Department of Computer Science Newsletter
Texas State University
Fall 2015, Issue 1

Bobcat Bytes

OUR DEPARTMENT – THEN AND NOW

The Department of Computer Science originated as a program in the Department of Mathematics and achieved departmental status in 1986. The first computer science course was offered in 1968. At that time, laboratory instrumentation consisted of a Univac Athena and a terminal connection to the CDC 6400 at the University of Texas. Early faculty included Wilbon Davis, Grady Early, Robert Goss, David Hufferd, Henry McEwen, Marcus Muirhead, Ronald Sawey, and Edward Hibbs. The first BS degree in Computer Science was awarded in 1973. The MA and MS degrees in Computer Science were approved in 1979, with the first degree awarded in 1980. In 1988, the first member with a PhD degree in Computer Science, Dr. Carol Hazlewood, joined the faculty. The MS degree in Software Engineering was approved in 1998, and the first degree was awarded in 2000. The BS program in Computer Science received accreditation from the Computer Science Accreditation Board in 1999. This accreditation has been extended and continued by ABET.

From its inception to the current date, the Department of Computer Science has gradually moved from a teaching department to a research-oriented department. While quality of teaching is very important to the department, research and publications are now equally important. The department currently enjoys research oriented faculty members who have been successful in both their research and teaching. Faculty research has been recognized by an IBM Faculty Award, a Google Faculty Award, and NSF CAREER Awards. In addition, the faculty has received grants from federal and state agencies such as NSF, DoE, DoD, NIST, THECB, and TxDOT, as well as contracts from national labs and local industry. The growth rate of research funding in quality and size has gained momentum since 2007.

Department chairs have been Dr. Grady Early 1986-1987, Dr. C.J. Hwang, 1987-1991, Dr. Moonis Ali 1991-2005, and Dr. Hongchi Shi 2007-present.

IN THIS ISSUE:

TEXAS STATE®

COMPUTER SCIENCE
601 University Drive
Comal Building, Ste. 211
San Marcos, TX 78666
http://www.cs.txstate.edu

FROM THE CHAIR

There are so many exciting endeavors in the department to report. Many thanks to Ms. Shannon Hicks for initiating Bobcat Bytes, the newsletter for the Department of Computer Science at Texas State University. This inaugural issue of Bobcat Bytes highlights the happenings of the department in the last few years.

When I joined the department in 2007, the department was a relatively small teaching department. In the last eight years, the department has been growing by leaps and bounds in both the quality and quantity of education and research. Eleven new tenured/tenure-track faculty and two full-time lecturers have joined the department. With a wide range of courses and research opportunities offered by a talented and dynamic faculty, we strive for an exceptional student experience while applying the highest forms of scholarship. The BS degree program is ABET accredited, and a PhD degree program is being developed. The total student enrollment has more than doubled in the last eight years (from 492 students in fall 2007 to 1012 students in fall 2014). Three students were the IBM Mainframe Contest top winners. Graduate students won two National Science Foundation (NSF) Graduate Research Fellowship awards. Faculty members have been keynote speakers at international conferences, chairs of international conferences, a journal editor-in-chief, the ACM International Collegiate Programming Contest super-regional director, and Distinguished and Senior members of ACM and IEEE. Faculty members have obtained 56 external research grants from federal agencies such as the NSF, NIST, Department of Defense, Department of Energy, IBM, Google, and NVIDIA since 2007 with annual research expenditures growing from zero to more than a million dollars. Faculty members have won three prestigious NSF CAREER awards, an IBM Faculty award, and a Google Faculty Research award.

The department was selected in the last three consecutive years as one of the two example excellent programs among more than 40 programs at Texas State in the Accountability System of the Texas Higher Education Coordinating Board.

DR. HONGCHI SHI

Chair and Professor

FACULTY RESEARCH SPOTLIGHTS

DR. VANGELIS METSIS
Assistant Professor

Dr. Metsis supervised a team of students to develop a system for Guided Physical Therapy through the use of the Barrett WAM Robotic Arm. Their work was published at the 2014 IEEE International Symposium on Haptic Audio-Visual Environments and Games, in October 2014.

Physical therapy is a crucial part of the rehabilitation process during recovery from an injury that has resulted in motor function loss. Newly introduced technologies can enhance traditional physical therapy by first complementing the expert's work, and second, by providing a platform for rich data collection and analysis.

In their work, the team supervised by Dr. Metsis, developed a prototype adaptive rehabilitation instrument, based on the use of a robotic arm, which can be dynamically controlled to guide the exercise motion of the upper extremities, in patients with motor disabilities. The proposed method enables simultaneous active and passive control of the robotic arm, to produce adaptive force feedback for motion guidance, and allow for data collection, for patient motor function assessment.

DR. APAN QASEM, Associate Professor

Together with his colleague, Dr. Cindy Royal, Dr. Apan Qasem won the ONA Challenge Award in April. The ONA challenge is highly competitive and is awarded to only the top submissions from across the nation that describe innovative ideas for incorporating computer programming into journalism education. This year, Texas State was the only winner from Texas.

As featured on Online News Association:
Winner: Texas State University
Texas State University is one of the 2014-15 winners of the Challenge Fund for Innovation in Journalism Education.

PROJECT TITLE:
TEXASMUSICVIZ: MUSIC, DATA AND STORYTELLING

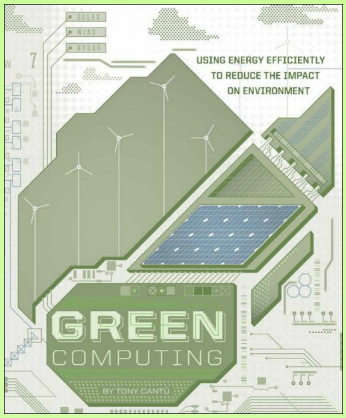
WHAT IS YOUR LIVE NEWS EXPERIMENT?
TexasMusicViz will combine data visualization and application development to tell important stories as they relate to music. Using alternative methods to tell stories can uncover unheard voices and untold tales. By using data and application development, new and important ways to tell stories will be uncovered relating to music in the community. The project will further shed light on how to engage the community and will demonstrate how these topics should be integrated into curriculum.

HOW WILL YOU COLLABORATE?
Faculty in Mass Communication and Computer Science at Texas State University will develop the curriculum for each course that will be creating the data visualizations and news applications.

Consulting on curriculum development will be provided by other media partners, including NPR, KUT-Austin and MakerSquare. The professional contacts at Texas Music Magazine, Texas Music Office, KUT-Austin and NPR will provide professional insight and access to data and resources.

Students in the classes will work throughout the year on this project. These students will be given training and exposure to the most progressive organizations doing this type of work.

Professional media partners will agree to promote acceptable reporting and visualizations and applications on their websites. TexasMusicViz will operate as a news service providing innovative music stories to media partners.



DR. ZILIANG ZONG
Assistant Professor
As featured in HillViews
Fall 2014 issue.

In Fall 2014, Dr. Zong began teaching a new course centering on green computing, with the aim of promoting energy efficiency in creating software. "Simply speaking, green computing strives to reduce the impact of Information Technology (IT) on our environment and planet," says Zong. Green computing involves the use of more renewable energy, such as solar or wind, for IT activities as well as improving the energy efficiency of computer systems, hardware, and software.

Zong is leading the Marcher Project funded by the National Science Foundation (NSF) that seeks to build a power-measurable high performance computing infrastructure to integrate the newest technologies, including Intel Many Integrated Cores, Graphics Processing Unites and Solid State Disks. The Marcher Project gives Zong's research group the distinction of being one of the few teams in the US which have the ability to develop both the hardware and software of the next-generation, power-aware, high-end computing systems.

Zong estimates that even if just a small portion of the computing industry were to implement green computing standards, millions of tons of CO_2 emissions a year could be eliminated from the environment. When considering the global race to build even faster and more powerful supercomputers, even the layman can conceive of the growing threat to the environment in the way of CO_2 emissions. "The majority of software developers either do not consider energy-efficiency of their software at all or they consider it as an afterthought," he says. But if anyone is up to the considerable challenge of changing those prevailing attitudes-one student at a time-it's Zong, already internationally known for his work on green computing.

DR. OLEG KOMOGORTSEV
Associate Professor
As featured on NSF.GOV November 3, 2014
Watch the video

Computer scientist sees new possibilities for ocular biometrics

New cybersecurity system senses eye shape and muscle movement to provide more secure, reliable identity recognition and more.

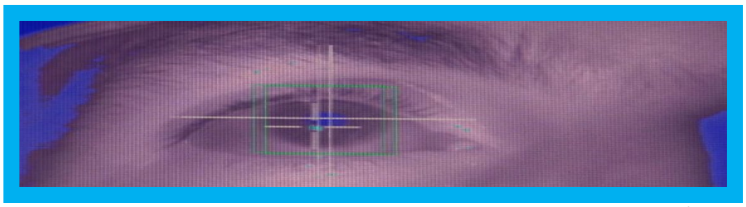
While many of us rely on passwords to protect our identity, there's more sophisticated identity recognition technology called biometrics that we could use. Security measures that use biometrics rely on a person's unique characteristics and traits rather than on what that person can remember, such as a password. Ocular biometrics, in particular, relies on iris and retinal scanning.

With support from the National Science Foundation (NSF), computer scientist Oleg Komogortsev and a team at Texas State University are taking the technology a step further, making it even more secure, reliable and nearly impossible to fool.

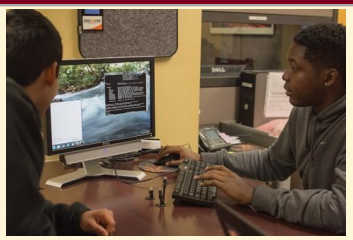
They are developing a three-layered, multi-biometric approach that tracks the movement of the eye globe and its muscles, and monitors how and where a person's brain focuses visual attention, in addition to scanning patterns in the iris. The iris is the colored part of the eye.

The team's system essentially upgrades the security of existing iris recognition technology with nothing more than a software upgrade, and the benefits extend well beyond security. This technology can detect not only the identity of the person, but the state of the person, including the individual's level of fatigue or stress. Komogortsev says it could even be used inside the helmets of football players to detect concussions.

Miles O'Brien, Science Nation Correspondent
Kate Tobin, Science Nation Producer



DR. QIJUN GU, Associate Professor and Alejandro Ramirez, Systems Analyst



featured in the University Star article titled "White hat hackers protect Texas State" 2/5/15 by Darcy Sprague

The recent Sony Pictures Entertainment attacks paint a picture of high-stakes, action-packed hacking that does not accurately represent the day-to-day traffic caused by cyber attacks.

Alejandro Ramirez, part-time graduate student and computer science systems analyst for Texas State, said the university is hacked daily, probably every minute. Hackers try to invade systems to sell server space or administrative access, Ramirez said. The buyers use servers to attack others, or look for information, including registrar data.

People who hack the system with malicious intent are called, 'black hat hackers,' Ramirez said. Hackers are considered white, black or gray hat depending on the ways they use their skills. "Black hat hackers use hacking techniques to sabotage other computer systems. White hat hackers typically work for government or cyber security companies," said Qijun Gu, computer security professor.

The most common attacks campus which cyber security faces are "phish e-mail attack scams," said Dan Owen, Information Technology vice president and information security officer. A hacker might prepare for a spear phishing attack by picking a public corporation and then researching the faculty, he said. "(Black hat hackers) go after everybody," Owens said. "I don't think (the university) is specifically targeted." Attacks often come from foreign countries, he said. A criminal investigation may take place if a large amount of money is involved. The number of attacks makes pursuing them all impossible.

Equipment is used to automatically detect "attacks and malicious traffic," on the university's network, Owen said. Owen and his team monitor network traffic and can detect abnormalities. "Every day we block millions of potential attacks," Owen said. The additional layers of defense make hacking into the network hard for an insider, he said.

Ramirez has caught some students trying to hack into their instructors' spaces and turned all the information over to the faculty. Internal attacks happen occasionally. These assaults are sometimes used to suspend service, "like a bomb threat," Ramirez said, referring to an incident last year that stopped the network for a minute. The attack happened when someone used a network of bots to flood the network with data. The firewall crashed as a result.

However, internal attacks are infrequent, Owen said. Owen and Ramirez say hacking into the university system successfully would be hard. Qijun said hacking is difficult in and of itself. "Hacking is like cooking," Gu said. "It requires skills. It requires intelligence."

TECHNOLOGY TIP
Ctrl + X == cut
Ctrl + C == copy
Ctrl +V == paste

The College of Science and Engineering is home to a number of departments at the university, including the Department of Computer Science. The College is currently conducting a search for a dean since the former dean, Dr. Stephen Seidman, retired at the end of May 2015.

DR. LUCY LU, Associate Professor

Dr. Lu joined the Computer Science Department at Texas State University in 2008. The explosive growth of Internet Media has triggered her research at Texas State, which focuses on large-scale media data acquisition, processing, retrieval, and understanding. This research is targeted at solving many fundamental multimedia information retrieval problems: social media data mining, large scale multimedia information retrieval, personalized media search, new interactive search mode, and mobile media applications etc. In the past five years, She developed a Media Lab at Texas State, and her research has been funded by NSF, DOD, Army Research, TxDOT, and Texas State. Her publications appear in leading international publication venues in multimedia such as *IEEE Transactions on Image Processing (TIP), IEEE Transactions on Multimedia (TMM), ACM Transactions on Knowledge Discovery from Data (TKDD), Pattern Recognition (PR), ACM Transactions on Multimedia Computing, Communications and Applications (TOMCCAP), ACM Multimedia (ACM MM), IEEE Computer Vision and Pattern Recognition (CVPR), IEEE Multimedia and Expo (ICME), and IEEE Pattern Recognition (ICPR)*. She received the Best Paper Award at ICME 2013 and the Best Paper Award at the International Conference on Internet Multimedia Computing and Service (ICIMCS) 2012. In the "Shape Retrieval Contest (SHREC)" held at Eurographics 2013, her team was the First Place Winner in large-scale sketch-based 3D retrieval competition, First Place Winner in the range scan competition, and Second Place Winner in the low-cost depth-sensing camera competition. Dr. Lu received 2014 College Achievement Award and was 2012 Dean's nominee for the Texas State University Presidential Award for Excellence in Scholarly/Creative Activities. She was also a nominee for the 2008 Microsoft Research Faculty Summit.

DR. WUXU PENG, Professor and Graduate Advisor

Dr. Peng's main research interests include:

- Specification and verification of software systems
- Concurrency models
- Computer networks and communications
- High-speed networking
- Distributed computing
- Specification and verification of communication protocols

He has applied for a patent and published several papers in his research areas.

DR. MOONIS ALI, Professor

Dr. Ali chaired "the Twenty Sixth International Conference on Industrial, Engineering, & Other Applications of Applied Intelligent Systems (IEA/AIE)" which was held in Amsterdam, Netherlands in June 17 – 21, 2013. He was presented with a "Distinguished Service Award" at this conference. In 2013, he was awarded the title of Honorary Professor of International Studies. Furthermore, Alpha Chi nominated Ali as one of the Alpha Chi Favorite Professors for 2014.

Ali is the Editor in Chief of *the International Journal of Applied Intelligence*. He is also an Advisory Board member of *the International Journal of Computer Applications in Technology.* He published the following two books in 2014 with Tibor Bosse, Koen V. Hindriks, Mark Hoogendoorn, Catholijn M. Jonker, Jan Treur:

1. Recent Trends in Applied Artificial Intelligence, Springer-Verlag, 2013.
2. Contemporary Challenges and Solutions in Applied Artificial Intelligence, Springer-Verlag, 2013

DR. MICHAEL EKSTRAND

Assistant Professor

Dr. Michael Ekstrand is a computer scientist, researcher, educator, and scholar. Since 2014, he has been an Assistant Professor in the Department of Computer Science at Texas State University. He received his PhD in computer science from the University of Minnesota, working with the GroupLens Research lab.

Shortly after joining Texas State, he presented the results of a new study on user satisfaction with different kinds of recommender systems at the ACM Conference on Recommender Systems in August. Since then, he has been working on recruiting students and getting his new research group up and running.

Here you can read about his research on human computer interaction and recommender systems, his teaching activities, or check out the various coding projects he has worked on. He also writes, both on his blog and in more persistent writings.

Dr. Ekstrand invites you to connect with him in several ways:
Follow him on Twitter .
Watch his work on GitHub or BitBucket .
Read his blog .
Connect with him on LinkedIn.
Contact him directly.

DR. MARTIN BURTSCHER

Professor

Martin Burtscher is Professor in the Department of Computer Science at Texas State University. He received the BS/MS degree from ETH Zurich and the PhD degree from the University of Colorado at Boulder. Burtscher's research interests include efficient parallelization of programs for GPUs, high-speed data compression, and performance assessment and optimization. He has co-authored over 90 peer-reviewed scientific publications. He also is a distinguished member of the ACM and a senior member of the IEEE and its Computer Society.

Burtscher directs the Efficient Computing Laboratory (ECL), whose goal it is to develop general techniques to parallelize complicated programs for GPU execution, improve performance and energy efficiency through the usage of accelerators, and devise effective high-speed data compression algorithms. The ECL team grew to a total of nine researchers in 2014. They published eight peer-reviewed papers and an invited article. One of the student members received an Undergraduate Research Excellence Award.
They released a GPU-accelerated high-speed 2-opt TSP solver for large problem sizes as well as the K20Power tool for accurately measuring the power and energy consumption of programs running on GPUs, and they continue to update the LonestarGPU benchmark suite, which has been downloaded from over 300 unique IP addresses.

Burtscher acquired three NSF grants, an internal grant, and hardware donations from Nvidia in support of his research and teaching. He co-hosted a workshop on teaching parallel processing and served on several program committees as well as a DOE workshop on exascale productivity. He received an excellence in research award from the College of Science and Engineering and an Alpha Chi Favorite Professors for Spring 2014 teaching award. His patent on future execution has been licensed by a company. Burtscher was named Distinguished Scientist by the ACM, a recognition that is reserved to the top ten percent of ACM's worldwide membership.

The department routinely receives requests for computer science students to participate in various programming contests, "hack-a-thons," and the like. Students are encouraged to take advantage of these opportunities as they arise. Announcements are made on the CS webpage, and information is also sent to students via email. This August, the department hosted a two-week visit from Dr. Yonghui Wu, a visiting professor at Stony Brook University and a professional known for helping train students on participating and doing well in the competitions.

Dr. XIAO CHEN, Associate Professor

Dr. Chen's main research areas are wireless heterogeneous sensor networks, mobile social networks and wearable sensor networks. She has written numerous papers on her research which have been published in various journals and conferences that include the Journal of Systems and Software, the Journal of Parallel and Distributed Computing, IEEE Globecom, and IEEE ICC. For years she has served on the technical program committees of IEEE conferences such as IEEE ICC, MASS, IFIP EUC, WiSARN, WCNC, and GLOBECOM and reviewed papers for international journals and conferences.

She has recently sponsored two successful thesis students, Zanxun Dai and Yuan Xu. She has also supervised six REU students during their summer research program. In addition, she was named by three students as a person at Texas State University who made a contribution to their academic career.

In Fall 2013, she did a sabbatical at The University of Texas at Austin. She worked with Prof. Lili Qiu. Their main research topic was wearable sensor networks. They worked on applications using wearable sensors such as smartphones, wristbands and bio-sensors, and applied linear algebra, machine learning, data mining and vision techniques.

Recent grants she has been awarded include:

- NSF II-NEW: Shared High Performance Data Center, Co-PI, 10/1/2013-10/1/2016, $375,759.
- NSF REU on Mobile Cyber-Physical Systems, Senior Personnel, $340k, 2012-2015.
- NSF REU supplement grant to CNS 0835834, $16k, 2009-2010.
- NSF CNS 0835834, A Novel Information Model for Efficient Routing Protocols in Delay Tolerant Networks with General Mobility, Co-PI, $60k, 2008-2010.

Grant highlight:

NSF CC*IIE Networking Infrastructure: Enabling and Improving Data-Driven Research at Texas State University, PI, 10/1/2014-9/30/2016, $499,896. This grant will transform science and engineering research at Texas State by dedicating a pathway to research data that allows for the transfer of gigabytes of data in minutes instead of hours. It will substantially improve researchers' pace of innovation and strengthen their partnership with their peers. It will also benefit seven other member institutions in the Texas State University System to upgrade their campus networks at nominal costs.

PROPOSAL FOR PhD PROGRAM

The department has diligently been preparing a proposal for a PhD in Computer Science. Strong support has been received from the university administration, industry, other universities, and students acknowledging the need to have the PhD program which is being proposed. Proposals for new programs of study go through a number of lengthy approval processes. The department hopes to have it approved by the Texas Higher Education Coordinating Board in 2016 in order to start the program in 2017.

DR. APAN QASEM, Associate Professor

CAREER Project

Achieving a high fraction of peak performance on complex architectures has been a longstanding challenge for the HPC community. The departure from Moore's Law and the emergence of multicore processors in the last decade has greatly exacerbated this problem.

The Exascale systems expected to come online around 2020 are expected to contain roughly a billion cores, be heterogeneous in nature with processors of varying speed and power efficiency and have deep memory hierarchies with shared and private caches using complex coherence protocols. Effectively managing these future machines will be next to impossible even for the most expert programmers.

Qasem's CAREER project aims to confront the challenge of programming these massively complex systems. Central to this research is the development of a suite of intelligent software tools (called autotuners), which when installed on a large scalalable system, assumes the role of human programmers and application tuners. The autotuners are grounded on the theories of artificial intelligence and takes a novel approach to performance characterization called feedback diagnostics. In this approach, the autotuner collects vast amounts of data about the execution environment including program characteristics, architectural parameters and attributes of code optimizations. This information is synthesized and fed into a machine learning algorithm that sifts through this multidimensional space and attempts to predict the configuration that produces the binary that will operate at the optimal level on a specific platform. The idea of feedback diagnostics has not only helped improve the performance and energy efficiency of several large-scale scientific simulations but also pioneered a new generation of feedback collection and analysis techniques.

An example of the success of this autotuning approach is the discovery of highly efficient solutions for the Quadratic Assignment Problem (QAP), which has many important applications in the areas of operations research and chip design. In the past year, Qasem along with his student Abhilash Chaparala and colleague Dr. Clara Novoa used feedback diagnostics and autotuning to develop efficient GPU implementations for QAP that yielded performance and energy efficiency which are orders-of-magnitude better than that of state-of-the-art implementations.

Concomitant with this research, Qasem is working on establishing SISTEM, a structured interdisciplinary program for undergraduates that brings together faculty and students from different STEM disciplines to explore cross-cutting research problems in which computational thinking, modeling and simulation play a central role. SISTEM will be instated as an innovative year-long project -based course and will be open to any STEM major. Participation in SISTEM will expose students to a diverse set of problems that span multiple fields of study, provide students with the foundations of interdisciplinary understanding, and help them develop requisite skills to engage in enterprises with differing disciplinary perspectives. SISTEM is currently in its initial year and is expected to be fully implemented in 2017.

DR. MINA GUIRGUIS, Associate Professor

Securing Emerging Cyber-Physical Systems (CPS)

In the near future, vehicles will be making decisions based on communications with each other and with the infrastructure, drones will be delivering packages and even our meals in some restaurants, and our buildings will be making smart decisions regarding power consumption, distribution and generation. Driven by major advances in wireless communication technologies and embedded systems, the development of such Cyber-Physical Systems (CPS) is underway. CPS is the term that refers to systems which combine sensing, communication and computation in meaningful scenarios. Two of the main prominent applications of CPS are intelligent transportation systems and multi-agent systems. In intelligent transportation systems, vehicles can sense road events (e.g., congestion, accidents, etc.) and communicate such critical information to other vehicles, which can compute an alternate route. In multi-agent systems, sensing, communication and computation are combined to coordinate different tasks such as tracking targets, covering a region, and carrying out search and rescue operations. As these systems integrate into our physical world, ensuring their safe and secure operations become crucial goals.

Funded by the National Science Foundation, Texas State computer scientist Mina Guirguis and his team are working on identifying new classes of attacks that are likely to appear and target emerging CPS, and are developing the proper defense mechanisms to prevent, detect and mitigate them.

A Denial of Service attack is one of the most well known attacks that target networks and computing systems. In such an attack, a continuous flood of requests is generated and directed towards the victim (e.g., a web service). The victim, under continuous strain, would not be able to respond to legitimate requests. Fortunately, it is very easy to detect ongoing Denial of Service attacks by the virtue of its heavy nature and to protect against them. Moreover, the damage inflicted – which can be costly – does not impact our physical world. A much worse attack is the one that is stealthy in nature and can have a direct impact on our physical world. Guirguis argues that we have not yet seen the worst of these attacks beyond few examples such as the Stuxnet virus that targeted uranium enrichment plants in Iran.

The attacks that Guirguis and his team are exposing target emerging CPS through interfering with a well-chosen communication signals between various components in a CPS. The decision to interfere with a signal is a result of a complex optimization problem that takes into account the current state of the system, how the system is evolving, the cost of the attack and the damage expected to be inflicted. By placing jamming devices in vehicles and at critical transportation points (bridges, tunnels, cellular towers, etc.), an adversary can impact the overall traffic flow, exploit the adaptation of the drivers to make abrupt decisions causing accidents, or attempt to maximize their gain by preventing critical information from reaching a neighboring subset of vehicles. A much worse scenario may occur if a terrorist can create severe congestion in an area before detonating a bomb. In a recent research study, Guirguis and his collaborators identified a class of attacks – coined Stuck in Traffic (SiT) attacks – that causes traffic congestion through jamming a subset of the communication signals between vehicles and smart traffic signs. SiT attacks resemble a “domino effect” in which each signal attacked causes the system to move from a bad to a worse state, causing congestion to build up. Other research studies carried by Guirguis and his team investigated vulnerabilities in coordination methods in multi-agent systems, with a focus on target tracking and pheromone-based swarming.

The attacks exposed provide a key component in defending against them. Through developing various defense mechanisms, Guirguis’s research is focused on distinguishing between normal and abnormal behaviors and to ensure that CPSs continue to evolve into trusted good states.

Another thrust of this effort is focused on educational and outreach activities in which current and future generations of students will learn how to adopt a “crypto-like” mind-set in which they explicitly consider the presence of adversaries in their design and implementation of computing systems. The Mobile CPS lab – which Guirguis directs – has been used to host many students from nearby schools. Demonstration sessions with robots are prepared and delivered to visitors by Guirguis and his research team.

DR. GUOWEI YANG, Assistant Professor

Annotating functional correctness properties of code, e.g., using assertions or executable contracts, offers a number of benefits in automated conformance checking of program behaviors to expected properties to support bug finding. However, effectively utilizing such properties in practice is complicated by two basic factors. One, it requires the properties to be written and maintained meticulously, so they correctly reflect the expected behaviors of the code, even as it evolves. Two, it requires efficient and cost-effective techniques to check the actual behaviors of the code with respect to the given properties. Yang has been investigating the techniques to address these factors, together with his collaborators at the University of Texas at Austin, NASA Ames Research Center, and NASA Langley Research Center. Dr. Yang published two papers in this topic and presented them at the 36th International Conference on Software Engineering (ICSE 2014) and the International Symposium on Software Testing and Analysis (ISSTA 2014), two flagship conferences in the area of Software Engineering.

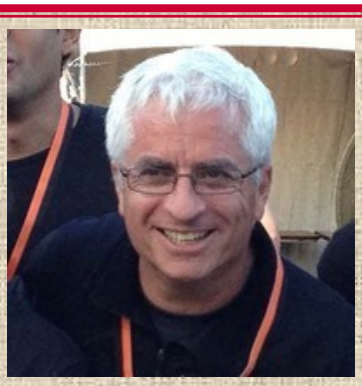
Yang's research addresses various elements of how to enhance software reliability and dependability, including software verification and testing, software maintenance and evolution, program analysis, and formal methods.

DR. HABIL ZARE, Assistant Professor

Dr Habil Zare joined the Department of Computer Science in September 2014. He established the Oncinfo Lab with a focus on projects in the areas of bioinformatics and computational biology. He develops and applies sophisticated machine learning algorithms to analyze large biological, or clinical, data sets. From such complicated data, the goal is to infer useful information which provides insight into biology, or leads to clinical applications. A promising project in the Oncinfo Lab is modeling interactions between genes by Bayesian networks. The model will be useful in pinpointing the cause and origin of diseases.

$TUDENT AWARD$

The Department of Computer Science awarded $9000 during Spring 2015 to graduate and undergraduate students, recognizing them for their outstanding research accomplishments with the computer science faculty. A departmental Awards Day is held every spring to recognize scholastic, service, and research achievements of our students. In addition, the department recognized the Outstanding Graduate Student, the only recipient in the entire College of Science and Engineering.



DR. DAN TAMIR, Associate Professor

Research Interests

Image and signal processing, computer vision, data compression, data mining, clustering, classification, pattern recognition, computer architecture, computer graphics

University Galleries launch interactive 'Musing' app for museums

Posted by Jayme Blaschke
University News Service
November 4, 2013

The University Galleries at Texas State University have released a new iPhone application for museums, called Musing, that promises to be a much more engaging experience for museum visitors.

Musing is an augmented reality iPhone application that allows the visitor to scan artworks in the gallery in order to learn more about its historical relevance, watch video interviews with the artist and learn about techniques used. The app allows visitors to learn much more about the artwork than what could be normally be presented in the wall labels traditionally used by museums. By placing links, or "points of interest," directly over the image being viewed on the iPhone screen, museum administrators are able to place pertinent information exactly where they want on the image, allowing them to pinpoint specific areas of interest in the artwork.

Dan Tamir of the Department of Computer Science, along with computer science students Gentry Atkinson and Kevin Whiteside, developed the application in collaboration with Grayson Lawrence of the Communication Design Program and Mary Mikel Stump, University Galleries director. The partnership represents the first time Computer Science and Communication Design have collaborated on a project of this kind.

Musing was launched to accompany a new exhibition of work by Houston artist Eric Zimmerman. The exhibition, titled West of the Hudson, is a collection of drawings, sculptural objects, publications, diagrams, writing and collage, utilizing the Native American myth of the bobcat (fog) and the coyote (wind) as his specific point of departure.

Musing can be downloaded from Apple's App store (https://itunes.apple.com/us/app/musing/id694382407?ls=1&mt=8).

DR. OLEG KOMOGORTSEV, Associate Professor

The need for accurate and unforgeable identity recognition techniques has become an issue of increasing urgency. Biometric approaches such as fingerprinting and iris recognition hold huge promise but still have significant limitations, including susceptibility to "spoofing". This project seeks to advance our knowledge of security and accuracy of multibiometric systems by inventing, evaluating, and applying innovative methods and tools to combine highly accurate static traits, such as iris patterns, with novel traits based on the dynamics of eye movements. According to Komogortsev, from eye movements we infer the internal structure of the eye muscles and the brain activity and are able to verify person's identity based on these traits. This is very important because we have mathematically shown that it is impossible to counterfeit those traits based on the current or foreseeable technologies unlike fingerprint or iris based approaches that can be easily counterfeited. For example we have proven if a rogue AI creates an exact mechanical replica (cyborg) of a person, our technology would be able to identify it with accuracy close to 99%. Our preliminary results indicate that in addition to detecting an identity of a person it is possible to infer person's physical state such as fatigue or concussion. The detection of other physical and even emotional states should be possible with further research. We have also demonstrated that this type of technology has the ability to run on the existing iris recognition devices with just a software upgrade, thus increasing the security and capabilities of such systems. The technology can also be potentially incorporated in such devices as Google Glass and Oculus Rift bringing authentication and health monitoring capabilities to such devices.

DR. HONGCHI SHI, Professor & Chair

Dr. Hongchi Shi joined the department as Professor and Chair in Fall 2007 after 12 years as Assistant Professor, Associate Professor, and Professor at the University of Missouri. He has been doing research with collaborators and students in wireless sensor networks and image processing.

At Texas State, Shi has published more than 10 journal articles in venues such as IEEE Transactions on Emerging Topics in Computing, IEEE Transactions on Wireless communications, and the Journal of Parallel and Distributed Computing, more than 20 conference articles mostly in IEEE conference proceedings, a book chapter, and a research monograph. He has also edited the proceedings for a conference and a special issue for a journal. He has been awarded six external research grants for a total amount of more than $1M as PI, Co-PI, or Senior Personnel. In addition to editing a journal special issue, Shi has served on the editorial board of four journals, chaired four symposia, and served on the technical program committee of numerous conferences.

DR. ANNE NGU, Professor

Dr. Anne H.H. Ngu is a full Professor in the Department of Computer Science at Texas State University. Her main research interests are in large-scale discovery and integration of information services, scientific and business process automation, agent systems, and Internet of Things. Ngu has published over 100 technical papers in journals and refereed conferences in computer science. She has recently served as the Workshop Chair of 9th IEEE International Conference on Collaborative Computing: CollaborateCom 2013 and Program Chair of the International Workshop of Internet of Things (C-IOT2013 and C-IOT2014).

Ngu was a recipient of the 2013 NCWIT Undergraduate Research Mentoring Award. The National Center for Women & Information Technology (NCWIT) created this award to recognize computing professors for their outstanding mentorship, high-quality research opportunities, and efforts to encourage and advance undergraduates (particularly women and minorities) in computing-related fields. She has obtained funding and directed two NSF REU site programs at Texas State University over the last four years. She was one of the Co-PIs of an NSF-STEM program for increasing the recruitment and retention of female undergraduates in Engineering and Computer Science in the last two years. She received Presidential Distinction Award in Services in 2014. During Fall 2015, Ngu is on sabbatical to CSIRO in Sydney, Australia.

TWO NSF GRADUATE RESEARCH FELLOWSHIP STUDENTS IN THE DEPARTMENT OF COMPUTER SCIENCE

The NSF Graduate Research Fellowship Program (GRFP) helps ensure the vitality of the human resource base of science and engineering in the United States and reinforces its diversity. The program recognizes and supports outstanding graduate students in NSF-supported science, technology, engineering, and mathematics disciplines who are pursuing research-based master's and doctoral degrees at accredited United States institutions.

As the oldest graduate fellowship of its kind, the GRFP has a long history of selecting recipients who achieve high levels of success in their future academic and professional careers. The reputation of the GRFP follows recipients and often helps them become life-long leaders that contribute significantly to both scientific innovation and teaching. Past fellows include numerous Nobel Prize winners, U.S. Secretary of Energy, Steven Chu, Google founder, Sergey Brin and *Freakonomics* co-author, Steven Levitt.

Fellows share in the prestige and opportunities that become available when they are selected. Fellows benefit from a three-year annual stipend of $32,000 along with a $12,000 cost of education allowance for tuition and fees (paid to the institution), opportunities for international research and professional development, and the freedom to conduct their own research at any accredited U.S. institution of graduate education they choose.

NSF Fellows are anticipated to become knowledge experts who can contribute significantly to research, teaching, and innovations in science and engineering. These individuals are crucial to maintaining and advancing the nation's technological infrastructure and national security as well as contributing to the economic well-being of society at large.

COREY HOLLAND

I began my research as an undergraduate in Dr. Oleg Komogortsev's human-computer interaction lab, and my early work involved a variety of subjects from adaptive user interfaces to mechanical modeling, all with a focus on using eye movements to improve usability. After several semesters, I began investigating methods of identifying users by their eye movements.

During this time, I developed an algorithm that showed promise, and received the prestigious NSF Graduate Research Fellowship to continue my research as a graduate student. Over the course of my graduate career, my research helped to improve the accuracy of eye movement biometrics from near-random to levels approaching modern face recognition.

After an intense research focus for several years, I came to the realization that I prefer writing code to writing papers. Early last year I decided to begin transitioning out of academia and into an industry position, and I have been enjoying the change of pace. I have learned a lot, and I hope that my research will have a lasting impact.

MOLLY O'NEIL

I was awarded an NSF Graduate Research Fellowship in 2011. This $132,000 grant provided three years of support including tuition, other educational expenses, conference travel, and an annual stipend.

During graduate school at Texas State, I was privileged to work with Dr. Martin Burtscher in the Efficient Computing Laboratory, investigating techniques for the acceleration of irregular graph- and tree-based programs on graphics processors (GPUs). My thesis research characterized the performance behavior of GPUs running important irregular algorithms via cycle-level simulation and analyzed the impact of microarchitectural design tradeoffs.

I was also involved in several GPU coding projects, including a highly parallel solver for the Traveling Salesman Problem and a fast lossless compressor for floating-point data. In addition to my thesis, this research has yielded two conference and two workshop publications as well as open-source software.

I am excited to have completed my MS this past spring and have continued at Texas State to fulfill my dream of being a computer science educator.

REU

The Department of Computer Science hosted two REU Site programs for the last four summers. The REU Site program is funded by the National Science Foundation, and stands for Research Experiences for Undergraduates. The primary objective of REU is to motivate a diverse body of undergraduate students (female, minority, non-traditional, first generation college students) in the exploration of research processes in computer science and to inspire them to undertake graduate studies in computer science and/or careers in the IT field. For each of the recent past summers, the REU programs recruited a total of up to 20 undergraduate students from a diverse set of institutions around the country to engage with 9-10 computer science faculty members in research. Overall, around 50% of the recruited students were from underrepresented groups. Some of the highlights of the program included field trips to IBM, Intel, the Southwest Research Institute, and Emerson Research Labs. In addition, each summer, the REU programs culminated in a Poster Day, recognizing the achievements of the participants. For more information about the summer 2015 REU program, please see http://reuiot.cs.txstate.edu.

Industrial Advisory Board (IAB)

The Department of Computer Science has an Industrial Advisory Board (IAB) comprised of about twenty scientists and executives of industrial companies with a profound interest in computer science. The IAB Board members' host companies provide financial support for the department's students through internship programs, and they also provide employment to some of our alumni. The IAB meets twice a year on the Texas State campus and continues to develop strong ties with industry. The main objective of the IAB is to advise the department in educational and professional matters.

The bond between the Department of Computer Science and the Industrial Advisory Board significantly strengthens the department's ties with many organizations beyond the university's boundaries.

NEW DIGS

The university has recognized the needs of the Department of the Computer Science and recently renovated the Psychology Building on the Texas State University campus so that the renovated building, renamed the Comal Building, now houses all of the computer science faculty offices as well as some dedicated research labs. Additional space in the Derrick Hall Mezzanine is being re-vamped to hold more lab space and teaching assistant or graduate assistant offices. As the department and its programs grow, there is a continuous need for new space in which to house research projects and people and students involved in the research.

ASSESSMENT AND ACCREDITATION

The Texas Higher Education Coordinating Board requires that all academic departments have an Academic Program Review every seven years. Computer Science underwent an APR review this year and has prepared an Action Plan which was submitted to the university administration. The department received a favorable review.

The university promotes academic assessment of its programs. This is an on-going process, and surveys or embedded exam questions are administered every semester to better assess success of programs. Assessment has proven to be a valuable information collection process which various accreditation agencies like ABET (national) or SACS (regional) review to evaluate programs they accredit.

Last year, the department went through a Bachelor of Science in Computer Science re-accreditation review by ABET. ABET can approve accreditation for up to six years, and the department indeed received approval for accreditation for the next six years, until 2020.

The Department of Computer Science webpages have a new look. Implemented this summer, the pages look cleaner and should be easier to navigate. It is a work-in-progress and suggestions are always welcome.

DEPARTMENT OF COMPUTER SCIENCE
TEXAS STATE UNIVERSITY

601 University Drive,
Comal Building, Ste. 211
San Marcos, TX 78666

512-245-3409 ph
512-245-8750 fax
http://cs.txstate.edu