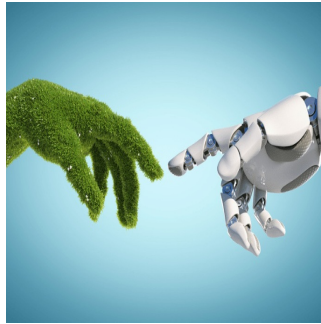


Balancing AI's Benefits with Climate Impact: Lancet's Call for Sustainability



The potential benefits of artificial intelligence (AI) in medicine are substantial and diverse. AI can significantly improve disease recognition and diagnosis, assist in risk stratification for patients, predict outcomes, aid decision-making, and serve as a tool for analyzing public health threats. However, as AI technology continues to grow and diversify, there is an urgent need to address one of the greatest threats to humankind: the climate crisis. The relationship between AI and the climate crisis is complex. AI has the potential to play a crucial role in addressing climate challenges by forecasting climate changes accurately, predicting specific impacts on human populations, developing low-emission infrastructure, facilitating smart grid design, and optimising the efficiency of data centres. On the other hand, the increasing power requirements and subsequent emissions from AI systems could exacerbate the climate crisis, necessitating a reevaluation of AI's risk-benefit profile.

Rising Environmental Cost of AI: Energy Demands and Carbon Emissions

AI's environmental impact is significant due to its energy consumption at various stages, including data storage, model training, and inference. The energy demands vary depending on factors like the size of training datasets, training duration, hyperparameter tuning, and the choice of computational infrastructure. The emissions from AI models are influenced by the type of energy used, the servers selected, backup generators, hardware turnover, and disposal techniques for e-waste. As AI continues to advance, its energy consumption and carbon emissions are expected to increase. For example, AI training computations have been doubling every 3.4 months since 2012, potentially leading AI servers to consume between 85 to 134 terawatt hours annually, approximately 1% of the world's total electricity use. There is also a likelihood that we currently underestimate the true impact of AI on the climate, especially with the massive scale of operations in certain AI types, such as generative AI.

Towards Sustainable AI: The Need for Transparent Reporting and Energy Efficiency

To mitigate AI's environmental impact, there is a need for transparent reporting of AI energy use and carbon emissions. Researchers and institutions should routinely report energy consumption associated with both the initial model development and retraining processes. Although emissions reporting standards for AI do not yet exist, there is a growing movement to incorporate energy efficiency as a key evaluation criterion in AI research. Responsible AI development should prioritize the least computationally intensive and most energy-efficient solutions. Not all scientific questions require high-emission technologies like deep learning, and establishing performance thresholds for models that are clinically useful can help reduce unnecessary energy consumption. Multidisciplinary teams, including physicians, nurses, healthcare workers, and scientists, should be involved in designing AI-driven solutions to maximize efficiency and potentially reduce the need for excessive data.

Optimizing AI Infrastructure: Balancing Security and Environmental Sustainability

The choice of computation location can also affect AI's climate impact. On-premises computing, supported by an institution's data center, has been traditionally preferred in healthcare due to security concerns, but cloud services could offer a more environmentally sustainable alternative. Cloud computing provides centralised infrastructure, reducing individual waste and optimizing energy use. Secure cloud technology that balances data protection and environmental sustainability is crucial. Institutions are also encouraged to consider ethically purchased carbon offsetting for AI-related emissions. Many industries have adopted carbon offsetting, and incorporating the cost of carbon credits into grant and funding proposals can help offset AI's climate impact.

Evaluating Environmental Impact in AI Models for Healthcare

A practical example of these strategies is demonstrated by the Sick Kids' emergency department census prediction model, which predicts hourly census using admission data from the hospital's electronic health record system. The model's estimated energy consumption and carbon emissions highlight the potential advantages of cloud computing in reducing environmental impact. However, this example also underscores several limitations, such as only accounting for energy consumption and not considering other aspects like hardware manufacturing, data center cooling mechanisms, and geographic variations in energy sources. A comprehensive approach should consider the entire life cycle of AI models, including procurement, manufacturing, and disposal of hardware.

The strategies discussed serve as a foundation for further action by medical professionals, scientists, and administrators to minimize the environmental impact of AI in healthcare. These include lowering optimization thresholds to reduce energy use, considering the location and infrastructure for AI computation, and advocating for sustainable AI practices. As medicine continues to innovate, it is crucial to advocate for environmentally responsible science and recognize the impact of AI on climate change, which remains one of the most pressing health threats of our time.

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Published on : Thu, 6 Jun 2024