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# AI's Climate Impact Goes beyond Its Emissions

To understand how AI is contributing to climate change, look at the way it's being used

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AI can be used to reduce climate change's impact—or to exacerbate it. [John Lund/Getty Images](#)

Climate Change ▾

Artificial intelligence is not limited to entertaining chatbots: increasingly effective programs trained with machine learning have become integral to uses ranging from smartphone GPS navigators to the algorithms that govern social media. But as AI's popularity keeps rising, more researchers and experts are noting the environmental cost. Training and running an AI system requires a great deal of computing power and electricity, and the resulting carbon dioxide emissions are one way AI affects the climate. But its environmental impact goes well beyond its carbon footprint.

“It is important for us to recognize the CO<sub>2</sub> emissions of some of these large AI systems especially,” says Jesse Dodge, a research scientist at the Allen Institute for AI in Seattle. He adds, however, that “the impact of AI systems in general is going to be from the applications they’re built for, not necessarily the cost of training.”

The exact effect that AI will have on the climate crisis is difficult to calculate, even if experts focus only on the amount of greenhouse gases it emits. That’s because different types of AI—such as a machine learning model that spots trends in research data, a vision program that helps self-driving cars avoid obstacles or a large language model (LLM) that enables a chatbot to converse—all require different quantities of computing power to train and run. For example, when OpenAI trained its LLM called GPT-3, that work produced the equivalent of around 500 tons of carbon dioxide. Simpler models, though, produce minimal emissions. Further complicating the matter, there’s a lack of transparency from many AI companies, Dodge says. That makes it even more complicated to understand their models’ impact—when they are examined only through an emissions lens.

This is one reason experts increasingly recommend treating AI's emissions as only one aspect of its climate footprint. David Rolnick, a computer scientist at McGill University, likens AI to a hammer: "The primary impact of a hammer is what is being hammered," he says, "not what is in the hammer." Just as the tool can smash things to bits or pound in nails to build a house, artificial intelligence can hurt or help the environment.

Take the fossil-fuel industry. In 2019 Microsoft announced a new partnership with ExxonMobil and stated that the company would use Microsoft's cloud-computing platform Azure. The oil giant claimed that by using the technology—which relies on AI for certain tasks such as performance analysis—it could optimize mining operations and, by 2025, increase production by 50,000 oil-equivalent barrels per day. (An oil-equivalent barrel is a term used to compare different fuel sources—it's a unit roughly equal to the energy produced by burning one barrel of crude oil.) In this case, Microsoft's AI is directly used to add more fossil fuels, which will release greenhouse gases when burned, to the market.

In a statement emailed to *Scientific American*, a Microsoft spokesperson said the company believes that "technology has an important role to play in helping the industry decarbonize, and this work must move forward in a principled manner—balancing the energy needs and industry practices of today while inventing and deploying those of tomorrow." The spokesperson added that the company sells its technology and cloud services to "all customers, inclusive of energy customers."

Fossil-fuel extraction is not the only AI application that could be environmentally harmful. "There's examples like this across every sector, like

forestry, land management, farming,” says Emma Strubell, a computer scientist at Carnegie Mellon University.

This can also be seen in the way AI is used in automated advertising. When an eerily specific ad pops up on your Instagram or Facebook news feed, advertising algorithms are the wizard behind the curtain. This practice boosts overall consumptive behavior in society, Rolnick says. For instance, with fast-fashion advertising, targeted ads push a steady rotation of cheap, mass-produced clothes to consumers, who buy the outfits only to replace them as soon as a new trend arrives. That creates a higher demand for fast-fashion companies, and already the fashion industry is collectively estimated to produce up to eight percent of global emissions. Fast fashion produces yet more emissions from shipping and causes more discarded clothes to pile up in landfills. Meta, the parent company of Instagram and Facebook, did not respond to *Scientific American’s* request for comment.

But on the other side of the coin there are AI applications that can help deal with climate change and other environmental problems, such as the destruction wrought by severe heat-fueled hurricanes. One such application is xView2, a program that combines machine-learning models and computer vision with satellite imagery to identify buildings damaged in natural disasters. The program was launched by the Defense Innovation Unit, a U.S. Department of Defense organization. Its models can assess damaged infrastructure, thereby reducing danger and saving time for first responders who would otherwise have to make those assessments themselves. It can also help search-and-rescue teams more quickly identify where to direct their efforts.

Other AI technologies can be applied directly to climate change mitigation by using them to monitor emissions. “In the majority of the world, for the

majority of climate change emissions, it's very opaque," says Gavin McCormick, executive director of WattTime, a company that monitors electricity-related emissions. WattTime is a founding partner of the nonprofit organization Climate TRACE, whose platform combines computer vision and machine learning to flag emissions from global pollution sources. First, scientists identify the emissions coming from monitored facilities. Then they use satellite imagery to pinpoint visual signs of the emission-causing activities—steam plumes from a factory, for example. Next, engineers train algorithms on those data in order to teach the programs to estimate emissions based on visual input alone. The resulting numbers can then help corporations determine to lower their emissions footprint, can inform policymakers and can hold polluters accountable.

As AI becomes more efficient at solving environmental problems, such as by helping to lower emissions, it could prove to be a valuable tool in the fight against climate change—if the AI industry can reduce its negative climate impacts. "From the policy standpoint, both AI policy and climate policy have roles to play," Rolnick says. In particular he recommends shaping AI policy in a way that considers all angles of its impact on climate. That means looking at its applications as well as its emissions and other production costs, such as those from water use.

Further, Dodge adds that those with expertise in AI, particularly people in power at tech companies, should establish ethical principles to limit the technology's use. The goal should be to avoid climate harm and instead help reduce it. "It needs to be part of the value system," he says.

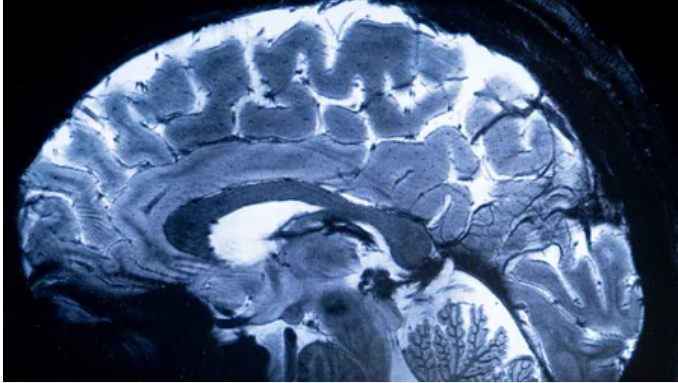


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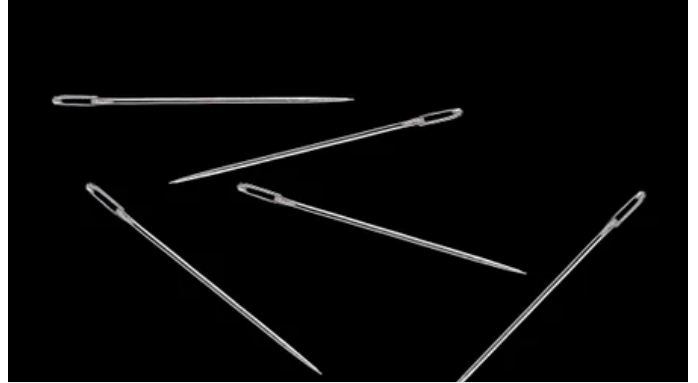


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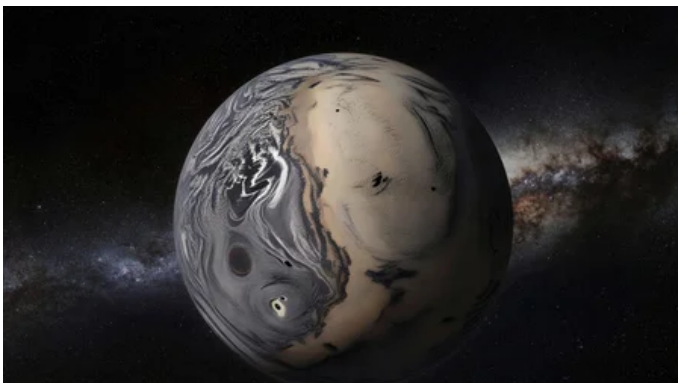


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