

COMPUTERBYTES

2017

NMSU COMPUTER SCIENCE

NMSU professors receive NSF grant on using wearable devices to coordinate drones for search and rescue teams. See page 8 for more info.

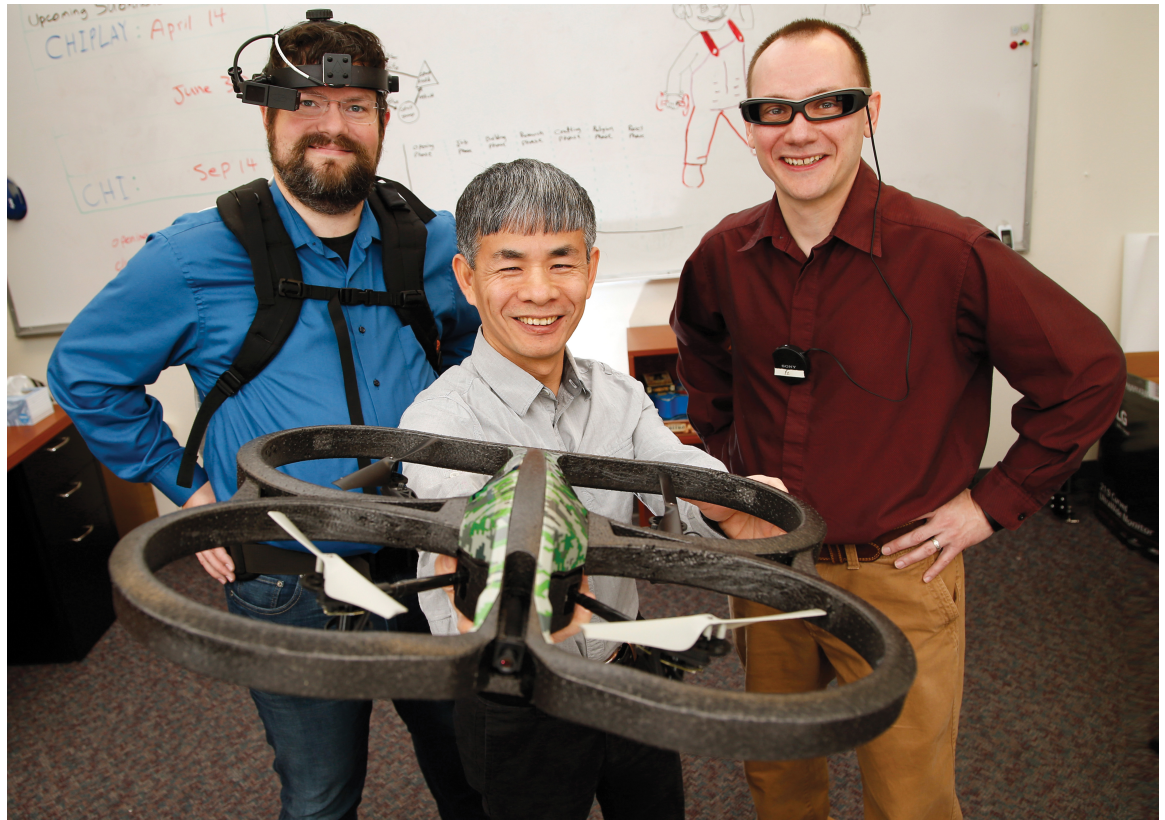


Photo by Andres Leighton

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Dr. Roopa Vishwanathan

NMSU's Latest Cryptographer

Roopa Vishwanathan joined the faculty of the CS department at NMSU in Fall 17. Her research area is cryptography, both theoretical and applied. On the applied side, she has interests in hardware-assisted cryptography, and its applications to the diverse areas such as secure outsourced data storage, verifiable encryption and fair exchange, privacy in location-based services, and more. On the theoretical side, she has done work in attribute-based signatures, new proof techniques for public key cryptography, secure function evaluation protocols, and more. Her current research project is about building tools to automate proofs of cryptographic protocols, specifically ones that use bilinear pairings. Most such proofs are currently done using

"pencil-and-paper"; proof automation would help in efficiently generating of proofs of families of cryptosystems, which have structural similarities. A stretch goal of the project is proof verification, which is a more involved undertaking, but can certify the correctness of proofs.

Prior to joining NMSU, she was an Assistant Professor in SUNY Polytechnic, Utica, NY. Before that, she served as a postdoctoral research associate in the department of Computer Science in UNC Greensboro. She received her PhD from the University of North Texas, Denton, TX in May 2011.

Dr. Parth Nagarkar

Researching Big Data Management and Optimization

Parth Nagarkar received his Ph.D. from Arizona State University in 2017 and B.S. from Louisiana Tech University.

His research interests include big data management, indexing, query optimization, and distributed query processing. He is particularly interested in exploring the challenges surrounding scalable index structures and data processing systems, which empower efficient large-scale, high-dimensional data processing. He is currently researching distributed

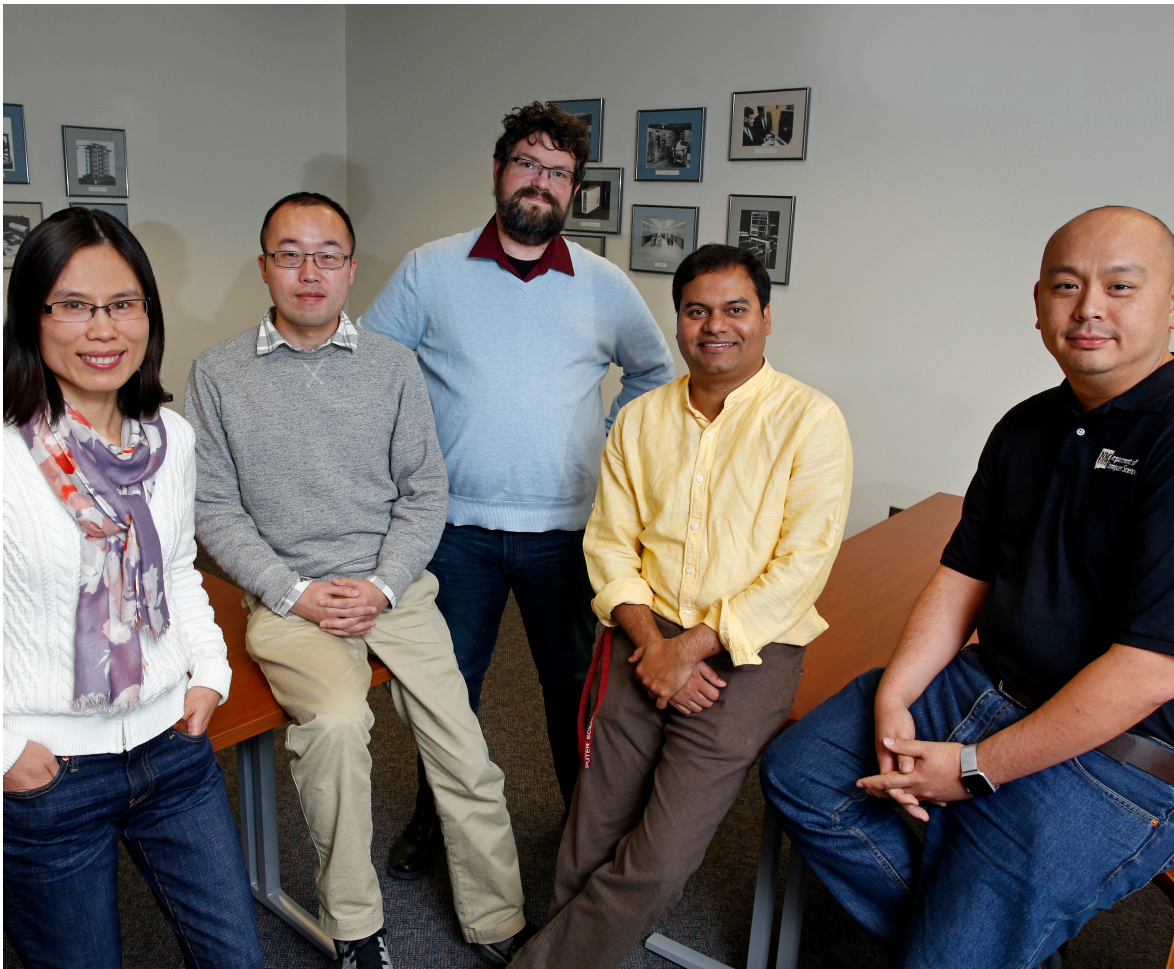
data processing systems for query processing in high-dimensional spaces.

His research was recognized at IC2E where he was awarded the best PhD Symposium Paper award.

His works have been published in top-tier database venues, such as PVLDB and EDBT. He has served as a PC member for DASFAA and CIKM. He has also been a reviewer for numerous conferences and journals such as SIGMOD, EDBT, SDM, IEEE TOC, and ACM TODS.



Courtesy Photo



Researchers in NMSU's Department of Computer Science from left: Huiping Cao, Mai Zheng, Zachary O. Toups, Satyajayant Misra and William Yeoh.

NMSU Computer Science Degree Earns Accreditation, Faculty get Nearly \$2 million in NSF Grants

By Minerva Baymann
(reproduced from the NMSU News Center)

Big data, cyber-human systems and flash drive technology are among the projects receiving more than \$1.89 million in National Science Foundation awards to computer science faculty at New Mexico State University this year.

In addition to the research grants, which range from two to three years long, NMSU's computer science department in the College of Arts and Sciences has another reason to be proud. The department recently received initial accreditation for NMSU's bachelor of science in computer science degree from the Accrediting Board for Engineering and Technology (ABET).

The process started four years ago and culminated in an 18-month review and

evaluation over the summer, after which the accreditation was granted. The ABET accreditation lasts for seven years.

"We really wanted to do it for our students because when they can say they've graduated from an ABET accredited program it really helps them," said Jonathan Cook, computer science professor and interim department head. "Just yesterday I had a student in the hallway thank me for getting accreditation because that actually helped him to get an internship at Sandia Labs."

The accreditation is retroactive so that alumni who graduated with the computer science degree back to 2014 can claim the status. However, it also

means the department will have to go through the process again in 2020 to renew the accreditation, which costs about \$10,000.

"The accreditation process is a lot of work, but it's worth it for our students," Cook said.

Another benefit for NMSU's computer science students is the opportunity to get involved in various research opportunities working closely with faculty members. This year alone, five NSF awards total nearly \$2 million.

“We as a small department have been extremely successful in being able to fund our research,” said Jonathan Cook, computer science professor and interim department head. “This year’s awards are wonderful examples of the strengths of our faculty and the quality of our faculty and the research they are already producing. It will allow them to continue doing great things.”

Huiping Cao (principal investigator) and Satyajayant Misra (co-principal investigator), both computer science associate professors, are leading the first NSF Research Experience for Undergraduates (REU) site at NMSU through a 3-year grant of \$361,791. This project will provide undergraduate students the opportunity to work with big data analytics in cyber physical systems to prepare them for future scientific work.

“This REU site will provide students with problem solving skills for conducting research in big data analytics and presenting scientific findings verbally and in writing,” Misra said. “The students will be mentored by researchers to disseminate their research findings at professional conferences and through the REU website.”

Cao is also the NMSU principal investigator for a three-year grant for \$359,151 through NSF’s BIGDATA program. The project goal is to establish the theoretical, algorithmic, and computational foundations of Context-Sensitive Impact Discovery in complex systems. The project will include mentoring of graduate and undergraduate students at both NMSU and Arizona State University.

“Successfully tackling many urgent challenges in socio-economically critical domains (e.g. sustainability, public health and biology) requires obtaining a deeper understanding of complex relationships and interactions among a diverse spectrum of entities in different contexts,” Cao said. “This project will fill an important hole in decision making in many critical application domains, including epidemic preparedness, biological pathway analysis and resilient water/energy infrastructures and will enable applications and services with significant economic and health impact.”

NMSU computer science assistant professor Mai Zheng’s award for \$173,747 will allow diagnosis of failures in flash-based storage systems. These hold financial transactions, scientific computation results, family photos and more. The goal of the project is to advance the dependability of storage systems for this important data. The project also will include undergraduate and graduate student participation

through the Alliance for Minority Participation and Young Women in Computing Programs.

“Flash-based storage systems are revolutionizing the way we store our data in computers,” Zheng said. “They can provide hundreds of times of speedup compared to traditional technologies under some common workloads. However, as a young and disruptive technology, their reliability is not as well-understood as the old systems. With this award, my students and I will investigate the unique failure modes of new systems and reveal the complicated causal paths leading to data loss. This is the first step towards building truly dependable storage for various invaluable data we have today and in the future.”

Zachary O. Toups, computer science assistant professor, is the principal investigator for a \$495,628 NSF grant along with co-principal investigators Son Tran, computer science professor, and Igor Dolgov, psychology associate professor. The aim is to consider how wearable computers can support urban search and rescue contexts as science advances to move from multiple humans piloting one drone to one human directing many drones. The project uses simulated drones supporting game players moving in the physical world as a way to design these systems

“With this project, my hope is that we can really impact future disaster response practice and employ games for design, rather than training,” Toups said. “Wearable computers often have impoverished means of input (e.g., a few buttons versus a full keyboard) but enable environmental awareness and physical world action, which are essential for the safety of disaster responders.”

In addition to the strong research opportunities and ABET accreditation, NMSU’s computer science students will be looking forward to a new degree in cyber security to begin next year. The computer science department in collaboration with electrical computer engineering will develop the curriculum and hire two new professors to teach the subjects. They expect to begin the degree in fall 2017 and to gain certification for that program within two years.

With 250 undergraduate students and 100 graduate students, NMSU’s computer science program has consistently increased enrollment over the 20 years Cook has been at NMSU. He credits the success of the program to the connection between professors and students that goes beyond the classroom.

“One of the strengths of all of our degree programs from undergraduate to graduate is that the students interact closely with our faculty. I hope we never lose that.”

Dr.
Zachary O.
Dugas
Toups.



NSF CAREER Award Helps NMSU Professor Design Devices for Search and Rescue Teams

By Minerva Baumann
(reproduced from the NMSU News Center)

Zachary Toups wasn't always a computer science professor. Before he started teaching at New Mexico State University, he was a researcher attached to the Disaster Preparedness and Response group involved with Texas Task Force 1, one of 28 federal teams under the Federal Emergency Management Agency's Urban Search and Rescue System. These teams go to the scene of a disaster and search the debris to find survivors.

"When I was working with Texas Task Force 1, the state of the art at the time was walking around with a waterproof box full of paper and pencils and we would write about what we'd find," said Toups.

Toups' experiences led to his current research working on human computer interfaces.

After receiving one National Science Foundation award for nearly \$500,000, Toups recently received an NSF CAREER award for related research.

"Although Dr. Toups is already succeeding in his young research career, receiving a prestigious NSF CAREER award will give him the extra boost to fully establish his exciting and productive research group," said Jonathan Cook, department head for computer science in the College of Arts and Sciences.

Toups, an assistant professor in computer science, received the five-year NSF CAREER award of more than \$132,000 per year to study wearable computers that may someday help urban search and rescue teams to work more effectively.

"Working closely with the Texas Task Force 1 response team, the project team will create custom-built wearable systems to support their mission as well as purpose-built mixed reality training simulations that combine virtual simulation with physical-world settings," Toups said. "The team will closely collaborate with its existing task force partners, using observation of their existing training practices and interviews with task force leaders to develop models of task force training requirements and design considerations for wearable systems to support them. These will be disseminated both to disaster response teams and the human computer interface community."

In Toups first NSF grant in which he is collaborating with computer science professor Son Tran and psychology professor Igor Dolgov, the team is focused on the use of drones. The aim is to consider how wearable computers can support urban search and rescue contexts as science advances to move from multiple humans piloting one drone to one human directing many drones. Both projects go hand in hand.

"They are complementary projects," Toups said. "The first NSF grant covers wearable interfaces for drone teams, while the CAREER grant covers wearable interfaces for human teams in search and rescue. I expect drone piloting to be one use case in the future of search and rescue but not our only use case. I also expect there to be work around wearable designs in general that will transfer between the two projects, as well as equipment and software."

NSF CAREER awards support junior faculty who exemplify the role of teacher-scholars through the integration of education and research. Toups' CAREER award will help him develop courses and outreach activities for NMSU students including projects based on a human computer interface class.

"With the support of this grant, I also plan to create outreach activities for Dona Ana Community College to expose students from underrepresented groups to research and allow them to work with advanced computing technology," Toups added.

Ultimately, Toups hopes his research will lead to a design catalog of existing interfaces and best practices for designing wearable and mixed reality interfaces that will guide the design of both wearable interfaces and training simulations for disaster response.

"The team will validate those simulations with the disaster response partners and use them to test and improve both the wearable technologies and the design guidelines the team creates," Toups said. "Both the work itself and the lessons learned will be used to improve classes at NMSU."

Toups is among several faculty members in NMSU's Department of Computer Science to receive NSF Awards in the last year.



Enrico Pontelli has accepted an appointment as dean of the College of Arts and Sciences at New Mexico State University.

Photo by Darren Phillips

Pontelli Named Dean of Arts and Sciences College at NMSU

By Minerva Baumann
(reproduced from the NMSU News Center)

A New Mexico State University Regents professor with nearly two decades of service to the university was selected to become dean of the College of Arts and Sciences. Enrico Pontelli has accepted the appointment after serving as interim dean of the college since February of last year.

“Dr. Pontelli is a highly respected researcher and teacher with a deep understanding of New Mexico State University and great confidence in the future of the institution,” said NMSU Executive Vice President and Provost Dan Howard. “He has a clear vision for the college and is committed to advancing its research, teaching and service mission. I look forward to helping him achieve his goals for the college.”

Pontelli was interim associate dean for planning and academic resources in the college for two years prior to being named interim dean of the college in 2016. He served as head of the Department of Computer Science for five years, during which he led the department on a path of growth. He is also an alumnus, earning his Ph.D. in computer science from NMSU in 1997.

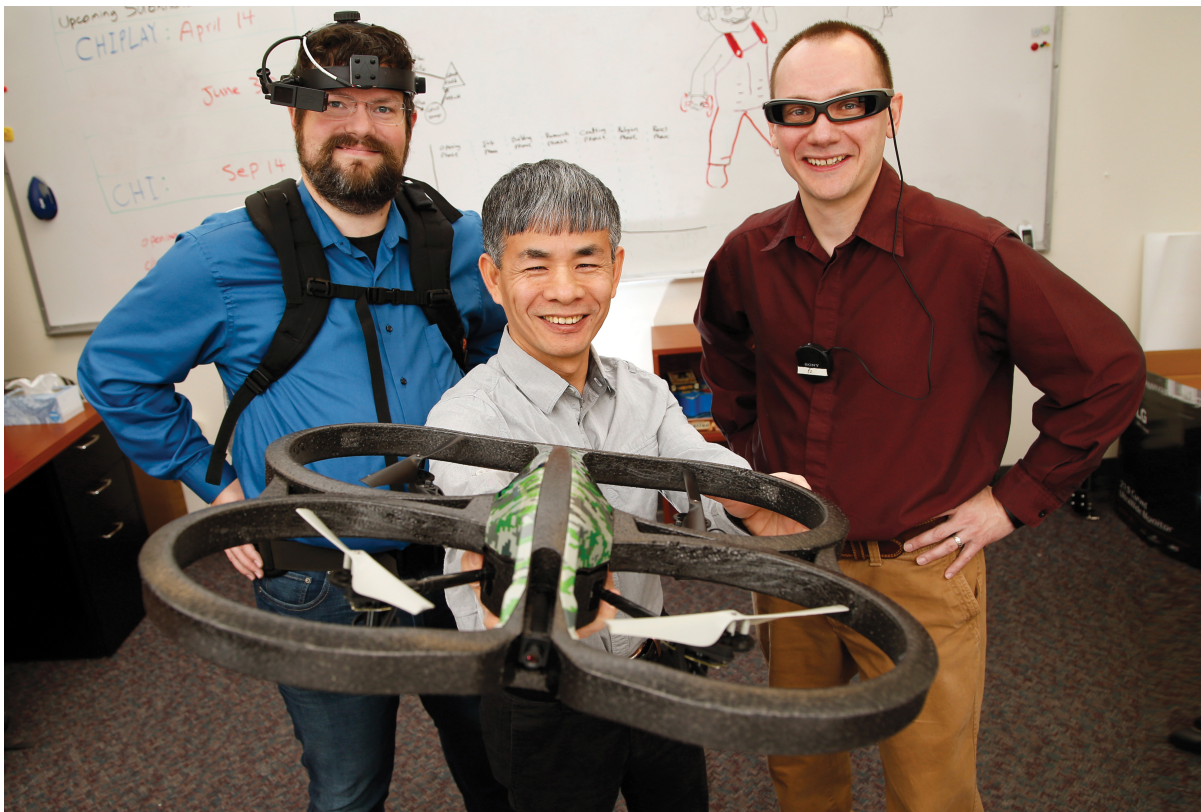
“I am a proud Aggie,” Pontelli said. “This institution has given a lot to me and the reason I want to do this is to give back to NMSU. I see the college as a team with a shared vision helping each other to serve our students.”

Pontelli’s research interests are in the general area of artificial intelligence, high performance computing, assistive

technologies and bioinformatics. He has published over 250 peer-reviewed papers in international venues and secured over \$14 million in funding for his research.

Community outreach is important to Pontelli. He is the founder of the university’s Young Women in Computing program, which has reached more than 14,000 students and raised the visibility of NMSU in the computer science education community.

“I have started a number of initiatives that I want to continue,” Pontelli said. “The college is strong and has incredible faculty and staff. We have challenges to face, but they are not insurmountable. In the months and years ahead, I believe we can work together to forge a new kind of graduate for the 21st century.”



From left:
Zachary Touns,
Son Tran, and
Igor Dolgov.

Photo by Andres Leighton

NMSU Research on Wearable Computers may Save Lives of First Responders

By Minerva Baumann
(reproduced from the NMSU Panorama)

The next generation of drone controls is the focus of new research at New Mexico State University, thanks to a nearly \$500,000 Cyber Human Systems award from the National Science Foundation.

Three NMSU scientists in the College of Arts and Sciences – Zachary O. Touns and Son Tran, computer science professors, and Igor Dolgov, psychology professor – are working together on the grant. The aim is to consider how wearable computers can support urban search and rescue contexts as science advances to move from multiple humans piloting one drone to one human directing many drones.

“With this project, my hope is that we can really impact future disaster response practice and employ games for design, rather than training,” says Touns, the principal investigator for the grant. Tran and Dolgov are co-principal investigators.

The project uses simulated drones supporting game players moving in the physical world as a way to design these wearable interfaces.

Their experiments over the next three years could someday lead to wearable computer equipment that would allow urban search and rescue teams in disaster zones to direct multiple drones with the wave of a hand or a few taps on a wrist device.

“Wearable systems don’t lend themselves to complex controls because they have to fit on the body and be accessible,” Touns says, adding that as the drones become smarter, they can have less input from the humans, which opens up the possibilities for the type of wearable interface the NMSU team of scientists is designing.

“You can imagine someone in treacherous terrain who needs to work with drones but needs to have their hands free in the environment to move safely,” Touns says. “Ideally, you envision the scenario where a group of drones provides intel but is smart about when they bother the human user.”

Right now, operating drones in U.S. airspace is a complex process, which requires more than one person operating each drone. Wearable interfaces currently available are often used for training and virtual reality games, but not to direct live operations.

With the NSF grant, Touns, Son and Dolgov will begin building and testing wearable cyber-human system designs that use virtual drones simulating adaptive autonomy in a video game environment.

“This grant is about studying the systems using games,” Touns says. “We want to make something that is compelling and interesting that people want to play with, and from that experience, we learn how best to use it.”



Courtesy Photo



NMSU Computer Science Outreach

By Rebecca Galves

CS Outreach experiences another year of record impact through the combined efforts from the Center for Smart Grid Technology (iCREDITS), Discovering Science through Computational Thinking (DISSECT) program, and the Young Women in Computing (YWiC) program. All 3 groups are funded by the National Science Foundation (NSF) and include outreach emphases that directly impact over 3,000 students at the K-12 levels.

iCREDITS outreach strives to introduce concepts of CS with the integration of sensors, power management and energy movement, in conjunction with our national power grid system. Over 1,100 students participated in the after-school program offered at middle schools throughout Las Cruces in 2016-17, and engaged in hands-on project development activities that explored personal impact on the grid, power management ideas for their homes, and the impacts of energy supply and demand.

DISSECT integrates undergraduate CS fellows in Las Cruces Public School (LCPS) classrooms, where they work with K-12 teachers to integrate concepts of computer science and computational thinking into traditional curricula. During

2016-17, approximately 200 students integrated computational concepts as dynamic instruments of scientific reasoning and problem solving in STEM disciplines, such as biology, mathematics, and engineering.

YWiC seeks to broaden the impact of CS on underrepresented groups, by introducing computing concepts in fun, engaging, and challenging ways that promote continued engagement and exploration. During the school year, YWiC hosts teams in competitions, after-school programs, supports field trip visitors, coordinates conferences, and organizes showcases. Over the last year, YWiC brought CS to over 2,000 young women and men through informal education and outreach experiences. Only the exceptional YWiC summer camps provide girls-only programming, and have just completed a remarkable 12th year of engaging young women in CS.

As a team, CS Outreach connects with over 3,300 students each year, of which over 70% are from underrepresented minority groups. CS Outreach closely mirrors the ethnicity breakdown of LCPS, whereas 75% identify as Hispanic, and female to male participation is close to 50-50.



Recent Ph.D. Graduates

Onwards to Make a Difference in the World!

By William Yeoh

Please join us in congratulating Drs. Chuan Hu (right in photo above) and Ping Hou, who successfully defended their Ph.D. dissertations in the previous 2016-2017 academic year.

Dr. Hu's dissertation is on "Discovering Influence Relationships from Graph Structured Data" and he is advised by Dr. Huiping Cao (left in photo above). He is currently a software engineer at Microsoft.

Dr. Hou's dissertation is on "Probabilistic Planning with Risk-Sensitive Criterion." He is advised by Dr. William Yeoh and is currently a software engineer at Uber.

When asked for their advice to current and aspiring graduate students, Hu shared three nuggets: (1) that they should "read a lot from top venues in their domains in the first several years"; (2) that they should "keep their advisors updated in order to avoid going in the wrong direction"; and (3) that they should "keep in mind that selling their research to others is critical to their academic careers!"

OUTSTANDING STUDENT AND FACULTY AWARDS FOR 2016-17

Outstanding Teaching Assistant Awards

Samuel Djiani
(Fall 2016)

Spencer Barnes
(Spring 2017)

Outstanding Research Assistant Awards

Reza Tourani
(2016 - Ph.D.)

Hitesh Nidhi Sharma
(2016 - M.S.)

Outstanding Graduate Faculty Award in Teaching

Hing Leung (2016)

Outstanding Graduate Faculty Award in Mentoring

William Yeoh (2016)
Jonathan Cook (2016)

Support NMSU CS

We Need You!

If you are an alumnus or alumna, current student, or just a friend of the NMSU CS Department, and you would like to support our activities and mission – Thank You! There are many different ways to give back to the department.

The simplest way is to make a donation. Your donation will support the students pursuing their educational dreams, through scholarships, renovation of equipment and acquisition of materials and supplies. You have also the option of supporting our faculty members, enabling them to be more effective in their research and educational efforts. In particular, we are launching a new campaign at creating new opportunities to help young women interested in pursuing studies in Computer Science.

Your donation is tax deductible and even a small contribution will make a big difference! Donations can be made using the online NMSU donations system at fndforms.nmsu.edu/giving.php.

The following are some of the funds that you can contribute to:

- Young Women in Computing
(Supporting outreach efforts to attract women to computing)
- Mark Nesiba Memorial Endowed Scholarship for Women in Computing
(Supporting a talented undergraduate woman in Computer Science)
- Richard H. Stark Scholarship
(Supporting outstanding undergraduate CS students)
- Founders' Endowment Fund
(Supporting faculty in the CS department)
- General Scholarships Fund
(Supporting outstanding undergraduate and graduate CS students)
- Equipment and Maintenance Fund
(Supporting the CS department in renovating its infrastructure)
- Software and Educational Materials Fund
(Providing students with funds to acquire software and other educational materials)
- J. Mack Adams Fund
(Supporting the establishment of an endowed professorship in CS)

DONATION TIERS

< \$64	NMSU CS Friend
\$64 – \$128	NMSU CS Supporter
\$128 – \$256	NMSU CS Contributor
\$256 – \$512	NMSU CS Sustainer
\$512 – \$1,024	NMSU CS Champion
> \$1,024	NMSU CS Hero

Donors will be acknowledged
in the newsletter and on our website.

Recent Publications

What Your NMSU CS Students And Faculty Members Have Been Up To

- C. Hu, H. Cao, Q. Gong.** Sub-Gibbs Sampling: a New Strategy for Inferring LDA. *Proc. Int'l Conf. on Data Mining*, 2017.
- M. Biswal, S. Brahma, **H. Cao.** Supervisory Protection and Automated Event Diagnosis using PMU data. *IEEE Trans. Power Delivery*, 31(4), 2016.
- J. Gardea, Y. Jin, H. Badawy, J. E. Cook.** Performance Evaluation of Mesh-Based 3D NoCs. *Proc. ACM Workshop on Network-on-Chip Architectures*, 2017.
- O. Aaziz, U. Panthi, J. E. Cook.** YAViT (Yet Another Viz Tool): Raising the Level of Abstraction in End-User HPC Interactions. Workshop on Monitoring and Analysis for High Performance Computing plus Applications, 2017.
- K. Alshammari, I. V. Pivkina.** Relationship between Time Management in Courses with Online Interactive Textbooks and Students' Performance. *Proc. IEEE Frontiers in Education Conf.*, 2017.
- I. V. Pivkina.** Peer Learning Assistants in Undergraduate Computer Science Courses. *Proc. IEEE Frontiers in Education Conference*, 2016.
- R. Sharma, S. Kumar, H. Zhong, M. Song.** Simulating Noisy, Nonparametric, and Multivariate Discrete Patterns. *The R Journal* (to appear).
- H. Nguyen, S. C. Tilton, C. J. Kemp, M. Song.** Non-monotonic Pathway Gene Expression Analysis Reveals Oncogenic Role of p27/Kip1 at Intermediate Dose. *Cancer Informatics* (to appear).
- I. Dolgov, E. K. Kaltenbach, **A. S. Khalaf, Z. O. Toups.** Measuring Human Performance in the Field. *Human Factors in Practice: Concepts and Applications*, 2017.
- A. Barin, I. Dolgov, Z. O. Toups.** Understanding Dangerous Play: A Grounded Theory Analysis of High-performance Drone Racing Crashes. *Proc. CHI PLAY*, 2017.
- M. Zheng, J. Tucek, F. Qin, M. Lillibridge, B. W. Zhao, E. S. Yang.** Reliability Analysis of SSDs under Power Fault. *ACM Trans. Computer Systems*, 34(4), 2016.
- Y. Shi, D. V. Murillo, S. Wang, J. Cao, M. Zheng.** A Command-Level Study of Linux Kernel Bugs. *Proc. Int'l Conf. on Computing, Networking and Communications*, 2017.
- R. Tourani, S. Misra, T. Mick, G. Panwar.** Security, Privacy, and Access Control in Information-Centric Networking: A Survey. *IEEE Communications on Surveys and Tutorials* (to appear).
- T. Mick, R. Tourani, S. Misra.** LAsER: Lightweight Authentication and Secured Routing for NDN IoT in Smart Cities. *IEEE Internet of Things Journal* (99), 2017.
- S. C. Tran.** Answer Set Programming and Its Applications in Planning and Multi-agent Systems. *Proc. Int'l Conf. on Logic Programming and Nonmonotonic Reasoning*, 2017.
- T. Le, S. C. Tran, E. Pontelli, W. Yeoh.** Solving distributed constraint optimization problems using logic programming. *Theory and Practice of Logic Programming*, 17(4), 634–683, 2017.
- F. Fioretto, **W. Yeoh, E. Pontelli.** A Multiagent System Approach to Scheduling Devices in Smart Homes. *Proc. Int'l Conf. on Autonomous Agents and Multiagent Systems*, 2017.
- S. Hug, **E. Pontelli, R. Cota, S. Eyerman.** Learning and Identity in YWIC: An Analysis of Program Implementation and Design as Promoting Agency in Computing. Special Interest Group on Computer Science Education, 2017.

Contact Us

If you are an alumnus or alumna of the NMSU CS Department, we want to hear from you! Let us know what you are doing so we can share your successes.

Please join our Facebook page (facebook.com/NMSUCS) and follow us on Twitter (twitter.com/NMSUCS) and help us develop a community of NMSU CS Alumni and Friends. If you are in the neighborhood, please come by and visit! Or simply send us your ideas: your experience is valuable to assist with development, to help our students connect with alumni and potential employers, and to grow into a bigger and stronger department.

Send your contact information, news, and suggestions to:

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