Innovation through research and technology
Florida International University (FIU), the state university of Florida in Miami, is ranked by the Carnegie Foundation as a comprehensive doctoral research university with high research activity. FIU offers more than 180 baccalaureate, masters, and professional and doctoral degree programs to over 48,000 students. Miami is a diverse international city renowned for being the business and IT hub for Latin America and is home for thousands of technology related businesses. As one of South Florida’s anchor institutions, FIU is worlds ahead in its local and global engagement and is committed to finding solutions to the most challenging problems of our times.

The School of Computing and Information Sciences (SCIS) is a rapidly growing program of excellence at the University, with 35 faculty members and over 1,300 students, including 65 Ph.D. students. SCIS offers B.S., M.S., and Ph.D. degrees in Computer Science, an M.S. degree in Telecommunications and Networking, and B.S., B.A., and M.S. degrees in Information Technology. SCIS has received approximately $19 million in the last four years in external research funding and donations, has six research centers/clusters with first-class computing infrastructure and support, and enjoys broad and dynamic industry and international partnerships.
Dr. Mark Rosenberg, FIU President

Florida International University has embarked on a campaign to engage communities from around the world by demonstrating the impact of our distinguished faculty and our dedicated and enthusiastic students. We call this effort Worlds Ahead; you will find it throughout our campus, embodied in the spirit and effort that drives units like our School of Computing and Information Sciences to pursue outstanding achievements. The School is a great ambassador for this vision since computing and information technology is at the heart of so much of our daily lives, is the engine for many innovations we enjoy today, and will be key for the development of the innovations to come.

The pursuit of innovation means going beyond what is expected - a tenant of Worlds Ahead. It means taking the opportunity you are given and doing something great with it. The words are as much a part of what you are today as what you aspire to be tomorrow. It is an attitude, one that commands us to think differently, exceed expectations and create new possibilities. I hope you will find in these pages many examples of that spirit, attitude and innovation, as we are very proud of the School’s accomplishments. We heartily invite you to work with the School, become a partner, and join our community as we realize this vision.

Dr. Amir Mirmiran, CEC Dean and Professor

Information Technology is a critical enabler for Engineering, Science and many Industries. Our School of Computing and Information Sciences provides the research infrastructure, faculty expertise and top students to pursue state-of-the-art research and technology development needed to solve the most challenging multi-disciplinary problems.

Dr. Ram Iyengar, SCIS Director and Ryder Professor

Our 25 year-old-school is a well-respected computer science and information technology research and education program. Over the last 10 years we have built a highly engaged and focused multi-disciplinary research community at one of the largest state universities in the US. Our School has experienced tremendous growth in degree offerings, research funding, and enrollment. Our School is one of the largest degree awarding programs of its kind. The success of our School is measured in the awards our faculty members have earned for their research and teaching excellence, the diverse, outstanding students our programs produce, the state of the art technologies and innovation our labs are developing, and our global collaborations with government, industry and academia.

We lead large-scale research consortia such as the Latin American Grid, a research and education partnership with leading international universities and IBM Research. Our faculty and students have engaged in many international scientific communities and publish in leading computing journals. Our highly competitive students work in top research labs throughout the world such as Barcelona Super Computing Center and IBM Research in China and India. We are eager to work with ambitious researchers and high-quality students with interest in international science and collaborations as we prepare the next generation of computer science and information technology professionals.
Undergraduate Degree Programs:

• The Bachelor of Science in Computer Science degree presents a course of study that includes mathematics, science, and computer science foundational topics necessary for the preparation of a successful computing professional. Students are taught skills in the art and science of computer programming that expose them to program design, logic, computing theory, software engineering, and validation. Students develop software in our state of the art labs that offer a variety of operating system and interactive development environments. Typical jobs obtained by recent graduates include; computer programmer, computer analyst, software engineer, and computer support specialist. Students who intend to pursue a software engineering career should select the Software Development Track.

• The Bachelor of Science in Information Technology degree presents a course of study that includes hands-on skill development in a broad array of subjects such as software development, databases, and networking. Students develop software in our state of the art labs that offer a variety of operating system and interactive development environments. Information Technology majors focus less on mathematical and theoretical concepts of computing than Computer Science majors and more on specific and state-of-the-art technologies. Students who want to add a strong theoretical foundation of Computer Science can pursue the Information Technology Software Major track. Typical jobs obtained by recent graduates include; systems administrator, applications support specialist, database administrator, computer programmer, computer analyst, and computer support specialist.

Graduate Degree Programs

• The Master of Science in Telecommunications and Networking is intended to educate individuals seeking employment with hardware and/or software companies, service providers, large user organizations, or telecommunications regulatory agencies as well as for those who are already employed by these companies/organizations and wish to obtain formal, higher-level, specialized degree in Telecommunications and Networking. Telecommunication and Networking students learn how to lead in the ever changing environment of real-time global information networking, telecommunications, wireless and optical strategies and how to amplify business value through communications, technologies and systems.
### Messages
from the FIU President, CEC Dean, and SCIS Director

### Degree Programs

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### Research Areas

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### Areas of Research

- The **Master of Science in Information Technology** is intended to educate students in the area of technical aspects of Information. It provides an emphasis on software technology, database technology, and security technology. The program is ideally suited for those who wish to obtain a higher level degree in Information Technology, and seek employment in the IT industry.

- The **Master of Science in Computer Science** degree provides study in state-of-the-art computer applications as well as an introduction to the theoretical foundations of computer science.

- The **Doctor of Philosophy in Computer Science** is designed to provide study in all major areas of computer science while leading to the frontiers of knowledge in a chosen field of concentration.

### Areas of Research

Our faculty embodies a broad range of computing interests and has built dynamic and innovative research centers and groups around several areas of specialization. These include:

- **Database Systems**, including database design, database management and applications, database theory and implementation, database machines, distributed databases, information retrieval in heterogeneous databases, multimedia databases, data mining and digital libraries.

- **Software Engineering**, including large-scale software design, programming language environments, software development and maintenance methodologies, object-oriented techniques, software reuse, and software quality assurance.

- **Parallel and Distributed Systems**, including formal specification methodologies, distributed file systems, distributed multimedia systems and operating systems, storage systems, high-performance systems, cloud computing systems, and security.

- **Computer Networks**, including network protocols, multimedia networking, and wireless communications.

- **Theory**, including algorithms and data structures, programming languages, computer security, program verification and logic.

- **Artificial Intelligence**, including neural networks, expert systems, automated reasoning, term rewriting systems and intelligent tutoring systems.

- **Affective Social Computing**, including knowledge representation, natural language processing, intelligent virtual characters, and multimodal user interfaces.

- **Cognitive Science**, with emphasis on the philosophical, psychological and linguistic underpinnings of artificial intelligence.

- **Bioinformatics and Computational Biology**.
Points of Pride

- Second largest Engineering College based Computer Science degree awarding program in the US.
- 1,300+ students
- 150+ degrees awarded/year
- Among the top 25 -36 Ph.D. granting Computer Science departments in the US on a per research faculty funding basis
- Over 20 percent of the State Universities’ undergraduates in Computer Science
- Our alumni are engineers at Apple, Citrix, Google, IBM, Microsoft, Oracle, etc.
- SCIS accounts for 13% of all Hispanic Ph.D. students
- Faculty external funding ratio is one of the best in the state for an academic department.
- Many faculty have earned NSF and DOE Career Awards, Research awards from Google, IBM, Xerox, and NetApp.
- Faculty recognized with Distinguished Awards such as IEEE Fellow, ACM Fellow, Kaufman Professor, and AAAI Nils Nilsson.
- Best Conference Paper Awards from IEEE, ACSAC and other Computer Societies.
- 157 Peer Reviewed Publications 2010-11

Research Centers, Institutes, Labs and Initiatives

cis.fiu.edu/research

NSF CREST Center for Innovative Information Systems Engineering

NSF I/UCRC: Center for Advanced Knowledge Enablement

NSF PIRE A Global Living Laboratory for Cyberinfrastructure Application Enablement

Latin American Grid and the IBM Center for Autonomic and Grid Computing

High Performance Database Research Center

Center for Advanced Distributed Software Engineering

Telecommunications and Information Technology Institute

Bioinformatics and Computational Biology Laboratory

Systems Research Laboratory

Discovery Lab

Distributed Multimedia & Information Systems Laboratory

Laboratory for Virtualized Infrastructure, Systems, and Applications

Affective Social Computing Laboratory

Disaster IT Research Group

Knowledge Discovery Research Group

Modeling and Networking Systems Research Group

Software Testing and Research Group
The School of Computing and Information Science at FIU is honored to recognize our prestigious speakers; Jack Dongarra, Moshe Y. Vardi, Mary F. Wheeler, Vince McKoy and Edward Seidel who participated in the 2011-12 Citrix Distinguished Lecture Series. The lectures presented exciting topics such as the challenges of petascale computing, simulating quantum collisions, subsurface modeling and simulation and Big Data science. We would like to thank our Industry Sponsor Citrix for their support of this enriching lecture series.

You can find these lectures and materials at: cis.fiu.edu/citrixdl5
Faculty Profiles: School Administration

Ram Iyengar
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Dr. Iyengar is the director and Ryder professor of School of Computing and Information Sciences at Florida International University, Miami, and is also the chaired professor at various institutions around the world. His publications include 6 textbooks, 5 edited books and over 400 research papers. His research interests include high-performance algorithms, data structures, sensor fusion, data mining, and intelligent systems. He is a world-class expert in computational aspects of sensor networks, data structures, algorithms for various distributed applications. His techniques have been used by various federal agencies (NRL, ONRL, NASA) for their projects. His work has been cited very extensively by researchers and scientists around the world. Dr. Iyengar is an SIAM Distinguished Lecturer, ACM National Lecturer/IEEE Distinguished Scientist.

Mark Allen Weiss
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Mark Allen Weiss is professor and associate director for the School of Computing and Information Sciences at Florida International University. He is also currently serving as director of undergraduate studies. He received his bachelor’s degree in electrical engineering from the Cooper Union in 1983, and his Ph.D. in computer science from Princeton University in 1987, working under Bob Sedgewick. He has been at FIU since 1987 and was promoted to professor in 1996. His interests include data structures, algorithms, and education. He is most well-known for his highly-acclaimed data structures textbooks, which have been used by a generation of students. Professor Weiss is the author of numerous publications in top-rated journals and was recipient of the University’s Excellence in Research Award in 1994. In 1996 at FIU he was the first in the world to teach data structures using the Java programming language, which is now the de facto standard. From 1997-2004 he served as a member of the Advanced Placement Computer Science Development Committee, chairing the committee from 2000-2004. The committee designed the curriculum and wrote the AP exams that were taken by 20,000 high school students annually.

In addition to his Research Award in 1994, Professor Weiss is also the recipient of the University’s Excellence in Teaching Award in 1999, the School of Computing and Information Science Excellence in Teaching Award (2005) and Excellence in Service Award (2007), the FIU Top Scholar Award (2012). In 2011, he was honored as an ACM Distinguished Educator.

Research and Instructional Interests: algorithm design and analysis, computer science education

Selected Publications:

Shu-Ching Chen
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Dr. Shu-Ching Chen is a professor in the School of Computing and Information Sciences, Florida International University, since August 2009. Prior to that, he was an assistant/associate professor in SCIS at FIU from 1999. He received Master’s degrees in computer science, electrical engineering, and civil engineering in 1992, 1995, and 1996, respectively, and the Ph.D. degree in electrical and computer engineering in 1998, all from Purdue University. He is the director of the Distributed Multimedia Information Systems Laboratory and associate director of The Center for Advanced Distributed System Engineering at SCIS. His main research interests include content-based image/video retrieval, distributed multimedia database management systems, multimedia data mining, multimedia systems, and disaster information management. Dr. Chen has authored and coauthored more than 240 research papers in journals, refereed conference/symposium/workshop proceedings, book chapters, and one book. Dr. Chen has been the PI/Co-PI of many research grants from NSFE National Oceanic and Atmospheric Administration (NOAA), Department of Homeland Security, Naval Research Laboratory (NRL), Florida Office of Insurance Regulation, and Florida Department of Transportation with a total amount of more than 17 million dollars.

Dr. Chen received the best paper award from 2006 IEEE International Symposium on Multimedia. He was awarded the IEEE Systems, Man, and Cybernetics (SMC) Society’s Outstanding Contribution Award in 2005 and was the co-recipient of the IEEE Most Active SMC Technical Committee Award in 2006. He was also awarded the Inaugural Excellence in Graduate Mentorship Award from FIU in 2006, the FIU Outstanding Faculty Research Award in 2004, the SCIS Excellence in Mentorship Award in 2010, the SCIS Outstanding Faculty Service Award in 2004, and the SCIS Outstanding Faculty Research Award in 2002. He has been a general chair and program chair for more than 35 conferences, symposiums, and workshops. He is the founding editor-in-chief of International Journal of Multimedia Data Engineering and Management and associate editor in 13 other journals. He is the chair of IEEE Computer Society Technical Committee on Multimedia Computing and co-chair of IEEE Systems, Man, and Cybernetics Society’s Technical Committee on Knowledge Acquisition in Intelligent Systems. Dr. Chen also has been a guest editor for more than ten journal special issues. He was a member of three steering committees (including IEEE Transactions on Multimedia) and several panels for conferences and NSF. He has also served as a member of the technical program committee for more than 200 professional meetings. He is a fellow of SIRI and an ACM Distinguished Scientist.

Research and Instructional Interests: distributed multimedia database systems, multimedia data mining, multimedia systems, GIS, disaster information management

Selected Publications:
Dr. Barton has worked in computer science related areas since 1963. In his early career, Dr. Barton began using the EDSAC 2 and more recently used the Blue Gene Computer. Dr. Barton began by developing symbolic algebra systems for use in celestial mechanics and later worked on the operating system project for the Titan computer writing the command program for that machine which was a type of early Shell program.

Dr. Barton was awarded the Adams Prize at Cambridge University with J. P. Fitch in 1974. He worked on high speed data communication networks for CERN in Geneva and later on numerical techniques for stiff equations. Most recently Dr. Barton has been involved with F. K. Urban on the application of numerical and mathematical techniques to the modeling of thin films for applications in microelectronics and possibly solar power technology.

After a distinguished thirty-year career at Florida International University, Prof. Barton announced his retirement at the end of the spring 2012 semester.

Peter Clarke  
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Dr. Peter J. Clarke received his B.S. in computer science and mathematics in 1987 from the University of the West Indies, Cave Hill Campus, Barbados followed in 1993 by an Advanced Diploma in computer science. In 1996 Dr. Clarke earned his M.S. in Computer Science from Binghamton University, SUNY and completed his formal education in 2003 with a Ph.D. in computer science from Clemson University, Clemson, South Carolina. In 2003, Dr. Clarke joined the School of Computing and Information Sciences at Florida International University, as an assistant professor and was promoted to associate professor in 2009.

Research and Instructional Interests: software testing, software metrics, software maintenance, model-driven software development

Selected Publications:  


Xudong He  
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Xudong He received the B.S. and M.S. degrees in computer science from Nanjing University, China, in 1982 and 1984, respectively. He received the Ph.D. in computer science from Virginia Tech in 1989. He joined the faculty in the School of Computing and Information Sciences at Florida International University in 2000, and is professor of SCIS and the director of the Center for Advanced Distributed System Engineering. Prior to joining FIU, he was an associate professor in the Department of Computer Science at North Dakota State University since 1989. His research interests include formal methods, especially Petri nets, and software testing techniques. He has published over 125 papers in the above areas. He was ranked among the top 15 scholars in systems and software engineering worldwide between 1999 and 2003 by Journal of Systems and Software. His research has been funded by the NSF, ONR, NASA, and DOE. He has been the major advisor of 12 Ph.D. and 36 M.S. graduates. Dr. He is a senior member of the Association for Computing Machinery, and a senior member of the IEEE Computer Society.

Research and Instructional Interests: software engineering, testing, formal specification and verification, Petri nets

Selected Publications:  


Vagelis Hristidis  
Associate Professor  
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Dr. Hristidis received his Ph.D. in computer science from University of California, San Diego in 2004 and his areas of expertise are databases, information retrieval, and in particular, the intersection of these two areas. Dr. Hristidis has a vision to make the information in databases easily accessible and useful across various application domains. His research emphasizes interdisciplinary topics, mainly health informatics and disaster management. Dr. Hristidis is the recipient of the prestigious NSF CAREER Award, the Google Research Award, the IBM Scalable Data Analytics for A Smarter Planet Innovation Award, the FIU SCIS Excellence in Research Award, the FIU University Faculty Award and the Kauffmann Entrepreneurship Award. Recently, Dr. Hristidis founded PatentsSearcher.com, a patent search engine, to help faculty as they work to commercialize their research.

Research and Instructional Interests: information discovery, data sharing, disaster management, presentation and navigation of query results, XML storage, and parsing

Jong-Hoon Kim  
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Dr. Kim is currently a visiting assistant professor in the School of Computing and Information Sciences, Florida International University. He received a B.S. from Seoul National University of Science and Technology, Seoul, South Korea in 2003.
Tao Li
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Dr. Tao Li is currently an associate professor in the School of Computing and Information Sciences at Florida International University. He received his Ph.D. in computer science from the Department of Computer Science, University of Rochester in July 2004. His research interests are in data mining, machine learning, information retrieval, and bioinformatics. He is the recipient of NSF CAREER Award (2006-2011), multiple IBM Faculty Research Awards (2005, 2007 & 2008), and Xerox Research Awards (2005-2008 & 2011-2014). He has published prolifically in top journals and conferences and has served on the program committees of many international conferences.

Research and Instructional Interests: data mining, machine learning, information retrieval, bioinformatics.

Selected Publications:


Christine Lisietti
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Dr. Christine Lisietti is an associate professor in the School of Computing and Information Sciences at Florida International University, and the director of the Affective Computing Laboratory (acls.cs.fiu.edu). She received her Ph.D. in computer science from Florida International University in 1995, and in 1996 she was awarded the Individual Research Award from the National Institute of Health (NIH) to conduct her Post-Doc Fellowship at Stanford University, jointly in computer science and psychology. She joined FIU from ENST/Sophia, France where she was a professor, and was previously an assistant professor in the Computer Science Department at the University of Central Florida.

Dr. Lisietti’s work on affective social computing aims at creating digital and engaging socially intelligent agents that can interact naturally with humans via expressive multi-modalities in a variety of contexts involving socio-emotional content. Her interests involve research on virtual characters for health communication and behavior change. While in Europe, her research was supported by grants from the European Commission (EC), EUREKA Information Technology for European Advancement (ITEA), the Provence-Alpes Cote d’Azur (PACA) Regional R&D Program, and ST Microelectronics. Dr. Lisietti has received funding from Interval Research Corporation, Intel Corporation, Vcom3D, as well as from Federal funding agencies including the Office of Naval Research (ONR), US Army STRICOM, NASA Ames, the National Institute of Health (NIH), and the National Science Foundation (NSF).

Christine Lisietti is on the Editorial Board of the IEEE Transactions on Affective Computing, the first journal in her field of research which launched in 2010. She is the recipient of the 2000 AAAI Nils Nilsson Award, and the author of numerous scientific articles. She has served on various program committees of international conferences, she has co-chaired several international events on affective computing, and has been an invited speaker at international conferences. Dr. Lisietti has served as a research expert for the National Science Foundation (USA), for the “Agence Nationale de la Recherche” (FRANCE), for the “Fonds de Recherche sur la Nature et les Technologies” (CANADA), and for the European Commission (BELGIUM).

Research and Instructional Interests: affective computing, human-computer interaction, artificial intelligence, health informatics.

Selected Publications:


Dr. Milani joined Florida International University after receiving his Ph.D. in computer science from the University of Central Florida in 1985. In the last 25 years he has been a faculty at the School of Computing and Information Sciences, director of the Information Technology Program, and director of External Programs.

Dr. Milani is currently the founding director of the Office of Student Access and Success. The mission of this new Office is to provide prospective and assistance to current students of the College of Engineering and Computing at FIU with value chain opportunities and services that will enhance their academic experiences and increase their rate of success in the school and their future careers. The Office supports students through recruitment, retention and enrichment programs, such as mentorship, undergraduate research opportunities, peer-to-peer tutoring, internship, and pre-college outreach activities.

Dr. Milani’s work in engaging students in research and providing scholarships and fellowships to undergraduate and graduate students has been supported by US Department of Education and the National Science Foundation.

Research and Instructional Interests: theory of computation, software engineering, computer science education


Giri Narasimhan
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Dr. Narasimhan is currently professor in the School of Computing and Information Sciences at Florida International University and also serves as associate dean for Research and Graduate Studies for the College of Engineering. Dr. Narasimhan completed his undergraduate studies in 1982 with a Bachelor in Technology degree in electrical engineering from the Indian Institute of Technology in Bombay. In 1989 he was awarded a Ph.D. in computer science from the University of Wisconsin, Madison and from there accepted an associate professor position at the University of Memphis in the Department of Mathematical Sciences. Dr. Narasimhan joined Florida International University as an associate professor in 2001 and was promoted to full professor in 2004.

Research and Instructional Interests: bioinformatics, algorithms, computational geometry


Jainendra K. Navlakha
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Dr. Iai Navlakha received his Ph.D. in computer engineering and information sciences from Case Western Reserve University in Cleveland, Ohio in December 1977. Since then, he has been employed at Florida International University, where he was promoted to the position of full professor in September 1987. He served as the director of the School of Computer Science in three stints: August 1988 to August 1992, August 1999 to August 2002, and July 2009 to August 2011. From July 2006 to June 2009, he was the associate dean of Graduate Studies and the Director of Corporate & Global Programs in the College of Engineering & Computing. He has published more than 30 articles in national and international journals and has presented his work at major conferences in computer science.

Research and Educational Interests: expert systems and neural networks, software engineering and software metrics, design and analysis of algorithms, software cost estimations, databases


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Dr. Deng Pan received his Ph.D. degree in computer science from State University of New York at Stony Brook in 2007. His research interests are generally in high performance switch design and high speed networking. His current research focuses on switch virtualization, data center networking, and energy efficient networking. He has published over thirty peer-reviewed papers in leading refereed journals and conferences, including the IEEE Transactions on Computers, IEEE INFOCOM, ACM/IEEE Symposium on Networking and Communications, and IEEE International Parallel and Distributed Processing Symposium. He has served as local arrangement co-chair or technical program committee member in many international conferences, including IEEE INFOCOM, IEEE GLOBECOM, and ICPP. He also had industry experience in VoIP software development, Linux kernel module development, and advanced software testing.

Research and Instructional Interests: high performance routers and switches, high speed networking, quality of service, network processors, network security


Alex Pelin
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Dr. Alex Pelin was awarded a B.S. in computer science and engineering from the University of Pennsylvania in 1973, an M.S. in computer and information sciences in 1974 and a Ph.D. in computer and information sciences in 1977, also from the University of Pennsylvania. After eight years on faculty at Temple University, Dr. Pelin joined the School of Computing and Information Sciences at Florida International University in 1985.

Research and Instructional Interests: artificial intelligence, logic, computer aided instruction, programming languages


Alex Pelin
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Dr. Alex Pelin was awarded a B.S. in computer science and engineering from the University of Pennsylvania in 1973, an M.S. in computer and information sciences in 1974 and a Ph.D. in computer and information sciences in 1977, also from the University of Pennsylvania. After eight years on faculty at Temple University, Dr. Pelin joined the School of Computing and Information Sciences at Florida International University in 1985.

Research and Instructional Interests: artificial intelligence, logic, computer aided instruction, programming languages
Niki Pissinou
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Dr. Pissinou has published over two hundred and fifty research papers in peer reviewed journals, conference proceedings and books chapters on networking, telecommunications, distributed systems, mobile computing, security and aspects of non traditional data management including co-editing over four texts in the area of mobile and wireless networking and systems and over fourteen IEEE and ACM conference volumes. Widely cited in books and research papers, her research has been funded by the National Science Foundation, Department of Homeland Security, Department of Defense, Department of Transportation, National Aeronautics and Space Administration, state governments and industry. Dr. Pissinou is the founding director of the Telecommunications and Information Technology Institute, founded in 2001 and funded by the State of Florida through a state appropriation. She is also the key architect of the Telecommunications and Information Technology M.S. program. She has graduated over nineteen Ph.D. students who now hold positions in academia, federal government and industry. Dr. Pissinou has served as the general and technical program chair on a variety of ACM and IEEE conferences. She also served in various capacities on hundreds IEEE and ACM conferences as general chair, technical committee chair, program committees, organizing committees, review panels, advisory boards, editorial boards etc. She also served as an editor of many journals including the IEEE Transactions on Data and Knowledge Engineering. She also has been the founder of many professional forums, including the ACM GIS. Dr. Pissinou has given keynote talks at various events and served as consultant to industry. Her achievements have been recognized by her peers, who have given her several awards and honors, including best paper awards.

Research and Instructional Interests: computer, communications and network systems

Selected Publications:
- Naguraj Prabakar
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Dr. Prabakar developed a scheme to access vast amount of spatial data from a semantic database and flowed the data in real-time – this emerged as TerraFly software from High Performance Database Research Center, FIU. He has also designed dynamic mosaicking algorithms for spatial images and integrated vector GIS data with spatial data sets. Towards external funding, seven grant proposals were funded for a total amount of $2.3M with Dr. Prabakar’s role in these proposals as Principal Investigator, Co-Investigator, or Senior Investigator. Currently, Dr. Prabakar is working with a team of his colleagues on a fault-tolerant distributed computing grid with large number of sensors.

Research and Instructional Interests: sensor networks, grid computing, applications of database and image processing for spatial data

Selected Publications:

Raju Rangaswami
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Professor Raju Rangaswami received a B.Tech. degree in computer science from the Indian Institute of Technology, Kharagpur, India, and M.S. and Ph.D. degrees also in computer science from the University of California, Santa Barbara. At Florida International University, he leads the Systems Research Laboratory (http://sylab.cs.fiu.edu/). His research interests include operating systems, storage systems, virtualization, security, and real-time systems. He is a recipient of the NSF CAREER Award and the Department of Energy Early CAREER Award as well as various awards from industry including an IBM Faculty Award and a NetApp Faculty Fellowship.

Research and Instructional Interests: operating systems, storage systems, virtualization, real-time systems, computer security

Selected Publications:

Naphtali David Rishe
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Dr. Rishe has authored three books on database design and geography and edited five books on database management and high performance computing. He has four U.S. patents on for inventions in the areas of database querying, semantic database performance, Internet data extraction, and computer medicine. Dr. Rishe has authored more than 300 papers in journals and proceedings on the topics of databases, software engineering, Geographic Information Systems, Internet, and life sciences and received awards of over $40 million in research grants by government agencies and industry, including NASA, NSF, IBM, DoD, USGS; Architect of major industrial projects. Dr. Rishe is the founder and director of the High Performance Database Research Center at FIU (HPDRC); director of the NSF Center for Research Excellence in Science and Technology at FIU (CREST) and of the NSF International FIU-FAU-Dubna Industry-University Cooperative Research Center for Advanced Knowledge Enable-ment (I/UCRC). He has mentored 70 postdocs, Ph.D. and M.S. candidates and received the inaugural FIU Outstanding University Professor...
award, Rishe's TerraFly project has been extensively covered by worldwide press, including the New York Times, USA Today, NPR, Science and Nature journals, and FOX TV News.

Research and Instructional Interests: semantic database management, semantic wrapper of relational databases, Terrafly and web based GIS

Selected Publications:

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Masoud Sadjadi received the B.S. degree in hardware engineering in 1995, the M.S. degree in software engineering in 1999, and the Ph.D. degree in computer science from Michigan State University in 2004. Dr. Sadjadi is currently an associate professor in the School of Computing and Information Sciences at Florida International University, where he has been on the faculty since 2004. He is the director of the Center of Partnership for International Research and Instruction (CPIRI) and the National Science Foundation (NSF). Luxembourg National Research Fund (FNR), and Florida Sea Grant. He has more than 80 refereed publications and is PI or Co-PI of 17 grants from NSF; IBM, Kaseya, TerraGrid, and FIU totaling approximately $6 million. Dr. Sadjadi is a member of the IEEE.

Research and Instructional Interests: distributed systems, software engineering, autonomic computing, high-performance computing, cloud computing, pervasive systems, mobile computing

Selected Publications:

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Geoffrey Smith completed his Ph.D. in computer science in 1991 at Cornell University. After three years as an assistant professor at American University, in 1994 he came to SCIS at FIU, where he is now an associate professor. He has twice been a visiting scientist at the LIX laboratory of the Ecole Polytechnique in Palaiseau, France (June 2009 and September to December 2011). His research areas include computer security, programming languages and semantics, and theoretical computer science. In recent years his main focus has been on secure information flow and quantitative information flow. His work in secure information flow has been quite influential; for instance his 1996 Journal of Computer Security paper has been cited 677 times, and his 2009 FOSSACS paper has been cited 70 times, according to Google Scholar. He has been supported at FIU by five NSF grants.

Research and Instructional Interests: computer systems security, dependable systems, software security, malware detection and mitigation, information flow, cloud computing, operating systems

Selected Publications:

Jinpeng Wei
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Jinpeng Wei received a Ph.D. in computer science from Georgia Institute of Technology in 2009. He is currently an assistant professor in the School of Computing and Information Sciences. His research spans stealthy malware detection and defense, operating systems security, cloud computing, cloud computing, information flow security in distributed systems, and file-based race condition vulnerabilities. He is the winner of three best paper awards, and his research is sponsored by the Department of Homeland Security and the Centre for Strategic Information Technologies, Singapore. In addition to his research activities, he has also served on the Program Committee of top international conferences such as ICDCS 2011, and served as reviewer for top journals such as ACM Transactions on Computer Systems, Elsevier Journal of Computers and Security, the IEEE Network magazine, and the IEEE Communications Magazine.

Research and Instructional Interests: computer systems security, dependable systems, software security, malware detection and mitigation, information flow, cloud computing, operating systems

Selected Publications:

Jinpeng Wei
faculty profiles


Ming Zhao is an assistant professor in the School of Computing and Information Sciences at Florida International University since 1990. Walid Akache has been cited more than 450 times. He won the Best Paper award (2008) and Excellence in Teaching Award (2006) from the FIU School of Computing and Information Sciences. He was a visiting instructor for five years in the School of Computing and Information Sciences, Miami. He was a professor of Computer Information Systems at Miami-Dade College from 1983-1999. He has received five computer science awards (2007, 2002, 1997), one College teaching award (2006, 2002). He is the author of a book on web design using Java.

Tim Downey has attended many conferences on computer science education. These conferences have stimulated his teaching style over the years. He is always open to learning new ways to enhance the learning process.

Selected Publication:

Research and Instructional Interests: virtualization, cloud computing, high-performance systems, autonomic computing

Selected Publications:


Selected Publications:
Walid Akache
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Walid Akache received his M.S. in mathematics from the American University of Beirut in 1970. Walid Akache has been an instructor in the School of Computing and Information Sciences at Florida International University since 1990. Walid Akache has reviewed numerous textbooks in support of computer science courses at FIU.

Research and Instructional Interests: introduction to microcomputers, microcomputer applications, Visual Basic, Pascal, VAX Basic

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Tim Downey earned Master's degrees in mathematics and computer science. He has been teaching at FIU since 2001. In that time, he has earned three University wide teaching awards (2007, 2002, 1997), one College teaching award (2007) and two School teaching awards (2006, 2002). He is the author of a book on web design using Java.

Tim Downey has attended many conferences on computer science education. These conferences have stimulated his teaching style over the years. He is always open to learning new ways to enhance the learning process.

Selected Publication:

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Dr. Kip Irvine is a senior instructor at the School of Computing and Information Sciences, Florida International University (2000-present). He holds an M.S. in computer science and a doctor of musical arts, both from the University of Miami. He was a professor of Computer Information Systems at Miami-Dade College from 1983-1999. He has published five computer programming textbooks in the following areas: Intel Assembly Language, C++, Visual Basic, and COBOL, with Prentice-Hall and Addison-Wesley. He is a recent recipient of the Excellence in Service Award (2008) and Excellence in Teaching Award (2010) from the FIU School of Computing and Information Sciences. He is a senior member of ACM (Association for Computing Machinery).

Research and Instructional Interests: Intel assembly language, desktop and web application programming, competition programming, and object-oriented programming.

Selected Publications:


Walid Akache has received his M.S. in computer science, from the University of Miami in 1984. He has earned his M.S. in mathematics from the American University of Beirut in 1970. Walid Akache has been an instructor in the School of Computing and Information Sciences at Florida International University since 1990. Walid Akache has reviewed numerous textbooks in support of computer science courses at FIU.

Research and Instructional Interests: introduction to microcomputers, microcomputer applications, Visual Basic, Pascal, VAX Basic

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Tim Downey earned Master's degrees in mathematics and computer science. He has been teaching at FIU since 2001. In that time, he has earned three University wide teaching awards (2007, 2002, 1997), one College teaching award (2007) and two School teaching awards (2006, 2002). He is the author of a book on web design using Java.

Tim Downey has attended many conferences on computer science education. These conferences have stimulated his teaching style over the years. He is always open to learning new ways to enhance the learning process.

Selected Publication:

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Dr. Kip Irvine is a senior instructor at the School of Computing and Information Sciences, Florida International University (2000-present). He holds an M.S. in computer science and a doctor of musical arts, both from the University of Miami. He was a professor of Computer Information Systems at Miami-Dade College from 1983-1999. He has published five computer programming textbooks in the following areas: Intel Assembly Language, C++, Visual Basic, and COBOL, with Prentice-Hall and Addison-Wesley. He is a recent recipient of the Excellence in Service Award (2008) and Excellence in Teaching Award (2010) from the FIU School of Computing and Information Sciences. He is a senior member of ACM (Association for Computing Machinery).

Research and Instructional Interests: Intel assembly language, desktop and web application programming, competition programming, and object-oriented programming.

Selected Publications:


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Norman Pestaina is a senior instructor in the School of Computing and Information Sciences, having joined FIU as a Visiting instructor in the Department of Mathematical Sciences in August 1984. He holds the B.S. in mathematics from the University of the West Indies, and the M.S. in computer science from the Pennsylvania State University. Prior to joining FIU, Mr. Pestaina was lecturer in computer science at the Cave Hill campus of the UWI and, earlier, assistant staff member of the MIT Lincoln Laboratory in Massachusetts.

Mr. Pestaina has taught 18 different courses at FIU and has been recognized for excellence in teaching on four occasions including an inaugural Teaching Incentive Program award in 1994. He has been an SCIS undergraduate advisor for 15 years, often representing the SCIS on College Curriculum Committees, and continues many years of service on the SCIS Undergraduate Committee. A principal architect of the SCIS program assessment processes, Mr. Pestaina has been the SCIS Assessments Coordinator since 2006 and has led the BS-CS ABET re-accreditation efforts in 2004 and 2010. He has been a Reader or Question Leader of the College Board’s Advanced Placement Computer Science Exam since 2000.

Research and Instructional Interests: computer systems and organization, programming methodology, computer science education

Greg Shaw
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Greg Shaw is a senior instructor in the School of Computing and Information Sciences. He was a visiting instructor for five years in the 1980s, and returned to FIU in 1995 as a permanent faculty member. Greg earned an M.S. in computer science education from Barry University, and was the recipient of a University wide teaching award in 2003.

Research and Instructional Interests: introductory and intermediate level programming courses
New Faculty members for 2012-13:

**Radu Jianu** received a Ph.D in Computer Science from Brown University in 2012. His research interest is using data visualization and visual analytics to solve problems in proteomics, genomics, neuroscience and other disciplines. He is also interested in links between general principles of cognition and visualization.

**Wei Zeng** received her Ph.D from Stony Brook University-SUNY, joint with the Chinese Academy of Sciences, in 2008. She is interested in the application of modern geometry to tackle fundamental problems in engineering and biomedicine to develop both computational theories and algorithms.

**Joslyn Smith**
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Joslyn Smith, an instructor, joined the School of Computing and Information Sciences, Florida International University in 1997. Joslyn came to FIU with fourteen years of teaching experience from the University of the West Indies, as a lecturer in computer science, in the undergraduate program. Mr. Smith holds an M.S and a B.S in mathematics both from Central Connecticut State University, CT. He earned an M.S degree in computer science from the University of New Brunswick Canada, and a non-degree Certificate in computer science from Clarke University, Massachusetts. Mr. Smith also holds a professional certificate in teacher education from the Mico University College, Jamaica.

At FIU, Mr. Smith’s major focus in programming language is the object oriented paradigm. Over the years he has attended many conferences on computer science education. He has served as reviewer for the SIGCSE Technical Symposium on Computer Science Education and has reviewed several manuscripts for major publishers such as McGraw Hill and Prentice Hall.

Research and Instructional Interests: programming languages, object oriented programming, graphical user interface programming.

**Tiana Solis**
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Tiana Solis is currently a visiting instructor at the School of Computing and Information Sciences. Prior to moving to Hawaii in 2007, she was an instructor and academic advisor for the School from 1994 to 2007. Ms. Solis taught different undergraduate courses and mentored several FIU students participating in the Florida-Georgia Louis Stokes Alliance for Minority Participation (FGLSAMP). She is a past adviser of the Women in Computer Science (WICS) student club.

From 2008 to 2010, Ms. Solis was a programmer analyst at the Department of the Attorney General in Hawaii, a member of the team revamping the State Juvenile Justice Information System.

Research and Instructional Interests: software development, programming languages, computer ethics

**Xin Sun** is currently a Ph.D candidate in the Internet Systems Laboratory in the School of Electrical and Computer Engineering at Purdue University. His research interests are in the design and management of emerging networks and networked systems, and in the migration of such networks and systems to innovative architectures. He is a recipient of the Bilsland Dissertation Fellowship from Purdue University Graduate School, and a finalist for the Intel Ph.D. fellowship

**Ning Xie** is currently a Ph.D. student in the theory group at the Computer Science and Artificial Intelligence Lab, MIT. His supervisor is Prof. Ronitt Rubinfeld. His main research area is sublinear algorithms. He received an M.S degree in computer science from the State University of New York at Buffalo, an M.S in theoretical physics from Fudan University and a B.E. degree in shipbuilding engineering from Harbin Engineering University.

**Jill Weiss**
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Professor Weiss received her M.S. in computer science education from Barry University in 1992, and has worked in the computer industry since 1985 in different capacities, mostly in computer education. She has been involved in all facets of the computer industry, including hardware/software installation, repair, trouble shooting, consulting, programming, and (multi-unit) managing training centers for a major Fortune 100 retailer. Professor Weiss worked as a computer consultant/trainer for large companies such as Texaco, Burger King, Kodak, and Motorola, and has trained users from various county and government agencies.

Jill has been an instructor in the School of Computing and Information Sciences since 2002, having previously taught as both an adjunct for ten years, and then as a visiting instructor for three years. She primarily teaches the School’s service courses, and since 2000, she has provided World’s Ahead instruction to roughly 14,000 students. Professor Weiss was the recipient of the School of Computing and Information Science’s Excellence in Teaching award in 2008.

Research and Instructional Interests: business applications
SyLab researchers are developing new systems software that address energy, performance and self-management for storage systems and resource isolation and performance guarantees within virtualized systems. Recent work at SyLab include the development of an extent-based dynamic tiering (EDT) storage solution which demonstrated that multi-tiered storage systems built out of SAS or SATA hard disk drives and solid state drives can be more cost effective than disk-only or SSD-only systems. EDT’s core strengths include the dynamic ability to combine the sequential I/O performance of disks and random I/O performance of SSDs seamlessly, consolidate load within tiers when feasible, rapidly respond to unexpected changes in the workload, and carefully control the overhead due to extent migration. An evaluation with production workloads show that EDT incurs lower capital and operating cost, consumes less power, and delivers similar or better performance relative to SAS-only storage systems as well as other simpler approaches to extent-based tiering such as static tiering (EST) and dynamic IOPS-based tiering (IDT). This work was conducted in collaboration with IBM Research – Almaden.

Another recent project addresses a long-standing bottleneck at the interface between memory and storage systems. Writing data within user or operating system memory often encounters the classic read-before-write problem whereby the page written to must first be read from the backing store, effectively blocking the writing process before modifications are made. The large gap between memory and storage access performance adversely affects workloads that require substantial read-before-write operations. We developed techniques to make writes to memory truly non-blocking. The basic approach involves absorbing writes immediately in temporary buffer pages and asynchronously merging the updates after reading in the on-disk version of the page, Figure 2. Doing so improves system performance by first, reducing blocking of processes and second, improving the parallelism of data retrieval from the backing store leading to better throughput for read-before-write operations.

SyLab’s work on energy proportional storage led to the development of Sample-Replicate-Consolidate Mapping (SRCMap), a storage virtualization layer optimization that enables energy proportionality for dynamic I/O workloads by consolidating the cumulative workload on a subset of physical volumes proportional to the I/O workload intensity. Unlike previous approaches that migrate data across physical volumes dynamically or replicating entire volumes, both of which are prohibitively expensive, SRCMap samples a subset of blocks from each data volume that constitutes its working set and replicates these on other physical volumes. During a given consolidation interval, SRCMap activates a minimal set of physical volumes to serve the workload and spins down the remaining volumes, redirecting their workload to replicas on active volumes. SRCMap is vastly superior in matching power consumption to offered load relative to alternate approaches for energy proportionality such as caching and replication. This work was conducted in collaboration with IBM Research, India.
Cyber security defenses against kernel queue hooking malware
Dr. Jinpeng Wei  ▸ Collaboration: Georgia Tech; CSTI, Singapore

Kernel Queue Hooking (KQH) attacks stealthily execute malicious functions by embedding their malicious hooks in dynamic kernel schedulable queues (K-Queues). Since kernel code and persistent hooks remain intact, KQH attacks can evade detection of state-of-the-art kernel integrity monitors. These attacks have been used by advanced malware such as the Rustock spam bot to achieve malicious goals. To defend against KQH attacks, Dr. Wei has proposed a Precise Lookahead Checking of function Pointers (PLCP) approach. The PLCP approach checks the legitimacy of pending K-Queue callback requests by proactively checking the function pointers that are invoked by the callback functions. To facilitate the derivation of specifications for any K-Queue, Dr. Wei’s group has built a unified static analysis framework and a toolset that derives the properties of legitimate K-Queue requests from kernel source code so they can be used by a runtime checker. A prototype defense against KQH attacks (Figure 4) has been developed for the Linux kernel's soft timer queue; more comprehensive defenses for the Linux kernel and the Windows Research Kernel (WRK) are under active development.

In brief

Virtual machine image security in cloud computing
Dr. Jinpeng Wei

Virtual machine images must have high integrity since the initial state of every virtual machine in the cloud is determined by its image. However, as some of the benefits of the cloud depend on users employing images built by third parties, users must also be able to share images safely. To address the risks faced by administrators and users, Dr. Wei’s group has proposed the first image management system (Figure 5) that controls access to images, tracks the provenance of images, and provides users and administrators with efficient image filters and scanners that detect and repair security violations. An early implementation of the system achieves efficiency by exploiting redundancy among images.
Virtualization is an enabling technology for creating important new system abstractions and addressing the various challenges faced by today’s computing systems. The use of virtualization can span across computing systems of different sizes, from desktops to supercomputers, and across different layers of the systems, from virtual machines and virtual storage to virtual networks. The fundamental goal of Dr. Ming Zhao and his VISA Research Lab is to explore innovative techniques in virtualization as well as autonemics in order to effectively utilize the resources in large-scale, dynamic, and complex computing systems and to support the high-performance, robust, and secure computing of challenging applications from different domains. Currently, his team is focusing on several projects related to virtualization in distributed and high-performance computing systems.

System virtualization is a powerful technology that enables the emerging computing paradigms such as public and private cloud systems. It allows applications to be conveniently deployed along with their required execution environments through virtual machines (VMs), and supports them to flexibly share the underlying physical resources with strong isolation. However, there exists an increasingly urgent need for virtualized systems to deliver strong Quality of Service (QoS) guarantees to their hosted applications. Currently such systems can meet only coarse-grained and relaxed performance requirements, and their management considers only limited facets of an application’s multi-type resource usage. The continued existence of the lack of strong QoS guarantees from virtualized systems presents a critical hurdle to their further adoption by applications with diverse QoS requirements and their support of more economical QoS-based charging models.

The objective of this FIU and DHS sponsored project is to create a QoS-driven multi-type resource management system and to support strong QoS guarantees for applications hosted on virtualized computing systems. Dr. Zhao and his team are creating novel nonlinear modeling and predictive control based techniques for accurate and adaptive on-demand resource allocation as well as new cross-layer optimization techniques for improved application QoS and resource-use efficiency (Fig. 6). The proposed research is significant because it will enable virtualized systems to support strong QoS guarantees and efficient resource allocation for applications with dynamic and complex multi-type resource usage behaviors. As a result, this project will allow a broader range of applications with different levels of QoS requirements to benefit from the use of virtualized computing. It will enable virtualized systems such as public clouds to provide QoS-based contracting models, which will allow resource providers to more efficiently allocate their resources across VMs and allow users to more cost-effectively purchase resources for their applications.

High-performance computing (HPC) systems are important platforms for solving challenging problems in many science and engineering domains. In such systems, the parallel file system (PFS) is at the core of the storage infrastructure, which provides ap-
plications high-throughput data access through the parallelism of I/Os. However, existing PFS-based storage systems are unable to recognize the different application I/O workloads and incapable of satisfying the applications’ different I/O bandwidth needs. These limitations prevent applications from efficiently utilizing the HPC resources while achieving their desired QoS. This problem is continuing to grow with the ever-increasing scale of HPC systems and with the increasing complexity and number of applications running concurrently on these systems. It presents a hurdle for the further scale-up of HPC systems to support many large, data-intensive applications. The objective of Dr. Zhao’s NSF HECURA-funded project is to address the research challenges in application of QoS-driven storage management in HPC systems, in order to support the allocation of storage resources on a per-application basis as well as the efficient execution of applications with I/O demands varying by several orders of magnitude. Dr. Zhao and his team are creating new parallel file system virtualization and autonomic bandwidth allocation techniques to enable per-application QoS-driven control and optimization of HPC storage resources. This research has the potential to drastically improve the state of the art in I/O management in existing HPC systems and generate an impact on the design of future systems. It will also allow HPC applications with diverse I/O characteristics and requirements to achieve their desired QoS on shared HPC resources.

In brief

**Integrity assurance of cloud computing**

Dr. Jinpeng Wei

One of the most critical security issues surrounding cloud computing is computation integrity. MapReduce, for example, suffers from integrity assurance vulnerability since it only takes one malicious worker node to render the overall computation result useless. In order to increase assurances of cloud computing integrity, Dr. Wei has proposed a set of measures that can tolerate malicious participants in cloud computing environments. These measures include job replication, verification, quizzing, and task obfuscation. Dr. Wei’s group has begun to design and implement these ideas into the Verification-Based Integrity Assurance Framework (VIAF), which detects both collusive and non-collusive mappers in a MapReduce environment, (Figure 7). The group’s theoretical analysis and experimental results demonstrate that VIAF can achieve high accuracy; its ongoing research plans are to overlay the VIAF framework on top of existing cloud infrastructures such as Amazon EC2 and Microsoft Azure.
In recent years, we have witnessed a great increase in the number and variety of multimedia communication services that have been developed and deployed. Examples range from IP telephony, instant messaging, video conferencing, and multimedia collaboration, to specialized communication applications for telemedicine, disaster management, and scientific collaboration. Given the ease of creation of multimedia data, the continuous improvements in network capacity and reliability, and the varying and changing communication needs of end-users, it is likely that the pace of innovation in multimedia communication services will further accelerate.

Although this trend presents a tremendous opportunity for technological growth and for an improved end-user experience, current approaches for developing multimedia communication services are severely lacking in several respects. Multimedia communication services today are conceived, designed and developed following a stovepipe (vertical) approach that has resulted in a fragmented set of incompatible tools, technologies, and products. In addition, there is limited separation between application logic, communication requirements, underlying platform specifics, and networking protocols and infrastructure. The fragmented development approach poses a great challenge in providing integrated multimedia communication services. Users are forced to hop between tools to satisfy their communication needs since the current suite of multimedia communication tools are technology-centric and largely ignore user-specific communication needs.

We argue that the root causes holding back rapid innovation in multimedia communication services are the lack of user-centric developmental approaches combined with stovepipe implementations. We are investigating a Communication Virtual Machine, a new paradigm for developing and deploying multimedia communication services through specification and automatic generation, rather than through traditional design and development. This paradigm advocates a model-driven process for conceiving and delivering multimedia communication that is tailor-made to fit user or application needs. Both general-purpose and domain-specific communication needs are specified in a model, called a communication schema, which is independent of device types and underlying network configuration. This model is instantiated, negotiated, synthesized, and executed via a fully automated process to satisfy user communication needs (Figure 8). Using this approach, multimedia communication services can be built within hours or days, rather than months or years as required by current development cycles. We are developing techniques for the automatic generation of user-centric multimedia communication services from communication schema descriptions, which allows changing the communication schema (or requirements) as required by the user or application at run-time. We refer to our automatic service generator as the synthesis engine. In contrast to general-purpose, model-driven application development, we focus on automatic synthesis for multimedia communication. Our preliminary studies suggest that automated synthesis is largely feasible at least for the functional aspects of the communication such as coordination of communication features, communication capabilities, and media delivery.
Software Testing
Dr. Peter J. Clarke

This research investigates implementation-based testing of object-oriented (OO) software, and testing of autonomic software systems. The core of the OO testing work is the classification of Java and C++ classes that supports the unification of testing techniques, testing of abstract class features, and predicting fault-proneness of classes in OO software. The classification results in a taxonomy of OO classes based on combinations of characteristics exhibited by the features of the classes. Using this taxonomy, we have developed an approach to unify implementation-based testing techniques and to efficiently test the features of abstract classes. The educational component is focused on introducing software engineering students to software testing concepts and to the use of testing tools. Dr. Clarke has developed WReSTT (Web-based Repository of Software Testing Tools), a web portal containing learning materials on software testing concepts, and interactive tools that facilitate collaborative learning (Figure 9).

Model-Driven Software Development
Dr. Peter J. Clarke

This research focuses on domain-specific modeling languages (DSMLs) and the semantics to support the interpretation of DSML models without generation of intermediate code. Dr. Clarke's work investigates these in the domains of user-driven communication services and micro-grid energy management systems, the principal problem being the dynamic definition of DSML semantics based on runtime changes to user-supplied DSML models. This research builds upon the communication modeling language (CML) and the communication virtual machine (CVM) – an interpreter of CML models – created by Dr. Clarke's team (Figure 10). The research group is currently applying the basic ideas of CML/CVM to the language, MGridML, and an interpreter, MGridVM, for micro-grid energy management systems. Dr. Clarke's recent graduates who have worked on CML/CVM projects include: Dr. Yingbo Wang (Summer 2009), Dr. Andrew Allen (Spring 2011) and Dr. Yali Wu (Summer 2011 - tenure-track assistant professor).
In depth

Sensor Localization: 3D wireless sensor networks based on geometric computation
Dr. Ram Iyengar

Geographic location information is critical in wireless sensor networks. The distributed sensors should organize a coordinate system so that the physical coordinates of any node or any detected object can be determined. Integrating GPS receivers into all the sensors is too expensive for huge-sized networks, so localization using a limited number of GPS resources is very important in many cases. Localization must be accurate and reliable while the cost must be as little as possible. To solve this challenging problem, many algorithms, hardware, and applications are being explored. However, several key issues necessary to support accurate localization for critical detection in complex and real environments have not been adequately solved.

To compute the localization, i.e. to construct a global coordinate system from metrics measured from distributed sensors, most existing methods build the coordinates on a flattened metric space (e.g., on a 2D Euclidean plane), assuming sensors are distributed on flat land. Such an assumption can often lead to significant distortions in reconnaissance tasks, where sensors are very often spread over curved terrain (2.5D) or underwater (3D, see the figure below, image from UCONN).

It is desirable to have a unified effective geometric-based localization paradigm for both centralized and distributed networks. It should work well for not only 2D sensor networks, but also 2.5D (e.g. terrain scouting) and 3D (e.g. underwater reconnaissance and atmospheric monitoring) networks. It should also facilitate robust localization in noisy and huge-sized military sensor networks, and should benefit many subsequent applications such as reliable routing, hole/boundary detection, and environment mapping and scouting.

Optimizing Centralized Approaches

Sensor’s coordinates are usually represented relatively, as rigid transformations away from beacon-nodes (also called anchor nodes). Beacon nodes (equipped with GPS receivers thus knowing their global coordinates) are expensive and ideally should be used as sparsely as possible. In a convex 2D (3D) region with no holes (voids), 3 non-collinear (4 non-coplanar) beacons are required to unambiguously define a global coordinate system; while in more general environments with obstacles, topological holes, etc. (e.g. sensing in urban environments, underwater reconnaissance, and atmospheric monitoring), many more beacon points are necessary to ensure accurate and robust localization within the sensor network.

Optimal anchor placement can be related to an NP-hard problem called region guarding. The problem is formulated as: given a 3D region M bounded by a discrete polygonal surface ∂M, where should a set of guarding cameras G = {gi} be placed within M, so that any point in M can be visibly covered by at least one point in G. The optimal guarding, which has been shown to be NP hard, seeks the minimal guarding set G. Here in the sensor localization problem, also due to the obstacles, walls, etc., a sensor within the interested network region may not be detectable from a given anchor. Therefore, we can consider the following discrete problem: given a set of spatially located sensors, upon which sensors shall we place GPS detectors so that, with the fewest GPS, we can build the global coordinate system that localizes all the sensor nodes.

We propose an effective optimization framework using hierarchical integer linear programming to seek for approximate optimal solutions for 3D region guarding. This scheme converts the guarding problem into a set-covering problem then computes its approximate solution. The conversion can be similarly applied here: sensor nodes are natural sampled points in the set and each of them can cover a sub-set of neighboring nodes with relatively high accuracy (such a reliable sub-set can then be associated with this node). The computation of intelligent placement of all the anchor sensors could certainly help the design of the localization sensor network; its hierarchical structure also suggests a way to design centralized multi-tier networks.

Fig. 11
This project develops a suite of bandwidth allocation and packet scheduling techniques as an integrated framework for switch virtualization, to achieve scalable, efficient, and isolated link sharing among virtual networks.

Network virtualization is the creation of multiple coexisting logical networks, each customized to a specific purpose, by reorganizing the resources of a common physical infrastructure. It has many important applications in delivering reduced hardware cost, improved resource utilization, simplified maintenance, and incremental service deployment. Implementation of network virtualization relies on creating slices for various resources of the underlying physical infrastructure.

However, there have been no effective solutions to create slices for switches, the important interconnecting components of any networks. Existing approaches to share switch bandwidth among multiple users have several drawbacks, including impractical bandwidth allocation, weak traffic isolation, poor performance guarantees, and lack of multicast support. In this project, we address the above issues and present the Scalability and Efficiency Aware Link Sharing (SEALS) framework for switch virtualization. We mainly consider two types of switch virtualization: intra-switch virtualization (Fig. 12) which creates multiple logical switches within a physical one, and inter-switch virtualization which creates a logical switch by combining multiple heterogeneous physical ones.

The SEALS framework accurately emulates the ideal Generalized Processor Sharing (GPS) model to realize scalable, efficient, and isolated switch virtualization. The project consists of three correlated research components. First, we design bandwidth allocation schemes for both unicast and multicast traffic, to fairly allocate switch bandwidth among virtual networks based on their requests. Second, we present unicast and multicast packet scheduling schemes for intra-switch virtualization, to assure the allocated bandwidth of each virtual network with strong traffic isolation, tight performance guarantees, and high bandwidth utilization. Third, we propose packet scheduling schemes for inter-switch virtualization, to enable a virtual switch with aggregated capacity, fault tolerance, and simplified control by combining multiple physical switches. We use a combination of theoretical analysis, simulations, and experiments to evaluate the proposed design. In particular, we will implement the SEALS framework in OpenFlow switches to obtain experimental data from a realistic environment.
Leveraging an innovative and successful international industry and university partnership called Latin American Grid (LA Grid) with funding from the US National Science Foundation’s Partnerships for International Research and Education (NSF PIRE) program, Florida International University’s (FIU) School of Computing and Information Sciences has been providing students with opportunities to receive multiple perspectives in three different aspects of research collaboration as they work with local and international researchers, in academic and industrial research labs, on basic and applied research projects. Consequently, PIRE students are able to participate in the full research pipeline from inception of ideas, through basic research, to practical applications with a wide choice of collaborators and international experiences. The research is focused on enabling cyberinfrastructure (CI) applications to allow domain experts to effectively express the logic and software artifacts of domain applications while hiding the details of the cyberinfrastructure architecture, software, and hardware. Our development paradigm, called Transparent Cyberinfrastructure Enablement (TCE), serves as the foundation for the study of application development methodologies, platforms, and tools that significantly ease CI-enabled application development and make applications more portable and adaptable to future changes of CI.

The faculty members at US institutions and their national and international collaborators lead PIRE research collaborations. All the local and remote advisors are expected to closely supervise the students’ progress in their research. During the recruitment process, a one-page research proposal is developed by each student and their local and remote advisors. After the review and approval of the proposals by the PIRE Program Committee local and remote advisors reaffirm their role as PIRE faculty advisors for the whole duration of their students’ participation in the program. Students who are selected participate in an orientation program conducted by FIU’s Office of Study abroad that prepares the students for their overseas travel to their research site. Students are provided with room and board, and office space in the remote site and work under the direction of their remote and local advisors. Each student is expected to send a formal weekly report to their advisors. The reports have to comply with a template that includes the following sections: activities, accomplishments, issues, plan for next week, and review of papers from the literature.

In the past four years of this project, 109 trips have been completed by seventy-seven individuals from four US institutions including FIU, FAU, UNCC, and UPRM. Students have visited eleven countries across four continents: North America, South America, Europe, and Asia. Twenty-four trips were taken by twelve PIRE PIs, Co-PIs, Sr. Investigators, and mentors. There have been two trips by one postdoc; sixty-four trips by forty-six graduate students; and nineteen trips by eighteen undergraduate students. Each travel event lasts an average of fifty-three days. As for diversity, a large percentage of our PIRE student participants at both graduate and undergraduate levels were Hispanics (22% of graduate student participants and 47% of undergraduate participants), Black (2% of graduates and 5% of undergraduates), and Female (30% of graduates and 16% of undergraduates). PIRE participants and collaborators have published thirteen journal articles, seven book chapters, forty-three conference and workshop papers, and sixty-six posters; these papers are co-authored by our PIRE participants have recommended this program to others.

In brief

Cyberinfrastructure Enablement and PIRE
Dr. S. Masoud Sadjadi
pire.fiu.edu

In the past four years of this project, 109 trips have been completed by seventy-seven individuals from four US institutions including FIU, FAU, UNCC, and UPRM. Students have visited eleven countries across four continents: North America, South America, Europe, and Asia. Twenty-four trips were taken by twelve PIRE PIs, Co-PIs, Sr. Investigators, and mentors. There have been two trips by one postdoc; sixty-four trips by forty-six graduate students; and nineteen trips by eighteen undergraduate students. Each travel event lasts an average of fifty-three days. As for diversity, a large percentage of our PIRE student participants at both graduate and undergraduate levels were Hispanics (22% of graduate student participants and 47% of undergraduate participants), Black (2% of graduates and 5% of undergraduates), and Female (30% of graduates and 16% of undergraduates). PIRE participants and collaborators have published thirteen journal articles, seven book chapters, forty-three conference and workshop papers, and sixty-six posters; these papers are co-authored by our PIRE participants have recommended this program to others.
TerraFly is a technology and tools for visualization and querying of geospatial data. The visualization component of the system provides users with the experience of virtual “flight” over maps comprised of aerial and satellite imagery overlaid with geo-referenced data. The data drilling and querying component of the system allows the users to easily explore geospatial data, to create geospatial queries, and get instant answers supported by high-performance multidimensional search mechanisms.

TerraFly’s server farm ingests, geo-locates, cleanses, mosaics, and cross-references 40TB of basemap data and user-specific data streams. TerraFly’s Application Programming Interface allows rapid deployment of interactive Web applications and has been used to produce systems for disaster mitigation, ecology, real estate, tourism, and municipalities. TerraFly’s Web-based client interface is accessible from anywhere via any standard Web browser, with no client software to install. (Figure 14)

TerraFly tools include user-friendly geospatial querying, data drill-down, interfaces with real-time data suppliers, demographic analysis, annotation, route dissemination via autopilots, customizable applications, production of aerial atlases, and an application programming interface (API) for production of Web-based map applications.

The TerraFly project has been featured on TV news programs (including FOX TV News), worldwide press, covered by the New York Times, USA Today, NPR, and Science and Nature journals.

The project’s primary sponsor is the National Science Foundation (NSF). Of the 53,000 NSF-funded projects in 2009, it chose 120, including TerraFly, for the NSF annual report to Congress.

The 40TB TerraFly data collection includes, among others, 1-meter aerial photography of almost the entire United States and 3-inch to 1-foot full-color recent imagery of major urban areas. TerraFly vector collection includes 3 billion geolocated objects, 50 billion data fields, 1B polylines, 120M polygons, including: all World roads (90M roads, 130M intersections, 1B segments), the U.S. Census demographic and socioeconomic datasets, 110 million U.S. parcels with property lines and ownership data, 15 million records of businesses with company stats and management roles and contacts, 2 million physicians with expertise detail, various public place databases (including the USGS GNIS and NGA GNS), Wikipedia, extensive global environmental data (including daily feeds from NASA and NOAA satellites and the USGS water gauges), and hundreds of other datasets.
An index structure is the backbone and the first step towards the satisfactory development of any database management system. However, traditional database management systems cannot accommodate multimedia indexing since multimedia data carry additional semantic information, which is not the case with traditional alphanumeric data. To solve this problem, several multidimensional index structures, such as the Affinity Hybrid Tree (AH-Tree), the AH+-tree, and the Generalized Multimedia Tree (GeM-Tree), have been developed by the DMIS Lab to support the retrieval of all types of multimedia data.

The AH-Tree is an efficient access and indexing framework that combines feature and metric spaces in a novel way and aims at incorporating high-level semantic information to generate results that overcome the well-known problems of semantic gap and user subjectivity. The AH-Tree is able to organize large image databases and supports popular multimedia retrieval mechanisms such as Content-Based Image Retrieval (CBIR) shown on figure 15. The high-level semantic information can be obtained from several sources, such as high-level affinity relationships between image data. The concept of affinity relationship stems from the idea that the more two images are accessed together the more related they are. The AH+-tree provides the same functionality as the AH-Tree but utilizes the high-level semantics in a novel way to eliminate I/O overhead incurred by the AH-Tree and thus provides the same functionality at lower I/O cost.

With the rapid development of the Internet and storage systems, enormous amounts of multimedia data such as images and videos have been generated. There is an increasing need of advanced technologies to effectively and efficiently process and manage such large-scale multimedia for various applications, and associated with this need is the emerging demand of multimedia systems that support semantic analysis. To address this research problem, the DMIS Lab actively conducts research in the areas of event detection and concept extraction.

Under the aforementioned research areas, the DMIS Lab has developed a novel multimodal semantic concept/event detection framework that can be utilized in high-performance computing facilities with large storage resources. The framework follows a layered architecture that consists of: (a) feature extraction, (b) filtering, (c) model training, and (d) testing. In order to effectively characterize the images and/or videos, low-level, mid-level, and object-level features are extracted. Since concepts/events of interest are often highly infrequent, filtering techniques are applied to address the class-imbalance problem. As for model training, the multiple correspondence analyses (MCA) technique, originated from statistics, is utilized to capture the complex interrelationship between features and concepts/events, which are modeled based on the training data. Finally, the generated MCA-based models are used for detecting concepts/events from images and videos.
Secure Content Distribution
Dr. Bogdan Carbunar

One of today’s ubiquitous trends is the online hosting of data and services. Users can access a wide range of content from Video on Demand services and sites such as Netflix or Hulu on their personal devices. Users can also store personal content on sites offering specialized services such as Yahoo Mail, Google Docs or YouTube and outsource complex computations to “cloud” providers such as Amazon, Google and Microsoft. The work of Dr. Carbunar focused on Video on Demand (VoD) services where he addressed scalability issues of Content Distribution Networks (CDN) used by Comcast, Charter and Time Warner. Based on request logs from such providers, Dr. Carbunar has proposed predictive caching algorithms that enable CDN servers to store only items that are predicted to be locally popular while simultaneously minimizing and balancing the network load and extending the lifetime of the cache storage technology. Furthermore, when transferred content is stored in client devices, Dr. Carbunar has proposed novel content sharing applications as well as efficient and secure synchronization protocols for Wi-Fi enabled mobile devices.

Secure Payments
Dr. Bogdan Carbunar

Dr. Carbunar has contributed to the field of electronic payments with the concept of conditional e-cash and its use in various network and cloud services. He introduced the notion of electronic payments whose correctness can be verified in zero-knowledge when they are received, but become valid only if the outcome of a future, pre-agreed upon event is favorable. He used this concept to provide secure incentives for cloud and volunteer computing efforts and designed the first anonymous micropayment system where double spending is prevented probabilistically.

Private Remote Data Access
Dr. Bogdan Carbunar

When accessing data stored on remote servers, users unwittingly reveal personal information which can lead to unwanted side-effects such as leaking personal information which can result in behavioral profiling, spam and targeted ad placement. Users have no control over who can access this information and the type of processing that can be performed on this sensitive data, which on multiple occasions has been sold or even made public (e.g., Netflix, AOL). Computational private information retrieval (cPIR) techniques allow users to access remote data without leaking their interests or their access patterns to the server storing the data. While in principle cPIR can be used to solve the problem previously mentioned, Dr. Carbunar showed that the deployment of non-trivial single server cPIR protocols on real hardware of the recent past would have been orders of magnitude less time-efficient than trivially transferring the entire database. To address this challenge, Dr. Carbunar designed a Bloom filter based construction that significantly reduces the amortized complexity of a cPIR protocol.
Protecting confidential information from improper disclosure has emerged as a fundamental issue for trustworthy computing. While it is sometimes possible to stop undesirable information flows completely, it is perhaps more typical that some undesirable flows are unavoidable. For instance, an ATM machine that rejects an incorrect PIN thereby reveals that the secret PIN is not the one that was entered. Similarly, revealing the tally of votes in an election reveals some information about the secret ballots that were cast. More subtly, the amount of time taken by a cryptographic operation may be observable by an adversary, and may inadvertently reveal information about the secret key. As a result, there is growing interest in quantitative theories of information flow, which allow us to talk about “how much” information is leaked and (perhaps) allow us to tolerate “small” leaks. But while it is tempting to base such theories on classic information-theoretic concepts like Shannon entropy and mutual information, these turn out not to provide very satisfactory confidentiality guarantees. As a result, Geoffrey Smith and other researchers have developed an alternative theory, based instead on Rényi’s min-entropy, which gives strong, direct operational security guarantees.

His current research aims to deepen our understanding of the theory and applications of min-entropy leakage, pursuing several themes concurrently. In the theory of min-entropy leakage, uncertainty is measured in terms of a random variable’s Bayes vulnerability to being guessed in one try by an adversary; note that this is the complement of the Bayes Risk. Dr. Smith and his collaborators are exploring the mathematical properties of this theory, for both deterministic and probabilistic systems, with the goal of better understanding the relationship to other theories, such as mutual information leakage and differential privacy. To support the compositional analysis of complex systems, they are establishing leakage bounds for channels in cascade, where the output of one channel becomes the input to another. Also, they are developing techniques for computing the min-entropy leakage of a given system, giving a way to verify whether it conforms to a given quantitative flow policy; both model-checking and statistical-sampling based techniques are being considered. Finally, applications of min-entropy leakage are being explored, for example to timing attacks against public-key cryptosystems, and to accountability systems that use logging and auditing to identify misbehaving entities. These efforts aim to develop new theory, enforcement techniques, and applications of min-entropy leakage, contributing broadly to a rigorous science of quantitative information flow.
In depth

Disaster Information Management
Dr. Shu-Ching Chen
Funding: NSF

3D Hurricane Storm Surge Animation and Visualization

Hurricanes are one of nature’s most powerful forces with the proven ability to take lives, destroy cities, and cause billions of dollars in damages. Therefore, it is crucial to determine the potential storm surge effects of an approaching hurricane, plan evacuation routes, and effectively communicate this information to warn citizens who may be in severe danger and to avoid over-evacuation of those who are not. It is well accepted that 3-D visualizations have a greater impact on people’s perception of a situation than textual descriptions and static graphics.

The DMIS Lab has developed a simulated 3-D hurricane environment complete with storm surge effects for hurricane prone regions in Florida, namely, Key West, Miami, etc. It utilizes LIDAR data to build city models and simulates the effects that a hurricane has on objects (such as cars, buildings, and sea-shores). This system can be linked to a streaming source of dynamic hurricane-related data that includes anticipated wind speeds and storm surge levels to emulate real-life scenarios (Figure 17). This visualization environment can also be utilized as a training medium to educate the public about the severity of hurricanes and their deadly effects, thus enabling them to practice appropriate safety measures when the situation arrives. Furthermore, to allow the general public get a detailed idea of hurricane conditions in locations of their choice, the environment integrates the simulated 3-D animations with 2-D interactive maps.

Florida Public Hurricane Loss Model

Homeowner insurance rate making is an important public policy issue in the State of Florida. The State of Florida has over 2 trillion dollars of residential properties exposed to hurricane risk. To assure that consumers are charged within lawful insurance ranges, the Florida Office of Insurance Regulation sponsored the development of a Florida Public Hurricane Loss Model (FPHLM) to assess hurricane risk and project insured residential losses. The FPHLM is a very complex set of computer programs that simulate and predict how, where, and when hurricanes form, their wind speeds, intensities and sizes, their tracks, how they decay and how they are affected by the terrain along their tracks after landfall, how the winds interact with different types of residential structures, how much they can damage house roofs, windows, doors, interior, and contents, how much it will cost to rebuild the damaged parts, and how much of the loss will be paid by insurers. The FPHLM consists of three major components: wind hazard (meteorology), vulnerability (engineering), and insured loss cost (actuarial). Its computer platform is a web-based distributed system that integrates all the functionalities of the model and is designed to accommodate future integration of additional sub-components or enhancements.
The Business Continuity Information Network (BCIN) Project is an initiative that engages university, local, regional, and global communities to work together as partners to benefit society. Its broader impact is provided by its web-based service (www.bizrecovery.org) where local businesses, emergency management offices, and organizations that assist businesses can gather to share critical information and support continuity efforts before, during, and after a disaster. BCIN is capable of capturing disaster preparation, response, and recovery data between communities to achieve a speedy recovery of locally impacted economies. In order to do this, this business-to-business community network currently maps and shares critical information about infrastructure conditions and recovery efforts in collaboration with County Emergency Management Offices (Miami-Dade, Broward, Palm Beach, and Monroe) and major private infrastructure providers. BCIN localizes and tailors relevant information to business managers who use this information to better assess an event’s impact to their facilities, employees, suppliers and customers.

Currently deployed in South Florida, BCIN has been well received by the disaster management community in Florida and may be deployed throughout the state and beyond. Companies use its information to better understand the current situation caused by the hazard, identify resources they need for recovery, maintain contact with their supply chain and key customers, and acquire the resources they need to resume operations faster.

In brief

**Visual Analytics for Command, Control, and Interoperability Environments**

Dr. Shu-Ching Chen, Dr. Tao Li, Mr. Steven Luis

Collaboration: Miami-Dade Emergency Management

Responders in the field (both public and private participants) are capturing footage (pictures and video) of a disaster area with mobile phones. These data are being collected, but are not integrated, in the incident command systems where situation reports and incidence action plans are being held. Moreover, such data are entered into incident command systems manually, which is time consuming and requires careful human review and management. To address this problem, the DMIS Lab has developed a framework that uses advanced data integration and visual analytics techniques to analyze situation reports and pictures, as well as text captured in the field, and automatically link reports directly to relevant multimedia content collected in the field.

The server layer of the framework implements an offline Multimedia Analysis Framework (MAF) to associate situation reports with relevant multimedia content. The MAF framework includes a hierarchical image classification component developed based on multi-source data fusion and some data mining techniques, such as multiple correspondence analyses (MCA). The situation reports are pre-processed using the GATE system and WordNet to associate location-subject pairs. In addition, the framework provides a prototype iPad application that allows emergency personnel to easily interact with situation reports and associated multimedia data (Figure 18). The framework also incorporates a mechanism that allows users to provide feedback information that is used to refine the association between situation reports and multimedia data. The system’s functionality was developed in collaboration with Miami-Dade’s EOC department, which has expressed interest in the application and encouraged us to develop the system into an operational pilot.

In brief

**Business Continuity Information Network (BCIN)**

Dr. Shu-Ching Chen, Dr. Tao Li, Dr. Jainendra Navlakha, Mr. Steven Luis

www.bizrecovery.org

Funding: NSF, DHS, IBM
The work required to build BCIN has been a collaboration with many government and industry partners including the Miami-Dade, Broward, Palm Beach, and Monroe Offices of Emergency Management (EOC), IBM, Office Depot, Walmart, Greater Miami Chamber of Commerce, and over 100 companies (both nationally or regionally known). BCIN links participating companies into a community network that is guaranteed to be available after a disaster such as a hurricane. This network supplies tools for company staff to gather and enter situation-awareness data in real-time, provides an automated means to integrate, analyze and present the data, offers information fusion techniques to channel the right information to the right people, and enables communication among company staff and between customers and vendors. In short, the networked information tools, the business community connected by the network, and the business intelligence data gathered in the network help to revive the business ecosystem interrupted by the disaster, thus achieving a speedy recovery. The BCIN system platform provides mechanisms for data integration, data mining, and visualization utilizing off-the-shelf Web-based technologies. Figure 19 shows a snapshot of the current BCIN prototype that displays the information collected from various sources in an intuitive and user-friendly manner. Many BCIN-enabled community activities have demonstrated the impacts this project has on the community. Miami-Dade and Palm Beach County Emergency Management offices have both developed procedures for using BCIN as an ongoing mechanism to reach out to the local business communities as part of their Emergency Support Function. As a result of the partnership with local emergency management offices, two live joint-county exercises have been conducted where companies run the system through a hurricane scenario to facilitate information sharing experiences and incorporate user feedback. Many other exercises enabled by BCIN include: Miami-Dade EM Business Recovery Desk, Florida Statewide Hurricane Suitor Training Exercise, UASI Operation Cassandra, and Miami-Dade EM Business Recovery Program Training. In addition, three internal activations with Miami-Dade EOC were executed where live situational data were injected from EOC sources into the system for 2008 hurricane threats Fay, Gustav, and Ike.

BCIN participates in a broader community of public and private programs working towards community resilience. Private initiatives include infrastructure hardening, like improving power and telecommunications availability after a storm. For example, Office Depot has built an infrastructure to allow business members to charge their phones and laptops and access the Internet when power outages occur after a hurricane. In another example, The Institute of Business and Home Safety, an insurance industry group, has developed a business continuity program that helps small businesses conduct an assessment of their operations. BCIN will provide a situational information platform to these small businesses to help them understand the risks presently affecting their employees, supply chain, assets, and other factors addressed in the continuity assessment. BCIN distinguishes itself from the vast array of independent tools such as instant messaging and resource databases by providing a platform that integrates such user scenario requirements without requiring participants to abandon their current business continuity systems or reveal private company data.
The Affective Social Computing Laboratory (ASCL) conducts research in affective computing, a new and growing field in computer science. Affective computing is an interdisciplinary field involving tasks that relate to emotion. It can be seen as the logical continuation within engineering of the “Emotion Renaissance” within psychology and neuroscience of the 60s and 70s. It explores the computational nature of affective phenomena, such as emotions, moods, personality, and attitudes, and their role in human intelligence, communication and decision-making. Such insights can then be applied to allow computers to account for and adapt to human affect. This research is highly interdisciplinary in nature; it lies at the intersection of Artificial Intelligence (AI) and Human-Computer Interaction (HCI) from computer science, emotion theories from psychology, social interaction theory from communication, and other domain knowledge when used to build systems within a domain (e.g., health informatics).

The research goal of ASCL is to create engaging, embodied socially intelligent agents that can interact with humans in innovative ways through expressive, multi-modal interaction. Such systems have applications in a wide variety of contexts involving socio-emotional content, such as car safety, social robotics, health care, social orthotic help companions, cyber-therapy, intelligent training systems, and other e-learning systems.

To carry out our research, we envision and create fundamental theories by finding and synthesizing relevant interdisciplinary findings into a computational form useful for artificial intelligent agents. Our research also seeks to discover innovative AI techniques that are best suited to become components of an intelligent agent (from sensing, to decision-making, to actuating), and to apply HCI principles toward the design of engaging interactive media for a specific domain (e.g., health promotion assistants). In each specific context, these intelligent agents must:

- Sense the affect, preferences, and personality of their interlocutor (bio-sensing, pattern matching, knowledge elicitation and/or representation of affective phenomena)
- Make decisions (logic-based and probabilistic reasoning) that are socially acceptable based on their dynamic user-model (knowledge representation)
- Carry out their interactions (HCI design principles) within the domain-knowledge (e.g. health communication, computer-based training, driver safety)
- While displaying social competence (social communication theory)
- Tailor and adapt (machine learning) their interactive styles to the specific socio-emotional profile (user-modeling) of their human counterpart

Applications and current emphasis on e-health

There are many potential application domains for our innovative affective computing technology. At ASCL we are particularly interested in conceiving affective computing systems in the domain of smart health and well-being.

Western healthcare interest has recently started to move toward finding ways to preventively promote wellness, rather than to solely treat already established illness. This new direction in healthcare has given rise to a variety of health promotion interventions aimed at helping people to improve their health by changing their lifestyle and behavior. US statistics are gloomy: for obesity alone, 33.8% of adults and 17% (or 12.5 million) of children are obese; similar numbers can be found for alcoholism and other forms of substance abuse.

It seems impossible to provide health counseling for 13 million obese children, much less preventative care for the children who are at risk and the rest of the population. At ASCL, we are studying how socially engaging virtual characters can provide some of the complementary personal health informatics automation that is needed to address this gap.
We build personal health informatics help agents that users can access anytime, that users can actually use (and do not require technical sophistication), that users will actually use (non-threatening and supportive), and who are emotionally competent since these lifestyle issues are intensely emotional for the users (Figure 20).

We aim to increase access to e-health by developing our help agents on different platforms: PC-based, internet-based, and mobile devices.

Publication venues and events

Affective Computing is an exciting new field of research which is now fully established as a sub-field of Computer Science. It has recently launched two journals specialized on the topic, namely the IEEE Transactions in Affective Computing and the International Journal of Synthetic Emotions. Many top rated journals also publish Special Issues on the topic.

Researchers from industry and academia gather at its dedicated International Conference on Affective Computing and Intelligent Interaction, and many prestigious international conferences feature Special Tracks on Affective Computing.
The analysis of ellipsometric spectra consists of data acquisition, processing, and interpretation. There are various data acquisition technologies but at a minimum each single measurement provides two real numbers relating the p and s waves, the relative amplitude angle, $\Psi$, and the phase shift difference, $\Delta$. Data processing (solving) is almost always required because the desired reflecting surface parameters, such as film thickness, are related to the measured data through a system of equations which are typically non-invertible and non-linear. We have restricted the current investigation to measurement of $\Psi$ and $\Delta$. The underlying treatment of the multivalued functions in present least-squares solving methods results in an inherent problem with multiple solutions which the present work eliminates.

Data acquisition is very similar regardless of the configuration of the films and substrate under investigation. On the other hand, data analysis may differ markedly depending upon the thickness, optical properties, and morphology of the reflecting surface. One reason for this is that the physical properties of particular film substrate combinations may result in parameter correlation in the mathematical models. Another reason is that particular material combinations may introduce numerical problems into the solution processes. A particular case in point of problematic analysis is the simultaneous measurement of the thickness and optical properties of thin absorbing layers such as metals. In an earlier work, one of the authors (Twald et al.), investigated prior known methods for analyzing the data from examples of absorbing films. All of those methods were based on numerical least-squares analysis. We have analyzed the same films and the measured data using the new mathematical and n–k plane numerical methodologies of Urban and Barton and have described the ways in which these new methodologies work better than previous analysis methods. There is reason to believe that other methods may be developed and used for obtaining these solutions. We are studying the numerical process to obtain solutions, not the physical model which, of course, is independent of solution method.

### In brief

**Numerical Ellipsometry: Analysis of Thin Metal Layers Using N–K Plane Methods with Multiple Incidence Angles**

**Dr. David Barton**

The analysis of ellipsometric spectra consists of data acquisition, processing, and interpretation. There are various data acquisition technologies but at a minimum each single measurement provides two real numbers relating the p and s waves, the relative amplitude angle, $\Psi$, and the phase shift difference, $\Delta$. Data processing (solving) is almost always required because the desired reflecting surface parameters, such as film thickness, are related to the measured data through a system of equations which are typically non-invertible and non-linear. We have restricted the current investigation to measurement of $\Psi$ and $\Delta$. The underlying treatment of the multivalued functions in present least-squares solving methods results in an inherent problem with multiple solutions which the present work eliminates.

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### In brief

**Metagenomics**

**Dr. Giri Narasimhan**

Working with collaborators from FIU’s College of Medicine, Prof. Narasimhan is building analytical protocols and tools for inferring the microbial community profile, whether it is in the soil, in other environmental niches, or in host environments such as the lungs of Cystic Fibrosis and COPD patients. Such studies will lead to improved treatments of infections and better long-term prognosis. Students M. Jaric and G. Gonzalez have contributed to this effort.

### In brief

**Phylogenetic Tools for Within-Host Evolution of HIV**

**Dr. Giri Narasimhan**

Phylogenetic tools are computational tools to study evolution of organisms. However, when studying the evolution of HIV within a single patient over a decade, existing tools fail to tease out the relationships. Prof. Narasimhan and graduate student P. Buendia developed MinPD to elicit the evolutionary relationships and to highlight critical stages in the development of the viral population and its virulent mutants within the population.
The Bioinformatics Research Group (BioRG) works on building tools for solving a variety of Bioinformatics problems. When existing tools failed to design primers for finding resistance genes in the plant T. cacao, the tool DePiCT developed by Prof. Narasimhan and his team. Wei used clustering techniques to help USDA scientists to discover many new resistance genes. When two new bacterial genome sequences were available from the Broad Institute and it was necessary to compare the sequences, Prof. Narasimhan and his group developed a suite of tools to help collaborators from Harvard University and FIU to perform a comprehensive analysis of the two new genome sequences along with five other existing ones. See figure 21 for a visual comparison for six genome sequences of bacterial strains.

**In brief**

**Comparative Genomics**

Dr. Giri Narasimhan

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**Image Registration**

Dr. Giri Narasimhan

Prof. Narasimhan and graduate student, N. Andres Parra, developed PoIRe, a point-based image registration tool for registering medical images. The applications include registering images taken before, during and after radiotherapy treatments, and in facilitating accurate delivery of radiotherapy. The laboratory has also developed registration techniques when images undergo non-rigid transformations, such as those that take place when a tumor changes in size and shape. The figure 22 shows images before and after registration.
High-throughput sequencing technology is now the standard tool for sequencing small and large genomes and laying the foundation for a systems biology approach to understanding the organisms. However, these techniques invariably result in a large number of gaps in the sequence. Prof. Narasimhan and graduate student X. Yang developed a tool called CloG that deftly exploits information from fresh sequencing data and the genomic sequences of closely related species and stitches fragments together to close the gaps. CloG helped close 75% of the gaps in the draft assembly of the bacterium Burkholderia dolosa.

MRI-based 4D Computational Modeling of Respiratory Motion for Lung Tumor Radiotherapy
Dr. Ram Iyengar

More than half of all solid tumors receive external beam ionizing radiation as part of multimodality treatment (e.g., radiotherapy + chemotherapy or radiotherapy + surgery + chemotherapy). The goal of radiation treatment is to treat disease while avoiding damage to normal tissue and critical organs that surround the tumor. Conventional radiotherapy involves administering a prescribed tumor-killing dose (typically around 50 – 70 Gray) over several sessions (~25 to 35) known as “treatment fractions”. In recent years, with technological advances as well as improved understanding of radiobiology, there have been two trends – either to deliver the same total dose in significantly fewer fractions (1 to 5) when accompanied by improved image-guidance using offline and online projection x-ray imaging and computed tomography (CT), or to increase the total radiation dose using the historical dose per fraction (2 Gray) with the same image guidance. In many anatomical sites, such “dose escalation” (per fraction) has been shown to offer local tumor control benefits. This has often been reported in the literature addressing irradiation of lung tumors.

Lung cancer is the most common cause of cancer related death in the United States. Overall, only 10-15% of lung cancer patients will be living five years after diagnosis. Its radiation treatment therefore attracts great attention and is in need of significant improvement. Due to the spatial relationship of lung tumors with important normal tissue structures – spinal cord, esophagus, heart, brachial plexus, normal lung tissue, bronchial tree, and trachea among others – total dose escalation is often not feasible to a great extent. Furthermore, radiation treatment planning for lung cancers is often complicated by complex motion of tumors during all phases of the respiratory cycle. This tumor motion and object deformation is also heavily influenced by the motion of intrathoracic normal tissue structures. Hence, for a number of reasons, treatment planning for intrathoracic radiation requires better tools to optimize precision and accuracy of delivery. We are developing a lung tumor modeling and computational infrastructure to facilitate the tracking and the prediction of respiratory movement and deformation of organs surrounding the tumor. These new results will help medical practitioners to accurately plan and deliver radiotherapy.
The Discovery Lab created in Spring 2012 is aimed at developing products for the marketplace. At the same time, the laboratory provides students with the hands-on experiences they need to solve real-world challenges, develops student-led research opportunities, fosters students’ entrepreneurial skills, and trains a new generation of IT professionals who reflect the diversity of South Florida.

“The Discovery Lab provides a platform to develop many new ideas. The lab is comparable in its mission to labs at top universities. We are educating entrepreneurs, sustaining research and, developing products that can be commercialized. We are training the next generation of students with the 21st Century skills they need to succeed.”

– Director Ram Iyengar.
FIU School of Computing and Information Sciences

The Discovery Lab mission is:

• Engage undergraduate students in hands-on learning experiences that solve real-world challenges, thereby strengthening FIU’s positioning as a solutions center.
• Develop student-led research opportunities guided by faculty with experience in systems development.
• Foster entrepreneurial skills among students.
• Train the next generation of IT professionals who reflect the diversity of South Florida, strengthening the School’s dedication to facilitate access to its programs among historically underrepresented minorities.

The Discovery Lab provides an infrastructure to promote collaborative research among universities and research organizations across the nation. In addition to addressing a comprehensive set of fundamental research topics, the Lab is pursuing commercialization, distinguishing itself from traditional research labs through its focus on translating research discoveries into technology transfer outcomes.

CIS researchers are currently performing advanced research in the areas of intelligent systems, advanced security systems, autonomous mobile robots, and smart grids. The use of advanced robotics and sensor networks in home and industrial applications presents dynamic opportunities for research discoveries. CIS researchers continue to explore several new promising avenues of research, including the Intelligent Home System, focused on enhancing security and energy efficiency through the power of home automation and robot technology. Additional areas of promise include the Smart Access Control system, designed to provide optimal security, and an autonomous pipeline maintenance robot.

Students are using exciting new tools such as 3D printers, semi-autonomous and autonomous robotic tools and techniques, and control devices such as iPhones and iPads to create rich multimedia control and analytic systems. CIS will use the latest 3D design tools such as AutoCad Studio and 3D Max and other tools to provide a platform for in-house development.

On April 10th, 2012, State Farm awarded FIU’s Discovery Lab lead by Dr. Ram Iyengar, SCIS Director and Ryder Professor, a donation of $50,000 to further the lab’s mission to inspire student innovation. State Farm has designated FIU as one of 20 Universities in the Nation where they recruit exclusively. This grant award was one of only four such grants awarded in the area of IT Systems this year by State Farm.
## Recent SCIS Contracts and Grants

<table>
<thead>
<tr>
<th>SCIS Faculty</th>
<th>Title</th>
<th>Agency</th>
<th>Amount</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Naphtali Rishe (PI), Shu-Ching Chen, Tao Li, Ming Zhao (Co-PIs)</td>
<td>MRI: Development of an Integrated, Geospatial Analytics Research Instrument</td>
<td>NSF</td>
<td>$710,693</td>
<td>2011-2014</td>
</tr>
<tr>
<td>Ram Iyengar (PI)</td>
<td>Multi University Research and Training in Protection of Critical Information Infrastructures</td>
<td>NSF</td>
<td>$299,998</td>
<td>2011-2013</td>
</tr>
<tr>
<td>Jinpeng Wei (PI)</td>
<td>Malware Persistence in OS Kernels</td>
<td>Georgia Institute of Technology / Centre for Strategic Infocomm Technologies (Singapore)</td>
<td>$121,730</td>
<td>2011-2013</td>
</tr>
<tr>
<td>Xudong He (PI)</td>
<td>SBIR Phase Ila: Petri Nets Controller for Robotic Grasping</td>
<td>Energid / NSF</td>
<td>$70,000</td>
<td>2011-2012</td>
</tr>
<tr>
<td>Christine Lisetti (PI), Naphtali Rishe (Co-PI)</td>
<td>Lifelike Expressive Avatars for the Instruction of Young Learners who are Deaf</td>
<td>Vcom-3D / NSF</td>
<td>$70,000</td>
<td>2011-2012</td>
</tr>
<tr>
<td>Naphtali Rishe (PI)</td>
<td>Knowledge Mining and Bioinformatics techniques to Advance Personalized Diagnostics and Therapeutics</td>
<td>NSF</td>
<td>$49,138</td>
<td>2011-2012</td>
</tr>
<tr>
<td>Shu-Ching Chen, Steven Luis (Co-PI)</td>
<td>Coordinated Damage Assessment Application</td>
<td>Miami-Dade County Office of Emergency Management</td>
<td>$43,670</td>
<td>2011-2012</td>
</tr>
<tr>
<td>Shu-Ching Chen (Co-PI)</td>
<td>Support for the Educational Activities at ACM Multimedia 2011</td>
<td>NSF</td>
<td>$15,000</td>
<td>2011-2013</td>
</tr>
<tr>
<td>Tao Li (PI), Shu-Ching Chen, and Steven Luis (Co-PIs)</td>
<td>All-Hazard Disaster Situation Browser on Mobile Devices</td>
<td>Eugenio Pino and Family Global Entrepreneurship Center</td>
<td>$10,798</td>
<td>2011-2012</td>
</tr>
<tr>
<td>Raju Rangaswami (PI), Jason Liu, Ming Zhao (Co-Pis)</td>
<td>Streamlining High-End Computing with Software Persistent Memory</td>
<td>NSF</td>
<td>$759,999</td>
<td>2010-2012</td>
</tr>
<tr>
<td>Naphtali Rishe (PI)</td>
<td>MRI-R2: Development of an Instrument for Information Science and Computing in Neurosciences (FIU SCIS Subaward)</td>
<td>NSF</td>
<td>$752,932</td>
<td>2010-2013</td>
</tr>
<tr>
<td>Raju Rangaswami (PI), Giri Narasimhan (Co-PI)</td>
<td>CSR: Small: Energy Proportional Storage Systems</td>
<td>NSF</td>
<td>$504,163</td>
<td>2010-2013</td>
</tr>
<tr>
<td>Shu-Ching Chen (PI), Tao Li, Jinpeng Wei, Zhengyu Yang, and Ming Zhao (Co-Pis)</td>
<td>A Research and Educational Framework to Advance Disaster Information Management in Computer Science PhD Programs</td>
<td>US Dept. of Homeland Security</td>
<td>$400,000</td>
<td>2010-2014</td>
</tr>
<tr>
<td>Giri Narasimhan (PI)</td>
<td>The Airway Microbiome in Chronic Obstructive Pulmonary Disease (COPD)</td>
<td>University of Miami / Florida Dept. of Health</td>
<td>$314,408</td>
<td>2010-2011</td>
</tr>
<tr>
<td>Tao Li (PI)</td>
<td>Unsupervised Learning from Multiple Information Sources Based on Non-negative Matrix Factorization (NMF)</td>
<td>Army Research Office</td>
<td>$300,000</td>
<td>2010-2013</td>
</tr>
<tr>
<td>Naphtali Rishe (PI)</td>
<td>RAPID: MRI: Development of Database Appliance Module for Multi-temporal Analysis and Correlation of Gulf Oil Spill Related Geospatial Data</td>
<td>NSF</td>
<td>$248,000</td>
<td>2010-2012</td>
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<tr>
<td>Naphtali Rishe (PI)</td>
<td>III: Gulf RAPID: Multi-temporal analysis and correlation of Gulf Oil Spill Related Geospatial Data on TerraFly Platform</td>
<td>NSF</td>
<td>$161,568</td>
<td>2010-2012</td>
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<tr>
<td>Naphtali Rishe (PI)</td>
<td>SBIR Phase Ila: Trust-GUARD-Enabled Secure TerraFly</td>
<td>BlueRISC / NSF</td>
<td>$105,000</td>
<td>2010-2012</td>
</tr>
<tr>
<td>Shu-Ching Chen (PI), Tao Li, Steve Luis (Co-Pis)</td>
<td>A Data Mining Framework for Enhancing Emergency Response Situation Reports with Multi-Agency Multi-Party Multimedia Data</td>
<td>Purdue Univ. / US Dept. of Homeland Security</td>
<td>$70,000</td>
<td>2010-2012</td>
</tr>
<tr>
<td>PI/Co-PIs</td>
<td>Title</td>
<td>Funding Agency</td>
<td>Amount</td>
<td>Years</td>
</tr>
<tr>
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<tr>
<td>Raju Rangaswami</td>
<td>IBM PhD Fellowship for Jorge Guerra</td>
<td>IBM</td>
<td>$60,000</td>
<td>2010-2012</td>
</tr>
<tr>
<td>Jason Liu</td>
<td>PrimoGENI-Developing GENI Aggregates for Real-Time Large-Scale Network Simulation</td>
<td>BBN Technologies</td>
<td>$525,200</td>
<td>2009-2012</td>
</tr>
<tr>
<td>Masoud Milani, Peter Clarke, Xudong He, Christine Lisetti</td>
<td>GAANN Fellowships in Computer Science at Florida International University</td>
<td>US Dept. of Education</td>
<td>$525,128</td>
<td>2009-2013</td>
</tr>
<tr>
<td>Tao Li</td>
<td>Gene Functional Prediction from Protein-Protein Interaction Data</td>
<td>NSF</td>
<td>$322,632</td>
<td>2009-2012</td>
</tr>
<tr>
<td>Niki Pissinou</td>
<td>REU SITE: Numerical Computing and Optimization in Multidisciplinary Applications: Methods and Software</td>
<td>NSF</td>
<td>$300,000</td>
<td>2009-2012</td>
</tr>
<tr>
<td>Tao Li</td>
<td>Information Delivery and Knowledge Discovery for Hurricane Disaster Management</td>
<td>US Dept. of Homeland Security</td>
<td>$199,999</td>
<td>2009-2012</td>
</tr>
<tr>
<td>Tao Li</td>
<td>Collaborative Research: Non-negative Matrix Factorizations for Data Mining: Foundations, Capabilities, and Algorithms</td>
<td>NSF</td>
<td>$149,981</td>
<td>2009-2012</td>
</tr>
<tr>
<td>Niki Pissinou</td>
<td>Providing Secure Communication for Mobile Ad-Hoc Networks</td>
<td>DoD / US Southern Command</td>
<td>$100,000</td>
<td>2009-2011</td>
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<tr>
<td>Naphtali Rishe</td>
<td>TIE: UF-IFU inter-I/UCRC collaboration to explore autonomic computing for the TerraFly server system</td>
<td>NSF</td>
<td>$50,000</td>
<td>2009-2011</td>
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<tr>
<td>Tao Li</td>
<td>EAGER: Collaborative Research: Cross-Domain Knowledge Transformation via Matrix Decompositions</td>
<td>NSF</td>
<td>$46,000</td>
<td>2009-2011</td>
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<tr>
<td>Naphtali Rishe, Xudong He, Shu-Ching Chen</td>
<td>CREST: Center for Innovative Information Systems Engineering</td>
<td>NSF</td>
<td>$5,250,000</td>
<td>2008-2013</td>
</tr>
<tr>
<td>Naphtali Rishe, Vagelis Hristidis, Tao Li, Raju Rangaswami</td>
<td>MRI: Development of High-Performance Database Appliance for Geospatial Applications</td>
<td>NSF</td>
<td>$1,084,000</td>
<td>2008-2013</td>
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<tr>
<td>Naphtali Rishe, Shu-Ching Chen, Vagelis Hristidis, Tao Li</td>
<td>I/UCRC: Center for Advanced Knowledge Enablement</td>
<td>NSF</td>
<td>$712,000</td>
<td>2008-2013</td>
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<tr>
<td>Raju Rangaswami</td>
<td>CAREER: Active Block Layer Extensions: A Foundation for Building Self-Managing Storage Systems</td>
<td>NSF</td>
<td>$460,000</td>
<td>2008-2013</td>
</tr>
<tr>
<td>Masoud Milani</td>
<td>Development of a Manual for New Construction Requirements and Water Consumption Data Analysis</td>
<td>Miami-Dade County Water &amp; Sewer Dept.</td>
<td>$349,999</td>
<td>2008-2011</td>
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<tr>
<td>Peter Clarke</td>
<td>Collaborative Research: Web-Based Repository of Software Testing Tools</td>
<td>NSF</td>
<td>$133,116</td>
<td>2008-2011</td>
</tr>
<tr>
<td>Tao Li</td>
<td>SGER: Collaborative Research: Nonnegative Matrix Factorization for Data Mining: Algorithms and Applications</td>
<td>NSF</td>
<td>$44,000</td>
<td>2008-2011</td>
</tr>
<tr>
<td>S. Masoud Sadjadi, Peter Clarke</td>
<td>PIRE: A Global Living Laboratory for Cyberinfrastructure Application Enablement</td>
<td>NSF</td>
<td>$2,279,991</td>
<td>2007-2012</td>
</tr>
<tr>
<td>Xudong He, Masoud Milani, Peter Clarke</td>
<td>GAANN Fellowships in Computer Science at Florida International University</td>
<td>US Dept. of Education</td>
<td>$387,165</td>
<td>2007-2011</td>
</tr>
<tr>
<td>Jason Liu</td>
<td>CAREER: Immersive Large-Scale Network Simulations</td>
<td>NSF</td>
<td>$380,821</td>
<td>2007-2012</td>
</tr>
<tr>
<td>Tao Li</td>
<td>CAREER: Mining Log Data for Computing System Management</td>
<td>NSF</td>
<td>$606,715</td>
<td>2006-2012</td>
</tr>
<tr>
<td>Shu-Ching Chen</td>
<td>Public Hurricane Loss Projection Model</td>
<td>Florida Dept. of Insurance Regulation</td>
<td>$7,880,000</td>
<td>2001-2013</td>
</tr>
</tbody>
</table>
Selected Awards and Honors

Ram Iyengar
• ACM Fellow
• IEEE Fellow
• AAAS Fellow
• SPDS Fellow
• Member European Academy of Science
• Distinguished Service Award Roy Paul Daniel’s Professor Award: 2008 - 2010
• Distinguished Research Award from Tunisian Mathematical Society: March 22, 2010
• Member of the Advisory Board for International Journal of Wireless and Mobile Computing, Inderscience Publishers: 2005 - Present

Mark A. Weiss
• Dr. Mark Weiss, elected ACM Distinguished Educator, 2011
• Excellence in Service Award, FIU SCIS: 2007
• Excellence in Teaching Award, FIU SCIS: 2005
• Excellence in Teaching Award, FIU: 1999
• Excellence in Research Award, FIU: 1994
• Teaching Incentive Program Award, FIU: 1994
• Outstanding Achievement and Performance Award, FIU: 1990
• RCA Fellowship and Merit Prize to Princeton University: 1983
• New York City First Place Winner, Putnam Mathematics Contest: 1981

Shu-Ching Chen
• Dr. Shu-Ching Chen, elected ACM Distinguished Scientist, 2011
• Best Paper Award, IEEE International Symposium on Multimedia: December 11-13, 2006
• Top Scholar Award, FIU: 2011
• Kauffman Professor Award: 2011
• The Inaugural Excellence in Graduate Mentorship Award, FIU: 2006
• Outstanding Faculty Research Award, FIU: 2004
• Excellence in Mentorship Award, FIU SCIS: 2010 and 2006
• Outstanding Faculty Service Award, FIU SCIS: 2004
• Outstanding Faculty Research Award, FIU SCIS: 2002

Xudong He
• Faculty Research Excellence Award, FIU SCIS: 2009
• Excellence in Faculty Scholarship, FIU: 2008
• Executive Dean’s Award in Service, College of Engineering and Computing, FIU: 2006
• Faculty Award for Excellence in Research, FIU: 2005
• Faculty Service Excellence Award, FIU SCIS: 2005
• Faculty Teaching Excellence Award, FIU SCIS: 2003

Giri Narasimhan
• Best Research Award, FIU SCIS: 2007
• Faculty Senate Award for Excellence in Research, FIU: 2004
• Best Research Award, FIU SCIS: 2004
• Editor, International Journal of Bioinformatics Research & Applications: 2007 - Present
• Editor, Journal of Discrete Algorithms: 2000 - Present
• Editor, Journal of Bionanoscience: 2005 – Present

Jainendra K. Navlakha
• Outstanding Contributions to the Achievement of Affirmative Action/ Employment Opportunities, FIU: 1992
• Teaching Incentive Program Award, FIU: 1995 and 1996
• Excellence in Service Award, FIU SCIS: 2003
• Awarded Honorary Professorship, Universidad Nacional Daniel Alcides Carrion, School of Post Graduate Studies, Peru: 2007
• Fulbright Senior Scholar Specialists in Information Technology: 2004-2009
• Fulbright Senior Scholar Assignment to Voronezh Institute of High Technologies, Voronezh, Russia: 2007

Naphtali Rishe
• Inaugural Outstanding Faculty Award, FIU: 2002
• Four US Patents

Peter J. Clarke
• Excellence Award in Mentorship Award, FIU SCIS: 2008

Tao Li
• Dr. Tao Li, College of Engineering and Computing Mentorship Award for 2011
• Scalable Data Analytics Innovation Award, IBM: 2010
• Excellence in Mentoring Award, FIU SCIS: 2009
• Excellence in Research, FIU: 2009
• NSF Faculty CAREER Award: 2006-2011
• Faculty Research Award, IBM: 2008
• Excellence in Faculty Scholarship, FIU: 2008
• Faculty Fellow for Mathematics of Knowledge and Search Engine, Institute for Pure and Applied Mathematics, UCLA

Christine Lisetti
• Editorial Board of the IEEE Transactions on Affective Computing: 2010
• Excellence in Teaching Award, FIU SCIS: 2009
• Marie-Curie International Fellowship, European Commission: 2006
• Distinguished Research Lecturer Award, UCF College of Engineering and Computer Science: 2003
• Distributed Mentoring Affiliate Award, Computing Research Association-Women: 2002
• Nils Nilsson Award for Integrating AI Technologies with Prof. R. Murphy, American Association for Artificial Intelligence: 2000
• Individual Research Service Award, National Institute of Health 1998
SCIS graduate Jairo Pava named FIU World’s Ahead Graduate

Jairo Pava, named an FIU World’s Ahead Graduate at the Fall 2011 commencement ceremony, was born in Ibagué, a small town in Colombia. In the early 1990s, his parents fled the drug-fueled violence in Colombia and brought three-year-old Jairo to the United States. Although his parents had humble jobs in Miami, they always told Jairo that higher education would allow him to achieve his dreams. Jairo came to FIU completely undecided about his future career. But a computer science course opened his eyes to the possibilities of research.

Jairo made significant contributions to the 3-D hurricane storm surge animation and visualization project, under the mentorship of Professor Shu-Ching Chen, and served as project leader. This research led to the creation of computer simulations that will help people decide whether to evacuate when a hurricane is approaching. Miami-Dade County has made the technology available to residents and it could help other areas affected by hurricanes, as well.

Jairo won the Greater Miami Chamber of Commerce’s “Top Technology Student” award and was the only Florida student to get recognition in the 2011 Computing Research Association Outstanding Undergraduate Researcher Award competition. Jairo has co-authored and published five peer-reviewed conference papers and is writing a chapter for a scientific book series. He currently works at IBM as a software engineer, writing software for mainframes, while he applies to some of the nation’s top graduate schools.
Selected Books by Faculty
Selected Research and Collaboration

Responding faculty:

Iyengar  Navlakha + Abi  Liu  Smith  Yang
Chen  Rishe  Milan  Carbunar  Pan  Zhao
He  Clarke  Rangaswami  Sadjadi  Wei
Narasimhan  Lisetti  

US Labs

• Jet Propulsion Lab, Pasadena, CA
• SPAWAR Systems Center Pacific (SSC-Pacific), San Diego, CA
• NOAA, Hurricane Research Division, Miami, FL
• Florida Institute for Human-Machine Cognition (IHMC), Ocala, FL
• TeraGrid, Chicago, IL
• Los Alamos National Lab, Los Alamos, NM
• Sandia National Lab, Albuquerque, NM
• Oak Ridge National Lab, Oak Ridge, TN

US Universities

• University of Alabama, Birmingham, Birmingham, AL
• San Diego State University, San Diego, CA
• University of California, Berkeley, Berkeley, CA
• University of California, Irvine, Irvine, CA
• University of California, San Diego, San Diego, CA
• University of Southern California, Los Angeles, CA
• Colorado State University, Fort Collins, CO
• Florida A&M University, Tallahassee, FL
• Florida Atlantic University, Boca Raton, FL
• Florida Institute of Technology, Melbourne, FL
• Florida State University, Tallahassee, FL
• University of Florida, Gainesville, FL
• University of Miami, Miami, FL
• University of North Florida, Jacksonville, FL
• University of South Florida, Tampa, FL
• Georgia Institute of Technology, Atlanta, GA
• Northwestern University, Chicago, IL
• Southern Illinois University, Carbondale, IL
• University of Illinois, Urbana, IL
• University of Illinois at Chicago, Chicago, IL
• Notre Dame University, South Bend, IN
• Purdue University, West Lafayette, IN
• Louisiana State University, Baton Rouge, LA
• University of Maryland, Baltimore County, Baltimore, MD
• Harvard University, Cambridge, MA
• University of Massachusetts, Lowell, MA
• University of Montana, Missoula, MT
• Rutgers University, New Brunswick, NJ
• Stony Brook University, Stony Brook, NY
• University of North Carolina, Charlotte, Charlotte, NC
• North Dakota State University, Fargo, ND
• University of Pittsburgh, Pittsburgh, PA
• Clemson University, Clemson, SC
• Dakota State University, Madison, SD
• East Tennessee State University, Johnson City, TN
• Memphis University, Memphis, TN
• University of Houston, Houston, TX
• University of Puerto Rico, Mayaguez, Mayaguez, PR

US Industry

• IBM Research - Almaden, Almaden, CA
• VMware, Palo Alto, CA
• IBM Research – Watson Research Center, Hawthorne, NY
• Marvell Semiconductor
• Motorola Applied Research Center, Schaumburg, IL
• IBM Research – Watson Research Center, Yorktown Heights, NY
• Raytheon
• Ultimate Software, FL
• Vcom3d, Orlando, FL
International Research Labs

- NICTA, Sydney, Australia
- Digiteo, http://www.digiteo.fr, Saclay, France
- French National Center for Scientific Research (CNRS), Paris, France
- Laboratoire d’Informatique (LIX) of the École Polytechnique, http://www.lix.polytechnique.fr/, Palaiseau, France
- National Institute for Research in Computer Science and Control (INRIA), Bordeaux, France
- National Institute for Research in Computer Science and Control (INRIA), Rennes, France
- National Institute for Research in Computer Science and Control (INRIA), Saclay, France
- Renal Epidemiology Information Network, Paris, France
- Korean Advance Institute of Science and Technology (KAIST), Seoul, Korea
- Center for Strategic Infoomm Technology (CSIT), Singapore
- Barcelona Supercomputing Center, Barcelona, Spain

International Universities

- National University of La Plata, La Plata, Argentina
- Fluminense Federal University, Niterói, Brazil
- Universidade Federal de Goiás, Goiás, Brazil
- University of Brazil, Rio de Janeiro, Brazil
- University of São Paulo, São Paulo, Brazil
- Carleton University, Ottawa, Ontario, Canada
- University of Waterloo, Waterloo, Ontario, Canada
- Hefei University of Technology, Hefei, Anhui, China
- Qingdao University, Qingdao, China
- Tianjin University of Technology, Tianjin, China
- Tsinghua University, Beijing, China
- University of Science and Technology of China, Hefei, Anhui, China
- Xiamen University, Xiamen, Fujian, China
- Zhengzhou University, Zhenzhou, China
- Télécom ParisTech, Paris, France
- University of Rennes 1, Rennes, France
- TU Berlin – Berlin Institute of Technology, Berlin, Germany
- University of Bamberg, Bamberg, Germany
- University of Bonn, Bonn, Germany
- Indian Institute of Science, Bangalore, India
- Indian Institute of Technology, Indore, India
- India Statistical Institute, Bangalore, India
- National University of Ireland, Maynooth, Maynooth, Ireland
- Technion – Israel Institute of Technology, Haifa, Israel
- Tel Aviv University, Tel Aviv, Israel
- University of Milan, Crema, Italy
- University of Tsukuba, Tsukuba, Ibaraki, Japan
- University of Guadalajara, Guadalajara, Mexico
- Eindhoven University of Technology, Eindhoven, Netherlands
- Utrecht University, Utrecht, Netherlands
- Dubna International University, Dubna, Russia
- Moscow State University, Moscow, Russia
- National University of Singapore, Queenstown, Singapore
- Complutense University of Madrid, Madrid, Spain
- Technical University of Catalonia, Barcelona, Spain
- University of Castilla-La Mancha, Ciudad Real, Spain
- Pompeu Fabra University, Barcelona, Spain

International Industry

- IBM Research – China, Beijing, China
- Microsoft Research Asia, Beijing, China
- Cloud VPS
- Oracle China, Hefei, China
- Dialonics, Lannion, France
- IBM Research – India, New Delhi, India
- IBM Research – India, Bangalore, India
- IBM Research – Israel, Haifa, Israel
- IBM Research – Tokyo, Tokyo, Japan
- Yahoo! Labs Barcelona, Barcelona, Spain
- Kaseya, Switzerland
Computer Science and Technology Curriculum

**Graduate Courses**
- COP 6556 Semantics of Programming Languages
- COP 6545 Advanced Database Management
- COP 5771 Principles of Data Mining
- CAP 5701 Advanced Computer Graphics
- CDA 5312 Micro Processing for Software Design
- CDA 5655 Virtualized Systems
- CDA 6939 Special Topics: Advanced Topics in Computer Architecture
- CEN 5011 Advanced Software Engineering
- CEN 5054 Software Design
- CEN 5076 Software Testing
- CEN 5082 Grid Enablement of Scientific Applications
- CEN 5087 Software and Data Modeling
- CEN 5120 Expert Systems
- CEN 6070 Software Verification
- CEN 6075 Software Specification
- CEN 6501 Distributed Processing
- CEN 6502 Advanced Topics in Concurrent and Distributed Systems
- CSS 5166 Introduction to Bioinformatics Tools
- CIS 5027 Computer Systems Fundamentals
- CIS 5346 Storage Systems
- CIS 5372 Information Assurance
- CIS 5373 Systems Security
- CIS 5374 Information Security and Privacy
- CIS 5800 Independent Study
- CIS 5910 Project Research
- CIS 5915 Research Experience for Graduate Students
- CIS 5931 Special Topics
- CIS 6612 Special Topics: Advanced Topics in Software Engineering
- CIS 6900 Independent Study
- CIS 6930 Special Topics: eHealth and Affective Computing
- CIS 6931 Special Topics: Advanced Topics in Information Processing
- CIS 6933 Computer Science Seminar
- CIS 6970 Thesis
- CIS 7910 Graduate Research
- CIS 7980 Ph.D. Dissertation
- CNT 6207 Distributed Processing
- CNT 6208 Advanced Topics in Concurrent and Distributed Systems
- COP 5614 Operating Systems
- COP 5621 Compiler Construction
- COP 5725 Principles of Database Management Systems
- COP 5949 Cooperative Education in Computer Science
- COP 6545 Advanced Database Management
- COP 6556 Semantics of Programming Languages
- COP 6611 Advanced Operating Systems
- COP 6727 Advanced Database Systems
- COP 6795 Special Topics on Databases
- COT 5407 Introduction to Algorithms
- COT 5420 Theory of Computation I
- COT 6405 Analysis of Algorithms
- COT 6421 Theory of Computation II
- COT 6930 Special Topics: Advanced Topics in Theory
- COT 6931 Topics in Cognitive Science
- COT 6936 Topics in Algorithms
- TCN 5010 Telecommunication Technology and Applications
- TCN 5030 Computer Communications Network Technologies
- TCN 5060 Telecommunications Software and Methods
- TCN 5080 Secure Telecommunication Transactions
- TCN 5150 Multimedia Computer Communications
- TCN 5440 Telecommunication Software Development
- TCN 5445 Telecommunication Network Programming
- TCN 5455 Information Theory
- TCN 5640 Telecommunications Enterprise Planning and Strategy
- TCN 6210 Telecommunication Network Analysis and Design
- TCN 6215 Advanced Network Algorithms
- TCN 6230 Optical Networks
- TCN 6260 Internetworking
- TCN 6270 Mobile and Wireless Networks
- TCN 6275 Mobile Computing
- TCN 6420 Modeling and Performance Evaluation of Telecommunications Networks
- TCN 6430 Networks Management and Control Standards
- TCN 6450 Wireless Information Systems
- TCN 6820 Industrial Development of Telecommunications
- TCN 6880 Telecommunications Public Policy Development and Standards
- TCN 6935 Graduate Seminar
- CTS 4408 Database Administration
- CTS 4348 UNIX Administration
- CGS 3416 Web-based Programming
- CGI 3559 Using the Internet
- CGI 3767 Computer Operating Systems
- CGI 4285 Applied Computer Networking
- CGI 4365 Knowledge-based Management Systems
- CGI 4854 Web Site Construction and Management
- CGI 3900 Independent Study
- CGI 3930 Special Topics
- CGI 4431 IT Automation
- CGI 4905 Independent Study
- CGI 4911 Senior Project
- CGI 4912 Research Experience for Undergraduate Student
- COP 1000 Introduction to Computer Programming
- COP 2210 Computer Programming I
- COP 2250 Programming in Java
- COP 2270 C for Engineers
- COP 3175 Programming in Visual Basic
- COP 3337 Computer Programming II
- COP 3333 Introduction to Using UNIX/Linux
- COP 3465 Data Structures for IT
- COP 3530 Data Structures
- COP 3804 Intermediate Java
- COP 3832 Advanced Web Server Communication
- COP 3835 Designing Web Pages
- COP 3949 Cooperative Education in Computer Science
- COP 4005 Windows Programming for IT
- COP 4009 Windows Components Technology
- COP 4226 Advanced Windows Programming
- COP 4338 Computer Programming III
- COP 4520 Introduction to Parallel Computing
- COP 4555 Principles of Programming Languages
- COP 4604 Advanced UNIX Programming
- COP 4610 Operating Systems Principles
- COP 4655 Mobile Application Development
- COP 4703 Information Storage and Retrieval
- COP 4710 Database Management
- COP 4722 Database Survey
- COP 4813 Web Application Programming
- COP 4814 Component Based Development
- COP 4906 Research Experience in Computer Science
- COP 4949 Cooperative Education in Computer Science
- COT 3420 Logic for Computer Science
- CNT 4403 Computer and Network Security
- CNT 4504 Network Administration
- CNT 4513 Data Communications
- CTS 4348 UNIX Administration
- CTS 4408 Database Administration

**Undergraduate Courses**
- Computer Science Undergraduate Courses
- CAP 4710 Principles of Computer Graphics
- CAP 4770 Introduction to Data Mining
- CDA 3003 Microcomputer Organization
- CDA 3103 Fundamentals of Computer Systems
- CDA 4101 Structured Computer Organization
- CEN 3721 Human Computer Interaction
- CEN 4010 Software Engineering I
- CEN 4021 Software Engineering II
- CEN 4072 Software Testing
- CGS 1920 Introduction to Computing
- CGS 2060 Introduction to Microcomputers
- CGS 2100 Introduction to Microcomputer Applications for Business
- CGS 2518 Computer Data Analysis
- CGS 3095 Technology in the Global Arena
- CIS 4912 Research Experience for Undergraduate Student
- CIS 4911 Senior Project
- CIS 4910 Project Research
- CIS 4915 Research Experience for Graduate Students
- CIS 5900 Independent Study
- CIS 5931 Special Topics
- CIS 6612 Special Topics: Advanced Topics in Software Engineering
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- CIS 6931 Special Topics: Advanced Topics in Information Processing
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- CIS 7910 Graduate Research
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- COT 6936 Topics in Algorithms
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- TCN 6270 Mobile and Wireless Networks
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- TCN 6420 Modeling and Performance Evaluation of Telecommunications Networks
- TCN 6430 Networks Management and Control Standards
- TCN 6450 Wireless Information Systems
- TCN 6820 Industrial Development of Telecommunications
- TCN 6880 Telecommunications Public Policy Development and Standards
- TCN 6935 Graduate Seminar
Alumni Updates

Dr. Konstantin (Kosta) Beznosov is an Associate Professor at the Department of Electrical and Computer Engineering, University of British Columbia, where he directs the Laboratory for Education and Research in Secure Systems Engineering. His research interests are usable security, distributed systems security, and access control. Prior UBC, he was a Security Architect at Hitachi Computer Products (America) and Concept Five. He received Ph.D. in Computer Science at FIU in 2000. He recently returned to FIU to give a talk entitled: On the Feasibility, Effectiveness, and Implications of Socialbot Nets.

Irene Polycarpou is an Assistant Professor at the Department of Mathematical and Computer Sciences at Colorado School of Mines. Her research interests are in computer science education, students’ cognition and learning styles, instructional software, and educational technologies. Polycarpou received her BS, MS, and Ph.D. degrees in Computer Science from Florida International University in 2002, 2004 and 2008, respectively.

Dr. James O’Brien, received his B.S. in Computer Science from FIU in 1992, is a Professor in the Department of Electrical Engineering and Computer Sciences at the University of California at Berkeley, where he conducts research in the area of computer graphics. He is the 2006 FIU Torch Award recipient as well as winning honors in Time Magazine, Technology Review and SIGGraph.

Dr. Tariq M. King is a tenure-track Assistant Professor in the Department of Computer Science at North Dakota State University (NDSU). He joined NDSU in August 2009 after graduating with his PhD in Computer Science from Florida International University, Miami. In Spring 2010, Dr. King founded the Software Testing Research Group (STRG) at NDSU to provide students with a collaborative environment for conducting research in software testing. Dr. King also serves as a co-principal investigator on an NIH SBIR Phase II subaward from WoWiWe Instruction Co. In his role at WoWiWe, Dr. King leads the software testing team and provides software engineering expertise for the products being developed.

Student Accomplishments and Outreach

SCIS Award Winners:
- Outstanding IT Graduate: Cesar Rojas
- Outstanding CS Graduate: Paul Vonnehring
- 2012 Finalists for Greater Miami Chamber for Commerce Student Technology Leaders: Luis Masieri, Jessie Domack

Game Developers Guild
- Incubator for Game Developers
  - Organizer: Frank Hernandez, CS PhD student
  - 20+ students/professionals participate
  - Advisor: Steve Luis
  www.gamedevelopersguild.com

- Organized International Game Developers Association Global Game Jam in Miami
  - Teams created 5 games in 48 hours
  - Support from Game Development Studios such as Blizzard and Unity
  - Created significant visibility in the SFL Tech Community

- Developed Apps for Andriod Market and Blackberry Markets
  - Knowledge Pets

- Started Kickstarter project: Video Game for the Blind

- Supporting USTLA STEM Tech Challenge on April 27th

- Next Hackathon in June, 2012
## Selected PhD Graduate Employment Profile

<table>
<thead>
<tr>
<th>STUDENT</th>
<th>MAJOR PROFESSOR</th>
<th>TERM AWARDED</th>
<th>PHD DISSERTATION TITLE</th>
<th>EMPLOYMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dmitry Vasilevsky</td>
<td>Naphtali Rishe</td>
<td>Spring 2004</td>
<td>Design Principles of Semantic Binary Database Management Systems</td>
<td>Microsoft</td>
</tr>
<tr>
<td>Yanli Sun</td>
<td>Naphtali Rishe</td>
<td>Summer 2004</td>
<td>3D TerraFly Quality of Service Management for Online Interactive 3D Geographical Information System</td>
<td>Industry Research, China</td>
</tr>
<tr>
<td>Chengcui Zhang</td>
<td>Shu-Ching Chen</td>
<td>Summer 2004</td>
<td>A Multimedia Indexing and Retrieval Framework for Multimedia Database Systems</td>
<td>Associate Professor, University of Alabama, Birmingham</td>
</tr>
<tr>
<td>Xiangyu Ye</td>
<td>Naphtali Rishe</td>
<td>Summer 2004</td>
<td>An Indexing Structure and Application Model for Vehicles Moving on Road Networks</td>
<td>Consultant</td>
</tr>
<tr>
<td>Lian Mo</td>
<td>Xudong He</td>
<td>Spring 2005</td>
<td>Refinement Methods for Software Architecture Design Using the Software Architecture Model</td>
<td>Software Engineer, Citrix Systems</td>
</tr>
<tr>
<td>Mario Sanchez</td>
<td>Naphtali Rishe</td>
<td>Spring 2005</td>
<td>Data Structures for Highly Efficient Querying of Spatial Data</td>
<td>Associate Professor, Miami Dade College</td>
</tr>
<tr>
<td>Li Yang</td>
<td>Raimund Ege</td>
<td>Summer 2005</td>
<td>Security Specification and Enforcement in Mediation System</td>
<td>Associate Professor, University of Tennessee at Chattanooga</td>
</tr>
<tr>
<td>Gaseem Kharma</td>
<td>Raimund Ege</td>
<td>Summer 2005</td>
<td>Enhanced Skip-List Search Algorithm in 3-Layer Mediator Framework</td>
<td>Assistant Professor, Yarmouk University, Jordan</td>
</tr>
<tr>
<td>Shu Gao</td>
<td>Yi Deng and Xudong He</td>
<td>Fall 2005</td>
<td>An Aspect-Oriented Approach to Designing Role-Based Access Control Services</td>
<td>Software Engineer, Beckman Coulter</td>
</tr>
<tr>
<td>Andriy Selivonenko</td>
<td>Naphtali Rishe</td>
<td>Fall 2005</td>
<td>Data Partitioning and Replication Management in Distributed GIS Database</td>
<td>Chief Technology Officer, mphrx.com</td>
</tr>
<tr>
<td>Tianjun Shi</td>
<td>Xudong He</td>
<td>Spring 2006</td>
<td>A Framework for Specification and Analysis of Software Architectures</td>
<td>Software Development Engineer, Microsoft</td>
</tr>
<tr>
<td>Zhijiang Dong</td>
<td>Xudong He</td>
<td>Summer 2006</td>
<td>A Framework for Transforming, Analyzing, and Realizing Software Designs in Unified Modeling Language</td>
<td>Assistant Professor, Middle Tennessee State University</td>
</tr>
<tr>
<td>Chengyong Yang</td>
<td>Giri Narasimhan</td>
<td>Summer 2006</td>
<td>Knowledge Discovery using Multiple Sources of Biological Data</td>
<td>Algorithm Lead, Life Technologies</td>
</tr>
<tr>
<td>Patricia Buendia</td>
<td>Giri Narasimhan</td>
<td>Fall 2006</td>
<td>Phylogenetic Analysis of within-Host Serially-Sampled Viral Data</td>
<td>Bioinformatics Software Engineer, Infotech Soft</td>
</tr>
<tr>
<td>Gaolin Zheng</td>
<td>Giri Narasimhan</td>
<td>Fall 2006</td>
<td>Statistical Analysis of Biomedical Data with Emphasis on Data Integration</td>
<td>Assistant Professor, North Carolina Central University</td>
</tr>
<tr>
<td>Yujian Fu</td>
<td>Xudong He</td>
<td>Spring 2007</td>
<td>An Integrated Framework for Ensuring the Quality of Software Design</td>
<td>Assistant Professor, Department of Computer Science, Alabama A &amp; M University</td>
</tr>
<tr>
<td>Min Chen</td>
<td>Shu-Ching Chen</td>
<td>Spring 2007</td>
<td>Knowledge Assisted Data Management and Retrieval in Multimedia Database Systems</td>
<td>Assistant Professor, University of Montana</td>
</tr>
<tr>
<td>Jianhua Yen</td>
<td>Shu-Ching Chen</td>
<td>Summer 2007</td>
<td>A Framework for Automatic Feature Extraction from LiDAR Data</td>
<td>Senior Software Developer, Paypal</td>
</tr>
<tr>
<td>Onyeka Ezenwoye</td>
<td>Masoud Sadjadi</td>
<td>Summer 2007</td>
<td>Enabling Adaptability in Service Aggregates using Transparent Shaping Techniques</td>
<td>Assistant Professor, Augusta State University</td>
</tr>
<tr>
<td>Na Zhao</td>
<td>Shu-Ching Chen</td>
<td>Fall 2007</td>
<td>DiMuSe: An Integrated Framework for Distributed Multimedia System with Database Management</td>
<td>Quant Trader, Aien Capital and Aien Technology</td>
</tr>
<tr>
<td>David Kaiser</td>
<td>Tao Li</td>
<td>Fall 2007</td>
<td>The Structure of Games</td>
<td>Director of Institutional Research, Miami Dade College</td>
</tr>
<tr>
<td>STUDENT</td>
<td>MAJOR PROFESSOR</td>
<td>TERM AWARDED</td>
<td>PHD DISSERTATION TITLE</td>
<td>EMPLOYMENT</td>
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<tr>
<td>Weixiang Sun</td>
<td>Yi Deng and Xudong He</td>
<td>Spring 2008</td>
<td>An Approach for Design and Analysis of User-centric Communication Middleware</td>
<td>Software Development Engineer, Amazon.com</td>
</tr>
<tr>
<td>Daniel Cazalis</td>
<td>Geoffrey Smith</td>
<td>Fall 2007</td>
<td>Algebraic Theory of Finite Nondeterministic Automata with Applications</td>
<td>Instructor, Barry University</td>
</tr>
<tr>
<td>Wei Peng</td>
<td>Tao Li</td>
<td>Spring 2008</td>
<td>Actionable Pattern Analysis in Computer and BI Systems</td>
<td>Research Member, Xerox Innovation Group</td>
</tr>
<tr>
<td>Irene Polycarpou</td>
<td>Ana Pasztor</td>
<td>Summer 2008</td>
<td>An Innovative Approach to Teaching Structural Induction for Computer Science</td>
<td>Assistant Professor, Colorado School of Mines</td>
</tr>
<tr>
<td>Erliang Zeng</td>
<td>Giri Narasimhan</td>
<td>Summer 2008</td>
<td>Bioinformatic Analysis for Exploring Relationships Between Genes and Gene Products</td>
<td>Research Assistant Professor, Notre Dame</td>
</tr>
<tr>
<td>Gonzalo Argote-Garcia</td>
<td>Xudong He</td>
<td>Spring 2009</td>
<td>Formal Verification and Testing of Software Architectural Models</td>
<td>Software Development Engineer, Microsoft</td>
</tr>
<tr>
<td>Ramakrishna Varadarjan</td>
<td>Vagelis Hristidis</td>
<td>Spring 2009</td>
<td>Ranked Search on Data Graphs</td>
<td>Software Engineer, Vertica Systems and HP Company</td>
</tr>
<tr>
<td>Tariq King</td>
<td>Peter Clarke</td>
<td>Summer 2009</td>
<td>A Self-Testing Approach for Autonomic Software</td>
<td>Assistant Professor, North Dakota State University</td>
</tr>
<tr>
<td>Medha Bhadkamar</td>
<td>Raju Rangaswami</td>
<td>Summer 2009</td>
<td>Improving I/O Performance Through Layout Optimizations</td>
<td>Research Scientist, Los Alamos National Laboratory</td>
</tr>
<tr>
<td>Fernando Farfan</td>
<td>Vagelis Hristidis</td>
<td>Fall 2009</td>
<td>Efficient Storage and Domain-Specific Information Discovery on Semi-structured Documents</td>
<td>Postdoctoral Research Associate, University of Michigan</td>
</tr>
<tr>
<td>Nestor Andres Parra</td>
<td>Giri Narasimhan</td>
<td>Fall 2009</td>
<td>Rigid and Non-Rigid Point-Based Medical Image Registration</td>
<td>Intermediate Programmer, Miller School of Medicine, University of Miami</td>
</tr>
<tr>
<td>Kasturi Chatterjee</td>
<td>Shu-Ching Chen</td>
<td>Summer 2010</td>
<td>A Generalized Multidimensional Index Structure for Multimedia Data to Support Content-Based Similarity Searches in a Collaborative Search Environment</td>
<td>Software Engineer, Technorati Media</td>
</tr>
<tr>
<td>Dingding Wang</td>
<td>Tao Li</td>
<td>Fall 2010</td>
<td>Document Understanding Using Data Mining and Machine Learning Techniques</td>
<td>Research Fellow, Center for Computational Science, University of Miami</td>
</tr>
<tr>
<td>Andrew Allen</td>
<td>Peter Clarke</td>
<td>Spring 2011</td>
<td>Abstractions to Support Dynamic Adaptation of Communication Frameworks For User-Centric Communication</td>
<td>Visiting Assistant Professor, Georgia Southern University</td>
</tr>
<tr>
<td>Rafael Alpizar</td>
<td>Geoffrey Smith</td>
<td>Spring 2011</td>
<td>Secure Information Flow Via Stripping and Fast Simulation</td>
<td>IT Director, City of Doral</td>
</tr>
<tr>
<td>Lily Chang</td>
<td>Xudong He</td>
<td>Spring 2011</td>
<td>A Nested Petri Net Framework for Modeling and Analyzing Multi-Agent Systems</td>
<td>Assistant Professor, University of Wisconsin - Platteville</td>
</tr>
<tr>
<td>Bo Shao</td>
<td>Tao Li</td>
<td>Spring 2011</td>
<td>User-Centric Music Information Retrieval</td>
<td>Database Administrator, Florida Department of Transportation</td>
</tr>
<tr>
<td>Zhengguo Sun</td>
<td>Naphatli Rishe</td>
<td>Spring 2011</td>
<td>Large Scale 3D Construction from Satellite/Aerial Imagery and Digital Elevation Models</td>
<td>Software Development Engineer, Microsoft</td>
</tr>
<tr>
<td>Yali Wu</td>
<td>Peter Clarke</td>
<td>Summer 2011</td>
<td>A Domain-Specific Modeling Approach for Coordinating User-Centric Communication Services</td>
<td>Assistant Professor, University of Detroit Mercy</td>
</tr>
</tbody>
</table>
Shared Computing Facilities and Laboratories

The School of Computing and Information Sciences (SCIS) maintains a data center, research and instructional labs, and computer classroom facilities. These facilities are housed in the Engineering and Computer Science Building (ECS) on the Modesto A. Maidique Campus located in Miami, FL. The facility is maintained by a dedicated professional IT support staff as noted in the staffing section below.

The School provides computing services such as file, compute, web, email, XMPP, backup, print, and other computing services. Our networking services include a 10 Gigabit Ethernet core network that interconnects rack mounted switches and servers. All school desktop systems are connected by 1 Gigabit switched ports. Our network is highly redundant with multiple fiber and copper paths and is designed with routing fail-over capacity. We provide automated monitoring of our network and servers 24x7. The building subscribes to the university 802.11 WiFi network and maintains a legacy research WiFi network. Our network interconnects at 10GBs to the campus backbone, which provides a 10GBs connection to the NAP of the Americas to provide for connections to Internet, Internet2, Florida and National Lambda Rail, and CLARA (South American Research) networks.

Our systems feature a variety of open source and commercial development and scientific software products from numerous vendors including IBM, Microsoft, ESRI, MathWorks, etc. We provide middleware technologies to support web services. Our environment takes advantage of hundreds of open source software solutions including Apache with full mods., PHP, Perl, and many others.

Notable Shared Computing Infrastructure
- **Primary File Server**: Silicon Mechanics Storform nServ A513, 2x Opteron 6140 proc, 128gb ram, Intel 82576 dual port gigabit nic, 12x 3tb 7.2k hdd (30TB usable)
- **Mail Server**: Dell Poweredge 2900 III, 32gb ram, 2x Intel Xeon 5410 proc, 4x 300gb hdd, 500gb PCIe Solid State Disk, gigabit nic,
- **Domain Controllers**: (2) Dell Poweredge R210, 8gb ram, Intel Xeon X3430 2.4ghz proc, raid 1, gigabit nic, 2x 250gb 7.2k hdd
- **Computing Server**: (1) Dell Poweredge R210, 8gb ram, Intel Xeon X3430 2.4ghz proc, raid 1, gigabit nic, 2x 250gb 7.2k hdd
- **Webserver and Learning Management System**: (2) Dell Poweredge R310, 16gb ram, Intel Xeon X3470 2.93ghz proc, raid 5, gigabit nic, 4x 600gb 15k hdd
- **Dell Poweredge 2900 III, 32gb ram, 2x Intel Xeon 5410 proc, 4x 300gb hdd, gigabit nic, Instructional Clusters:**
  - **IBM Blade Center** – 5 dual processor Intel blades, 2 dual processor Power blades. 23+TB of IBM SANS disk storage. Linux operating system.
  - **Dedicated 12+ node research and instructional Linux Beowulf cluster.**
  - **Online Backups**: (2) Silicon Mechanics Storform nServ A513, 1x Opteron 6124 proc, 8gb ram, Intel 82576 dual port gigabit nic, 12x 3tb 7.2k hdd
- **Tape Backup Capacity**: 45TB, LTO3 and LTO4

Dedicated Shared Research and Instructional Infrastructure
- **Virtual Machine Servers**: (2) Dell Poweredge R900, 64gb ram, 4x Quad Core Xeon E7340 2.4ghz proc, raid 5, gigabit nic, 4x 400gb 10k hdd; (3) Dell Poweredge R410, 64gb ram, 2x Intel Xeon E5620 2.4ghz proc, raid 5, gigabit nic, 4x 600gb 15k hdd

Offsite Business Continuity Infrastructure
- **General Compute Servers**: (2) Dell Poweredge R710, 72gb ram, 2x Intel Xeon X5570, gigabit nic, 8x 300gb hdd

Student Laboratories

SCIS operates four instructional laboratories for use by undergraduates and graduate students in support of our computer science and information technology degree programs. Our instructional labs offer students access to Windows 7/XP, CentOS Linux, and Mac OS X which run a variety of software development tools, libraries, databases, and have the capacity to host virtual machines. The specific lab equipment is listed in sections below. The School has dedicated servers for student files and/or computing services and a printer in each lab. Each student receives at least 1,000MB of backed up file storage space. Students can login remotely into several Linux and Solaris file and compute servers. The labs provide a “laptop bar” for students to connect their laptops to the SCIS network and a “design bar” outfitted with 42” LCD displays where students are able to collaborate on programming assignments or other joint projects. In addition, the lab and a majority of the ECS building provide 802.11b wireless service. The school maintains a computer training classroom also noted in the specifications below.

**ECS 241 - John C. Comfort Lab I Advanced Undergraduate Lab**
- (44) Dell Precision T1500, Quad Core i7-860 2.8ghz, 4gb ram, 250gb hdd, nvidia Quadro NVS295, 1gb to desktop, 16x dvd rw, dual 19in or single 24in display
- (2) Apple iMac 27 Quad Core i7 2.8ghz, ATI Radeon HD 4850, 4gb, 1tb hdd, 8x Superdrive
• (2) 42” Display LCD Monitors for group projects

**ECS 237 - John C. Comfort Lab II Advanced Undergraduate Lab**
• (8) Apple iMac 27, Quad Core i5 2.7 (2nd gen), AMD Radeon HD 6770M, 1tb hdd, 8gb, 8x Superdrive
• (2) Apple iMac 27 Quad Core i7 2.8ghz, ATi Radeon HD 4850, 4gb, 1tb hdd, 8x Superdrive
• (5) Dell Precision T1500, Quad Core i7-860 2.8ghz, 4gb ram, 250gb hdd, nVidia Quardo NVS295, 16x dvd rw, single 24in display
• (15) Dell Precision T1600, Dual Core i3-2100 (2nd gen) 3.1 ghz, 1gb nVidia Quadro 600, 8gb, 250gb hdd, 16x dvd rw, P2411H display

**ECS 256 - Networking Lab**
• (48) Dell Optiplex gx760 Core2Duo e8400, 4gb, 320gb hdd, 16xdvd rw, ATi Radeon HD 3450
• (7) Dell Precision T1500, Quad Core i7-860 2.8ghz, 4gb ram, 250gb hdd, nVidia Quardo NVS295, 16x dvd rw, single 24in display
• Cisco routers, switches and KVMs necessary to manage

**ECS 252 - Graduate Lab**
• (12) Dell Precision T1500, Quad Core i7-860 2.8ghz, 4gb ram, 250gb hdd, nVidia Quardo NVS295, 16x dvd rw, dual 19in or single 24in display
• (2) Apple iMac 27 Quad Core i7 2.8ghz, ATi Radeon HD 4850, 4gb, 1tb hdd, 8x Superdrive
• (2) 42” Display LCD Monitors for group projects.

**ECS 141 - Instructional Lab (ILab)**
• (48) Dell Precision T1600, Dual Core i3-2100 (2nd gen) 3.1 ghz, 1gb nVidia Quadro 600, 8gb, 250gb hdd, 16x dvd rw, P2210 display

**Staffing**
The school maintains all its computing facilities (total research and instruction: 25 labs, 350+ desktops, 100+ servers, layer 2 and 3 networking) via a dedicated Technology Group. The SCIS Technology Group consists of 4 FTE of permanent professional staff assigned to all of the school’s research and instructional laboratories management. In addition, there are at least 2 FTE of temporary students specifically assigned to laboratory assistance. The SCIS Technology Group staff is organized into two groups: Engineering Services, including Networking, Systems, Desktop, and Help Desk Support, and Business Services including Technology Procurement, Asset Management, and Budget/Contract Management.
Miami, a vibrant and multi-cultural city known as the technological and financial hub of the Americas, is the home of the FIU School of Computing and Information Sciences.