

Five ways AI could improve the world: 'We can cure all diseases, stabilise our climate, halt poverty'

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Recent advances such as Open AI's GPT-4 chatbot have awakened the world to how sophisticated artificial intelligence has become and how rapidly the field is advancing. Could this powerful new technology help save the world? We asked five leading AI researchers to lay out their best-case scenarios. 'More intelligence will lead to better everything' In 1999, I predicted that computers would pass the Turing test [and be indistinguishable from human beings] by 2029. Stanford university found that alarming, and organised an international conference – experts came from all over the world. They mostly agreed that it would happen, but not in 30 years – in 100 years. This poll has been taken every year since 1999. My guess has remained 2029, and the consensus view of AI experts is now also 2029. Everything's going to improve. We will be able to cure cancer and heart disease, and so on, using simulated biology – and extend our lives. The average life expectancy was 30 in 1800; it was 48 in 1900; it's now pushing 80. I predict that we'll reach "longevity escape velocity" by 2029. Now, as you go forward a year, you're using up a year of your longevity, but you're actually getting back about three or four months from scientific progress. So, actually, you haven't lost a year; you've lost eight or nine months. By 2029, you'll get back that entire year from scientific progress. As we go past 2029, you'll actually get back more than a year. Most movies about AI have an "us versus them" mentality, but that's really not the case. This is not an alien invasion of intelligent machines; it's the result of our own efforts to make our infrastructure and our way of life more intelligent. It's part of human endeavour. We merge with our machines. Ultimately, they will extend who we are. Our mobile phone, for example, makes us more intelligent and able to communicate with each other. It's really part of us already. It might not be literally connected to you, but nobody leaves home without one. It's like half your brain. If the wrong people take control of AI, that could be bad for the rest of us, so we really need to keep pace with that, which we are doing. But we already have things that have nothing to do with AI, such as atomic weapons, that could destroy everyone. So it's not really making life more dangerous. And, it can actually give us some tools to prevent people from harming us. The rate of change will be difficult for some people. The railways changed the US, but it took decades; this is changing it in months. If we were in 1900 and I went through all the different ways people made money, and I said: 'All of these will be obsolete in 100 years,' people would go: 'Oh, my God! There's gonna be no jobs.' But in fact, we have more jobs today – in areas that were really only invented in the last few decades. That will continue. We've made great progress but there are still people who are desperate. More intelligence will lead to better everything. We will have the possibility of everybody having a very good life. Ray Kurzweil, computer scientist, inventor, author and futurist 'We can

use AI tools right now to help fight climate change' Everyone wants a silver bullet to solve climate change; unfortunately there isn't one. But there are lots of ways AI can help fight climate change. While there is no single big thing that AI will do, there are many medium-sized things. The first role AI can play in climate action is distilling raw data into useful information – taking big datasets, which would take too much time for a human to process, and pulling information out in real time to guide policy or private-sector action. For example, taking satellite imagery and picking out where deforestation is happening, how biodiversity is changing, where coastal communities are at risk from flooding. These kinds of tools are already starting to be used by organisations around the world, from the UN to insurance companies, and we're working to scale them up and improve them. The second role is optimisation of complicated systems – such as the heating and cooling system in a building, where there are many controls that an algorithm can operate efficiently. Smart thermostats have become mainstream in our homes, and now we're starting to see that for skyscrapers and factories. Many companies are improving energy efficiency, and there is a lot of progress still to be made, especially in industries such as steel and cement, which are often resistant to adopting new technologies. The next theme is forecasting. AI can't predict something big-picture like what's going to happen to the economy – but forecasts make sense for narrow problems with lots of data, such as what the power demand is going to be at a particular time, or what power is going to be available based on the sun and the wind, forecasting how a storm is going to move, or the productivity of crops based upon the weather. The fourth theme is in speeding up scientific simulations, such as in climate and weather modelling. We have really good climate models, but sometimes they can take months to run, even on supercomputers, and that is an obstacle. We understand climate change very well but that doesn't mean we know exactly what is going to happen at each point. So, having faster climate models can aid local and regional responses. AI in climate action isn't about what computers can do in the far future – we can't trust some speculative future technology to rescue us. Climate change is already killing people, and many more people are going to die even in a best-case scenario, but we get to decide now just how bad it gets. Action taken decades from now is much less valuable than action taken soon. Thinking of AI as a futuristic tool that will lead to immeasurable good or harm is a distraction from the ways we can and are using AI tools right now, and what we can do to align them with what's best for society. David Rolnick, assistant professor and Canada CIFAR AI Chair, McGill University School of Computer Science, Montreal 'There is going to be an amazing revolution in healthcare' There is a rapid transformation in the pharmaceutical industry and university research, where they're shifting to the use of AI to help discover new molecules and new drugs that would have fewer side-effects, and that would help us cure diseases that currently we don't know how to cure, including cancer, potentially. One reason AI can be useful here is that the body is very complicated. Even a single cell is extremely complicated: you have 20,000 genes, and they all interact with each other. Biotechnology has progressed to the point where we can measure all the genes' activity in a single cell at once. While we collect huge quantities of data, the quantity of data is so large that humans are unable to read it. But because machines can, they are able to build models of how your cells work, and how they could be changing under different circumstances that cause disease. So, you can see what happens if you make an intervention; if you introduce a pollutant or a drug, what will be the effect? There are many academics working in these areas right now. One of the research programmes in my group is about using AI for discovering drugs for infectious diseases, which don't get a lot of attention from pharma – because they're not profitable, they're happening in developing countries, or they're very rare, such as pandemics. There is also the issue of antimicrobial resistance – where mutations of microbes mean that our current drugs are no longer effective. This is like a catastrophe dangling in front of our noses, it could come at any time. This is not just something happening in academia. There are now dozens of startups that have been created at the intersection of AI and drug discovery, broadly speaking. These have been injected with billions of dollars, while pharmaceutical companies are beefing up their machine-learning departments. Having better models could be a real gamechanger. The big cost of drug discovery is that you have to try a lot of things that don't work. Trying one drug isn't that expensive, but usually there's something that goes wrong. Currently, it costs a billion dollars to develop a new drug; it could easily be 10 times less with these advances. It is probably going to take years before people see an effect, but I am pretty sure it's going to be an amazing revolution in terms of healthcare. Yoshua Bengio, professor of computer science, the University of Montreal; scientific director, Mila – Quebec AI Institute 'AI could radically accelerate the process of technological progress itself' If we figured out how people are going to share in the wealth that AI unlocks, then I think we could end up in a world where people don't have to work to eat, and are instead taking on projects because they are meaningful to them. I often use the analogy of children. They do a lot of things because they enjoy them, and not just because they're the best person in the world at them. They paint and draw, and they have a lot of fun; I paint and draw, and I have a lot of fun, even though [AI image generator] Midjourney is way better at making pictures than me. Similarly, since the 90s, we have had computer programs that can beat humans at chess, but lots of people still play chess. If you have intelligent AI systems that are accessible to people, it's as if everybody has access to an infinitely patient teacher so you could imagine training these AI systems to be an interface between humans and other humans. I think there are things that we might choose to not have AI replace. Those will probably have to do with governance of our society and our processes of trying to figure out what are good things to do with the world. How do we manage our resources? What are the laws we're going to put in place? What is the way to treat people fairly? And, if you imagine, for example, the possibility of expansion into space with technology invented by AI systems, we would have choices: should we do that? And what would we do with the resources that we unlock if we do expand into space? AI systems could help us think that through, but it might be that we

want those decisions to be made by people. When you zoom out and look at where humanity has come from, on the scale of centuries and millennia, freedom and health and equality have been getting better over time, and better technology has played a huge part in that. Truly advanced AI systems could continue that story – they could be more than just another technology; they could automate and radically accelerate the process of technological progress itself. In just a couple of decades, humanity could get to the kind of advanced future that feels like it's hundreds or thousands of years away. This is not at all guaranteed, but I think it's within reach if we get this right. Ajeya Cotra, senior research analyst on AI alignment, Open Philanthropy; editor, *Planned Obsolescence* 'We can flourish, not just for the next election cycle, but for billions of years' The positive, optimistic scenario is that we responsibly develop superintelligence in a way that allows us to control it and benefit from it. The "control" part is, I think, more hopeful than many people assume. There is a field of computer science called formal verification, where you come up with a rigorous mathematical proof that a program is always going to do what it's supposed to. You can even create what is called "proof-carrying code"; it works in the opposite way to a virus checker. If a virus checker can prove that the code you are going to run is malicious, it won't run it; with proof-carrying code, only if the code can prove that it's going to do what you want it to do will your hardware run it. This is the type of mechanism we need to ensure advanced AI is safe. We can't do this yet with GPT-4 or other powerful AI systems, because those systems are not written in a human programming language; they are a giant artificial neural network, and we have almost no clue how they work. But there is a very active research field called mechanistic interpretability. The goal is to take these black-box neural networks and figure out how they work. If this field makes so much progress that we can use AI itself to extract out the knowledge from other AI and see what it has learned, we could then reimplement it in some other kind of computational architecture – some sort of proof-carrying code – that you can trust. Then you can still use the power of neural networks to discover and learn, but now you can trust something that's way smarter than you. Then what are we going to do with it? Well, the sky's the limit. We can cure all diseases, stabilise our climate, eliminate poverty, etc. We can flourish not just for the next election cycle, but for billions of years. We have been on this planet for more than 100,000 years, and most of the time we have been like a leaf blowing around in the wind, without much control of our destiny, just trying to not starve or get eaten. Science and technology and human intelligence have made us the captains of our own ship. I find that inspiring. If we can build and control superintelligence, we can quickly go from being limited by our own stupidity to being limited by the laws of physics. It could be the greatest empowerment moment in human history. Max Tegmark, a professor of physics and AI researcher at the Massachusetts Institute of Technology • Do you have an opinion on the issues raised in this article? If you would like to submit a letter of up to 300 words to be considered for publication, email it to us at guardian.letters@theguardian.com