Live Demostration: Low Power Vision Sensor with Robust Dynamic Background Rejection

Yu Zou, Massimo Gottardi, Matteo Perenzoni
Fondazione Bruno Kessler, Trento, Italy
Email: {zou, gottardi, perenzoni}@fbk.eu

I. Introduction

Commercial cameras are mainly targeted to visual tasks, where resolutions and image quality are the most important parameters. However, in several applications, such as surveillance and monitoring, they are not very energy efficient. In fact, they continuously acquire images, forcing an external processor to process images in real-time, looking for events to occur in the scene that may rarely or even never happen. This causes the system to process a large amount of data uselessly, burning high power. Embedding low-level image processing on-chip would make the system more efficient, dispatching only salient features, thus reducing data bandwidth and the off-chip burden of computation as well. During this live demonstration, we will present an always-on QVGA (320 x 240 pixels) visual sensor embedding unusual motion detection [1] targeted to surveillance applications. The sensor detects anomalous motion in the scene and dispatches the grey-scale image and related bitmap of event at 15 fps with 1.6mW power consumption. Differently from other sensors relying on frame-difference to detect motion, the presented sensor embeds a two-thresholds dynamic background subtraction algorithm [2], which allows noisy background (such as swaying vegetation and rippling waves) to be suppressed in a more robust way, thus making the sensor to be suitable also for outdoor applications.

II. Demostration Setup

The demo is shown in Fig. 1. It consists of a QVGA vision chip with a C-mount lens hosted on a custom PCB. A commercial FPGA (Xilinx Spartan-3) board generates the timing for the vision chip and sends images to a laptop, through the USB. A Graphic User Interface (GUI) visualizes both grey level images with related event bitmaps and allows some sensor parameters to be changed according with the dynamics of the scene. The system works at 15 fps. The demo is not intended to emphasize the low-power performance of the chip but rather to demonstrate the advantages of the embedded algorithm.

III. Visitor Experience

During the demonstration, the visitors will see the grayscale images and their related event bitmaps which are delivered by sensor in real-time through the GUI, running on the laptop. Some recorded videos, acquired by the sensor during outdoor tests, will also be shown on the laptop. These videos demonstrate the good background rejection capability of the sensor. Fig. 2 shows an example of outdoor scenario, with grey-scale image and event bitmap.

Acknowledgment

The authors would like to thank Daniele Rucatti for his valuable support.

References

[1] Y. Zou, M. Gottardi, D. Perenzoni, M. Perenzoni, D. Stoppa, “A 1.6 mW 320x240-Pixel Vision Sensor with Programmable Dynamic Background Rejection and Motion Detection,” IEEE SENSORS 2017.

[2] Z. Smilansky, “Miniature Autonomous Agents for Scene Interpretation,” 7,489,802 B2, US Patent Application, Feb. 2009.

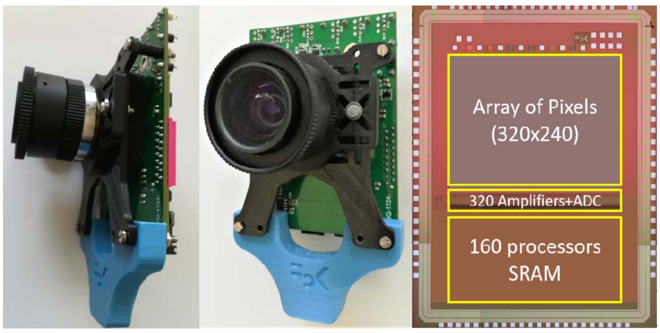

Fig. 1. The demo (left and middle); vision Chip microphotograph (right).

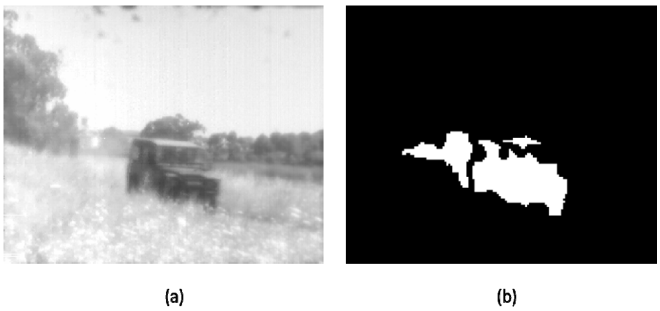

Fig. 2. Example of sensor outdoor test. a) QVGA grayscale image; b) Quarter-QVGA event bitmap after the chip-embedded erosion filter.

This work was funded by the EU H2020-FCT-2014 FORENSOR Project under Grant n. 653355.