Live Demonstration: A Bio-inspired Event-based Size and Position Invariant Human Posture Recognition Algorithm

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***Abstract*—We demonstrate a realtime human postures recognition platform. The algorithm employs temporal difference imaging between video sequences as input and then decompose the contour of the active object into vectorial line segments. A scheme based on simplified Line Segment Hausdorff Distance combined with projection histograms is proposed to achieve size and position invariance recognition. Inspired by the hierarchical model of human visual system, the whole classification is described as a coarse to fine procedure. 88% average realtime recognition rate is achieved in the experiment.**

I. Introduction

Human posture recognition is gaining increasing attention due to its promising application in the area of personal health care, environmental awareness, intelligent visual human machine interface (such as video game systems and human-robot interaction), to name a few. Unfortunately, currently implementation of human posture system needs power computers, even when recognizing only a small subset of human body postures, such as standing, bending, sitting and lying. This will limit the use of these algorithms in real life applications. On the other hand, small and lightweight wireless platforms, such as ultra-mobile PCs or smart cellular phones, are becoming an ubiquitous computation platform. To investigate high power efficient algorithms implementable in low-complexity hardware will enable quite a few novel applications. A cellphone capable of image interpretation can be turned into a virtual cane for the blind, a monitoring device for elderly and for assisted living environments.

We developed a realtime human postures recognition platform which combines innovative event-based hardware and energy-efficient algorithms. This work sets the foundation for size and position invariant object recognition for the implementation of event-based vision systems. We show that the use of event-based sensors and processing hardware can at the same time increase the computational throughput and the efficiency of that computation.

II. Demonstration Description

The equipment of the proposed demo system includes an image sensor working at temporal difference mode (MotoTrigger [1]), an OpalKelly 3001v2 FPGA board to perform hierarchical edge feature extraction and posture classification, a laptop computer providing user interface to display the recognition result. The proposed system has achieved good performance in our preliminary experiment. As shown in Fig.1, good accuracy up to 97% is achieved. We can even distinguish between quite similar postures, for example, "raise-1-hand" and "swing hand".

Posture Group	Postures Library	Success Rate
bend		192/200=96%
raise-1-hand		152/200=76%
raise-2-hand		189/200=94%
squat		178/200=89%
stand		190/200=95%
swing hand		166/200=83%

Fig. 1. Six groups of postures used in our experiment.

III. Demonstration Experiencing

During the demo, a visitor may stand in front of our image sensor and try to recognize his posture using our platform. The visitor will be impressed by the high computing efficiency provided by the combination of custom event-based sensory hardware with fast categorization algorithms based on models of the human visual system.

References

[1] Z.M. Fu, E. Culurciello, "A 1.2mW CMOS Temporal-Difference Image Sensor for Sensor Networks," ISCAS 2008, May 2008, pp. 1064-1067.

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