UNIVERSITÉ DE SHERBROOKE

Real-Time Intelligent Data Acquisition Systems for High Rate Radiation Instrumentation

Record number : OPR-517

Overview

RESEARCH DIRECTOR

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Information
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ADMINISTRATIVE UNIT(S)

Faculty of Engineering
Department of Electrical and Computer Engineering
Interdisciplinary Institute for Technological Innovation

LEVEL(S)

Master's degree
Ph.D.

LOCATION(S)

3IT - Institut interdisciplinaire d'innovation technologique

Project Description

CONTEXT
Large scientific experiments require increasingly sophisticated instruments and generate ever higher data rates. These detectors combine physics, microelectronics and advanced algorithms to “see” individual molecules, detect dark matter or image a patient with micrometer precision. To design and fabricate these novel detector systems, we need a creative and diverse multidisciplinary team.
Our group develops intelligent, embedded acquisition systems for radiation instrumentation generating enormous data rates, of the order of 100 GB/s to 100 TB/s. This acquisition system integrates artificial intelligence techniques at the detector to analyze and reduce data in real time.
WORK ENVIRONMENT
Our research group operates from the l'Institut interdisciplinaire d'innovation technologique (3IT), a research institute of the Université de Sherbrooke in Sherbrooke, Quebec, Canada. 3IT provides the infrastructure for scientific innovation and technology maturation, from idea to marketing, device to proof-of-concept and validation, by supporting the collaborative work of university researchers and industrial members, and by integrating the disciplines of nano and microtechnologies, biomedical engineering, telecommunications, information systems, robotics, ethics of technological development and innovation management.
PROJECT DESCRIPTION
Two projects are available
1 – Artificial intelligence algorithms for X-ray billion-pixel camera
Development and validation of AI algorithms for a billion-pixel camera targeting compressed sensing X-ray applications. The AI algorithms need to be lightweight, efficient and compatible with low-level hardware implementation (FPGA/ASIC).
2 – Conversion framework for AI to hardware
Several experiments require flexible acquisition strategies, and the AI implementation needs to be changed on a daily to a weekly basis. The goal of this project is to build a framework to convert Machine Learning models into low-level hardware (ASIC/FPGA) implementations automatically, prioritizing low latency and high throughput.

REQUIREMENTS

• Bachelor’s (for Master) or Master’s (for PhD) in electrical engineering, computer engineering, computational science or experience in a related field within the past 5 years.
• Experience with machine learning and open-source machine-learning tools, such as TensorFlow, pyTorch or Keras
• Familiarity with microelectronics and FPGA architectures
• Creativity, autonomy, diligence, and ability to work in large diverse teams
PREFERRED QUALIFICATIONS
• Experience in physics-informed machine learning
• Experience with uncertainty quantification methods
• Experience working in Linux environments on large high-performance cluster computing architectures
• Experience with VHDL/Verilog
• Experience designing microelectronics (ASIC)
Ability to speak French is not required, but will facilitate team communication.
The Université de Sherbrooke encourages diversity, equity and inclusion and invites all qualified persons to submit an application, and in particular, women, members of visible or ethnic minorities, autochthones and handicapped persons in relation to the program “programme d’accès à l’égalité en emploi (PAEE)”. Selection tools can be adapted for handicapped persons who request it, under the seal of confidentiality. The Université de Sherbrooke also encourages persons of all sexual orientations and identities to apply.

Discipline(s) by sector

Natural Sciences and Engineering

Electrical Engineering and Electronic Engineering

Funding offered

Yes

The last update was on 26 November 2020. The University reserves the right to modify its projects without notice.