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Technologies de l'information — Intelligence artificielle — Aspects de durabilité environnementale des systèmes d'IA

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Foreword

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Introduction

Unprecedentedly large and ever-growing deep learning models, large language models, natural language understanding networks and generative AI applications require vast data storage capacities, take weeks to train, are running continuously and require a lot of compute power as well as memory to load the models. And once completed they consume substantial amounts of network connectivity bandwidth in operation. Sixty per cent of IT industry carbon emissions come from the downstream use of products by customers.

The use of power intensive GPUs to run machine learning training (and non-AI uses such as crypto currency mining) has already been cited as contributing to increased carbon dioxide emissions.[1] Many machine learning packages have been modified to take advantage of the extensive parallelism available inside the average graphics processing unit. Often this resource intensity is used to exemplify environmental concerns with AI systems.

According to the World Economic Forum and experts in the field, AI has “the potential to accelerate environmental degradation, and is already doing so” [1,2]. In 2022, the OECD’s Policy Observatory [3] that provided input into basic framework for understanding, measuring and benchmarking domestic AI computing capacity by country and region, did not consider environmental sustainability in its charter [4].

The AI system life cycle does provide opportunities to consider and positively influence the environmental sustainability aspects of the system: for example, using and applying teacher–student models [5] in deep neural networks represents a trade-off between more learning and better inference performance when in production.

Improving in-operation product performance can, conversely, aid sustainability. Publications from the European Union,[6,7] the United States,[8-10] the United Nations [11,12] and other regional [13] and global think tanks [14] have called for better understanding and disclosure with regards to ICT’s environmental footprint and that of AI systems in particular.