



Laboratory / Company: TIMA / Orioma

PhD Advisors:

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Title: Smart IRIS, Smart event-based IR Image Sensors

PhD Proposal (Cifre)

Motivations

One of the most important research fields in image sensing is the ability to power-efficiently acquire images. Indeed, image acquisition is usually done by reading all the image pixels at a fixed frame rate. Such a strategy generates a huge amount of data, which increases with the image size and the frame rate. Therefore, imaging systems are usually very power hungry and not suited for low-power applications. On one side, we developed at TIMA low-power solutions based on two main strategies: asynchronous design and sparse sampling techniques. Thanks to these techniques, image sensors are not permanently scanning a scene, reducing the produced amount of data and consequently the power consumption. On the other side, Orioma develops IR solutions for IoT applications, which highly power-efficient IR image systems. Therefore, Orioma and TIMA collaborate on the definition on new low-power IR image systems able to target the IoT market.

Proposed Work

The PhD candidate will be in charge of developing a new IR image sensor system based on a microbolometer array and an on-chip integrated circuitry able to sparsely sample and process the image. The proposed approach exploits event-based pixels - which will be jointly developed with an engineer - and an asynchronous strategy for the readout and the image pre-processing. This asynchronous readout will be helpful for reducing the throughput and compressing the data, which is a requirement for low-power operations.

The objectives of the PhD is to develop an original event-based strategy for an IR image sensor readout and to design a dedicated readout circuit. Moreover, the study will take into account the specificity of IR sensing, the Signal-to-Noise Ratio (SNR) and an integrated strategy for calibrating the microbolometers. The long-term goal targets a fully integrated implementation with on-board calibration and preprocessing.

Agenda

1st year

- Bibliography
- Study of microbolometers (principle, design, calibration, ...)
- Study of asynchronous circuit design
- First design of the event-based pixel and its readout circuit

2nd year

- Optimization of the readout architecture
- Insertion of the required calibration circuitry
- Design of the sensor readout and its calibration / pre-processing module
- First design simulations
- Writing of journal and conference articles

3rd year

- Analysis and characterization of the Smart IRIS sensor (power, speed, calibration...)
- Writing of journal and conference articles
- Writing of the manuscript