

[ICC]

Institute of Computing
and Cybersystems

2023 ANNUAL REPORT



```
admin.py --catalog 1 X admin.py --accountant 3
admin.py > ...
def delete_post(self, request, queryset):
    queryset.update(archived=True)
    queryset.update(archivedType=ArchivedType.Type
    # Decrement number of points by three
    for item in queryset:
        profile = user_profile.objects.get(user
        profile.points = profile.points - 3
        profile.save()
    delete_post.short_description = "Delete posts"

def allow_post(self, request, queryset):
    make_item_public(queryset)
    allow_post.short_description = "Make public"

def ignore_post(self, request, queryset):
    ignore_report(queryset)
    ignore_post.short_description = "Ignore"

def get_actions(self, request):
```

Annual Report FY 2023

Published by the Michigan Tech
Institute of Computing and
Cybersystems

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William and Gloria Jackson Professor

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An aerial photograph of a town, likely Houghton, Michigan, showing residential houses, streets, and a large parking lot in the foreground. In the background, a river flows through the town, with a suspension bridge crossing it. The sky is clear and blue.

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From the Director

Dear Friends,

I hope that fiscal year 2024 (July 2023 - June 2024) has started as strong for you as it has for the ICC and College of Computing at Michigan Tech. The ICC and College have experienced unprecedented growth in research in the last year and enrollment at the College grew nearly 16% this year. These are certainly exciting times for computing and science, in general. Computing has become a ubiquitous part of our everyday lives; depending on who you ask, AI is going to save us and or destroy us (my beliefs lie somewhere in the middle); and the knowledge we have about our world and universe is being discovered at an astonishing rate. Michigan Tech is right in the midst of this next industrial revolution and the world is catching on to the amazing research and education we offer. I am eager to see both the ICC and College grow to meet the increasing demand for computing innovation and education.

I would like to congratulate our members for an exceptionally productive year; by nearly every metric, FY23 was a resounding success. Research expenditures eclipsed \$3 million for the first time in our existence, and new awards totalled a record \$6.1 million. As a preview, we have already been awarded nearly \$7 million in the first quarter of FY24. The research of ICC members is having a huge impact on the region and the world. We had several large projects funded, including Michigan Tech's first National Science Foundation Research Traineeship program: "Integrative Training in Data Science-Enabled Sensing of the Environment for Climate Adaptation (DataSENSE)." Congratulations to Laura Brown (Computer Science) and her team for this monumental achievement!

This financial success ensures that we continue to grow the research support available to our members and their research teams. Joining Amanda Stump's (ICC Associate Director, Research Development) team this year is James Townsend as ICC Research Coordinator. James is working with us from his home in Tennessee and has already made a huge impact on our level of support and ability to disseminate the stories of our members' research—James authored this report! We also had two students join our team. Yogendra Kanchapu (Health Informatics) is helping us with marketing and social media and Hollis Aitkens (Computer Science) is assisting with event planning and general support.

We also anticipate that the ICC will be hiring its first professional research staff soon. We have been interviewing for a posted Research Scientist position and hope to have announcements on that in next year's report. These personnel resources are part of a long term strategic plan to grow the professional research activities in the ICC, with the overall aim of enabling world-class research impacts for Michigan Tech and the world.

To close, thanks to everyone in the ICC for making FY23 so fantastic and for fulfilling our mission to promote research and learning experiences in computing and cybersystems. To FY24 being a productive and fulfilling year!



Timothy C. Havens
Director, Institute of Computing and Cybersystems
William and Gloria Jackson Professor, Computer Science

University Centers and Institutes

The ICC is one of more than 50 research centers and institutes at Michigan Tech that 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 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

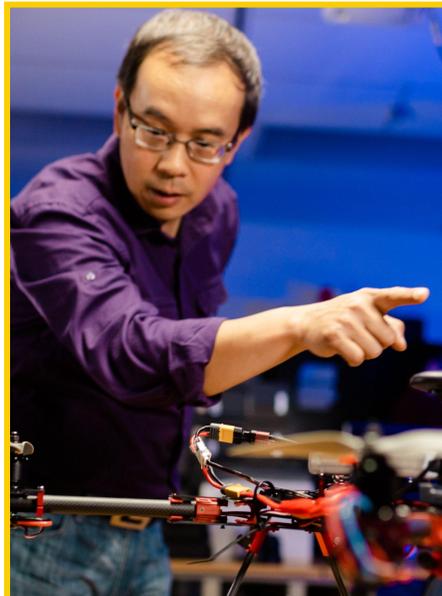
The ICC comprises seven research centers, each pursuing research in a broad computing discipline. A director provides Institute leadership; associate directors lead the Centers.

ICC Membership

The ICC's 82 members represent at least 20 Michigan Tech departments.

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



[ICC]

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

Fiscal Year 2023 was a strong year for the Institute of Computing and Cybersystems, characterized by expansion and escalating efforts. Only chartered in 2015, membership, funding, and research have increased steadily since. This concluded fiscal year saw an explosion of activity, aided by new ICC faculty and staff as well as additional efforts such as the Rapid Seedling Grants. In FY23, ICC researchers submitted 88 proposals for a total of \$49,034,262: a 76% increase from FY22.

New Awards

New FY23 ICC grants add up to 35 and \$6,091,842: a 48% increase year-over-year.

Research Expenditures

FY23 research expenditures reached \$3.33 million, a fourteen percent increase from FY22.

Active Awards

As the fiscal year wrapped up, the ICC had 99 currently active projects, adding up to \$13.19 million. In project-to-date expenditures, that number is \$5.73 million (which includes previous years).

Scholarship and Service

ICC members are leaders among their peers. In FY23, 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.

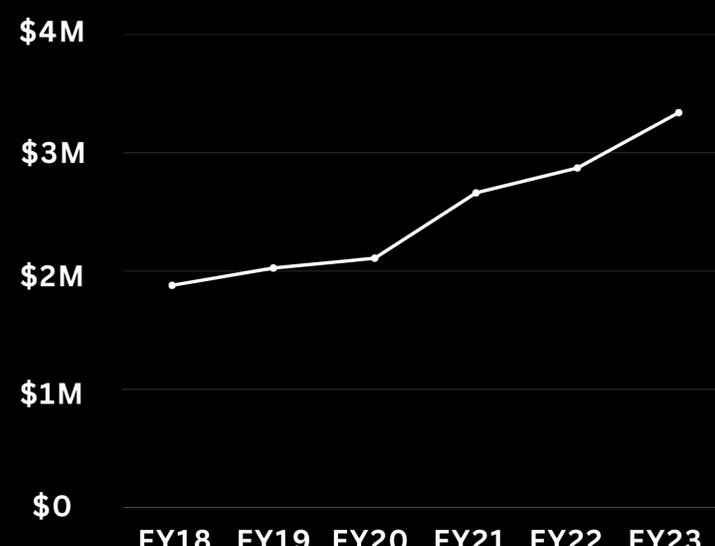
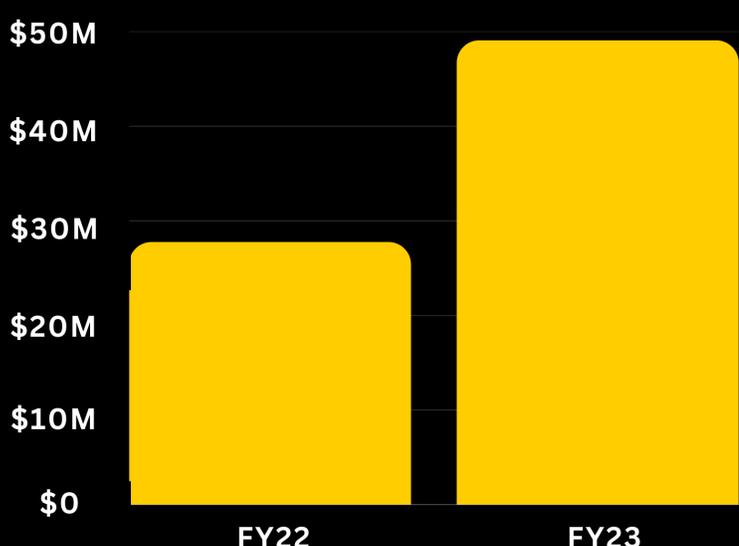
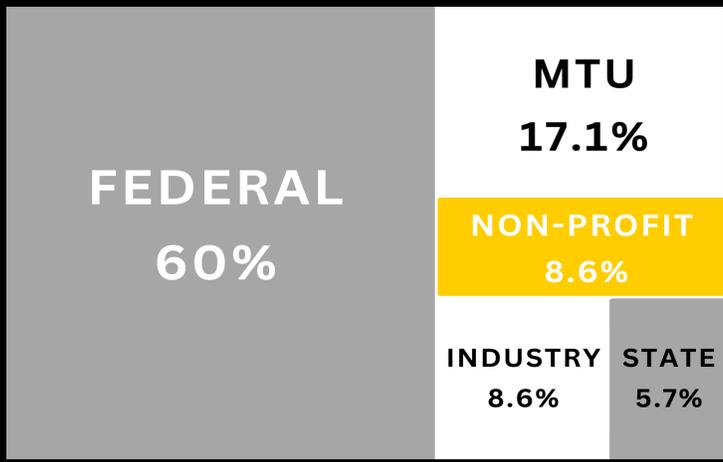
FY23 By the Numbers

↑ **\$13.2M**
99 Active Awards

\$3.3M
Research Expenditures

\$6.1M ↶
35 New in FY23

Research Activities	FY18	FY19	FY20	FY21	FY22	FY23
New Awards (\$)	2.9M	2.4M	3.5M	2.7M	4.1M	6.1M
Expenditures (\$)	1.9M	2.0M	2.1M	2.7M	2.9M	3.3M
No. of New Awards	21	25	30	21	26	35
No. of Proposals Submitted	21	37	25	76	91	88



PROPOSAL AMOUNTS FY22/23 ICC

ICC EXPENDITURES FY18-FY23 ICC

New Awards

Jean Mayo was awarded a 2-year grant by the Advanced Research and Invention Agency and DOD to develop non-real-time hardware-assisted computer-system simulation.

Xiaoyong Yuan and Lan Zhang were awarded a 3-year grant by NSF to enhance privacy-preserving on-device intelligence.

Yu Cai and Tim Van Wagner were awarded a 2-year grant from NSF to fund the Innovative GenCyber Teacher Camp.

Bo Chen and Zhenlin Wang received a 3-year grant from NSF to develop hardware assisted self repairing decentralized cloud storage capabilities to increase resiliency to malicious attacks.

Dukka KC's research on deep learning based approaches for protein post-traditional modification received a transfer and concluded in June 2023.

Yakov Nekritch received a 3-year grant from NSF for fundamental geometric data structure research.

Dukka KC was awarded a 2-year grant for the acquisition of a GPU-accelerated cluster for research, training, and outreach.

Tim Havens was awarded a 2-year grant to investigate ways to predict the radar signature of vehicles.

Chee-Wooi Ten was awarded a 1-year NSF grant for prototyping a power substation blackbox.

Guy Hembroff was awarded a 6 month grant from Henry Ford Health for his research in improving fracture risk predictions through low bone mass detection.

Susanta Ghosh was awarded a 1-year grant from UCLA and DOE for his studies in chiral nanomaterials.

Leo Ureel was awarded a 2.5 year grant from ICC and GLRC for an online journal of undergraduate applied computing and research called Infinite Loop.

Sidike Paheding was awarded a 4 month grant from ICC and GLRC for using deep learning to understand the triggering factors of landslides.

Yu Cai submitted an awarded revision for the Scholarships for Service Program at Michigan Tech (CyberCorps), lasting 3 years.

Dennis Livesay was awarded a 6 month grant by MEDC for Talent Action Team (TAT) and Mobility.

Leo Ureel was awarded a 1-year grant from NSF for critiques of antipatterns in novice programmer code.

Hoda Hatoum received a rapid grant from ICC and GLRC for predicting patient prosthesis mismatch after aortic valve replacement.

Briana Bettin received a rapid grant from the ICC and GLRC and an MTU REF award for advancing student learning, equity, and accessibility in computing.

Hongyu An received a 2-year grant from NSF to further neuromorphic circuit design.

Nathir Rawashdeh received a 1-year grant from Orbion to implement automated control systems using PLCs for Evergreen Cooling Towers.

Dukka KC received a 2-year grant for the development of a smart telehealth ECGT and Human Activity Monitoring system targeting cardiovascular health in older adults.

Dennis Livesay received a second round of funding from the Michigan Economic Development Corporation for Talent Action Team (TAT) and Mobility Scholarships, ending in February 2024.

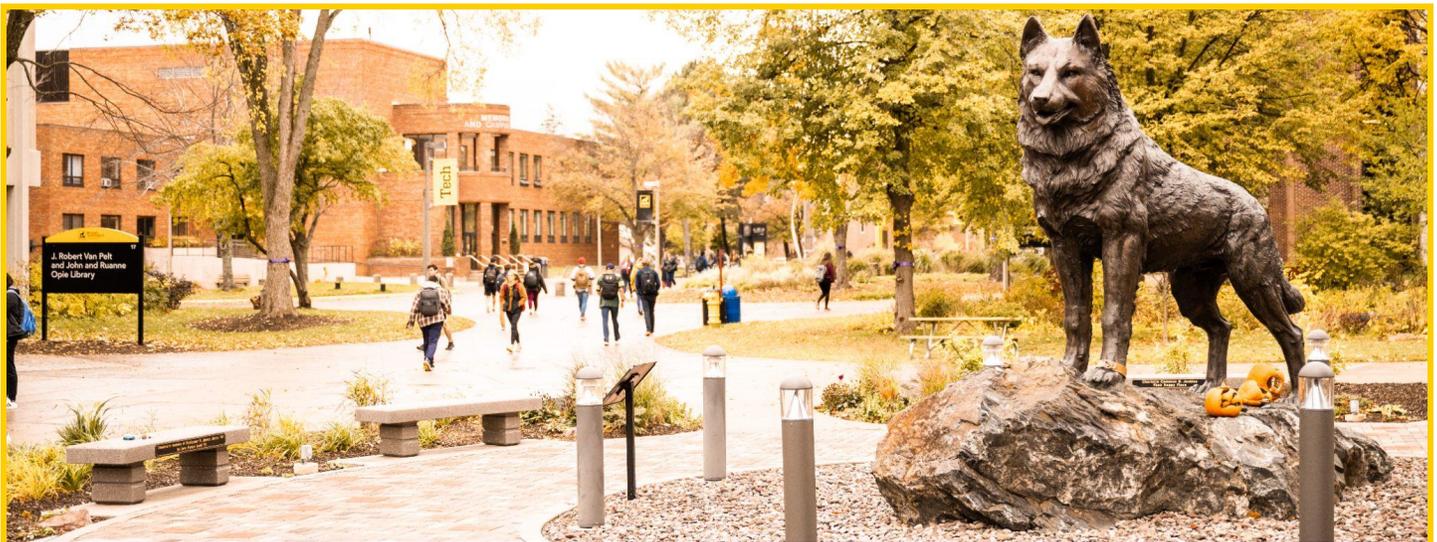
Weihua Zhou received a 1-year grant from SynterMed for integrating deep-learning-based methods into automated reorientation of PET myocardial perfusion images.

Jun Dai received a 1-year grant from IMA for furthering trustworthy AI in management accounting.

Jinfeng Jiang received a 2-year grant from Spectrum for multi-modality image analysis and integration.

Jun Dai received a REF award from the ICC for using blockchain to combat greenwashing in ESG reports.

Tim Havens received a 3-year grant from the Naval Surface Warfare Center to develop robust algorithms for complex autonomous robots systems.



Major Grants

Jean Mayo - Phase II: STTR Non-Real Time Hardware-Assisted Computer System Simulation

The Missile Defense branch of the US Department of Defense is funding research for non real-time hardware assisted computer system simulation. There are three phases to their support of this goal, and Dr. Mayo was awarded a grant for Phase II of this work, totalling around \$512,000. The expected outcomes for this phase include the creation of prototype software for experimental trials by government users, and documentation to support approval decisions to load the software onto government computer systems. This phase is slated for completion in May of 2024.

Brian Yuan, Lan Zhang - CNS Core: Small: Privacy-Preserving On-Device Intelligence in the IoT Era

In July of 2022, just at the start of FY23, Principal Investigator Brian Yuan, who is an Assistant Professor in the both the Applied Computing and Computer Science departments, was awarded a \$500,000 grant from NSF for on-device intelligence that preserves privacy in the “Internet of Things” era.



Dennis Livesay - Talent Action Team (TAT) and Mobility Scholarships

Dave House Dean of Computing Dennis Livesay as well as Michigan Tech as a whole have always been strong supporters of the MEDC’s Talent Action Team and the EV Scholars program, both of which have enabled Michigan to stay at the top of the EV industry in America. Because of this Livesay received a \$500,000 grant from

MEDC to support their vision by awarding scholarships to top tech students at Michigan Tech, with an attached commitment to work with one of the TAT private sector partners in EV and battery tech industries after graduating. Not only does this benefit the state of Michigan, but it helps Michigan Tech in their commitment to play a major role in the Fourth Industrial Revolution.



Bo Chen, Zhenlin Wang - SaTC: CORE: Small: Hardware-assisted self-repairing in decentralized cloud storage against malicious attacks

Bo Chen, associate professor of Computer Science, is the Principal Investigator for a three-year \$598,000 NSF grant working with co-PI Zhenlin Wang that aims to develop the first hardware-assisted self-repairing decentralized cloud storage system.

Such a system is utilized to defend against malicious attacks, and Dr. Chen has utilized the help of Dr. Wang as well as three students to produce two publications in 2023 and present their work at three conferences.

Yakov Nekritch - AF: Small: Fundamental Geometric Data Structures

In June 2022, Yakov Nekrich was awarded a grant from NSF for his research into geometric data structures. The \$594,000 allotted to support his project on the problems in geometric data will continue until September 2025 (estimated). Dr. Nekritch aims to attain a better understanding of data structures to gain insight into long-standing problems in data structures.



Art_in_Silico



The inaugural Art in Silico event was born in spring 2023, attracting creative people from within MTU and beyond. The computational art exhibition showcased how the logical nature of STEM and the creative spirit of art can work hand in hand. Along with the many intrigued visitors that came to view the ambitious displays and works created by the participants, the event raised \$1,200, supporting student scholarships and the Copper County Community Arts Center.

The collaboration event between the ICC, College of Computing, College of Visual and Performing Arts, and Great Lakes Research Center proved successful in attracting pure creativity and originality. ICC Director **Tim Havens**, an organizer for the event, spoke on the stage of the Rozsa Center for the Performing Arts to present awards to the winning participants after a viewing period for the entries. The art jury at the event voted on three different criteria—Best In Show, Most Creative, and Most Innovative—and they certainly had their work cut out for them.



Best In Show - Chloe McCarthy
“Computational Sona-Kolam with Rainbow Loop”



Most Creative - Scott Kuhl
“Film Streaks”



Most Innovative
“Emails from Dean Lovecraft”

Best In Show went to Chloe McCarthy for her computer rendition of a nearly lost form of Central African art. Diagrammatic designs, called Sona, had disappeared in the modern era, but were originally used by storytellers by drawing geometrically arranged dots in the sand enclosed with winding loops while telling their tale to those who would listen. McCarthy studies the properties of Sona and utilized machine learning to create an original and beautiful Sona-esque image.

Most Creative went to Associate Professor of Computer Science **Scott Kuhl** for his use of algorithms to extract frames from popular movies such as “Finding Nemo” and visualize them by putting them in “streaks” that can be read left from right and top to bottom like a book. **Most Innovative** was received by Evan Lucas for his original usage of a large language model to create a fascinating crossover. Lucas trained the language model with H.P. Lovecraft books as well as emails from the MTU Dean of Students. Upon entering a subject line into the model, it generates an email inspired by H.P Lovecraft and the Dean of Students

Growing Team

New ICC Faculty

Ashraf Saleem comes from a background of Mechatronics, earning his MS and PhD in that field in the United Kingdom after finishing his BS in Jordan. Joining the ICC in the third quarter, his background of robotics systems characterizes his interest in using automation to solve real-world problems such as monitoring environmental pollution. Additionally, **Dr. Saleem** delves into developing smart controllers for engineering systems. Broadly, his research interests can be unified under the deployment of robotics systems and AI in the field of remote sensing.

Yan Zhang is the last new member to join the ICC in FY23, also receiving many of her accolades and education in China. After completing her PhD at the University of Missouri-Kansas City, **Dr. Zhang** has made a name for herself in Houghton studying autosomal dominant polycystic kidney disease (ADPKD), which is the most common genetic disorder. Her work intends to expand upon the currently limited avenues afforded in terms of treatment options, in which **Dr. Zhang** has established a lab at MTU where she will recruit students to aid her research.

Tan Chen completed his education outside of his PhD (earned at Notre Dame) in China and France before joining the ICC in the first quarter of the fiscal year. In France, **Dr. Chen** was a recipient of the Eiffel Scholarship, a highly regarded financial aid from the French

Ministry for Europe and Foreign Affairs given to the brightest students in France. Entering the Department of Electrical and Computer Engineering, his research interests include applied mechanics, control, robotics, and AI usages in healthcare and smart manufacturing.

Wenbin Zhang After spending time at multiple global institutions, including the L3S Research Center, University of Milano-Bicocca, King Abdullah University of Science and Technology, to name a few, **Wenbin Zhang** found himself in Houghton, Michigan at MTU. His research focuses on designing machine learning algorithms that have theoretical performance guarantees and social consciousness, with a particular interest in developing machine learning usable in high-stakes decision-making in sectors such as healthcare, business, law, and climate policy.

Kaichen Yang is another valuable addition to the Electrical and Computer Engineering Department, receiving his BS and MS in China before completing his PhD at the University of Florida. **Dr. Yang** then moved from Florida to Houghton to join MTU, with his research interests lying within deep learning-related cybersecurity, hardware security, and network security. He has published many works and presented at various conferences, also serving as a reviewer for multiple top journals and conferences.



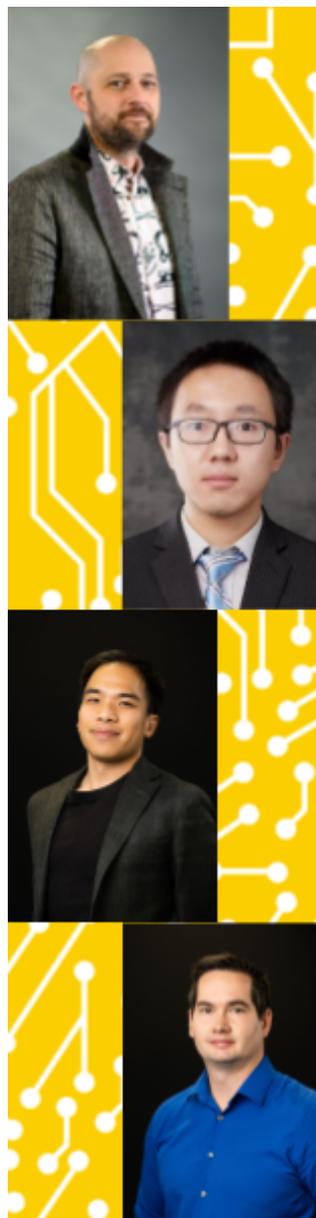
Jason Archer came to Houghton from not too far away. Receiving his BA, MA, and PhD from surrounding institutions in the University of Iowa, Wake Forest University, and the University of Illinois at Chicago, **Dr. Archer** resides in the Department of Communication and Media Technologies at MTU with many of his research interests aligning with the ICC, including human machine communication, haptic media studies, science and technology studies, sensory studies, and the relationship between communication, culture, and technology.

Zequn Wang joined the ICC in the first quarter of the year. Receiving his bachelors and master's in Beijing, **Dr. Wang** immigrated to America to pursue his PhD at Wichita State University. Not long after finishing a postdoc at Northwestern University, **Dr. Wang** came to Houghton to join the Department of Mechanical Engineering-Engineering Mechanics.

Vinh Nguyen is another first quarter addition to the ICC, and also joined the Department of Mechanical Engineering-Engineering Mechanics. **Dr. Nguyen** has two masters degrees to underline his PhD from the Georgia institute of Technology, with his main research interests residing in Industry 4.0, production processing including sustainable manufacturing, human-robot-machine interaction, and general industrial automation.

Tim Van Wagner joined in the third quarter of this previous fiscal year, adding to the Department of

Applied Computing at MTU. Outside of MTU, **Dr. Van Wagner** enforces his skillset doing outside consulting. As a lecturer, his teaching interests lie within network infrastructure, device endpoint configuration and management, implementation of wireless technologies, and network storage technologies. In terms of research, he focuses on network issues within healthcare, namely interoperability between healthcare organizations and the improvement of patient data management.



New ICC Staff

James Townsend has joined the ICC as a Research Coordinator, which entails a diverse array of tasks ranging from proposal writing to social media, with so much in between. The filling of this position added much needed support to ICC Associate Director Amanda Stump. James received his Bachelor's degree from UT Chattanooga and is now pursuing his Master's in American Studies at Kennesaw State University, where he additionally works as a graduate research assistant.

Yogendra Kanchapu immediately became a major contributor to ICC's public outreach efforts as soon as he started this fiscal year as a part time graduate student worker in social media and communications. Yogendra also just completed an internship as an EHR Assistant and is earning his master's in Health Informatics at MTU. He has experience as a pharmacist, owning a doctorate from Acharya Nagarjuna University.

Hollis Aitkins enters the ICC as a coordinator of ICC events and outreach. He is the communications coordinator for Michigan Tech Orientation 2023, a student help desk consultant in MTU's IT department, and a member of the Husky Games Enterprise. Hollis is an undergraduate student of computer science.

These three new team members will enhance the efficiency and agility of support at the ICC, fortifying our researchers and amplifying their globally recognized achievements.

Mechatronics

Late in FY23, Michigan Tech's Mechatronics program was ranked second in the country in an article by KnowInsiders, only trailing MIT. Despite the department's obvious success to anyone involved with the Mechatronics program, this was still a startling surprise to many.

"I was completely blown away by the article"
-Mark Gauthier, president of Donald Engineering and a longtime donor to the program. While Gauthier can acknowledge the quick growth of the program paired with the brilliant minds that run it, it is hard for him amongst others to fathom that the program is not even half a decade old. But it is true. Michigan Tech's Mechatronics program has truly sprung forth. This could absolutely not have been possible without the major contributors that paved the way for its success.

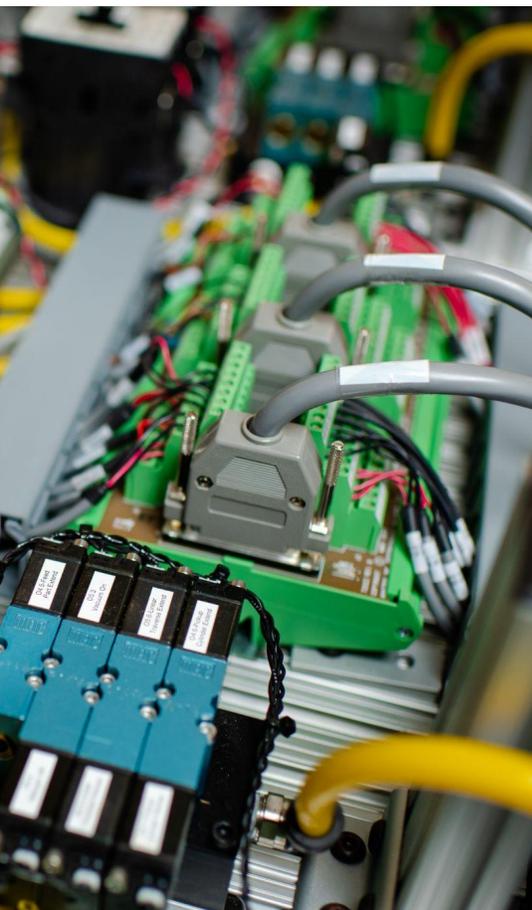
Aleksander Sergeev

After receiving his BS in Electrical Engineering in Moscow, Russia, Sergeev has since made Houghton, Michigan his home. Obtaining both his MS and PhD at Michigan Tech, he has become a leading professor, the director of the FANUC Certified Industrial Robotics Training Center, and the director of the Mechatronics graduate program.

Outside of mechatronics, his research interests are industrial robotics, automation and controls, optics, and image processing.

"It is my honor to direct the mechatronics program"
-Aleksander Sergeev, when asked about this achievement.

Dr. Sergeev was very quick to extend credit to others as well. He cites that upon the foundation of MTU Mechatronics, the dean of the School of Technology at the time, Adrienne Minerick, set the program up to succeed from the beginning. Minerick is now a professor in the chemical engineering department, but other major contributors are still around. Sergeev extended the same regards to the Dave House Dean of Computing Dennis Livesay as well as Dan Fuhrmann, chair of the Department of Applied Computing. Both have been very active in ensuring the program's success and growth. Other notable thanks have been extended to Nathir Rawashdeh, Assistant Professor of Applied Computing, whose efforts have also greatly contributed to the boom of Mechatronics at MTU.



Brian Power



Oak Ridge Associated Universities award a yearly research stipend to applicants from the universities that comprise the institution. This award, which is the Ralph E. Powe Junior Faculty Enhancement Award, is available solely to young university faculty in their first two years of a tenure track position. Similar to the rapid seedling grants awarded this year at MTU, the award is designed to provide seed money for projects that will likely scale up towards larger funded research or publications.

Xiaoyong (Brian) Yuan was selected from a pool of 155 applications from 87 ORAU member institutions. His application was awarded based on scientific/technical merit, his approach/method, past research, available facilities, scalability, and the quality of his application. This selection comes following Dr. Yuan's accepted proposal with NSF previously in this fiscal year, which is a \$500,000 grant together with co-PI Lan Zhang that addresses privacy concerns in on-device intelligence.

NSF MRI Grant

The National Science foundation gave the green light to funding Dukka KC along with others within the ICC to the tune of a \$432,000 grant. MRIs in the NSF are Major Research Instrumentation Programs, which are given out to high priority instrumental advancements to science and engineering.

Dukka KC, along with co-PI's Zhenlin Wang, Laura Brown, Jinfeng Jiang, and Issei Nakamura, undertake this interdisciplinary research with the goal of acquiring a GPU-accelerated computing cluster for research, training, and outreach. This high-performance computing cluster, called DeepBlizzard, will enable ground-breaking research at Michigan Tech. Through accelerating research, disseminating results, expanding collaboration, providing training and outreach, and addressing emergent and longer-term needs with broad societal impacts through multiple disciplines, DeepBlizzard will revolutionize the entire process, and promote seamless integration of research activities. Beyond Dukka KC and co-PIs, there are more than 20 additional faculty involved in this effort as senior personnel from many disciplines within Michigan Tech.



Wenbin Zhang

Wenbin Zhang, assistant professor of computer science, has had an impactful year in his research. Since the start of FY23, Dr. Zhang has been a main or contributing author in six publications, a few of which received additional recognition.

In the international journal KAIS, Dr. Zhang's publication was awarded "Bests of ICDM" in the IEEE Data Mining Awards. Another receipt of Dr. Zhang's excellence came about in FY23, as it was learned that his 2022 publication on datasets for fairness-aware machine learning was a top-10 article for the year in the WIRE Data Mining and Knowledge Discovery Journal.



Dr. Zhang also oversaw his graduate student Zichong Wang in his research, providing valuable support. With his guidance, Dr. Wang has produced two publications in 2023. One of the works discusses how to mitigate discrimination in data-streams, and received a Best Paper Award at the FAccT Conference in Chicago. Another, entitled "Fair Graph Generative Adversarial Networks," was recently accepted for presentation at a machine learning conference in Turin, Italy. Dr. Zhang's dedication to valuable research and his students embodies his character and the vision of Michigan Tech and the ICC.

Computing Showcase

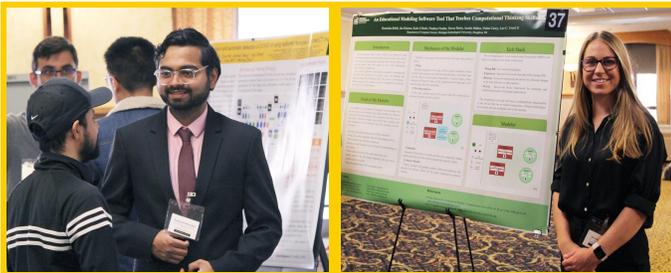
With the inaugural Computing [MTU] Showcase hosted by the ICC having been in the Spring of 2022, the second round of the event took place in the Fall of 2022. The research poster session attracted students from all across campus and from many disciplines to display and discuss their work. The Fall session included a competition between presenters, while the Spring session was a miniature alteration.

Many talented students entered the Fall showcase, and two separate award categories were established: one for graduate and one for undergraduate students. Dominika Bobik won the undergraduate group of presenters for her research on educational modeling software that can teach computer science students on its own in order to address the shortage of computing teachers. Shashank Pathrudkar received the first place honors amongst the graduates having showcased his research on utilizing machine learning to predict electronic structures of quasi-one-dimensional materials.

The Spring showcase Graduate group was won by Shruti Amre for his work with ADAS systems of automated vehicles and what methods are effective in keeping the driver alert while the car is driving itself. Lastly, Anthony Palmer and Elijah Cobb took home first place for undergraduates from their research regarding improvements in the collection and processing of U.S. Navy underwater sensor data.

The Spring showcase was a miniature version of the event, but still received a strong turnout and had many computing workshops put on by faculty as well as some keynote speakers from outside MTU, such as Dianne Marsh (Netflix) and Phil Bourne (University of Virginia)

The computing showcase will return this fall, on October 5-6, 2023, as Showcase[AI]. Be sure to swing by to view some amazing graduate and undergraduate research, pick the minds of some of MTU's brightest students and researchers, and learn a thing or two!



To Havens and Back

Tim Havens, director of both the Great Lakes Research Center and the ICC, made a splash this past year. Through multiple grants combined between the ICC and GLRC, Dr. Havens was awarded around \$1.4 million. From the Naval Surface Warfare Center to the U.S. Geological Survey, his research efforts are clearly valued and it will be exciting to see the outcomes.

While leading several projects with the ICC and GLRC, Dr. Havens presented findings at multiple locations, including the Traverse City NO SPILLS Conference in February of 2023. At this event, he discussed the integration of autonomy and sensing into disaster prevention and management. Another trip was made by Dr. Havens and other researchers at the GLRC—Erik Kocher and Andy Nold—to the U.S. Coast Guard Response Equipment Demonstration and Deployment Exercise at Rogers City, Michigan. Researchers at the GLRC have developed an Autonomous Waverunner, which was showcased in a live demonstration where the Waverunner successfully navigated the waters in response to a simulated environmental accident.



Onder and Upward



A long-unsolved problem of computer program management is being tackled by Dr. Soner Onder and others in a collaborative effort to increase the performance of application programs on every conceivable platform, from mobile devices to data centers. The initiative cites an issue with fast branch instructions, which affect the response time of programs. The team will build the foundations for a completely new strategy by applying the principle of vectorization to the instruction space, which will make it possible to eliminate many unpredictable and clunky branch instructions. Taking this novel approach, Dr. Onder and others believe they can revolutionize system design.

This collaborative project involves researchers from Florida State University, with MTU and FSU sharing \$600,000 in funding to support the project. Upon Dr. Onder's acceptance of this role, he now has over \$1.6 million of concurrently active NSF awards. Dr. Onder is the sole PI on this project for MTU. The project ends in August 2024.

Kedmon Hungwe

Over the course of summer 2023, Kedmon Hungwe will be in Grahamstown, South Africa, at Rhodes University. The professor of Cognitive and Learning Sciences will be there to develop a digital literacy curriculum for pre-service teachers in a developing country university. These efforts will bolster the growth and effectiveness of digital media platforms by increasing public knowledge and enhancing the ability for individuals to connect.



This effort is a part of the Carnegie African Diaspora Fellowship Program (CADFP), which strengthens connections between academic institutions in the United States and African countries. Featuring curriculum co-development, research collaboration, and graduate teaching/mentoring, this initiative has been going strong for a decade now and is funded by the Carnegie Corporation of New York, and managed by the Institute of International Education and the Association of African Universities.

Zhenlin Wang

Progress needs leaders throughout, top to bottom, and look no further for a leader than in Zhenlin Wang.



Since early this fiscal year, Dr. Wang proved his capacity to lead. In September, there was a vacancy as the Computer Science Graduate Program Director after longtime position holder Jean Mayo stepped down. Dr. Wang jumped at this role and had a hard act to follow, as Dennis Livesay advocates on how well Dr. Mayo played the role, but is excited to see Dr. Wang's vision for the program.

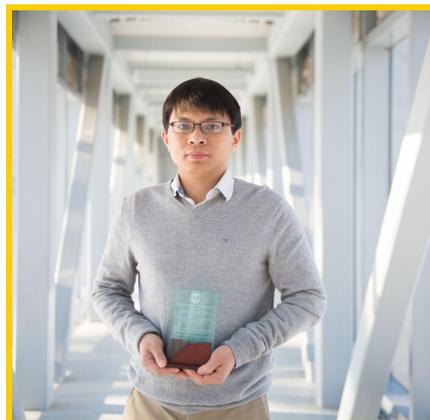
Fast forward to June 2023. The Chair of Computer Science needed to be filled, and again Zhenlin Wang availed himself at the opportunity. With the move being official as of the last day of FY23, Zhenlin Wang became the Interim Chair, while still holding his position as Director of the CS Graduate Program. According to Dr. Livesay, Dr. Wang is “held in the highest regard by department and university communities alike.” Having been the Interim Chair several years before, it is clear to see how equipped he is for this role and for leadership in general.

Bo Chen

Early 2023 brought recognition in a few forms to associate professor of computer science Bo Chen. As one who attends many conferences, Dr. Chen was awarded for his involvement in and research presented at these events.

The European Alliance for Innovation (EAI) has more than 85,000 members across the globe, empowering collaboration and growth amongst its members. Each year, the organization chooses a select few members to receive recognition as an EAI Distinguished Member. This year, 487, including Dr. Chen, were chosen through a regular nomination process by the community across the world.

Further recognition came a month later, in February of 2023. With the excellent work that Dr. Chen has produced in the field of security and privacy in computing, he was selected as the general chair for the inaugural SmartSP conference in Chicago, which takes place in October. Dr. Chen will coordinate with faculty from nine research universities in the United States as well as four international universities to organize this event.



Parkinson's Disease Research

Deep brain stimulation systems work as a “pacemaker for the brain,” and have shown their potential to be revolutionary in suppressing the motor symptoms of Parkinson's. Concerning road blocks have hindered these devices' current effectiveness, however, including battery life. The non-rechargeable batteries last 2-5 years and replacement requires an invasive surgical procedure. The existing open loop approach to DPS systems include 24/7 brain stimulation, regardless of the fluctuating nature of Parkinson's symptoms. ICC members Chunxiu (Traci) Yu and Hongyu An have introduced a closed loop solution, which is designed to respond directly and effectively by receiving signals from the brain to determine the stimulatory response. This approach utilizes neuromorphic computing. Dr. Yu states that the initiative is revolutionary and is the first of its kind to his knowledge. Spiking neural networks, the cornerstone of their closed loop BDS, only issues stimulation when necessary, which is highly energy efficient, alleviating power concerns as well as the unwanted side effects that have been caused by existing open-loop BDS's constant stimulation. This research will likely lead further to scalable efforts, including wearable devices, and has provided An and Yu's students with valuable experience with cutting edge chip design, AI, and neuromorphic computing.

Bhakta Rath Award

The Bhakta Rath Research Award was established in 2010 to award exceptional research in science and engineering. PhD students and their collaborating Michigan Tech faculty members are eligible recipients of this award. The 2022 Bhakta Rath Award winners were [Jingfeng Jiang](#) and [Kevin Sunderland](#) for their research into unruptured brain aneurysms.

A condition that affects approximately 6.5 million people in the United States, unruptured brain aneurysms have been a challenge tackled by researchers for decades. Several active researchers in the field cite [Dr. Jiang](#) and [Dr. Sunderland](#) for their exemplary work in this interdisciplinary research with others across the country. [Dr. Jiang](#) cites collaboration as a necessity for research of this condition, and both him and [Dr. Sunderland](#) embrace the challenges of medical science because of their devotion to achieving a breakthrough that would save many lives around the world. This much is evident from [Dr. Jiang's](#) desire to develop accompanying low-cost health care delivery that can bridge the gap in rural communities for diagnosis and treatment, and [Dr. Sunderland's](#) dream to help play a part in improving the condition of others.

Cai's CyberCorps

While many students have graduated with degrees under the umbrella of computer science, technology has advanced so fast that there is always a shortage of educated computer science workers to join a booming field.

That's why [Yu Cai](#) and others helped bring the Cybercorps to Michigan Tech. In 2021, NSF awarded the 5-year program a total of \$3.3 million, with the goal of providing 2-3 years of scholarships to cybersecurity students tied to employment in a government cybersecurity position after graduating. Now, Cybercorps - Scholarships for Service is heading strongly into FY24.

With the last round of applications for the year wrapping up in March 2023, [Yu Cai](#) and the many ICC faculty involved in the project will continue the application and award process in 2024. These scholarships provide full-time tuition, a substantial stipend, and allowances for student travel for professional development, such as traveling and personal certifications. The initiative encourages those from underrepresented groups to apply.



More ICC Awards

Gartner Prize

Kuilin Zhang is associate professor of civil, environmental, and geospatial engineering, affiliated associate professor of computer science, and ICC member. A research interest of his is the rapidly advancing technology of automobile automation, a field in which he and his PhD student Yintong Tan have received the Gartner prize.

The Gartner prize was awarded at the Transportation Research Board's Traffic Flow Theory and Characteristics Committee. The awarded paper is part of Dr Zhang's NSF CAREER project on vehicle connection and automation, investigating issues in automated cruise control like time delay and actuator lag.



Hoda Hatoum's Students

Hoda Hatoum, assistant professor of biomedical engineering, has had a strong year. On top of her work with NSF and her ICC rapid seedling grant, Dr. Hatoum inspires the best in her students. Dr. Hatoum's support enables her students to be better equipped to tackle their research and gain valuable experience. Brennen Vogl, one of her bright PhD students, was awarded the DeVlieg foundation fellowship and HRI Fall Fellowship, and took second place

at the MTU HRI Student Forum for his oral presentation. On top of that, he was awarded a travel grant to attend the Summer Biomechanics, Bioengineering, and Biotransport Conference. He and another of Hatoum's students, Alireze Asadbeygi, were awarded the Blue Cross Blue Shield of Michigan Foundation Student Award, a \$3000 scholarship. Asadbeygi was also recognized as a PhD level finalist for 2022 ASME-BED/SB3C Student Paper Competition.



Briana Bettin Best Paper Award

Dr. Bettin continues to amaze in her work for inclusive education in computer science and the barriers that hinder student learning. In July of 2022, she received the Best Paper Award at the ITiCSE conference in Dublin, Ireland. The work, entitled "Semaphore or Metaphor?: Exploring Concurrent Students' Conceptions of and with Analogy," was co-authored with Linda Ott (Computer Science). The paper is about concurrency in computing and how it is a difficult learning challenge for students, proposing analogies to increase understanding of this extremely important concept in advanced computing.

Dr. Bettin has been on a roll. In addition to receiving the 2022 Distinguished Teaching Award and aforementioned Best Paper Award, she also secured a Rapid Seedling Grant and a Research Excellence Fund Award for her project entitled "Revealing the Hidden Curriculum: Advancing Student Learning, Equity, and Accessibility in Computing Education," in collaboration with co-PIs Leo Ureel and Laura Brown.



Research Excellence Fund

The office of the Vice President for Research at Michigan Tech awards Research Excellence Fund (REF) awards to jumpstart projects undertaken by faculty less than six years into their current position. Typical REF projects develop preliminary data for larger funding proposals, acting as a building block. Three REF awards were received by ICC members this fiscal year.

Tan Chen - developing robust and safe controllers for robots in healthcare and smart manufacturing

Briana Bettin - achieving equality and accessibility by identifying and addressing barriers in computing education

Jun Dai - addressing greenwashing in ESG reports and how blockchain can enable greater accountability and accuracy