

SEMINAR NOTICE

Preston M. Green Department of Electrical and Systems Engineering

MULTIGPU ACCELERATION OF ITERATIVE X-RAY CT IMAGE RECONSTRUCTION

PhD Preliminary Research Examination

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Abstract: Model based iterative reconstruction (MBIR) algorithms have the potential to improve image resolution, noise and reduce artifacts by minimizing a cost function that models the physics and statistics in X-ray CT. They can also reconstruct images in non-standard geometries arising from irregular sampling, limited angular range, and missing data. As a result, MBIR can be useful in low dose CT scanning for lung cancer detection, treatment planning before proton therapy, material classification etc. These MBIR techniques rely on projection and backprojection to refine an image estimate. While these MBIR techniques provide superior image quality, the computational cost of iterative updates makes it impractical for many clinical applications.

There are various pathways to decrease the time in iterative image reconstruction; two approaches are proposed in this work. The first approach includes multiple graphical processing unit (GPU) implementations of the computationally expensive projection and backprojection operations using CUDA programming tools. The second approach uses variable step sizes for additive updates in existing algorithms for increasing convergence rate at the expense of not having guaranteed convergence properties. We have proposed a novel adaptive auxiliary variable and momentum based update scheme in the Alternating Minimization (AM) algorithm, resulting in more aggressive updates in iterations. Each approach is implemented on real clinical helical CT data from a Siemens Sensation 16 scanner and compared to straightforward implementations of the alternating minimization algorithm of O'Sullivan and Benac with a Huber-type edge-preserving penalty.

DATE: Monday, November 21, 2016
TIME: 3:00 p.m.
PLACE: Green Hall, Room 0120

Thesis advisor:
Dr. Joseph O'Sullivan

This seminar is in partial fulfillment
of the Doctor of Philosophy degree