

Introduction and Motivation

As Artificial Intelligence (AI) advances, the ecological impact of resource-intensive computing becomes increasingly significant in terms of sustainability. Over the course of AlexNet (2012) to AlphaGoZero (2018), there was an increase by the factor of 300,000 regarding computational effort. [Amo+19] Since, in addition to research, the continuous spread of AI in companies has an influence, the research question arises here:

What is the awareness and status of sustainability of artificial intelligence in companies and how can it be improved?

The topic of sustainability of (and not with) AI in business is so far and unexplored research area.

Methodology

literature review

Identifying and evaluation measures for improved sustainability

expert interview

Relevance and status in companies, hurdles and future directions

practical benchmark

Evaluating benchmark effort for companies, ranking of energy consumption of models

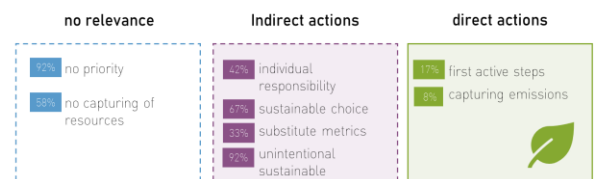
Expert Interviews

12 expert interviews were conducted, transcribed and analyzed according to qualitative content analysis according to Mayring [May14]

The **hurdles** mentioned are the lack of transparency, the lack of (economic) incentive or priority, the complexity of AI applications, and the Rebound Effect.

Necessary steps for more sustainability of AI in companies are to track and measure emissions, relieve the developers of responsibility and manual effort, balancing sustainability with performance and monetary interests and generate and spread knowledge.

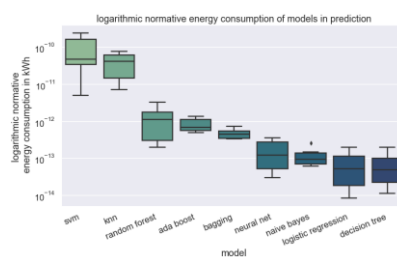
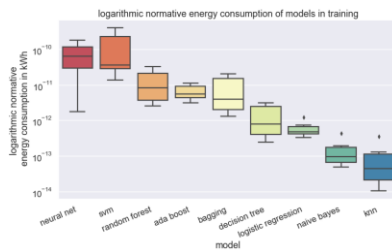
What is the relevance of sustainability in data science in companies?



categorized relevance of sustainability of AI and occurrence in percentage of the interviews

Benchmark of classification models

A benchmark regarding the energy consumption of 9 classification models in their vanilla configuration on 6 datasets was performed for the training and prediction. The consumption (measured with the library codecarbon) was normed by the number of features and data points.



Conclusion and outlook

The sustainability of AI systems is not yet a major issue for companies; this is due in particular to the low level of maturity of the use of AI. In particular, the lack of awareness and transparency about actual emissions is an additional obstacle. The measures for sustainable AI must therefore be better communicated and efficient methods implemented in open source libraries. Procedures such as a benchmark of algorithms are shown to be easy to set up.

Background

Sustainability in IT (here Green IT) has been a niche topic since 2007. The term "GreenAI" was defined in 2019 [Sch+19] with the primary focus to consider efficiency along performance in the model development.

Since then, there are some tools like CarbonTracker, codecarbon, ML Emissions Calculator that measure the footprint of machine learning models.

Measures sustainable AI

The measures for resource-saving AI were collected from research and evaluated for corporate use. A total of 27 measures were found and categorized.

Category	amount
hardware and infrastructure	7
model selection	6
model training and AutoML	6
model operation	4
organizational	4

Literature

[Amo+19] Dario Amodei, Danny Hernandez, Girish Sastry, Jack Clark, and Ilya Sutskever. ai and compute. 2019.

[May14] Philipp Mayring. Qualitative content analysis: theoretical foundation, basic procedures and software solution. 2014.

[Sch+19] Roy Schwartz, Jesse Dodge, Noah A. Smith, and Oren Etzioni. "Green AI." In: CoRR abs/1907.10597 [2019]. arXiv: 1907.10597.