Enclosure 3

Committee on Science, Space, and Technology

U.S. House of Representatives Witness

Disclosure Requirement - "Truth in Testimony"
Required by House Rule XI, Clause 2(g)(5)

1. Your Name: Daniel A. Reed

2. Are you testifying on behalf of the Federal, or a State or local government entity?	Yes	No
3. Are you testifying on behalf of an entity that is not a government entity?	Yes	No

4. Other than yourself, please list which entity or entities you are representing:

None

5. Please list any Federal grants or contracts (including subgrants or subcontracts) that you or the entity you represent have received on or after October 1, 2010:

I am the institutional official for all UI federal grants and contracts as the Vice President for Research and Economic Development at the University of Iowa. I hold a personal contract as a consultant to the Department of Energy. Other than that, I have not personally been the recipient of Federal grants or contacts during since 2010 as I was at Microsoft from 2007 to late 2012. The attached list summarizes computing-related grants/contracts to Iowa.

6. If your answer to the question in item 3 in this form is "yes," please describe your position or representational capacity with the entity(ies) you are representing:

N/A

7. If your answer to the question in item 3 is "yes," do any of the entities disclosed in item 4 have parent organizations, subsidiaries, or partnerships that you are not representing in your testimony?	Yes	No

8. If the answer to the question in item 3 is "yes," please list any Federal grants or contracts (including subgrants or subcontracts) that were received by the entities listed under the question in item 4 on or after October 1, 2010, that exceed 10 percent of the revenue of the entities in the year received, including the source and amount of each grant or contract to be listed:

[redacted]

I certify [redacted] rect.

Signatu[redacted] Date: 5/21/13

The University of Iowa's Federal Computing Research Grants and Contracts (including sub-grants and sub-contracts) Awarded on or after October 1, 2010

Official Full Name	Increment Total Costs	Proposal Title	Sponsor	Prime Sponsor	Project Summary
Casavant, Thomas L	$21,780.00	University of Iowa Holden TRNG WG	Booz-Allen & Hamilton, Inc.	US Department of Health & Human Services, National Institutes of Health	The Documentation and Training (D&T) Workspace mission is to support the creation and dissemination of documentation, training, and educational outreach materials for caBIG®. The workspace does this by creating new templates and guides, providing communications expertise related to content presentation to the caBIG® community, and generating outreach materials to help those deploying caBIG® in their own institutions.
Chipara, Octav	$148,893.00	NeTS: Small: Collaborative Research: Protocols and Analysis for Predictable Wireless Sensor Networks	US National Science Foundation		The next generation of wireless sensor networks is expected to have a profound societal impact: wewill entrust sensor systems to monitor critical infrastructure, collect vital signs from ambulatory patientsin hospitals, and disseminate medical and planning information during emergency responses. However,in contrast to earlier wireless sensor networks for which best-effort services were sufficient, such systemsrequire predictable performance and high reliability. Consider a patient monitoring system that collects vitalsigns from patients in a field hospital and notifies the nursing staff when a patient?s condition has deteriorated.For the proper operation of the system, the system designer would like to (1) ensure a patient's vitalsigns may be collected at any location within the unit, as patients may be ambulatory; (2) determine ifthe current patients can be monitored without exceeding network capacity; and (3) bound the maximumlatency before an alarm is delivered to the medical personnel. Failure to meet these requirements willlead to failures to detect the clinical deterioration of patients or to notify the medical personnel in time tointervene before a patient?s condition worsens.Today, there are no effective mechanisms for developing predictable wireless sensor systems. Thebest practice involves a combination of simulations and in-situ performance measurements. However, atest-driven approach may only evaluate a fraction of all possible system configurations. Moreover, noprincipled approach for accounting for the impact of mobility or system dynamics exists. Due to theselimitations, a designer is usually forced to take significant engineering margins to ensure the desired levelof performance. This approach is unacceptable in resource-starved wireless sensor networks.Intellectual Merit: The intellectual merit of our proposal is the development of an engineering methodologyfor predictable wireless sensor networks. A predictable wireless sensor network is a system forwhich it is possible to check that its requirements are met under reasonable assumptions regarding itsworkload and network properties. The fundamental hypothesis of this work is that predictable wirelesssensor networks may be built by closing the gap between theory and practice: developers should beprovided with analytical tools to characterize and optimize the performance of systems under realisticassumptions. We expect that our work will improve the development of wireless sensor networks in thefollowing ways:¤ Develop statistical methods for assessing the properties of wireless sensor networks and provisioningwireless resources to achieve robustness in the face of node failures and temporal variations. Toreduce the burden of system deployment, the proposed methods focus on the accurate prediction ofnetwork properties from a small number of in-situ measurements.¤ Novel transmission scheduling techniques that ensure a system meets its reliability and real-timerequirements without sacrificing either scalability or flexibility. This is accomplished by effectivelycoordinating the activities of the media access, link, and routing layers.¤ Devise a new schedulability analysis for wireless sensor networks
Chipara, Octav	$18,538.00	WIISARD SAGE: Self-Scaling Systems for Mass Casualty Management	University of California, San Diego	US Department of Health & Human Services, National Institutes of Health	Gossip-based Communication Protocols for Emergency Response. A major challenge in emergency response systems that use mesh networks is to develop networking protocols that disseminate information reliably to all first responders. This is not an easy task in a dynamic wireless environment that does not benefit from existing communication infrastructure. First responders will be mobile as they provide first aid to victims. Fire trucks, heavy equipment, and people attenuate radio signals to various degrees as they move within the environment and, as a result, link quality is subject to significant temporal variations. Moreover, interference from other wireless networks (e.g., video broadcast) can corrupt packets transmitted within the wireless network. Many wireless mesh networks that must support mobile entities are typically deployed in advance to ensure sufficient coverage. However, on a disaster scene, networking resources arrive incrementally and it is unlikely that complete coverage will exist. Therefore, the system must achieve high reliability even in the presence of frequent network disconnections and network partitions due to lack of coverage.As part of the contract, the PI will be coordinating the analysis of the data obtained during an emergency response during which a gossip-based communication protocol has been used. The purpose of the study is to assess the feasibility and performance of using gossip-based communication during emergency response. Of particular interest are the throughput, delay, and energy efficiency of such communication. Based on the study further refinement to the WIISARD Communication protocol (WCP) will be developed, implemented and evaluated. This will result in at least one conference paper with the goal of being

Christensen, Gary E	$81,112.00	Image Registration for Image-Guided Adaptive Radiation Therapy	Virginia Commonwealth University	US Department of Health & Human Services, National Institutes of Health	Image-guided adaptive radiotherapy (IGART) has the potential to provide optimal delineation and targeting of tumors and critical structures at any moment during treatment. A critical component of this process is tracking the dose delivered to tumors and adjacent normal tissues over the course of multiple radiation treatments in the presence of nonrigid motion and deformation of the anatomy. 3D CT images and temporal sequences of planar radiographs provide snap shots of the position and shape of the anatomy as well as the dose delivered during the course of treatment. We propose to use nonrigid image registration to find the correspondences between the CT images to track the dose delivered to tumor and normal tissue over the course of treatment. The long term objective of this project is to develop nonrigid image registration tools that will enable the routine application of image-guided adaptive radiotherapy techniques in the clinic. The specific aims of this project are (1) To generalize the 3D small deformation inverse consistent linear elastic image registration algorithm to incorporate a probabilistic surface matching criteria; (2) To generalize the 3D fluid image registration nonrigid image registration algorithm by incorporating a probabilistic surface matching criteria; and (3) To validate the new surface driven elastic and fluid registration algorithms. The work in this project will be coordinated with that proposed in Project 1 of the IGART program project. Relevance to public health: This project has the potential to improve the treatment of cancer in the prostate and cervix by providing better radiation treatment dose delivery to tumors over the course of many treatments. This project will allow the radiation dose that is delivered to a tumor and normal tissue to be tracked over time in the presence nonrigid tissue deformations. Better tracking of the anatomy will improve treatment by maximizing the radiation dose to the tumor while minimizing the dose to the adjacent normal tissue.
Christensen, Gary E	$75,191.00	Image Registration for Image-Guided Adaptive Radiation Therapy	Virginia Commonwealth University	US Department of Health & Human Services, National Institutes of Health	Image-guided adaptive radiotherapy (IGART) has the potential to provide optimal delineation and targeting of tumors and critical structures at any moment during treatment. A critical component of this process is tracking the dose delivered to tumors and adjacent normal tissues over the course of multiple radiation treatments in the presence of nonrigid motion and deformation of the anatomy. 3D CT images and temporal sequences of planar radiographs provide snap shots of the position and shape of the anatomy as well as the dose delivered during the course of treatment. We propose to use nonrigid image registration to find the correspondences between the CT images to track the dose delivered to tumor and normal tissue over the course of treatment. The long term objective of this project is to develop nonrigid image registration tools that will enable the routine application of image-guided adaptive radiotherapy techniques in the clinic. The specific aims of this project are (1) To generalize the 3D small deformation inverse consistent linear elastic image registration algorithm to incorporate a probabilistic surface matching criteria; (2) To generalize the 3D fluid image registration nonrigid image registration algorithm by incorporating a probabilistic surface matching criteria; and (3) To validate the new surface driven elastic and fluid registration algorithms. The work in this project will be coordinated with that proposed in Project 1 of the IGART program project. Relevance to public health: This project has the potential to improve the treatment of cancer in the prostate and cervix by providing better radiation treatment dose delivery to tumors over the course of many treatments. This project will allow the radiation dose that is delivered to a tumor and normal tissue to be tracked over time in the presence nonrigid tissue deformations. Better tracking of the anatomy will improve treatment by maximizing the radiation dose to the tumor while minimizing the dose to the adjacent normal tissue.
Christensen, Gary E	$3,483.00	Image Registration for Image-Guided Adaptive Radiation Therapy	Virginia Commonwealth University	US Department of Health & Human Services, National Institutes of Health	Image Registration for Image-Guided Adaptive Radiation Therapy
Cowles, Mary Kathryn	$498,425.00	IGERT: Geoinformatics for Environmental and Energy Modeling and Prediction (GEEMaP)	US National Science Foundation		Intellectual MeritPrediction of physical phenomena is an essential component in the development of soundpolicies and procedures designed to ensure public safety, protect the environment, and satisfy food andenergy needs. For example, prediction of surface and ground water flows is essential in flood prevention,control, and mitigation; assuring adequate water supplies for agriculture; provision of hydroelectric power;and preventing drinking water contamination. Similarly, long- and short-term prediction of wind speed anddirection is crucial for siting and operating wind farms for alternative electric power production.Geoinformatics is the science of measuring, storing, organizing, analyzing and visualizing data related tophysical phenomena occurring on the earth and in earth's atmosphere. As such, geoinformatics offersprecisely those tools and strategies that enable prediction of natural processes underlying environmentaland energy studies.The proposed GEEMaP project will bring together a team of faculty with expertise incore geoinformatics areas (spatiotemporal statistical modeling, distributed computing, optimization,geographic information science, agent-based modeling, dynamic modeling, simulation methods) and applications(wind energy; hydroelectric energy; watershed management; contamination of air, soil, and water; floodprevention and control) to accomplish two broad goals:1.To develop a graduate program of coursework,research experiences, and internships in industry and government that will produce scientists with thequantitative, computational, and communication skills needed to conduct interdisciplinary research and tocontribute to public- and private-sector decision making on vital issues in environmental science and energyproduction.2.To design and implement scalable models and methods applied to integrated research onenergy and environmental issues. This effort wil proceed from addressing environmental and energyquestions that are specific to the state of Iowa to harnessing cyberinfrastructure tools to model andpredict similar phenomena on a continental scale.Broader ImpactThe GEEMaP project will recruitstudents from populations underrepresented in the science, technology, engineering, and mathematical (STEM)fields and will mentor and support them in completing the program and finding their places in academia,government, and the private sector.This effort will be carried out in partnership with alreadywell-established programs at The University of Iowa that have successfully fostered communities of women andminority students in the STEM disciplines.KeywordsComputer Science/Information Technology,Environmental Science, Mathematics, Geographic Information Science

Hourcade, Juan Pablo	$99,791.00	Powerful User Interfaces for Interactive Theorem Proving	US National Science Foundation		The increasing ubiquity of digital devices used for safety- and mission-critical tasks is currently driving a major research effort in software verification, in both academia and industry. Interactive theorem provers (ITPs) are a key tool in software verification, enabling users to create complex proofs of deep properties beyond the reach of automated provers. In spite of the increasing need for their use, ITPs have limited user interfaces that have hardly evolved in the past 20 years. As a consequence, potential users require significant amounts of training to even begin to use these systems and expert users have difficulty a) managing and understanding long, hard-to-read, proof documents and b) exploring the many potential ways of proving a given theorem. Advances in the user interfaces of ITPs are thus an important enabler for increased adoption of these most powerful of formal methods. The long-term goal of this research is to increase the effectiveness and efficiency of ITP expert users and to lower the barriers for ITP novice users. The objective of this proposal is to create a powerful user interface for ITPs, focusing on the widely used theorem prover Coq as an example. The hypothesis is that a novel ITP user interface that addresses ITP users information needs through advanced editing techniques will enable novices to prove theorems and understand proofs more quickly and accurately than current ITP user interfaces. Advanced editing techniques will include complex syntax visualization and manipulation. Intellectual MeritThe following approach will be followed to pursue the research goal and test the hypothesis: Develop a novel user interface for the Coq ITP. This will be accomplished using an iterative, user-centered approach. The new user interface will be based around complex syntax visualization and manipulation. Evaluate the new user interface. The evaluation will include comparisons with other user interfaces for Coq in terms of efficiency for completing and understanding proofs. The proposed research is potentially transformative, as it has the potential to make software verification through ITPs accessible to a larger population and more efficient for current users. It is innovative in bringing HCI research to a new domain in ITPs. In fact, the combined background of the PI and co-PI in HCI (Dr. Hourcade), and automated reasoning and computational logic (Dr. Stump) provides the project with a rare conjunction of the experience and skills needed to carry out this research. Broader ImpactsSuccessfully applying modern HCI techniques to interactive theorem provers will result in a major step forward in the usability and applicability of ITPs. This in turn will help facilitate the increased use of formal methods and verification in academic research, but also with industrial applications. An improved interface for a major ITP like Coq has the promise to release the vastly greater expressive power of these systems to a much wider group of users, in both academia and industry. Likewise, it will provide a useful tool for teaching software verification courses by helping students concentrate on proving theorems instead of focusing their attention on how to interact with software. The resulting interface will be made
Jacob, Mathews	$433,897.00	CIF: Small: Adaptive signal representation for accelerated multidimensional imaging	US National Science Foundation		
Jacob, Mathews	$236,087.00	Novel Algorithm for Improved Contrast Enhanced Cardiac MRI	US Department of Health & Human Services, National Institutes of Health		Myocardial first-pass perfusion and late gadolinium enhancement (LGE) schemes are keycomponents of most clinical cardiac MRI exams. The limitations of current MRI schemesoften makes it challenging to simultaneously achieve high spatio temporal resolution,sufficient spatial coverage, and good image quality in first-pass perfusion MRI, making itdifficult to interpreting the results. Similarly, the large number of breath-holds and their longduration often makes LGE acquisitions challenging for many patients, resulting in significantmotion artifacts and reduced patient throughput. In this context, there is an immediate clinicalneed for a novel dynamic imaging framework that can enable free-breathing acquisitions andconsiderably improve spatio-temporal resolution and coverage, without degrading the quality.The main objective of this proposal is to develop a novel dynamic imaging framework, whichcan enable free-breathing cardiac MRI and significantly accelerate it with minimal artifacts.We recently introduced a novel regularized reconstruction algorithm to significantlyaccelerate free-breathing dynamic MRI data. Preliminary validations of the algorithmdemonstrated the ability of the proposed scheme to provide accelerations of up-to elevenfold with minor artifacts. The main focus of this proposal is to further improve the k-t SLRscheme and use it to realize high-resolution clinical myocardial perfusion and free-breathingLGE MRI. The successful completion of the proposed research will provide quantitativeperfusion estimates with a temporal resolution of one heartbeat and spatial resolution of0.15x0.15x0.8 cc from the entire heart, which is a four-fold improvement over currentschemes. Similarly, we expect to considerably improve the patient compliance by relaxingthe breath-holding requirement and reducing the scan time in LGE MRI data. Thesedevelopments are quite significant and will considerably advance the state of the art incontrast-enhanced CMRI. The proposed algorithm is a radical departure from the classicalapproaches that rely on x-f space sparsity. In addition, we introduce non-convex spectralpriors and additionally exploit the sparsity of the dynamic images to further improve the datafidelity and acceleration rate. Thus, the proposed scheme is highly innovative and its impactis expected to extend beyond the specific applications. Our team is well qualified to performthe proposed research because of our combined scope and breadth in expertise (includingsignal/image processing, MR physics, radiology, and cardiology), in addition to the extensivepreliminary data.

Jacob, Mathews	$172,372.00	Novel Algorithm for Improved Contrast Enhanced Cardiac MRI	US Department of Health & Human Services, National Institutes of Health		Myocardial first-pass perfusion and late gadolinium enhancement (LGE) schemes are key components of most clinical cardiac MRI exams. The limitations of current MRI schemes often makes it challenging to simultaneously achieve high spatio-temporal resolution, sufficient spatial coverage, and good image quality in first-pass perfusion MRI, making it difficult to interpreting the results. Similarly, the large number of breath-holds and their long duration often makes LGE acquisitions challenging for many patients, resulting in significant motion artifacts and reduced patient throughput. In this context, there is an immediate clinical need for a novel dynamic imaging framework that can enable free-breathing acquisitions and considerably improve spatio-temporal resolution and coverage, without degrading the quality. The main objective of this proposal is to develop a novel dynamic imaging framework, which can enable free-breathing cardiac MRI and significantly accelerate it with minimal artifacts. We recently introduced a novel regularized reconstruction algorithm to significantly accelerate free-breathing dynamic MRI data. Preliminary validations of the algorithm demonstrated the ability of the proposed scheme to provide accelerations of up-to eleven fold with minor artifacts. The main focus of this proposal is to further improve the k-t SLR scheme and use it to realize high-resolution clinical myocardial perfusion and free-breathing LGE MRI. The successful completion of the proposed research will provide quantitative perfusion estimates with a temporal resolution of one heartbeat and spatial resolution of 0.15x0.15x0.8 cc from the entire heart, which is a four-fold improvement over current schemes. Similarly, we expect to considerably improve the patient compliance by relaxing the breath-holding requirement and reducing the scan time in LGE MRI data. These developments are quite significant and will considerably advance the state of the art in contrast-enhanced CMRI. The proposed algorithm is a radical departure from the classical approaches that rely on x-f space sparsity. In addition, we introduce non-convex spectral priors and additionally exploit the sparsity of the dynamic images to further improve the data fidelity and acceleration rate. Thus, the proposed scheme is highly innovative and its impact is expected to extend beyond the specific applications. Our team is well qualified to perform the proposed research because of our combined scope and breadth in expertise (including signal/image processing, MR physics, radiology, and cardiology), in addition to the extensive preliminary data.
Johnson, Hans Joseph	$164,443.00	National Alliance for Medical Image Computing (NA-MIC)	Brigham & Women's Hospital	US Department of Health & Human Services, National Institutes of Health	The purpose of this proposal is to define the relationship between the Neurobiological Predictors of Huntington's Disease [5 R01 NS04006] (PREDICT-HD) and the National Alliance for Medical Image Computing projects. The Iowa PREDICT-HD investigators will collaborate with the NA-MIC cores to developing new and refined existing tools to achieve the specific aims of the HD-DBP. This will include participation in the two All-Hands meetings each year, as well as generation of presentations for scientific conferences and peer-reviewed publications. When it is mutually beneficial, development of the tools will be coordinated with other DBP's.The developed tools will follow the software engineering best practices guidelines established by NA-MIC, and will be made available through the Slicer3 project or the Neuroimaging Informatics Tools and Resources Clearinghouse (www.nitrc.org). The Iowa PREDICT-HD will work closely with the Algorithm Core to define use cases, develop representative test cases, and implement solutions compliant with the NA-MIC best practices guidelines. In addition, we will work with the larger Huntington's Disease user community to integrate NA-MIC Kit software into standard research workflows We will work with the NA-MIC algorithm and software developers to develop implementation strategies to meet the needs of Huntington's Disease medical image processing users by adapting and/or extending existing code in the NA-MIC Kit. Examples of the engineering work required include writing code to integrate several filters into a pipeline, building user interfaces to algorithms, converting data file formats, and automating repetitive analysis tasks.In the second and third years of the project training events will be held that coincide with the annual European Huntington's Disease Network meeting (http://www.euro-hd.net) , and the annual Human Brain Mapping conference (http://www.humanbrainmapping.org) to expose the larger HD community to the NA-MIC resources.Anonymized versions of the imaging data sets necessary to achieve the stated aims of this DBP will be made available to the entire NA-MIC community to facilitate algorithm, workflow, training and documentation efforts. An XNAT instance will be deployed with the entire deidentified PREDICT-HD imaging data set, representative standard workflows, and links to the clinical variables in the dbGaP (http://www.ncbi.nlm.nih.gov/gap) will be made available to external researchers through a standard approval processes.
Johnson, Hans Joseph	$173,727.00	National Alliance for Medical Image Computing (NAMIC)	Brigham & Women's Hospital	US Department of Health & Human Services, National Institutes of Health	
Johnson, Hans Joseph	$165,000.00	National Alliance for Medical Image Computing (NAMIC)	Brigham and Women's Hospital	US Department of Health & Human Services, National Institutes of Health	

Mudumbai, Raghuraman C	$400,000.00	CAREER: A First-Principles Approach to Smart Electric Grid: Fundamental Limits and Optimal Control Algorithms	US National Science Foundation		Project Summary We propose a comprehensive research program to develop a systematic mathematical theory and algorithms for the optimal design and control of a smart electric microgrid and to develop a small-scale experimental smart microgrid laboratory to test the feasibility of new smart-grid applications and to integrate the proposed research into graduate and undergraduate teaching and research. We are interested especially in a grid with a large number of small autonomous distributed generators and loads. Our main focus in the proposed research is on wind power generators in order to best leverage the institutional strengths and resources at the University of Iowa; however, we expect that our proposed research will have broad application to other renewable energy sources. While previous work has focused mostly on grid integration of renewable energy generators, our proposal focuses on fundamental limits and a ?rst principles approach; assuming that we have the freedom to design the electric grid from scratch without constraints of integrating into the existing grid, we propose to explore the limits of reliability and ef?ciency of an electric grid consisting of unpredictable renewable energy generators and loads, develop distributed and scalable algorithms to achieve these limits, and design simple experimental prototypes to test the practical feasibility of these techniques. We make extensive use of the conceptual device of an islanded microgrid which is either completely isolated from the larger public grid or interacts with it in an extremely limited and carefully controlled way. The experimental part of the proposed research is aimed not just to support the above research goals, but also to promote outreach and present opportunities for undergraduate research. The overall goal of the experimental part of the proposal is to develop an open-source set of tools to enable individuals and consumers to contribute to smart grid innovation. We have already had some success in this regard: our preliminary work motivated at least two undergraduate senior design projects and several class projects in the past year at the University of Iowa.
Srinivasan, Padmini	$133,120.00	Collaborative: ABI Development: Methodology for Pattern Creation, Imprint Validation, and Discovery from the Annotated Biological Web	US National Science Foundation		The wealth of knowledge from decades of successful bioinformatics research is captured in public repositories such as PubMed and Entrez Gene and in model organism resources such as The Arabidopsis Information Resource (TAIR). Each repository includes a collection of curated records. Curation involves enriching records with annotations and significant investments have been made to develop ontologies, e.g., Gene Ontology (GO) and Plant Ontology (PO), for increased interoperability within research communities. The Linking Open Data initiative and semantic Web technologies have also played a role in providing access to machine-readable annotated resources. Scientists today rely on tools to mine this wealth of annotated data, in synergy with the scientific literature, to obtain biologically meaningful patterns. We propose algorithms that will uncover patterns from the annotation graph of knowledge (pattern creation). We will exploit literature-based methods to explore the biological meaning underlying these patterns (pattern validation). The pattern creation, validation and discovery process will be tailored to enhance the workflow of a bioscientist. We have the following objectives for synergistic exploration and discovery: (1) Develop a pattern creation methodology: This will involve a protocol to create annotation graph datasets of triplets. We will develop novel graph data mining techniques and efficient algorithmic solutions to identify dense subgraphs (DSG) and to perform graph summarization (GS). Patterns are composed of multiple triplets across multiple genes. (2) Develop an imprint validation methodology: We will develop novel algorithms to mine the literature for the imprint of a triplet. We will perform sentence extraction and ranking and we will determine the certainty of an imprint. A validated triplet is one with an imprint of high certainty. (3) Develop a pattern discovery methodology: We will allow scientists to identify a context of interest, i.e., a dataset of experiment and control genes or sets of GO-PO search terms. Next, we will build and refine the annotation graph from TAIR and create patterns. Control genes will check if patterns are robust. Novel patterns may lead to hypotheses. Our methodology will enable iterative exploration and will incorporate allied steps such as consulting gene function predictions. (4) Develop the PattArAn suite tools to explore annotation datasets and the literature. This proposal contributes directly to the Arabidopsis thaliana community. We will offer our datasets and tools to scientists through TAIR (and the planned IAIC Arabidopsis Information Portal), and the Stanford NCBO portal, as a complement to existing tools such as Textpresso and AraNet. This collaborative project will offer significant research and educational experiences for graduate students (Maryland and Iowa) and undergraduate students (St. Bonaventure University). We will bring bioinformatics research into the undergraduate classroom. Team members already mentor women and students from underrepresented communities. Journal clubs and research sessions will be lead by PIs in their units. This project assembles an experienced interdisciplinary team that
Stern, Frederick	$75,000.00	High Performance Computing CFD-Based Global Optimization of Hybrid Ship Hull: Expansion	US Department of Defense, Department of the Navy		
Stern, Frederick	$150,000.00	High Performance Computing CFD-Based Global Optimization of Hybrid Ship Hull: Expansion	US Department of Defense, Department of the Navy		
Stern, Frederick	$40,000.00	High Performance Computing CFD-Based Global Optimization of Hybrid Ship Hull	US Department of Defense, Department of the Navy		
Stern, Frederick	$80,000.00	High Performance Computing CFD-Based Global Optimization of Hybrid Ship Hull	US Department of Defense, Department of the Navy		

Stump, Aaron D	$1,707,270.00	Collaborative Research: CI-ADDO-NEW: StarExec: Cross-Community Infrastructure for Logic Solving	US National Science Foundation		Automatically solving logical formulas from various logical theories is a core capability enabling applications in many important areas of Computer Science. This project will develop a single piece of shared computing infrastructure, called StarExec, that can be used by many different research communities working on logic solvers. This infrastructure will consist of a custom web serviceinterfacing with a cluster of 150 computer nodes. StarExec will provide solver community organizers the ability to manage their benchmark libraries, and solver community members to execute jobs comparing solvers on the benchmarks. StarExec will provide sophisticated graphical and statistical tools for viewing and analyzing job results. StarExec will be designed by the PIs based on their past experience as community organizers for the Satisfiability Modulo Theories (SMT) and First-Order Automated Theorem Proving (ATP) communities.
Stump, Aaron D	$15,700.00	SHF: Large: Collaborative Research: TRELLYS: Community-Based Design and Implementation of a Dependently Typed Programming Language	US National Science Foundation		This Reseach Experiences for Undergraduates (REU) supplement requests funds for two undergraduate researchers to implement a translation from computerized proofs in the format of the Coq computer-proof tool, to the format of the Trellys computer-proof tool being developed by the project which is being supplemented. The REU researchers will design and implement the translation from Coq to Trellys proofs in the OCaml functional programming language, for which past experience in OCaml, for example from the Computer Science class 22c:111, Programming Language Concepts, will be required.
Sugumaran, Ramanathan	$23,500.00	IowaView: StateView Program Development and Operations for the State of Iowa	AmericaView	US Department of the Interior, US Geological Survey	IowaView was established in 2007 and is presently working with several federal, state, local and tribal agencies in Iowa on remote sensing related research, education and outreach activities to advance the availability, timely distribution, and widespread use of remotely sensed data in the state. The long-term objectives for this consortium are to:
Tierney, Luke	$88,172.00	Computing Environments for Statistics	US National Science Foundation		The objective of the proposed research is to improve the ability of researchers, instructors, and other users of statistical methodology to apply statistical methods in new problem areas. The primary intellectual contribution of the proposed research will be the exploration and development of new principles for the design of statistical software to take advantage of modern computing power. This work will explore a range of issues, including the use of compilation and parallel computing in statistical computing environments. The broader impact resulting from the proposed research is to improve the ability of researchers, instructors, and other users of statistical methodology to effectively apply this methodology in scientific research and teaching. This is accomplished by making available results of the research as enhancements and additions to the open source statistical software system R, and by influencing the design of other statistical software through the R system and through publications resulting from the proposed research.
Tierney, Luke	$97,179.00	Computing Environments for Statistics	US National Science Foundation		The objective of the proposed research is to improve the ability ofresearchers, instructors, and other users of statistical methodologyto apply statistical methods in new problem areas. The primaryintellectual contribution of the proposed research will be theexploration and development of new principles for the design ofstatistical software to take advantage of modern computing power.This work will explore a range of issues, including the use ofparallel computing, compilation and static code analysis instatistical computing environments. The broader impact resulting fromthe proposed research is to improve the ability of researchers,instructors, and other users of statistical methodology to effectivelyapply this methodology in scientific research and teaching. This isaccomplished by making available results of the research asenhancements and additions to the open source statistical softwaresystem R, and by influencing the design of other statistical softwarethrough the R system and through publications resulting from theproposed research.
Tinelli, Cesare	$127,681.00	Collaborative Proposal: Scalable and Accurate SMT-based Model Checking of Data Flow Systems	US Department of Defense, Air Force		This project's overall objective is to improve the effectiveness and sefulness of model checking for embedded reactive software. The pro ject seeks to extend the scalability of model checking to systems with a very large or infinite state space, improve its accuracy in applications relying on non-linear arithmetic, and develop modular model checking approaches for infinite-state systems.The project will focus on systems following the synchronous data-flow model and will achieve its ob jectives by developing techniques based on automated reasoning engines working with more powerful logics than propositional logic, the logic of choice in most current model checkers. Comparable levels of automation will be maintained by exploiting recent advances in Satisfiability ModuloTheories (SMT) which has produced practically efficient and powerful tools for reasoning in richtheories of various data types.The expected outcome of this project will be a set of model checking techniques and tools forreactive systems with significantly higher scalability and accuracy. The expected impact will be an increase in industrial use of such techniques for the design and development of safety-critical systems. This, in turn, will lead to substantially higher levels of reliability and quality for suchsystems, with comparable or even superior productivity.
Tinelli, Cesare	$397,708.00	TWC: Medium: Collaborative: Breaking the Satisfiability Modulo Theories (SMT) Bottleneck in Symbolic Security Analysis	US National Science Foundation		This collaborative project with CMU and NYU will bring together experts in security and in automated reasoning to pursue two complementary research goals:(1) harness the full power of Satisfiability Modulo Theories solvers to improve current software security tools based on symbolic analysis; and (2) design and develop new techniques to address the needs of anticipated future security applications.

Tinelli, Cesare	$131,511.00	Collaborative Proposal: Scalable and Accurate SMT-based Model Checking of Data Flow Systems	US Department of Defense, Air Force		This project's overall objective is to improve the effectiveness and sefulness of model checking for embedded reactive software. The pro ject seeks to extend the scalability of model checking to systems with a very large or infinite state space, improve its accuracy in applications relying on non-linear arithmetic, and develop modular model checking approaches for infinite-state systems.The project will focus on systems following the synchronous data-flow model and will achieve its ob jectives by developing techniques based on automated reasoning engines working with more powerful logics than propositional logic, the logic of choice in most current model checkers. Comparable levels of automation will be maintained by exploiting recent advances in Satisfiability ModuloTheories (SMT) which has produced practically efficient and powerful tools for reasoning in richtheories of various data types.The expected outcome of this project will be a set of model checking techniques and tools forreactive systems with significantly higher scalability and accuracy. The expected impact will be an increase in industrial use of such techniques for the design and development of safety-critical systems. This, in turn, will lead to substantially higher levels of reliability and quality for suchsystems, with comparable or even superior productivity.
Tinelli, Cesare	$74,988.00	Formal Verification of Quasi-Synchronous Systems	Rockwell Collins, Inc.	US Department of Defense, Air Force	The goal of this project is to integrate innovative formal verification tools such as model checkers into widely used system engineering tools to allow systems engineers to easily specify and formally verify the high level architecture and synchronization logic of their systems.
Tinelli, Cesare	$99,353.00	Collaborative Proposal: Scalable and Accurate SMT-Based Model Checking of Data Flow Systems	US Department of Defense, Air Force		This project's overall objective is to improve the effectiveness and usefulness of model checking for embedded reactive software. The project seeks to extend the scalability of model checking to systems with a very large or infinite state space, improve its accuracy in applications relying on non-linear arithmetic, and develop modular model checking approaches for infinite state systems.The project will focus on systems following the synchronous data-flow model and will achieve its objectives by developing techniques based on automated reasoning engines working with more powerful logics than propositional logic, the logic of choice in most current model checkers. Comparable levels of automation will be maintained by exploiting recent advances in Satisfiability Modulo Theories (SMT) which has produced particularly efficient and powerfu tools for reasoning in rich theories of various data types.The expected outcome of this project will be a set of model checking techniques and tools for reactive systems with significantly higher scalability and accuracy. The expected impact will be an increase in industrial use of such techniques for the design and development of safety-critical systems. This, in turn, will lead to substantially higher levels of reliability and quality for such systems, with comparable or even superior productivity.
Wahle, Andreas	$36,725.00	Center of Excellence for the Prevention and Treatment of Visual Loss	US Department of Veterans Affairs, Iowa City Veterans Affairs Medical Center		IPA
Wahle, Andreas	$55,988.00	Internet-Based Distributed Quantitative 4-D Analysis of Aortic MR/MDCT Images	Medical Imaging Applications, LLC	US Department of Health & Human Services, National Institutes of Health	This is a fast-track STTR (R42) application. The proposed work involves technology transfer of a method to segment and quantitatively analyze MR image data for assessing the progression of congenital aortic disease (e.g., Marfan syndrome) that originated at the University of Iowa within the scope of NIH R01 HL071809 to Medical Imaging Applications, and atherosclerotic aortic disease as assessed by MDCT imaging by extending methods developed within the scope of NIH R01 EB004640. The aim is to further develop this technology for building a commercial product for local, distributed, or centralized aortic image analysis from MR and MDCT images, and will seek FDA approval for patient care.
Wahle, Andreas	$19,000.00	Center of Excellence for the Prevention and Treatment of Visual Loss	US Department of Veterans Affairs, Iowa City Veterans Affairs Medical Center		
Wahle, Andreas	$38,000.00	Center of Excellence for the Prevention and Treatment of Visual Loss	US Department of Veterans Affairs, Iowa City Veterans Affairs Medical Center		Dr. Wahle will be in charge of data storage design, backup, data transfer, data communication among the Center members. He will also collaborate with other Center scientists to develop and execute scientific computational tasks. Advise in the implementation of implement the XNAT database.
Wahle, Andreas	$11,000.00	Center of Excellence for the Prevention and Treatment of Visual Loss	US Department of Veterans Affairs, Iowa City Veterans Affairs Medical Center		Dr. Wahle will be in charge of data storage design, backup, data transfer, data communication among the Center members. He will also collaborate with other Center scientists to develop and execute scientific computational tasks. Advise in the implementation of implement the XNAT database.

Wu, Xiaodong	$145,830.00	Accurate Target Delineation and Motion Tracking to Improve IMRT Effectiveness	US Department of Health & Human Services, National Institutes of Health		The proposed K25 career development award will allow the candidate to become an independent and successful researcher in the emerging multidisciplinary biomedical computing area armed with a unique set of knowledge and breadth of experience both in computational and biomedical sciences. The University of Iowa with a well-rooted multidisciplinary culture, has newly established the Center of Excellence in Image-Guided Radiation Therapy, a world-class radiation therapy facility. In this excellent environment, the candidate, having a joint appointment at Departments of Electrical & Computer Engineering and Radiation Oncology, will develop his research career through (i) taking courses in radiation therapy and medical imaging; (ii) presenting research results at the most pertinent medical and computer science conferences; (iii) attending research group meetings and clinical evaluation and planning meetings at the Center. The research project of the candidate is to develop novel algorithms, methods, and software tools that make use of the latest advances in computer science and medical imaging for accurate target definition and motion tracking, thus improving the treatment effectiveness of Intensity-Modulate Radiation Therapy (IMRT). Target delineation and intra-fraction organ motion are two major sources that compromise the treatment effectiveness of IMRT. The computational feasibility is accomplished by formulating the target delineation and motion tracking problems as computing an optimal closed set in a weighted directed graph. The novel features of our method will be designed with a continuing focus on the global optimality of the solution. We hypothesize that advanced graph algorithmic and geometric techniques enable accurate target delineation and precise tracking of internal tumor/organ motion, thus improving IMRT effectiveness. The specific aims of the proposed research are as follows:1) Develop and validate a method for the optimal delineation of single and multiple interacting surfaces in volumetric image data; surfaces with terrain-like, tubular, and closed shapes as well as those with complex topologies will be included.2) Develop and validate a method for tracking optimal organ motion over the treatment course using 4-D image data.3) Develop and validate a method for accurate tissue voxel mapping which enables to transfer a 3-D treatment plan at one motion phase to all other phases to form a 4-D treatment plan.Public Health Relevance: We expect the clinical applications of the proposed approaches will have a measurable improvement on IMRT treatment effectiveness, leading to a better local tumor control and a significant increase of cancer survival rate.
Wyman, Christopher Ryan	$60,000.00	Cooperative Agreement: Applying GPU Computing and Computer Graphics to Engineering Analysis and Military Applications	US Department of Defense, Army		This proposal seeks to establish a cooperative agreement with scientists at the Army Research Laboratory to address shortcomings in current production simulations. We aim to dramatically improve performance, reduce cost, and add new capabilities. We propose the following areas of major effort over a five year period, as funding becomes available: evaluation of current GPU ray tracing techniques for ballistic simulation; improve depth peeling techniques to allow simulation of trajectories with non-infinitesimal cross-sections; apply global illumination techniques to radio and acoustic frequency propagation; identify good visualization techniques for various live-fire test simulations; and apply the parallelism techniques on modern CPUs and GPUs to a variety of traditionally single-threaded military simulations.
Wyman, Christopher Ryan	$40,000.00	Cooperative Agreement: Applying GPU Computing and Computer Graphics to Engineering Analysis and Military Applications	US Department of Defense, Army		This proposal seeks to establish a cooperative agreement with scientists at the Army Research Laboratory to address shortcomings in current production simulations. We aim to dramatically improve performance, reduce cost, and add new capabilities. We propose the following areas of major effort over a five year period, as funding becomes available: evaluation of current GPU ray tracing techniques for ballistic simulation; improve depth peeling techniques to allow simulation of trajectories with non-infinitesimal cross-sections; apply global illumination techniques to radio and acoustic frequency propagation; identify good visualization techniques for various live-fire test simulations; and apply the parallelism techniques on modern CPUs and GPUs to a variety of traditionally single-threaded military simulations.
Wyman, Christopher Ryan	$35,000.00	Cooperative Agreement: Applying GPU Computing and Computer Graphics to Engineering Analysis and Military Applications	US Department of Defense, Army		This proposal seeks to establish a cooperative agreement with scientists at the Army Research Laboratory to address shortcomings in current production simulations. We aim to dramatically improve performance, reduce cost, and add new capabilities. We propose the following areas of major effort over a five year period, as funding becomes available: evaluation of current GPU ray tracing techniques for ballistic simulation; improve depth peeling techniques to allow simulation of trajectories with non-infinitesimal cross-sections; apply global illumination techniques to radio and acoustic frequency propagation; identify good visualization techniques for various live-fire test simulations; and apply the parallelism techniques on modern CPUs and GPUs to a variety of traditionally single-threaded military simulations.