

Case Study Sustainability

May 10, 2023

1 Case Study

1.1 The energy consumption and impact of large-scale machine learning models

Large-scale machine learning models, such as ChatGPT, have become increasingly popular in recent years. However, the training and operation of these models require vast amounts of computational power and energy. As a result, concerns have been raised about the environmental impact of these models, particularly their energy consumption, and subsequently, their carbon footprint.

1.1.1 Estimating the energy consumption of ChatGPT

The following article provides an estimate of the energy consumption of ChatGPT based on the electricity consumption per query and the query rate.

<https://towardsdatascience.com/chatgpts-electricity-consumption-7873483feac4>

The article shows that ChatGPT's electricity consumption in January 2023 was estimated to be between 1.168 GWh and 23.364 GWh, which roughly equals 14 to 280 GWh annually. Note that ChatGPT was in its early stage in January 2023, and its power consumption is expected to drastically increase in the next few months.

Comment on the method on estimating the energy consumption of ChatGPT. How does this estimation sounds to you?

1.1.2 ChatGPT vs Global energy consumption

The energy consumption of ChatGPT is significant, but what proportion of the global energy consumption does ChatGPT's energy consumption represent? Here is a collection of data on global energy production and consumption on "Our World in Data". It's an interesting webpage to explore.

<https://ourworldindata.org/energy-production-consumption>

The global energy consumption in 2021 is estimated to be 176,000 TWh, and ChatGPT represents between 0.1 to 2 parts per million. If we narrow down the scope to Switzerland, Switzerland consumed 298 TWh of energy in 2021, while ChatGPT's energy consumption represents 0.05 to 1 part per thousand.

Comment on the impact of a single ChatGPT-like language model, is that negligible? How does it compare to other industries?

1.1.3 Climate neutral ChatGPT

One way to mitigate the environmental impact of ChatGPT's energy consumption is to make it climate-neutral. This can be achieved by powering it with renewable energy sources such as solar power.

https://en.wikipedia.org/wiki/Cestas_Solar_Park

The Cestas Solar Park is the largest photovoltaic power station in France, and the largest in Europe when it was built. It covers an area of around 250 hectares and consists of over 1 million solar panels. Its annual net output reaches 350 GWh, sufficient to cover the energy consumption of ChatGPT.

Discuss on the feasibility of powering large language models such as ChatGPT using renewable energy sources.

1.1.4 Machine learning models in all scenarios?

The growing popularity of large machine learning models and their widespread use in various applications means that their energy consumption can have a considerable impact on the environment. However, large machine learning models can provide significant benefits in specific scenarios, such as improving accuracy and efficiency in natural language processing, computer vision, and speech recognition.

In which scenario large machine learning models are justified to incorporate into existing products? What are the benefits and how they are justified? Discuss on some examples.