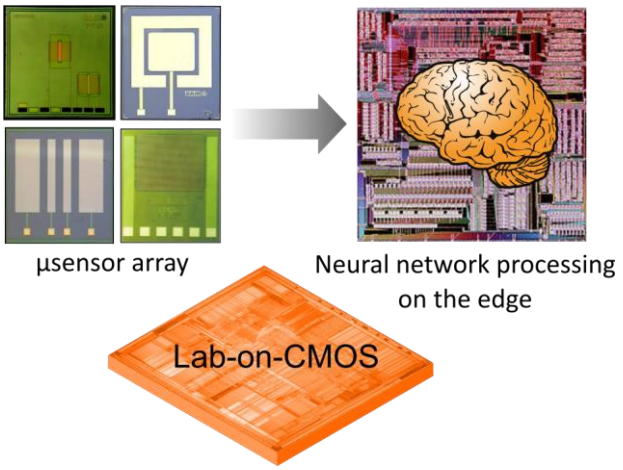
Project Description **Master's Thesis (with possibility of PhD Thesis)**

Low-Power Neuromorphic Processor Design for Smart Lab-on-CMOS Devices

Description



Integrated microanalytical systems are poised to enable ubiquitous (bio)chemical fluid assessment, and to have a revolutionary impact on the prevention of key health and sustainability threats of our time. In these systems, the use of electrochemical sensor arrays stands out due to their capability to generate multivariate data from liquid samples, enlarging the number of chemical properties that can be determined simultaneously. To manufacture the arrays, microsensors fabricated in semiconductor technologies offer advantages such as miniaturization, robustness, mass fabrication, and ease of integration with electronic circuits for embedded artificial intelligence, making them particularly suitable for advanced monitoring at the point of interest.

In this project, you will collaborate with a multidisciplinary team with expertise in neuroscience, computer science, chemistry and microelectronics to develop cutting-edge lab-on-CMOS solutions with intelligent microanalytical capability in a single tiny and affordable CMOS chip. Your specific objective will be to integrate a brain-inspired, digital deep neural network processor to embed and accelerate chemical perception on chip.

Background & skills

- Finishing a Master's degree in Electronics/IT/Computer Science Engineering (or similar) covering digital circuit design, synthesis and test.
- Knowledge of Deep Neural Network training/inference in accelerated computing environments (TensorFlow and/or PyTorch libraries).
- Experience with FPGA/embedded systems programming.

Tasks

- Modelling of the neuromorphic neural network processor on software, including corner cases.
- Architectural design and Verilog implementation of the hardware, departing from open-source code.
- Functional and post-synthesis simulation based on a Xilinx FPGA.
- Performance characterization including accuracy, latency, and power.

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