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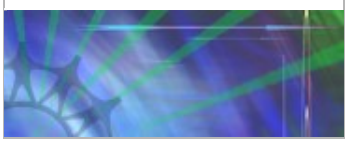

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Award Abstract #0946463

A Biomedical Imaging Acceleration Testbed

NSF Org:	EEC Div Of Engineering Education and Centers
Initial Amendment Date:	December 10, 2009
Latest Amendment Date:	July 23, 2012
Award Number:	0946463
Award Instrument:	Standard Grant
Program Manager:	Deborah Jackson EEC Div Of Engineering Education and Centers ENG Directorate For Engineering
Start Date:	December 15, 2009
End Date:	November 30, 2013 (Estimated)
Awarded Amount to Date:	$1,300,000.00
Investigator(s):	David Kaeli kaeli@ece.neu.edu (Principal Investigator) Badrinath Roysam (Co-Principal Investigator) William Karl (Co-Principal Investigator) Gregory Sharp (Co-Principal Investigator) Nayda Santiago (Co-Principal Investigator) Homer Pien (Former Co-Principal Investigator)
Sponsor:	Northeastern University 360 HUNTINGTON AVE BOSTON, MA 02115-5005 (617)373-3004
NSF Program(s):	EEC Innovation Awards
Program Reference Code(s):	124E, 130E
Program Element Code(s):	7960

ABSTRACT

Biomedical imaging generates enormous amounts of data - a CT scanner can generate more than 5GB of raw data in 20 seconds - timely extraction of useful information from raw data requires a new computing paradigm. Graphical Processing Units (GPUs) have been used to accelerate many of these applications, but there remain a number of challenge associated with the current state of the art in biomedical imaging acceleration: (1) As each new many-core computing platform comes on the market, the ability to leverage this class of platforms turns into a time-consuming process and generally requires extensive knowledge of the underlying system hardware to extract all the potential performance available. (2) As new biomedical imaging applications are developed, each

programming task becomes a repetitive time-consuming effort. What is needed is a methodology to semi-automatically parallelize biomedical imaging codes that can leverage a set of available libraries (the libraries need to be available in a format that can be easily remapped to the most current hardware). (3) Presently, there is a lack of an effective strategy to perform a cost/performance benefit analysis that could be used to justify moving a biomedical imaging application to a new hardware platform. There is also the question of whether multiple GPUs could provide advantages to a particular application.

Intellectual Merit: This effort will develop a testbed that can aggressively address these three issues. The activity will leverage the extensive knowledge base available within the Center for Subsurface Sensing and Imaging Systems (CenSSIS), an ERC at Northeastern University (CenSSIS), and Engineering Research Center (ERC) to accelerate a range of key biomedical imaging applications/algorithms. The goals are: (1) develop a methodology for rapid parallelization of biomedical imaging applications by following a set of prescribed steps, and then applying best practices in GPU programming, (2) produce a rich library of parallelized biomedical imaging codes, (3) provide the capability to "right-size" a multi-GPU system to best meet the goals of any biomedical imaging application, (4) deliver these capabilities in a web-based framework that will allow a larger community to leverage the technology available in this Testbed. The project will develop a distributed Testbed where each partner will provide either biomedical imaging or GPU parallelization expertise (or both). The outcome should include a new set of parallel libraries for the biomedical research community, as well as a Testbed model that can be replicated across other research communities that require acceleration using many-core platforms.

Broader Impacts: The broader aspects of this proposal include having an accompanying educational program on biomedical acceleration, which will leverage the availability of the Testbed hardware and software. The broader impact of this work (if successful) would ultimately be a seamless high performance computing system for scientists in biomedical imaging who can focus on their respective projects (rather than investing time to learn about technologies that would help them utilize hpc systems.) This project will directly engage students and researchers from underrepresented groups. This project will also leverage the ongoing Research Experiences for Undergraduates programs within CenSSIS, which have provided rich summer experiences for undergraduates from minority-serving institutions, providing a pathway to pursue graduate research in high performance computing a biomedical imaging.

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