

Active Research Grants

Bowler, Leanne

Principal Investigator

Pitt - CRDF

Efficacy of Design-Based Research Methods in Revealing Adolescent Metacognitive Thinking

The primary purpose of this pilot study is to refine a participatory design method for investigating adolescent metacognitive knowledge during the information search process. Work in the area of design-based research has shown that participatory design projects are a good platform for discovering the thoughts, feelings, motivations, and preferences of information seekers. This study is the first phase of a research program that will use the platform of design-based research to open the window on adolescent metacognitive knowledge during the information search process.

Brusilovsky, Peter

Principal Investigator

NSF

Ensemble: Enriching Communities and collections to Support Education in Computing (Supplement)

This project proposes to develop a stand-alone computing pathway within the National Science Digital Library (NSDL). The goal of the project is to organize an online digital resource to support teaching and learning across the full range of computing disciplines, within the framework of the NSDL Pathways project. The central role played by computing in almost every sector of the economy implies that computing has become a core collection of disciplines that should have its own place in Pathways.

Brusilovsky, Peter

Principal Investigator

Google

Personalized Social Systems for Local Communities

The goal of this proposal is to improve social feedback and recommendation in social systems for local communities. The nature of modern community-based systems such as social bookmarking and recommender systems effectively limits their area of applicability to large communities, but additional

support for information sharing and finding the most relevant information provided by community-based systems is even more important for smaller local communities. To resolve this issue, the PI will explore two innovative ideas. The first idea is to provide access to information "beyond desktop" by adding mobile and ubiquitous ways to access information and thus increase both the number of active users and the amount of their contributions. The second idea is to leverage the co-presence of several social technologies in one system through development of cross-cutting techniques that use the assets of one technology to enhance another technology, creating a positive feedback loop that allows each technology to collect more knowledge and increase its impact. The subjects to be investigated are two existing social systems - CoMeT system for sharing research talks at CMU and Pitt, and Eventur, a social system. These systems will be extended with mobile (android phones) and ubiquitous (flat-screen building displays) interfaces, and they will integrate recommendation and social networking functionalities, allowing the research team to explore the value of these innovations in the local community context.

Brusilovsky, Peter

Principal Investigator

NSF

EAGER: Interactive Visualization and Modeling of Latent Communities

The goal of the proposed project is to expand the results the earlier funded project "Modeling and Visualization of Latent Communities". The original project demonstrated the feasibility of using various social data to model and visualize latent coherent communities that exists withing social systems. The proposed project will investigate techniques of discovering latent communities in much richer datasets with larger number of datatypes. The main challenge at this stage will be interactive visualization that engages both experts and users in contributing new data. The new kind of visualization will allow experts to contribute knowledge about the communities and observe the changes of visualization once it takes into account new knowledge. It will also allow end users to to augment and improve the quality of systemgenerated community clusters.

Currier, James D. "Kip"

Co-Principal Investigator

Andrew W. Mellon Foundation

iSchool Inclusion Initiative

The School of Information Sciences at the University of Pittsburgh proposes to host an annual series of Summer Institutes to allow rising juniors to explore the opportunities available to them with advanced

study in the Information Sciences. The Institutes will enable the students to understand how the Information Sciences play a critical role in society and business, how a graduate degree from one of the Information Schools (iSchools) may benefit them, and how careers in academia can be very challenging and fulfilling. This proposal requests funding from the Andrew W. Mellon Foundation in the amount of \$599,964 to support this three-year pilot project, which is based on planning efforts at the University of Pittsburgh School of Information Sciences, funded by a planning grant awarded by the Andrew W. Mellon Foundation. The i3 project is proposed in response to a lack of faculty and students from underrepresented populations within academia and the workforce in general, and the Information Schools (iSchools) specifically. To address this critical shortfall, the Initiative's primary aims are (1) to increase the number of students with a demonstrated commitment to eradicating racial disparities in graduate programs at U.S. iSchools, and (2) to encourage these students to consider academic career opportunities and achieve successful and satisfying positions as academic faculty members. The program will involve recruiting 20 sophomores to each cohort (3 cohorts in the pilot project) from throughout the US for a four-week introductory residential Summer Institute at the University of Pittsburgh. The Institute will provide a comprehensive overview of the information professions, introduce the nature of graduate study, and to engage in experiential activities to acquaint the participants with the work of an information professional. After completing this introductory institute, participants will engage in a team project to be undertaken throughout the Junior year, supported by faculty mentors and social networking among the cohort. Then, the cohort will come back to the University of Pittsburgh for a two-week concluding residential Summer Institute, where the participants will present the results of their team project for critique, will develop a plan of graduate study, will be counseled on strategies for success, and will be recruited by iSchools in attendance. With the support of the Andrew W. Mellon Foundation, the School of Information Sciences aims to increase the number of graduate students - and, eventually, faculty - who are from underrepresented groups or those who have a demonstrated commitment to eradicating racial disparities. Research has shown that a diverse faculty encourages those from underrepresented populations to more likely consider advanced educational opportunities. More diverse and inclusive student bodies may in turn yield academic faculties and workforces that are more representative of U.S. societal demographics.

Druzdzal, Marek

Principal Investigator

Wake Forest/NIH

Dynamic Multichain graphical Models for the Analysis

The project focuses on the development of an extended version of the dynamic Bayesian network developed earlier by the Decision Systems Laboratory for the analysis of multilevel data. The Decision Systems Laboratory (DSL) will serve as a subcontractor on the grant to Wake Forest University. The task of the DSL will be to provide support for the development of the dynamic Bayesian network model proposed. The research team will develop a graphical user interface for the model, test it with users,

and improve it to the point of practical deployment. They will also collaborate with the Wake Forest University's Department of Biostatistical Sciences team on the dissemination of results and programs that are generated from the proposed project.

Joshi, James

Principal Investigator

National Science Foundation

A Scholarship Program for Security Assured Information Systems Track

Through this scholarship program, the University of Pittsburgh offers highly qualified students the opportunity to become information assurance (IA) professionals of high caliber who will serve the nation and the global society by protecting the cyberspace. Under this program, each scholarship recipient is required to complete a Masters degree in Information Science or Telecommunication and Networking with the Security Assured Information Systems (SAIS) track option. In addition, Ph.D. students in either program with IA concentration can request support for the last two years of their studies. The scholarship program supports three cohorts of 4 students over a period of four years.

Intellectual Merit: Scholarship students benefit from a highly fertile multidisciplinary educational environment and a strong and diversified, high quality IA curriculum, which is among the only eight in the nation that has been certified for all the five national IA educational standards set by the Committee on National Systems Security (CNSS). The program establishes a well-coordinated management and administration structure to ensure that:

- (1) Scholarship opportunities are available to highly competitive, students from underrepresented groups in IA,
- (2) Scholarship students are provided with appropriate mentoring support throughout their academic program, and
- (3) Scholarship students are engaged in professional development and synergistic activities that enrich their academic experience.

Broader Impact: The program places significant emphasis on the recruitment of students from underrepresented groups in IA areas through its links with minority serving postsecondary institutions such as the University of Puerto Rico, Mayaguez and Lincoln University. The program also benefits from synergistic interactions among the various IA and homeland defense related initiatives within the university.

Joshi, James

Principal Investigator

Cisco

DiCoTraM: Towards a Distributed Collaborative Traffic Monitoring System

The key goal of this project is to develop a Distributed Collaborative Traffic Monitoring (DiCoTraM) framework for intrusion detection tasks. Traditional host-based and centralized network-based monitoring mechanisms have been found to be inadequate in this area. Network-based monitoring mechanisms usually incur high storage and processing overhead at the routers; these overheads increase if each router performs redundant monitoring of the same traffic flows. In host-based systems, a key issue is the lack of enough information at the sources to detect an attack in timely fashion. To defend against sophisticated, coordinated attacks, defense mechanisms should also form alliances and collaborate with each other. Hence, the best alternative to traditional systems would be hybrid defense mechanisms in which monitoring tasks can be deployed at multiple locations including sources, destinations or intermediate networks. A distributed monitoring environment can continue to function even if some of the monitoring components fail or are compromised, thus, providing a better defense mechanism. Furthermore, detecting attacks as soon as possible (before they reach the victims), identifying the sources of the attacks, and finally stopping (blocking or rate limiting) them are the ultimate goals of all defense mechanisms. Such a goal can be best achieved through a comprehensive distributed and collaborative defense mechanism. The most critical component of such a mechanism is a comprehensive distributed and collaborative traffic monitoring system.

Krishnamurthy, Prashant

Co-Principal Investigator

National Science Foundation

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Krishnamurthy, Prashant

Co-Principal Investigator

UC/Davis (MURI)

ARSENAL: A cross layer ARchitecture for SEcure resilieNt TacticAL mobile ad hoc networks

The goal of this project is to develop a cross layer architecture that provides comprehensive security and resilience. Depending on the services desired, the proposed architecture will be able to adaptively provide the right trade-offs between performance, security and fault-resilience. The project as a whole will undertake three simultaneous but interdependent tasks geared towards a) performing measurements via real deployments and enhancing our understanding of layer dependencies and vulnerabilities in mobile ad hoc networks; these measurements will be on existing testbeds at various PI institutions b) building analytical models to characterize the behavioral nuances of these networks and c) design of new cross layer protocols that protect against vulnerabilities and provide the desired robustness as mentioned above. The distinguishing aspects of this proposed work are that the approach (i) provides accurate, experimentally validated physical and higher layer characterization and dependencies between layers, (ii) unlike previous approaches, accounts for physical layer effects and exploits specialized physical layer features to provide better security and (iii) models and takes into account, a comprehensive set of possible attacks including attacks by insider nodes and eliminates/alleviates their impact. At Pitt, the PIs will participate in experimental work (data collection at Pitt to complement testbeds at UC Davis and elsewhere), developing analytical models in conjunction with other universities, and integrating them with the cross-layer protocols likewise.

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Techno-Economic Models of Secondary Spectrum Use

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Larsen, Ronald

Principal Investigator

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Larsen, Ronald

Principal Investigator

Andrew W. Mellon Foundation

A Research Program for Advancing New Models of Scholarly Communication across Disciplines

This grant will support the development of a graduate research program designed to understand and influence the emergence of digital communication and research in academia, known as cyberscholarship. It provides resources to hire a professor in SIS and ULS to explore how disciplines are re-examining scholarly priorities, reshaping methodologies, and redefining evidence bases as a result of new media and new tools.

Larsen, Ronald

Principal Investigator

NSF

Workshop: Emerging Configurations of the Virtual and the Real

The world is witnessing a sea change in the way in which information is generated, stored and deployed. Streaming sensor networks produce terabits of data per day across many fields of human and natural concern (generation). With the rise of the database as a key unit of exchange within and between fields, we are in the process of creating a revolution as large as that of the printing press (storage). New fields such as virtual archeology are producing new kinds of knowledge impossible even thirty years ago (deployment). A central concern for our nation moving forward is how to grasp these developments and stay at their helm. Further, there are promising developments using cyberinfrastructure to create strong ties between elite institutions and those working in disadvantaged universities through techniques such as the remote operation of laboratory equipment. The proposed workshop offers a unique angle of vision through taking stock of innovations in practice and generating potential new innovations in scholarship.

Lewis, Michael

Principal Investigator

CMU/MURI/Army

Modeling Synergies in Large Human-Machine Networked Systems

Network centric military systems (NCW) are planned to involve hundreds to thousands of manned and autonomous entities cooperating to achieve complex joint objectives in incomplete information environments. While in today's military tight automated coordination exists within isolated, stovepiped systems most information and instruction still passes through a human chain of command. Benefits from pervasive networking are expected to result in enabling an increased pace of coordinated activity and reactivity among forward forces. By sensing, communicating, and acting locally rather than sending information up and down the hierarchy, forces are expected to be able to coordinate their actions laterally to take advantage of local and rapidly changing situations. Traditional human roles will need to be adapted to fit the new NCW architecture. The quantities of peer-to-peer information available at the edge of the network will be much greater than those currently handled by filtering and aggregating up the hierarchy and likely beyond the cognitive capabilities of a human. Conversely, with decision making and cooperation occurring at the edge outside of the conventional chain of command, new mechanisms may be needed for conveying the commander's intent and assessing progress on the battlefield. In both cases research is needed to identify potentially beneficial or damaging emergent effects. The proposed research will be mathematically based drawing on human data and models as necessary to accurately characterize their behavior within the system.

Lewis, Michael

Principal Investigator

CMU/ONR

Cognitively Compliant Command for Multirobot Teams

Autonomous behavior, particularly that of robot teams, may be difficult to understand because their algorithms may be much different from those humans would employ under the same circumstances. These differences may become critical when robots must deal with inexperienced, naïve, stressed, or fatigued humans. Current technologies fall far short of meeting the demands of combat systems. At one extreme, single-operator control models, such as teleoperation or waypoint following have shown severe scale limitations; at the other extreme, swarm-based algorithms can manage hundreds of robots, but only for simple tasks and with very limited direct operator influence. Thus, these paradigms impose severe limitations on our ability to deploy and command effective robot forces. The PIs propose to develop a framework for dramatically increasing operator span of control while improving the ability to convey intent and maintain Situation Awareness (SA). They will explore techniques for enhancing intelligibility through displaying cues and designing more humanly intelligible behaviors. They will develop measures of command complexity to identify the range of commands a human can effectively employ for teams of various sizes, dictating minimal levels of autonomy for the team and appropriate multi-operator configural displays to support the available commands. The proposed research will overcome the current limitations of the existing human-UV control paradigms.

Lewis, Michael

Principal Investigator

CMU/MURI/Army

Cultural Models, Collaboration & Negotiation

The goal of this multidisciplinary research is to develop validated theories and techniques for creating descriptive and predictive models of dynamic collaboration and negotiation that take into consideration cultural and social effects. We are interested in modeling interactions of US personnel with friendly, neutral, or hostile individuals and groups for STTR operations. The domain of study will be Turkey and Iraq initially with possible extensions to Iran and other Arab cultures. The team will use proven methods to collect relevant cultural, demographic, socio-political and historical data including working with SMEs, including data gathered through role playing experiments in the laboratory and through web-based multi-player games, and experimental surveys. Analysis will be done using statistical techniques as well as simulations. The results of the analysis will be incorporated in novel ways into dynamic theoretical and computational collaboration and negotiation models. The team will use game theoretic, machine learning and cultural assessment techniques in model development. The models will be validated through extensive experimentation. The models will be integrated and implemented into software artifacts (e.g. virtual agents in life-like simulation environments) for training and operational planning. The software will in turn be validated and evaluated using realistic operational scenarios.

Pelechrinis, Konstantinos

Principal Investigator

Pitt - CRDF

Building & Maintaining Trust in Wireless Networks

The Principal Investigator proposes to design and implement a framework for trust establishment and maintenance in a wireless network. In particular, the following tasks will be undertaken: trust establishment, evidence collection and propagation, trustworthy routing, and accounting for contextual dependencies. The proposed work will be applicable in many mission critical settings (such as in disaster recovery or tactical networks). It is expected that this work will be a stepping stone to increasing the popularity of open networks and applications thereof (such as distributed gaming). Finally, it is also anticipated that the work will directly influence the growth of wireless social networks.

Spring, Michael

Co-Principal Investigator

National Science Foundation

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Spring, Michael

Co-Principal Investigator

National Institutes of Health

Online Treatments for Mood & Anxiety Disorders in Primary Care

The primary hypothesis of the research team is that patients in their CCBT+ISG arm will report a clinically meaningful 0.30 effect size (ES) or greater improvement on the S-12 MCS vs. patients in their CCBT-alone arm at 6 months follow-up. Secondary hypotheses are that CCBT-alone patients will report a 0.50 ES or greater improvement on the SF-12MCS vs. “usual care,” and that the ISG provides synergistic benefits to CCBT. The team will monitor patients for 12 months following enrollment to better evaluate the durability and usage patterns of the interventions and for any alterations in health services utilization and cost that occur.

Spring, Michael

Co-Principal Investigator

National Institutes of Health

SmartCare: Innovations in Caregiving Interventions

Multiple studies have shown that the psychological and physical consequences of providing care to a family member with a chronic illness can include anxiety, depressive symptoms, burden, altered immune function, poor overall health, and increased overall mortality. The proposed study addresses research priorities set by both NCI and NINR to improve the quality of life of patients and their families and NINR's emphasis on integrating bio-behavioral science and adopting, adapting and generating new technologies. The significance of the project is great in terms of its potential societal and economic impact. The web-based and telephone intervention delivery allows for easy translation and should the

hypotheses be supported, this trial could fundamentally change how caregiver interventions are delivered.

Spring, Micheal

Co-Principal Investigator

National Institutes of Health

Web-based Ovarian Cancer Symptom Control: Nurse-guided vs Self-directed

The primary aim of the study is to compare the efficacy of nurse-guided WRITE (Written Representational Intervention to Ease Symptoms) Symptoms vs. self-directed WRITE Symptoms vs. care as usual in improving symptom representations for women with recurrent ovarian cancer. The role of the SIS research team is to design the internet systems.

Tipper, David

Principal Investigator

UC/Davis (MURI)

ARSENAL: A cross layer ARchitecture for SEcure resilieNt TacticAL mobile ad hoc networks

The goal of this project is to develop a cross layer architecture that provides comprehensive security and resilience. Depending on the services desired, the proposed architecture will be able to adaptively provide the right trade-offs between performance, security and fault-resilience. The project as a whole will undertake three simultaneous but interdependent tasks geared towards a) performing measurements via real deployments and enhancing our understanding of layer dependencies and vulnerabilities in mobile ad hoc networks; these measurements will be on existing testbeds at various PI institutions b) building analytical models to characterize the behavioral nuances of these networks and c) design of new cross layer protocols that protect against vulnerabilities and provide the desired robustness as mentioned above. The distinguishing aspects of this proposed work are that the approach (i) provides accurate, experimentally validated physical and higher layer characterization and dependencies between layers, (ii) unlike previous approaches, accounts for physical layer effects and exploits specialized physical layer features to provide better security and (iii) models and takes into account, a comprehensive set of possible attacks including attacks by insider nodes and eliminates/alleviates their impact. At Pitt, the PIs will participate in experimental work (data collection at Pitt to complement testbeds at UC Davis and elsewhere), developing analytical models in conjunction with other universities, and integrating them with the cross-layer protocols likewise.

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Co-Principal Investigator

National Science Foundation

Techno-Economic Models of Secondary Spectrum Use

There still exist barriers to adoption of dynamic spectrum access techniques and technologies. A significant barrier to adoption is that the constraints of both primary and secondary users of spectrum are still foggy. The incentives that primary users have for sharing have been studied, though these studies often do not consider the business strategies, investment, and technological risks that primary users face. The decision processes of potential secondary users that sheds light on the circumstances under which they may select a particular dynamic spectrum access choice has received little or no attention. It is the objective of this proposal to fill this gap by creating a comprehensive framework for analyzing (and thereby providing a quantitative evaluation of) the choices that secondary users of spectrum may have, both in terms of technical and business risk aspects. This proposal addresses two types of stakeholders in the secondary market for spectrum. The first stakeholder comprises entrants to the market who need a sound method and metrics for quantifying their spectrum choices and the second stakeholder comprises regulatory agencies that also need such methods and metrics to advise their policy making in this area in order to encourage an economically viable secondary market that can better utilize the available spectrum.

Tomer, Christinger

Principal Investigator

Institute of Museum and Library Services

Post-Master's Degree Certificate of Advanced Studies in Health Sciences Librarianship

Health sciences information is increasing in complexity, and health sciences librarians are increasingly being called to actively collaborate with medical professionals. Seeking to provide advanced training to meet these challenges, the School of Information Sciences at the University of Pittsburgh, partnering with the university's Health Sciences Library System, will create a 15-credit, post-master's certificate of advanced studies in health sciences librarianship. The new course of study will build upon the school's successful medical librarianship/informatics specialization within the master's degree program. This project will also provide scholarships for an initial cohort of 27 students.

Weiss, Martin

Principal Investigator

NSF

Cooperation Under Competition: System Implications for DSA & Computing Systems

Electricity generation and computing have progressed through stages from captive resource through shared resource to utility. Doing this required new levels of cooperation from competing users. Wireless systems are at present substantially in the captive resource stage, characterized by exclusive use of radio spectrum. Given that we see some shared resource systems (via unlicensed devices), we have every reason to believe that wireless systems will follow the trail blazed by electric power and computing industries. Indeed, more advanced sharing is taking place, but, in its current conception, dynamic spectrum access (DSA) technology is simply a more advanced form of the shared resource? model. However, if this is done properly, DSA can set the stage for utility mobile connectivity.

The primary objective of the proposed research project is to explore the design of cooperative, yet competitive frameworks for efficient resource sharing in future networks. To this end, we propose a research agenda, designed to study spectrum sharing as a special case to gain critical understanding of what the design of these frameworks entail. This understanding will be used to explore the more challenging problem related to the design of holistic approaches to enable cooperative, yet competitive environments.

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Weiss, Martin

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Costs and benefits of Spectrum Sharing in Next Generation Radio Systems

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Zadorozhny, Vladimir

Co-Principal Investigator

National Science Foundation

Center for Historical Information and Analysis (CHIA)

Contemporary globalization and concerns about future global trends naturally raise questions about past patterns of global change. What were the interactions of population, economy, governance, and social inequality with each other and with climate and disease? Historical social science, focused at national and subnational levels, has scarcely addressed global issues. This research team expects to collect, document, and analyze historical data to permit cross-disciplinary analysis of human society over time. The overall topic is immense, but the PIs believe they have found an orderly and productive way to work on it.

Znati, Taieb

Co-Principal Investigator

NSF

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