A YEAR IN REVIEW

2017 2018

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COLLEGE OF ENGINEERING

NAVIGATING ICY WATERS

Due to new shipping routes through icy areas, high-fidelity propeller and ice interaction is being researched by UNT mechanical and energy engineering assistant professor, Hamid Sadat, graduate student, Morteza Heydari, and engineering technology interim chair and professor, Seifollah Nasrazadani.

“One of the major concerns for ships operating in icy water is the extreme loads applied to the propulsion system due to propeller-ice interaction. Current literature predictions on the propeller-ice interaction are mainly based on specific measurement data or empirical models and not very accurate,” Sadat said.

With ice melting at a quick pace, transportation across the sea has changed. New routes have decreased the travel and shipping distances, which allow ships to consume considerably less fuel, speed up trade and reduce undesirable environmental impacts.

The aim of the team’s study is to develop advanced numerical techniques to accurately simulate the interaction between a ship’s propeller and the ice along the routes and gain an understanding of the complex physics involved in this process.

“Some of what we’ll be looking at from the materials perspective would be the selection of the propeller material – which is cost effective, durable and resistant to cracking – and developing a coating that would allow the propeller material to survive in extreme environments,” Nasrazadani said.

The team has divided the simulation into three parts in order to develop a proper model and validate their results between stages.

“The first part is open water simulation where we only have the propeller and no ice,” Heydari said. “Then, after that, we add the ice part to our solution domain, and lastly, we want to add more details to our assumptions where we have both propeller and ice. Currently, we are in the second stage.”

The difficulties that they’ve encountered include modeling the brittle ice structure.

“The model we have for the fluid field is perfect, but once you add ice, the physics cannot be captured well,” Sadat said.

After they move on to the final stage, it will be possible to investigate other factors such as erosion on the propeller surface due to contact with ice blocks.

Kristal Jacobs

MAKING CONNECTIONS IN CYBERSECURITY, ANALYTICS

UNT College of Engineering hosted its first Cybersecurity Summit on Oct. 27, 2017, and its first Data Analytics Summit on May 4, 2018, at the John Q. Hammons Center in Allen. The summits will be hosted annually as a part of the College of Engineering's initiative to showcase insights from the industry, research and academia.

"The goal of these summits is to engage the college and members of industry in further dialogue about the future of engineering and technology," said Yan Huang, interim dean of the college.

The Cybersecurity Summit included keynote speeches from Armor Chief Security Officer, Jeff Schilling, and Vice President of Enterprise Cybersecurity Threat Detection, Daniel Shnowske, while the Data Analytics Summit included keynote speeches from CEO of Lone Star Analysis Steve Roemerman and CEO of Lease Analytics Tom Agnew.

Connecting on cybersecurity topics

As the first program in the U.S. to be federally certified by the National Security Agency as a Center for Academic Excellence in information assurance, education and research and cyber defense research, UNT College of Engineering hosted 125 people at the one-day Cybersecurity Summit. During the summit, Schilling delivered his keynote speech focusing on his journey and experiences within the cloud, while Shnowske spoke on trends in the industry and how Fidelity Investments was tackling the latest cyber threats.

"There are still those out there who will question the security of the cloud and write it off as too high-risk," said Schilling. "Over the course of my career, I've become a firm believer that your workloads are safer residing within the cloud, should users abide by the shared security and compliance model that makes those reliant on it accountable for its security. I'm honored to be included amongst so many notable industry experts on a topic that has, and will, become more relevant with the progression of the digital transformation."

Through the guest speakers and three panels, the summit addressed the latest cybersecurity topics pertaining to today's business world, including the Internet of Things, network security, big data analytics and wireless security. Panelists included the Department of Computer Science and Engineering Professor Ram Dantu, director of UNT's Center for Information and Cyber Security, Professor Krishna Kavi, director of the Network Centric Systems Center at UNT, and Assistant Professor Hassan Takabi.

Diving into data

At the Data Analytics Summit, Roemerman discussed seven problems and issues that should be addressed as part of maturing and defining data analytics, while Agnew tackled the many issues associated with oil and gas leases and the roles natural language processing and deep learning play in mining thousands of documents.

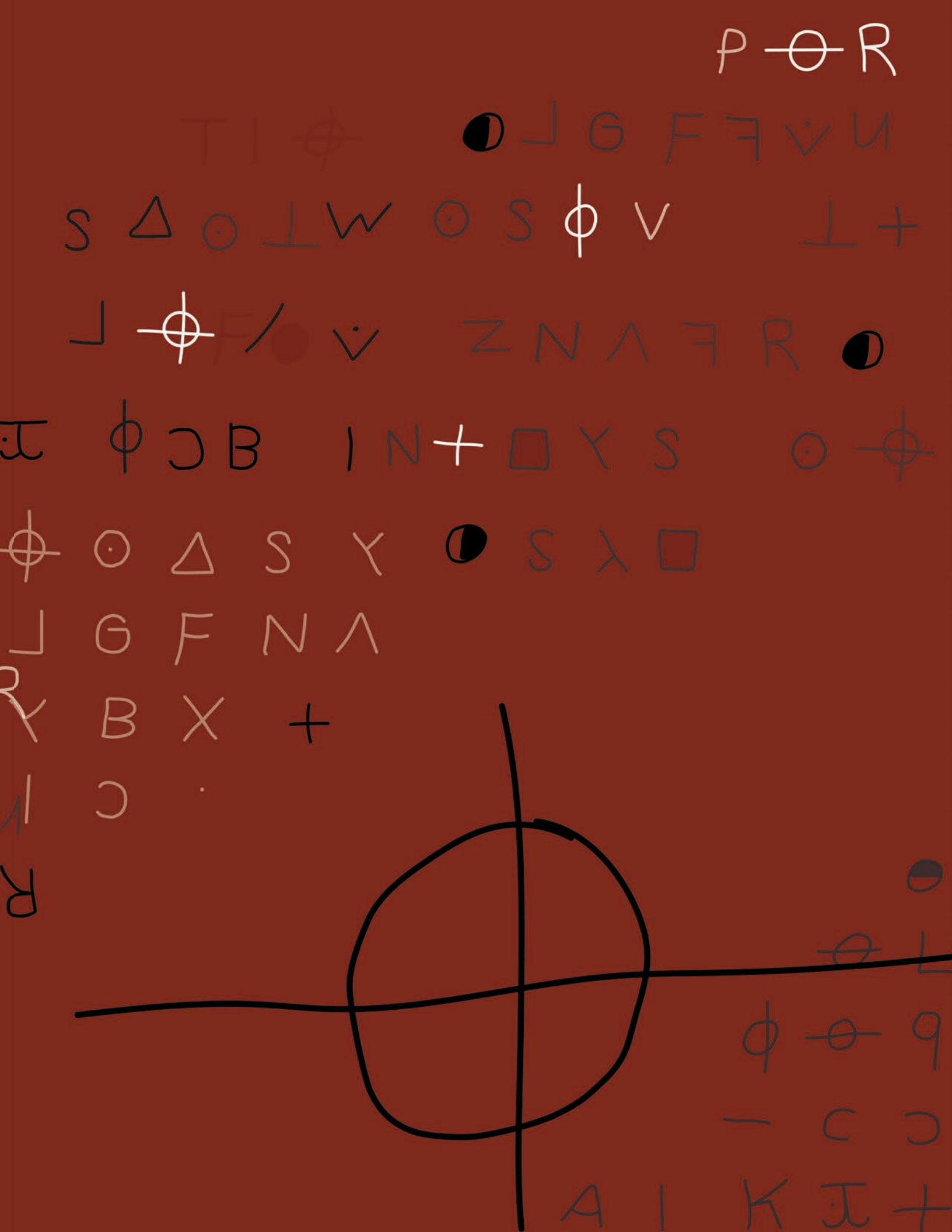
The one-day summit hosted 60 people and addressed the latest data analytics topics, including state-of-the-art analytical/machine learning methods, business and intelligence applications and future trends. Panelists from Verizon, Walmart Technology, UPS, Armor and the U.S. Army Research Laboratory also provided insight into how they are using and integrating data analytics into their daily operations.

"Our goal for the summit was to facilitate a discussion and inform participants about the current state of analytics, and I think we did just that," said Thomas Derryberry, assistant dean of corporate relations for the College of Engineering.

Kristal Jacobs

FEATURES

SOLVING THE ZODIAC KILLER CIPHER



To aid in solving a decades old cipher to help reveal the infamous Zodiac Killer's identity, University of North Texas computer science and engineering professor, Ryan Garlick, joined a five-member code team in a special series, "The Hunt for the Zodiac Killer," that premiered in November 2017 on the History Channel.

The Zodiac Killer

The Zodiac Killer terrorized northern Calif. in the late 1960's and early 1970's. It has been confirmed that he killed at least five people, but he claimed to have killed up to 37 people in the letters and postcards he sent to local newspapers and law enforcement. The killer would taunt law enforcement and the public in the letters.

In July 1969, the Zodiac Killer sent his first letters to the Vallejo Times-Herald, San Francisco Examiner and the San Francisco Chronicle claiming responsibility for two shootings and providing specific details about the murders. Accompanied by the information, he included a cipher split into three parts for each newspaper and a threat to kill again if the cipher was not published by the newspapers. The cipher was solved within a week by a couple at their breakfast table. The cipher began "I like killing people because it is so much fun" and continued with why he liked killing and described his victims as slaves for his afterlife. A few months later, the Zodiac Killer sent another 340 character cipher, "Z340," along with a humorous greeting card. Almost five decades later, the 340 character cipher is still challenging experts like Garlick.

Garlick's Expertise

Garlick began his work on solving the Zodiac cipher because he was always interested in solving puzzles and intrigued by the unsolved Zodiac Killer case. Based on his knowledge and experience of the cipher and coding, Garlick was asked to join the code team for the History Channel series. Garlick, who has had students in his UNT computer science class develop software to try to crack the Z340 cipher, was previously on the 2009 National Geographic documentary "Code Breakers" for his work with the cipher in his class. His paper, "How to know that you haven't solved the Zodiac-340 cipher," is what Garlick believes gained the initial attention from the networks, along with his existing connections to other members of the code team.

In his paper, he discussed the similar patterns of people who believed they have solved the cipher, but likely had not. Using patterns such as a symbol representing multiple letters and anagramming often led to incorrect solutions because these methods allow the possibility of inserting virtually any solution. Garlick thinks they should focus on a consistent pattern.

"All of these people thought they solved the cipher, but unknowingly introduced many degrees of freedom in their solution," Garlick said. "They were really opening up so many possibilities that the solution could be any number of things."

The Hunt for the Zodiac Killer

Garlick was joined on the code team by York College math professor Craig Bauer, Google computer engineer Sujith Ravi, Zodiac expert David Oranchak and University of Southern California computer science professor and the code team leader, Kevin Knight. The show also features Knight's high-tech artificial intelligence called Carmel, which is a super computer that can search through trillions of patterns in the cipher and is programmed to think like the killer.

On "The Hunt for the Zodiac Killer," along with the detectives working on the case, Garlick and the code team were evaluating evidence and other previously unrevealed details to make connections and solve the cipher. In an attempt to recreate the killer's thought process, all known Zodiac writings and code were

plugged into Carmel to look for the language he uses in the cipher. Through the team's software, they could evaluate words and word usage in the evidence database. The software was able to discover common words used and even repeated misspellings, so every detail could aid in revealing the killer's identity.

"The show was unscripted," Garlick said. "They told us a topic; we started talking and they picked out what was interesting."

On the code team, Garlick worked specifically on transpositions of the ciphers. In other words, he looked at the different directions the cipher could be read. Instead of reading left to right and top to bottom, he would look at reading it vertically, in a spiral, or thousands of other possibilities.

Garlick also had two UNT students, TAMS student Julian LaNeve and Ph.D. student Jacob Hochstetler, contributing to the process while on "The Hunt for the Zodiac Killer." Garlick believes working on the Zodiac Killer cipher is a good practical application of algorithms and computer science for students.

"We're not just solving a problem in a textbook," Garlick said. "We have a real problem here that might help solve one of the biggest serial killer cases in history. We can use computers to write software to help us with that."

The biggest challenge for Garlick is how many different possibilities of how the cipher could be read. From the direction the cipher is read to what each character represents to any other minor or major detail, every possibility has to be tried. There is a chance the cipher is in a language other than English. Some theories even say the cipher could be entirely gibberish. However, Garlick doesn't think it is because of linguistic statistics and corrections made by the killer in his ciphers.

"It hasn't been solved in 50 years and the Zodiac liked to taunt the public and police so what better way to do it than to send something that you knew they would work on forever," Garlick said. "But there are some things that indicate that it is not gibberish. Some of the statistics of the cipher itself, once transposed - it doesn't look like random symbols."

Join the Hunt

For those who want to contribute to solving the case and cipher, Garlick's advice is to "keep at it." He believes the internet community working on the case have contributed to it greatly. He says that more people working on the case results in more diverse viewpoints and ideas being contributed to the case.

"There is a really great community of people working on it that have uncovered amazing things," Garlick said. "They've uncovered comic books that he clearly referenced in his communications to the police. Just knowing that he had this comic book gives us a year range; we might find a subscription list for that comic book."

Garlick encourages anyone interested in the Zodiac Killer case and coding to watch "The Hunt for the Zodiac Killer" on the History Channel and join the online communities. He recommends looking at message boards to learn more about the case and going to the website, zodiackillerciphers.com, to use the tools David Oranchak has created for exploring and experimenting with statistics and patterns of the cipher text.

"The number of people the internet can bring to work on this is incredible and very helpful," Garlick said. "The more people we have in the community to look at it, the greater the chance someone is going to come up with something."

Kristal Jacobs

STEM @ THE PARK
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The UNT College of Engineering hosts STEM@thePark events to give local youth to learn about science, technology, engineering and mathematics (STEM) principles in a hands-on environment at the Discovery Park Campus.

STEM@thePark began under the name Design Your World, a daylong outreach program for girls in grades 4-12 that was co-hosted by UNT's Society of Women Engineers and the Society of Women Engineers Dallas chapter in 2016.

"I was the VP for Outreach of Dallas SWE and hearing how exceptionally our students led and organized the daylong event inspired me to create a program that could be led by UNT," Associate Dean of Undergraduate Studies Nandika D'Souza said.

The first official STEM@thePark event, co-organized with West Point LEADS, hosted more than 200 high school students Nov. 11, 2017.
During STEM@thePark, there are a variety of activities that enable K-12 students to get hands-on engineering and leadership experience. Through projects like robotics, ballistics, construction and drones, students acquire a comprehensive view of the many fields of engineering. Students learn principles, cause and effect, parameters of the design and then work towards the solution in interactive ways.

"While the solution is just as cool and cutting edge, we explore the joy of thinking and cognitive experiences," she said.

The activities are led by many UNT diversity organizations, honor societies and professional technical organizations. Since projects are organized by UNT student organizations, K-12 students are able to engage with them and learn more about what it's like to be a UNT student.

"We mix race, gender and cultural diversity into each volunteer group so that every design has role models for students to identify with even as they gain courage and experience in solving problems," D'Souza said.

Kristal Jacobs

ALUMNI

Biomedical engineering major Ashton Baltazar started her academic experience in the public school system before entering a fine arts charter school for high school. There, she found herself surrounded by peers who play instruments, dance and write creatively. But she was more interested in discovering the "how" and "why" things work.

So instead of pursuing college degrees in the fine arts like her peers, Baltazar wanted to grow the opportunities females had in STEM degrees.

"With the help of some school faculty, I developed the National Science Honor Society to help broaden STEM subjects, student projects and my own personal interest in the fields of math and science," Baltazar said.

The summer of her senior year, she began volunteering at a local hospital where she discovered the many ways math and science added value in health care. She was given the opportunity to follow an orthopedic surgeon into the operating room and observed patients receiving total joint replacements.

"It was during this time I realized how necessary the utility of innovation was as I observed the mechanisms of the instruments used in the operations," Baltazar said. "The joints that were being replaced and the mechanics behind the techniques of the surgeon all relied heavily on engineering designs."

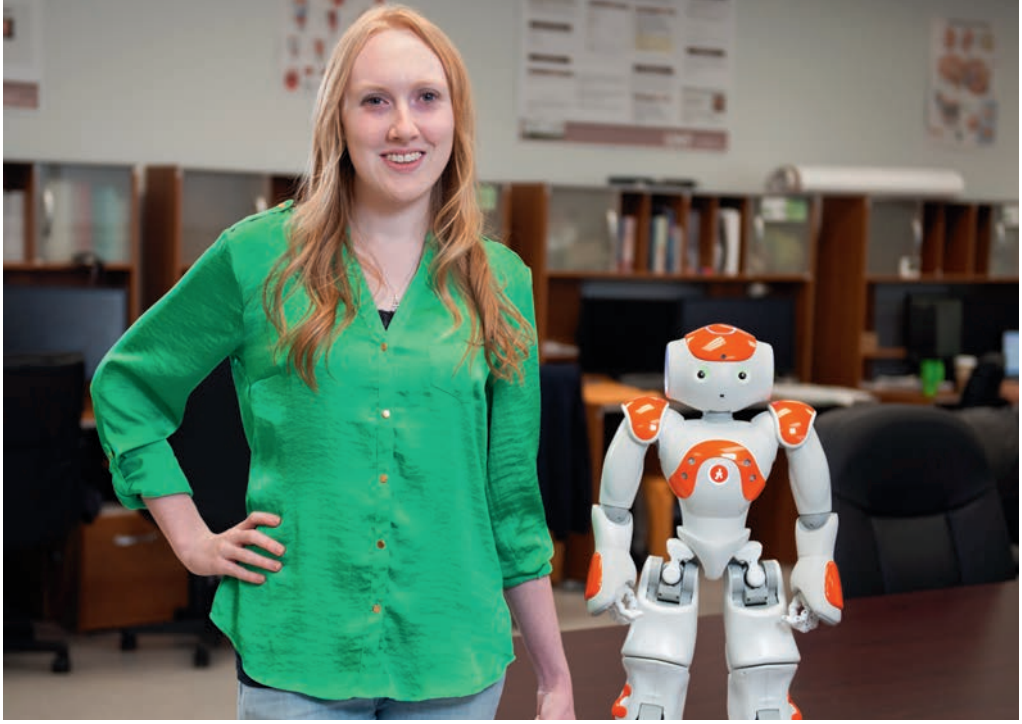
After many college tours, scholarships from fine art universities she'd turned down, and her parents' support in passion to study math and science, Baltazar made the decision to join UNT's new biomedical engineering program. This program allowed her to continue graduate work in a STEM field and provide a strong academic basis for pursuing medical school.

While at UNT, Baltazar was involved with numerous student organizations including the Biomedical Engineering Society, UNT student alumni and Zeta Tau Alpha Panhellenic Sorority. She also continued to volunteer with local hospitals and community activities in her spare time.

"I was a very busy student on top of working part time and minoring in mathematics, biology and chemistry, but it was extremely fulfilling, and I never regretted my decision to major in biomedical engineering," Baltazar said. "I owe my perseverance to the University of North Texas biomedical engineering department for pushing me through my shortcomings from when I first started," Baltazar said.

Kristal Jacobs

ASHTON BALTAZAR



NATALIE PARDE

Recent College of Engineering doctoral graduate, Natalie Parde, has been a consistent face in the Department of Computer Science and Engineering. Not only did she receive her Ph.D. in computer science and engineering in August at UNT, but she also received her bachelor's and master's degrees in computer science at UNT in 2013 and 2016.

A lot of Parde's time at UNT was spent in the Human Intelligence and Language Technologies Laboratory (HiLT) where she pursued her research interests in natural language processing with an emphasis in human-robot systems, computational processing of creative language and grounded language learning. The research allowed her to work with HiLT's companionbots, Grace, Bobby and Banlu.

"I was afforded a lot of flexibility to explore different projects and applications that really resonated with me, and I'm very grateful for that," Parde said. "My dissertation work combined aspects of computer science, linguistics and psychology to create a reading robot companion for elderly adults."

In 2014, Parde was awarded the National Science Foundation Graduate Research Fellowship for her work researching natural language processing, which advances how computer systems understand and interact with how humans speak and write.

"I was extremely happy to receive it, because not only did it mean I'd have more flexibility to pursue my personal research interests in the coming years, it also helped increase visibility for UNT," Parde said.

While at UNT, she received a number of other external and internal awards, co-authored 19 publications and spoke about her research at a variety of national and international conferences. Parde also was part of many student and professional organizations, participated in various outreach programs and even mentored UNT and TAMS students. As president of the UNT's Women in Computing student organization, her favorite memories include the women in computing book clubs and attending the Grace Hopper Celebration of Women in Computing.

"There really aren't a ton of women in STEM fields, and particularly in computer science and engineering, so it was awesome being able to build a cool, supportive community of peers interested in two of my passions: computer science and STEM diversity," Parde said.

After graduating from UNT, she accepted a position as an assistant professor of computer science at the University of Illinois at Chicago.

"In the long-term, I'd like to become a leading figure in AI and natural language processing research and mentor students who go on to do the same," Parde said.

Kristal Jacobs