Master's Thesis Proposal

Title: *EcoIA – Contextual Evaluation of the Environmental Impact of Artificial Intelligence in Research*

Supervisors:

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Context and Motivation

Artificial Intelligence (AI) has become deeply embedded in scientific research practices, from data analysis and simulation to knowledge discovery. However, the environmental footprint of these technologies is now a major concern. Data centers already account for almost half of the digital carbon footprint in France, and the intensive use of AI — especially Large Language Models (LLMs) — is significantly amplifying this impact.

Despite growing awareness, **most evaluations of AI's environmental cost remain simplistic**, focusing only on model size or the electricity consumed during training or inference. These metrics fail to capture the **contextual nature** of impact: the same model can have very different footprints depending on how, when, and where it is used. To promote more sustainable research practices, new tools are needed to **measure and contextualize** the environmental impact of AI in scientific workflows.

Objectives

The **EcoIA project** (Contextual Evaluation of the Environmental Impact of AI in Research) aims to create a **practical and contextualized indicator** of the environmental footprint of AI models. This indicator will guide researchers in selecting and using AI tools more responsibly, based on transparent and reproducible metrics.

The Master's student will:

1. Conduct a **state-of-the-art review** of existing assessment frameworks and tools (e.g., EcoLogits, CodeCarbon, AFNOR SPEC 2314).
2. Identify the **key contextual variables** influencing AI's environmental cost: model architecture, hardware efficiency, execution time, usage frequency, and research domain.
3. **Design and prototype** an indicator integrating these parameters into a usable decision-support tool (e.g., Python library or web interface).
4. **Validate the approach** through real-world case studies in different research contexts (e.g., natural language processing, data analysis in social sciences).

Candidate Profile

We seek a motivated student with:

- Knowledge of **AI or data science** (Python, model APIs, computational workflows).
- Interest in **environmental sustainability and responsible AI**.
- Analytical and interdisciplinary skills, and an ability to link technical evaluation with ethical or ecological reasoning.

Expected Outcomes

The thesis will deliver a **validated prototype** for assessing the environmental impact of AI in research and propose a **conceptual framework** for "contextual frugality" — a way to align scientific innovation with ecological responsibility.