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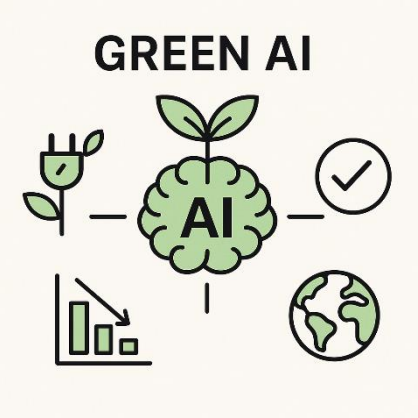
Energy Profiling & Carbon-Aware AI Model Comparison



Background:

The growing deployment of large-scale machine learning models has led to rapidly increasing energy consumption and environmental impact. Green AI research focuses on optimizing models and systems not only for accuracy but also for efficiency and sustainability. This project investigates the energy usage and carbon footprint of different neural network architectures and precision settings during inference on GPUs. Students will perform systematic energy profiling using available measurement tools and convert these measurements into carbon-aware metrics (e.g., CO_2 per inference). The results will enable fair comparisons between models under a sustainability perspective and foster awareness of energy-efficient AI design.

Tasks:

- Gain an understanding of the fundamentals of Green AI and energy-efficient machine learning.
- Study existing energy and carbon measurement tools
- Set up a GPU measurement environment and log power, energy, and runtime for model inference.
- Select 4–5 representative deep learning models and measure their inference performance and power draw.
- Calculate total energy consumption (kWh) and translate to carbon emissions (gCO_2) using standard conversion factors for grid electricity.
- Evaluate and visualize the trade-offs between accuracy, latency, energy, and carbon footprint.
- Discuss measurement limitations, regional carbon intensity differences, and future extensions
- Prepare a written report summarizing findings and recommendations for low-carbon AI inference.

Keywords:

Green AI, energy profiling, carbon awareness, GPU inference

Contact:

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- Language: English