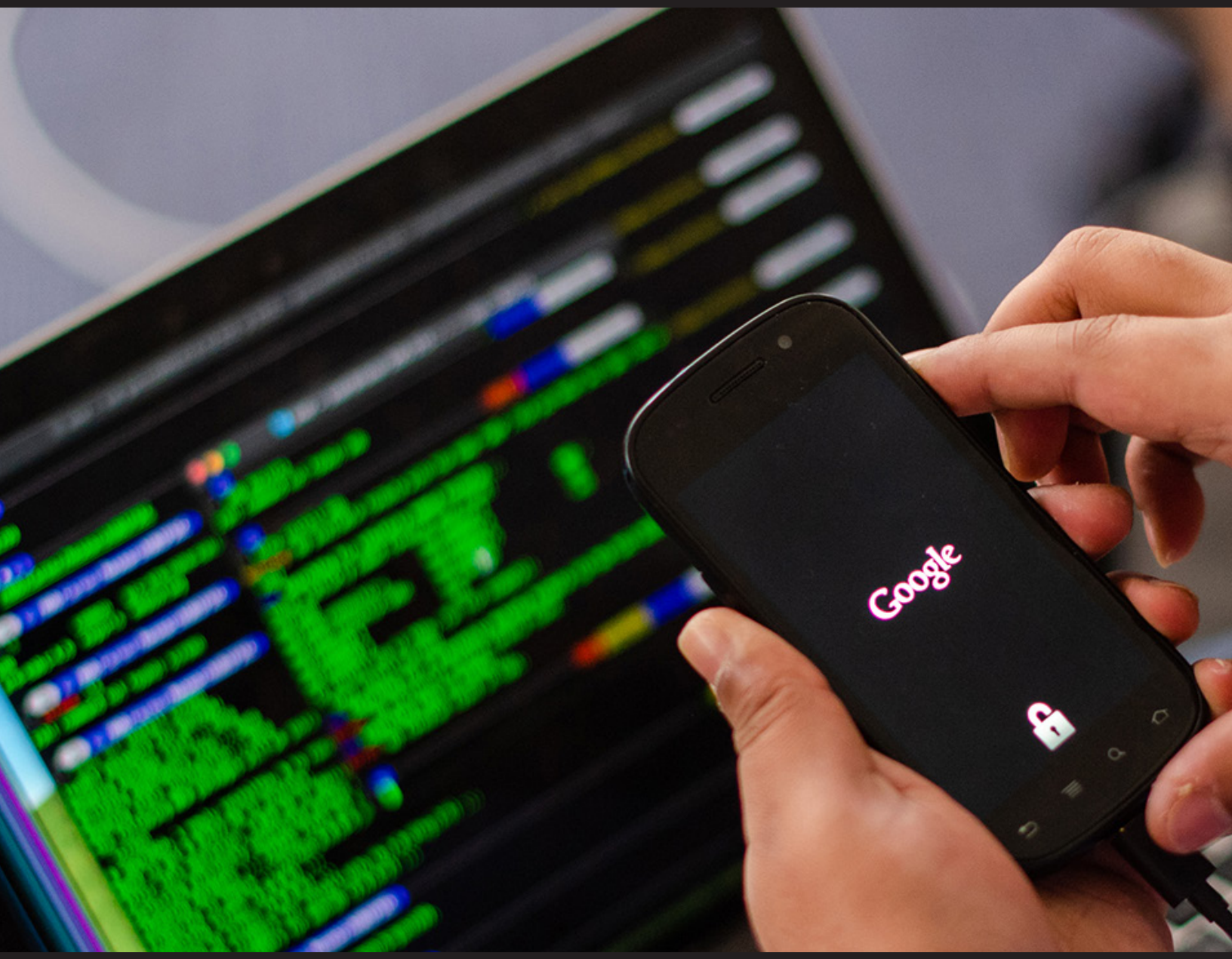
ANNUAL REPORT

[ICC] Institute of Computing and Cybersystems



FY22 Annual Report

ANNUAL REPORT FY 2022
Published by the Institute of Computing and Cybersystems, Michigan Technological University

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Executive Summary

University Centers and Institutes The ICC is one of more than 50 Research Centers and Institutes at Michigan Tech, which are intended to encourage interdisciplinary research projects larger in scope and/or breadth than typically undertaken by individuals or small intradepartmental groups. To encourage these collaborative endeavors, the University provides incentives, including increased returns on research overhead, access to limited submission proposal opportunities, and support from the office of the Vice President for Research. In return, Centers and Institutes provide a positive return on investment (ROI) to the University, support the University's strategic direction, and provide a positive contribution to the University overall.

History

In 2014, the Alliance for Computing, Information, and Automation (ACIA) initiated a collaboration among the Department of Computer Science, the Department of Electrical and Computer Engineering, and the Computer Network and Systems Administration and Electrical Engineering Technology undergraduate programs, then part of the School of Technology. Plans were laid for a research institute, and in 2015 the ICC was launched. On July 1, 2019, the ICC became associated with the newly-formed Michigan Tech College of Computing.

ICC Organization

The ICC comprises seven research centers, each pursuing research in a broad computing discipline. The leadership of the Institute is an executive committee composed of the director, associate director for research development, and the seven center directors.

ICC Membership

The ICC's 83 members represent at minimum 20 Michigan Tech departments and academic disciplines. Nine researchers joined the ICC in FY22.

The MTU Strategic Plan

The work of the ICC embodies in particular Goal 3 of the University's strategic plan, "Research, scholarship, entrepreneurship, innovation, and creative work that promotes a sustainable, just, and prosperous world." Further, President Rick Koubek's "Tech Forward" vision, which aims to position Michigan Tech as an internationally recognized academic thought leader in the Fourth Industrial Revolution, is fully embraced by the ICC and its membership. In fact, the 2014 proposal to create the ICC articulates as its vision the need to prepare for and respond to such a revolution.

Proposal Activity

In FY22, ICC members submitted 91 grant proposals, totaling $27,727,263. 39% of all proposals were awarded.

New Awards

31 grants were awarded to ICC members, totaling $4,091,343.

Research Expenditures

FY22 research expenditures reached $2.87 million, an eight percent increase from FY21.

Active Awards

ICC active FY22 grants and contracts number 89, with awards totaling $9.68 million.

Scholarship and Service

ICC members are leaders among their peers. In FY22, ICC members collectively attended dozens of national and international academic conferences; published hundreds of articles, papers, book chapters, and books; presented dozens of talks, and seminars; and provided prodigious professional service of many kinds.

Associate Professor Laura Brown (right) and students

FY22 by the Numbers

4.1 million in 36 new research awards

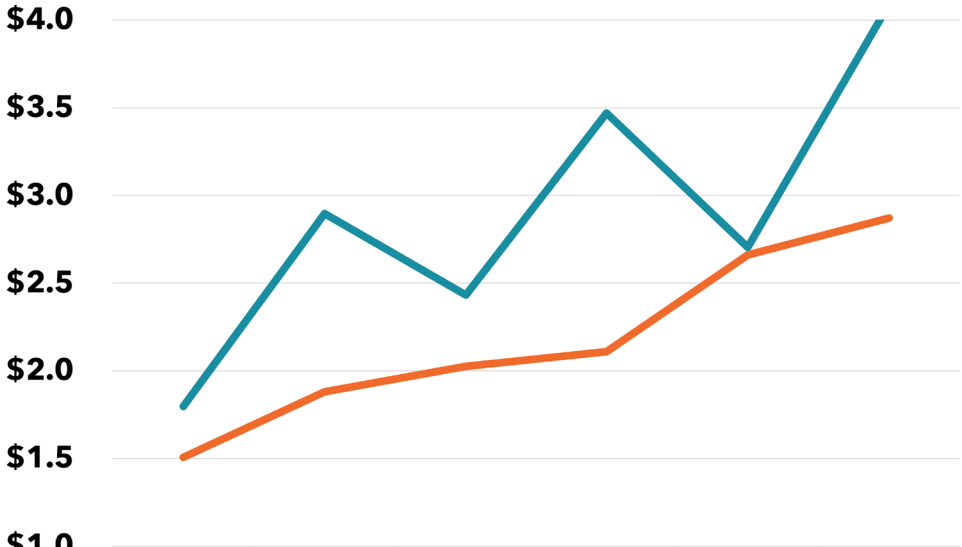
89 Active Awards

$2.87 million in research expenditures

Research Activities	FY18 Results	FY19 Results	FY20 Goal	FY20 Results	FY21 Results	FY22 Results
New Research Awards	2.9M	2.4M	2.8M	3.5M	2.7M	**4.1M**
Research Expenditures	1.9M	2.0M	2.6M	2.1M	2.67M	**2.87M**
No. of New Research Awards	21	25	10	30	21	**36**
No. of Proposals Submitted	21	37	47	25	76	**91**

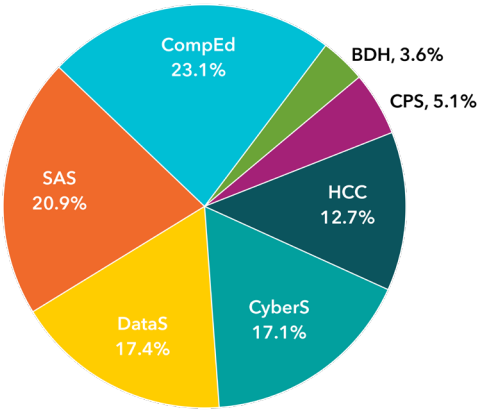
Awards and Expenditures

FY17-FY22

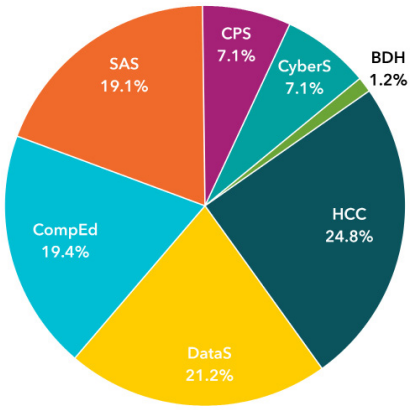


	FY17	FY18	FY19	FY20	FY21	FY22
Awards	$1,798,494	$2,897,137	$2,431,192	$3,467,792	$2,704,680	$4,091,343
Expenditures	$1,508,400	$1,879,387	$2,025,936	$2,108,726	$2,661,305	$2,871,685

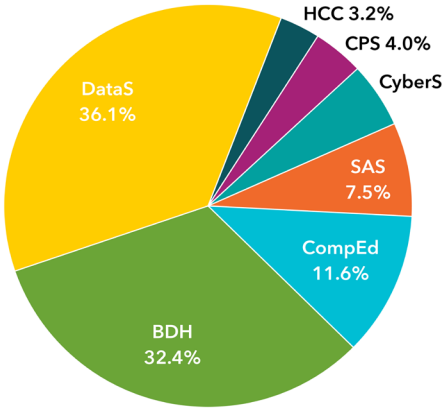
New Awards
by ICC Center



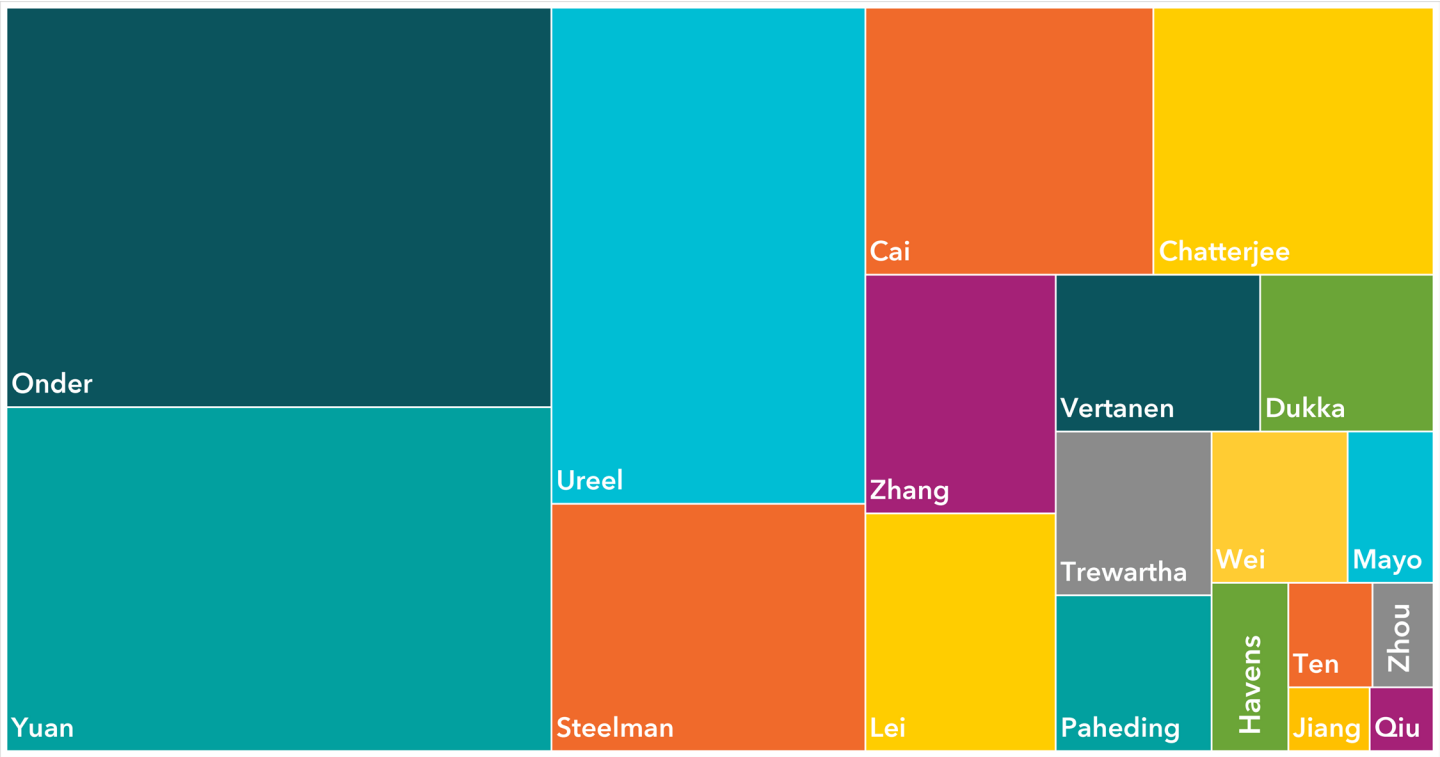
Active Awards
by ICC Center



Proposals
by ICC Center



New Awards by PI



New Awards, FY22

Yu Cai, CompEd/CyberS: "GenCyber Student Camp in the Age of Artificial Intelligence" | Sponsor/Duration/Amount: DOD/2 year/$148,660

"GenCyber Student Camp through Doing+Gaming+Case Study+Teaching" Sponsor/Duration/Amount: DOD/2 year/$148,708

S. Chatterjee, DataS: "Mine Health and Safety Big Data Analysis and Text Mining by Machine Learning Algorithms" | Sponsor/Duration/Amount: DHHS/2 year/$288,343

Tim Havens, DataS: "Information Theory Approaches for Machine Learning Algorithm Performance Assessment with Limited Testing Data" | Sponsor/Duration/Amount: Signature Research, Inc./1 year/$49,998

J. Jiang, BDH: "Machine-learning based detection of heart defects in neonatal patients" | Sponsor/Duration/Amount: Spectrum Health Foundation/1 year/$20,000

Dukka KC, BDH/DataS: "III: Medium: Collaborative Research: Multi-Level Computational Approaches to Protein Function Prediction" | Sponsor/Duration/Amount: NSF/1 year/$104,623

X. Lei, CyberS: "CRII: SaTC: Enabling Secure Machine Learning Queries over Encrypted Database in Cloud Computing" | Sponsor/Duration/Amount: NSF/2 year/$174,855

Jean Mayo, CompEd/HCC: Restricted | Sponsor/Duration/Amount: Restricted/4 month/$50,000

Soner Onder, SAS: "SHF: Medium: Collaborative Research: Statically Controlled Asynchronous Lane Execution (SCALE) | Sponsor/Duration/Amount: NSF/2 year/$157,345

"SHF: Medium: Collaborative Research: Statically Controlled Asynchronous Lane Execution (SCALE)" | Sponsor/Duration/Amount: NSF/2 year/$331,496

"Collaborative Research: SHF: Medium: Vectorized Instruction Space" | Sponsor/Duration/Amount: NSF/4 year/$331,704

"NSF-ICC-FoMR: Collaborative Research" | Sponsor/Duration/Amount: NSF (Florida State)/1 year/$18,382

Sidike Paheding, DataS: "REF-CY22-RS: M2DeepPhosSite: MultiModal Deep Learning-based Approaches for Protein Phosphorylation Site Prediction" | Sponsor/Duration/Amount: MTU REF/1 year/$24,000

"Collaborative Research: FW-HTF-P: IntelEUI: Artificial Intelligence and Extended Reality to Enhance Workforce Productivity for the Energy and Utilities Industry" | Sponsor/Duration/Amount: NSF/1 year/$69,711

J. Qiu, CPS: "CRII: SHF: GPU-accelerated FSM computations with advanced speculation" | Sponsor/Duration/Amount: NSF/1 year/$15,600

Kelly Steelman, HCC: "EAGER: SAI: Illuminated Devices: A Sociotechnical Approach to Empowering Digital Citizens and Strengthening Digital Literacy" | Sponsor/Duration/Amount: NSF/2 year/$299,617

Chee-wooi Ten, CPS: "Power Systems Transformation Summer School" | Sponsor/Duration/Amount: ASU/Alfred P. Sloan Foundation/1 year/$34,050

Kevin Trewartha, HCC: "Motor Learning as a Sensitive Behavioral Marker of Mild Cognitive Impairment and Early Alzheimer's Disease" | Sponsor/Duration/Amount: DHHS/1 year/$98,240

Leo Ureel, CompEd: "Rich Immediate Critique of Antipatterns (RICA in Novice Programmer Code: Broadening Adoption Supporting Student Learning and Enhancing Programming Competencies" | Sponsor/Duration/Amount: NSF/3 year/$599,732

Keith Vertanen, HCC
"CAREER: Technology Assisted Conversations" | Sponsor/Duration/Amount: NSF/1 year/$123,525

Hairong Wei, DataS
"ECA-PGR: Under the Hood: The Genetic Components of Maize Transformation" | Sponsor/Duration/Amount: KSU/1 year/$79,765

Brian Yuan, CyberS/DataS
"Collaborative Research: SHF: Medium: A Heterogeneous Architecture for Collaborative Machine Learning" | Sponsor/Duration/Amount: NSF/3 year/$200,148

"Collaborative Research: SHF: Small: Artificial Intelligence of Things (AIoT: Theory, Architecture, and Algorithms" | Sponsor/Duration/Amount: NSF/3 year/$409,355

"Collaborative Research: SHF: Medium: Heterogeneous Architecture for Collaborative Machine Learning" | Sponsor/Duration/Amount: NSF/3 year/$109,022

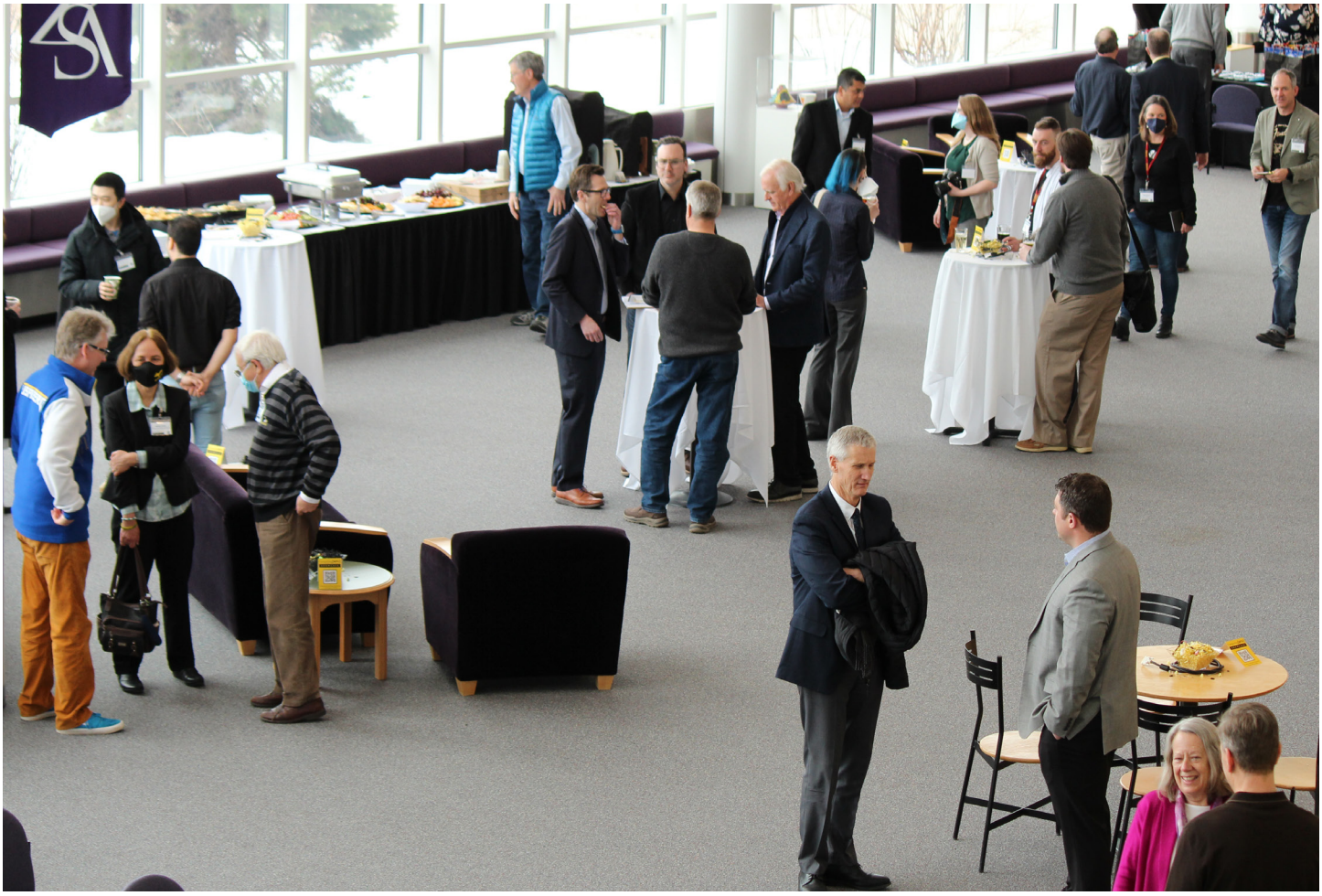
"POWE Privacy Preserving Machine Learning at the Edge" | Sponsor/Duration/Amount: Oak Ridge Associated Universities (ORAU)/1 year/$5,000

Lan Zhang, CPS
"CRII:CNS: IoT-aware Federated On-Device Intelligence" | Sponsor/Duration/Amount: NSF/1 year/$174,967

Weihua Zhou, BDH: "Trans-omics integration of multi-omics studies for male osteoporosis" | Sponsor/Duration/Amount: Tulane University (NIH)/1 year/$24,497

Celebrating 100_2 Years

Chartered in 2015, the Institute of Computing and Cybersystems (ICC) is celebrating 1000_2 years. From about 25 members in three research centers, in eight years the ICC has grown to seven centers and 83 researchers from across campus representing all five Michigan Tech colleges and more than a dozen academic departments. The ICC was established through the generosity of alumnus and major donor Dave House ’65, and the House Family Foundation, with other major donations to support our research coming from Kanwal Rekhi ’69 and Paul Williams ’61. Originally the research arm of the Alliance of Computing, Information, and Automation (ACIA) at Michigan Tech, the ICC provides faculty and students the opportunity to work across organizational boundaries to create Celebrating 1002 Years an environment that is a reflection of contemporary technological innovation. Member scientists are collaborating to conduct impactful research, make valuable contributions in the field of computing, and solve problems of critical national importance. The ICC brings distinguished scholars to campus, hosts and sponsors seminars, and co-hosts, with the College of Computing, the annual Computing[MTU] Showcase. Additional member benefits include support for graduate students, student travel support, seed funds for junior faculty, proposal development services, computing facilities, and communications and marketing support, among many other activities. The ICC is directed by Timothy Havens, the William and Gloria Jackson Professor of Computer Science, as well as the director of Michigan Tech’s Great Lakes Research Center. Dukka KC, College of Computing associate dean for research and associate professor of computer science, is the ICC’s associate director. Each of the research centers is led by an associate director. The founding director of the ICC was former faculty member Min Song, then chair of the Department of Computer Science. The Michigan Tech Alliance for Computing, Information, and Automation (ACIA) was formed in 2014 as an agreement among the departments of Electrical and Computer Engineering and Computer Science, and the academic programs in Electrical Engineering Technology and Computer Networks and Systems Administration, to promote cooperation in academic programs in order to align scholarly activities more closely with each other.



Looking Ahead: Top 3 by FY27

The Institute of Computing and Cybersystems (ICC) is on its way to becoming a leading research institute at Michigan Tech, continuing to support the prominence and growth of the College of Computing and interdisciplinary computing researchers at Michigan Tech, providing top-notch research services for faculty and students across campus, and hosting visiting lecturers and scientists, a new faculty seminar series, and the annual Computing [MTU] Showcase.

The ICC continues to seek opportunities to develop the research services and capabilities of the ICC staff, invaluable resources for member faculty and students. Building these services also encourages productive and research-active faculty: i.e., researchers who can utilize services and capabilities to grow their own research program.

In the near term, the ICC is searching for a research coordinator, supervised by the assistant director for research development, Amanda Stump. The coordinator will assist with proposal development, budget preparation, ICC event planning and execution, and day-to-day ICC activities.

Also sought, a full-time, PhD-level research scientist will both assist ICC members with their externally funded research and lead their own research projects. The initial salary and startup for this new position is supported by a gift from alumnus Kanwal Rehki.

Further out, the ICC will continue to identify and act on opportunities to build institute staff, for instance additional research services personnel, research engineers, software developers, or research scientists.

By FY27, the ICC seeks to be a “Top-3” research institute at Michigan Tech in terms of research expenditures and new awards. To this end, the institute is working to grow expenditures to $6 million per year, grant awards to $10 million per year, and receive one multi-university center award with a budget of more than $10 million.

Providing necessary computing for our members will continue to be a priority for the ICC into the near future. For example, this year, Dr. Dukka KC and other ICC member faculty were awarded an NSF MRI grant to fund investments in high-performance computing.

The ICC also seeks to invest in opportunities related to Industry 4.0, such as automation, data science, robotics, and mechatronics. And in collaboration with the Great Lakes Research Center, the ICC is investing in research at the nexus of freshwater sciences, marine autonomy, and computing through a $100,000 in Rapid Research Seedling Grants opportunity. To help accomplish these goals, ICC fund-raising goals over the next five years include $500,000 for startup funds for personnel hires over the next five years and $1 million to endow and provide startup costs for an endowed research scientist position

GLRC/ICC Collaboration Announced

The Institute of Computing and Cybertsystems (ICC) and the Great Lakes Research Center (GLRC) have formed a collaborative institute. FY23 budget and revenue projections have been established, and GLRC-ICC networking events have been scheduled. A research manager position has been advertised and the first round of Rapid Seed Grants have been awarded.

"The collaboration is intended to build capacity for research services at the intersection of the institutes and spur and encourage collaborative research," says Tim Havens director of the GLRC and ICC.

Tim Havens Named GLRC Director

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

$100K in GLRC/ICC Seedling Grants

The GLRC-ICC collaborative institute has committed $100,000 in rapid seedling research grants for faculty and research staff projects conducted in the spring, summer, and fall 2023 semesters.

The seedling funding is intended to provide backing for idea development and data collection that will become part of larger externally sponsored funding requests. Michigan Tech tenured, tenure-track, and research faculty, and research scientists and engineers are invited to submit proposals.

Amanda Stump: Supporting Researchers

Amanda Stump, the Institute of Computing and Cybersystems's (ICC) assistant director for research, supports faculty in all aspects of their research, from opportunity scouting to proposal initiation to grant closeout and more. She began her position with the ICC in fall 2021.

Stump promotes the ICC externally through relationship building and events and activities to share the ICC's cutting-edge research, such as the Computing[MTU] Showcase and the ICC Distinguished Lecturer series. She supports student research through poster session opportunities and the facilitation of student travel grants.

Stump especially likes the variety of her position. "I work with and reach so many different people at MTU and beyond," she says. "Everyone has been so inclusive and welcoming. It has been great being part of the community here."

Stump has many years experience in development and grant writing, and she has worked extensively in human medical research. At Mayo Clinic, she helped diagnose rare genetic diseases in the biochemical genetics laboratory.

She was a research scientist and lab manager for the University of Utah School of Medicine in Neurotrauma/ Radiology, and a lab and project manager at a regenerative medicine start-up PolarityTE.

She worked as a grant manager and development officer for Nuzzles & Co., an animal rescue organization in Park City, Utah, that partners with the tribes of the Mountain West to save animals' lives, and continues to volunteer remotely.

Stump is a licensed veterinary technician in Michigan and Utah. For several years, she instructed veterinary technician students as an adjunct professor. She has also worked with raptor rescue in Iowa. She is looking forward to volunteering for the Copper Dog 150.

Stump is pursuing a PhD in molecular genetics in Michigan Tech's College of Forest Resources and Environmental Sciences, continuing her master of science research. She holds a dual BFA/BA degree in scientific illustration and art history from the University of Michigan; a BA in genetics from the University of Northern Iowa; and an MS in plant biochemical genetics from the University of Northern Iowa.

Stump is a self-described hockey nut, playing goalie and left wing, and she hopes to get back on the ice this winter. She also helps with animal rescue, and she and her husband have fostered hundreds of medical needs or special needs animals over the years. They have 3 dogs and 3 cats.

Computing[MTU] Showcase

ICC Achievement Awards

Three Institute of Computing and Cybersystems (ICC) researchers were honored with achievement awards at the opening event of the Computing[MTU] Showcase in April 2022. The annual awards recognize exceptional contributions to the mission of the ICC.

Sidike Paheding, an assistant professor in the Applied Computing department, was recognized for achievements in research in out-of-this-world deep learning and cybersecurity. Paheding's areas of expertise include machine learning, deep learning, computer vision, image and video processing, hyperspectral image analysis, and remote sensing.

"I deeply appreciate the collaborative and supportive research environment that ICC creates for faculty across different disciplines," says Paheding.

Kelly Steelman, department chair and associate professor, Cognitive and Learning Sciences, was recognized for achievements in collaborative, interdisciplinary research and mentorship and support of junior faculty. Steelman's research interests include basic and applied attention, models of attention, human performance in aviation, display design, tech adoption, and technology training.

Brian Yuan, assistant professor in the Computer Science and Applied Computing departments, was recognized for achievements in research in heterogeneous architectures for collaborative machine learning. Yuan's areas of expertise include machine learning, security and privacy, and cloud computing.

Showcase Poster Session Winners

More than 40 students presented their research posters at the Computing[MTU] Showcase Poster Session in April 2022. Sincere thanks to all for participating and congratulations to the winners and honorable mentions!

Graduate Students

Best Poster: Shruti Amre, Applied Cognitive Science and Human Factors, Cognitive and Learning Sciences: "Keep your hands on the wheel: the effect of driver engagement strategy on change detection, mind wandering, and gaze behavior"

2nd Place (two-way tie): Evan Lucas and Steven Whitaker, Electrical Engineering, ECE: "Active learning with binary feedback on multiclass problems," and Suresh Pokharel, Computer Science: "O-GlcNAcylation (O-GlcNAc) Site Prediction Using Deep Learning Methods."

Honorable Mention-Best Demonstration: Dylan Gaines, Computer Science: "Optimizing an Ambiguous Keyboard for Location-Independent Text Entry"

Undergraduate Students

Best Poster: Anthony Palmer and Elijah Cobb, Physics and Applied Mathematics: "Universal Sensor Description Schema: An extensible metalanguage to support heterogenous, evolving sensor data"

Second Place: Joshua Reynolds, Software Engineering: "Results of typing on three different angled virtual keyboards using the HoloLens Version 2, a Mixed Reality device"

Third Place: Thomas Grifka, Computer Science:"Image Steganography: Unknown Information

Honorable Mention-Best Visual Design: Kevin Cornell and Christian Clemmons, Computer Science: "Supply Chain Simulator"

Honorable Mention-Best Presentation: Kirk Thelen, Computer Science: "Illuminated Devices: A Sociotechnical System to Broaden Access to Digital Assistance"

Andy Duan: New Chair

Andy Duan is the Department of Computer Science chair and professor. He joined the Michigan Tech College of Computing from the Department of Electrical Engineering and the Computer Science University of Missouri at Columbia, where he was an associate professor 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 of computer science.

"It is great to have Andy on our team," says Dennis Livesay, Dave House Dean of Computing. "The Department of Computer Science is doing really well, 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.

Duan is the principal investigator of active research projects exceeding $1 million, and over $16M in total external funding.

Briana Bettin: Amazing Success

Assistant Professor Briana Bettin, Computer Science and Cognitive and Learning Sciences, has accomplished in one year what most professors accomplish over a decades-long career.

Bettin was awarded the 2021 Michigan Tech Distinguished Teaching Award and she 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 Dean's 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%, which he finds impressive for a second-year instructor charged with teaching large sections of introductory programming courses.

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

Brian Yuan: New Grants and Awards

Xiaoyong (Brian) Yuan, assistant professor of Applied Computing and Computer Science, has had a fantastic 2022.

Yuan joined Michigan Tech in fall 2020 directly following his completion of a PhD in computer science at University of Florida. Since then, Yuan has twice been recognized by his peers and he is the principal investigator of grants totaling more than $1 million.

Yuan's areas of expertise include machine learning, security and privacy, and cloud computing. He is a member of the Institute of Computing and Cybersystems' (ICC) Centers for Cybersecurity and Data Science.

In April 2022, Yuan received an ICC Achievement Award recognizing his accomplishments in research in heterogeneous architectures for collaborative machine learning.

As a junior faculty member, Brian Yuan says he has received a lot of support from ICC.

"It is an honor to be a part of the ICC, and I appreciate the recognition," he adds. "I will continue my research on machine learning and cybersecurity to contribute to the ICC."

In June 2022, Yuan received the 2022 Oak Ridge Associated Universities (ORAU) Ralph E. Powe Junior Faculty Enhancement Award in Mathematics/ Computer Sciences, which represents public recognition by academic peers of the quality and promise of Yuan's research. Yuan will receive a grant of $5,000 from ORAU and a matching award from Michigan Tech.

Also in June 2022, Yuan received a three-year, $409,355 National Science Foundation (NSF) grant titled, "Collaborative Research: SHF: Small: Artificial Intelligence of Things (AIoT): Theory, Architecture, and Algorithms." The project intends to facilitate the deployment of hardware-efficient AI techniques in federated IoT environments, which fills a critical void as existing approaches fail to address the widespread resource, efficiency, and privacy challenges in AIoT. Yuan's co-PI is Lan (Emily) Zhang, assistant professsor of Electrical and Computer Engineering. The research is a collaboration is between Michigan Tech, as lead institution, and the University of Florida.

In July 2022, Yuan received a $200,148 NSF research and development grant titled "Collaborative Research: SHF: Medium: Heterogeneous Architecture for Collaborative Machine Learning," which intends to develop heterogeneous architectures for collaborative machine learning to achieve efficiency, adaptivity, and privacy. Lan (Emily) Zhang (ECE/ICC-CPS) is s co-PI.

In August 2022, Yuan was awarded a $500,000 National Science Foundation grant titled, "CNS Core: Small: Privacy-Preserving On-Device Intelligence in the IoT Era." Lan Zhang (ECE/ICC–CPS) is co-PI. The project intends to develop privacy-preserving on-device intelligence to facilitate the deployment of hardware-efficient AI techniques in federated IoT environments, which fills a critical void – the existing approaches fail to address the widespread resource, efficiency, and privacy challenges in AIoT.

IMPACT [ICC] Institute of Computing and Cybersystems

Your gifts support multidisciplinary research and education in the fields of biocomputing and digital health, computing education, cyber-physical systems, cybersecurity, data sciences, human-centered computing, and scalable architectures and systems for the benefit of Michigan Tech and society at large.

- **GRADUATE FELLOWSHIPS** to grow and sustain a diverse and growing body of smart, promising graduate students.
- **UNDERGRADUATE RESEARCH FELLOWSHIPS** to support and retain talented students with financial need, students from diverse backgrounds, and women and under-represented students.
- **SEED GRANTS** to stimulate and encourage opportunities for original research and provide students with valuable, hands-on experience.
- **OUTREACH SUPPORT** to help recruit top undergraduate and graduate students.
- **HONORARIUMS, TRAVEL FUNDS** to host seminars and distinguished lecturers, spark inspiration, and bring fresh ideas to campus.
- **ENDOWED PROFESSORSHIPS** to attract and retain top talent and give those individuals freedom and time for scholarship and research.
- **VISITING PROFESSORS, RESEARCH SCIENTISTS** to host expert scholars on campus and augment and diversify teaching and research capabilities.
- **FACILITIES AND EQUIPMENT** for top-notch learning and research equipment, software, and infrastructure.

Biocomputing and Digital Health
Conducts research, develops innovative solutions, and provides educational opportunities in biocomputing and digital health.

Computing Education Center
Fosters collaborations and develops interventions that encourage adoption of computer technology across campus.

Cyber-Physical Systems
IoT, smart homes, buildings, communities and grids, smart transportation, smart health, and underwater communications.

Cybersecurity
Information security and biometrics, privacy protection, trusted software engineering, security in mobile computing and wireless communications.

Data Sciences
Big data and data- intensive computing, AI and machine learning, pattern recognition, signal and image processing, sensor and data fusion.

Human-Centered Computing
Human-agent interactions, assistive technologies, intelligent health, computational modeling, collaboration and trust, decision making and adaptive learning.

Scalable Architectures and Systems
Heterogeneous parallel and distributed computing, embedded systems, dependable computing, formal methods, fault tolerant systems, architectures for secure systems, virtualization, scalable algorithms.

"There is growing interest in ICC members' research as external stakeholders learn more about what we are building here at Michigan Tech in all things computing."

—Dr. Timothy Havens, ICC Director

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