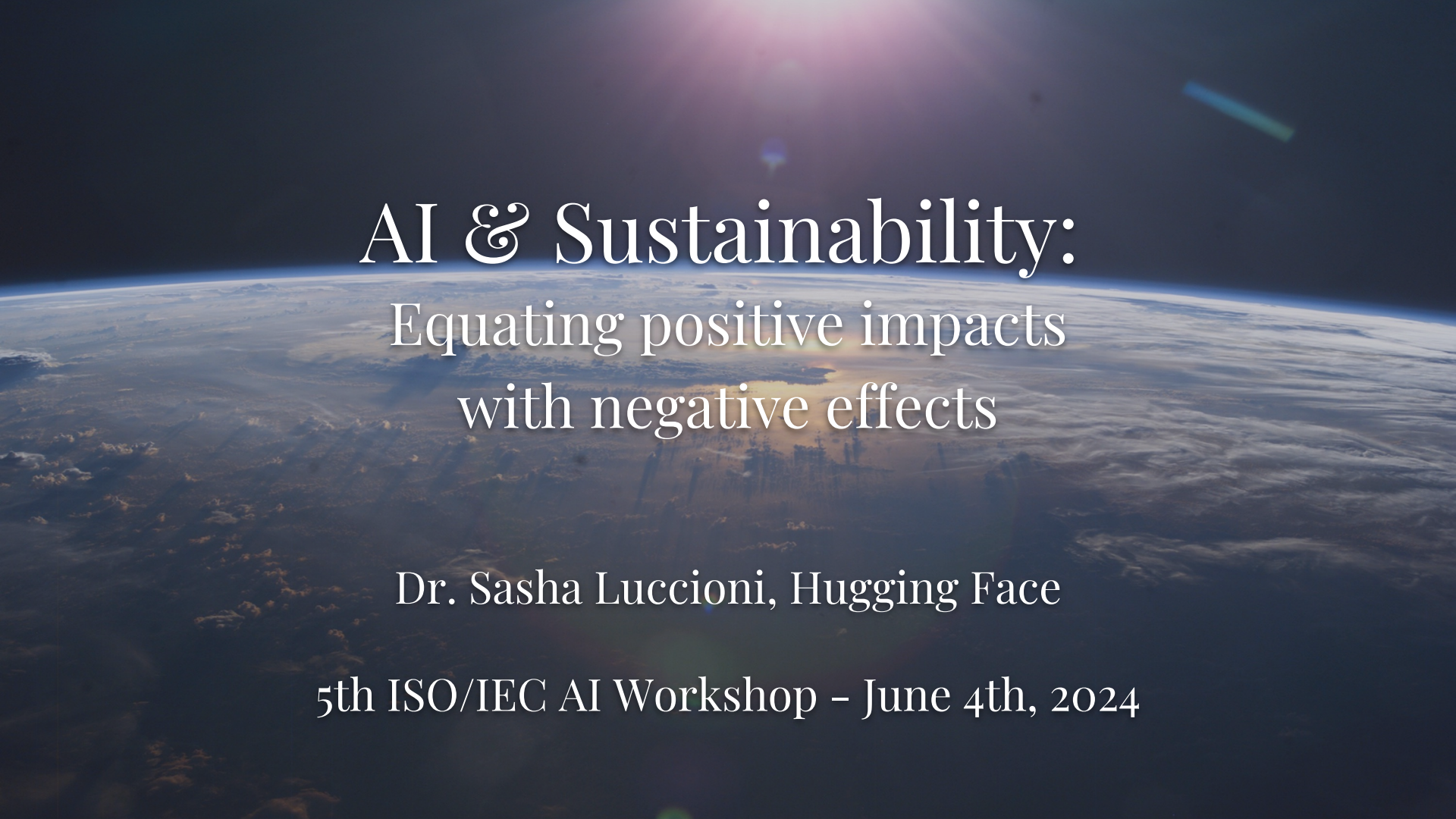




AI & Sustainability:

Equating positive impacts
with negative effects

Dr. Sasha Luccioni, Hugging Face

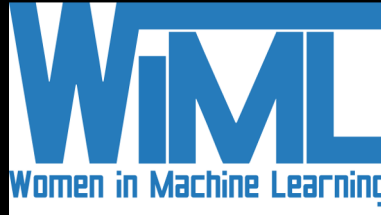
5th ISO/IEC AI Workshop – June 4th, 2024

Hi, I'm Sasha!



I'm the Climate Lead at Hugging Face, where I work on evaluating the environmental and societal impacts of AI models and datasets.

I'm also a Board Member of **WiML** (Women in Machine Learning) and a Founding member of **Climate Change AI**

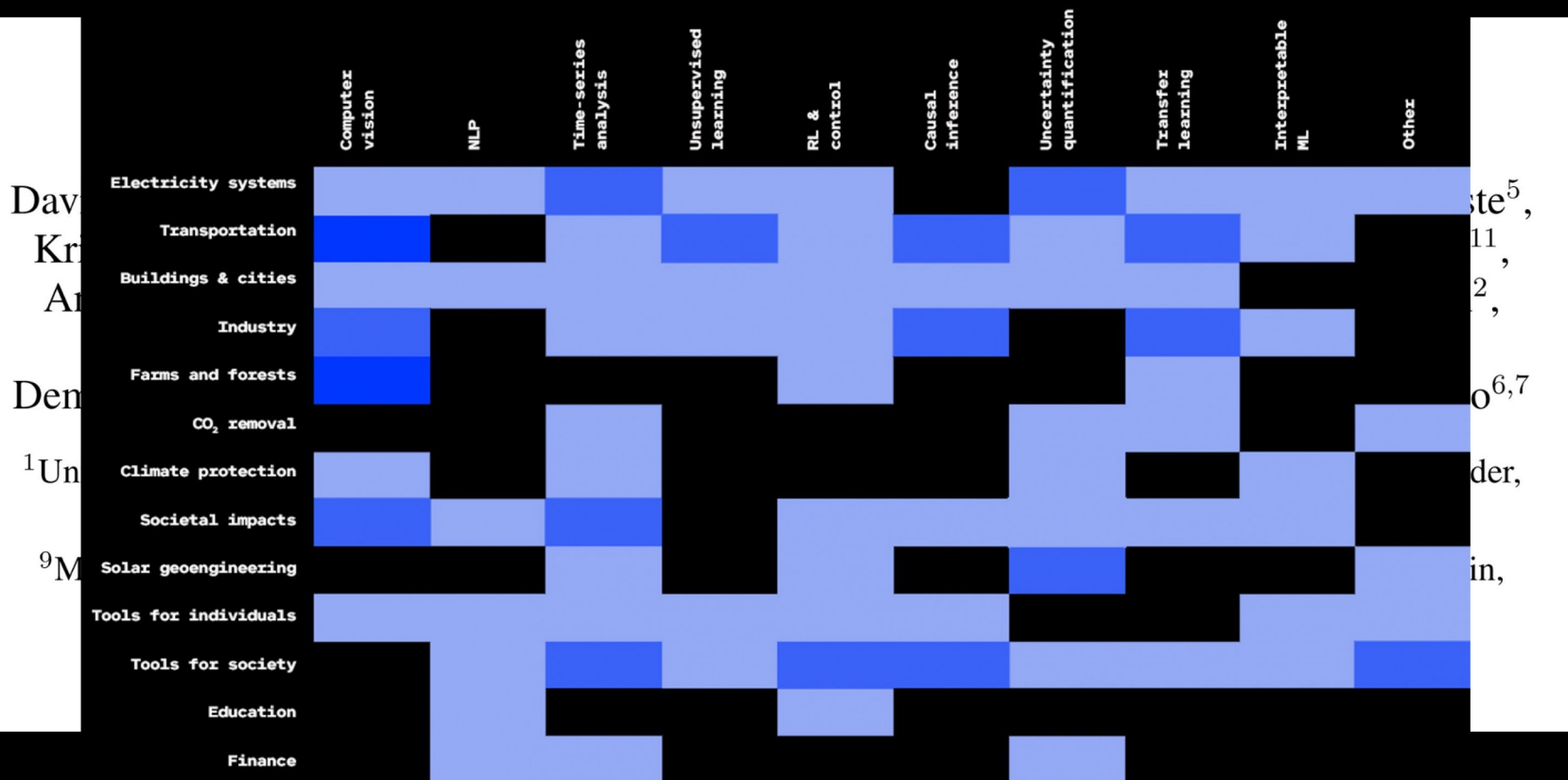




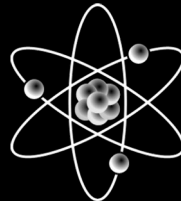
A high-angle, wide-view photograph of Earth from space. The horizon of the planet is visible, showing a thin blue line of the atmosphere against the blackness of space. The sun is positioned at the top center, creating a bright lens flare and illuminating the clouds below. The clouds are dense and white, covering most of the visible surface. The text "Climate Change: How can AI Help?" is overlaid in a white, serif font, centered horizontally and slightly below the vertical center.

Climate Change: How can AI Help?

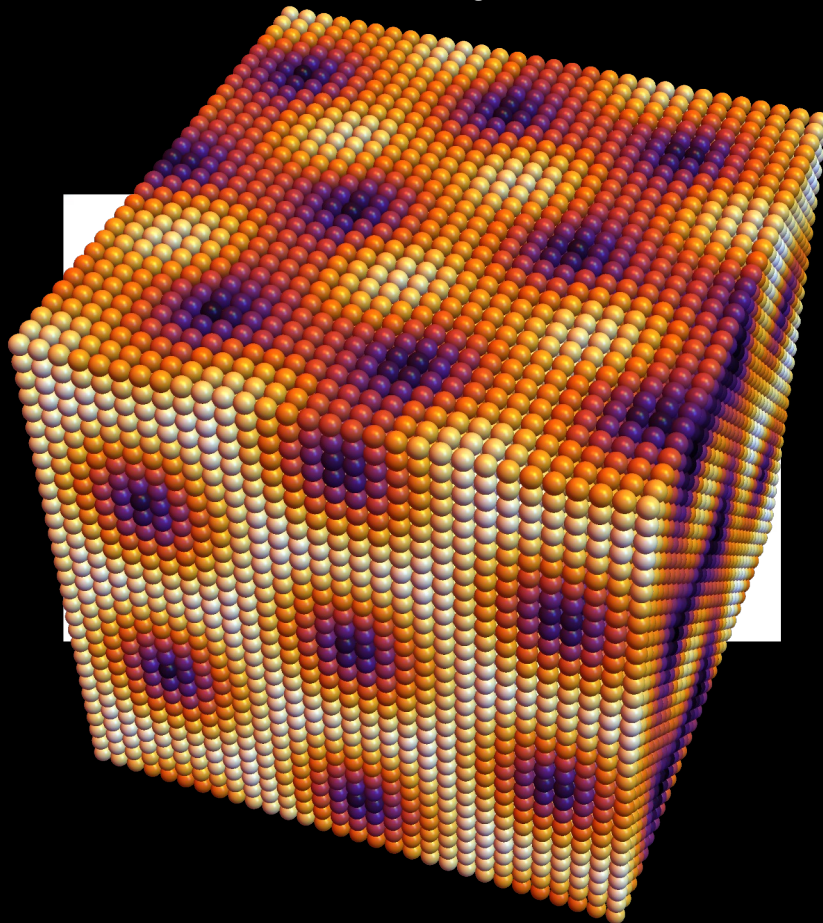
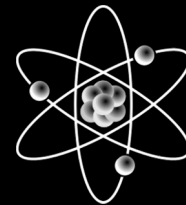
Climate Change AI



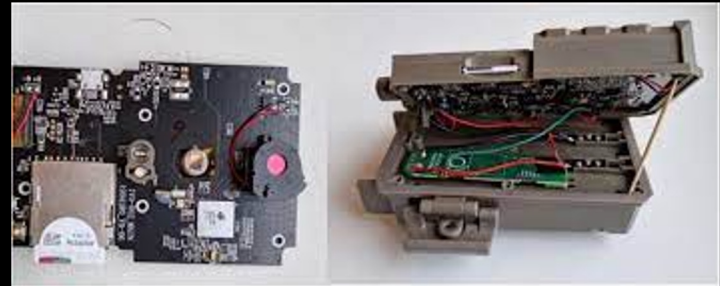
**From the micro
to the macro**



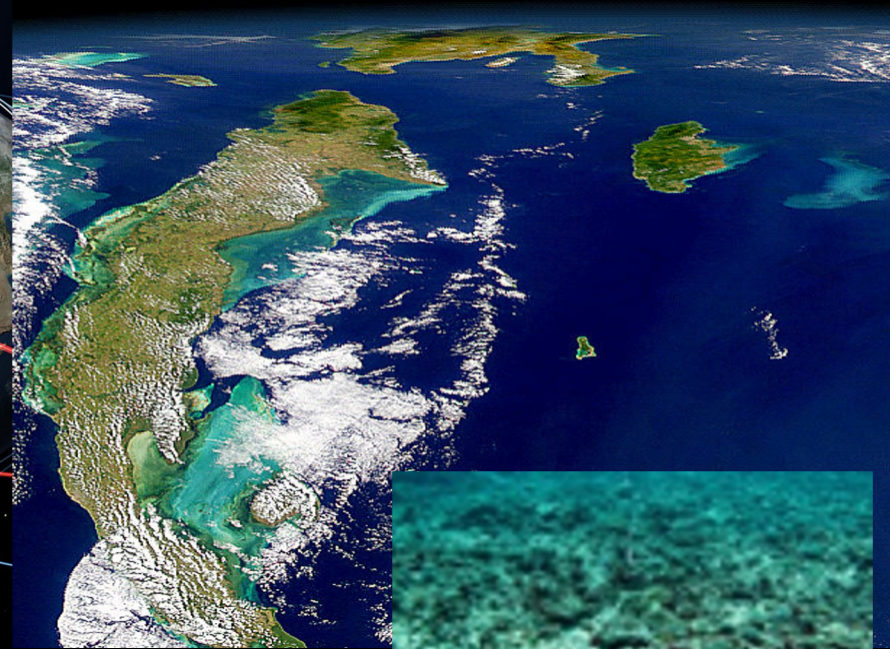
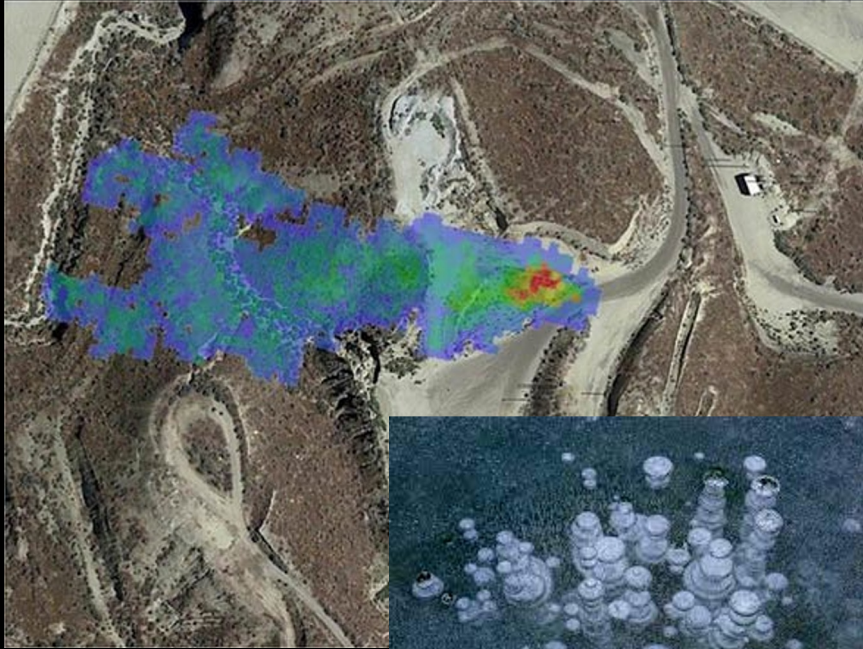
Micro: Molecular Discovery



Meso: tracking deforestation and biodiversity



Macro: detecting emissions and monitoring corals



Climate Change AI is a global not-for-profit that catalyzes impact at the intersection of climate change and machine learning.

Solar Geoengineering

- + **Understanding and improving aerosols: design** Long-Term
- + **Understanding and improving aerosols: modeling**
- + **Engineering a planetary control system** High Leverage Long-Term Uncertain Impact
- + **Modeling impacts** Long-Term

Individual Action

- + **Understanding personal carbon footprint**
- + **Facilitating behavior change** High Leverage

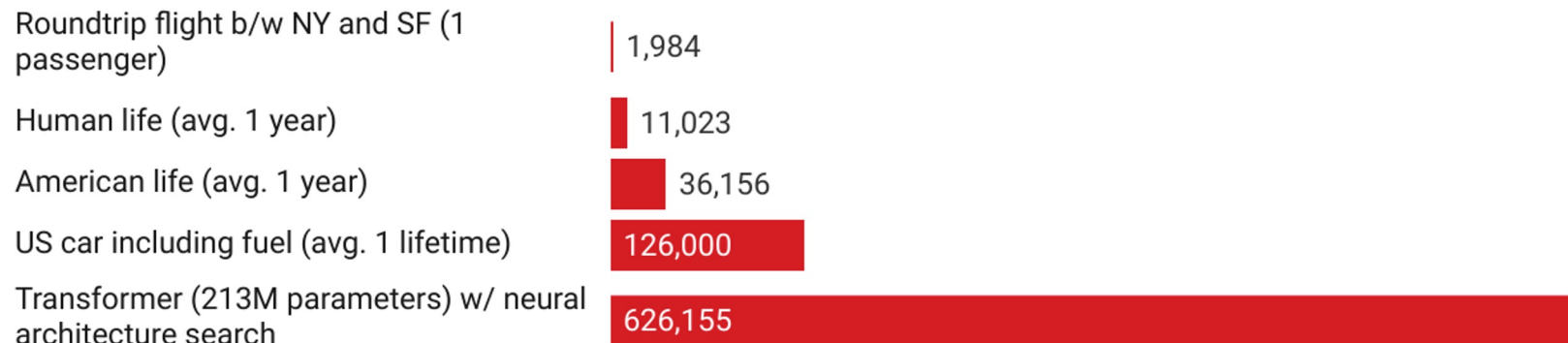


But AI comes with a cost to the planet

Training a single AI model can emit as much carbon as five cars in their lifetimes

Common carbon footprint benchmarks

in lbs of CO2 equivalent



Recent AI models and their environmental footprint

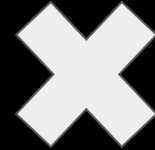
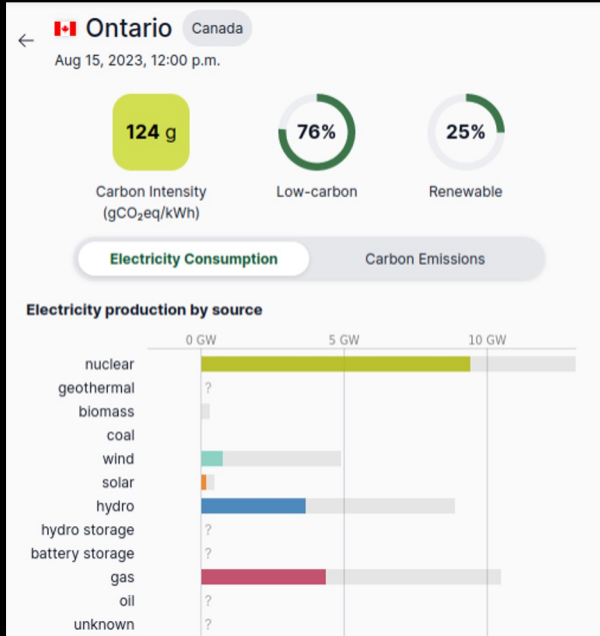
Model name	Number of parameters	Power consumption	CO ₂ eq emissions
GPT-3	175B	1,287 MWh	502 tonnes
Gopher	280B	1,066 MWh	352 tonnes
OPT	175B	324 MWh	70 tonnes
BLOOM	176B	433 MWh	25 tonnes

1 tonne of CO₂ is equal to...

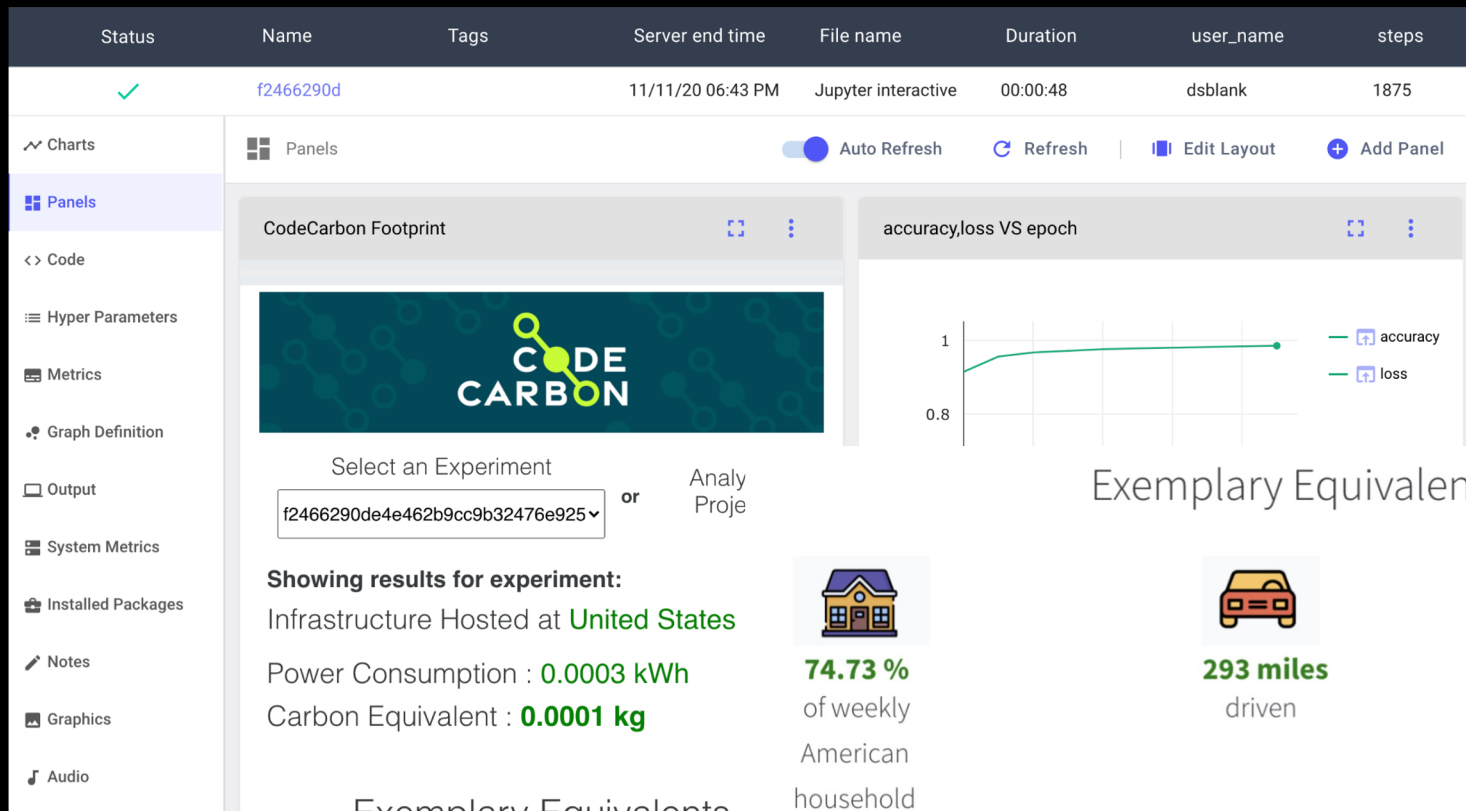
1 car on gasoline driving 6 months

1 transatlantic flight, e.g. NYC–London

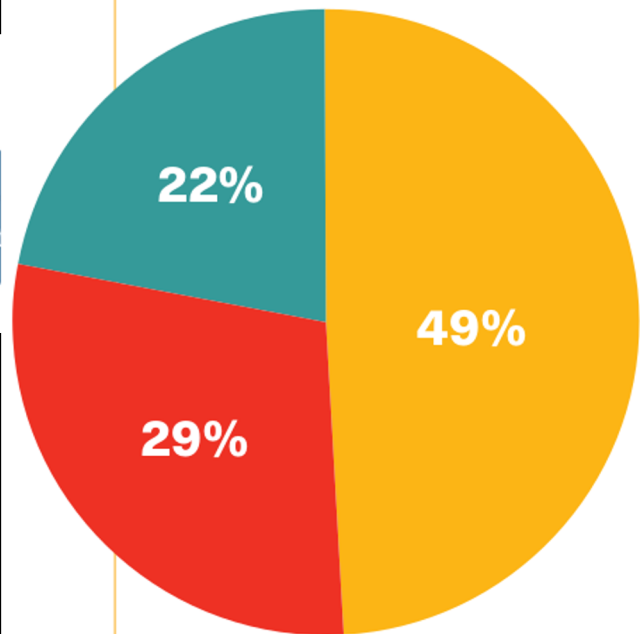
How we can estimate that



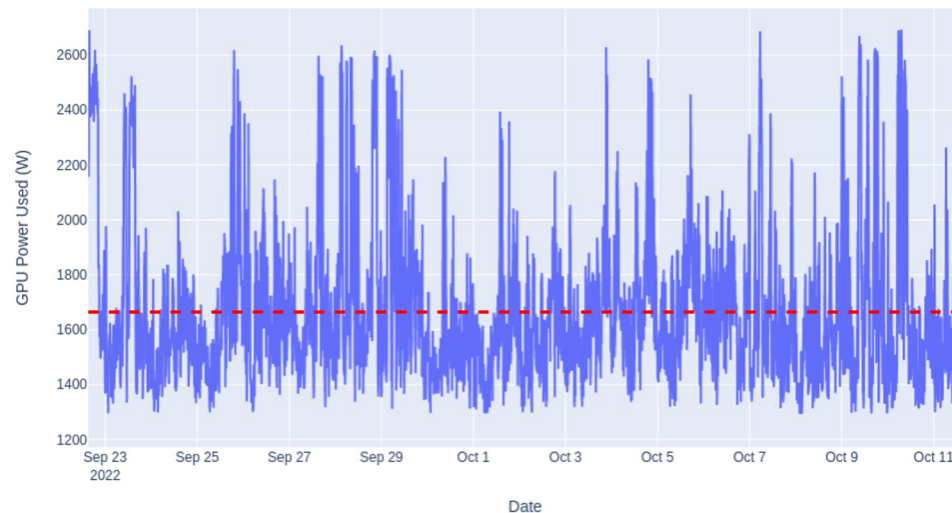
Measuring the Climate Emissions of ML



Above and beyond training

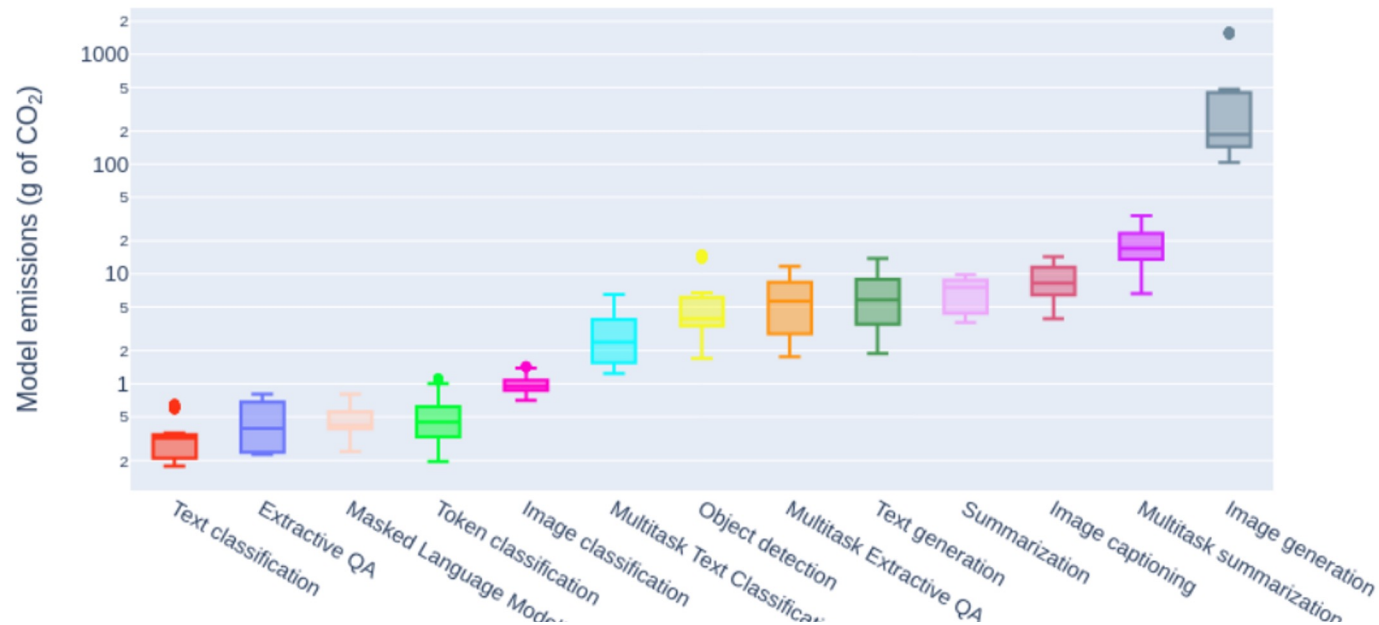


- EQUIPMENT MANUFACTURING
- DYNAMIC ENERGY CONSUMPTION
- INFRASTRUCTURE OVERHEAD



s · 59 languages · Open-access

Generative vs Discriminative Tasks



Generative tasks are more energy- and carbon-intensive compared to discriminative tasks.

Training vs. Inference

	BLOOMz-7B	BLOOMz-3B	BLOOMz-1B	BLOOMz-560M
Training energy (kWh)	51,686	25,634	17,052	10,505
Finetuning energy (kWh)	7,571	3,242	1,081	543
Inference energy (kWh)	1.0×10^{-4}	7.3×10^{-5}	6.2×10^{-5}	5.4×10^{-5}
Cost parity (# inferences)	592,570,000	395,602,740	292,467,741	204,592,592

Table 5. The BLOOMz models from our study with their training energy cost (from [31]), finetuning energy cost (from [34]), inference cost (from the present study), and cost parity, as the number of inferences required to sum to the training cost.

Training remains orders of magnitude more energy- and carbon-intensive than inference

AI Energy Star Ratings

The aim of this project is to develop an **Energy Star rating system** for AI model deployment that will guide members of the community in choosing models for different tasks based on energy efficiency.

★ AI Energy Star Rating Project ★

👥 People involved 👥:

@sasha, @yjernite, @IlyasMoutawwakil, @regisss, @sarahooker, Carole-Jean Wu,....

🌐 Website: Coming Soon!

🌐 Project Mission 🌐:

To develop an Energy Star rating system for AI model deployment that will guide members of the community in choosing models for different tasks based on energy efficiency.

🕒 Timeline (2024) 🕒:

mid-end Feb: project scoping and definition **early-mid March:** defining testing datasets and experimental protocol **mid-late March:** experimentation on HF cluster **April:** report writing + launch!



Please reach out if you want to collaborate on this!

Current and future legislation

FEBRUARY 01, 2024

MARKEY, HEINRICH, ESHOO, BEYER INTRODUCE
LEGISLATION TO INVESTIGATE, MEASURE
ENVIRONMENTAL IMPACTS OF ARTIFICIAL
INTELLIGENCE



EU AI Act: first regulation of
artificial intelligence

Society Updated: 19-12-2023 - 11:45
Created: 08-06-2023 - 11:40

*the measurement and logging
methods to enable calculations and
reporting of the environmental impact
of systems to comply with the
obligations in this Regulation,
including carbon footprint and energy
efficiency, taking into account state-
of-the-art methods and economies of
scale.*



A wide-angle photograph of Earth from space, showing the curvature of the planet and a dense layer of white clouds. The sun is visible in the upper center, creating a bright lens flare and illuminating the scene. The text "So, what can we do?" is centered in a white, serif font.

So, what can we do?

Increased transparency will help compare
the **costs** and **benefits** of AI and make more
informed decisions

Not all AI models have a huge
environmental footprint, and it's
important to focus on **smaller, more
efficient models**

ISO certification for ‘Green AI’
to guide & incentivize sustainability

AI is not a silver bullet, but can be a **key part** of a series of informed solutions to tackle the climate crisis.

A high-angle, wide-view photograph of Earth from space. The horizon of the planet is visible, showing a thin blue line of the atmosphere. Below the horizon, the Earth's surface is covered in a dense layer of white clouds, with some darker patches of land or water visible. A bright sun is positioned in the upper center of the frame, creating a strong lens flare effect that radiates across the top half of the image. The overall color palette is dominated by deep blues, whites, and the golden-yellow glow of the sun.

Thank you for your attention!