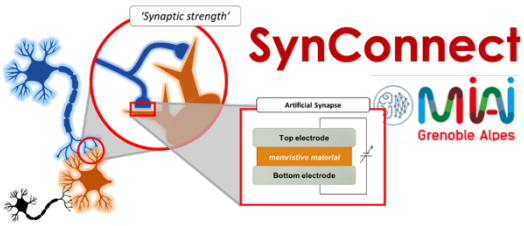
Techniques of
Informatics and
Microelectronics for Integrated Systems
Architecture

TIMA

LMGP

Laboratoire des
Matériaux et du
Génie
Physique



Study and development of Spiking Neural Network (SNN) with bio-plausible learning algorithm based on La2NiO4 memristive synapses

Position: Post Doctoral researcher
Starting date: before 31/12/2022
Duration of the project: 12 months
Salary: 2900 € (gross monthly)

Context of the research work

The computing performance needed by emerging electronic applications (such as Internet-of-Things) is posing a serious challenge to current computer architectures and technologies, required to provide increasing computing power while withstanding severe constraints on size, energy consumption and reliability. Conventional Von-Neumann architectures and memories are not likely to fulfill all the needs of modern applications, due to inherent technological and conceptual limitations. Hence, in order to be at the forefront of the electronic industry in terms of design and manufacturing capabilities, it is essential to focus research and innovation efforts on the development of novel non-Von Neumann architectures enabled by emerging technology devices. In this context, the **neuromorphic computing paradigm** has a huge potential when it makes use of **emerging technologies such as memristors**.

The SynConnect project focuses on the analysis and development of a Spiking Neural Network (SNN) with bio-plausible learning algorithm optimized for the use of La2NiO4 devices as artificial synapses. The learning should be executed on hardware and applied on each synapse independently of the global state of the network; therefore, the synapse must be doted of computation capabilities. The goal of the project is to demonstrate, at small scale, the feasibility of a La2NiO4-based SNN and understand the main advantages and shortcomings (from technology and application) such that concomitant optimization of device and algorithm can be performed to guarantee the achievement of a truly efficient bio-inspired electronic system.

The SynConnect project has three **main objectives**:

- To develop the SNN algorithm which allows for the use of specific synaptic dynamic models,
- To design and test the SNN architecture which will run the previously developed algorithm,
- To optimize the neural algorithm and architecture for high accuracy training based on the measured properties of the La2NiO4 devices.

cnrs

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Work environment

This research grant is funded by the University of Grenoble Alpes, via the MIAI (Multidisciplinary Institute in Artificial intelligence) program. The SynConnect is a pluri-disciplinary project and it will be hosted by 2 laboratories: **TIMA & LMGP, Grenoble, FR.** The candidate will have access to all the facilities present in the LMGP, the TIMA lab, the university and all the necessary platforms and resources, including with direct access to the Consortium des Moyens Technologiques Communs (CMTC), the Upstream Technology Platform (PTA) - MINATEC and the Centre Interuniversitaire de MicroElectronique et Nanotechnologies (CIME) technological platforms.

Profile of the researcher:

We are looking for a highly-motivated candidate with a PhD degree in a related field of microelectronics technologies, and/or new advances in Artificial Intelligence. Interpersonal skills, dynamism, rigor and teamwork abilities will be appreciated. Candidates should be fluent in English and have good English writing skills.

Application instructions:

A complete application consists of:

- **Cover page:** short motivation of the applicant and connection with the position, including how this position serves future career goals. Include name and contact information of applicant (1 page max)
- **CV:** Academic and professional background, detailing relevant experience, particularly research.
- **Relevance for Application:** The applicant should include a clear description of how his or her scholarly background and expertise is applicable, and might add value, to the project set out above.

Our team welcomes applicants with diverse backgrounds and experiences. We regard gender equality and diversity as strength and an asset.

Advisors:

Elena Ioana Vatajelu, CNRS Researcher – TIMA Laboratory
Monica Burriel, CNRS Researcher – LMGP Laboratory
Celine Ternon, MCF INPG – LMGP Laboratory

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