

Titolo: Development of AI algorithms for digital systems power consumption analysis and control

As effect of the of the Dennard's scaling and with the steaming out of the Moore's law, computer architectures in a wide range of market segments (i.e. embedded systems, cyber physical systems and high-performance computing) are becoming power constrained, complex and heterogeneous. In the HPC systems this made performance improvements possible only with energy-efficiency gains. Not only energy efficiency is important but also absolute power consumption as heat-removal cost and facility constrains these systems. In embedded computers energy-efficiency translates directly in battery life time which is of primary concern in many applications. Finally, in Cyber-physical systems (CPS) power consumption cannot be considered only for the digital electronics, but must account also for the mechanical parts and communication. The latter expands the previous two use-cases (HPC and embedded) relying on complex software stacks composed of real-time operating systems, network stacks with mesh connectivity to support multi-agents cooperation and integration with mechanical parts.

RESEARCH ACTIVITY (Attività di ricerca)

(ENG)

The research activity aims to develop: i) a testbed combining HPC, embedded and CPS devices to evaluate the power consumption under realistic workload; the workload will consists of applications leveraging AI components. ii) the optimization of these algorithms on the target platforms; iii) the development of AI/ML-based models for predicting the power consumption and the power hotspot.

This research activity is part of REGALE project and TII research project.

(ITA)

L'attività di ricerca mira a sviluppare: i) un banco di prova che combini dispositivi HPC, embedded e CPS per valutare il consumo energetico sotto scenari d'uso realistici; tali scenari consisteranno in applicazioni che sfruttano i componenti dell'IA. ii) l'ottimizzazione di tali algoritmi sulle piattaforme target identificate all'interno del progetto; iii) lo sviluppo di modelli basati su AI/ML per la previsione del consumo energetico e dell'hotspot di potenza.

Questa attività di ricerca è parte del progetto EuroHPC REGALE e del progetto TII.

ACTIVITY PLAN

The researcher will acquire or consolidate, in parallel with the research activity, the knowledge of: i) HPC, embedded and CPS systems; ii) AI applications for those scenarios; iii) power modelling and optimization. The research activity will be done in the context of the REGALE project and TII projects.

The research will encompass the following phases:

- Survey of the HPC, embedded and CPS commonalities and characteristics
- Selection of application scenarios and realization of selected testbed
- Monitoring of the power consumption under different conditions
- Modelling and optimization of the systems under power constraints.