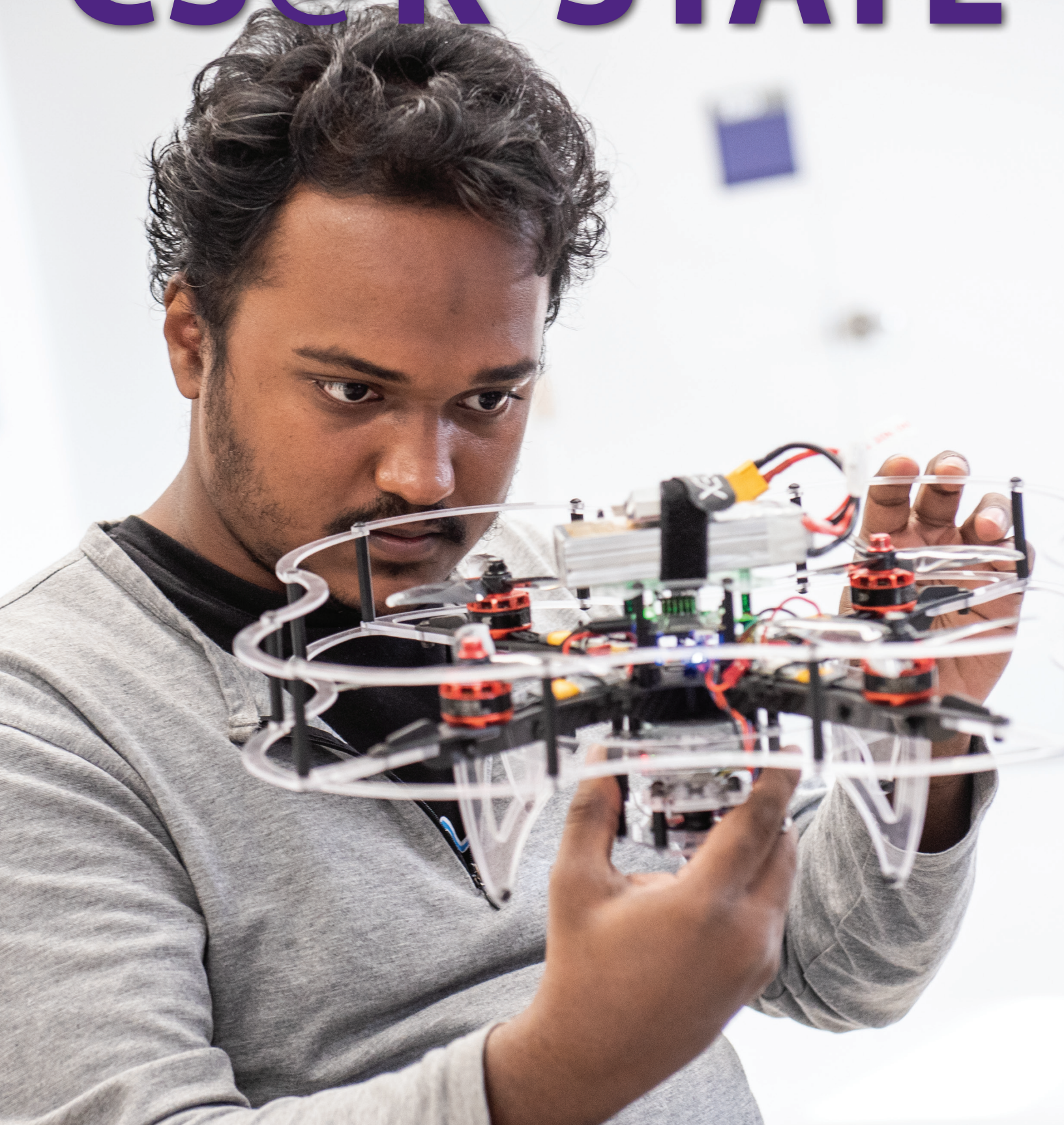


CS@K-STATE



CS@K-STATE

Summer 2022

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Students collaborating at a computer.

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Department of Computer Science

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@KStateEngg

From the Department Head

We just finished the spring semester, and it was literally a breath of fresh air. No masks, full use of classroom capacities and much more activity! K-State sports drew its normal raucous crowds, the shows returned to McCain and students were all over campus. I had forgotten how much I enjoyed the student energy in the building and on campus.

We are starting to see a turnaround in our student enrollment numbers. We are expecting to see our first increase in freshman enrollment since 2019. We also continue to graduate near record numbers of new computer scientists with 112 in 2020-2021 and more than 100 in 2021-2022.

A long-time favorite professor is retiring this summer. Masaaki Mizuno is retiring after 36 years of award-winning service to the department. Over the years, Masaaki taught many subjects. You may remember him from your distributed computing, operating systems, real-time systems, software architecture or computer architecture class. He will certainly be missed!

But, even as we say goodbye, we welcome a new faculty member as well! Hande McGinty will be joining the department as an assistant professor this fall. McGinty received a master's from Eastern Michigan University and a doctorate in computer science from the University of Miami. While she spent the last few years in industrial and academic research, her goal has always been to be a professor, following in the footsteps of both her mother and father. Her research interests include analysis and representation of big data, biological networks in bioinformatics tools, clustering algorithms and bioinformatics algorithms. We are very excited to have her!

Spring break 2022 also marked our first computer science study abroad trip to Prague in the Czech Republic. While there, the students visited Czech Technical University, local companies and several local historical sites. The trip was led by professor Dan Andresen and advisor Kelly Beikmann. Everyone had a great time, and we are looking to expand our study abroad trips next year.

The Computational Core program — our program to teach computer science to non-computer scientists — is going strong.



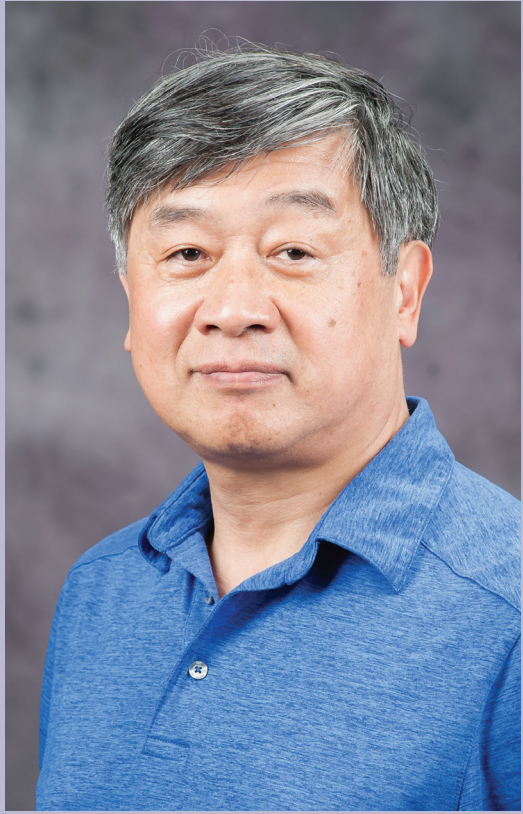
In this issue, we highlight the new integrated computer science, or ICS, program that started last fall. In its inaugural year, we had 12 students in the program. However, there are already 42 students enrolled in the program for this fall, with half of those being enrolled online.

We are also excited to announce that starting this fall, the department will offer a full-fledged cybersecurity bachelor's degree. A unique aspect of the degree is that if a student satisfies all the requirements of a cybersecurity degree, they will automatically satisfy the requirements of our existing computer science degree as well. Thus, students will be able to graduate with both degrees at the same time!

Overall, this year was quite memorable. But most importantly, we continue to produce great computer scientists who are in demand by industry. Yet another reason why it's a great day to be a K-State computer scientist!

Scott DeLoach
Department head and professor

Masaaki Mizuno retiring after 35 years



*After 35 years of dedicated service, **Masaaki Mizuno**, professor of computer science, will retire on Aug. 5.*

Mizuno obtained his bachelor's and master's degrees in electrical engineering at Keio University in Japan as well as a secondary master's in computer science from Pennsylvania State University. He graduated with his doctorate in computer science from Iowa State University in 1987. Later that year, he joined Kansas State University as an assistant professor of computer science.

From 1987 to 2022, Mizuno served as an assistant, associate and full professor in the computer science department. During his tenure, Mizuno taught several core undergraduate- and graduate-level computer science courses. He was also active in research, advising four doctoral students and numerous master's students. Mizuno's research interests are in the areas of distributed computing, synchronization, operating systems, real-time embedded systems and cybersecurity systems. His research projects have been funded by the National Science Foundation, U.S. Department of Defense, U.S. Department of Homeland Security, the French Institute for Research in Computer Science and Automation, and private industry.

Mizuno's research was always focused on the integration of theory and implementation. During the 2006-2007 academic year, he took a sabbatical leave to work at Hitachi Ltd. in Japan, where he installed a real-time operating system for Hitachi's vehicle dynamic control system, which was used in Nissan's luxury division of vehicles, Infiniti. During that time, he also installed a real-time operating

system on the Lego Mindstorms NXT robot kit and made it available through an open-source license. The system is used by many universities in Europe, Asia and the U.S. for real-time embedded systems courses. Mizuno also received the William L. Stamey Teaching Award from the College of Arts and Sciences in 1991 and the Department of Computer Science Undergraduate Teaching Award in 1997.

The Carl R. Ice College of Engineering and computer science department wish Mizuno and his wife, Kyoko, all the best in retirement.



From left to right, top row: Bill Hankley, Rodney Howell, Masaaki Mizuno, Joe Campbell, Dave Schmidt, Virg Wallentine; from left to right, bottom row: Myron Calhoun, Maarten van Swaay, Dave Gustafson, Maria Zamfir-Bleyberg, Beth Unger

De La Torre named 2022 Paul & Daisy Soros Fellow



Amy Chow and Patricia Miranda; U.S. Ambassador to Spain Julissa Reynoso Pantaleón; Stanford AI leader Fei-Fei Li; computational biologist Pardis Sabeti; composer Paola Prestini; Maine Center for Disease Control Director Nirav Shah; Aspiration CEO Andrei Cherny; award-winning writer Kao Kalia Yang; and more than 700 other fellows.

De La Torre spent her childhood in Guadalajara, Mexico. At age 12, she crossed the Mexican border to reunite with her mother in Kansas City, Missouri. De La Torre obtained her associate degree at the Metropolitan Community College in Kansas City in 2015.

By winning various scholarships, De La Torre was able to continue her studies at Kansas State University, obtaining her bachelor's in computer science in 2019, where she first began to marvel at the mysteries of the human mind. While in college, her former high school principal, Thomas Herrera, helped her become documented through the Violence Against Women Act and her college professor, William Hsu, supported her interests in artificial intelligence and encouraged her to pursue a scientific career.

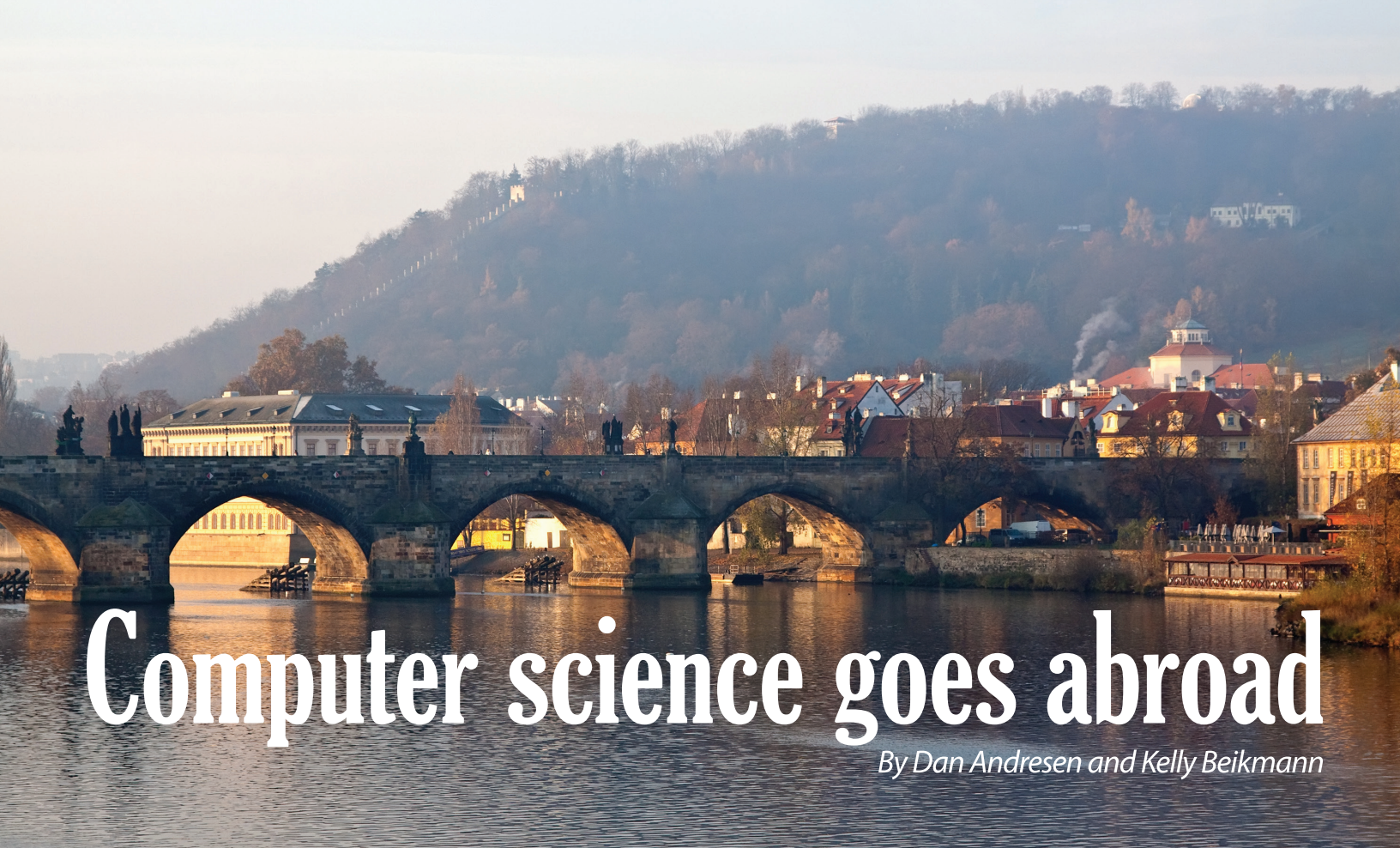
After her undergraduate studies, De La Torre won a two-year post baccalaureate fellowship from the department of brain and cognitive sciences at MIT, where she worked with Professor Tomaso Poggio on the mathematical foundations of deep learning. De La Torre then transitioned into the department's doctoral program, where she is now a graduate student in the laboratories of Professors Josh McDermott and Robert Yang. There, she develops computational models of multisensory perception (how we integrate sound and vision to form a coherent, unitary percept) and imagination (how we consider and plan actions without executing them).

Beyond contributing to scientific knowledge, De La Torre plans to use science to create spaces where people from all backgrounds can innovate and thrive, and has already begun organizing diversity initiatives at MIT. De La Torre has also enjoyed developing some new interests, such as meditation and playing the ukulele.

A computer science undergraduate alumna, **Fernanda De La Torre**, has been named a Paul & Daisy Soros Fellow for 2022. The Paul & Daisy Soros Fellowships for New Americans program supports outstanding immigrants and children of immigrants who are pursuing a graduate education in the United States. They select 30 individuals per year and each receive up to \$90,000 toward their graduate education.

The selection criteria focuses on a student's drive, creativity, intellectual spirit and their commitment to the values at the heart of the United States Constitution and Bill of Rights.

The 2022 fellows will join an active alumni network, which includes U.S. Surgeon General Vivek Murthy; Olympians



Computer science goes abroad

By Dan Andresen and Kelly Beikmann

The computer science study abroad program aims to enrich, empower, engage, encourage and expose students to many opportunities. This year, students went to the Czech Republic for one week during spring break. The trip was recommended for any student in the computer science program and related fields who has been in the program for at least one semester. The benefits of this trip were numerous, allowing students to experience a new country and gain exposure to new experiences and points of view. This opportunity also was a way to make connections that could open doors for their future. The students were accompanied by CS faculty member Dan Andresen and advisor Kelly Beikmann.

All students on the trip were enrolled in CIS 118 for course credit. The purpose of this course is to provide students with a professional development class that teaches them work skills. Traveling abroad provided new opportunities while students navigated their transition to learning about an international institution. This program also benefited our next generation of leaders and the computer science department. At the end of the trip and class, the students prepared a presentation

and paper detailing what they learned on their trip. Their reflection is essential to the trip because it allows the students to compare the differences between culture, professional life and the academic environment of the two countries.

Kansas State University has had a unique relationship with Czech Technical University since 1992. For many years, exchange students from the Czech Republic have received generous scholarships from Joseph Barten-Dobenen, a former professor at K-State. He was also involved in helping to set up Manhattan’s partner city relationship with Dobrichovice, Czech Republic. Brent Holliday, acting director of Education Abroad, said since 2003, K-State has sent 357 students to Czech Tech, while K-State has received 246 students from Czech Tech, often for the full academic year.

“It is by far K-State’s most robust exchange program and has been a fantastic partner for students in engineering, technology and mathematics fields,” Holliday said.

The computer science department continued the relationship by going abroad for one week to see the professional

“It is by far K-State’s most robust exchange program and has been a fantastic partner for students in engineering, technology and mathematics fields.”

— Brent Holliday
Acting Director of
Education Abroad



development opportunities for students as well as Czech Technical University.

During the trip, the students were able to explore Prague and visit Czech Technical University and local companies. Highlights included the opportunity to see Prague Castle, St. Vitus Cathedral, St. George’s Basilica, Old Town Hall with Astronomical Clock, Tyn Church, and the Strahov Monastery and Library. At Czech Tech, the students were given a campus-wide tour and a detailed tour of the Department of Computer Science and the Czech Institute of Informatics, Robotics and Cybernetics, or CIIRK. This tour included attending a FIT lecture and lunch on campus with faculty members from CIIRK. The main presentation was from G2OAT, a research group that focuses on research in discrete optimization. The focus of this group is in computational and combinatorial problems that arise mostly in graph theory, game mechanisms, cooperative and non-cooperative games, and computational social choice theory.

The local tech company that the students visited first is Paralelni Polis. Paralelni Polis is a nonprofit organization

with the legal form of a “society,” where the structure of the company is based on membership. The members of the organization contribute to the running of the project financially or through their own activity. This project combines art, social sciences and modern technology. The income of this company consists of many donors. Our students saw the new technologies, decentralization and cryptarchy in the company. The students also saw how Paralelni operates completely without state participation and how it does not draw any finances from the public.

The computer science study abroad program aims to expose students to new and exciting opportunities, thus enriching their overall undergraduate experience. This professional development trip offered chances for students to learn about a new country and see different types of professional companies in action, all while experiencing a new culture. It helped them develop contacts for future jobs and added valuable international experience to their resume. It also helped them to develop personal responsibility and independence. This unique environment fostered social, academic and professional development.

Trio of noteworthy milestones

Pascal Hitzler, Lloyd T. Smith Creativity in Engineering Chair and professor in the department of computer science at Kansas State University, has been busy collaborating on a variety of projects over the last year, with a trio of noteworthy projects being announced to the public.

KnowWhereGraph released in May

A team of collaborators that includes Hitzler released the KnowWhereGraph, designed to be one of the biggest publicly available knowledge graphs ever, in May 2022.

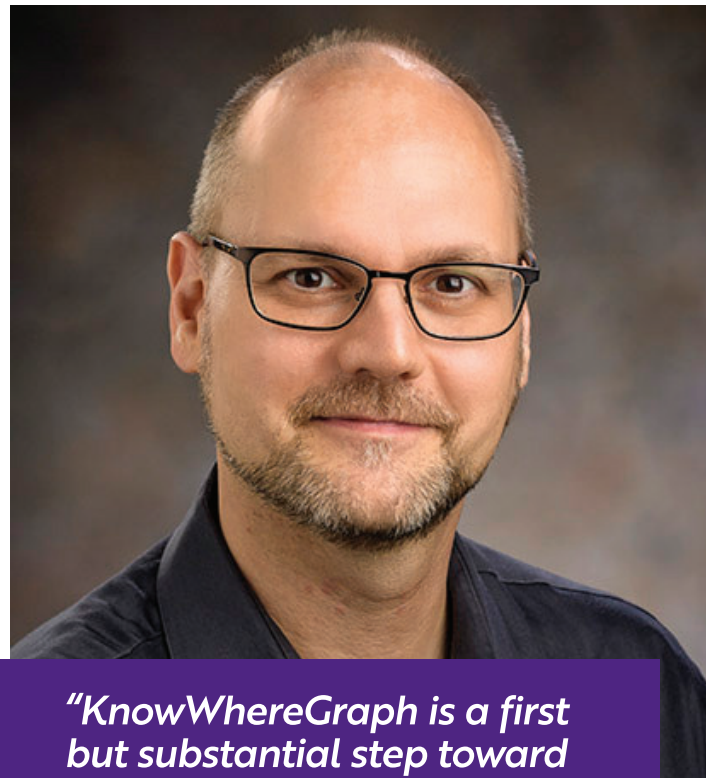
The KnowWhereGraph Project is an open cross-domain knowledge graph and associated toolset that rapidly raises the situational awareness of data scientists and decision-makers by providing detailed area briefings for any place on Earth.

KnowWhereGraph features a set of tools for representing, exploring, visualizing and analyzing human and environment data that are open, cross-domain, deeply integrated and densely connected. At the project's core is the KnowWhere Graph, a geo-knowledge graph that is based on existing standards like RDF, OWL and GeoSPARQL. It incorporates custom ontologies and uses a hierarchical discrete global grid for spatial representations.

Its current size exceeds 12 billion triples or graph statements, and the covered data support pilot scenarios in disaster relief, agricultural land use and food-related supply chains. These data include observations of natural hazards — such as hurricanes, wildfires and smoke plumes — and spatial characteristics related to climate, such as temperature, precipitation and air quality; soil properties; crop and land-cover types; demographics; experts and their expertise; and human health; among others.

Hitzler and Cogan Shimizu, postdoctoral fellow in the K-State computer science department, have centrally contributed to knowledge graph design and construction.

"KnowWhereGraph is a first but substantial step toward comprehensive and easy-to-use publicly available data that is highly relevant to the food system," Hitzler said.



"KnowWhereGraph is a first but substantial step toward comprehensive and easy-to-use publicly available data that is highly relevant to the food system."

– Pascal Hitzler

KnowWhereGraph is funded by the National Science Foundation as part of its Convergence Accelerator program. The team includes members from the following groups:

- Academia, including the lead principal investigator Krzysztof Janowicz from the University of California, Santa Barbara; Kansas State University; Michigan State University; Arizona State University; and the University of Southern California.
- Nonprofit sector, including Direct Relief.
- Industry, including Esri, Oliver Wyman and Hydronos Labs.
- U.S. federal government, including the U.S. Geological Survey and U.S. Department of Agriculture.

Hitzler publishes book on neuro-symbolic artificial intelligence

Hitzler and Md Kamruzzaman Sarker, a Kansas State University alumni and current assistant professor in the computing sciences department at the University of Hartford, announced publication of their edited book, "Neuro-Symbolic Artificial Intelligence: The State of the Art," in February 2022.

This book provides an overview of the development of artificial intelligence in the subfield of neuro-symbolic AI that brings together two hitherto distinct approaches; "neuro" referring to the artificial neural networks prominent in machine learning, and "symbolic" referring to algorithmic processing on the level of meaningful symbols which are prominent in knowledge representation. The two approaches differ significantly in terms of their strengths and weaknesses and, from a cognitive-science perspective, there is a question as to how a neural system can perform symbol manipulation, and how the representational differences between these two approaches can be bridged.

"The book provides a timely overview of the state of the art in the emerging and increasingly important field of neuro-symbolic artificial intelligence," said Frank van Harmelen, professor in the computer science department at the Vrije Universiteit Amsterdam and principal investigator of the Hybrid Intelligence Centre.

Hitzler has been working on neuro-symbolic artificial intelligence since the beginnings of his career. He initiated the annual international workshop on Neural-Symbolic Learning and Reasoning (NeSy), the 16th installation of which will be held in Windsor, England, in September 2022. Besides the above-mentioned book, Hitzler has also co-authored recent overview articles on the topic, including "Neuro-Symbolic Artificial Intelligence: Current Trends" in AI Communications, and "Neuro-Symbolic Approaches in Artificial Intelligence" in National Science Review.

The book is available as an eBook or print version from the publisher, IOS Press.

Hitzler teams with local biological and agricultural engineers on \$6 million NSF grant

Hitzler joined principal investigator Vaishali Sharda, assistant professor in the Carl and Melinda Helwig Department of Biological and Agricultural Engineering at Kansas State University, on a nearly \$6 million National Science Foundation grant-funded project to develop spray-on bioplastics that protect soil and control weeds in an environmentally friendly way.

Sharda will direct the four-year collaborative project, "RII Track-2 FEC: BioWRAP (Bioplastics With Regenerative Agricultural Properties): Spray-on bioplastics with growth synchronous decomposition and water, nutrient and agrochemical management for enhanced field crop production," alongside three co-principal investigators from K-State and two teams of researchers from the University of Nebraska-Lincoln and the South Dakota School of Mines. Joining Sharda and Hitzler from K-State are Ajay Sharda, associate professor of biological and agricultural engineering, and Katherine Nelson, assistant professor of geography and geospatial sciences.

The project was announced in February 2022.

The project aims to reduce the use of plastics, herbicides and associated environmental impacts in agricultural production by creating an all-in-one bioplastic system that can better manage weeds, nutrients, soils and water resources.



To check out KnowWhereGraph, go to knowwheregraph.org.

ICS degree offers computer science skills to everyone

As the world becomes more driven by computers and emerging technologies, the need for experts in a variety of industries who also possess computer science skills has emerged. Kansas State University's solution to this problem, launched in fall 2021, was a new bachelor's degree in integrated computer science, or ICS.

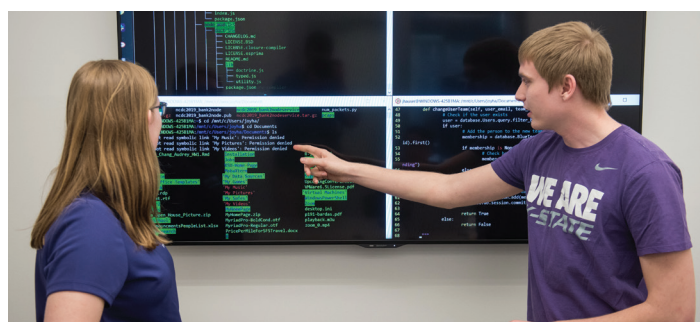
The new degree program is dedicated to the idea that computer science isn't just for engineers, but for everyone. The overall goal of the ICS degree, along with the related computer science certificate, is to integrate programming and computational thinking to every part of the undergraduate curriculum at K-State.

ICS majors learn computer science from instructors in the computer science department with the Carl R. Ice College of Engineering, taking 29 credits of computational core courses, which are computer science courses specifically designed for nontraditional computer science students. The courses encompass basic programming concepts in CC 110 and CC 210, to advanced computer science topics in the 500-level courses, such as databases, data science, system administration and security, and web development.

While mastering their computer science knowledge and skills, ICS students simultaneously develop a concentration area, which is a major, minor or certificate program from any college at the university. ICS students also take a range of "integration electives" from the College of Arts and Sciences, which teach them to think clearly and critically about the cultural, artistic and ethical dimensions of computer technology. A student might concentrate in the visual arts to build a foundation for a career in web design, or in business to get a head start toward a career as a technologically savvy entrepreneur. Another example would be a concentration in mathematics as groundwork for the future study of automated proof discovery and verification. The possibilities are endless.

The ICS program is off to a roaring start. One year into the program, there are approximately 40 majors with 15 incoming students, which is already as large as many established degree programs on campus. With the scope and ambition of the vision for computer science at K-State, it looks like it's just the beginning!

Engineering college adding bachelor's degree in cybersecurity



The Carl R. Ice College of Engineering at Kansas State University, with recent approval from the Kansas Board of Regents, will add cybersecurity as its 13th Bachelor of Science degree program.

Offered through the computer science department, the curriculum of 120 credit hours will be officially available in fall 2022.

As our world continues to integrate computers into every part of our lives, the need to protect those systems only becomes more important over time. Currently, the demand for cybersecurity professionals is at an all-time high and continues to grow rapidly.

According to data from Cyber Seek, there are more than 2,500 open jobs in cybersecurity in the state of Kansas, with more than 3,000 in the Kansas City metro area. The Bureau of Labor Statistics projects the job market for information security analysts, defined as cybersecurity specialists requiring a bachelor's degree, is expected to grow 31% from 2019-2029 with a median salary of \$103,590.

Additionally, educational pathways to a career in cybersecurity remain limited, especially in the state of Kansas, where K-State's bachelor's program will be the first undergraduate offering in cybersecurity in the state.

The program will be directed by Eugene Vasserman, Michelle Munson-Serban Simu Keystone research scholar and associate professor of computer science.

The college will seek accreditation by the Computing Accreditation Commission of ABET for the cybersecurity program after the first graduates of the program have completed their degrees, which is the standard ABET process for accreditation of new programs.

Arslan Munir receives funding from AFOSR



The Air Force Office of Scientific Research has awarded \$149,900 to **Arslan Munir**, Michelle Munson-Serban Simu Keystone research scholar and associate professor in the computer science department, for a project to investigate multimodal real-time activity recognition.

Multimodal information fusion for human activity recognition is expected to outperform the models that rely on a single modality. The Air Force has shown considerable interest in multimodal fusion for activity recognition in recent years. Many of the existing approaches for activity recognition perform poorly under varying environmental and/or lighting conditions and are not suitable for real-time activity recognition.

Munir will serve as principal investigator on the project, "A Multimodal Attention-Based Deep Learning Framework for Real-Time Activity Recognition at the Edge."

Munir is the founding director of the Intelligent Systems, Computer Architecture, Analytics and Security Laboratory

in the computer science department within the Carl R. Ice College of Engineering.

This research project proposes a deep learning-based framework for real-time human activity recognition at the edge under varying environmental and/or lighting conditions by leveraging multiple sensor modalities — e.g., color cameras, infrared cameras, depth cameras, radars, etc. — and an attention-based mechanism to fuse sensor data. The proposed framework performs comprehensive preprocessing of raw signal data followed by a specialized individual convolutional neural network for each modality to extract meaningful features. The proposed framework then utilizes attention-based convolutional neural networks and recurrent layers to fuse spatial and temporal features. To help enable real-time and energy-efficient human activity recognition at the edge, this project also aims to propose innovative algorithms and techniques for hardware acceleration of the proposed activity recognition framework.

The success of this project will have an impact on safeguarding national security and defense. Activity recognition in different environments and conditions is particularly important for the Air Force. Furthermore, real-time activity recognition is crucial for the Air Force because often real-time response is required to minimize losses.

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Revised August 14, 2020.

