Abdullah Muzahid, assistant professor in the UTSA Department of Computer Science, has been awarded a National Science Foundation (NSF) Faculty Early Career Development (CAREER) Award. The award includes a $450,000 grant to support his research in machine learning over the next five years. He is the seventh faculty member in Computer Science to receive this award.

His project, CAREER: A Dynamic Program Monitoring Framework Using Neural Network Hardware, focuses on utilizing a specialized hardware that implements neural network. Neural network is a machine learning technique that mimics human brain. Therefore, neural network hardware provides some unique capabilities that can be utilized in many different ways.

The usage that this project considers is about "program monitoring." Program execution monitoring is often used to detect software bugs, performance issues, security attacks etc. When neural network hardware is used to monitor program executions, at first it tries to learn the normal behavior of the program. Such behavior is defined in terms of various events or features that the program exhibits. Once the neural network hardware learns the normal behavior, it can detect deviations from the normal behavior, which can be indicative of software bugs, performance issues, security attacks etc.

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to the Cloud, performance uncertainty puts many potential Cloud users in doubt. This performance uncertainty makes it very difficult to determine if Cloud services can meet a user's performance target. Even in the case where Cloud can meet a performance target, this uncertainty makes it very challenging to project the potential resource usage and cost of using Cloud services.

Performance testing is traditionally the way to determine if a system satisfies certain performance targets. However, cloud services are provided to the users as black boxes, i.e., users have limited control over the execution environments. This black-boxed approach is also one of the causes of performance uncertainty. If traditional performance testing is employed in Cloud, extremely time-consuming tests have to be conducted to extensively explore the unknown execution environments, which is cost prohibitive in practice.

To reduce the testing cost, Wang’s LASOR lab is investigating how to incorporate Cloud system knowledge into performance testing. The knowledge of Cloud systems help users better control and interpret execution environments to reduce the number of tests. Additionally, to help users determine the Cloud resource configurations that minimize their costs, LASOR also applies machine learning into Cloud testing. Machine learning that may help reduce the search space of potential cost-efficient resource configurations.

**Automatic Elasticity Management for Cloud Application**

Elasticity is used to describe the characteristic of Cloud Computing where users can dynamically increase or decrease their resource usages based on workload demands. While elasticity is the key to achieve low-cost-of-ownership of Clouds, users are responsible to design elasticity policies. However, properly designing elasticity policies is extremely challenging even to power users.

A good elasticity policy requires two predictions: 1) the prediction of in-come workloads, so that a Cloud application can prepare in advance for future workloads spikes or drops; 2) the prediction of the performance of Cloud resource configurations, so that a Cloud application can correctly choose the configuration with lowest cost while meeting performance goals. However, accurately making these predictions remains open questions.

It is worth noting that, for any deployed applications, there is usually a history of past workloads, performance and resources usages. This history may reveal valuable insights of application behaviors, and thus help improve the accuracy of workload and performance predictions. Because this history is already available to Cloud providers, Wang believes Cloud providers can supply users with accurate predictors to help them design elastic policies. In fact, given the large application pool and the histories of a wide range of applications, Cloud providers may be able to directly supply users with elasticity policies, completely relieving the users from the burden of designing their own policies.

At LASOR, Wang’s research team combines the knowledge of Cloud Computing, computer systems and data mining to identify the type of historical data that are required for elasticity policy design, and investigate how to utilize the history to improve elasticity policies.
When Cindy Murphy joined UTSA 23 years ago, the Math, Computer Science, and Statistics programs were all housed in one department office. Class enrollments were conducted manually through paper-based add forms and students would form lines wrapping around the third floor of the science building to register for classes.

Fast forward to 2017, the Computer Science department is thriving and located in the North Paseo Building where Murphy serves as an Administrative Services Officer II.

Murphy plays a key role in the department by managing the budget, handling all employment and payroll related issues, faculty grant management, and taking care of student related financial activities (stipends paid, tuition/scholarship payments, and graduate and doctoral student funding).

The College of Sciences Staff Service Award was established in 2015 by Dr. George Perry to recognize one staff member’s exceptional accomplishments, leadership, and service to the university each year. Murphy was the second recipient of this award in December of 2016 for her contributions and leadership in the growth of the department and the university college.

Upcoming CS Events
Spring 2017

February 2017

♦ Fri 2/10 1:00pm—2:00pm
Graduate Research Seminar
Presentations by David Holland and Jin Han

♦ Fri 2/24 3:00pm—4:30pm
CS Student Career Development
Mock Interviews

March 2017

♦ Fri 3/3 1:00pm—2:00pm
Graduate Research Seminar
Presentations by Foyzul Hassan and Brita Munsinger

♦ Wed 3/29 1:00pm—2:00pm
Graduate Research Seminar
Presentations by Joy Rahman and Sharif Mohammad Shahnewaz Ferdous

April 2017

♦ Fri 4/7 3:00pm—4:30pm
CS Student Career Development

♦ Fri 4/14 1:00pm—2:00pm
Graduate Research Seminar
Presentations by Sam Silvestro and Richard Garcia-Lebron

Scan this QR code with your cell phone to see all upcoming department events or go to http://cs.utsa.edu/events
behavior sufficiently, it looks for any deviation of that behavior. Such deviation can be attributed to software bugs, performance issues or security attacks. By focusing on different behavior, the proposed approach can detect different software bugs, performance issues or security attacks. Since the neural network hardware can learn any new behavior, this approach is adaptive, can be done on-the-fly, and creates a general framework for bugs and security attacks. The project proposes a multi layer approach consisting of hardware, runtime system, and compiler to implement this idea.

Besides this project, Dr. Muzahid is leading few other projects. One project is exploring the idea of approximate computing. There is a domain of applications (such as scientific simulation, modeling, graphics etc.) that does not require 100% accurate results. For such applications, we can introduce some inaccuracy (e.g., by relaxing certain constraints on synchronization, communication etc.) and still be able to produce acceptable results. On the positive side, the relaxation of various constraints can enable simplification of hardware, runtime system or even programming models and help us improve overall performance and energy efficiency. Other projects look into issues ranging from multiprocessor’s memory model, data center scheduling, and workload characterization.

Besides the NSF CAREER award, Dr. Muzahid was previously awarded another NSF grant of around $250K. Currently, he is in the process of receiving a seed grant from Intel Corporation.

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**COMPUTER SCIENCE MAJOR? SCHOLARSHIPS AVAILABLE FOR CURRENT AND PROSPECTIVE STUDENTS**

- Armed Forces Communications Electronics Association Cyber Security (AFCEA)
- Will Winsborough Memorial Endowed Scholarship
- NSF Scholarships for Service
- Allen N. Martinese Endowed Scholarship
- Center for Infrastructure Assurance and Security (CIAS) Annual Scholarship
- CNF Cyber Security Scholarship
- Edward Engates Memorial Scholarship
- Michael Maltrud Memorial Scholarship
- Richard Murphy & Mary Bancroft Book Fund
- Computer Science Academic Graduate Scholarship
- Doctoral student scholarship

If you are an alumni or a business/organization interested in funding student scholarships, email us at cs@utsa.edu

For more information on how to apply, please contact scholarships@cs.utsa.edu
AC: What drew you to a career in cloud computing?
CC: Cloud computing is not this new revolutionary way of computing. It’s actually an evolutionary process. We can go back to high-performance computing. Think of these as huge monolithic systems of computers that were all operating to perform a common task. Typically, these systems were used in the scientific, research and academic fields. Over a period of time, we saw what's called grid computing come up where it borrowed a lot from high performance computing. The grid was very rigid in terms of what could be used, deployed and provisioned. In the natural evolution of things, they took the core pieces of grid and high performance computing and used that as the basis for cloud computing. Clouds enabled elasticity, fluidity and utilized a common framework which allowed people to use and deploy different models. So, cloud computing is just a fancy name for a whole bunch of technologies over the last twenty some odd years wrapped up with some orchestration. Where that parallels with me working in cloud computing was that I started in high performance computing.

AC: Describe your typical work day as a cloud expert.
CC: In the typical day for a cloud systems-admin, you would see all network traffic, including perhaps some peaks or some spikes. You have to be able to dig down and look at the traffic, not only at the micro-level with packet analysis but also at the macro-level through traffic pattern recognition on a geographical basis. If it’s a bug, you need to be able to track down the bug, whether you file the case to your development team or you make patches yourself. Another aspect is that you take the same concept from networking and move it over to compute and storage and determine if these things are benign in nature or malicious. A lot of the work consists of instrumenting, data analysis, and bug fixing.

AC: What skills are most important for someone who wants to become a cloud expert?
CC: You have to be a jack of all trades. You definitely want to know operating systems, how the kernel works, how the operating system works (at least at the macro-level), and be able to drill down and find out more information at the micro-level as needed. Next, you need to know about networking and be able to drill down and find more information on the nitty-gritty, especially when an issue arises. The same thing goes for the different storage technologies. Lastly, what ties everything together is your working knowledge of programming languages. It’s best to know multiple because whenever you look at the entire cloud stack, pretty much everything is written in a different language. You have to be very adept at using the correct tools for the job, especially whenever you’re trying to isolate and replicate bugs.

AC: Thank you for sharing your experiences with us. Is there anything else you’d like to add?
CC: The only thing I’d like to add is just to tell the students to keep on doing y’all’s thing. I for one know, some semesters in CS are going to be difficult. Just take it in stride and know that what you’re learning is really invaluable. I think y’all will come out on top and have a really enjoyable career in the future.
Lee Boyd, CSGSA chapter president and CS doctoral student, kicked off the seminar series by presenting his research titled Optimizing Parallelized Deep Learning. Boyd’s research is supported by UTSA associate professor Dr. Weining Zhang and the Data Science and Technology Laboratory (DSTL).

Riad Akram, CS doctoral student, presented his research to his fellow CS students and faculty attendees. His research, titled Approximate Lock: Trading off Accuracy for Performance by Skipping Critical Sections, presents modifications to provide performance improvement for applications.

The Computer Science Graduate Student Association (CSGSA) hosted the first session of the Spring 2017 CS Graduate Research Seminar Series on January 25th. The five scheduled sessions will feature UTSA student research currently being conducted in the department. All computing students and faculty are welcome to attend the sessions to support the student community and provide feedback on their presented research.

S P R I N G  2 0 1 7

- Friday 2/10 1:00pm—2:00pm Presentations by David Holland and Jin Han
- Fri 3/3 1:00pm—2:00pm Presentations by Foyzul Hassan and Brita Munsinger
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- Fri 4/14 1:00pm—2:00pm Presentations by Sam Silvestro and Richard Garcia-Lebron

For more information, scan the QR code or email jianhua.ruan@utsa.edu
What is the Internet? Most of us rarely think about it in 2017, just like we do not think about the highway system when we get into our car. Those under the age of 30 mostly likely expect the internet to be present everywhere they go.

When William Gibson coined the word “cyberspace” for his novel Neuromancer back in 1984, besides being visionary, he provided the meme that has been with us ever since. This word conjures an intangible entity that pervades space, in this case carrying information to control things.

Students enrolled in CS 3873 (Computer Networks) learn to visualize the Internet as a Lego-like construct of interacting protocols, which is still as abstract as cyberspace. Hence we come to Andrew Blum, who was overcome with curiosity one day when his Internet went out due to a squirrel damaging a cable near his house. He wanted to actually see the physical infrastructure that underpins the internet and set out on a journey just to do that.

The book’s title, *Tubes: A Journey to the Center of the Internet*, is an allusion to Jules Verne’s iconic novel *A Journey to the Center of the Earth* due to the uncanny similarity between Blum’s journey and the journey of protagonist Professor Lidenbrock who followed volcanic tubes to the center of the earth. Blum describes visiting a lonely cove in Cornwall, England in order to see where the transatlantic fiber cables come ashore. This particular location has hosted ocean crossing cables since the days of the telegraph.

While his language sometimes veers into the poetic, Blum expounds at length about international fiber optic cables: who builds them, who owns them, and the effect their bandwidth has on the continents and countries that they serve. Readers are provided a true picture of the many entities that together bring the Internet into existence. These include the bandwidth providers (many not household names), the many critical exchange points where these providers meet, and the vast warehouses of computers behind the content providers like Google and Facebook.

*Tubes* covers many interesting aspects of the Internet vis-à-vis other major inventions that changed communications. Blum points out that, unlike the telephone or telegraph, the Internet and its foundational technologies were not the product of a single person. Many people contributed to create various protocols and technologies that built the early networks of computers; many of their ideas live on today through the magic of “backward compatibility.”

Many of his visits to these locations involved invitations inside of security perimeters rarely granted to non-employees. His insights can be startling at times, such as his description of one exchange point that sounds like a creepy warehouse from a Stephen King novel and the data centers of the high desert of eastern Oregon that could easily fit into an X-Files plot.

The book is a fun read as Blum knows how to tell a good story without over simplifying the technology. If you are interested in the Internet as a physical thing, the hidden corporate structure behind the curtain, or are interested in deeper research into network resilience, this a great book to get you started on your journey.

**We want to hear from you!**

Do you have any suggestions for topics you would like to see covered? Do you have any UTSA or CS related photos that we can include?

Email us at cs@utsa.edu
## Featured Job Opportunities!

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<tr>
<th>#</th>
<th>Employer</th>
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<td>Girlstart STEM CREW Intern</td>
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<td>Bioinformatics Assistant</td>
<td>Part time</td>
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<td>Submit a simple CV with a short description of education, research interests and experience</td>
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<td><a href="mailto:tojinv@uthscsa.edu">tojinv@uthscsa.edu</a></td>
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<td>Synaptics, Inc.</td>
<td>Research Scientists</td>
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<td>Paid</td>
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<td>Submit a cover letter, résumé, unofficial transcripts, and two references online at <a href="http://www.cbo.gov/careers">www.cbo.gov/careers</a>.</td>
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<td>Student Tutor</td>
<td>Part time</td>
<td>Open until filled</td>
<td>Apply via UTSA Handshake job board</td>
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