Approximate Computing: A way towards Sustainability

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Abstract

As the United Nations organisation states on its website [1], "Climate change is the defining issue of our time and we are at a defining moment.". Human activities, including Information and Communication Technologies (ICTs), are a major driver of accelerated climate change [1]. Faced with this daunting challenge, the different stakeholders (*i.e.,* decision makers, scientists, general public) are urged to act [2]. Even though ICTs are contributing to the increase of the CO_2 emissions with their ever increasing usage, they can also help in tackling the climate change acceleration, and in reaching more sustainability. More particularly, we argue that, when focusing on software, the approach of Approximate Computing (AC), based on applying an accuracy-performance trade-off, is a determining tool. It can address two strategies: (i) making the use of software more environmentally friendly (*i.e.,* Green Software), and (ii) using software to achieve greater sustainability, *e.g.,* in the context of decision making (*i.e.,* Software Engineering for Sustainability). Through two examples, we show the potential of AC to achieve more sustainability, using more energy-efficient software and software as a decision-support tool. The first use case applies AC to complex and time-consuming simulation models to provide decision makers with an interactive tool to explore climate prediction scenarios and to assess flood risks, in order to support them in making more sustainable land use decisions. The experimentation demonstrates the ability to drastically decrease the simulation time while preserving acceptable results with a minimal set-up [3]. The second use case concerns the reduction of the colossal energy consumption of training artificial intelligence models by applying the AC approach in reducing the size of the data sets. Our results show evidence that, by exclusively conducting modifications on datasets, energy consumption can be drastically reduced (up to 92.16%), often at the cost of a negligible or even absent accuracy decline [4].

Index Terms

Approximate Computing; Sustainability; Software Engineering

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