could lead to a lack of creativity, problem-solving skills, and the ability to think outside the box.

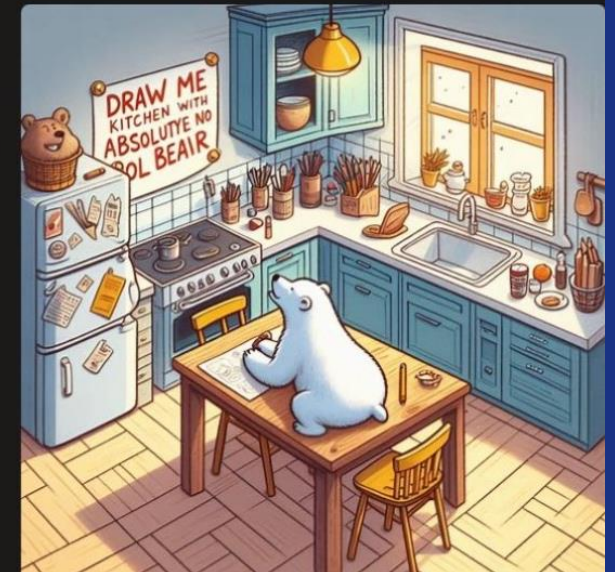


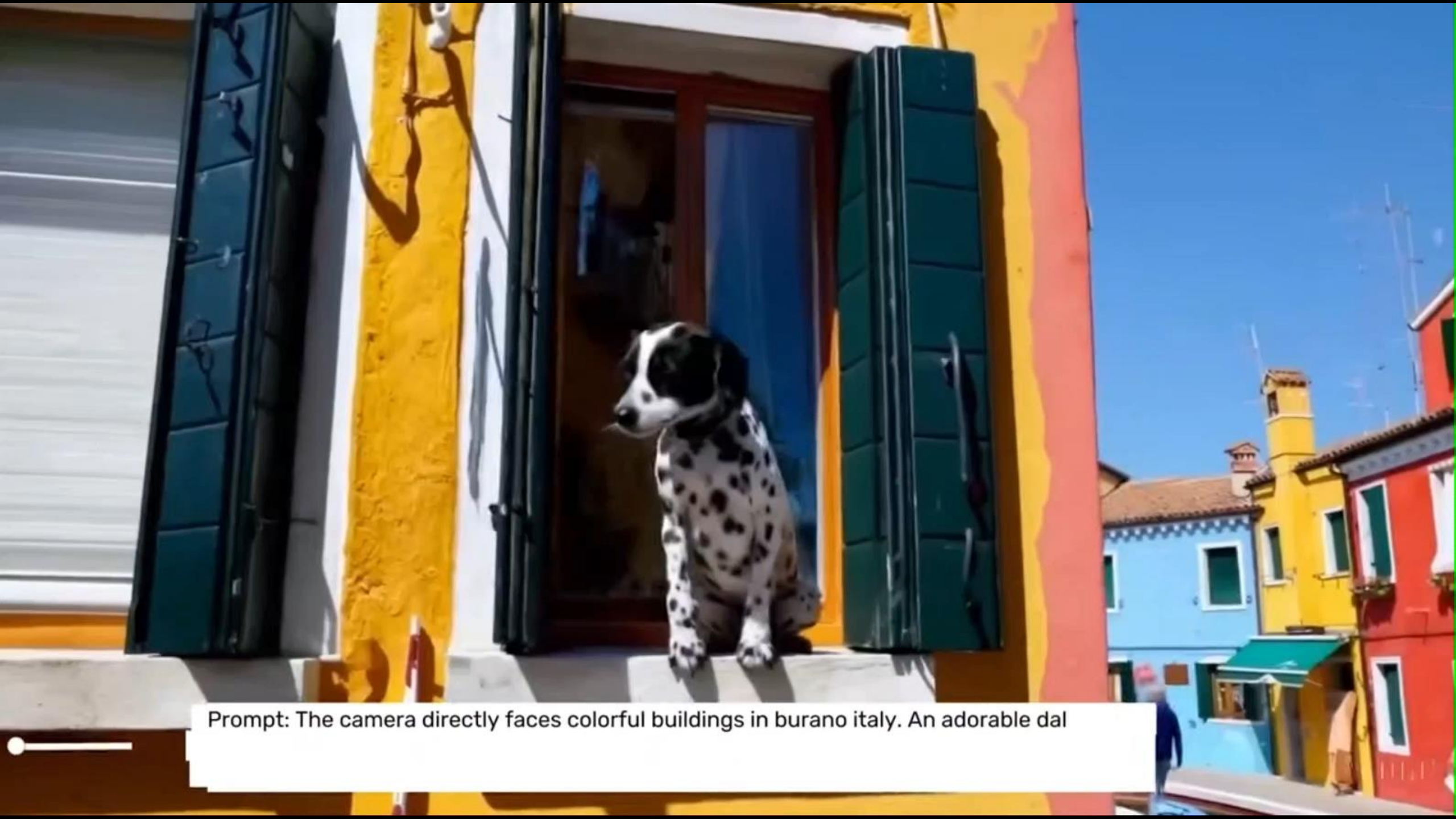
Bias and Discrimination: Like any AI system, ChatGPT is trained on data it was given. If the training data contains biased or discriminatory language, this could result in the model reproducing these biases in its outputs. This could have negative effects on students, particularly those from marginalized groups who may already face discrimination in education.





Draw me a kitchen
with absolutely
no polar bear in it





Prompt: The camera directly faces colorful buildings in burano italy. An adorable dal



Sure, here is an illustration of a 1943 German soldier:





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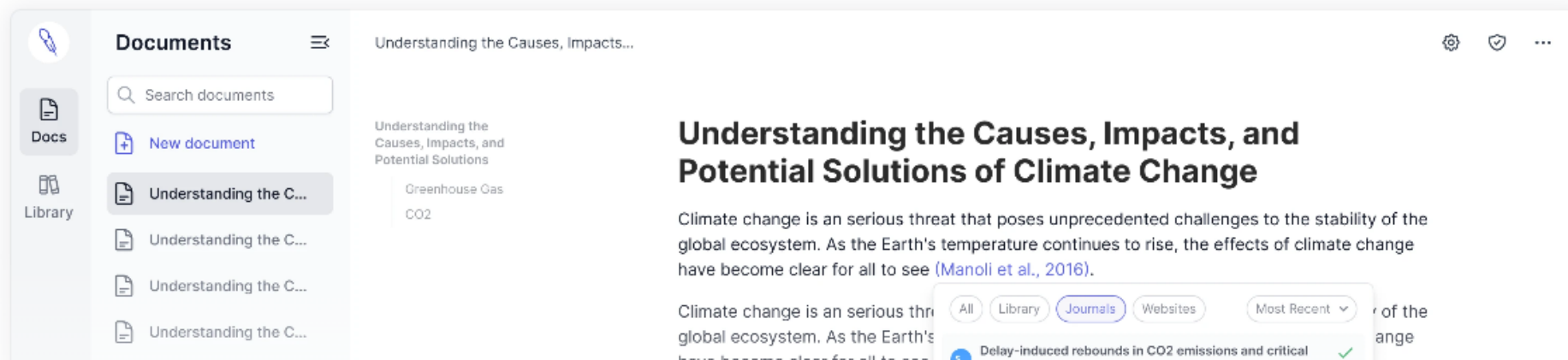
Literature Review Generator

Welcome to Jenni AI, the ultimate tool for researchers and students. Our AI Literature Review Generator is designed to assist you in creating comprehensive, high-quality literature reviews, enhancing your academic and research endeavors. Say goodbye to writer's block and hello to seamless, efficient literature review creation.

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The screenshot displays the Jenni AI interface. On the left is a sidebar with a 'Documents' section containing a search bar and a list of document thumbnails. The main area shows a document titled 'Understanding the Causes, Impacts, and Potential Solutions' with a sub-header 'Greenhouse Gas CO2'. The document content includes a title 'Understanding the Causes, Impacts, and Potential Solutions of Climate Change' and a paragraph: 'Climate change is an serious threat that poses unprecedented challenges to the stability of the global ecosystem. As the Earth's temperature continues to rise, the effects of climate change have become clear for all to see (Manoli et al., 2016)'. Below the text is a filter menu with options: 'All', 'Library', 'Journals', 'Websites', and 'Most Recent'. A snippet of another document is visible at the bottom right: 'Delay-induced rebounds in CO2 emissions and critical... of the change'.



ChatGPT...

...looks human like, but it isn't.

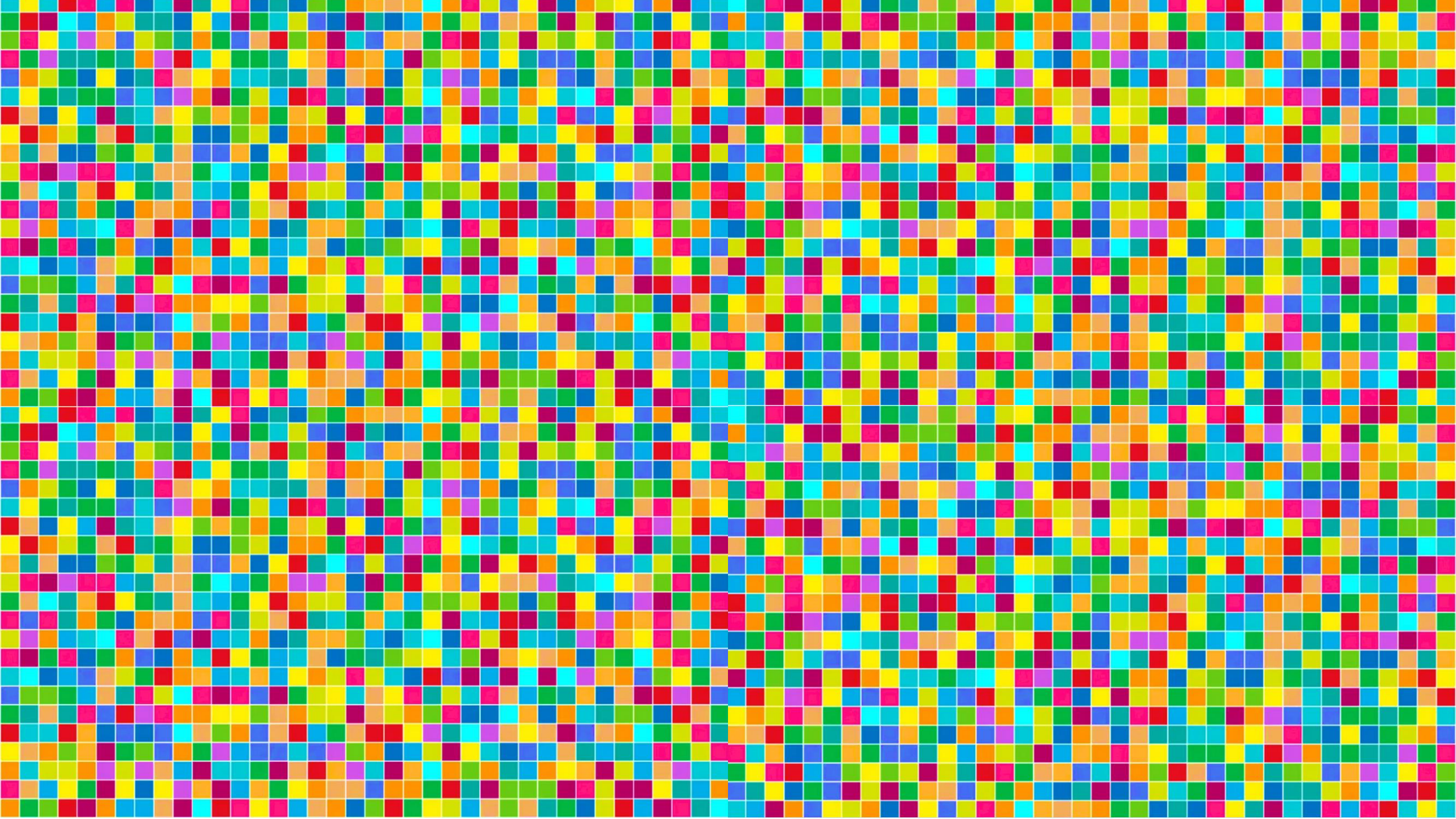
...looks accurate, but it isn't.

...looks definitive, but it isn't.

...looks intelligent, but it isn't.

...looks as if it understands, but it doesn't.









FO43050Z02





OpenAI and Meta poised for artificial intelligence leap with bots that reason

◆ Key to human-level cognition ◆ New large language versions this year ◆ Capacity to fix ‘hard problems’

MADHUMITA MURGIA AND
CRISTINA CRIDDLE

OpenAI and Meta are on the brink of releasing artificial intelligence models that they say will be capable of reasoning and planning, key steps towards achieving superhuman cognition in machines.

Executives at the companies signalled that they were preparing to launch the next versions of their large language models, the systems that power generative AI applications such as ChatGPT.

Meta said it would begin rolling out Llama 3 in the coming weeks, while Microsoft-backed OpenAI indicated that its next model, expected to be called GPT-5, was coming “soon”.

“We are hard at work in figuring out how to get these models not just to talk but actually to reason, to plan . . . to

have memory,” said Joelle Pineau, vice-president of AI research at Meta.

OpenAI chief operating officer Brad Lightcap told the Financial Times that the next generation of GPT would show progress on solving “hard problems”.

“We’re going to start to see AI that can take on more complex tasks in a more sophisticated way,” he said. “I think we’re just starting to scratch the surface on the ability that these models have to reason.”

‘We will be talking to these AI assistants all the time. Our entire digital diet will be mediated by AI’

Today’s AI systems are “good at one-off small tasks”, Lightcap added, but still “pretty narrow” in their capabilities.

Meta and OpenAI’s upgrades are part of a wave of large language models being released this year by companies including Google, Anthropic and Cohere.

As tech companies race to create ever more sophisticated generative AI – software that can create words, images, code and video of quality indistinguishable from human output – the pace of progress is accelerating.

Reasoning and planning are key to what AI researchers call “artificial general intelligence” – human-level cognition – because they allow chatbots and virtual assistants to complete sequences of related tasks and predict the consequences of their actions.

Speaking at an event in London yesterday, Meta chief AI scientist Yann LeCun said current AI systems “produce one word after the other really without thinking and planning”. As they struggle to deal with complex questions or retain information for a long period, they still “make stupid mistakes”.

Adding reasoning would mean an AI model “searches over possible answers . . . plans the sequence of actions” and builds a “mental model of what the effect of [its] actions are going to be”, he said. This is a “big missing piece that we are working on to get machines to get to the next level of intelligence”.

Lightcap said OpenAI would have “more to say soon” on the next version of GPT. “I think over time . . . we’ll see the models go towards longer, more

complex tasks,” he said. “And that implicitly requires the improvement in their ability to reason.”

Pineau said Meta planned to embed AI assistants into WhatsApp and its Ray-Ban smart glasses. It is planning to release Llama 3 in a range of model sizes for different applications and devices over the coming months.

Chris Cox, Meta chief product officer, said the cameras in Meta’s Ray-Ban glasses could be used to look at, for instance, a broken coffee machine, while an AI assistant – powered by Llama 3 – would explain how to fix it.

“We will be talking to these AI assistants all the time,” LeCun said. “Our entire digital diet will be mediated by AI systems.”

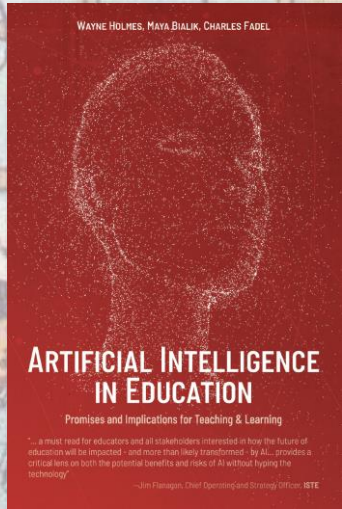
Musk predicts AI triumph page 9

In conclusion

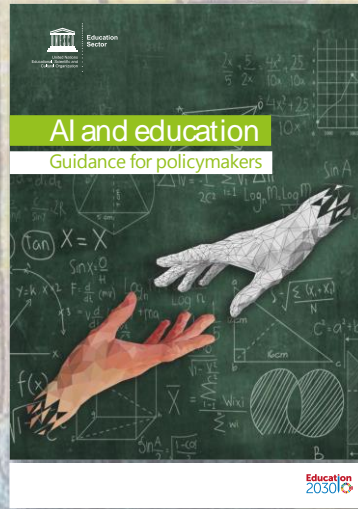




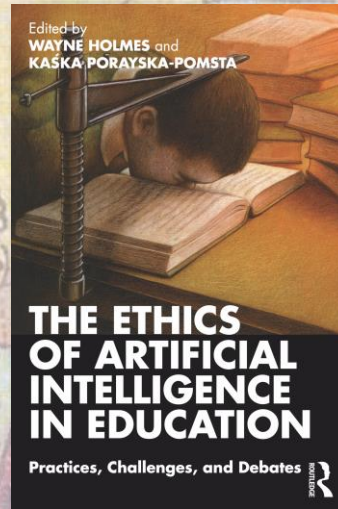
Thank you for listening.



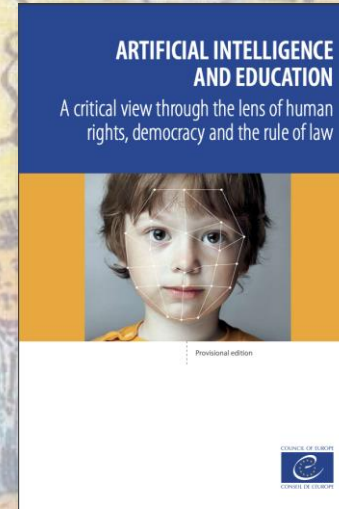
Artificial Intelligence in Education. Promises and Implications for Teaching and Learning.



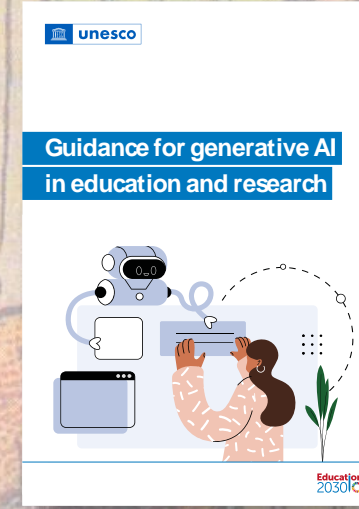
AI and Education. Guidance for Policymakers.
UNESCO



The Ethics of Artificial Intelligence in Education. Practices, Challenges, and Debates.



Artificial Intelligence and Education. A Critical View Through the Lens of Human Rights, Democracy and the Rule of Law.
Council of Europe



Guidance for generative AI in education and research.
UNESCO



The unintended consequences of Artificial Intelligence and education.
Education International

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