UNIVERSITY of HOUSTON
DEPARTMENT OF COMPUTER SCIENCE

Fall/Winter 2017

CS NOW!

Computer Science Department Newsletter

In This Issue

New Computer Science Faculty Introduction

Amin Alipour joined the department in 2017 after receiving his Ph.D. in computer science along with Vice Provost's Award for Excellence in Innovative Teaching from Oregon State University.

His main research area is software testing and analysis in which he devises techniques for finding bugs of complex software systems such as compilers and interpreters. His recent line of work concerns with evaluation of the reliability of learning systems. HIs paper on Cause Reduction for Quick Testing won a Best Paper Award at the IEEE Conference on Software Testing, Verification and Validation in 2014. He is a passionate programmer and enjoys mentoring undergraduate students.

Aron Laszko joined the department as an Assistant Professor in September 2017. His research interests revolve around the security and resilience of cyber-physical systems and IoT, the economics of cyber-security, and game-theoretic modeling of security problems. He is currently working on correct-by-design smart contracts for blockchain-based platforms, transactive energy systems, and bug-bounty programs. Previously, he was a Research Assistant Professor at Vanderbilt University (2016–2017) and a Postdoctoral Scholar at the University of Calirfornia at Berkeley (2015–2016). He graduated summa cum laude with a Ph.D. in Computer Science from the Budapest University of Technology and Economics in 2014.

Giulia Toti obtained a bachelor and master degree in biomedical engineering from the polytechnic of Turin. She then moved to Houston to pursue a Ph.D. in computer science, which she completed in 2016. Upon graduation, Giulia joined the Addictions Department of the King's College London as postdoctoral researcher. There, she worked on mining of large electronic health records databases and on the development of risk prediction models. In 2017 Giulia came back to UH as instructional faculty. She offers several core classes in the CS curriculum and enjoys working with our undergrad students. She promotes research among undergrads and is one of the mentors for the Summer Research Experience for Undergraduates (REU) program. She is also a member of The National Center for Women in Information Technology (NCWIT).

Panruo Wu joined the Department of Computer Science in Jan 2018. His research spans high performance computing, numerical methods and software, parallel computing, and high performance data analytics. Specifically, his approach to high performance, energy efficient, and reliable computing is to form synergy between the applications and the systems through algorithmic insights. He received B.S. degree in mathematics from University of Science and Technology of China in 2011, and Ph.D. in computer science from University of California Riverside 2017. Before joining UH he was a postdoctoral research associate in Innovative Computing Laboratory at University of Tennessee Knoxville, where he worked on massively parallel numerical linear algebra algorithms and software. In his spare time he likes playing basketball for fun.

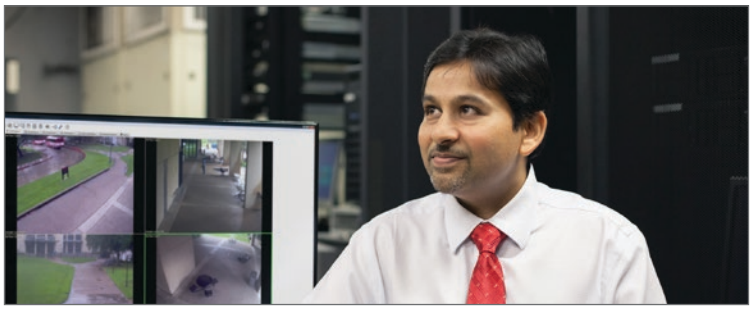
Message from the Chair

Year 2017 was an important one for the department. We are fortunate that four Professors decided to make UH Computer Science their new home. Please join me in welcoming Dr. Amin Alipour, Dr. Aron Laszka, Dr. Giulia Toti and Dr. Panruo Wu! And there is another reason to celebrate! UH Computer Science is 50!! University of Houston had the foresight 50 years ago to open a new Department of Computer Science when few universities had one. If the history of the department intrigues you, don't miss the second installment of the History of UH CS by Prof. Olin Johnson in this issue. And if you are just interested in celebrating, and you should, it is my pleasure to invite all members of the UH Computer Science community to a celebration on June 2. Details are available at http://celebrate50.cs.uh.edu. I hope to see you there.

- Jaspal Subhlok

Working to Make Security Cameras "Smarter"

Security cameras deployed across the nation – at transit stops, sporting events and other places where people gather – can provide valuable clues to law enforcement investigating trouble after the fact. A University of Houston researcher is developing a system that would allow the cameras to recognize and send an alert at the first sign of a threat to public safety.



Shishir Shah, professor of computer science, received a $1.57 million grant from the National Institute of Standards and Technology Public Safety Innovation Accelerator Program to pursue research using video analytics to develop "smart" camera security systems that can automatically alert first responders to relevant issues and emergencies. NIST is a division of the U.S. Department of Commerce.

Shah works in image analysis and "computer vision," a field related to artificial intelligence that deals with analyzing large numbers of images to extract data which can be used to guide real-world decisions.

He will collaborate with the city of Houston, working with Julie Stroup, program director of the Public Safety Video Initiative, to ensure the work addresses the needs of public safety/homeland security personnel and other first responders. The video initiative was started in 2007 by Dennis Storemski, director of the Mayor's Office of Public Safety and Homeland Security. There are currently more than 850 city-owned cameras in public spaces, and the office collaborates and shares video with other regional public safety agencies.

Shah's lab, the Quantitative Imaging Laboratory, has a network of cameras set up in and around a classroom building on the UH campus. There are thousands more spread across the city's public spaces.

It's not practical to have people watch the feeds from all those cameras in real time, he said, both because there is too much video footage to make it cost-effective and because nothing of note happens most of the time, raising the risk that people will miss the few seconds of meaningful information.

Instead, the project will seek to build mathematical models that reflect how people act or behave and, based on that, predict deviations from the norm.

"The long term plan is to try and move the needle in smart cameras, cameras that have some intelligence about what they are recording and how that can be used," Shah said.

It will start with what he describes as "lower levels of intelligence," including teaching the cameras to send an alert when something prevents optimal operation – a smudged or covered lens, a mechanical problem and even an external obstruction, such as a tree sprouting leaves that blocks the view.

Mid-level intelligence will involve things like recognizing when a vehicle is traveling the wrong way on a one-way street.

More complex programs would determine whether people's behavior has deviated from the norm, incorporating variables including the laws of gravity – people don't walk on the ceiling – and such social norms as where people stand and walk. That has to account for situational and cultural cues, Shah said, noting that walking on the grass might be aberrant in some situations but normal at a backyard barbecue, and people of different cultural backgrounds have different ideas about personal space.

Those are things that people watching a video feed automatically use to analyze what they are seeing. "How do we get cameras to that level of intelligence, which people bring to interpreting what is happening in a scene?" Shah asked. "For now, that analysis is really still dependent on people."

- Jeannie Kever, UH Media Relations

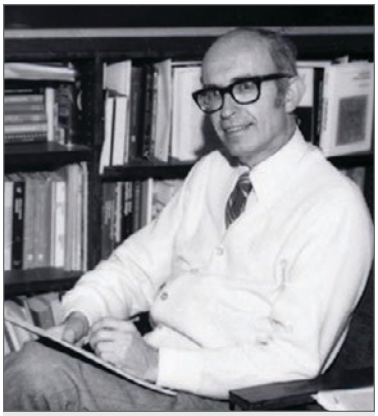
History of UH CS – Part 2: The First Years

The History of CS is a three-part series that relates the story of the birth and rise of Department of Computer Science at the University of Houston. The first article, "Part 1: the Beginning," was published in Spring 2017 edition of CS NOW! Newsletter. This article narrated about the founding of the UH Department of Computer Science in 1967 and Professor Elliott Irving Organick, a member of Manhattan project during World War II, being named as the first department chair.

The articles are written by Dr. Olin Johnson, Professor Emeritus, who served as UH Computer Science faculty for more than 40 years (1973–2015). He is also the author of the 2001 historical novel "The Newlanders."

The first university catalog listing of UH Computer Science as an academic department was 1968–69.

But, how difficult had it been to put this "department" together? Where did the professors and teachers come from? Where did the curriculum come from? Where did the infrastructure come from, and where did the money come from?



Elliott Irving Oragnick, the first Chair of Computer Science department

On an even more basic level, what precisely was computer science?

Help on these fundamental issues came from the experts. For example, in May 1966 Stanford produced Technical Report CS39: *A University's Educational Program in Computer Science*, by George E. Forsythe. In it, Stanford's graduate CS program was laid out in detail. Forsythe also gave his definition of the subject and where it should fit within a university.

I consider computer science in general to be the art and science of representing and processing information and, in particular, processing information with the logical engines called automatic digital computers. Computer science deals with such related problems as designing automatic digital computers and systems, the design and description of suitable languages for representing both processors and algorithms, the design and analysis of methods of representing information by abstract symbols, and of complex processes for manipulating these symbols.

One thing computer science is not: it is not merely the union of the applications of a computer to diverse problems. Rather, the core of the field is application-independent and rather abstract,

Probably a department of computer science belongs in the school of letters and sciences, because of its close ties with departments of mathematics, philosophy, and psychology. But its relations with engineering departments concerned with systems analysis and computer hardware technology should be close.

The undergraduate curriculum was derived easily from "An Undergraduate Program in Computer Science — Preliminary Recommendations" published in Comm. ACM in September 1965. The blue ribbon committee responsible for this report had been working on it for three years and included David Young of University of Texas.

The money for the UH program came primarily from the State of Texas whose legislature admitted UH as a state-funded institute of higher learning in 1963.

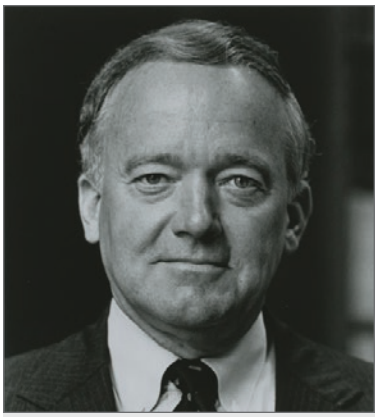
The initial CS faculty at UH was the following: *Chair* E.I. Organick; *Professors* Newhouse, Organick; *Associate Professors* Channen, Sibley, Wyatt; *Instructors* Hall, Shores; *Lecturer* Johnston.

So, the department had: 2 professors, 3 associate professors, 2 instructors, and 1 lecturer. (delete of space needed)

Albert Newhouse fled Germany during the dark days of Nazi domination. After finishing his Ph.D. in Chicago, he got an appointment in UH's math department. His interest in computers led to his departmental transfer. He helped run the department as Director of Undergraduate Studies and served a temporary appointment as Chair. He retired at age 65 in 1978.

The associate professors were hired from industry. Two of these remained with the department for several years and deserve comment.

Bob Sibley was hired from IBM where he worked in Armonk, NY. Sibley was a specialist in computer languages. At IBM, he invented and managed a team that developed a "compiler-compiler" called SLANG (not to be confused with later systems of the same name). He held a master's degree from David Young at UT. Sibley stayed with the department until 1980.



Joe Wyatt, the professor of Computer Science

Joe Wyatt was with the department for seven years beginning in 1965. He was hired from General Dynamics in Fort Worth. Like Sibley, he had a B.S. (from TCU) and an M.S. (from UT) in math. Wyatt served half-time in CS and half-time as Director of UH's Computer Center. Wyatt left UH for Harvard where he rose to the rank of Vice President of Administration. He then became Chancellor of Vanderbilt University for 18 years.

- Olin Johnson

Virtual reality program aimed at helping people with Asperger's

A team of doctoral candidates and a University of Houston professor are developing various augmented reality and virtual reality programs, which include programs designed to help people with Asperger's identify emotions, teach people what to do in disasters and create 3-D models of MRI data.

The programs are being developed primarily for the Microsoft HoloLens, an augmented reality headset that places holograms and information over the physical world, said computer science professor Chang Yun. Some, however, are made in virtual reality using the HTC Vive.

The team is working alongside CERT, a division of FEMA that helps educate the public about disaster preparedness, Yun said.

"In a nutshell, what CERT does is teaching civilians how to do particular tasks to both save themselves and their family in times of emergency," said Brian Holtkamp, a doctoral candidate working on a program to teach people how to properly use a fire extinguisher. "So hurricanes, tornadoes, those type of natural disasters or man-made disasters."

The fire extinguisher program is in VR and will go into testing next month, he said.

"We put them into a house that has fire, and you have to go extinguish them or see if you can extinguish them," Holtkamp said.

Another program the team is working on aims to help people with Asperger's or high functioning autism converse with others. It uses the Microsoft HoloLens and tells the user what emotion — happy, sad, angry, neutral or surprised — is displayed on the face whoever they are talking to.

"If we can rely on it, imagine how much accessibility we can give those patients, so they can practice at least in their homes or even with their friends," said Mohammed Alshair, a doctoral candidate working on the project. "They can wear it or just look and know this person is getting frustrated, getting mad, getting angry, and over time, they get better."

They are working with doctors from the University of Texas Health Science Center to test the viability of such a program.

Yun has been working for several years to find ways to help those with Asperger's or high functioning autism, previously by using Kinect-based games at the UH Clear Lake Center for Autism and Developmental Disabilities.

"The high functioning autistic patients or Asperger's (patients) having problems recognizing social cue, like the facial expression," Yun said. "So they fail conversing with other people, time after time after time. In the end, what happens is people, after enough defeat, they give up. Now we are providing a tool, so they can understand how other people are feeling, at least facially."

Five years ago, a family with a son who has autism came to Yun. The son's mother told Yun that teaching him to program would be more than enough — more so than earning a degree.

"That kind of do things on you, literally," Yun said. "Seeing mother beg me to death. After then, just chances came by, and I met this faculty director leading UHCL's Autism Center."

MRI data typically come in slices with parts of the brain shown in each slice, Yun said. The team has an AR program that creates a 3-D hologram of the brain in the physical world, so doctors and physicians can walk around and view the hologram and any tumors or blood vessels connected to it as large as they want.

"Say a doctor needed to find a tumor in the lower portion of the brain. We can take that and just put a little color on that, it'll pop straight out," Holtkamp said. "Surgery is obviously something very serious at that point in time, so minimizing potential problems is a huge win."

Yun said he is optimistic about how prevalent augmented reality will be 10 years from now with its ability to overlay more information on top of anything and as AR headsets become smaller and cheaper.

"This is like iPhone One. Nobody has concept of what smartphone is all about. Now everybody knows it's an essential," Yun said. "Ten years from now, this will be more like an essential. All of this information that you need to know and want to know, in addition. Have a imagination of what this type of device can do for you to better your living."

"This is like iPhone One. Nobody has concept of what smartphone is all about. Now everybody knows it's an essential." said computer science professor Chang Yun. "Ten years from now, this will be more like an essential. All of this information that you need to know and want to know, in addition. Have a imagination of what this type of device can do for you to better your living."

Courtesy of Wikimedia Commons

Augmented reality is a new computing territory, and the HoloLens is the only mass market AR headset. Virtual reality has been around in some form for several years. The team is dealing with the initial problems and finding the solutions for AR to pave the way for those who want to build on it in the future.

"If enough people are impressed, screw it. We are going to make this work," Alshair said. "I'm one of them. Annoying, yes, I'm cursing Microsoft everyday for like why, why, why. But at the end, I'm not choosing not to, because it's worth the trouble."

NOTE: This article originally appeared in the Daily Cougar (Michael Slaten | September 2017).

Computer Science Undergraduate and Friends Qualify for NASA Robotics Finals

Saurabh Sogi, a UH computer science major, was part of a team that qualified for the finals of the NASA Space Robotics Challenge. For their efforts, they received $15,000 from NASA and competed in the finals.

Twenty finalist teams were selected out of 92 in the preliminary round; 405 teams signed up for the challenge. Anyone was allowed to compete, with teams made up of students and professionals coming from universities, industry, and research labs from around the world.

Working alongside Sogi were Shireen Bahadur, from University of Texas at Dallas, and Vamsi Ghorakavi, from University of Texas at Austin. As a team, they called themselves BIT PLEASE.

Sogi, a UH sophomore, became interested in computer science and robotics while in high school. Ghorakavi, a friend from high school, shared similar interests.

When Sogi learned about the Space Robotics Challenge, he decided to put together a team.

"As soon as I saw the video announcing the contest, I called Vamsi and said, 'We're doing this," Sogi said. "When I saw the other teams, some of which had up to 39 people, I knew we needed another member. I also knew that person had to be someone with a really good mind."

Sogi's childhood friend Bahadur, who he met while living in Boise, Idaho, had just moved to Dallas to study computer science. Just six hours before the registration deadline closed, Sogi called her, asking if she wanted to join the team.

After a brief hesitation, Bahadur said yes.

"I'd never done anything like this before," Bahadur said. "However, I've always had a habit of teaching myself how to do something."

For the preliminary round, the team had to figure out how to program NASA's Robonaut 5, nicknamed "Valkyrie," to perform specific tasks.

Valkyrie, a humanoid robot designed to assist with NASA procedures, was created to accompany astronauts on long missions, such as a trip to Mars. On the way, Valkyrie would help the crew by performing tasks too complicated or dangerous for the astronauts.

In the preliminary round, the first task was to identify a correct sequence of flashing lights while the second task was for Valkyrie to walk to a door, press a button, then walk through the door. These challenges were scored according to time and accuracy.

Programming a robot to do these tasks requires a sophisticated level of computation that has to be done in real-time.

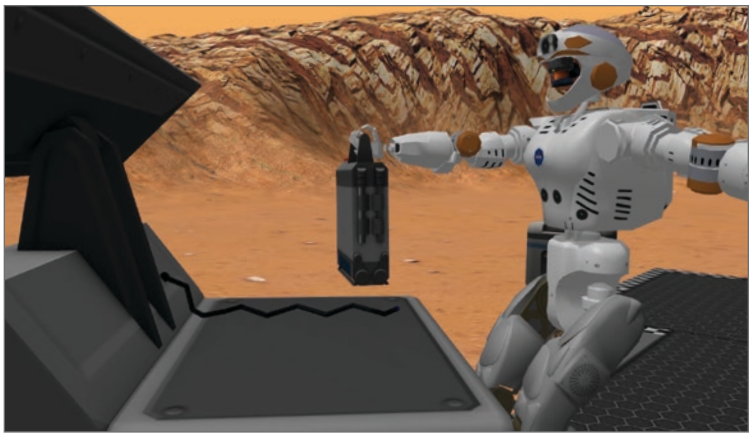
The first task of identifying a series of flashing lights meant programming Valkyrie to analyze images in real-time. This meant cleaning up an image, segmenting it into identifiable regions, and then comparing sequential images to a baseline image. This process allows the robot to determine which light has flashed on at what time.

For the second task, programming a robot to walk means taking into account the physics of walking, programming the robot to position its torso and limbs in a coordinated manner.

"It only takes 0.05 seconds for the robot to become so unbalanced it can't recover," Sogi said. "This was about pushing everything to the limit."

With the help of Ghorakavi, Bahadur, who has a background in dance, was the team member who helped optimize the walking code to figure out the fastest way to get the robot to push the button and walk out the door.

"We had to optimize a lot of our code," Sogi said. "In the beginning, it was a lot of trial-and-error. By the end, we got to a point where we were able to extract usage out of every possible hardware and software component."



During the final round, which took place June 13-16, teams programmed Valkyrie to align a communications dish, repair a solar array, and fix a habitat leak.

"Another thing that came out of this competition has been the formation of a well-knit team," Sogi said. "We have some great minds in this group."

- Rachel Fairbank, College of Natural Sciences and Mathematics

Faculty and Students attend Defcon 2017

Several computer science faculty members (Professors Gnawali, Shi and Verma) and students attended Defcon in the summer of 2017. Defcon, one of the largest hacker conferences in the world, has been held annually since 1993.

Computer science students included researchers from Professor Shi's lab and three Scholarships for Service (SFS) students: Boris Chernis, Calvin Raines and Nicholas Troutman. The Cybercorps (SFS) grant, led by Professor Verma and funded by the National Science Foundation, includes a career development component for each student, which can be used to attend conferences such as Defcon or for certifications such as Certified Information Systems Security Professional (CISSP).

Defcon has an innovative format with keynote speakers presenting to large audiences, and smaller, more focused workshops running in parallel. There are also hacking competitions running in some of the workshops. UH CS faculty visited the automobile security display and hackathon and the workshop on wireless security.

Defcon 2017 included some memorable presentations: "From Box to Backdoor: Using Old School Tools and Techniques to Discover Backdoors in Modern Devices" and Gary Kasparov's "Brain's Last Stand." Kasparov impressed the audience by showing no bitterness toward artificial intelligence, making the cornerstone of his talk how to meld the different strengths of artificial and human intelligence to reach a goal.

There was also an interesting and a bit technical presentation on "Jailbreaking Apple Watch." Security tip: A backdoor is any undocumented feature, or defect, in a computer system or software that allows easy, uncontrolled access to sensitive sections of data or code.

Facial Recognition: Grad Student Constructs 3D Images from 2D Images

From the curve of a person's cheekbone to the proportion of their nose and eyes, every face is unique. So unique that, similar to fingerprints, a person's facial features can serve as identification.

Facial recognition systems work by identifying characteristic features from a subject's face, analyzing their appearance, relative size, position and shape. This information can then be used for everything from automatic tagging of social media photos to unlocking a smartphone.

Pengfei Dou, a UH computer science December graduate, worked on improving methods for facial recognition. His research, advised by Ioannis A. Kakadiaris, Hugh Roy and Lillie Cranz Cullen University Professor of Computer Science, focused on using two-dimensional images, such as photos, to create a three-dimensional facial model.

This three-dimensional reconstruction, when used in other contexts, increases the robustness of facial recognition, including photos where facial poses and expressions have changed.

"A three-dimensional facial model works better for facial recognition, however, it's not always practical to get one," Dou said.

To reconstruct a three-dimensional model from a photo, Dou uses deep learning, which is a powerful machine learning technique. Machine learning works by giving computers large amounts of data, which trains them to learn how to perform specific tasks. This can be used to spot patterns and make predictions.

Deep learning uses artificial neural networks, loosely modeled on the way neurons connect with each other, which are assembled into layers which sequentially analyze patterns. This deepens the size and complexity of a computer's ability to learn and process information.

Dou's research was based on two different scenarios. In the first scenario, the task was to reconstruct a three-dimensional facial model from a single photo. In the second scenario, the task of reconstructing a three-dimensional facial model included multiple photos.

"For cases where we had multiple two-dimensional images, we were able to reconstruct a better three-dimensional facial model," Dou said.

Dou has already accepted a job offer in the tech industry, where he'll continue to work on novel computer vision techniques.

When asked about his experience as a graduate student, Dou noted that the projects for his graduate courses helped him try out new techniques. Meanwhile, his advisor expected the highest possible quality of work from him, both in his research, as well as his coursework.

"The research conducted in our lab has always been motivated by practical problems that needed to be solved," Dou said.

- Rachel Fairbank, College of Natural Sciences and Mathematics

AWARDS & GRADUATION

Upcoming Events

February

- UH Computer Science Alumni Mixer
  Saint Arnold's Brewery Company
  Saturday, February 24
  6 PM – 9 PM

May

- Spring 2018 University Commencement
  College of Natural Science and Mathematics
  NRG Arena
  Friday, May 11
  9 – 11:30 AM

June

- Department of Computer Science 50th Anniversary Celebration
  Saturday, June 2

September

- Fall 2018 Computer Science Career Fair
  Wednesday, September 5
  10 AM – 2 PM

November

- 5th Annual UH CodeRED National Hackathon
  November 3–4
- 3rd Annual Immersive Technology Conference (AR/VR)
  November 5–6
  (Sponsored by CS Department - CS in Partner status)

CodeRed Hackathon

CS Career Fair

Immersive Technology Conference

CS Welcome Back Bash

Student and Faculty Awards – Fall 2017

Undergraduate Excellence Award

- Julia Hofmeister
- Duc Truong

UHCS Academic Excellence Award

- Ioannis Pavlidis
- Thamar Solorio

Summer/Fall 2017 Graduates

B.S.

Adam Able
Eduardo Aguilar
Syed Ahmed
Sadia Alam
Sumaiya Asif
Nicholas Biddle
Joshua Bird
Alexandra Bryant
Jose Cabrera
Andres Carrillo
Jacob Collins
Jonathan Cooke
Cody Coomes
Christopher Cupples
Viktor Dahbura
Krishan Desai
Tyler Do
Taqees Duka
Omar Gharandoq
Mario Gonzalez
Aaronpal Grewal
Juan Gutierrez
Benjamin Heasley
Chad Hoang
Angela Hoch
Weston Hodge
Kevin Kwan
Andrew Lehmann
Ethan Lundgaard
Justin Mangawang
Debra Mendez
Jiacheng Mo
Cole Mujadzic
Dat Nguyen
Jonathan Nguyen
Nicole Nguyen
Tin Nguyen
Ty Nguyen
Maniroth Ouk
Qaem Parasla
James Perry
Michael Pham
Sam Phan
Minnah Prufer
Janie Ramirez
Dhawal Sandesara
Alen Shaju
Jonathan Shakib
Timothy Shepard
Derreck Stellpflug
Binh Tran
Di Tran
Quang Huy Tran
Visak Varghese
Heather Vo
Kong Chung Chan
Chonghua Li
Ahmed Saeed
Adithya Srinivasa

M.S.

Yue Cao (w/thesis)
Boris Chernis (w/thesis)
Datskova
Pengfei Dou
Zhimin Gao
Xin Liu
Behrang Mehrparvar
Seyyedeh Qazale Mirsharif
Mohammad Tanvir Rahman
Muhsin Zahid Ugur
Lingfeng Zhang
Yiqun Zhang
Lei Zhang
Xingliang Zou

Ph.D.

Olga Vladimirovna

CONTACT

Sponsors

Chevron

ExxonMobil

eog resources

INT

leidos

NOKIA

PARIVEDA SOLUTIONS

PROS

Submit News

Please submit Alumni News to csnow@cs.uh.edu.

For information on upcoming alumni events, Join the **Computer Science at University of Houston** group on LinkedIn.

Contact Us

Department of Computer Science
501 Philip G. Hoffman Hall
Houston, Texas 77204-3010

P: 713.743.3350 - **F:** 713.743.3335
www.uh.edu/nsm/computer-science/