SECTOR: Higher Education Institution

LOCATION: France, Grenoble

RESEARCHER PROFILE:

□ First stage researcher

INSTITUTION: Univ. Grenoble Alpes, University of Innovation

One of the major research-intensive French universities, Univ. Grenoble Alpes1 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 Alpes is an internationally engaged university.

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

In 2016, Univ. Grenoble Alpes was labeled «Initiative of Excellence ». This label aims at the emergence of around ten French world class research universities. By joining Univ. Grenoble Alpes, you have the opportunity to conduct world-class research, and to contribute to the social and economic challenges of the 21st century ("sustainable planet and society", "health, well-being and technology", "understanding and supporting innovation: culture, technology, organizations" "Digital technology").

* 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

1 https://edu.univ-grenoble-alpes.fr/en/
The growing need to deploy deep learning applications on embedded devices [1] entails a need for architectures that are more energy-efficient than the mainstream solutions based on general-purpose processors and GPUs. The use of non-standard arithmetic formats is one promising direction to reduce the application-level energy consumption. For inference, very good results [2] have been obtained using ternary networks, i.e. networks where coefficients and weight can take only the values -1, 0, and 1. Larger number formats are still used inside the neural network accelerators to hold, for instance, partial accumulation results.

For learning, there is a consensus that a large dynamic is needed, and that single-precision (32 bits) floating point offers more than needed accuracy and range. There is also a consensus that the standard half-precision 16-bit format (5 bits of exponent, 10 bits of significand), which was designed for graphics, lacks dynamics for machine learning. Intel and ARM push the bfloat16 format with 8 bits of exponent [3,4], while IBM push their DLFloat format with 7 bits of exponents[5]. Radically new formats are also proposed, such as the poset format by Gustafson or a logarithmic system proposed by Jeff Johnson at Facebook [6]. In all these cases, the intermediate computations are performed in larger formats, just as in the ternary case.

The objective of this PhD is to explore such arithmetic opportunities with a focus on the learning phase, and the objective to use the smallest possible formats. The candidate will build a framework in which new number formats and micro-architectures can be evaluated in terms of application-level metrics (resource consumption, performance and accuracy). The deployment is initially envisioned on FPGAs, and the candidate will investigate FPGA-specific formats and architectures. The design of autoencoders will be used as a first case study.

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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).

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: frederic.petrot@univ-grenoble-alpes.fr, florent.de-dinechin@insa-lyon.fr