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Master and Engineer Internship: 2023-2024

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Title : Neuromorphic Sensing System for Embedded AI applied to IoT

Abstract :

The objective is to achieve a real breakthrough in the field of the Internet of Things (IoT) through a new approach inspired by biology. This approach, for which the first proofs of concept have already been validated, will be carried out on the basis of an industrially mature CMOS technology node. The main objectives are to study, optimize and realize a neuromorphic system with ultra-low energy consumption (1000 times better than existing technologies). The targeted system will be completely integrated (SoC - System-on-Chip) and of very small size (a few mm²). This SoC will present all the functionalities of a communicating sensor, which will be able to develop, thanks to learning carried out using a 3rd generation AI (impulse neural network), cognitive functions such as the recognition and classification of stimuli from different modalities perceived by the sensor in its immediate environment (Edge-computing). After classification, its functions will enable it to transmit only relevant data to the cloud and thus avoid the congestion of IOT frequencies induced by blind data transmission between sensors.

Locks to be lifted

The motivations are to achieve record energy efficiency (reduction of current energy consumption by a factor of one thousand) of communicating sensors and to realize a brand new technology for transmitting information between sensors based on a bio-inspired self-learning process. By mimicking biology, such a cognitive system will be able to operate in extreme noise conditions and will take an essential step towards autonomous systems inspired by living beings.

Background

This subject is part of a regional context in which it is necessary to reinforce the development of embedded A.I. with industrialists, particularly in the field of IoT. Based on a patented neuromorphic technology involving techniques for achieving industrial maturity (CMOS technology), the device developed in the context of this study will have a high TRL level (7) in order to facilitate its technological transfer and reduce time-to-market. The development of this technology, initiated at IEMN, is currently supported by SATT-Nord in the framework of co-maturation projects. The objective is to develop, in the regions, a strong activity in the field of the development of integrated neuromorphic systems in connection with regional and national actors of the 4.0 industry, home automation and transport.