

The Transformative Impact of AI on Energy, Manufacturing, and Medicine

Artificial intelligence (AI) is on the brink of revolutionizing the physical world in profound ways, particularly in energy, manufacturing, and medicine. By the time today's children are in kindergarten, AI is expected to surpass human capabilities in all cognitive tasks, from science to creativity. Ray Kurzweil, a futurist who predicted in 1999 that artificial general intelligence (AGI) would emerge by 2029, now sees this prediction as increasingly likely, given recent advancements in AI technology.

Energy: Harnessing the Sun's Power

Energy is fundamental to modern civilization, yet for centuries we have relied on non-renewable fossil fuels. Despite the enormous potential of solar energy—harvesting just 0.01% of the sunlight that hits Earth could meet all human energy needs—it has not yet become the dominant energy source. The main obstacles are the high cost and inefficiency of photovoltaic materials and the challenge of storing solar energy for use when the sun isn't shining.

AI is poised to address these challenges by rapidly evaluating billions of chemical combinations to discover more efficient and cost-effective materials for solar cells and batteries. Google's Gnome AI, for example, recently identified 421,000 stable inorganic compounds, far surpassing the 20,000 compounds previously discovered. With the help of AGI, solar energy could become so abundant that it is virtually free, leading to a significant reduction in energy costs and a major shift towards renewable energy sources.

Manufacturing: Reducing Costs and Increasing Efficiency

Cheap, abundant energy will drive a revolution in manufacturing. The costs of producing goods such as food, clothing, electronics, and cars are largely influenced by energy, labor, and raw materials. AI is set to dramatically reduce these costs by enhancing robotic capabilities and finding substitutes for expensive raw materials. For example, AI can help replace rare-earth elements with more common materials like zirconium, silicon, and graphene.

Moreover, AI-driven advancements in robotics will lower labor costs by automating many tasks that are currently dangerous and physically demanding. This will make manufacturing processes more efficient and less costly, leading to a decrease in the price of various goods and making them more accessible to people worldwide.

Medicine: Towards Personalized Healthcare

The third major area where AI will have a transformative impact is medicine. Despite significant progress over the past two centuries, our understanding of the human body remains incomplete, and medical treatments often rely on trial and error. AI has the potential to change this by turning medicine into a precise science.

Molecular biosimulation, which involves computer modeling of the human body and how drugs interact with it, can quickly evaluate billions of possibilities to identify the most promising treatments. This approach is already yielding results: the first drug designed entirely by AI has entered phase-2 clinical trials for idiopathic pulmonary fibrosis, a serious lung disease.

AI is also revolutionizing the discovery and testing of new drugs. DeepMind's AlphaFold 2, for instance, has determined the shapes of over 200 million proteins, providing valuable data to researchers and accelerating the development of new treatments. This massive increase in available data will enhance the accuracy of simulations, eventually allowing AI to model entire biological systems, from proteins to organs.

In the future, AI will enable digital clinical trials that are faster, cheaper, and more accurate than current methods. These trials will be able to tailor treatments to individual patients, taking into account their unique genetic makeup, lifestyle, and other factors. This personalized approach promises to cure diseases like cancer and Alzheimer's and could even combat the effects of aging.

The Future of AI in Medicine and Beyond

As AI continues to advance, it will significantly extend human life expectancy. Kurzweil predicts that by achieving "longevity escape velocity," where each year of scientific progress adds more than a year to human life expectancy, aging will no longer increase the annual risk of dying. This could happen as soon as 2029 to 2035 for those who adopt healthy habits and new therapies.

In conclusion, AI is set to bring about unprecedented changes in energy, manufacturing, and medicine. These advancements will lead to cheaper, more abundant resources, and longer, healthier lives, fundamentally transforming the human experience.