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Backgrounder

What Is Artificial Intelligence (AI)?

Artificial intelligence breakthroughs promise unprecedented opportunity but also economic, political, and social disruption. Experts say AI needs oversight to ensure the changes it engenders are for the better.

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UPDATED
December 27, 2023 3:25 pm (EST)

Summary

Artificial intelligence (AI) made a generational leap forward in 2022 with the release of the generative AI chatbot ChatGPT, created by the company OpenAI.

Private companies control the majority of AI development in the United States. Experts say the technology will require new rules to maximize its potential and avoid grave risks.

AI's growing international adoption could reshape the global balance of power, with potentially dramatic geopolitical consequences.

Introduction

Artificial intelligence (AI) has been around for decades, but new advancements have brought the technology to the fore. Experts say its rise could mirror previous technological revolution adding billions of dollars worth of productivity to the global economy while introducing a sl of new risks that could upend the global geopolitical order and the nature of society itself.

Managing these risks will be essential, and a global debate over AI governance is raging as major powers such as the United States, China, and European Union (EU) take increasingly divergent approaches toward regulating the technology. Meanwhile, AI's development and deployment continues to proceed at an exponential rate.

How is artificial intelligence defined?

While there is no single definition, "artificial intelligence" generally refers to the ability of computers to perform tasks traditionally associated with human capabilities. The term's orig trace back to the 1950s, when Stanford University computer scientist John McCarthy used th term "artificial intelligence" to describe "the science and engineering of making intelligent machines." For McCarthy, the standard for intelligence was the ability to solve problems in a constantly changing environment.

Since 2022, the public availability of so-called generative AI tools, such as the chatbot ChatG has raised the technology's profile. Generative AI models draw from massive amounts of training data to generate statistically probable outcomes in response to specific prompts. Toc powered by such models generate humanlike text, images, audio, and other content.

Another commonly referenced form of AI, known as artificial general intelligence (AGI), or "strong" AI, refers to systems that would learn and apply knowledge like humans do. Howeve these systems do not yet exist and experts disagree on what exactly they would entail.

How did AI develop?

Researchers have been studying AI for eighty years, with mathematicians Alan Turing and Jo von Neumann considered to be among the discipline's founding fathers. In the decades since they taught rudimentary computers binary code, software companies have used AI to power tools such as chess-playing computers and online language translators.

In the countries that invest the most in AI, development has historically relied on public funding. In China, AI research is predominantly funded by the government, while the United States for decades drew on research by the Defense Advanced Research Projects Agency (DARPA) and other federal agencies. In recent years, U.S. AI development has largely shifted the private sector, which has poured hundreds of billions of dollars into the effort.

Where Are Private Companies Investing the Most in AI?

Total private investment in AI from 2013 to 2022, constant 2021 dollars

United States	$248.9B
China	$95.1B
United Kingdom	$18.2B
Israel	$10.8B
Canada	$8.8B
India	$7.7B
Germany	$7B
France	$6.6B
South Korea	$5.6B
Singapore	$4.7B
Japan	$4B
Hong Kong	$3.1B
Switzerland	$3B
Australia	$3B
Spain	$1.8B

Source: NetBase Quid via Stanford University Artificial Intelligence Index Report.

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In 2022, U.S. President Joe Biden signed the CHIPS and Science Act, which refocuses U.S. government spending on technology research and development. The legislation directs $280 billion in federal spending toward semiconductors, the advanced hardware capable of supporting the massive processing and data-storage capabilities that AI requires. In January 2023, ChatGPT became the fastest-growing consumer application of all time.

The arrival of AI "marks a Big Bang moment, the beginning of a world-changing technologic revolution that will remake politics, economies, and societies," Eurasia Group President Ian Bremmer and Inflection AI CEO Mustafa Suleyman write for *Foreign Affairs*.

What effects could AI have on the global economy?

Companies and organizations across the world are already implementing AI tools into their offerings. Driverless-car manufacturers such as Tesla have been using AI for years, as have investment banks that rely on algorithmic models to conduct some trading operations, and technology companies that use algorithms to deliver targeted advertising. But after the arriv of ChatGPT, even businesses that are less technology-oriented began turning to generative A tools to automate systems such as those for customer service. One-third of firms around the world that were surveyed by consultancy McKinsey in April 2023 claimed to be using AI in sc capacity.

Widespread adoption of AI could speed up technological innovation across the board. Alread the semiconductor industry has boomed; Nvidia, the U.S.-based company that makes the majority of all AI chips, saw its stock more than triple in 2023—to a total valuation of more than $1 trillion—amid skyrocketing global demand for semiconductors.

Many experts foresee a massive boon to the global economy as the AI industry grows, with global gross domestic product (GDP) predicted to increase by an additional $7 trillion annua within the next decade. "Economies that refuse to adopt AI are going to be left behind," CFR expert Sebastian Mallaby said on an episode of the *Why It Matters* podcast. "Everything from strategies to contain climate change, to medical challenges, to making something like nuclea fusion work, almost any cognitive challenge you can think of is going to become more solubl thanks to artificial intelligence."

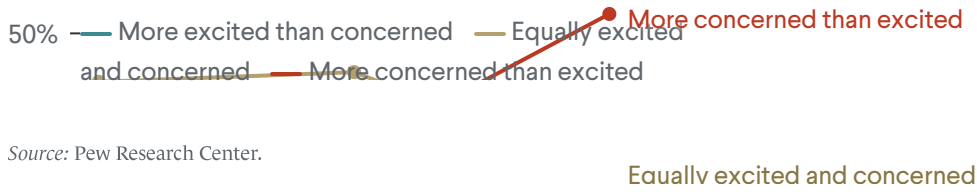
Will AI take people's jobs?

Like many other large-scale technological changes in history, AI could breed a trade-off betw increased productivity and job loss. But unlike previous breakthroughs, which predominantly eliminated lower-skill jobs, generative AI could put white-collar jobs at risk—and perhaps supplant jobs across many industries more quickly than ever before. One quarter of jobs arou the world are at a high risk of being replaced by AI automation, according to the Organizatic for Economic Cooperation and Development (OECD). These jobs tend to rely on tasks that generative AI could perform at a similar level of quality as a human worker, such as informa

gathering and data analysis, a Pew Research Center study found. Workers with “high-exposur to replacement by AI include accountants, web developers, marketing professionals, and technical writers.

Americans Have Grown More Concerned About AI

Percentage of U.S. adults who say increased use of AI in daily life makes them feel...



Source: Pew Research Center.

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The rise of generative AI has also raised concerns over inequality, as the most high-skilled jol appear to be the safest from disruptions related to the technology, according to OECD. But other analysis suggests that low-skilled workers could benefit by drawing on AI tools to boos productivity: a 2023 study by researchers at the Massachusetts Institute of Technology (MIT) and Stanford University found that less-experienced call center operators doubled the productivity gains of their more-experienced colleagues after both groups began using AI.

How will AI affect climate change?

AI’s relationship with the environment heralds both peril and promise. While some experts argue that generative AI could catalyze breakthroughs in the fight against climate change, others have raised alarms about the technology’s massive carbon footprint. Its enormous

processing power requires energy-intensive data centers; these systems already produce greenhouse gas emissions equivalent to those from the aviation industry, and AI's energy consumption is only expected to rise with future advancements.

AI advocates contend that developers can use renewable energy to mitigate some of these emissions. Tech firms including Apple, Google, and Meta run their data centers using self-produced renewable energy, and they also buy so-called carbon credits to offset emissions fr any energy use that relies on fossil fuels.

There are also hopes that AI can help reduce emissions in other industries by enhancing research on renewables and using advanced data analysis to optimize energy efficiency. In addition, AI can improve climate adaptation measures. Scientists in Mozambique, for examp are using the technology to better predict flooding patterns, bolstering early warning syste for impending disasters.

What does AI have to do with national security?

Many experts have framed AI development as a struggle for technological primacy between United States and China. The winner of that competition, they say, will gain both economic geopolitical advantage. So far, U.S. policymakers seem to have operated with this framework mind. In 2022, Biden banned exports of the most powerful semiconductors to China and encouraged U.S. allies to do the same, citing national security concerns. One year later, Bide proposed an outright ban on several streams of U.S. investment into China's AI sector, and t Department of Commerce announced a raft of new restrictions aimed at curbing Chinese "breakthroughs in artificial intelligence." Most experts believe the United States has outpace China in AI development to date, but that China will quickly close the gap.

AI could also have a more direct impact on U.S. national security: the Department of Defens expects the technology to transform "the very character of war" by empowering autonomou weapons and improving strategic analysis. (Some experts have pushed for a ban on autonom lethal weapons.) In Ukraine's war against Russia, Kyiv is deploying autonomously operated A powered drones, marking the first time a major conflict has involved such technology. Warri

parties could also soon rely on AI systems to accelerate battlefield decisions or to automatica attack enemy infrastructure. Some experts fear these capabilities could raise the possibility c nuclear weapons use.

Furthermore, AI could heighten the twin threats of disinformation and propaganda, issues th are gaining particular relevance as the world approaches a year in which more people are se vote than ever before: more than seventy countries, representing half the global population, hold national elections in 2024. Generative AI tools are making deep fakes easier to create, a the technology is already appearing in electoral campaigns across the globe. Experts also cite the possibility that bad actors could use AI to create sophisticated phishing attempts that are tailored to a target's interests to gain access to election systems. (Historically, phishing has be a way into these systems for would-be election hackers; Russia used the method to interfere the 2016 U.S. election, according to the Department of Justice.)

Together, these risks could lead to a "nihilism about the existence of objective truth" that threatens democracy, said Jessica Brandt, policy director for the Brookings Institution's Artifi Intelligence and Emerging Technology Initiative, on the podcast *The President's Inbox*.

Will artificial general intelligence exist?

Some experts say that it's not yet accurate to call AI "intelligent," as it doesn't involve human level reasoning. They argue that it doesn't create new knowledge, but instead aggregates exis information and presents it in a digestible way.

But that could change. OpenAI, the company behind ChatGPT, was founded as a nonprofit dedicated to ensuring that AGI benefits "humanity as a whole," and its cofounder, Sam Altma has argued that it is not "possible or desirable" to stop the development of AGI; in 2023, Goo DeepMind CEO Demis Hassabis said AGI could arrive within five years. Some experts, includ CFR Senior Fellow Sebastian Mallaby, contend that AI has already surpassed human-level intelligence on some tasks. In 2020, DeepMind used AI to solve protein folding, widely considered until then to be one of the most complex, unresolved biological mysteries.

Could AI lead to human extinction?

Many AI experts seem to think so. In May 2023, hundreds of AI leaders, including the CEOs c Anthropic, Google DeepMind, and OpenAI, signed a one-sentence letter that read, "Mitigatir the risk of extinction from AI should be a global priority alongside other societal-scale risks s as pandemics and nuclear war."

One popular theory for how extinction could happen posits that a directive to optimize a certain task could lead a super-intelligent AI to accomplish its goal by diverting resources aw from something humans need to live. For example, an AI tasked with reducing the amount o harmful algae in the oceans could suck oxygen out of the atmosphere, leading humans to asphyxiate. While many AI researchers see this theory as alarmist, others say the example accurately illustrates the risk that powerful AI systems could cause vast, unintentional harm the course of carrying out their directives.

Skeptics of this debate argue that focusing on such far-off existential risks obfuscates more immediate threats, such as authoritarian surveillance or biased data sets. Governments and companies around the world are expanding facial-recognition technology, and some analysts worry that Beijing in particular is using AI to supercharge repression. Another risk occurs wl AI training data contains elements that are over- or underrepresented; tools trained on such data can produce skewed outcomes. This can exacerbate discrimination against marginalized groups, such as when AI-powered tenant-screening algorithms trained on biased data disproportionately deny housing to people of color. Generative AI tools can also facilitate chaotic public discourse—"hallucinating" false information that chatbots present as true, or polluting search engines with dubious AI-generated results.

What are governments doing about AI?

Almost all policymakers, civil society leaders, academics, independent experts, and industry leaders agree that AI should be governed, but they are not on the same page about how. Internationally, governments are taking different approaches.

The United States escalated its focus on governing AI in 2023. The Biden administration followed up its 2022 AI Bill of Rights by announcing a pledge from fifteen leading technolog companies to voluntarily adopt shared standards [PDF] for AI safety, including by offering th frontier models for government review. In October 2023, Biden issued an expansive executive order aimed at producing a unified framework for safe AI use across the executive branch. A one month later, a bipartisan group of senators proposed legislation to govern the technolog

EU lawmakers are moving ahead with legislation that will introduce transparency requireme and restrict AI use for surveillance purposes. However, some EU leaders have expressed conc that the law could hinder European innovation, raising questions of how it will be enforced. Meanwhile, in China, the ruling Chinese Communist Party has rolled out regulations that include antidiscrimination requirements as well as the mandate that AI reflect "Socialist cor values."

Some governments have sought to collaborate on regulating AI at the international level. At Group of Seven (G7) summit in May 2023, the bloc launched the so-called Hiroshima Proces develop a common standard on AI governance. In October 2023, the United Nations formed AI Advisory Board—which includes both U.S. and Chinese representatives—to coordinate gl AI governance. The following month, twenty-eight governments attended the first ever AI Safety Summit, held in the United Kingdom. Delegates, including envoys from the United St and China, signed a joint declaration warning of AI's potential to cause "catastrophic" harm a resolving to work together "to ensure human-centric, trustworthy and responsible AI." China has also announced its own AI global governance effort for countries in its Belt and Road Initiative.

What should AI governance look like?

AI's complexity makes it unlikely that the technology could be governed by any one set of principles, CFR Senior Fellow Kat Duffy says. Proposals run the gamut of policy options with many levels of potential oversight, from total self-regulation to various types of public-policy guardrails.

Some analysts acknowledge that AI's risks have destabilizing consequences but argue that th technology's development should proceed. They say that regulators should place limits on compute, or computing power, which has increased by five billion times over the past decade allowing models to incorporate more of their training data in response to human prompts. Others say governance should focus on immediate concerns such as improving the public's A literacy and creating ethical AI systems that would include protections against discriminatio misinformation, and surveillance.

AI Computing Power Has Increased Exponentially

Computing power used to train notable AI systems

*Number of floating point operations (FLOP)

Note: Data is as of December 27, 2023. Notable machine learning systems are selected based on use, citations, and other criteria.

Source: Epoch.

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Some experts have called for limits on open-source models, which can increase access to the technology, including for bad actors. Many national security experts and leading AI compani are in favor of such rules. However, some observers warn that extensive restrictions could reduce competition and innovation by allowing the largest AI companies to entrench their

power within a costly industry. Meanwhile, there are proposals for a global framework for governing AI's military uses; one such approach would be modeled after the International Atomic Energy Agency, which governs nuclear technology.

What's next for AI?

The U.S.-China relationship looms large over AI governance: as Beijing pursues a national strategy aimed at making China the global leader in "AI theories, technologies, and applicati by 2030, policymakers in Washington are struggling with how to place guardrails around AI development without undermining the United States' technological edge.

Meanwhile, AI technology is rapidly advancing. Computing power has doubled every 3.4 months since 2012, and AI scientists expect models to contain one hundred times more comp by 2025.

In the absence of robust global governance, companies that control AI development are now exercising power typically reserved for nation-states, ushering in a technopolar world order, Bremmer and Suleyman write. They argue that these companies have become "themselves geopolitical actors," and thus they need to be involved in the design of any global rules.

AI's transformative potential means the stakes are high. "We have a chance to fix huge problems," Mallaby says. With proper safeguards in place, he says, AI systems can catalyze scientific discoveries that cure deadly diseases, ward off the worst effects of climate change, a inaugurate an era of global economic prosperity. "I'm realistic that there are significant risks but I'm hopeful that smart people of goodwill can help to manage them."

Recommended Resources

This episode of the *Why It Matters* podcast looks at how AI could influence elections across the globe in 2024.

At this CFR webinar, panelists discuss how to confront disinformation in the digital age.

For *Foreign Affairs,* Eurasia Group's Ian Bremmer and Inflection AI's Mustafa Suleyman write that governing AI has created a power paradox.

Experts at the Atlantic Council unpack the EU AI Act.

AI pioneer Geoffrey Hinton tells the *New Yorker* why he fears what he built.

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