# Approximate Computing: A way towards Sustainability

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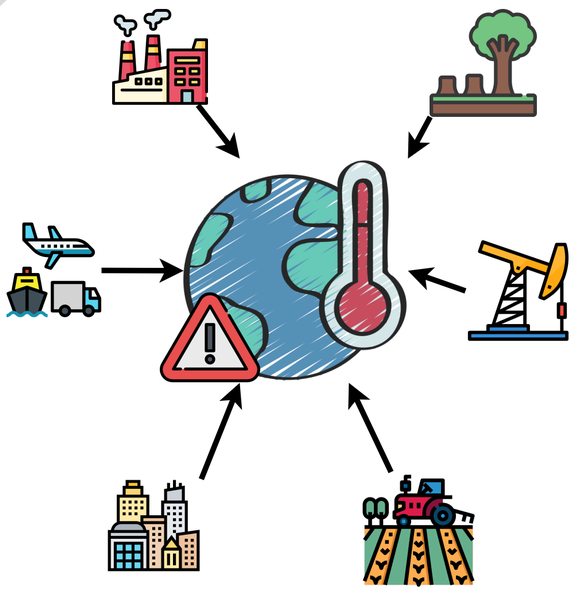
## Software is (h)eating the world!



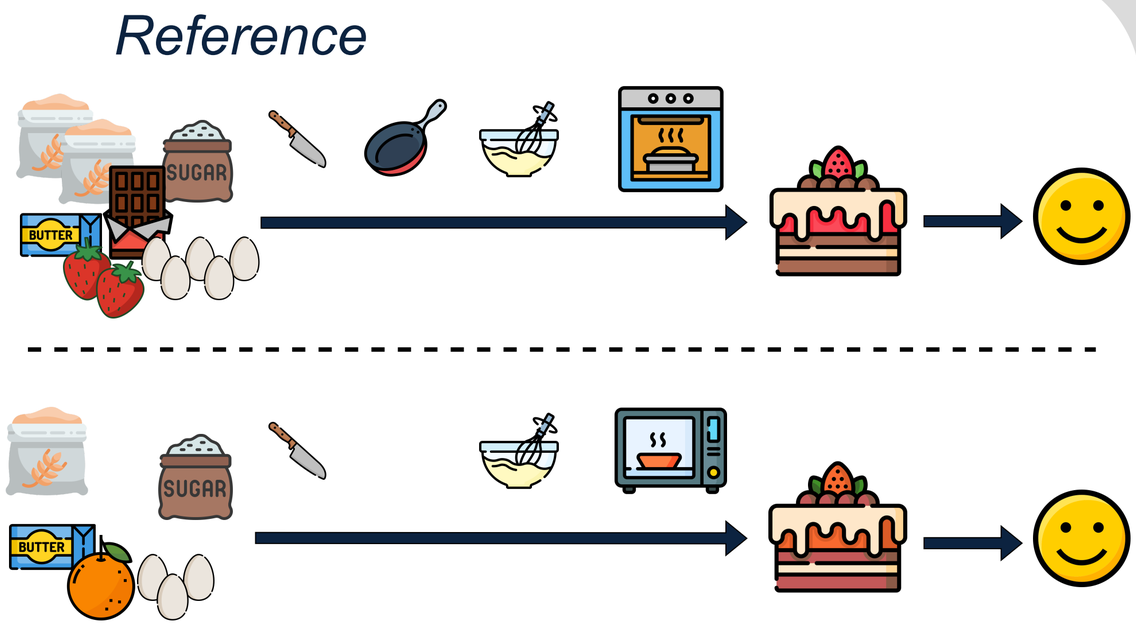
*"Climate change is the defining issue of our time and we are at a defining moment."*
Human activities play a significant part in this issue (e.g., industry, deforestation, transportation, agriculture, fossil fuels, buildings). Software is not only eating the world, but is involved in all activities accelerating climate change to some extent. Software is rather heating the world!

**How can the role of software be changed from villain to hero regarding sustainability?**


## Approximate Computing *(or Good-Enough Baking)*

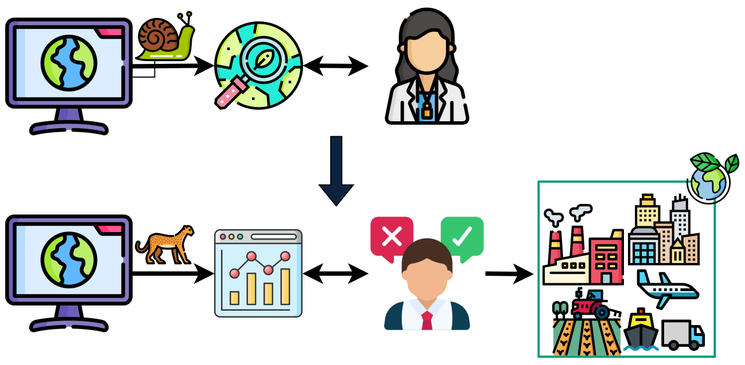
Approximate Computing (i.e., AC) is based on the principle of a *trade-off between accuracy and performance* (either execution time or energy consumption in this context).

In baking, when our goal is to save time or effort, we simplify the recipe, reducing and adapting the ingredients and steps. The cake is a bit different but still tastes good and satisfying. Similarly, software execution can be adapted to a new purpose by reducing or simplifying the data (ingredients) and the algorithm (steps), while ensuring valid good-enough results.




## Sustainability BY Software

Scientific simulation software is elaborated by scientists to understand real-world phenomena. Such software is complex and long to execute. Hence, software is not interactive, and not usable to support the decision making of stakeholders impacting activities involved in climate change.

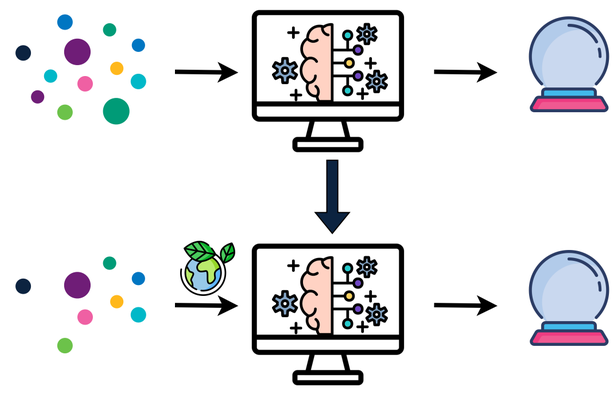


We apply AC to speed up the simulation execution. We adapt the software (data & algorithm) by reducing the number of iterations of the simulation. The experimentation shows a median speed-up of **95.13%**.

## Sustainability IN Software

With the growing availability of large-scale datasets, and the popularization of affordable storage and computational capabilities, the energy consumed by AI is becoming a growing concern.

We apply AC to investigate the potential impact of modifying datasets to improve the energy consumption of training AI models. Our results show evidence that energy consumption can be drastically reduced (up to **92.16%**).



## Take-Away Messages

- **Good-enough** is great for sustainability!
- These studies pave the way for **impactful** and **innovative** applications of AC for more sustainability.
- Need to include sustainability as a **software requirement.**
- Software has a crucial role to play in **tackling Climate Change**. AC is a way to make it take the role of a hero in the battle.

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