Call for applications – PhD candidate

Lyon Institute of Nanotechnology http://inl.cnrs.fr
Ecole Centrale de Lyon, 36 av. Guy de Collongue,
F-69134 Ecully, FRANCE

Stochastic matrix multiplier based on PCM-enhanced silicon photonics

Today, the design of most computing systems, from data centers to edge computing devices, is driven by the need to efficiently transfer and process massive amounts of data. The shift to communication-centric architectures and in-network computing is expected to facilitate the deployment of numerous applications such as autonomous vehicles, decentralized web, cognitive cyber-physical systems and 5G. The need for data-centric architectures naturally calls for silicon photonics technology, i.e. the integration of high-speed optical devices on microelectronic chips using existing semiconductor fabrication techniques. It is necessary to research next generation computing architectures relying on hardware accelerators based on silicon photonics.

The main focus of this work will be the photonic implementation of stochastic computing (SC) functions. SC is perceived as a promising route to a reliable, low-cost, and low-power alternative to conventional computing approaches enabling an elegant and natural way of dynamically tuning the accuracy according to application requirements.

In the framework of a national research project (ANR Octane) and with research and industrial partners, the Heterogeneous Systems Design group at INL aims to research novel stochastic matrix multiplication functions based on phase-change memory (PCM) enhanced silicon photonics to explore energy-efficient embedded artificial intelligence computing paradigms for edge computing. In this context we are currently looking for a (m/f) **PhD student** for a **3 year** contract.

Job description

This thesis aims to explore the use of PCM-enhanced silicon photonics in stochastic energy-efficient computing paradigms for artificial intelligence applications. This will involve (i) contributing to the design and layout of devices and circuits for small-scale hardware demonstrators with CEA-LETI (France), (ii) building a multi-level simulator with ICB (France) capable of evaluating large-scale (10^3-10^6 elements) architectures built of stochastic PCM-enhanced silicon photonic matrix multiplier blocks, and (iii) assess the benefits and drawbacks of such architectures in prospective computing paradigms as compared to other emerging technologies through the use of high-level application benchmarking activities with U. Concordia (Canada).

The work will involve behavioral and system-level modeling of PCM-enhanced silicon photonic devices, novel low-power stochastic computing architecture design, and system-level evaluation of architectures and benchmarks.

As a member of a team set up to work on this topic with the support of several sources of funding at national and European level, you will also be expected to supervise MSc students.

Profile

You have or are about to obtain an MSc in Electronic Engineering / Computer Science and have studied closely at least one of the following areas: analog / digital / photonic integrated circuit design, multi-disciplinary or system-level modelling. Knowledge of Cadence, Verilog, SystemC is a plus. Fluency in French is also a plus but is not mandatory.

About INL

INL is a 250-strong research institute based in Lyon, France, carrying out fundamental and applied research in electronics, semiconductor materials, photonics and biotechnologies. The Heterogeneous Systems Design group is a leader in the area of advanced nanoelectronic design, with research projects and collaborations at both national and European level. Recent highlights include the development of high-performance design strategies for complex 3D integrated circuits, ferroelectric logic in memory, VNWFET-based logic and silicon photonic networks on chip.

Send CV and statement of purpose (in English or French) to

Ian O'Connor, INL - Lyon Institute of Nanotechnology
Ecole Centrale Lyon
Tel: +33 472 186054
Email: ian.oconnor@ec-lyon.fr