Artificial intelligence is restructuring a new world

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Recently, the 2024 Nobel Prizes in Physics and Chemistry were awarded to artificial intelligence (AI) scientists for their groundbreaking contributions. John J. Hopfield and Geoffrey E. Hinton received the Physics Prize for their foundational discoveries and inventions that enabled machine learning through artificial neural networks. David Baker was awarded the Chemistry Prize for his work in computational protein design, while Demis Hassabis and John M. Jumper were recognized for their work in protein structure prediction. AI has profoundly impacted the research paradigms in fundamental disciplines, significantly enhancing the efficiency of scientific research.[1] In fact, in recent years, large AI models, exemplified by ChatGPT, have been profoundly changing the generation, organization, and dissemination of knowledge and gradually exhibiting characteristics of artificial general intelligence (AGI). Moreover, a large number of AI-powered industrial manufacturing, agricultural pro-duction, medical and healthcare, and transportation systems are also rapidly developing, all moving toward the intelligent direction of unmanned, autonomous, and collaborative operations. This progress is also giving rise to new materials, tools, and capabilities that surpass human imagination. AI has triggered a new technological revolution and is even influencing the global political, economic, and military development landscape. The old world is being transformed, and a new one is emerging (Figure 1).

AI IS BECOMING THE PINNACLE OF HUMAN WISDOM

In 1922, Ludwig Wittgenstein famously said, "The limits of my language mean the limits of my world." For thousands of years, human knowledge, technology, and culture have been recorded and passed down in written form. With the development of information technology over the past few decades, data from multiple
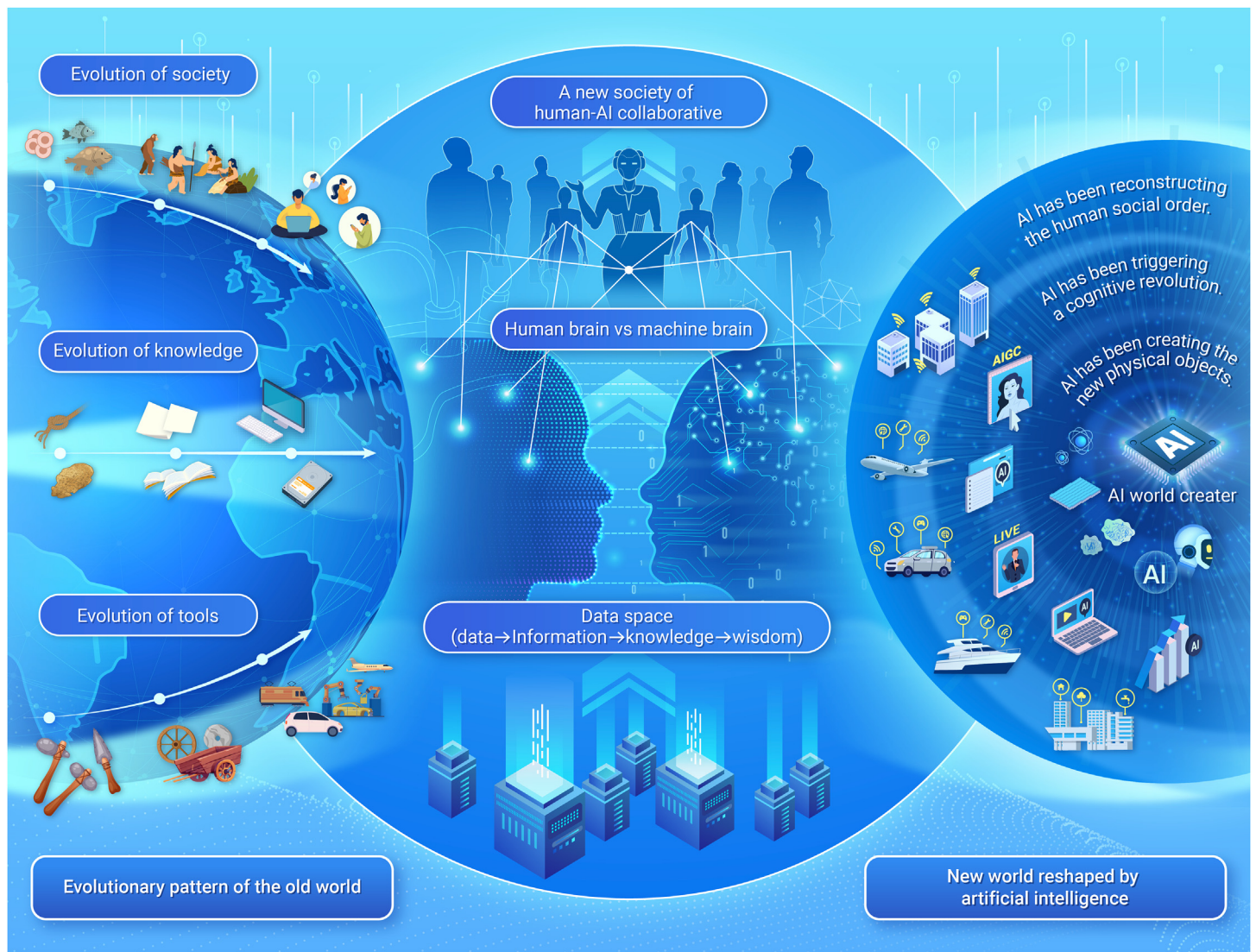

Figure 1. AI is restructuring a new world

sources and modalities (audios, images, videos, and spatiotemporal data) have also become means of transmission, leading to an explosive growth in the scale of data and knowledge. These data and knowledge form the corpus for large AI models, helping humans continuously acquire new wisdom.[2] Large AI models are absorbing all of humanity's learning, associations and reasoning capabilities since the beginning of time and are continuously evolving, particularly in terms of aligning multidisciplinary heterogeneous data, generating cross-modal knowledge, generating scientific hypotheses, and searching complex problem spaces. Their abilities far exceed those of individual humans, even the most distinguished scientists. Large AI models are becoming the omniscient sages.

The continuous refinement of disciplines and the constant expansion of domain knowledge have made interdisciplinary learning and integration increasingly difficult. However, the integration of multiple disciplines remains an important source of innovation, as exemplified by this year's Nobel Prize winners in Physics and Chemistry. In fact, polymaths like Aristotle, Newton, and Einstein were epitomes of multidisciplinary integration, a rarity in modern society. Today, we increasingly rely on AI and big data analysis tools to assist us. Large AI models are not only powerful aids for scientists but also help them break through cognitive limitations. With their strong capabilities in model generation, reasoning, self-evolution, and interactive learning, they greatly accelerate scientific discoveries.[2] These models even have the potential to surpass AGI, enabling AI-based object creation, cognitive breakthroughs, and world reshaping, paving the way for a brand-new silicon-based world.

AI HAS BEEN ACCELERATING NEW DISCOVERIES OF NATURAL SCIENCES

The concept of silicon-based life was discussed by astrophysicist Julius Sheiner at the University of Potsdam as early as 1891. In recent years, AI has been used not only to observe and understand the world[3] but also in conjunction with the first principles of physics, chemistry, and life (brain) sciences to create various new entities. The protein folding milestone[4] has brought about a revolutionary shift in the research paradigm of life sciences. The starch synthesis from carbon dioxide, gene editing, synthetic cells, and synthetic life are all becoming hot topics, providing important foundations for the potential transition from carbon-based to silicon-based life.

Professor James Collins's team at the Massachusetts Institute of Technology has used AI and interpretable deep learning models to identify a revolutionary new type of antibiotic from over 12 million compounds, capable of killing the clinically common superbug methicillin-resistant *Staphylococcus aureus*. Researchers Amil Merchant and Ekin Dogus Cubuk at DeepMind have explored "graph networks for materials exploration," predicting the structures of 2.2 million new materials, more than 700 of which have been synthesized in the lab. Yan Zeng and Gerbrand Ceder from A-Lab have extracted data from material databases and used machine learning and experimental robots to design and synthesize new materials without human assistance. AI has become a powerful tool and a new master in the creation of objects.

AI HAS BEEN TRIGGERING A COGNITIVE REVOLUTION IN HUMANITY

In 2024, OpenAI launched ChatGPT o1, which far surpasses the capabilities of ChatGPT-4o and human experts in solving complex problems. This version has made significant progress in tackling challenges in science, programming, and mathematics.[5] Otherwise, large AI models have significantly amplified the depth, speed, and breadth of our comprehension of knowledge and entities in the real world. For instance, in education, large language models have been leveraged to provide personalized learning experiences, enhancing the speed at which students can access tailored educational content. Generative AI technology, driven by high computational power and large models, is developing rapidly, producing literary works, images, virtual humans, and even scientific papers. AI-generated content technology is quickly permeating traditional media, online platforms, social networks, and streaming websites, making it increasingly difficult to distinguish between what is real and what is machine generated. This flood of information creates a solid "information cocoon" around us, influencing and altering our perception of the world. The world we understand is increasingly shaped by what the algorithms want us to see.

Platforms like Meta, X, and Instagram profoundly influence our understanding of the world. During political elections, they amplify ideological segregation by exposing users to political news aligned with their views. In daily life, they shape people's social interactions and lifestyles through algorithms and the design of information flows. These social media platforms allow young people to accumulate social capital, reinforcing their social roles and expectations. The worldviews and values embedded in large AI models also influence people's judgments. People are constantly affected by the information pushed to them, and their thoughts begin to be shaped by machines and algorithms. Additionally, AI-created virtual humans make it increasingly difficult to distinguish between reality and fiction. The deep integration of internet bots that pass the Turing test with humanoid robots can achieve a perfect blend of form and spirit, making them virtually indistinguishable from real humans.

AI HAS BEEN RESHAPING THE REAL WORLD OF HUMAN LIFE

AI is also creating entirely new tools and equipment for people. Tesla has just released a Robotaxi without a steering wheel or brake system, signifying that people are entrusting their lives to intelligent algorithms. In the rapidly growing low-altitude economy of Shenzhen, drones and autonomous vehicles freely navigate the city, greatly enhancing daily life. Driverless agricultural vehicles are fully replacing human labor, significantly boosting production efficiency. Intel has deployed thousands of AI models in semiconductor manufacturing, from online defect detection to advanced process control. Tesla's Full Self-Driving system and Boston Dynamics' evolving robots are showing increasing levels of autonomous intelligence.

Social systems are also moving in a more intelligent direction. Transportation systems, urban governance, epidemic prevention and control, emergency command, and ecological monitoring systems are becoming increasingly intelligent. Various social systems, controlled by intelligent algorithms, allow us to live in new types of communities, breaking down barriers of geography, nationality, ethnicity, and industry. These systems are reconfiguring the organizational forms of productivity and production relations, constructing an entirely new intelligent society.

AI IS FACING NEW SECURITY RISKS

AI is driving significant social changes, but it also introduces a range of new risks related to ethics, privacy, security, and values, which could potentially lead to a loss of societal control. First, AI will have a tremendous impact on traditional economic and social structures, potentially leading to unemployment and anxiety, as well as creating unfairness toward children, the elderly, and those with lower education levels, possibly resulting in algorithmic discrimination and bias. Second, AI models utilize personal data to build task profiles, which can lead to data leaks, data misuse, and identity exposure, resulting in numerous privacy concerns. Third, large models could be used to disseminate specific political agendas, value systems, racial ideologies, and beliefs, potentially becoming tools for extremists. Last, numerous intelligent algorithms, systems, and unmanned platforms are vulnerable to threats such as cyberattacks, data poisoning, and model theft or extraction. This could further endanger personal safety and social stability, lead to system failures, and even pose risks to national security.

The development of AI should ultimately serve humanity. To address these risks, a series of measures must be taken, including strengthening global cooperation in AI governance, establishing legal and regulatory frameworks for the industry, improving the transparency and interpretability of AI technologies, enhancing data privacy protection, and raising public awareness and understanding of AI ethics.

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DECLARATION OF INTERESTS

The authors declare no competing interests.