Applications of Machine Learning in Green Computing
AKA Help Save the World

After attention, energy is the most precious resource in computing. Computing systems comprise hardware platforms on which software is executed. Even though low-power hardware has been an active discipline for more than 20 years, the same certainly does not hold for software. But it is the software that governs the hardware.

Meanwhile, Moore's Law keeps dying. Multi-processor systems are now the norm, and their meaningful utilization demands the sacrifice of any hope to produce readable, simple, high-level code. Engineers will soon have squeezed out the last drops of performance/watt on modern commodity hardware. And then what?

Enter the domain of Green Computing. An as of yet fragmented domain of science which tries to unify energy efficiency methods along all abstraction layers (from machine instructions to, say, Python applications) and across all components of a computer (computation, storage, communication). We no longer have the luxury to ignore what happens under the hood. We need an integral view of how energy is spent in the machine, and how to manage it in an optimal way.

The student(s) assigned this thesis will produce a non-trivial paper about an intelligent Green Computing application of their choice. The subject is wide enough to provide individual theses to more than one student, or teams.

CONSTRAINTS:

- The work should be Green, in the sense that it views energy as its Holy Grail.
- A learning mechanism will have to exist at the core (examples: graph neural networks, causal reasoning, federated learning).
- Full time commitment for at least 9 months. No pending courses.
- Manolis Kellis' process for writing papers will be followed. We want to go from ideas to results, not the other way around.
- Weekly discussions on the progress of the paper will be held. Concise reports will be written and communicated after each discussion.
- **No easy stuff.**

READING MATERIAL:

1. System-level power optimization: techniques and tools
2. The design, implementation, and evaluation of a compiler algorithm for CPU energy reduction
3. A survey of design techniques for system-level dynamic power management

CONTACT:

Christos Lamprakos (cplamprakos@microlab.ntua.gr)
Prof. Dimitrios Soudris (dsoudris@microlab.ntua.gr)