NCSS Evaluates Changes to Research Focus

Since NCSS started operations in 2009, its research projects have emphasized competencies related to net-centric systems. In 2012, cloud systems and software technologies were added as industry members began to consider how these capabilities could be exploited by their respective companies. The Center will reach a major milestone in April 2019 when it completes its 10th year of operation and also begins a major restructuring of research focus.

Many of our member companies have told us that net-centricity has become less of a priority for them as cyber-physical and Internet of Things (IoT) technologies, particularly security, dominate their current business interests. For example, TI is expanding its services to enable IoT designs and applications ranging from sensors to cloud connectivity in the industrial, consumer and automotive domains. Raytheon researchers want to leverage new technologies to assess vulnerabilities, reduce threat surfaces and maximize security effectiveness, including identifying avenues of attack to develop mitigation plans. Armor is focusing on delivering a set of validated methods and technologies for enabling security and trust in large-scale IoT conditions and defining frameworks to support development of secure and trusted IoT applications.

To meet these emerging technology needs, NCSS is looking to create a new research center to complement IoT R&D efforts. The center would provide the same advantages as the NCSS I/UCRC in terms of reduced project overhead costs, multi-company collaboration opportunities, and access to faculty and student resources available from member universities. The scope of the new center will be explored over the coming months with the involvement of current NCSS academic and industry members. We are also reaching out to connected colleagues on LinkedIn for thoughts regarding preferred research goals, operational expectations for the new center, and its value proposition.

As the Internet of “Things” morphs into the Internet of “Anything”, making it possible to design smarter physical systems, the need for research competencies to support cyber-physical systems is compelling. There are implications for any company involved in the design of systems to augment human capabilities. A research center devoted to these technologies is an appropriate evolutionary step for the NCSS I/UCRC.

Patent Established by ASU Site

The NCSS ASU site director Dr. Andreas Spanias, along with his former Ph.D. students and colleagues, established a US Patent titled, “Kernal Sparse Models for Automated Tumor Segmentation.” The ASU team developed a new imaging method that can be used in Magnetic Resonance Imaging (MRI) systems for identifying tumors. This invention is on a method that automatically segments and detects tumor regions by identifying pixels belonging to timorous regions. A sparse classifier is trained with a few expert-segmented images. A low complexity classifier then identifies timorous regions. The NCSS ASU Site established four patents in the last 3 years.

The 2017 NSF I/UCRC Biennial Meeting provides an opportunity for Center Directors, Operations Personnel, Assessment Coordinators, NSF I/UCRC program staff, and other stakeholders to interact and exchange ideas to promote center improvement, growth, and collaboration. This year’s conference included NSF-sponsored students from each I/UCRC who participated in a poster session, numerous training sessions, as well as the first Innovation Pitch Student Competition. NCSS was one of the few centers permitted to bring two sponsored students, both of whom were from UNT and are PhD students – Patrick Kamongi and Rohith Yanambaka Venkata.

Students participated in a training delivered by Neil Sheridan of SVPI to help students produce a content-rich and interesting 3-minute pitch to help foster further discussions about their ideas. A renowned business speaker, Neil walked them through the structure of a successful pitch including diction, time management, and being persuasive. He also taught them about what investors look for in a pitch.

During the training, Patrick Kamongi learned that the key elements of a good “elevator pitch” involve using a custom formula with a focus on a value proposition, and the best practices needed to present it to potential investors or customers in 3 minutes or less. His view of what constituted a good elevator pitch before the training was limited to his academic research experience, but after the training he was able to incorporate the business interests of a commercial client into his proposal.

Rohith Yanambaka Venkata learned to start the pitch off with a “punch in the nose”, a dramatic introductory sentence that would captivate the listener, followed by the value proposition and finally, the “ask”. He gained first-hand experience about the intricacies of a startup creation, from the initial pitch to product development and marketing.

The elevator pitches presented during the actual competition were structured around the learning outcomes from Neil’s training and feedback received from peers and mentors. The presenters had first-hand experience with judges grilling them with questions. Throughout the conference, they gained key skills to apply to their class projects, market their research, present to potential investors, and better represent the research objectives of our center.

Dynamic Multi-Group Secure Data Sharing Scheme for Cloud

The Netcentric IUCRC received funds from AFRL in lieu of membership, using federal MIPR agreement. These funds will be used by Professor Sanjay Madria of the Missouri University of Science and Technology, by means of a subcontract from the University of North Texas. The primary focus of the project is securing data shared via cloud, social media or online blogs. Such sharing is significantly different and more challenging than that of a traditional trusted server model. In a trusted server model, servers are normally housed within the organization’s premises and protected by the network and firewalls. Thus, these servers can be reasonably trusted to act properly for access control including addition and deletion of users. However, this cannot be assured with data hosted in the cloud. For example, cloud can alter or expose some sensitive data to users that were removed or to some other adversaries motivated by financial incentives. Moreover, cloud is prone to both insider and outsider attacks. Thus, secure group data sharing in cloud requires the data to be encrypted and remain hidden from cloud as well as potential adversaries. In addition, fine-grained access control on shared data is desirable since different members of the group can have different levels of privileges. Additionally, data owner may not know the specific identity of each of the user s/he shares his data with. Yet, s/he should have some degree of control on who can access the shared data.

In this project, we will provide the first solution for secure cloud data sharing in multi-group setting. Our solution will be distributed and scalable in nature that is preferable for cloud platforms.
UNT Summer Research Experience for Undergraduates and Veterans

The NSF funds a large number of research opportunities for undergraduate students through its Research Experiences for Undergraduates (REU) program. REU students work in the research programs of the host institution. Each student is associated with a specific project and works closely with faculty and other researchers. Students are granted stipends and, in many cases, assistance with housing and travel. This summer, Dr. Krishna Kavi supported five REU students at the University of North Texas.

UNT senior Jason Vann worked on Heterogeneous Memory Architecture with his mentor, PhD student Mahzabeen Islam. The purpose of his research is to improve the performance of computer systems while ensuring energy efficiency. During his summer internship his main responsibility was to run simulations to gather datasets to support Mahzabeen’s research. He learned how challenging it is and how much determination one needs to be involved in a research project.

Mukundan Kuthalam, a senior at the University of Texas at Austin, collaborated with UNT senior John “Jack” Todd on the Avian project. PhD student Patrick Kamongi mentored both students. Avian identifies exploits in a computer system through machine learning by combing through Linux kernel logs. This could prove to be very useful for identifying attacks such as Denial of Service (DoS) or unauthorized privilege escalation that may have been carried out by exploiting commonly known vulnerabilities and weaknesses on Linux machines. A proof of concept was developed based on the ELK stack, and system logs that were generated from testing many malicious code examples available for public use. Machine learning models identified anomalies in the system calls of the kernel as indicators of successful exploits against test virtual machines. As an intern, Jack gained research experience he’ll be able to apply on future projects. He helped co-author a paper and read numerous articles and publications on similar projects. He also expanded and sharpened his knowledge of the Linux architecture, Git, and the ELK stack, all of which gave him an appreciation of the level of research that would be required in graduate study.

UNT senior Jesse Culver studied voice assistant security this summer. His research focused on improving the security of a smart home network using voice assistants. The objective of this project is to police access to certain privileged commands by using security questions. Despite some setbacks during the project, Jesse was encouraged by his mentors Dr. Krishna Kavi and PhD student Rohith Yanambaka Venkata. He finished his 10 week internship with a better understanding of his own project’s research goals and the objectives of other projects running concurrently in the lab.

Clement Cole, a grad student at UNT, is an REU student (Research Experiences for Veterans) and is mentored by both Dr. Krishna Kavi and Dr. Robin Pottathuparambil. His summer project consisted of building a neural network architectural design on an FPGA. The purpose of this project was to expose how utilizing parallelism techniques such as instruction pipelining of multiple components within the neural network can improve on the throughput of a neural network application. The application implementation aspect was to demonstrate how such hardware architecture can be used in handwriting of numeric figures can be identified using the neural networks. Based on his research exposure, Clement decided to pursue his MS degree at UNT starting in Fall 2017.

The REU students describe working with Dr. Kavi and their mentors as a beneficial and rewarding experience, and would recommend it to anyone looking to expand their professional growth beyond the normal curricula.

SenSIP REU Site Graduated its First Cohort of REU Students

The projects are listed below:

1) Nanopore Sensors and Signal Processing
2) Mobile Applications for Health Monitoring
3) Photoplethysmogram Sensor Array
4) Development of a CO2 Analyzer for Health Monitoring
5) Fluorescent-based point of care detection of cervical cancer biomarkers
6) Managing Respiratory Disease with Wearable Devices
7) Physiological Monitoring for Childhood Asthma
8) Crowd Sourced Environmental Monitoring
9) Exercise Routine Optimization Via Sensor Fusion

Co-Directors: Andreas Spanias (PI) and Jennifer Blain Christen (Co-PI)

The REU was sponsored by NSF award 1659871.

From left: Jesse Culver, Mukundan Kuthalam, Jack Todd, and Jason Vann. Not pictured: Clement Cole.
Upcoming Events
The semi-annual meeting of the NCSS Industrial Advisory Board will be held October 11-12 at the University of North Texas.

For more information about the NCSS I/UCRC or how you can join our center, please contact:

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NWave Technologies
Poundra
PSG
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Recent Publications on NCSS Related Research


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