Address-Event Imagers for Sensor Networks: Evaluation and Modeling

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I. Demonstration Abstract

Camera sensor networks provide an information-rich sensing modality that can offer quantitatively and qualitatively better observations than other, simpler sensors. Their deployment and use, however also gives rise to numerous challenges and reservations. In order to last unattended for extended periods in WSNs, imagers must consume as little power as possible – while maximizing the rate of information per bit. What is more, for deployment in sensitive human environments, there is the added concern of privacy preservation. We propose the use of Address-Event (AE) imagers to fulfill these requirements, and we present a two-part demonstration to reinforce this claim:

1) Pattern recognition on a PC using a software AE imager emulator (Figure 2) coupled with a COTS camera.
2) The same pattern recognition algorithm, but taking as input the event stream for a custom Address-Event Representation imager connected to an XYZ sensor node (Figure 1).

Both demonstrations utilize a simplistic algorithm that can competently run on small microcontrollers. It works by comparing each incoming event to a set of templates. If the address of an event is present in a given template, this situation characterizes a *hit*. The *score* of the template is incremented with every hit. Scores are weighted according to the pre-calculated *brightness* (which translates to the probability of a hit) of the corresponding template, so as to equalize all template probabilities. The largest score is declared winner if it has a wide enough margin over the second largest.

For the seconds part of the demo, the ALOHA imager provides the event streams that are the input of the recognition algorithm. The ALOHA is an Address-Event Representation imager that converts pixel intensities to event frequencies, and is capable of ultra-low power consumption. In the first part, an AE emulator is utilized to allow different types of AE imagers to be explored before they are fabricated. The demonstrations aim to make evident that AE imagers provide a processing advantage over traditional cameras, by producing streams of features that can promptly be utilized with minimal computational demands.

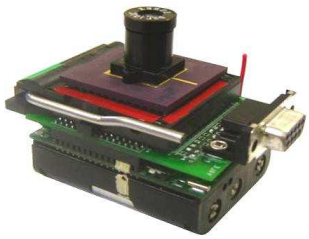

Fig. 1. The XYZ sensor node interfaced to the ALOHA image sensor.

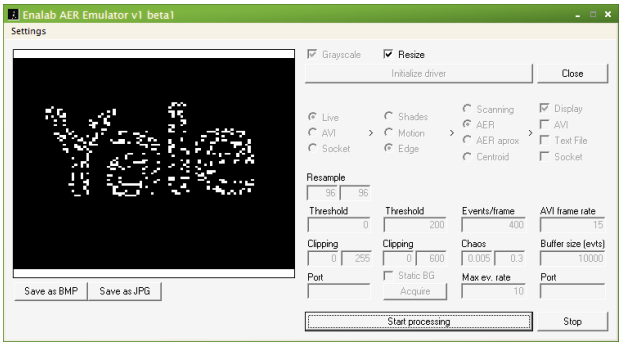

Fig. 2. Screenshot of AER emulator.