

Computing [MTU]

GATEWAY

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Professor of Applied Computing
Yu Cai assists undergraduates
Destiny Michaels (computer network
and system administration major) and
Drew Youngstrom (cybersecurity major)

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Message from the Dean



“The demand for computing talent in the tech industry has never been stronger. Our College’s growth reflects that demand. We’re thrilled to be offering the quality education that our students need for success in the 21st century workforce.”

Dennis Livesay
Dave House Dean
of Computing

Michigan Tech has long been the best-kept secret in higher education, but not anymore. This is a spectacular university, and we mustn’t shy away from making sure that everyone understands that. Over the past few years, all of us at MTU have significantly increased our storytelling efforts, with a focus on growing the University’s national presence like never before.

As the newest academic unit on campus, this is doubly true for the College of Computing. Since I arrived 18 months ago, we have created several new outlets to connect with friends and colleagues and highlight our successes. Among the most notable of these efforts was the Computing[MTU] Showcase in April 2022, which brought together colleagues, alumni, and students from across Michigan Tech to highlight our growing focus on computing and computing-adjacent disciplines.

The Showcase (see page 6) included a panel discussion about the College of Computing, the first inductions to our Honor Academy, keynote speakers, a Women in IT panel, workshops, seminars, and much more. The Showcase will be an annual event, and I encourage everyone reading this to join us in our next celebration of computing in October 2023.

Computing [MTU]

Speaking of Computing[MTU], we have also introduced a new visual identity for the College. Computing[MTU] is now an official sub-brand at Michigan Tech, which allows us to specifically market the College of Computing. There is obviously some nerd-humor associated with it—square brackets in a language like C define subscription, meaning MTU is the index within the larger “computing” space.

But more than that, the brackets have become a unique visual identifier for the College used widely in our materials and events. In fact, we have a seven-foot pair of brackets that we physically transport to College events.

Our social media presence is growing quickly and we have increased the creation of content to tell our stories, including a trio of in-depth articles discussing the past, present, and future of computing at Michigan Tech. And this fall we refreshed the interior of Rekhi Hall, including colorful new wall art to better connect with our current and prospective students.

This magazine is a continuation of all these visibility efforts. *Gateway* is not meant to be an exhaustive annual report. Rather, it’s a magazine with compelling stories from the College of Computing at Michigan Tech. In this inaugural issue, you’ll learn more about our cutting-edge academic programs, the excellence of our faculty, our recent research successes, and our work to increase diversity within the computing space.

Thanks for reading,

Dennis R. Livesay, PhD
Dave House Dean of Computing

P.S. Please join us on our journey! As you’ll read in this magazine, the common denominator in the success of all our academic and outreach activities is our engaged and generous community of alumni, friends, organizations, and industry leaders. Scan the QR code to find out how you can support computing education and outreach at Michigan Tech.



Ye Duan Is New Chair, Computer Science

Andy Duan loves his work. Each day, he is excited to begin another day.

“As a professor, I feel I can make a difference. Over the years, I can see the impact I’ve made on my students. Sometimes just one simple word or sentence can impact lives,” he says.

Duan is the new Department of Computer Science chair and professor. He joins the College of Computing from the Department of Electrical Engineering and Computer Science at the University of Missouri at Columbia, where he was a faculty member and director of the Computer Graphics and Image Understanding Lab. Duan replaces Linda Ott, now emerita chair of the computer science department; Ott remains in the department as a professor.

“I am extremely excited to have Andy join our team,” says Dennis Livesay, Dave House Dean of Computing. “The Department of Computer Science is doing really well right now, with significant growth in enrollment, faculty, and externally funded research. I’m confident that the future will be even brighter under Andy’s leadership.”

“The College of Computing inspired me,” Duan says. “As one of only a few academic colleges in the nation dedicated to computing, it’s a unique opportunity.”

Duan holds a PhD in Computer Science from the State University of New York at Stony Brook. His research follows two tracks: computer vision, machine learning, and biomedical imaging; and computer graphics, virtual reality, and augmented reality. He is the principal investigator of research projects with active awards exceeding \$1 million, and over \$16 million in total external funding.

Duan’s leadership philosophy is based on a consensus-building approach. He says, “I believe that the faculty and chair need to work together to develop successful curricula, attract top-quality students and faculty, generate external research funding, and work with alumni to develop new opportunities for our students.”

“As department chair, I will work to build a strong team focused on a sustainable and strong program and pursue efforts to enhance the standing of the department among our peers,” Duan says.

“The College of Computing inspired me. ... It’s a unique opportunity.”

Andy Duan
Chair, Computer Science



Dan Fuhrmann Named Applied Computing Chair

Daniel Fuhrmann, Dave House Professor of Computing, was appointed permanent chair of the Department of Applied Computing in June 2021, having served as interim chair of the department since 2019. Prior to joining the College of Computing, he was chair of Michigan Tech’s electrical and computer engineering department from 2008 to 2019.

“Dan was instrumental in the creation of the College, and I know that his leadership will help the department achieve its promise,” says Dean Dennis Livesay. “Computing is transforming every discipline and it’s hard to imagine any unit on campus reflecting that more than applied computing.”

“I view the job of department chair as essentially one of service,” Fuhrmann says. “Basically, I want to be useful, and by extension I want the Department of Applied Computing to be useful to Michigan Tech and all of our stakeholders in the Great Lakes region. Anything I can do to improve the lives of our students and promote our regional economic development makes me happy.”

Fuhrmann sees the growth of the department as his first priority, noting that the unit is making good progress, particularly in cybersecurity and mechatronics.

“To grow student enrollment, we also need to grow the faculty to expand our programs,” Fuhrmann adds. “A larger

department can offer more learning opportunities for students, a wider variety of courses, and more resources for faculty research and instruction.”

A second priority for Fuhrmann is helping applied computing academic programs evolve to reflect the reality of what is happening in industry today. “I want very much for our students and our graduates to have the cross-disciplinary skill sets that will be in demand,” he says.

The Department of Applied Computing brings together faculty and programs in the College of Computing with a common interest in applied aspects of computing.



Broadening Participation

College Outreach Programs Serve Diverse Audiences

Outreach and helping others are long-time priorities for College of Computing faculty, staff, and students. From hands-on youth learning experiences and building digital literacy in adults to people-centric research and staying in touch with the needs of industry, our passion for computing drives us to get out of the classroom and into the community.

As the digital revolution continues to transform our society, many older adults

Michigan Tech students benefit from the program, too. Student Mitchell Eckstrand has been a BASIC tutor for several years. He says, “If I can do my part to help other people feel more comfortable with their devices or other tasks that they’re doing on their computer, then it’s rewarding for me.”

Since 2011, Copper Country Coders has given middle and high school students a low-stakes, fun opportunity to gain programming experience and build a

“Being a part of Coders meant a lot to me,” says student Laura Albrant, who was Copper Country Coders president in 2021-22. “It taught me the value of patience and positive reinforcement, and I felt like I was giving back to the local community. I also made many friends with fellow student leaders/teachers.”

Young women, too, don’t always have opportunities to learn about computing careers or to meet role models in the field.

And without that, many don’t gain the background they need to consider computing as a career.

To change that, since 2000, the Women in Computer Science (WiCS) Summer Youth Programs (SYP) exploration has reached dozens of high school girls with the message that computing careers are for women, too.

Organized by Linda Ott and the computer science department, WiCS helps young women learn more about computing and the opportunities it offers.

Another summer camp experience—GenCyber—reaches out to K-12 students and teachers.

The grant-funded program helps participants understand safe on-line behavior and learn fundamental cybersecurity concepts, also serving to increase interest in cybersecurity careers and share teaching methods for delivering cybersecurity content in K-12 curricula. The GenCyber camps are managed by the applied computing department and SYP, and presented by faculty and students.

College outreach also happens on campus. Open to all Michigan Tech students in computing classes, student tutors in the



2021 GenCyber Teacher Camp

and other groups are being left behind. To help close this knowledge gap, on Saturday mornings during the academic year a group of Michigan Tech students and faculty can be found at the Portage Lake District Library, Houghton.

They’re with the Department of Computer Science’s outreach program, BASIC—Building Adult Skills in Computing. Now in its 11th year, BASIC provides tutoring to technological newcomers and others looking to expand their digital skills.

broader view of how computer science fits in with life and career. Started by faculty members, for several years the outreach has been led by undergraduate students.

The Tech students are fully in charge of the program, from identifying the classes they’ll teach to drawing up lesson plans and conducting the classes to end-of-semester reflections about how they can improve. The undergraduates build communication, teamwork, and leadership skills while reinforcing their understanding of the concepts they are teaching to the students.

College of Computing Learning Center (CCLC) help their fellow students succeed through free one-on-one help sessions.

“I consider this an opportunity to strengthen my communication and leadership skills,” says computer science major Xiaojie Chen, a CCLC coach. “I love to help other students, and I believe that tutoring them also reinforces my skills and techniques.”

Also on campus, CyberCorps: Scholarship for Service (SFS), a five-year, \$3.3 million project funded by the National Science Foundation, will fund scholarships for 20 students. The program provides up to three years of full scholarship support for undergraduate and graduate students studying cybersecurity at Michigan Tech. The cross-disciplinary SFS program is coordinated and conducted by multiple departments and faculty across campus.

SFS student Thad Sander, cybersecurity, says of the SFS the program, “This opportunity means a lot. It gives me the funds to focus on my education instead of juggling a job at the same time.”

Keeping up with industry changes is also critical to preparing students for careers in today’s constantly changing workplace. College and department advisory boards meet regularly to advise leadership on topics including academic success, job readiness, and making sure program curricula are up to date.

“ I love to help other students, and I believe that tutoring them also reinforces my skills and techniques.”

Xiaojie Chen, Computer Science Learning Center Coach

And finally, the Computing[MTU] Showcase, presented annually by the College of Computing and the Institute of Computing and Cybersystems (ICC), reaches out to campus and community to share the success and initiatives

of researchers, students, and alumni. Activities include lectures, workshops, discussion panels, a poster competition,

networking opportunities, and more. Our next Computing[MTU] Showcase is in October 2023.



BASIC at the Portage Lake District Library

BASIC—Building Adult Skills in Computing

Digital literacy. It’s the ability to use technology to find, evaluate, and apply information. If you’re digitally literate, you can effectively operate whatever device or technology you’re using to gather the information you need.

For younger generations, digital literacy seems to come naturally. For many older adults, however, using computers, smartphones, and other digital devices remains unfamiliar territory and can be a source of great anxiety.

Since 2011, Michigan Tech students and faculty have been helping older adults break down these digital barriers through Building Adult Skills in Computing (BASIC), a free weekly tutoring program at Portage Lake District Library, Houghton.

“Even if you design technology well, you still need to have supports in place to help people learn to be confident users,” says Charles Wallace, associate professor

of computer science.” If people aren’t confident, they’re not going to be willing to explore and figure it out.”

“Many in the technology world haven’t realized that simply being older might cause accessibility issues,” he says, “and that’s what we’re addressing.”

Led by Wallace and Kelly Steelman, chair and associate professor, cognitive and learning sciences, BASIC tutors use a “let’s figure it out together” approach, making BASIC a comfortable, safe spot for people to ask questions and feel empowered to seek out answers.

Stelman and Wallace are studying the techniques of the most effective BASIC tutors—including both Michigan Tech professors and students—to reduce anxiety, encourage exploration, and boost confidence.

They plan to use the results of their research to develop software that will work in tandem with other tutoring programs to help support development of digital literacy.

The Past, Present, and Future of Computing

“Every discipline is being disrupted by computing. Every discipline is deeply connected and advanced by computing. The College of Computing is making sure that all of our colleagues, programs, and students across campus, are staying ahead of that transformation,” said Dennis Livesay, Dave House Dean of Computing, at the start of a panel discussion at the opening event of the Computing[MTU] Showcase in April 2022.

The panel, “The Past, Present, and Future of Computing at Michigan Tech,” engaged distinguished alumni and faculty in a conversation exploring the ever-increasing role of computing in everyone’s lives and where it is headed next.

“The computer industry’s dream has always been to make computing invisible, to make it like the air we breathe,” said alumnus and major donor Dave House

“Having managed large teams of engineering professionals, it’s amazing the degrees that people have,” said House. “There are a lot of computer engineers, electrical engineers, and computer scientists, but you also see astronomers, mathematicians, and philosophers. They earned their way into the system.”

“And the system is craving that level of diversity and that approach from different areas and perspectives,” said Christine Roberts ’91, senior vice president and general manager at Poly. “Because everybody comes at a problem from a different direction, it actually makes it better, faster, stronger when we have folks from all the different areas.”

But we need to do it well. “Knowing how to do computing well is why we need the College of Computing,” said Linda Ott, emerita chair of the Department of Computer Science.



’65. “It’s necessary for life but we don’t think about it. We do that by making it more capable and more human-centric.”

What stands out to Eric Roberts ’93 is that the College of Computing is evolving in real time. He says, “I completed my mechanical engineering degree with almost no programming. You can’t do that today. It’s an ingredient of your degree.”

Roberts, director of the Traverse City, Michigan, business incubator 20Fathoms, added that in the start-up space, you better know computing. “Your business is going to touch computing. It doesn’t really care if you’re a mechanical, biomedical engineer, or electrical engineer.”

“A lot of people dabble in programming, but it’s really important that as a University we recognize that there is a discipline behind all of this, that there is value in doing it right,” Ott said.

And we need to pay attention to the ethical and security aspects. “It’s not ‘Can we build it?’ It’s ‘Should we build it?’” said Christine Roberts. “I think that’s a really important key to everything.”

“Computing is ubiquitous and everyone’s using it, but we’re not always aware of all the less visible things that are going on,” noted Dan Fuhrmann, Department of Applied Computing chair.



“That’s why we have so many cybersecurity job openings. People need to understand those security issues,” said Fuhrmann. “When we say computing’s like the air we breathe, we have to make sure the air is not poisonous.”

And there’s another contemporary conversation concerning the role of a public university. “It’s to create well-educated citizens who can be a part of a well-informed society,” said Fuhrmann. “That has been part of the vision for public universities for a hundred years or more. Helping individuals become good citizens is also an important component of higher education.”

What does the future have in store? “Today’s computing is going the same place that computing of the past has gone. It’s going to be obsolete,” said House.

Whatever computing issues become relevant in the future, learning to solve problems and think deeply will be key.

“We’re now educating the next generation who will move into the computing space,” said Fuhrmann. “One of the things I would love for us to stress is how this new generation can change the world.”

“You can build a diverse team, but if you don’t build an inclusive team, you’ve wasted your time.”

Dianne Marsh ’86 ’92
Director of Content Security, Netflix

Copper Country Coders Share Computing with Youth

“There is a nationwide lack of computing curriculum in middle and high schools,” says Charles Wallace, associate professor of computer science. “I saw this gap locally and several years ago I started to teach some free after-school coding classes at Houghton Middle School, where my son was attending.”

“In programming, perseverance is more important than super smarts,” says Wallace. “It’s about problem-solving and getting through that process. When it works, when students understand that this is something they can do, it’s super exciting to them. Copper Country Coders gives youth a low-stakes, fun opportunity to get some programming experience and offers a broader view of how computer science fits in with life and the kinds of career options that are out there.”

teach to drawing up lesson plans and conducting the classes to end-of-semester reflections about how they can improve the classes in the next semester.

Jacob Wysko ’24, a geospatial engineering major with a minor in computer science, has been a Copper Country Coders instructor for two years. “It has been an extremely rewarding experience teaching a subject I’m passionate about to an eager group of students,” he says. “I’ve gained more education and leadership skills by having taken on this opportunity, and I have contributed to computer science education in our area.”

Computer Science major Laura Albrant participated in CC Coders for three years, last year as president of the student organization. “Being a part of Coders meant a lot to me,” she says. “It taught



Wallace conducted the classes on his own for a couple of years, then computer science faculty member Leo Ureel got involved. “We wanted to help students over a barrier of perception that computer science and robotics is something only ‘brainiacs’ can do,” Ureel says.

Soon, Wallace and Ureel started recruiting Michigan Tech students to instruct the youth classes. “Giving Tech students the opportunity to work as educators is as important a goal as teaching the middle and high school students,” Wallace notes.

Now, with Wallace and Ureel as advisors, the Tech students are fully in charge of the program, from identifying the classes they’ll

me the value of patience and positive reinforcement, and I felt like I was giving back to the local community. I also made many friends with the fellow student leaders/teachers.”

Albrant loved teaching the Copper Country Coders classes, as she could teach what she wanted to teach and make it fun. “The more fun the kids had, the more fun I could have,” she says. “It was also extremely satisfying when a student would correct my own programming mistakes, made either on purpose or by accident. To me, that meant they were learning, paying attention, and comfortable enough to call me out.”

External Advisory Boards

College of Computing external advisory boards, composed of industry leaders and distinguished alumni, share open and honest feedback about the quality of the College’s academic programs and other scholarly activity. Essential for continuous improvement and required by undergraduate program accreditation bodies, this input ensures that College programs remain relevant and in keeping with current industry needs and expectations.

“The College’s External Advisory Board helps me think about where we’re going over the next five to 10 years and helps us make strategic connections,” says Dean Dennis Livesay. “Recently we’ve discussed high-level topics including ‘What does being an industry engaged University and/or College look like?’ and ‘How do we ensure the professional success of our graduates?’”

“The key word here is advisory,” adds Livesay. “Unlike corporate boards, the role of the advisory board members is to be consulted and make recommendations.”

Department Chair Dan Fuhrmann explains that the two applied computing industrial advisory boards evaluate proposed curriculum updates and offer recommendations to ensure their relevance to industry needs. They also share advice on department leadership, organization, and processes.

Advisory board members also perform a valuable service by acting as judges for projects in the Senior Design and Enterprise Programs.

“We also look to board members for advice on gaining financial support for our activities, such as capstone design projects, and in some cases the board members represent companies that are providing this financial support,” says Fuhrmann.

[Growing Diversity]

Detroit High School Students Learn Programming

Through the leadership of the Detroit Hispanic Development Corporation (DHDC), with Michigan Tech and Ford, eight César Chávez Academy High School students completed an online section of CS1121 Introduction to Programming I in fall 2021. Dual-enrolled, the students earned academic credit from both Michigan Tech and the academy.

In spring 2022, three of the students continued to the next course in the sequence, CS1122 Introduction to Programming II, again dual-enrolled at Michigan Tech. All three (Arnold Contreras, Yahir Corona-Martinez, and Jax Lugo-Rivera) applied and were accepted to begin their undergraduate studies at Michigan Tech in fall 2022.

“I was delighted when we were asked to work with DHDC,” says Linda Ott, emerita chair of Michigan Tech’s Department of Computer Science. “It’s always rewarding to participate in outreach that provides

high school students a chance to discover their passion for computing. It opens a world of opportunities for them. Students who are exposed to programming in high school are much more likely to pursue a degree in computer science.”

The students met daily, attending live online lectures instructed by Department of Computer Science Assistant Professor Briana Bettin, and live online lab sessions conducted by Michigan Tech students. The DHDC transported the students from the academy to the DHDC, provided classroom space for the lectures and associated labs, and offered many other forms of student support.

Webcams and headsets were donated by the College of Computing, and Ford covered half the cost of the students’ tuition. The remaining tuition was funded by the academy.



César Chávez Academy students

The response from the academy students has been enthusiastic. “The students really opened up, chatting and joking, as well as asking insightful questions and engaging with the lecture even while remote,” says Bettin. “They were excited and vibrant, and I felt like I had become part of a club as they started to open up and share their energy and their personalities with me.”

“Dr. Bri is an amazing instructor. She was the perfect choice for this program,” says Leah Goodwin, director of STEM education and career pathways at the DHDC. “I can’t tell you how pleased I’ve been with MTU’s willingness to accommodate our needs.”

“I was grateful to make it possible for these students to actually take a CS program through a university that’s ranked No. 1 on some lists,” says Goodwin. “That was huge. It really made it relevant and impactful for the students.”

Academy student Lugo-Rivera has always been interested in computer science, and after completing an introductory computer programming class their sophomore year, their interest grew. “I really like the ability to create things from nothing,” they say. “I like being able to get all these ones and zeros together and create something.”



César Chávez Academy students

“I like the problem-solving aspects of computer science,” says Corona-Martinez. “I also like the collaborative aspect of computer science and sharing ideas with one another.”

The Michigan Tech courses aren’t easy, and the students have had challenges to overcome. “Sometimes, the concepts would be a bit difficult, but I would make the effort to watch a YouTube video or read additional documentation about how the code works,” says Corona-Martinez.

The academy students agree that it’s important to complete a bachelor’s degree. “Just getting a job after high school doesn’t feel right for me,” says Contreras. “Going to college and then getting a job suits me better.”

Help from Ford

In 2019, Goodwin channeled some of her passion for STEM to apply for a grant from Ford, proposing that the DHDC become an adjunct STEM educational facility to offer science, technology, engineering, and math courses through student dual-enrollment.

“Teaching shortages exist, so we can’t just credential teachers to teach these classes,” Goodwin notes. “The idea was that, since we are a community nonprofit facility, we should be able to bring our programming to a broader audience through facilitating the college classes.”

The Ford grant was awarded, with a request from Ford to focus on computer science outreach. Goodwin began reaching out to area colleges, connecting with Michigan Tech through the DHDC’s already-established relationship with MTU’s Summer Youth Programs.

The Learning Lab

Computer science PhD student Kieran Young led the learning lab for the class. “Kieran absolutely rocked working with the students, but it was clear he could benefit from having some extra hands on deck,” says Bettin. “We were able to bring in two amazing undergrad assistants, Marie Zgurich and Katie Ulinski, to be lab assistants for these students.”

“Helping out with the class was a great opportunity and the students were awesome,” Ulinski says.

“It always made me happy to see how excited they were when they got a program to run correctly. It also made me happy to hear that a few of them are thinking about coming to MTU once they graduate,” she adds.

A Special Visit

Bettin visited the academy students during the eighth week of the semester. “I was able to tour their high school, ride back with them to DHDC, help them out, answer questions about college during their class session, and even go on a trip with a few of them to a cider mill to spend a bit more time getting to know them!”

“I marveled as the students shared with me about their neighborhood and their school, and their day-to-day experiences that were so different from mine,” Bettin reflects. “In the same way, they marveled as I described how baling hay is a common summer job out on the farms, and what that job entails. The way the field trip let me share things from my world with them, just as they were sharing with me things from their world, was so unexpected and wonderful. It wasn’t a computer science learning moment—it was a human learning moment.”

In her research, Bettin is intrigued by how we communicate in a sociotechnical society, both about and with technology.

“We live in an increasingly technological society, and its impacts affect everyone. Far too much technology is developed without consideration of the real experiences and needs of those who aren’t present in the room,” says Bettin.

“Creating more diverse teams—teams that bring in more diverse perspectives—encourages building better solutions,” Bettin adds. “These solutions take into account cases that would have gone unnoticed by a team without that perspective, resulting in a more innovative and objectively better outcome at launch.”

“College graduates with a computer science degree have a world of opportunities available to them,” says Ott. “The diversity of career opportunities is astounding. There is a huge demand for software engineers in the automotive industry, and many other industries.”



Soheil Sepahyar, graduate student, Computer Science

All Topics Considered

From the opening reception and induction of the first members of the College of Computing Honor Academy the evening of April 4 to a Visualizations in Python workshop with Associate Professor Laura Brown on April 6, the first annual Computing[MTU] Showcase engaged hundreds of individuals in a full slate of talks, workshops, panel discussions, and research poster session.

Keynote talks were delivered by Dianne Marsh ’86 ’92, director of content security at Netflix, and by data science expert Phil Bourne of the University of Virginia.

In two discussion panels, diverse groups explored the ever-increasing role of computing in everyone’s lives and the challenges and opportunities for women in IT.

Conference sessions found distinguished alumni and industry professionals sharing information and ideas about data science in the defense sector, machine learning, health information modeling, and graduate education programs.

In a poster competition, close to 40 students presented their research. Winning posters described projects investigating a universal sensor description schema, virtual keyboards using a HoloLens, and a system to broaden access to digital assistance.

A Commitment to Diversity

“The founding of the College of Computing in 2019 presented an excellent opportunity for the College to reaffirm its commitment to student diversity,” says Linda Ott, emerita chair of the computer science department.

And University goals underscore that: By 2045, Michigan Tech envisions a student body with 40% percent women.

In its Broadening Participation in Computing (BPCnet.org) plan, the computer science department sets out its own diversity goals.

Goal 1: Increase the percentage of women who graduate from our degree programs from 17 percent to 20 percent by 2025 and match the overall graduation percentage at MTU by 2030 (anticipated at 30 percent).

Goal 2: By 2025, increase the percentage of African American students in our BS programs from 1 percent to 3 percent, Hispanic students from 3 percent to 5 percent, and Native American students from just above 0 percent to 0.5 percent.

Goal 3: Encourage more faculty involvement in BPC activities.

Alumna Empowers Universities with Enrollment Analytics

Even as she was completing her bachelor’s degree, Michigan Tech alumna Ashley Kern ’15 ’17 had already set out on an entrepreneurial path. And before she completed her MS in Data Science, in 2016, she started SightLine, a growing market intelligence and predictive analytics consulting firm.

Kern pursued a bachelor’s in geological engineering at MTU through her junior year, but she wasn’t certain it was the right fit. So, she took some time off to think things over, returning home for a semester.

To fill her time, Kern began working on some projects for her father, John Kern, an independent data analysis and research consultant. She started learning computer code and found that she enjoyed it.

“Working with my dad for that time, I discovered that I liked the flexibility of consulting work. I liked problem-solving in a less structured way because you get to do it independently.”

When Kern returned to Michigan Tech the next semester, she changed her major to mathematics, completing her BS in just one additional semester. But she felt that she needed additional credentials to pursue the kind of entrepreneurial work she now knew she wanted. It was great timing that Michigan Tech had just launched its Master of Science in Data Science degree program.

During her first year as a graduate student, Kern started looking around for some consulting work. She enrolled in a SmartStart class at the MTEC Smart Zone, Houghton, and “through the grapevine,” Michigan Tech Vice President for University Relations and Enrollment John Lehman heard that Kern was looking for data science consulting work.

“As VP for enrollment, John is very data-focused, so he really digs in,” says Kern. “He had some complex problems that nobody else was really tackling, and he gave me some tough questions to solve. That was my very first contract in higher education and it all grew from there.”

Today, Kern is the CEO of SightLine, which develops predictive models and data assessments to help universities increase enrollment, retention, and overall net revenue. The company uses machine learning to give schools insight into what kind of aid a school should offer a particular student, and how the school’s financial metrics compare with those at nearby colleges.

SightLine’s chief operating officer is Michigan Tech alumna Erin Thompson ’02, who joined the company full-time in 2020.

“We’re looking long-term to help small- and medium-sized educational institutions maintain and grow sustainably, and to



share new ideas and fresh perspectives,” Kern says. “What our customers repeatedly tell us is that they’ve been working with the same types of predictive analytics and data and education management companies for a long time, and they feel that they’re receiving the same responses and solutions.”

This fall, SightLine introduced a new solution to help parents understand what they can expect to pay for tuition based on their children’s grades and extracurricular activities, instead of relying on the sticker price posted on a school’s website.

“The goal of the new platform is to make education more accessible and to help with price transparency,” Kern says. “Parents and students don’t always understand the full value of higher education.”

SightLine began talking with general and tech-specific venture capital groups this summer in a multi million-dollar fundraising effort. In July, the company was featured in a Crain’s Detroit Business article focused on a small-business boom in the Upper Peninsula.

Kern was pleased to learn more about the recent growth of the College of Computing and the data science MS during a recent visit to campus. “It’s great to see how it’s growing and evolving and becoming a staple of campus,” she says.

Briana Bettin: Amazing Achievements

Assistant Professor Briana Bettin of the computer science and cognitive and learning sciences departments was awarded the 2021 Michigan Tech Distinguished Teaching Award. In one year, Bettin accomplished more than many professors do in a decades-long career.

Also this academic year, Bettin was inducted into the Michigan Technological University Academy of Teaching Excellence, which recognizes those who have demonstrated continued dedication to and support of the University's teaching mission. She received a Deans' Teaching Showcase Award in January 2022.

"We couldn't be prouder of Briana and her accomplishments. In her short time here, she has quickly become one of the very best educators that we have at Michigan Tech," says Dennis Livesay, Dave House Dean of Computing.

Livesay describes Bettin as a dedicated teacher with amazing rapport with her students and excellent teaching evaluations. Further, he notes that her student evaluations have been consistently in the top 10 percent, which he finds impressive for a second-year instructor charged with teaching large sections of introductory programming courses.

Department of Computer Science Emerita Chair Linda Ott attributes Bettin's success as a teacher to her enormous energy.

In Ott's words, Bettin "works hard to engage students through in-class activities. She really cares about the students and makes sure that they know it. And she makes learning fun by using amusing props such as little rubber ducks in her class. It turns out that these props also give the students something very tangible to help them remember the abstract concepts that we deal with in introductory programming courses."

"Briana is very concerned about reaching all of her students," Ott adds. "She really understands that not all of our students are



Briana Bettin

'just like us,' and she regularly participates in programs that focus on addressing issues of systemic racism and bias."

"Dr. Bri goes out of her way to make students feel welcome, included, and valued," says one of Bettin's students. "She sparks a perfect balance between showing students empathy and leniency while upholding the prestige of our institution and facilitating the excellence in education that MTU is known for."

A graduate teaching assistant (GTA) supervised by Bettin echoes this focus on inclusion: "Dr. Bri is a fierce advocate for justice in the classroom; she ensures a high level of coordination between GTAs so students are graded with fairness."

Bettin completed her PhD at Michigan Tech in August 2020. In Fall 2020, she was hired as an assistant professor for the Department of Computer Science. Her research interests include user experience, human factors, human-computer interactions, and mental models. She is a member of the Institute of Computing and Cybersystems' Centers for Computing Education and Human-Centered Computing.

"I am so grateful and humbled to see my efforts have value to others," Bettin says. "I hope I can continue to have an impact."

“Creating more diverse teams—teams that bring in more diverse perspectives—encourages building better solutions.”

Briana Bettin '14 '20
Computer Science



César Chávez Academy students with Assistant Professor Briana Bettin (right)



Linda Ott (right) and Ashley Villar, 2021 WiCS participant

Women in Computer Science

“Young women don’t always have opportunities to learn about computing careers or to meet role models in the field,” says Linda Ott, emerita chair, computer science. “And without that, many don’t gain the background to consider computing as a career option.”

To change that, since 2000, Women in Computer Science (WiCS), a weeklong Summer Youth Programs exploration, has reached high school-age girls with the message that computing careers are for women, too.

Organized by Ott and the computer science department, WiCS has helped dozens of high school girls learn more about computing and the exciting opportunities it can offer.

“Careers in computing can be fun, rewarding, and well-paying,” says Ott. “If we are a just society, young women should have equal access to the field.”

And diversity benefits industry, as well. “We’ve seen lots of examples of software products that work well for only a portion of the population,” says Ott. “Industry benefits significantly from a more diverse workplace.”

The exploration is offered without cost to students. Scholarships are funded by alumni and companies such as Ford and IBM.

The best approach to succeeding in STEM disciplines is to learn by doing. And this summer, a cohort of community college students did just that through the Michigan Tech MiCUP (Michigan College and University Partnership) program. Three of those students were mentored by College of Computing faculty.

The MiCUP students spent seven weeks on campus, working on a research project one-on-one with their faculty mentor and learning what it’s like to live and study on a university campus.

MiCUP funds housing and meals in a Michigan Tech residence hall, a scholarship for a 1-credit University summer course, a stipend, and an opportunity to develop a professional research poster with a faculty member.

The program aims to help make the transition to a four-year university an achievable goal for low-income students and students who are the first in their families to attend a four-year college.

Marco Britton

Marco Britton, a second-year student majoring in cybersecurity at Wayne County Community College, was mentored by Yu Cai, a professor of cybersecurity in the Department of Applied Computing. Titled “Raspberry Pi - A Tool For Cybersecurity,” Marco’s project aimed to demonstrate how Raspberry Pi can be used as an introductory tool for learning cybersecurity, particularly for college and K-12 students.

Raspberry Pi is a low-cost, credit-card-sized computer that enables the exploration of computing and learning how to program in languages like Scratch and Python.

To demonstrate Raspberry Pi coding capabilities, Marco developed a clicker game using Scratch, a platform that allows use of building blocks, animation, and graphics to write games and programs. He also developed a dice game to demonstrate Raspberry Pi coding capabilities using Python, a language for writing scripts and automated programs.

And he coded a wireless signal scanner to build a dummy Wi-Fi network, monitor network traffic, and crack Wi-Fi network

passwords using AirCrackNg, a tool that monitors wireless signals, cracks passwords, and hacks into wireless networks.

Marco also investigated password security, interviewing students and faculty members, and discovering that using the same passwords on multiple websites is a common security vulnerability.



Marco Britton

“Marco is self-motivated and very interested in cybersecurity,” says Cai. “He has a clear vision for his future career pathway.”

“I have gotten tremendous help from Professor Yu Cai and his graduate student, Brandon Cox,” writes Marco on his research poster. “They are very knowledgeable, patient, and friendly. I would also like to thank the MiCUP program for giving me the opportunity to learn more about cybersecurity at Michigan Tech.”

Alec Mirambeau

Alec Mirambeau, a computer science major at Grand Rapids Community College, worked with Leo Ureel, an assistant professor of computer science. For his MiCUP research, Alec explored computational methods to automatically solve a Wordle puzzle, a simple online word game that challenges people to find a five-letter word in six or fewer guesses.

The project, titled “Solving Wordle Using AI,” explores several methods of solving the puzzles, with the aim of developing curriculum materials for MTU’s CS 4811 Artificial Intelligence course.

Ultimately, Alec concluded that it is possible to use AI to solve Wordle puzzles. He also spent a lot of time studying Python's tools and gained a better understanding of Python concepts.

"Learning about these AI algorithms and then creating one is incredibly beneficial," writes Alec on his research poster. "It forces us to gain a better understanding of Python and how it works."

"Alec was an enthusiastic participant. He explored several ways of solving the puzzle and learned a lot about Python, programming, and AI," says Ureel. "It was a pleasure working with him."

DeAndre' Neal

DeAndre' Neal, a cybersecurity major at Wayne County Community College, was mentored by Bo Chen, associate professor of computer science. For his research, DeAndre' learned about the metaverse and blockchain, and clarified the relationship between them. Then he investigated how blockchain enables NFTs (non-fungible tokens), which are used to represent ownership of unique items, such as art, real estate, collectibles, and games.

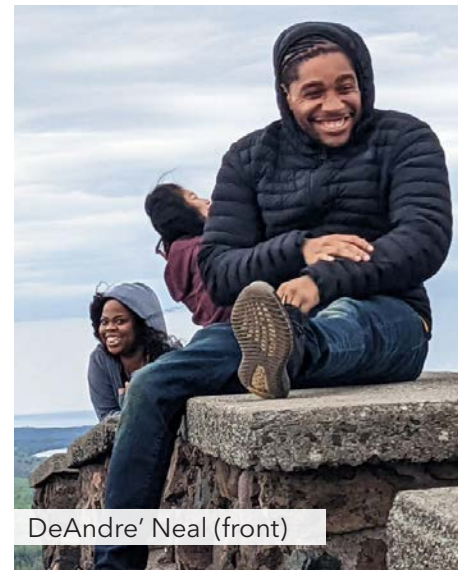
With content analysis techniques and comparison of content, DeAndre' gathered relevant research journals to learn about the ways blockchain enables NFTs to enhance the metaverse experience.

He learned that blockchain is a digital ledger of transactions that is duplicated and distributed across an entire network, and that the metaverse is a next generation internet that aims to create 3D environments where metaverse users can interact via a digital avatar. The metaverse connects the physical world with the virtual world and allows avatars to perform activities such as creation, display, entertainment, social media, and trading.

DeAndre' concluded that the metaverse will create jobs, enhance social media experiences, and provide a platform to create wealth.

"Blockchain technology protects the information of users, allowing seamless transactions to take place in the metaverse," DeAndre' explains on his research poster. "Unlike cryptocurrency, NFTs are non-interchangeable and cannot be divided, which increases their value."

"DeAndre' did a great job in understanding NFT," says Chen.



DeAndre' Neal (front)

MiCUP is a collaborative effort among three Michigan community colleges and Michigan Tech. Since 2012, the outreach program has hosted 189 students at Tech. Funding is shared by the King-Chávez-Parks program (70 percent) and Michigan Tech. Delta College, Grand Rapids Community College, and Wayne County Community College District are Michigan Tech's partners in MiCUP.



Summer 2022 MiCUP scholars (left to right) Alec Mirambeau, Chau Nguyen, DeAndre' Neal, Nancy Martinez, Zelda Jones, Stacie Aguirre-Jaimes, Marco Britton, Will Ward, Chloe Wilson, Tomika Rybkowski, Gavin Kinney, Antonique White, Samantha Whitmore

Developing Solutions to Prepare Students for the 21st Century

A guest editorial by Wayne Gersie, vice president for diversity and inclusion.

In her book, *Algorithms of Oppression: How Search Engines Reinforce Racism*, Safiya Umoja Noble tackles a continuing challenge that transcends academic disciplines and professions: that search engine results reinforce racism by queuing up websites that engender negative racial stereotypes. Noble is well qualified for this analysis as a professor of gender and African American studies at UCLA, where she was the co-founder of the UCLA Center for Critical Internet Inquiry. Her publication is specific to the relationship between search engines and discriminatory biases, but it is only one among many problems surrounding technology design and inclusivity that will continue until we confront it in the academy and workforce.

One facet of this issue regards demographic shifts, both domestically and globally, that will require innovative and inclusive thinking to meet market and end-user demands. According to the most recent census data, “the U.S. population is much more multiracial and diverse than what we measured in the past” (Jensen et al., 2021). Further, “The nation is diversifying even than predicted, according to new census data” (Frey, 2020).

These positive trends are diluted by access inequities related to computing and education. While 53 percent of high schools now offer computer science courses, and 76 percent of high school students overall could take these courses, only 5.6 percent students enroll in them (Ward, 2022). Further, demographic disparities persist: young women only constitute 32% of high school computer science courses, two or more races, 4 percent, and Native American/Alaskan and Native Hawaiian/Pacific Islander, 1.3 percent.

Also, comparing the overall high school population of various demographic groups to their enrollment in computer

science courses, we find economically disadvantaged students at 52 percent to 36 percent, Latinx 27 percent to 20 percent, White 48 percent to 48 percent, Black 15 percent to 16 percent, and Asian 5 percent to 11 percent (Ward, 2022; Tamez-Robledo, 2022). While some progress has occurred, obviously, much work remains.

The downstream impact is revealed in post-secondary education and workforce development. In 1984, women accounted for 37 percent of computer science college graduates, but more recently this percentage has declined to around 20 percent (Cheryan, S. et al., 2022). Not surprisingly, the percentage of women employed in computer science lags behind recent, though modest, gains for women in other STEM fields (Pew Research Center, 2021).

Employment data for diverse racial/ethnic groups follow similar patterns, with the percentage of Black computer scientists typically hovering between 3 percent and 5 percent from 2010-19, Asian increasing from about 15 percent to 20 percent, and Latinx with a small gain from about 3 percent to 5 percent (Zippia, 2022).

As a leader of the Fourth Industrial Revolution, Michigan Technological University and our newly minted College of Computing accept the charge to prepare students for the 21st century. We must increase the representation of women and diverse racial/ethnic groups in computer science and ensure that our graduates are not only technically, but also culturally proficient and equity minded to develop solutions for next-generation challenges.

At its core, the College of Computing leverages its expertise to facilitate



Wayne Gersie

complex problem-solving that requires imagination and innovation. To the degree that the College can augment its inclusivity profile among all its students, especially among students with diverse backgrounds and lived experiences, it will more successfully achieve its goals.

To achieve these aspirations, we must expedite the integration of diversity, equity, inclusion, and sense of belonging (DEIS) into the fabric of the College and University as not only the right thing to do, but the smart thing to do. By celebrating diverse perspectives and lived experiences, along with the uniqueness of our community members, we provide everyone with opportunities to thrive and enhance our ability to innovate and conduct transformational research for the betterment of humanity.

Having the privilege of serving as Michigan Tech's inaugural vice president for diversity and inclusion and the opportunity to partner with the inaugural dean of the College of Computing, Dennis Livesay, along with his team, I am excited about the possibilities for Michigan Tech's fastest-growing college. Specifically, I look forward to partnering with the College as it develops its strategic plan for DEIS, future K-12 outreach partnerships, and research collaborations with its faculty and academic and business partners.

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About Wayne Gersie

Prior to joining Michigan Tech, Wayne Gersie served as assistant research professor and chief diversity officer for the Applied Research Laboratory at Pennsylvania State University. He is the founder and principal of Oasis Strategic Consulting LLC.

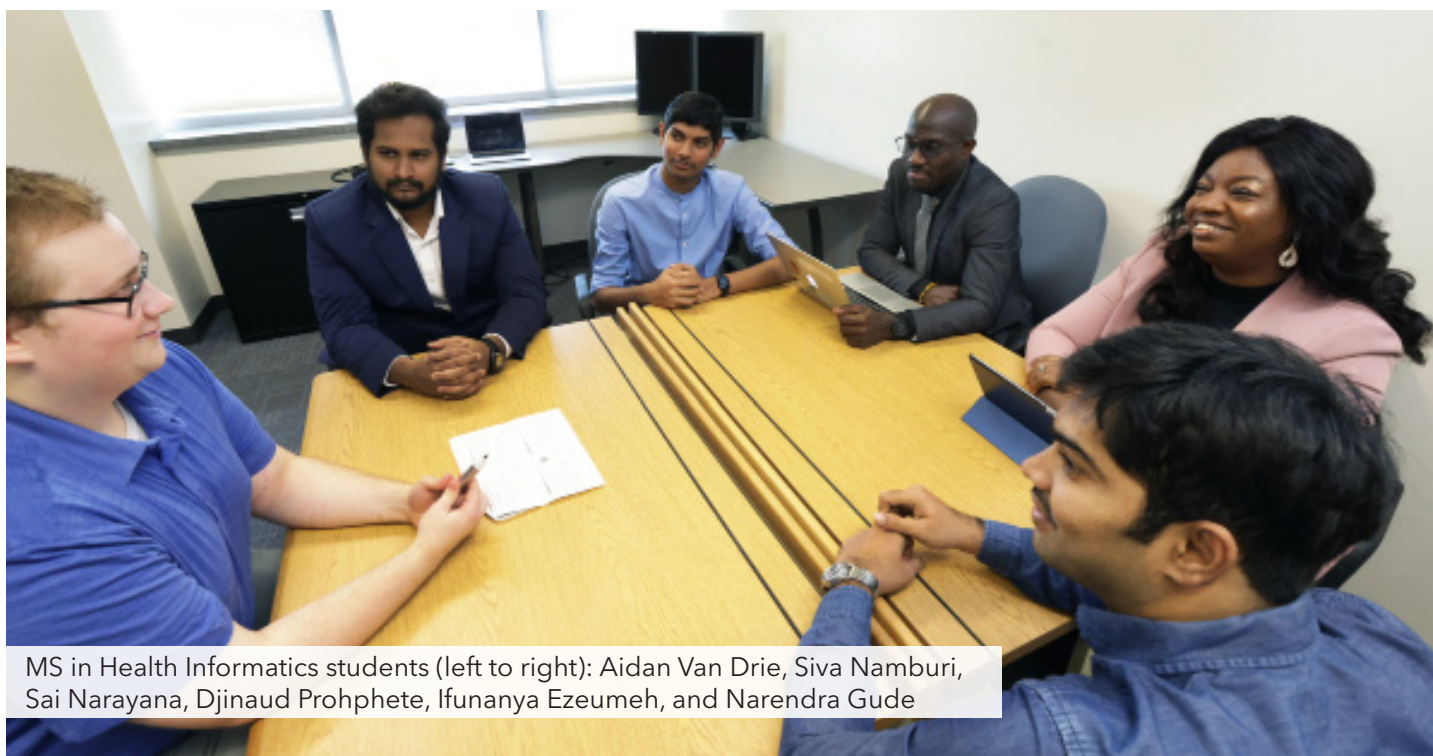
Gersie earned his PhD in Workforce Education and Development, with an emphasis on human resources, and a MEd in Counselor Education, both from Penn State. He holds certificates from the Harvard University Institute for Management and Leadership Education, Cambridge, Massachusetts, and the Center for Creative Leadership, Colorado Springs, Colorado.

Gersie has been recognized for his service with multiple awards, including the Pennsylvania State University College of Engineering Ally Recognition Award, the Penn State Engineering Alumni Society Equity and Inclusion Award, and the Penn State Multicultural and the Resource Center Faculty/Staff Diversity Recognition Award. He has also served his community, regionally and nationally, as a committee member, panelist, and keynote speaker for many organizations.

About the Center for Diversity and Inclusion

The mission of the Center for Diversity and Inclusion (CDI) at Michigan Tech is to foster student success by providing engaging programs that create safe spaces for students of multiple social and cultural identities. Through a broad range of services, workshops, and events, CDI fosters student success by:

- Providing a welcoming and safe environment for all students
- Encouraging cross-cultural interactions and conversations
- Supporting the exploration of differences as well as similarities
- Recognizing and celebrating the contributions of historically marginalized populations
- Facilitating students' self-exploration and exploration of others' identities
- Collaborating on campus initiatives that support/foster cultural diversity



MS in Health Informatics students (left to right): Aidan Van Drie, Siva Namburi, Sai Narayana, Djinaud Prohphete, Ifunanya Ezeumeh, and Narendra Gude

[Focus on Cybersecurity]

Cybersecurity Is a Key Priority Across the College

It is estimated that by 2025, cybercrime will cost \$10.5 trillion globally, increasing by 15 percent annually. And a recent study found that cybercriminals can potentially penetrate 93 percent of worldwide company networks.

The world has become a complex synergy of the physical world and the cyber world. Whatever your occupation, wherever you live, everyone is impacted by cyberattacks such as email phishing and cyber fraud. Crucial cyber-physical infrastructures are also in danger, from power grid,

especially on ordinary people, there is a cadre of people who want to defend the US and its citizens,” adds Mayo.

With funding from the National Science Foundation (NSF) through two grant awards Yu Cai and his colleagues are working to educate the next generation of cybersecurity professionals.

“Cybersecurity is a fast-growing trend in higher education,” says Yu Cai, professor of cybersecurity in the Department of Applied Computing. “Michigan Tech has developed a national and international

at Michigan Tech. The program currently supports 10 students.

“The US is facing a significant shortage of well-trained and well-prepared cybersecurity professionals,” says Cai. “This new scholarship will continue to develop Michigan Tech’s national and international reputation as a leader and innovator in cybersecurity education, research, and outreach activities.”

The cross-disciplinary SFS program is conducted by multiple departments and faculty across campus and collaborates with the Pavlis Honors College at Michigan Tech, mentoring, advising, and engaging SFS scholars with a blend of faculty mentoring, peer mentoring, and customized honors pathways.

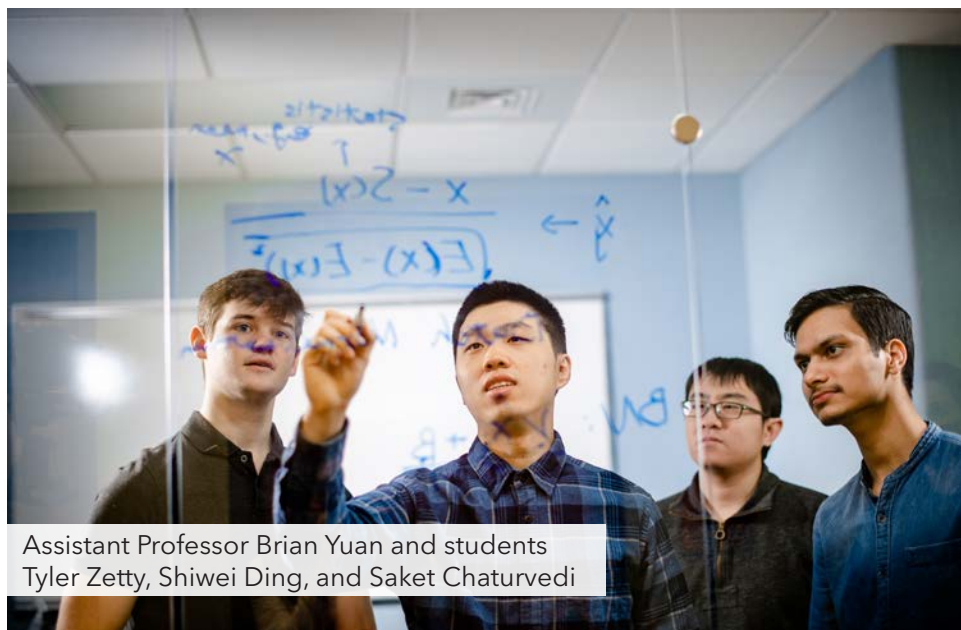
Undergraduate cybersecurity major and SFS scholarship recipient Thad Sander says, “This opportunity means a lot. It gives me the chance to accelerate my career readiness. It has also been a large motivational factor to excel and put myself forward for more opportunities so I can stand out as an applicant for jobs within the federal government.”

Following graduation, SFS recipients agree to work in a cybersecurity-related job for federal, state, local, or tribal government for a period equal to the length of the scholarship, among other requirements. The first graduate of the Michigan Tech SFS program is expected in spring 2023.

GenCyber Camps

Before they get to college, K-12 students need to be aware of the many cybersecurity career options. To that end, the National Science Foundation/National Security Agency-funded GenCyber program at Michigan Tech is working to build interest and enthusiasm in cybersecurity careers.

Part of a nationwide program, GenCyber camps seek to ignite and sustain



Assistant Professor Brian Yuan and students Tyler Zetty, Shiwei Ding, and Saket Chaturvedi

water, and utility pipeline systems to healthcare systems to industry control and manufacturing systems.

“It’s a war with no discernible front,” says Jean Mayo, professor of computer science. “The increasing pervasiveness and connectivity of computing devices, and the software those devices run, are network-accessible across the world. Attacks can come from anywhere.”

“Not only is the number of jobs in cybersecurity increasing, as people learn more about the impact of cyberattacks,

reputation in cybersecurity education, research, and outreach. We are thrilled to be part of the solution to the nation’s cybersecurity workforce challenge.”

CyberCorps

A five-year, \$3.3 million project funded by the NSF in 2021, CyberCorps: Scholarship for Service (SFS) aims to train the next generation of cybersecurity professionals. The scholarship provides up to three years of full support for 20 undergraduate and graduate students studying cybersecurity

cybersecurity interest among youth in order to build a competent, diverse, and adaptable cybersecurity workforce pipeline. The camps are open to student and teacher participants at no cost.

More than 300 students and teachers have completed the GenCyber camps at Michigan Tech. “We are very lucky to have hosted the GenCyber camps almost every year since 2019,” says Cai.

“As we become more and more reliant on cyber-based technology in our daily lives, ensuring that enough young people are inspired to pursue cybersecurity careers is critical to the future of our country’s national and economic security,” says Cai. “It’s better if youth are exposed to cybersecurity careers before college.”

The GenCyber classes focus on hands-on learning, engaging students in games, labs, and exercises. Topics include cyber hygiene and fundamental security knowledge, including email phishing, password management, cyber ethics, and more. Campers also learn about computer hardware and programming using Raspberry Pi mini computers.

Teachers also develop cybersecurity lesson plans. “The teacher camp is critical from a cost-benefit perspective. It makes more sense to train one teacher who can impact many students,” says Cai.

Laurel Givens, a teacher at Houghton Elementary, completed the camp in 2019. As a second grade teacher with an interest in technology, but not a lot of experience, before the camp she knew next to nothing about cybersecurity.

“My students have technology in their hands from the time they can hold things!” Givens says. “They’re really good at figuring out new software and websites, but they need instruction on how to keep themselves safe with digital tools.”

“Before we use technology in the classroom in the fall, I teach lessons on internet safety and netiquette,” Givens says. “We review these concepts throughout the year. One of my lessons is one I helped prepare during my week at the GenCyber teacher camp.”

Another great part of the camp, Givens says, was spending time with like-minded

teachers and learning what MTU has to offer students who are interested in computer science.

Jarrett Davidson, who teaches grades 6-12 in Baraga, Michigan, completed the teacher camp in 2021. “I have done some cybersecurity in my classes, but this really helped jump-start more computer science conversations and lessons,” he says.

“It was truly an awesome experience,” says Davidson. “No matter what your skill level and cybersecurity familiarity, you will gain so much to take away from the camp, you’ll have new resources, and you’ll meet teachers that want to help you succeed.”

“The US is facing a significant shortage of well-trained and well-prepared cybersecurity professionals.”

Yu Cai
Professor, Applied Computing



First Place Success for the MTU RedTeam

Third place among 100 teams, 96 percent accuracy, fifth of 119 teams, sixth of 576 teams. Facing competitors from colleges across the nation, the MTU RedTeam consistently ranks among the top college and high school teams in biannual National Cyber League competitions and industry-sponsored events.

Facing industry professionals and college students, in September 2021 the RedTeam took first place in an open source intelligence capture the flag contest hosted at the GrrCON Cyber Security Summit and Hacker Conference.

Advised by faculty members Yu Cai, applied computing, and Bo Chen, computer science, the MTU RedTeam is a registered Michigan Tech student

organization. The team works to promote a security-driven mindset among students, and provide a community and resource for those wishing to learn more about information security.

“Our RedTeam students view cybersecurity as a fun and critical subject,” says Cai. “Fun, because you get a chance to explore the cyber world and discover unknown secrets. Critical, because the nation needs you to defend its digital frontier and protect valuable infrastructure and data.”

The student organization also co-hosts capture the flag and hackathon competitions on campus, including the annual Winter Wonderhack.

Is Your SmartWatch Secure? Cybersecurity Students Decide to Find Out

The Internet of Medical Things (IoMT), a system of interrelated medical devices and applications, connects healthcare information technology systems using networking technologies. One-third of all IoT devices are found in healthcare (as IoMTs) and they are expected to account for 40 percent of total global IoT technology by 2025 (Darwis et al. 2017).

Healthcare data is frequently the target of fraud, extortion, and other illegal activities, with the average data breach costing \$9.42 million (HIPAA Journal, July 2021). Therefore, it becomes imperative to investigate the security resiliency of IoMT devices, which continue to gain wide popularity, especially in wearable devices such as smartwatches, fitness trackers, and heart rate monitors. These devices can reduce unnecessary hospital visits and ease the burden on healthcare systems, but are they secure?

A team of students decided to find out when their advisor, Guy Hembroff, associate professor of health informatics, applied computing department, presented the topic to the group in September 2021. The project's result, "IoMT Device Security," was awarded first place in the Senior Design category of the 2022 Michigan Tech Design Expo. Team members were graduating BS in Cybersecurity seniors Jacson Ott, Stu Kernstock, Trevor Hornsby, and Matthew Chau.

The Design Expo showcases experiential, discovery-based learning. This spring, the work of more than 1,000 students in Enterprise and Senior Design capstone projects were represented. The event is hosted by the Michigan Tech Enterprise program and supported by industry and University sponsorships.

A Security Review

"The goal of this project was to perform a security review of Internet of Medical Things wearable devices," explains Ott. "Our intention was to provide end users with a better understanding of the security implications of their everyday devices, and to present an updated picture of the industry's current stance of implementing security."

The research project specifically focused on the communication among several different Apple smartwatches, smartphones, and the applications that run on the smartphones.

"Apple devices are the most popular fitness tracking devices on the market, and research shows that Bluetooth is vulnerable to attacks," explains Hornsby. "This is especially true with its counterpart, Bluetooth Low Energy."

Bluetooth Low Energy is intended to considerably reduce power consumption and cost while maintaining a similar

communication range to that provided by other communication technologies.

"We looked for common security weaknesses between the connection of an Apple Watch and an iPhone and analyzed the effectiveness of current practices to protect sensitive health information. We also identified steps for improvements and recommendations for mitigation measures to address existing threats and vulnerabilities," says Hornsby. "Several potential areas for continued research were also revealed."

"The tests we performed proved that in some scenarios anyone could realistically attempt to compromise some of these devices," adds Hornsby. "A wide selection of smartwatches and accompanying smartphone apps were tested for potential vulnerabilities. Our tests included physical attacks, sniffing, man in the middle, DoS, and reverse application engineering."

The Judges Were Impressed

"I was very impressed with the presentation," says Steve Knudstrup, Michigan Tech help desk consultant and Design Expo judge. "The team took something pretty complicated and communicated it well so that I could understand both the technical aspects and why the project was important. I liked that the relevance was clear and that they were using devices that real people use every day. The students were also upbeat and very friendly, and very willing to answer any questions anyone had."

Design Expo judge and Michigan Tech Career Advisor Amanda Hagerl, Career Services, was also impressed with the group's presentations.

"They all showed a real interest in their work," Hagerl says. "Their enthusiasm really kept me captive. We live in a world where we fear for our security, and so many of us wear Bluetooth devices. It made their topic interesting to many. They were able to answer all the questions I had, and they provided me with solutions to help with my security in the future."



Jacson Ott, Stu Kernstock, Trevor Hornsby, and Matthew Chau

Long Hours in the Lab

The team followed a phased approach, breaking down the project into smaller pieces and collaboratively working on each phase. Hornsby says the testing phase was very intensive and the team encountered several roadblocks.

“This team of students was very bright, motivated, and professional, each with individual areas of expertise and research goals that complemented those of the other team members, pushing them to become better as individuals and as a group,” says Hembroff.

While this project was similar to most research endeavors, with challenges and setbacks throughout the course of the project, Hembroff says the students met each of the challenges and worked very hard to meet the expectations established for this project.

“I really enjoyed working with the group and witnessing their progression in teamwork, research, troubleshooting, and written and oral communication, which are critical to success in the cybersecurity industry,” adds Hembroff.

“Our project was heavily dependent on collaboration, from the early phase of researching the devices and tools, to testing and analyzing the data, and finally writing up the results,” says Hornsby.

“As a group, we did our best to rotate the project roles, ensuring that everyone was knowledgeable about all project areas,” notes Ott. “This approach also allowed us to leverage the unique perspectives and ideas of all group members.”

“There was a long period in which the result of every attempted attack resulted in failure,” says Ott. “It was difficult to avoid becoming discouraged as the team encountered one roadblock after another.

“But it was important to keep in mind that every success and failure we encountered helped us to build an increasingly whole picture of the space,” he adds. “The first time I managed to expose personal health data in a real-time connection between devices really boosted team morale.”

Jacson Ott '22



Jacson Ott is proud of the long hours and dedication he put into completing his BS degree. “I will deeply miss the communities I’ve found here,” he says. He graduated this spring with a BS in Cybersecurity with a focus on system and network security.

It was the quality and diversity of the Michigan Tech cybersecurity BS program that drew Ott to Houghton, and the communities he found at the University kept him connected and engaged. He says he found the true value of his education in the program’s hands-on experiences and that the most valuable skill he gained is the ability to think critically and learn new topics.

Ott notes that the remote learning necessitated by the pandemic posed a unique set of challenges, but in the end it was of benefit, better preparing him for the workforce. This summer he’ll pursue his third fully remote internship, this time with Palo Alto Networks Unit 42. He’ll be working as an incident response intern until August, when he’ll return to Michigan Tech to pursue a MS in Cybersecurity focused on network security management.

Ott says applied computing faculty member Tim Van Wagner was invaluable to his college experience. “He’s always ready to offer advice or talk about technology, and his passion for what he does is evident in every conversation.”

During his undergraduate studies, Ott was involved in the Networking and Computing Student Association, serving as president, public relations head, and network team lead. He was a competitor for the MTU RedTeam, achieving several high-ranking finishes in National Cyber League events.

Ott advises all students to find ways to apply their knowledge outside the classroom. “Joining student organizations that enhance your degree is one of the best ways to get the most out of your time at Michigan Tech.”

An Honest Effort to Discover Something New

The deep knowledge and enthusiasm of his advisor, Guy Hembroff, inspired Ott to put in his best effort and see where the project took him. “I valued this opportunity to apply the knowledge and skills built over my time at Tech in an environment where it was okay to fail,” he says.

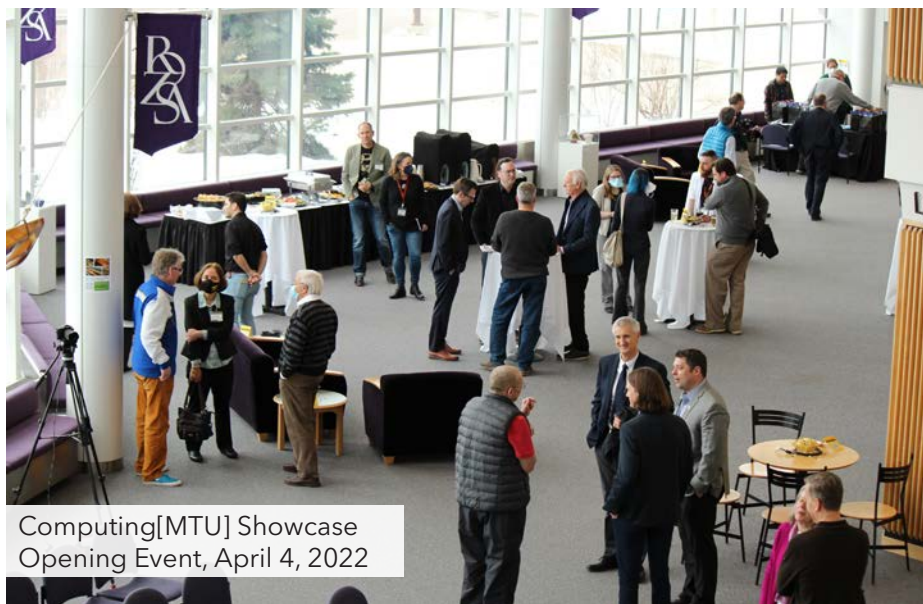
At the beginning of the project, Hembroff stressed a particularly important aspect of the Senior Design capstone. “He said that our success or failure wouldn’t be the most important factor in the end. Instead, the true value of this capstone

project would be found through honest effort and discovering something new,” Ott says. “He always took the time to respond to our questions, assist us where needed, and provide guidance.”

“Dr. Hembroff provided us with frequent meaningful feedback throughout the entire course of the project,” agrees Hornsby. “He also helped us immensely with troubleshooting roadblocks and refining the scope of our project.”

Celebrating Excellence

Dave House and Linda Ott Honored for Extraordinary Contributions



Computing[MTU] Showcase
Opening Event, April 4, 2022

At the opening event of the Computing[MTU] Showcase this April, two individuals were inducted into the College of Computing Honor Academy for their lasting contributions: Dave House and Linda Ott.

“When we created the Honor Academy, we wanted to celebrate our distinguished alumni, and we also wanted to celebrate the folks that have had an outsized impact on computing at Michigan Tech,” said Dean Dennis Livesay.

“The work that they have done is very different, but it’s connected by one thing: a long-standing legacy. The impact of their work will continue on for generations,” Livesay added.

Dave House ’65, a longtime supporter of Michigan Tech and the College of Computing, was recognized for “his profound and long-term commitment to computing and Michigan Tech.”

“I came to Michigan Tech as a graduate of a community college and I managed to

take three years of electrical engineering in two years, which was the hardest thing I’ve ever done in my life,” said House. “But I came out of here a changed person. I came out of here with an engineering degree from a noted technological university.”

“Dave is one of the University’s most successful alumni, he’s one of our biggest supporters, and he is the person who always challenges us to innovate and to shoot for nothing less than excellence,” said Livesay.

“Computing has invaded every part of our lives and its influence is only growing with time,” said House. “I’m glad to help Michigan Tech advance both the science of computing and the application of computing in every field of learning.”

Linda Ott started her career at Tech in 1987. She is recognized for a lifetime of work advancing the Department of Computer Science, and broadening campuswide participation in computing.



Dave House ’65

“I’m passionate about inclusivity and making sure that students, particularly high school students who don’t have a lot of opportunities, are given exposure to computing.”

Linda Ott
Emerita Chair, Computer Science



Linda Ott

“Linda is the heart and soul of computer science at Michigan Tech,” said Livesay. “Her legacy

is within our alumni, our growing prominence, and our exciting future.”

Ott served as chair of the computer science department from 1996 to 2010, and as acting chair from 2019 to 2022. She played a major role in the formation of the College in 2019.

Vertanen Named Dave House Associate Professor of Computing



Keith Vertanen has been named the inaugural Dave House Associate Professor of Computing in the Department

of Computer Science. The endowed professorship recognizes Vertanen's commitment to his research and to Michigan Tech students.

"I'm excited and honored to be the first Dave House Associate Professor of Computing," said Vertanen. "The opportunity will further my group's mission of advancing the future of computer interfaces, especially for users with diverse abilities."

"Keith is one of the College of Computing's leading researchers, both in the quality of his work and his research expenditures," said Dean Dennis Livesay. "His work expanding the opportunities for how humans interact with computers has garnered significant national exposure and funding from the National Science Foundation (NSF) and Google."

Vertanen was awarded an NSF CAREER grant in 2018, the agency's premier recognition for early-career scientists. He has also received University recognition for his exceptional teaching performance.

Outstanding Teaching, Improving Student Experience



Todd Arney has a long record of outstanding teaching. This spring, he was further recognized for his behind-the-scenes

efforts to modernize the curricula in the Department of Applied Computing, and to enhance the use of state-of-the-art computing resources across campus through the College's Virtual Cluster.

Dan Fuhrmann, applied computing chair, noted that instructional changes required by the pandemic made Arney's work particularly valuable because it enabled remote teaching and facilitated a vast improvement in student experience.

"Ensuring that our students have access to the latest technology is time-consuming and represents work that isn't acknowledged as regularly as it should be," says Dean Dennis Livesay. "As such, we're especially proud to recognize Todd's accomplishments in deploying virtual machines broadly in our classes, and helping others do the same in theirs."

Arney was featured in the 2021 Deans' Teaching Showcase and was awarded a 2021 CTL Instructional Award for Curriculum Development or Assessment.

Arney presented his talk, "The Challenge of Making Complex Topics Accessible and Engaging to a Broad Audience," for the CTL award lecture series.

Arney has also received the Provost's Award for Sustained Teaching Excellence, a new teaching award that celebrates the work of individuals whose teaching consistently and dramatically benefits students.

“ Todd Arney represents the very best that Michigan Tech offers in undergraduate education.”

Dan Fuhrmann
Chair, Applied Computing

Bo Chen Promoted to Associate Professor



Bo Chen, computer science, was recently promoted to associate professor with tenure. Chen is director of the Secure and Privacy (SnP) Lab, and a member of the Institute of Computing and Cybersystems. He started at Michigan Tech in fall 2017.

Tenure and promotion are awarded in recognition of academic and professional merit. The tenure and promotion system is intended to attract capable and highly qualified faculty, enhance institutional loyalty, and encourage academic excellence.

Chen is the principal investigator of a new National Science Foundation grant award of \$598,416, which aims to develop the first hardware-assisted self-repairing decentralized cloud storage system to defend against malicious attacks. Chen explains that a major and novel point of the research is to leverage the trusted hardware components to establish trustiness among the untrusted storage peers in the decentralized cloud.

"This is completely different from the existing approaches, which rely on blockchain and smart contracts, and require a large performance overhead," he says.

The research will support two graduate students and several undergraduate students.

College News Briefs



Wenbin Zhang

New Computer Science Faculty: Fall 2022

The Department of Computer Science welcomed three new faculty members this fall. Andy Duan is the new chair and professor of the department. He comes to Michigan Tech from the University of Missouri at Columbia, where he was an associate professor of electrical engineering and computer science.



Serein al-Ratrout

Wenbin Zhang, assistant professor, comes to the College of Computing from Carnegie Mellon University. He earned his PhD in Information Systems at the University of Maryland, Baltimore County. His research interests include societal aspects of AI, health informatics, representation learning, data stream mining, and machine learning for science and interdisciplinary.

Serein Al-Ratrout, a teaching assistant professor, was an adjunct assistant professor in the College's computer science department in the 2021-22 academic year. She has a PhD in software engineering from De Montfort University, UK.



Dukka KC

New Computer Science Faculty: Fall 2021

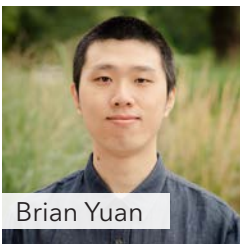
The Department of Computer Science welcomed two faculty members in fall 2021.

Dukka KC, an associate professor, came to Michigan Tech from Wichita State University. He was appointed associate dean of research for the College in October 2021, and associate director of the Institute of Computing and Cybersystems in February 2022. His expertise is in applied deep learning and bioinformatics.

Xinyu Lei, assistant professor, joined Michigan Tech directly following completion of his PhD at Michigan State University. Lei's cybersecurity research is applied to help users protect their private information while using Internet of Things devices.



Xinyu Lei



Brian Yuan

Brian Yuan Receives ORAU Award

Xiaoyong (Brian) Yuan, assistant professor in the Departments of Applied Computing and Computer Science, has received the 2022 ORAU Ralph E. Powe Junior Faculty Enhancement Award in Mathematics/Computer Sciences.

Awarded by the Oak Ridge Associated Universities (ORAU) Council of Sponsoring Institutions, Yuan was selected from 155 applications at 87 ORAU member institutions. The award represents public recognition by academic peers of the quality and promise of Yuan's research. He will receive a one-year grant of \$5,000 from ORAU and a matching award from Michigan Tech. The award funds can be used for expenses relevant to Yuan's research.

Yuan's areas of research include machine learning, security and privacy, and cloud computing.



Laura Brown Is Director of Data Science Initiatives

Laura Brown, associate professor of computer science, was appointed director of data of science initiatives in October 2021. The new College leadership position reinforces the growing importance of data science in both the College's strategic growth priorities and the industries the College serves.

Brown will guide the College's focus on growing enrollment in the MS in Data Science, work to identify new data science degree opportunities, and assist in developing broad research teams across the University.

"Laura has provided exemplary leadership in data science to the College and University for years. This new role formalizes her role, while also setting our expectations even higher," says Dean Dennis Livesay. "Growing data science at Michigan Tech is one of our biggest priorities."

This fall, enrollment in all College of Computing graduate programs jumped 60.5 percent with total graduate enrollment of 183 students. The MS in Data Science grew by 87.5 percent.

Pictured are (left to right) MS in Data Science students Michael Ngala, Sneha Kaiki, and Charlotte Hildebrandt, and Laura Brown

Leo Ureel Is PI of \$599K NSF R&D Grant



Leo Ureel, assistant professor of computer science, is the principal investigator of a \$599,732 research and development grant from the National Science Foundation. The project, “Rich, Immediate Critique of Antipatterns (RICA) in Novice Programmer Code: Broadening Adoption, Supporting Student Learning, and Enhancing Programming Competencies,” aims to develop a system that will automatically detect coding mistakes and provide immediate, high-quality feedback to students in introductory programming classes.

“Providing feedback in a timely manner using human graders is often difficult due to rapidly increasing class sizes and instructor shortages,” says Ureel. “Immediate feedback to students significantly improves learning outcomes and results.”

Tim Havens Is Director of Great Lakes Research Center



In January 2022, Tim Havens was appointed director of the Great Lakes Research Center (GLRC), in addition to continuing his roles as director of the Institute of Computing and Cybersystems and the William and Gloria Jackson Professor in Computer Science.

“The GLRC is striving to become the premier research institution on campus, both in terms of research excellence and in the support that GLRC staff bring to campus researchers,” said Havens. “GLRC faculty and staff and their diverse research are at the top of their fields. The Center will not only continue to push the envelope about what can be learned about Great Lakes and coastal oceans systems, but also look for opportunities in the uncharted waters of complex, real-world problems that require multiple-disciplinary approaches to resolve.”

\$4.3M Funding for Genomic Surveillance



Dukka KC



Guy Hembroff

Michigan Tech has received \$4.3 million as part of an \$18.5 million, two-year federal grant to collect and analyze genomic data to address emerging infectious disease threats and enhance the state’s ability to respond to those threats. The funding will increase sequencing capacity in the state, starting with SARS-CoV-2.

Dukka KC, associate professor of computer science, is a co-PI on the project. Dukka will develop a robust computational infrastructure and a bioinformatics workflow/pipeline for genomic surveillance. The scalable computational infrastructure will build bioinformatics capabilities in Michigan, improve timely genomic surveillance of infectious disease threats, and alert the public of detrimental SARS-CoV-2 variants in Michigan.

Guy Hembroff, associate professor of health informatics in the applied computing department, is senior personnel on the project. Hembroff has expertise in developing and managing AI prediction models for large-scale medical data and images. He’ll establish an outbreak surveillance infrastructure model for the public health disease population in the western Upper Peninsula and facilitate a partnership among Michigan Tech, healthcare providers, and federal and state agencies to transport and report environmental, human, and animal information and samples in the region.

Soner Onder Awarded \$1.2M



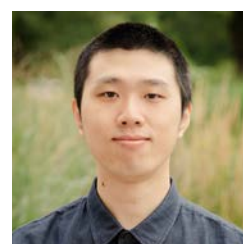
Soner Onder, professor of computer science, was awarded a \$1.2M collaborative medium grant from the National Science Foundation (NSF) titled, “Collaborative Research: SHF:

Medium: Vectorized Instruction Space (VIS).” A joint project with Florida State University, each university receives an equal share of \$600,000. Michigan Tech is the lead institution.

The project targets a long-unsolved problem in the handling of computer programs: the efficient processing of control-flow instructions. It aims to significantly increase the performance of application programs ranging from those running on mobile devices to those utilized by ever-growing data centers.

Onder has four active NSF grant awards; the combined MTU share is over \$1.6 million.

Brian Yuan Awarded \$900K NSF Grant



Brian Yuan, assistant professor of computer science and applied computing, is the principal investigator (PI) of a \$500,000 National Science Foundation (NSF) grant,

“CNS Core: Small: Privacy-Preserving On-Device Intelligence in the IoT Era.” Lan Zhang (electrical and computer engineering department) is co-PI. The project intends to develop privacy-preserving on-device intelligence for the Internet of Things era.

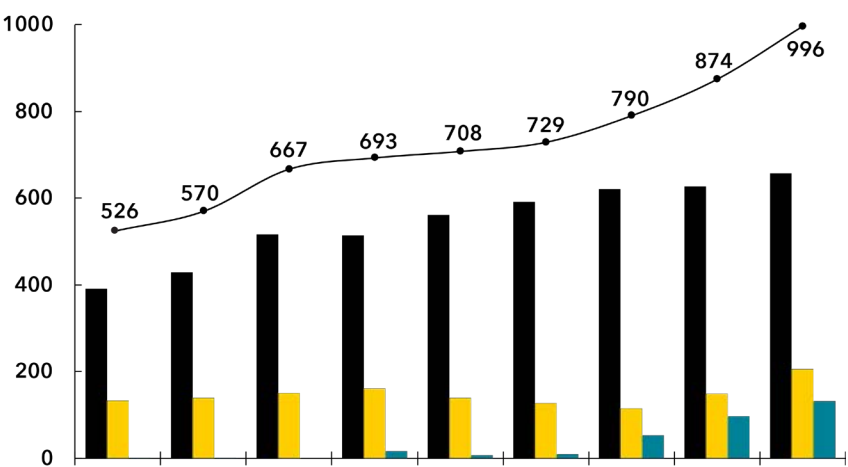
Yuan is also PI of a new \$409,000 NSF grant project, “Collaborative Research: SHF: Small: Artificial Intelligence of Things (AIoT): Theory, Architecture, and Algorithms.” The research is a collaboration between Michigan Tech and the University of Florida.

[By the Numbers]

This fall, enrollment in Michigan Tech computing programs grew 13.6 percent over academic year (AY) 2022, the second consecutive year of greater than 10 percent growth, and 95 percent growth in computing programs since 2014.

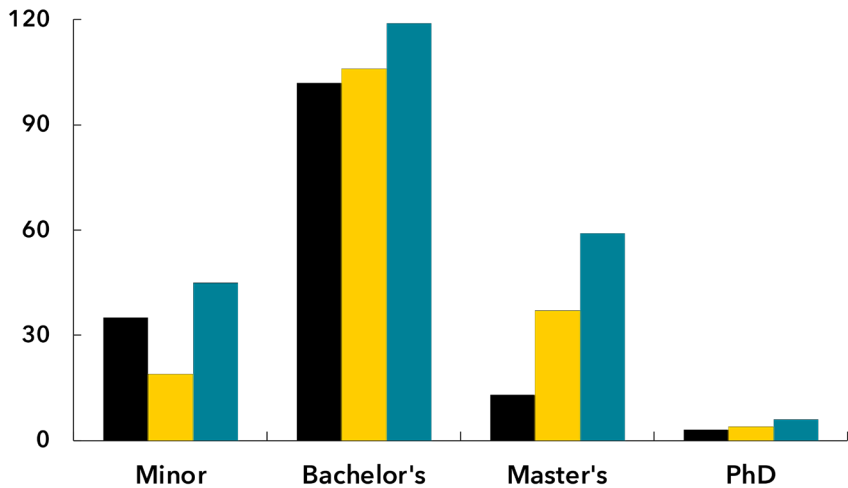
The biggest gains are in graduate programs, with enrollment jumping 60.5 percent led by 300 percent growth in the MS in Health Informatics, 85.7 percent growth in the MS in Data Science, and 39 percent growth in the MS in Mechatronics.

Enrollment in undergraduate programs grew 6.4 percent, with the largest gains in the BS programs in Mechatronics and Cybertsecurity at 78.9 percent and 47.4 percent, respectively. Total fall 2022 computing student enrollment is 993.



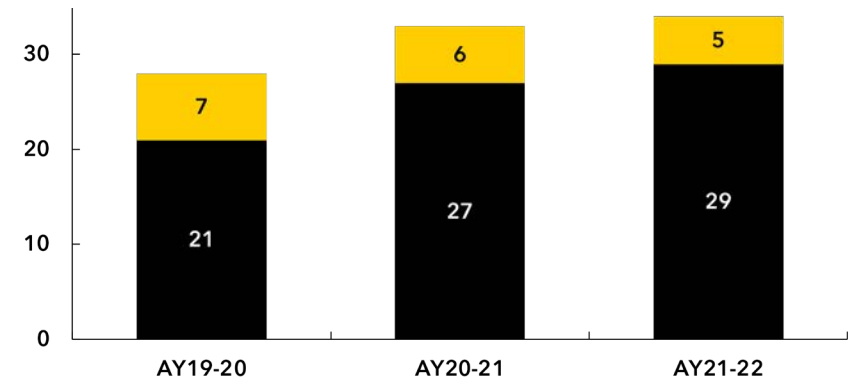
Student Enrollment
2014-2022

- Computer Science
- Applied Computing
- Shared
- Total



Degrees and
Minors Awarded
2019-2022

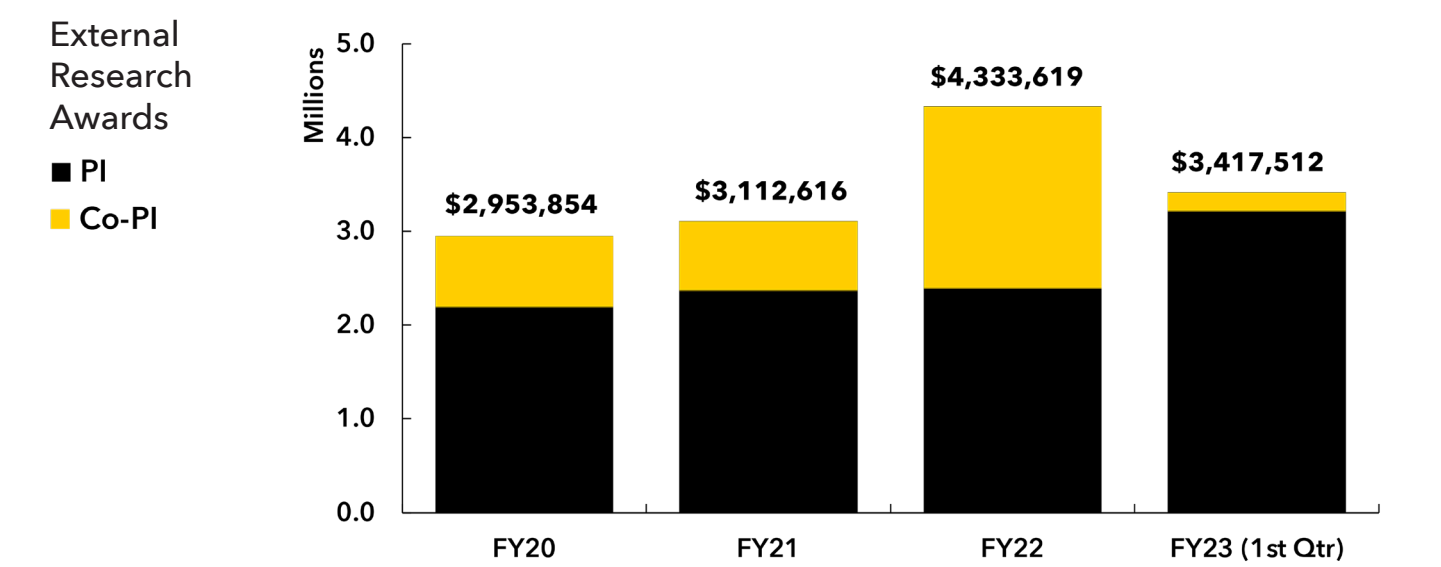
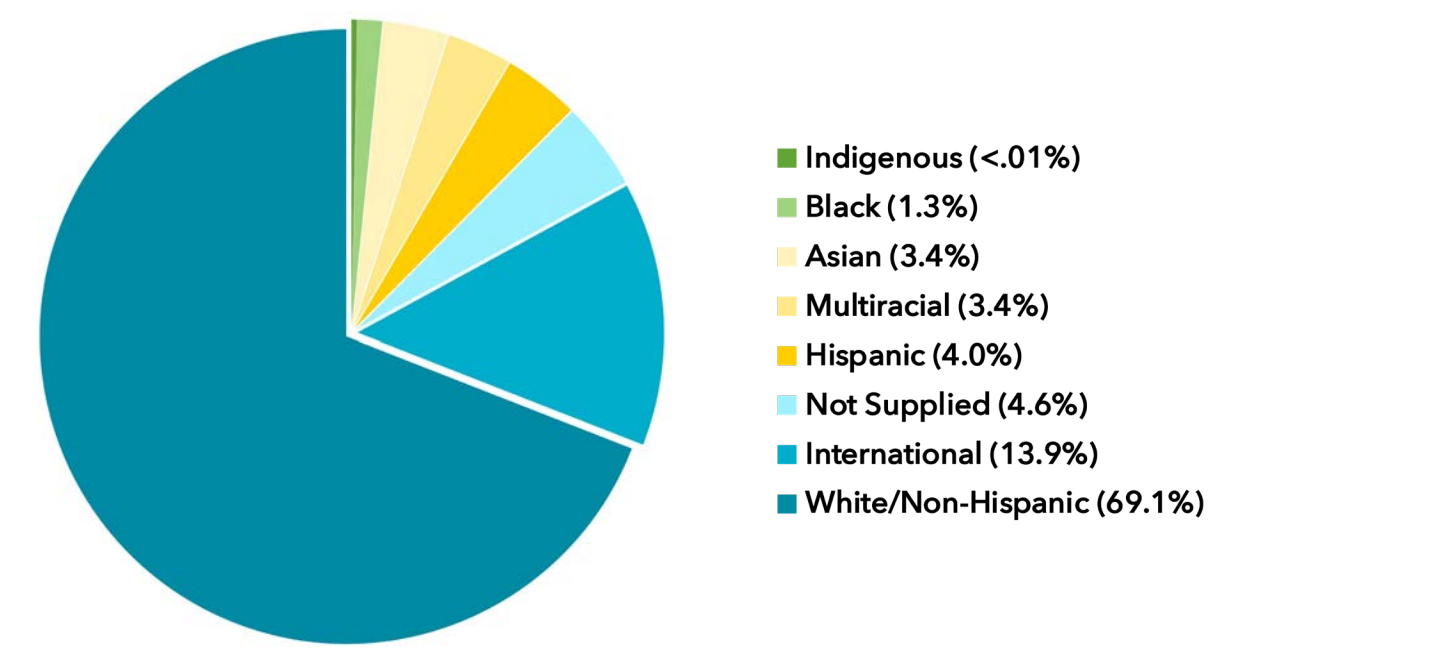
- AY19-20
- AY20-21
- AY21-22



Number of Faculty
Fall 2022

- Instructional Track
- Tenure Track

College of Computing Ethnicity Profile, Fall 2022



College of Computing Majors

Applied Computing	Computer Science	Shared
Computational Science (PhD) Computer Networking and System Administration (BS) Electrical Engineering Technology (BS) Health Informatics (MS) Mechatronics (BS, MS)	Computer Science (BS, MS, PhD) Cybersecurity (MS) Data Science (MS) Software Engineering (BS)	Cybersecurity (BS) General Computing (First-Year Program)

Computing [MTU]



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