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3D Image Segmentation Implementation on FPGA Using EM/MPM Algorithm

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Abstract:

In this thesis, 3D image segmentation is targeted to a Xilinx Field Programmable Gate Array (FPGA), and verified with extensive simulation. Segmentation is performed using the Expectation-Maximization with Maximization of the Posterior Marginals (EM/MPM) Bayesian algorithm. This algorithm segments the 3D image using neighboring pixels based on a Markov Random Field (MRF) model. This iterative algorithm is designed, synthesized and simulated for the Xilinx FPGA, and greater than 100 times speed improvement over standard desktop computer hardware is achieved. Three new techniques were the key to achieving this speed: Pipelined computational cores, sixteen parallel data paths and a novel memory interface for maximizing the external memory bandwidth. Seven MPM segmentation iterations are matched to the external memory bandwidth required of a single source file read, and a single segmented file write, plus a small amount of latency.

Description:

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