artificial intelligence. biomedical nanotechnology. human-computer interaction. web application authoring. machine learning. computer vision. computer graphics. computer forensics. parallel computer architecture. pen-based user interface. cryptography and information security. internet applications. embedded systems. database concepts. software engineering. enterprise computing. wireless security. network security. object oriented programming. digital communications systems. computer control systems. telemetry and space computer systems. engineering software design. biomedical sensors. robotic systems. image processing. communications systems design. neural networks. software testing theory. knowledge processing. artificial intelligence. biomedical nanotechnology. human-computer interaction. web application authoring. machine learning. computer vision. computer graphics. computer forensics. parallel computer architecture. pen-based user interface. cryptography and information security. internet applications. embedded systems. database concepts. software engineering. enterprise computing. wireless security. network security. object oriented programming. digital computing.

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UNIVERSITY OF CENTRAL FLORIDA

COLLEGE OF ENGINEERING AND COMPUTER SCIENCE

A Message From The Chair

Recently I asked the faculty in Computer Science here at UCF what their motivations are for their work as a professor or lecturer. I explained that my personal motivations for becoming chair are to help make life better for the faculty and students at UCF, and to help both groups achieve professional success and happiness. In order to do that, and to help with our long-term planning, I thought it would be useful to understand similar motivations from all members of the faculty. In what follows I will share some of that, but without revealing the names of the faculty members.

Many faculty members are motivated by a desire to express their creativity.

I started by saying that for me, "my mind resonates with Computer Science, especially with programming, because I'm somewhat compulsively neat: I like to have everything organized and working perfectly, which may explain why I am interested in formal methods. I became a professor because I enjoy teaching and helping students learn new things. Perhaps I feel like I'm organizing the world a bit more that way. I find teaching rewarding when I can articulate beautiful generalizations and ways of doing things (especially programming techniques). This carries over into my research in that what I like doing best is explaining beautiful and simple ideas in an elegant way."

At least one faculty member responded that they also "enjoy it when students see/understand 'beautiful generalizations'," and noted that they are also "compulsively neat." That faculty member also said that they also enjoy it when "students see connections between topics."

The motivations of several faculty members are scientific; that is, they are motivated primarily to understand and explain the world of computing. One professor said that they want to understand how scientific explanations work, so this professor likes to "turn explanations into algorithms." This professor feels that "algorithms are creative outlets that not only work or don't work, but also make a point about the right way to look at the world." In addition to understanding computing, there is a scientific drive to be the first to understand something. As another professor said, they "like to explore new things and gain satisfaction from knowing something other people do not commonly know." Yet another professor said they are motivated by "achieving a deeper understanding of fundamental principles and ideas and its culmination in the discovery of new knowledge." One lecturer also expressed similar motivations, saying that from their student days they "wanted to learn what happens inside the black box between when a user inputs data and the device outputs information." At least one other professor said that their primary motivation was also to achieve understanding.

Dr. Gary T. Leavens

(continued on page 2)

Coding Their Way to The Top: UCF's Programming Team

The most successful team at UCF in the past 30 years has been its programming team. UCF has participated in the ACM International Collegiate Programming Contest for the last 30 years. UCF is in the Southeast Region, which includes Florida, Georgia, South Carolina, Alabama and Mississippi. There are usually about 85 teams competing in the region. UCF has always finished in the top 3 in the Southeast Regional Contest (1st place: fourteen times, 2nd place: nine times, 3rd place: seven times).

UCF's record is matched by no other school in the region.

UCF has had teams that have also gone on to finish as high as 2nd, 4th and 5th in World Contest Finals. It should be noted that finishing, for example, 5th in World Contest Finals means 5th out of more than 8,000 teams, which means UCF finished in the top 1% in the world! UCF's overall performance is matched by very few schools in the world.

The ACM International Collegiate Programming Contest is organized by the Association for Computing Machinery (ACM), the largest computing organization in the world. The contest is a 2-tiered process: first teams compete in regional contests and, based on regional results, some teams advance to Contest Finals to determine the world champion. In 2011-12, over 8,000 teams from more than 80 countries…

(continued on page 3)

New Computer Vision Center Announced

By: Barb Abney

Dr. Mubarak Shah, Trustee Chair Professor of Computer Science, is the founding director of the Center for Research in Computer Vision at UCF.

The science of electronically acquiring, analyzing and understanding images in ways superior to the human brain will be the focus of a new research center at the University of Central Florida. The Center for Research in Computer Vision, or CRCV, will be led by Mubarak Shah, UCF's expert in the field, and report to the Office of Research & Commercialization.

Shah specializes in developing the theory and algorithms used for such disparate tasks as scanning crowd scenes for suspicious people, analyzing brain scans for tumors, indexing and effectively searching a large database of images and videos, and triggering a warning when a car or person approaches a railroad crossing when a train is near.

The CRCV will put UCF in a position to capture major grants in this developing research area and support more local industries that can benefit from the technology, said MJ Soileau, vice president for research & commercialization. "We want to build on Dr. Shah's expertise and be in the forefront of this important field," Soileau said.

Computer vision is the science of acquiring and processing images and videos and using computational methods for analyzing and understanding them. Since 1986 Shah has run UCF's computer vision laboratory which has trained hundreds of students in the science behind computer vision and its use in crowd surveillance, visual tracking, human behavior analysis, determining a geo-spatial location of an image using only the contents of the image contents, unmanned aerial video analysis and bio-medical image analysis.

Shah relies extensively on algorithms which allow computers to duplicate the analytical abilities of humans, only much faster and without error.

Shah has worked with a wide range of industries including aerospace, biomedical, and modeling and simulation.

The work is important to many high-tech industries because it allows scientists to rapidly monitor and leverage large amounts of video without constant human monitoring.

"The proliferation of video sensors creates more visual data than humans can effectively review, categorize, and understand. The algorithms being developed by Dr. Shah's team help automate the process, providing 'intelligent triage' to focus on important events and analyze information over long time intervals" said Jeff Pridmore, vice president of Applied Research at Lockheed Martin Missiles and Fire Control.

"The more resources we have the more high-quality students and faculty we can attract and this will help us move to the next era of computer vision research and education at UCF. This will also increase our capacity for large projects in order to provide world-class research to local high-tech industries" he said.

Shah said his vision for the CRCV is to hire world class faculty-three positions have initially been approved-and encouraging existing faculty and industry leaders to utilize the center.

Specifically Shah is interested in working with faculty at UCF's College of Medicine on projects such as automatic tracking of E. coli bacteria and early cancer detection, and with the Institute for Simulation and Training and fellow researchers in the College of Engineering and Computer Science on developing robots and driverless cars navigated by computerized sensors.

"There are many areas we can use the technology once we have the bandwidth," he said.

In addition to starting the computer vision lab, Shah has run UCF's longest Research Experience for Undergraduates program funded by the National Science Foundation, bringing dozens of high school students to UCF each summer and immersing them in the research environment.

He has been honored with several awards, including Pegasus Professor, the highest award given by UCF to a faculty member who has made a significant impact on the university. He has a Ph.D. from Wayne State University and is a fellow of IEEE, AAAS, IAPR and SPIE, the largest professional organizations in his field.

A Message From The Chair

Continued from page 1

Scientific and technological advances in computing have happened at a furious pace, and this is a stimulus to the scientific motivation. One professor said, "I can't think of any other scientific or engineering domain which would give you such a thrill."

Many faculty members are motivated by a desire to express their creativity. One professor said that they chose Computing over other sciences because they "wanted to *create* things which nature cannot, rather than just *investigate* the laws of nature."

Many faculty members also are motivated by their desire to teach and inspire. As one professor put it, they "want to inspire curiosity in the students." One professor said that they "particularly like supervising graduate students because it is interesting watching them tackle very complex problems and also quite informative to watch different graduate students attempt the same problem. By working with graduate students, I come up with different solutions to problems than I would have discovered by myself which indicates how important the social aspects of learning are." Another professor said that they "really enjoy teaching undergraduates because they are in general 'dynamic:' they often times have significant energy/passion …, and the difference in knowledge from beginning to end of a course is really fun to see/

accomplish."

Some professors like to combine all these motivations in their teaching. One professor said, "I enjoy teaching when I can show students how exciting it is to see intuitively the elegance of an algorithmic explanation that may have seemed complex on paper. Generally I think students deserve more opportunity to be creative ..., which is why my classes often center on projects largely designed by the students." Another professor said that they like to teach graduate students critical thinking about problems in computing.

A related motivation is social. One professor said that a primary motivation is "my liking for in-person social interactions (not the Facebook type)." Faculty members are certainly in contact with many colleagues, collaborators, and students. This same professor also said, "I always enjoy talking to my same colleagues and ever-changing students on a variety of topics. I find those discussions very intellectually stimulating."

Finally, several professors enjoy doing things well. One highly-successful professor said that they are always motivated by the desire to do "better." Another professor said that they got into computing somewhat by accident, but found that it was a unique match to their talents; their success in the field drew them in.

It is my pleasure to work with such a highly-motivated group of faculty, and I hope I can facilitate all of them to do better at their chosen profession.

—Dr. Gary T. Leavens

UCF Programming Team

Continued from page 1

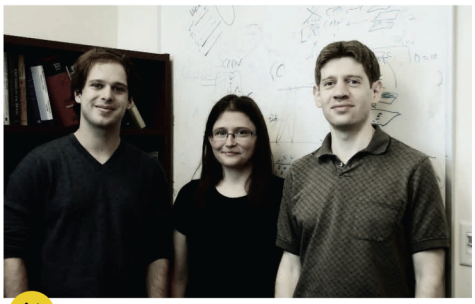
...competed in 39 regional contests with 110 teams advancing to the World Contest Finals. It is interesting to note that there are now more teams competing from other countries than from the USA.

Each team is composed of three students. The teams get a set of problems (6-12 problems) and have 5 hours to solve as many problems as they can. Each team has one computer. The team that solves the most problems wins the contest (in case of ties, a penalty point system is invoked).

Please feel free to contact the team faculty advisor, Dr. Ali Orooji (phone: 407-823-5660, email: orooji@eecs.ucf.edu), for more details.

Research in Artificial Intelligence Leads to NSF Project on Computer-Assisted Music Generation

When you think of computer science or artificial intelligence, the first thing that comes to mind might not be music. Yet music is exactly what Prof. Ken Stanley and graduate students Amy Hoover and Paul Szerlip of the Evolutionary Complexity Research Group (**eplex.cs.ucf.edu**) have been making as part of the NSF-funded project, "Pilot: Assisted Musical Composition through Functional Scaffolding" (grant no. IIS-1002507).



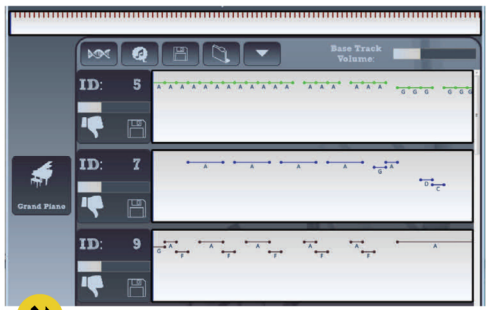
Paul Szerlip, Amy Hoover, and Professor Stanley in Professor Stanley's office.

The project is the culmination of years of research that began in a research seminar on special topics in artificial intelligence given by Prof. Stanley in 2006. In the class, Michael Rosario, a Masters student at the time, wrote a program for his class project for generating percussion solos based on a theory of pattern generation developed by Prof. Stanley. Interestingly, the theory was originally aimed at generating images rather than at generating music. Seeing a lot of potential in the application of the theory to music, Prof. Stanley later showed the project to then-undergraduate Amy Hoover, who was searching for an honors thesis topic. However, their subsequent insight went beyond simply generating patterns of notes. Rather, they realized that one pattern of notes can be generated from another by establishing a functional relationship between them. The implication was that this method could be effective for helping non-musicians generate plausible accompaniment for a pre-existing instrumental part.

Amy established the promise of this idea as an undergraduate by applying it first to the problem of generating percussion accompaniment. Users of the program she developed can listen to a number of candidate accompaniments to any piece they set as input and choose the accompaniments they like best. Next, the program generates a new generation of percussion accompaniments that are variants of the ones chosen by user. In effect, over time the user *breeds* accompaniment that is generated through the theory that relates one part to another, which is called *functional scaffolding for musical composition* (FSMC).

The project was so successful that it won the Best Paper Award in Evolutionary Music and Art at the Sixth European Workshop on Evolutionary and Biologically Inspired Music, Sound, Art and Design (EvoMUSART-2008). Amy also won first place at UCF's Showcase of Undergraduate Research Excellence and the Best Undergraduate Student Award in Computer Science for the work. Motivated by these successes, Prof. Stanley and Amy decided to propose a project to NSF to extend the theory to full-blown computer-assisted harmonic accompaniment generation (i.e. not just percussion).

NSF accepted the proposal and Amy also was awarded a National Science Foundation Graduate Research Fellowship to continue her research as a Ph.D. student at UCF, kicking off a much bigger project with the aim of opening up the joy of musical creativity to non-musicians. Ph.D. student Paul Szerlip also joined the project and subsequently led the creation of the publicly-available software package MaestroGenesis (**maestrogenesis.org**), which allows users without musical expertise to generate harmonic accompaniment to their pre-existing compositions. In fact, MaestroGenesis also helped the group win yet another best paper award, this time in Digital Entertainment Technologies and Arts at the Genetic and Evolutionary Computation Conference (GECCO-2011).



The MaestroGenesis program interface

The NSF-funded project also includes an innovative educational component in which undergraduate students from UCF's Music Department enroll in special independent study credits as members of the MaestroGenesis team. This experience gives the music students an opportunity to learn about computer science and its application to music generation while also contributing their own knowledge of music, creating a productive synergy. In fact, through their contributions these students became as undergraduates co-authors of a publication at an international conference, the 3rd International Conference on Computational Creativity (ICCC 2012).

While these successes highlight the impact of the research, it is important to note that it is not only about music but also about how computers can help to enhance human creativity in general. In the future, such human-machine collaborations will become increasingly important in both engineering and the arts, and the methods developed here in this project at UCF promise to help make that future a reality.

COMPUTER SCIENCE AT UCF

A BRIEF HISTORY

Florida Technological University (FTU) was authorized by the Florida Legislature on June 10, 1963. Classes began in the Fall of 1968 in the present day John Hitt Library, the only completed building on campus at the time. The Florida Board of Regents, in 1967, approved the Computer Science B.S. degree offered in the Department of Mathematical Sciences, chaired by Dr. Arthur Dutton, a statistician. The Computer Science curriculum and courses were initially developed by Mathematical Sciences faculty members Dr.'s David Falconer, Charles Lindahl, and Walter Rhein and an instructor Mr. Kenneth Wagner whose degrees were in mathematics, engineering, physics and business, respectively. The first faculty member with a Ph.D. in Computer Science, Dr. Ronald Dutton (no relation to Arthur Dutton), was hired in 1972.

The M.S. degree program in Computer Science began in the Fall of 1973.

An application to offer the Ph.D. degree in Computer Science was submitted in 1973, but was denied by the Board of Regents because of resistance from other institutions in the State University System, as well as some internal to FTU, itself.

Despite this, planning for the program continued.

Dr. Terry Frederick, Associate Chair of Computer Science at Purdue University, was named Chairman of the Department of Mathematical Sciences in 1975 and was charged with creating a separate Department of Computer Science with a secondary goal of establishing a Computer Science Ph.D. degree program. The Computer Science Department was approved two years later, 1977, with Dr. Frederick appointed as the founding chair. Faculty members at that time were Dr.'s Larry Cottrell, James Driscoll, Ron Dutton, Homer Gerber, Allen Lang, Walter Rhein, and David Workman. The founding faculty also included two instructors, Ms.'s Suzanne Lore and Agnes Ma.

Dr. Terry Frederick, CS Founding Chair

In the Fall of 1978, the department hired Dr. Maurice H. Halstead, renown author of the book "Elements of Software Science," which introduces an area of computer science that has become known as Software Metrics. Evidence of the high level of academia that he would bring to UCF is provided in the following anecdote. When asked what textbook would be used in the graduate course he was proposing, his response was "By definition, there can be no textbook for a 6000 level course."

Unfortunately, Dr. Halstead unexpectedly passed away in January of 1979, shortly before his contract was to begin.

On Dec. 6, 1978, FTU became the University of Central Florida (UCF) and, in 1979, the Board of Regents designated the Department of Computer Science as a "Center of Excellence," which provided extra funding from the State Legislature. Center of Excellence funds were used to expand the faculty with the additions of Dr. Amar Mukherjee in 1979 and Dr. Charles Hughes in 1980.

In 1980, the Board of Regents approved the department's request to award the Ph.D. degree in Computer Science, the first Ph.D. program at UCF and the first Computer Science Ph.D. program in the state of Florida.

The only other Computer Science Ph.D. program in the Southeast United States, 13 states, was at Georgia Tech. The first graduate of the UCF Computer Science Ph.D. program, Ali Hurson, under the direction of Amar Mukherjee, occurred in the same year. Later, 1983, Kate Kinsley, under the direction of Dr. Charles Hughes, became the first female graduate of the program. The Computer Science Department, in 1982, developed the first departmental level network operating under NSF-

NET and the first e-mail system at UCF.

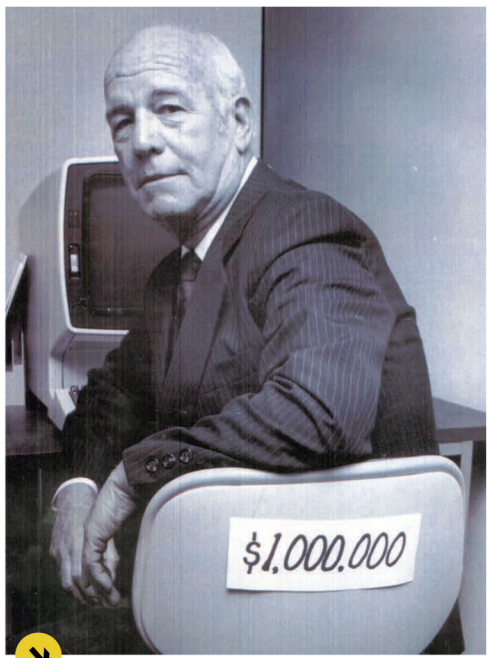
The nationally acclaimed Computer Science Programming team was formed in 1983 and placed 2nd in the 1986 ACM International Programming Competition. Upon returning to Orlando, the team was met at the airport gate by a welcoming crowd that included the UCF head football coach, Gene McDowell, and members of his team. When questioned about their participation in the welcoming group, McDowell replied that,

"Any UCF team that ranks 2nd in the world in anything, deserves our support and praise."

The programming team advisor, Dr. Ron Dutton, in the following year, organized the first UCF High School Programming Contest. Each member of the winning team was awarded a one-year tuition waiver at UCF.

1986 Computer Science Programming Team

The Charles N. Millican Endowed Chair, the first endowed chair at UCF and named for the founding president of the University, was created in 1984. Shortly thereafter, Dr. Narsingh Deo was recruited to occupy the position and to also serve as head of the department's Center of Parallel Computing.



Founding UCF President, Charles Millican

In 1985, Dr. Amar Mukherjee was named chair of Computer Science. The department received accreditation by CSAB, the Computer Science Accreditation Board, in 1987. Also in 1987, Dr. Mubarak Shah received initial funding by NSF as the Principal Investigator for a Research Experience for Undergraduates in Computer Vision, a funding that has been continuously renewed for 25 years.

Terry Frederick was reappointed chair of Computer Science in 1990 and in 1995 the Computer Science Department was elevated to School status.

Dr. Erol Gelenbe, chair of Computer Engineering at Duke University, was named director of the School of Computer Science at UCF in 1998. A Digital Media undergraduate program, under the supervision of Dr. Michael Moshell, also began in 1998 and was given separate departmental status in 2000. The Information Technology B.S. degree, a program in the School of Computer Science, was also established in 2000.


From Left to Right: Dr. Moshell and Dr. Hughes

Notable guest speakers and visitors during these formative years include Dr.'s Tom Corman, Dorothy and Peter Denning, Paul Erdös, Frank Harary, Grace Hopper, Tom Leighton, George Nemhauser, J. Nievergelt, Christo Papadimitriou, Seymour Papert, Richard Stalling, Robert Tarjan, and Jeff Ullman.

In 2001, a University-wide administrative reorganization split the College of Arts and Sciences into the College of Arts and Humanities and the College of Sciences. The School of Computer Science was moved to the College of Engineering, which was subsequently renamed the College of Engineering and Computer Science.

Many names and dates appearing in this report were obtained and/or verified with the able assistance of the staff of the Special Collections & University Archives of the University of Central Florida Libraries.

Associate Professor Hassan Foroosh

A Co-Principal Investigator in UCF's History-Making $55 Million NASA Grant

Dr. Hassan Foroosh, Associate Professor of Computer Science is a key investigator in the history-making team that landed the largest single grant in UCF's history. Work on this grant has gone on for several years, with some funding from NASA received along the way. That work paid off on April 12, 2013, when NASA awarded the team $55 million to build and launch into space an instrument the size of a microwave oven that will provide unprecedented imaging of the Earth's upper atmosphere. The award is the largest single grant in UCF's history, and UCF will become the first Florida university to lead a NASA mission.

Dr. Foroosh is a co-principal investigator on the Global-scale Observations of the Limb and Disk (GOLD) mission. The mission is led by principal investigator, Dr. Richard Eastes, from UCF's Florida Space Institute (FSI), who also has a secondary joint appointment in Computer Science.

Dr. Foroosh, who has been working as a key member of the GOLD team since 2005, will lead the GOLD Science Data Center (GSDC). His work on the concept study for GSDC helped in the selection of the mission. He will now be heading the effort to building and managing the GSDC. The GSDC team will develop and integrate all algorithms for processing and producing various levels of data products from the raw ultraviolet images provided by the two UV imaging channels onboard the instrument.

Dr. Foroosh's team will also be responsible for data archiving and management, and facilitating the dissemination of the mission data products to the GOLD team, NASA, and the scientific community as a whole.

The information collected by GOLD will have a direct impact on understanding space weather – such as solar wind – and its impact on communication and navigation satellites, which we have come to rely on for everything from television programming to cell phone coverage and GPS in our vehicles. This information may also lead to advances in directing airline traffic in a safer manner, by providing a greater understanding of how phenomena in the upper atmosphere influence communication signals.

Professor Hassan Foroosh

The project is a collaboration between UCF, the Laboratory for Atmospheric and Space Physics (LASP) at the University of Colorado, and the commercial satellite company SES Government Solutions. UCF will oversee the project and build the data center that will collect, process and distribute the data for the mission. LASP will build the compact instrument, which will operate in a geostationary orbit, and SES is scheduled to launch it on a communication satellite in 2017.

GOLD's collaborative approach may lead the way for similar projects at UCF and other universities nationwide. The scientific goals of the GOLD mission are to determine how geomagnetic storms alter the temperature and composition of Earth's atmosphere; analyze the global response of the thermosphere to extreme ultraviolet variability; investigate the significance of atmospheric waves and tides propagating below the thermosphere; and resolve how the structure of the equatorial ionosphere influences the formation and evolution of plasma-density irregularities. The thermosphere is the part of the atmosphere that begins about 50 miles above the earth's surface and extends to outer space. Given the sophistication of the measurements needed, the team at UCF turned to LASP to build the GOLD instrumentation. LASP has an international reputation for excellence and has been around since before NASA was formed. The five-year project will begin immediately. Once the design is finished and checked, rechecked and rechecked again, LASP will begin construction.

After launch in 2017 the instruments will provide data to the team, and other scientists throughout the world, for at least two years.

The instruments will likely continue to function for an additional three to five years.

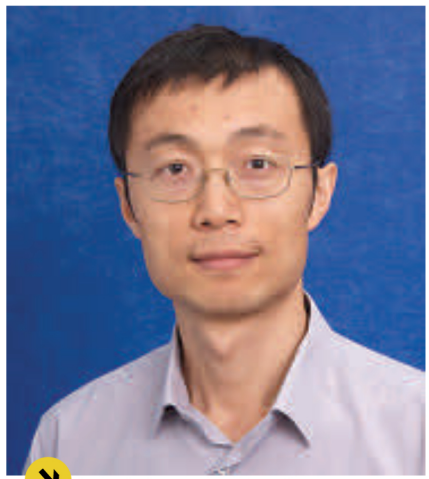
Other members of the GOLD team that will be supporting the mission include the National Center for Atmospheric Research (NCAR), the University of California at Berkeley, Computational Physics Inc., and the National Oceanic and Atmospheric Administration (NOAA).

Search Engine Tracking, Profiling, and Privacy

Internet search engines are used daily by billions of people around the world. Today they have become the most important portals for people when using the Internet. Search engines are free to use, but they make a profit in two main ways: (1) providing customized/targeted online advertising on search engine result pages (SERP); and (2) selling detailed user profile data to companies. To do this, search engines deploy various techniques for collecting

online users' usage profiles on SERPs, such as recording the website links in a SERP on which a user clicks, and search query terms a user inputs. However, such user tracking and profiling can cause serious privacy concerns for privacy-savvy users, and hence, various back-and-forth actions will be conducted by both sides (search engines and privacy-concerned users) to achieve their own goals. Dr. Cliff Zou and his PhD students, Erich Dondyk and Roberto Alberdeston, are conducting pioneering research on this important topic.

They first studied possible actions that could be conducted by privacy-savvy users to protect their privacy against current search engines' tracking and profiling. Currently the SERPs returned by Google, Bing, and Yahoo will always redirect a user to their search engine companies first when a user clicks on any website link on the SERPs. In this way, search engines can track what website a user actually visits for the corresponding search term. Search engines achieve this click tracking by encoding all website links on their SERPs. Dr. Zou's research group has found the encoding algorithms used by all three major search engines. Based on this finding, they have developed **browser plug-in programs** (downloadable at: **www.cs.ucf.edu/~czou/clickTrackBlocker/**) that can automatically decode and replace all website links on SERPs (including both organic links and advertisement sponsored links) to remove the click-tracking capability of search engines.



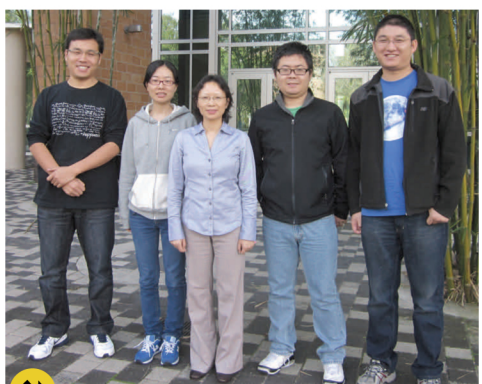
Dr. Cliff Zou, Associate Professor

They then conducted research on the possible actions that could be conducted by search engines to protect search engines' monitoring on user search queries. Because of privacy concerns, a group of researchers from NYU has developed a browser plug-in, TrackMeNot, which can generate garbage search queries to prevent effective user queries from being monitored by search engines. Dr. Zou's group proposes several techniques search engines can use in order to counteract privacy-protection tools such as TrackMeNot. The basic idea is to distinguish which search queries are generated by human users and which are generated by programs. They have discovered two features that could be used for this detection: (1) Human users will often click a website link on a SERP while programs such as TrackMeNot do not; (2) There are distinct statistical differences between human keyboard inputs and program-generated queries.

Dr. Zou and his two graduate students are also conducting research on other aspects related to search engine based monitoring. For example, by combining user profiling with network traffic analysis, search engines can **accurately identify computers behind network address translation (NAT) devices** such as home-based wireless routers.

In summary, Dr. Zou and his graduate students are conducting research at the frontiers of both attack and defense measures for privacy-concerned users and search engines. This research has resulted in prototypes that are readily deployed in the current Internet, and have great social impact. The research will also have potential economic impact on the business model of search engines in terms of marketing, advertisement and user profiling.

A Career Goal of Understanding Epigenetic Gene Regulation



Dr. Nancy Hu with her students

Dr. Nancy Hu and her students are working on creating practical and efficient computational methods that can model and integrate epigenomic data, with a view towards gaining a systematic understanding of the functional roles of epigenome in gene regulation and disease development.

What is epigenomic data? The eukaryotic genomic DNA is wrapped around proteins called histones. Both the DNA and these histones are covered by chemical tags. Just like tuning the radio, chemical reactions associated with these chemical tags can turn on or off some parts of genome and orchestrate genes' activities and cells' behaviors. This collection of chemical tags, also called a cell's overall chromatin state, constitutes a second layer of the genome called the epigenome. Stress, diet, behavior, toxins and other factors in our life can change the chemical tags, which can subsequently change the behavior of genes. Regulation of heritable changes in genes' transcriptional activities by the epigenome is called epigenetic regulation.

The epigenome helps solve several problems in Biology. For example, how can two identical twins with identical DNA talk in different styles, run at different speeds and have different appearance, especially later in life? And how can a stem cell differentiate into different cell types such as heart cell, muscle cell and blood cell while keeping the same copies of their DNA? The answer is epigenetic regulation. One special characteristic of epigenetic changes is that they sometimes can be reversed without too much toxicity or side effects, while genetic damage such as gene mutations are often difficult to correct. This particular characteristic of the epigenome will have significant implications for developing future therapy for many complex diseases.

The lab of Data Integration and Knowledge Discovery led by Dr. Nancy Hu at UCF is in a good position to realize the opportunities and potential impact of interdisciplinary research on the epigenome. Dr. Hu and her graduate students Jun Ding and Amy Wang, working together with Dr. Shawn Li, a faculty member in the Burnett School of Biomedical Science have recently developed a novel method that can systematically discover gene regulatory elements in the DNA using high throughput sequencing (HTS) data. Yiyu Zheng, another graduate student in Dr. Hu's lab, has recently identified a number of combinatorial patterns of DNA sequence features that potentially affect nucleosome forming and depletion from genome-wide epigenetic data. He is continuing to look for functionally interesting patterns in the histone modification data. Such research endeavors will not only boost the speed of biological discovery processes, but will also motivate advanced method development and problem formulation in Computer Science research. Results from this ongoing research are being incorporated into the Bioinformatics courses Dr. Hu is teaching such as "Data mining in Bioinformatics" and "Machine learning in Bioinformatics". Graduate and Undergraduate students from different disciplines such as Biology, Biomedicine, Statistics, Industrial Engineering and Computer Science have been registered in these courses and get to be the first to know this next frontier in science.

Computer Science sometimes is driven by the availability of data: the scale of data, the purity of data, and the complexity of the data. Rapidly accumulating epigenomic data are generated by recent advances in HTS. Several ongoing projects have generated large-scale mapping of epigenetic modifications such as Encyclopedia Of DNA Elements, Alliance for the Human Epigenome and Disease Task Force, Human Epigenome Project, and others. A number of public resources such as UCSC genome browser, Gene Expression Omnibus, ArrayExpress, NCBI Sequence Read Archive and Human histone modification database have been created to store and share the rapidly accumulating HTS data from different platforms and different labs.

These overwhelming large-scale HTS data definitely make traditional biologists nervous, but at the same time present exciting challenges and unprecedented opportunities for Computer Scientists. How to make meaningful biological discovery from rapidly-growing data requires not just intelligent computational algorithms or just insightful biological hypotheses, it needs both! Today, it is paramount to develop efficient computational methods that can perform high-level biological data analysis and interpretation.

Cyber Defense Team Wins First Place

UCF's Collegiate Cyber Defense Club competition team won 1st Place and also Best -in-Services at the 2013 Southeast Collegiate Cyber Defense Competition (seccdc.org) held March 5-7 at Kennesaw State University in Georgia. This was UCF's first appearance in this annual competition jointly sponsored by Deloitte, the Department of Homeland Security, and Dell SecureWorks. The team's victory establishes UCF as the top collegiate cyber defense team in the 7-state southeast region. Based on their victory in the regional competition, the UCF team secured an invitation to compete in the 2013 National Collegiate Cyber Defense Competition **nationalccdc.org**.

While similar to other cyber defense competitions in many aspects, the SECCDC, as part of the national CCDC, is unique in that it focuses on the operational aspect of managing and protecting an existing network infrastructure. While similar competitions examine the abilities of a group of students to design, configure, and protect a network over the course of an entire semester, this competition is focused on the more operational task of assuming administrative and protective duties for an existing "commercial" network. Teams are scored based on their ability to detect and respond to outside threats, maintain availability of existing services such as mail servers and web servers, respond to business requests such as the addition or removal of additional services, and balance security needs against business needs.

The SECCDC Director acknowledged the professionalism, leadership, teamwork, and depth of skills displayed by the UCF team.

UCF's Collegiate Cyber Defense Club was established in September 2012 with the objective of fielding a competitive team to enter in this competition. On January 12, 2013, an informational meeting about forming a competitive team was held in HEC 101 and interviews were conducted with interested students. Shortly after this meeting, 12 students (8 active and 4 alternate members) were chosen to compete as UCF's Collegiate Cyber Defense Competition Team. The team immediately started training and practices on Tuesday and Thursday evenings from 7 pm to midnight and on Saturdays from 9 am to 3 pm. On Saturday, February 2, the team participated in the virtual SECCDC Preliminary Qualification event utilizing the Network Lab located in HEC 322. UCF finished among the top 8 teams in the southeast region and secured an invitation to compete in the region competition held at Kennesaw State University on March 5-7.

The team's initial success in the SECCDC Preliminary Qualification event spurred the team on to practice and train even harder for UCF's first appearance at the Southeast Collegiate Cyber Defense Competition. The team faced nearly insurmountable issues in funding their travel expenses. The Department of Computer Science graciously paid the $300 registration fee for the team to enter the event, unfortunately, that was the only financial support provided by the College. The team was left to arrange and fund their own transportation, lodging, and meal expenses.

The UCF Team hard at work defending the fictitious HAL Corporation's network from the malicious Red Team's professional hackers.

Since the Collegiate Cyber Defense Club is a registered student organization, the team was able to secure $1500 through the SGA Conference Travel Request process. The team attempted to solicit donations from companies in related industries but without a proven track record, only received vague promises of potential future contributions. With less than two weeks until the SECCDC competition, the team met to decide whether to accept the invitation to compete in Kennesaw or decline due to lack of financial resources. The team members decided to self-fund their travel expenses, arranged their own transportation in personal vehicles, and negotiated a lower nightly rate and complimentary breakfasts with the Kennesaw Super 8 motel.

The team's confidence in their own skills and abilities proved well placed. In their very first appearance at this competition, the UCF team won 1st Place with a 200 point lead over 2nd Place finisher University of North Carolina–Wilmington and a 250 point lead over 3rd Place finisher Florida State University. The other teams participating in the SECCDC regional included Kennesaw State University, Southern Polytechnic State University, Clemson University, Mercer University, and University of North Carolina–Charlotte.

1st Place Award Ceremony. Pictured L to R: SECCDC Director Dr. Mike Whitman, UCF Captain Jonathan Singer, Luis Sosa, Carlos Beltran, Grant Hernandez, Mark Ignacio, Team Co-Captain Gaelan Adams, Austin Brogle, and Troy Micka. Not pictured are alternates Kevin DiClemente, Cody McMahon, Michael Harris, and Brandon Catubig

UCF also won the "Best in Services" award for maintaining 89% network uptime during the 3-day event despite continuous attacks by the notorious Red Team, a group of professional penetration testers. UCF was able to successfully secure the fictitious HAL Corporation network from external attacks while still providing the requested business services such as wireless network access, email services, and external Internet access to HAL employees. UCF was the only team to receive two awards during the competition. The SECCDC Director acknowledged the professionalism, leadership, teamwork, and depth of skills displayed by the UCF team.

A recruiting reception was held prior to the awards ceremony. Recruiters from Deloitte, Department of Homeland Security, and Dell SecureWorks collected resumes and spoke with interested students about career opportunities in cyber security. The UCF team advanced to compete in the National Collegiate Cyber Defense Competition held in San Antonion, TX on April 19-21 where it represented the Southeast Region and competed against the 1st Place finishers from the other nine geographic regions.

The club regularly competes in virtual international Capture-The-Flag competitions under the name "KnightSec", sponsors cyber security guest speakers, provides demonstrations of various exploits and vulnerabilities, and selects and trains members for UCF's Collegiate Cyber Defense Competition Team. As of April 2013, the club had 187 active UCF student members. For additional information, visit **hackucf.org** follow us on . **ctftime.org/team/2500/**, like us on. **facebook.com/UCFCCDC**, and join us on **facebook.com/groups/ucf.ccdc/**