

How to adopt a Green AI approach in business?

Impact AI publishes a toolkit for companies to initiate and accelerate the process of integrating a green AI approach

The summer of 2022 was a sad witness: the multiplication of extreme weather events (heat domes, floods, fires, drought, hurricanes...) highlighted by the various IPCC reports, confront us every day with the climate disruption caused by human activities that emit greenhouse gases into the atmosphere.

The increase in temperature on Earth depends, in part, on the total amount of carbon present in the atmosphere, and not on the speed at which we emit it. To limit the temperature rise to 1.5 degrees by 2050, we must first stop adding carbon to the atmosphere, and then achieve neutrality on the remaining emissions. This means that for every gram of carbon we emit, we must remove one gram: the overall mass of carbon in the atmosphere remains fixed.

In this context of climate change, digital technology appears to be a "Pharmakon" for the environment, which in Greek means both remedy and poison.

On the one hand, according to ADEME, digital technology currently accounts for 3.5% of greenhouse gas emissions, and the sharp increase in usage suggests that this figure will double by 2025 if nothing is done to limit its impact.

On the other hand, digital technology is essential to the transformation of organizations and can play a positive role in reducing the GHG emissions generated by other sectors (energy, transport, heating, industry, etc.).

In order to reconcile the ecological transition and the digital transition, we must put sustainability at the heart of technology (Green IT) and use technology to serve sustainability (IT for

Impact AI is the Think & Do Tank of reference for ethical artificial intelligence in France. Our vision is to work together with the digital ecosystem (companies, startups, institutions, research or training organizations, civil society actors...) to create a collective AI approach that meets the needs and expectations of citizens. Our Taskforce dedicated to the environment aims to study, deep dive and share know-how, best practices and use cases around two key concepts at the crossroads of AI and the environment: Green AI & AI for Green.

We hope you enjoy reading our paper dedicated to Green AI, which will help you understand the major issues and sort out the real from the fake, but also to initiate an ambitious and state-of-the-art Green AI approach thanks to the sharing of best practices, tools and methodologies¹.

Our main contributors to this article are: Axionable, DC Brain, Intel, Microsoft et Orange

Green). The particular case of the use of Artificial Intelligence (AI) is a perfect example of this contradictory injunction.

Artificial intelligence presents use cases with positive impacts on the environment (AI for Green). Their impact can be measured by their contribution to the 17 United Nations Sustainable Development Goals, encompassing societal, economic and environmental outcomes: AI could contribute to 134 targets but would have a negative effect by inhibiting 59 targets (2020 study published in Nature Communications). The AI for Earth program or the Climate Change AI initiative are examples of initiatives that bring out use cases of AI for sustainable development.

On the other hand, AI has a strong and growing carbon impact and therefore contributes to climate change. Indeed, the availability of data and computing capacities has led to a race for performance (Red AI) and a sharp increase in computing costs. We note that the relationship between performance and model complexity (measured in number of parameters or inference time) is at best logarithmic: for a linear gain in performance, model complexity grows exponentially. For example, training the model emits 50% of its CO₂ only to achieve a final decrease of 0.3 in the word recognition error rate ("The Energy and Carbon Footprint of Training End-to-End Speech Recognizers") or GPT-3, a powerful (175 billion parameters) and recent OpenAI language model, would have consumed enough energy during training to leave a carbon footprint equivalent to driving a car from the Earth to the Moon and back.

A Green AI approach to meet global performance requirements

The awareness and urgency of climate change has led to the structuring of the "Green AI" movement, initiated by researchers in natural language processing, proposing a compromise between model accuracy and carbon cost. Some conferences (NeurIPS 2019, EMNLP 2020, SustainLP2020) now require the computational costs necessary to generate the proposed results in all submissions.

Peter Drucker's quote "You can't manage what you can't measure", applies of course to sustainable AI for which it is imperative to 1/ understand and apprehend the subject as a whole, 2/ measure greenhouse gas emissions and other environmental impacts and 3/ manage and reduce these impacts.

The Impact AI collective offers you a toolbox around the three components 1/ understand 2/ measure 3/ reduce, in order to help you structure and initiate your Green AI approach and accelerate its operational implementation.

The exemplarity of a Green AI approach is key: robust methodologies and tools exist, but it is necessary to understand and use them well in order to adopt a global, ambitious and consistent approach. Through this paper, we wish to contribute to raising awareness and increasing collective maturity around the understanding, measurement and reduction of the environmental impacts of AI.

As Gwendal Bihan, CEO of Axionable, Vice-President of Impact AI and leader of the environment taskforce says:

Overview of the 3 main parts :

Find here the complete paper with details of key concepts, methodologies, tools and best practices

1/ Understanding

Our 5 key points to remember in order to understand the Green AI concept and adopt a holistic approach:

- It is necessary to take into account the impact of all 3 GHG emission scopes and not only the impact of electricity consumption;
- It is necessary to take into account the whole life cycle of AI, from ideation, design to inference, through training and production of models;
- It is necessary to consider the impact of all the infrastructures and services associated with the AI project: hosting, networks, equipment, applications and software, terminals and edge;
- It is strongly recommended that the Green AI approach is part of a more global Green IT approach, to ensure consistency at the boundaries of AI, which are still difficult to define precisely;
- although it is currently the key indicator of Green AI, carbon is not the only environmental impact of AI and other impacts can be considered (water, abiotic resources, climate change, electrical and electronic waste, etc.)

2/ Measuring:

The exercise of measuring the carbon footprint of AI is not necessarily a simple one (lack of specific repository and methodology, unavailability of data, incomplete scope, etc.). Find our overview of available methodologies and resources to help you :

- work on the exhaustive measurement of the carbon footprint of AI, related to the energy consumption of AI models but also to other upstream and downstream scope 3 emissions;
- understand the main limits of the measurement methodologies in order to take the necessary precautions in the interpretation of the results.

3/ Reducing

In order to initiate and operationalize a Green AI approach, find all our concrete actions to reduce the carbon footprint of AI, throughout the lifecycle of AI.