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Internship proposal (6 months)

Neuromorphic Machine Learning - Algorithms and Prototyping for Energy Efficient Artificial Intelligence (reference SASIN053)

Internship supervisor

Mitsubishi Electric R&D Centre Europe**:** Nguyen Viet-Hoa, Senior researcher

Overall context

Member of the MITSUBISHI ELECTRIC Group, the Japanese leader in the development and manufacture of electrical and building equipment, the MITSUBISHI ELECTRIC R&D CENTRE EUROPE FRANCE (MERCE-FR) based in Rennes is the French branch of the European R&D centre within Mitsubishi Electric's Corporate R&D organization. MERCE-FR conducts its R&D activities around two main axes: digital information systems (DIS Division – Digital Information Systems) and power electronics (PES Division – Power Electronic Systems).

The technical work proposed here falls within the scope of the DIS division and, more specifically, of the SAS - Synergistic Autonomous Systems team - which focuses on the development and optimization of systems in vehicular, rail, satellite, industrial, robotic and related contexts. As embedded devices and autonomous systems demand more intelligent processing at the edge with strict energy and latency constraints, neuromorphic computing and neuromorphic machine learning offer a promising path: brain inspired spiking neural networks (SNNs), event driven sensing, and specialized neuromorphic hardware enable low power, low latency perception and control. This internship will contribute to MERCE's strategy of developing sustainable and frugal AI systems.

Internship subject

The objective of this internship is to develop the student's applied research skills in neuromorphic machine learning and to deliver experiments and prototype evidence that neuromorphic approaches can meet MERCE product constraints (energy, latency, robustness) for a clearly defined use case. The intern will investigate algorithms, training, and evaluation protocols for spiking neural networks (SNNs), then implement and benchmark at least one end-to-end pipeline in simulation.

Detailed objectives

- Targeted literature review of SNNs, conversion techniques from deep networks to SNNs and available neuromorphic hardware/emulators.
- Selection and definition of a concrete application use case aligned to MERCE needs (examples: low power anomaly detection in industrial sensors, nonlinear adaptive control for robotics).
- Design and implementation of neuromorphic model(s) and training/conversion pipelines using appropriate frameworks and methods.
- Implementation of simulation and evaluation pipelines (e.g., Nengo, Brian2, Norse).

- Comparative evaluation against conventional ML baselines in terms of accuracy, inference latency, energy consumption, and robustness under realistic noise/latency conditions.
- Documentation of code, experimental protocols, and preparation of a demonstration and technical report for internal review.

Prerequisites

- Interest in neuromorphic computing/machine learning, spiking neural networks and energy-efficient AI.
- Strong background in machine learning/Artificial Intelligent.
- Capacity to develop experiments in Python.
- Autonomy, initiative
- Good communication skills in English (written and spoken).
- Preferred: prior exposure to neuromorphic computing/machine learning, spiking neural networks, SNN toolkits (Nengo, Brian2, norse, BindsNET).

Duration: 6 months

Period: from … (possibility of flexibility, depending on schools' internships periods)

Contact : Magali BRANCHEREAU (jobs@fr.merce.mee.com)

Thank you for sending your application (letter and CV) with the internship reference.

The signature of an Internship Agreement with your school is mandatory.