OPPORTUNITY 47

SCOPE (WITHIN REACH)

UNCERTAINTIES

Technology, Values

MEGATRENDS

Future Humanity

TRENDS

Artificial Intelligence
Ideation, IP & Entrepreneurship
International Collaboration
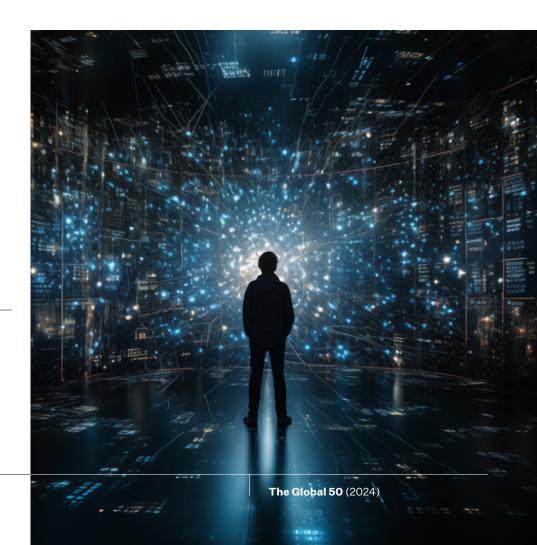Open Data
Transforming Education

SECTORS IMPACTED

Agriculture & Food
Automotive, Aerospace & Aviation
Chemicals & Petrochemicals
Communication Technologies & Systems
Consumer Goods, Services & Retail
Cyber & Information Security
Data Science, AI & Machine Learning
Digital Goods & Services
Education
Energy, Oil, Gas & Renewables
Financial Services & Investment
Government Services
Health & Healthcare
Immersive Technologies
Infrastructure & Construction
Insurance & Reinsurance
Logistics, Shipping & Freight
Manufacturing
Materials & Biotechnology
Art, Media & Entertainment
Metals & Mining
Professional Services
Real Estate
Sports
Travel & Tourism
Utilities

What if multimodal large language models (LLMs) allow disruptive science once again?

OPEN-SOURCE SCIENCE

A global scientific task force trains LLMs on scientific theories and data prioritising concerns related to bias, privacy, and reliability to accelerate research, enhance science communication, and inform policy.

LLMs – open or proprietary – are costly. It has been estimated that running ChatGPT costs OpenAI nearly

$700,000

per day

WHY IT MATTERS TODAY

Science is critical to society, informing decisions that impact on society, such as those related to climate change and biotechnology.[958] It is critical for effective policymaking and leadership,[959] particularly in terms of solutions to improve the quality of life.[960] Even though it is widely understood that accumulated knowledge enables future scientific and technological progress, and despite exponential growth in the number of papers and patents in recent decades, science and technology have become less disruptive, i.e. they push less often in new directions.[961]

Generative artificial intelligence (GenAI) and foundational LLMs are speeding up application development and empowering non-technical users. Even though they are expected to contribute $4.4 trillion in economic value, the full potential of AI can be more profoundly realised by combining GenAI with emerging AI technology to process unstructured data and enhance existing solutions.[962]

LLMs – open or proprietary[963] – are costly. While it has not been publicly disclosed by OpenAI, it has been estimated that running ChatGPT costs nearly $700,000 per day.[964] Customised models can be purpose-built or fine-tuned versions of public models, such as BloombergGPT and smaller LLMs by NVIDIA, or they can combine public, private, and open-source LLMs to leverage their benefits while maintaining control over AI initiatives and avoiding vendor lock-in.[965] In 2023, the UAE launched Falcon 180B, an open-source LLM free of royalties with 180 billion parameters,[966] close to OpenAI's GPT-4, which is thought to have around 220 billion parameters.[967]

AI can offer real-time support to scientists, innovators,[968] and publishers. Frontiers' Artificial Intelligence (peer) Review Assistant (AIRA) reads papers, makes quick recommendations (up to 20 recommendations in seconds) on language, integrity, plagiarism, and conflicts of interest.[969] LLMs can specifically enhance research visibility, transparency, and reputation and connect scientists with diverse audiences,[970] particularly on scientific topics that concern, or can impact on, societies.

OPPORTUNITY

A global task force of research and higher education institutions train multimodal LLMs on scientific theories and open data, prioritising concerns related to bias, accuracy,[971] privacy, reliability, and intellectual property. From abstracts and expert evaluation, LLMs accelerate research, enhance science communication and education, and foster interdisciplinary insights focused on a specific socio-scientific angle, feeding into policy decision-making. Continuous data collection through authorised access enables learning from successes and failures, uncovering new scientific principles and applications, while ensuring that quality is maintained. This opens the doors for ideation and entrepreneurship in fields that otherwise seem inaccessible or not possible to others.

Connecting LLMs with other forms of GenAI can involve producing multimodal outputs, including audio and images, enhancing understanding and providing greater opportunities for creativity and ideation.

BENEFITS

Accessible science accelerates the scientific process and makes it open-source – throughout society, people are constantly ideating, testing, and revising innovations.

RISKS

Over-reliance on accessible science causes scientific educational systems and thinking skills to degrade, like a muscle atrophying, resulting in fewer foundational scientific discoveries. With scientific theories operating as axioms that guide people's daily lives, inaccurate scientific theories could steer people towards harm. Operating the LLMs may be costly.

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