PhD on the topic:FPGA-accelerated emulation framework for self-aware neuromorphic system-on- chip architectures

The REACT MSCA DN Project: Self-awareness in humans is an innate capability, arising from the brain's ability to process a multitude of sensory inputs. Emulating this functionality in electronic systems—commonly referred to as neuromorphic computing—holds the potential to create highly intelligent machines capable of supporting a wide range of everyday applications, from autonomous vehicles to smart navigation systems. However, realizing neuromorphic computing in practice presents significant challenges, particularly in the areas of energy efficiency, reliability, and security.

The REACT MSCA Doctoral Network addresses these challenges by developing a neuromorphic platform that is inherently self-aware in terms of energy consumption, secure operation, and system reliability. As part of this initiative, 15 Doctoral Candidates (DCs) will be trained through a comprehensive, interdisciplinary program spanning material science, device physics, computer architecture, hardware prototyping, compiler design, simulation and emulation tools, as well as cybersecurity, reliability, and system verifiability.

REACT offers a uniquely structured training environment, combining academic excellence with industrial collaboration. DCs will benefit from close mentorship by leading researchers and industry experts, while also developing essential skills in scientific writing, research ethics, time management, and entrepreneurship.

By the conclusion of the REACT project, participants will be well-equipped to pursue impactful careers across academia and industry, with the REACT program serving as a strong foundation for their future success.

Organization:

UMONS INFORMATION

The **Electronics and Microelectronics Department (SEMI)** at the **University of Mons (UMONS)** is a dynamic research unit specializing in **integrated circuit design, signal processing, embedded systems, and AI hardware**. As a key member of the **Infortec** (ICT) and **Numediart** (digital media) institutes, brings together over **150 researchers**, SEMI is working on cutting-edge technologies, from low-power microelectronics to intelligent sensor systems. With strong industry collaborations and a robust publication record in top-tier journals and conferences, SEMI offers an exciting environment for PhD candidates to contribute to innovative projects in **IoT, biomedical electronics, and beyond**.

A 3-year interdisciplinary PhD position is available. The position is funded by MSCA DN for 36 months. The candidate is expected to undertake secondment(s) during the first three years of the project.

DC 14 Proposed PhD Title: *FPGA-Accelerated Emulation Framework for Self-Aware Neuromorphic System-on-Chip Architectures*

100-Word Project Description

Current RRAM-based neuromorphic emulators on FPGAs remain limited to device-level characterization and cannot assess full-stack compatibility of self-aware architectures. This PhD will design and validate an FPGA-accelerated emulation framework that maps emerging non-volatile memory, adaptive routing, and on-chip learning mechanisms onto a reconfigurable SoC. By coupling cycle-accurate hardware models with runtime electronics, the platform will deliver in-situ energy, latency, and fault-tolerance metrics thousands of times faster than software simulation. The framework will support early algorithm development, automated design-space exploration, and cross-technology benchmarking, providing unprecedented insight into the co-evolution of hardware and learning rules for future edge-intelligent systems at global scale.

Supervisors: Prof. Carlos Valderrama carlos.valderrama@umons.ac.be (Dr. Alessandro Brunetti a.brunetti@iqrypto.com)

Qualification & Eligibility:

- Our selection procedure follows the guidelines of the European Commission's European Code of Conduct for recruitment of researchers: https://euraxess.ec.europa.eu/jobs/charter/code
- Mobility Rule: Candidates must not have resided or carried out their main activity in “host country” for more than 12 months in the 3 years immediately before the recruitment date.
- PhD Rule: Applicants must not already possess a doctoral degree at the date of recruitment.
- Master’s in Electrical/Computer Engineering (or equivalent), with excellent grades and focus on FPGA design, embedded systems, or neuromorphic computing.
- Technical skills: FPGA development (Xilinx/Intel) using VHDL/Verilog, Hardware-software co-design or edge-AI acceleration.
- Desired: hands-on experience with EDA tools (Synopsys/Cadence), proficiency in MLIR/Python for simulation/emulation, familiarity with neuromorphic architectures (SNNs/ANNs), ReRAM, or in-memory computing and knowledge of emerging memories (RRAM/FeRAM) or hardware security (e.g., PUFs).
- We seek candidates with strong programming/scripting skills, excellent English communication, polished presentation abilities, and a collaborative team-player attitude.

Conditions of employment:

We offer you in accordance with the Collective Labour Agreement for **Universities**:

- A salary of €3025 gross per month, for the duration of the convention, based on a full-time position. Net salary would be +/- 2589 €
- The holiday bonus and end-of-year bonus are already included in the amount of the grant.
- A temporary position of one year with the option of renewal for another two years; prolongation of the contract is contingent on sufficient progress in the first year to indicate

that you will successfully complete your PhD thesis within the three years. A PhD training programme is part of the agreement.

- **Intended start date: December 1st, 2025**.

Application:

Please submit the following material, concatenated in a single PDF file and upload this file as your 'CV' by means of the application form at Vacancies – project-react.eu.

- A cover letter motivating your application and detailing the motivation to apply for this specific PhD project (1 page max).
- An academic CV.
- A research statement (2 pages max) describing your personal research interests and previous research projects.
- A certified list of grades from your undergraduate degree(s) up to the moment of application (in case your MSc degree has not yet been awarded).
- The names and e-mail addresses of 2 academic referees who are willing and able to write recommendation letters for you, including the supervisor of your MSc research project.

- You may apply for this position until **August 15 2025** by means of the project website Vacancies – project-react.eu Applications will be evaluated as received.