

7. Conclusion

The original Canny algorithm relies on frame-level statistics to predict the high and low thresholds and thus has latency proportional to the frame size. In order to reduce the large latency and meet real-time requirements, we presented a novel Split Canny edge detection algorithm which has the ability to compute edges of multiple blocks at the same time. To support this, an adaptive threshold selection method is proposed that predicts the high and low thresholds of the entire image while only processing the pixels of an individual block. This results in three benefits: 1) a significant reduction in the latency; 2) better edge detection performance; 3) the possibility of pipelining the Canny edge detector with other block-based image codecs. In addition, a low complexity non-uniform quantized histogram calculation method is proposed to compute the block hysteresis thresholds. The proposed algorithm is scalable and has very high detection performance. We show that our algorithm can detect all psycho-visually important edges in the image for various block sizes. Finally, the algorithm is mapped onto a Xilinx Virtex-5 FPGA platform and tested using ModelSim. The synthesized results show 64% slice utilization and 87% BRAM memory utilization. The proposed FPGA implementation takes only 0.721ms (including the SRAM read/write time and the computation time) to detect edges of 512×512 images in the USC SIPI database when clocked at 100 MHz. Thus the proposed implementation is capable of supporting fast real-time edge detection of images and videos including those with full-HD content.

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