SoC4sensing PhD-3: Neuromorphic processing systems for Dynamic Vision Sensors (DVS)

Context

The University of the Basque Country (UPV/EHU) **SoC4sensing** University-Business Chair presents an ambitious Research and Training Plan to develop microelectronics design skills in new generations of electronics engineers.

The SoC4sensing chair is supported by 17 researchers from the APERT and GDED research groups in the UPV/EHU. It is co-funded by the Spanish Government and private sector companies such as IKERLAN Coop., System-on-Chip engineering S.L.. and the Basque Industry Association of Applied Knowledge and Technologies GAIA. This chair responds to the motivation of generating new economic activity based on new semiconductor devices that include differential elements for the industrial sectors of which there is a deep knowledge in the region.

Research Topic

This thesis is aimed at adapting an already developed DVS-based processing pipeline prototyped in FPGA for its implementation in silicon. The proposed pipeline includes DVS interface with foveation control, event-driven filter, event-to-frame conversion and frame delivery via AXI Stream interfaces and memory-mapped registers for access from a main CPU via AXI. Pioneering research lines will be explored within the framework of manufacturing this novel technology in silicon for the first time. Key areas of investigation may include:

- Power consumption optimization, such as analyzing advanced circuit design techniques for low power.

- Performance enhancement, which could be focused on improving the speed and efficiency of event processing in DVS, studying new architectures and parallelization methods to increase processing capabilities, leveraging the asynchronous nature of events generated by the sensors.

- Comparative studies could be conducted on the efficiency of DVS processing algorithms implemented in silicon compared to their FPGA counterparts. This will allow the evaluation of the performance in terms of latency, accuracy, and power consumption, providing a framework for future optimizations and improvements of the pipelines.

The PhD candidate will work in collaboration with other Soc4Sensing candidates in the integration of the DVS pipeline with RISC-V-based SoC designs (see PhD Position 1), and potentially, neural networks accelerators or co-processors to demonstrate joint functioning pre and post tape out.

Required expertise

• A Master's degree in Electronic Engineering, Electrical Engineering, Computer Science or equivalent with a background in design of digital circuits using HDL.
• Team player with strong analytical, interpersonal, communication, and English language skills.

Other relevant skills

• Background in signal processing, computer vision, machine/deep learning and associated frameworks.
• Prior knowledge of neuromorphic architectures (especially relevant are event-based processing) and dynamic vision sensing.
• Experience in microarchitecture modelling.
• Experience with EDA tools for semiconductor design.

Conditions (what we offer)

A unique collaborative framework to conduct a PhD that includes fully funded enrollment in a leading university in promoting this technology in the regional and national environment and close collaboration with a key high-tech research center. This ensures that the outcome of the thesis is both innovative and realistic in line with the current state of the technology, as well as applicable to real-world industry products in the short- to mid- term.

Additionally, SoC4sensing Chair offers expert training on SoC VLSI design and funding for the tape-out of developed designs.

We offer a flexible work model and a range of various training opportunities for personal growth.

Expression of Interest

Interested candidates should contact Prof. Koldo Basterretxea via email (koldo.basterretxea@ehu.eus) and indicate [PhD-SoC4SENSING-PIF3] as the subject. Please, attach your CV including education, prior knowledge, skills, and publications, if any.

Candidates will be contacted for an interview and request of additional information for finalizing the application.

The Ph.D. scholarship will start 2024/11/01.

Location and others

The SoC4sensing Chair is based at the Faculty of Engineering of Bilbao (https://www.ehu.eus/en/web/bilboko-ingeniaritza-eskola/website). This Faculty is located in the city center of Bilbao, very close to San Mames Stadium and is excellently connected by public transportation.

City of Bilbao

Faculty of Engineering