MIAI – Joint industry/academy PhD grant

SECTOR: Higher Education Institution

LOCATION: France, Grenoble

RESEARCHER PROFILE:
　　□ First stage researcher

INSTITUTIONS:

Univ. Grenoble Alpes, University of Innovation One of the major research-intensive French universities, Univ. Grenoble Alpes[1] enjoys an international reputation in many scientific fields, as confirmed by international rankings. It benefits from the implementation of major European instruments (ESRF, ILL, EMBL, IRAM, EMFL*). The dynamic ecosystem, grounded on a close interaction between research, education and companies, has earned Grenoble to be ranked as the 5th most innovative city in the world. Surrounded by mountains, the campus benefits from a natural environment and a high quality of life and work environment. With 7000 foreign students and the annual visit of more than 8000 researchers from all over the world, Univ. Grenoble Alps is an internationally engaged university.

A personalized Welcome Center for international students, PhDs and researchers facilitates your arrival and installation.

* ESRF (European Synchrotron Radiation Facility), ILL (Institut Laue-Langevin), IRAM (International Institute for Radio Astronomy), EMBL (European Molecular Biology Laboratory), EMFL (European Magnetic Field Laboratory)

Key figures:
- + 50,000 students including 7,000 international students
- 3,700 PhD students, 45% international
- 5,500 faculty members
- 180 different nationalities
- 1st city in France where it feels good to study and 5th city where it feels good to work
- ISSO: International Students & Scholars Office affiliated to EURAXESS

COMPANY:

STMicroelectronics is a global semiconductor leader delivering intelligent and energy-efficient products and solutions that power the electronics at the heart of everyday life. ST's products are found everywhere today, and together with our customers, we are enabling smarter driving and smarter factories, cities and homes, along with the next generation of mobile and Internet of Things devices.
By getting more from technology to get more from life, ST stands for life.augmented.

Strong of 46000 employees worldwide, including 6000 in Grenoble area with several local major R&D teams, STMicroelectronics provides solutions to bring intelligence and security close to the sensors, particularly in the frame of embedded AI and AI on the edge and is one of the industrial partners of the MIAI@Grenoble Alpes Institute.

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[1]　　https://edu.univ-grenoble-alpes.fr/en/

MANDATORY REFERENCES:
PROJECT TITLE: MIAI @ Grenoble Alpes
SUBJECT TITLE: Extreme Learning Machine for embedded neural networks.
RESEARCH FIELD (cf mots-clés sur Euraxess Jobs): <mark>computer vision, mathematics, embedded architecture</mark>
SCIENTIFIC DEPARTMENT (LABORATORY'S NAME): STMicroelectronics – Imaging / TIMA Laboratory
DOCTORAL SCHOOL'S: MST2I, Mathématiques, Sciences et technologies de l'Information Informatique
SUPERVISOR'S NAME: Marina NICOLAS (ST), Stéphane MANCINI (HDR, TIMA)

<mark>**SUBJECT DESCRIPTION:**</mark>

Motivation. Although machine learning algorithms are achieving performances in detection or classification tasks that surpass classical computer vision solutions, their adoption on resource-constrained embedded devices is still limited. Recent works to allow neural network inference when memory and processing ressources are highly limited have mainly focused on the reduction of the number of parameters or on their pruning or quantization. Still a disruptive step further is needed to reduce the complexity by several orders of magnitude, in particular for near-sensor applications.Empirically we observed remaining redundancy or correlations in network structure, even after classical dimension reduction techniques. Therefore we believe we could avoid storing some of the coefficients generating them at a very low cost, with few parameters, when running the inference.
This motivates our interest for Extreme Learning Machines (ELM), in the spirit of the Random Matrices topic and related to Compressed Sensing, as pseudo-random coefficients could be easily generated. Recent works show that it is possible to design efficient neural network by incorporating random layers of coefficients, which are issued from a random process of a specific probalistic distribution law, accompanied by a small set of learned coefficients.

PhD description. The goal of the PHD is to study how these works on ELM could be integrated in our smart cameras , focusing both on algorithm optimization and on the embedded architecture trade-offs between memories and computing resources.
The student will investigate how to derive from existing networks an approximated network with a set of learned parameters and a set of pseudo-random ad-hoc coefficients and built-in layers. These latter could be deeply optimized and hardwired for ultra-low power, taking into account the proximity of the sensor and the specificities of our targetted applications. From the architectural point of view, the student will search for a trade-off between massive memory area (coefficient storage), data transfers between memories and computing units (accesses to coefficients), and computing resources to generate pseudo-random coefficients, of lower area and power consumption.
The student will also investigate how we can benefit from ELM possibility to explain and predict the network performance, in particular to release the effort to benchmark and validate the algorithm optimizations and to ease the adaptation of the network to different sensors or evolving databases.

Organization. The position is held at STMicroelectronics (temporary 3-year employee). The PHD location will be shared between STMicrolectronics premices in Grenoble and TIMA Lab.
The PHD will be advised by Stéphane MANCINI at TIMA and co-advised by Marina NICOLAS at STMicroelectronics.

Expected outcomes. Results **should** result to demonstrations on ST embedded platform and associated patents. They will be presented at international conferences (NIPS, IEEE ICIP, ICASSP or others)

ELIGIBILITY CRITERIA
Applicants must hold a Master's degree (or be about to earn one) or have a university degree equivalent to a European Master's (5-year duration),
The applicant will have to fulfill STMicroelectronics ZRR (Zone à Régime Restrictif) security access criteria.

Applicants will have to send an **application** letter in English and attach:
▪ their last diploma
▪ their CV
▪ a short presentation of their scientific project (2 to 3 pages max)
▪ letters of recommendation are welcome

Address to send their application:
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