Title:

Real-time Ellipse Detection on an Embedded Reconfigurable SoC

Abstract:  
Computer vision algorithms have historically been difficult to deploy in resource-constrained embedded systems.  Ellipse detection or fitting is an important subproblem in computer vision, and these algorithms are computationally complex enough to pose significant design challenges when targeting an embedded system problem domain.  This work describes a least squares ellipse fitting system targeting the Xilinx Zynq 7000 series of SoCs, and uses a well-known methodology to accelerate our algorithm designed to locate six circular markers in a plane from 0.0930 frames per second (FPS) using a Matlab implementation, to 64 FPS.  Additionally, the Zynq implementation also achieves a speed-up of 1.14x over an optimized Matlab implementation running on a conventional workstation.  Our results demonstrate the effectiveness of a hardware/software co-design approach for obtaining real-time performance for ellipse detection algorithms in an embedded context.