Annual Report FY21

INSTITUTE OF COMPUTING AND CYBERSYSTEMS

BIOCOMPUTING AND DIGITAL HEALTH • COMPUTING EDUCATION
CYBER-PHYSICAL SYSTEMS • CYBERSECURITY • DATA SCIENCES
HUMAN-CENTERED COMPUTING • SCALABLE ARCHITECTURES AND SYSTEMS

icc
institute of computing & cybersystems

Annual Report

July 1, 2020 to June 30, 2021

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THE MISSION OF THE ICC IS TO PROMOTE RESEARCH AND LEARNING EXPERIENCES IN THE AREAS OF MOBILE COMPUTING, BIOCUMPUTING AND DIGITAL HEALTH, COMPUTING EDUCATION, CYBERSECURITY, CYBER-PHYSICAL SYSTEMS, CYBER-HUMAN SYSTEMS, AND COMPUTER SYSTEMS FOR THE BENEFIT OF MICHIGAN TECH AND SOCIETY AT LARGE.

FY21

FY21 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. A director provides Institute leadership, associate directors lead the Centers.

ICC Membership

The ICC's member faculty represent at minimum 20 Michigan Tech departments and academic disciplines. Notably, 23 new member researchers joined the ICC from July 1, 2020, to June 30, 2021, matching FY20 membership growth. A roster of ICC members appears at the end of this report.

The Michigan Tech 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.

New Awards

New ICC awards granted in FY21 number 21 and total more than 2.7M.

Active Awards and Expenditures

ICC active FY21 grants and contracts number 40, with awards totaling $8.96M. FY21 research expenditures reached $2.67M.

Proposal Activity

In FY21, ICC researchers submitted 79 proposals totaling $29.9M, 13% of all FY21 proposals were awarded. At fiscal year end, 39 proposals totaling $18.4M were pending.

Scholarship and Service

ICC members are leaders among their research and academic peers, on and off campus. In FY21, ICC members collectively attended dozens of national and international academic meetings and conferences; published hundreds of journal articles, conference papers, book chapters, and books; presented dozens of papers, talks, and seminars; and provided prodigious professional service of many kinds to Michigan Tech and professional and scientific societies and organizations of all kinds.

From the Editor

This report highlights the activities of the Institute of Computing and Cybersystems for the period July 1, 2020, to June 30, 2021. The data in this report were gathered from a number of internal sources. Every effort has been made to ensure the accuracy and completeness of this document. This report was prepared in its entirety by Karen S. Johnson, ICC Communications Director.
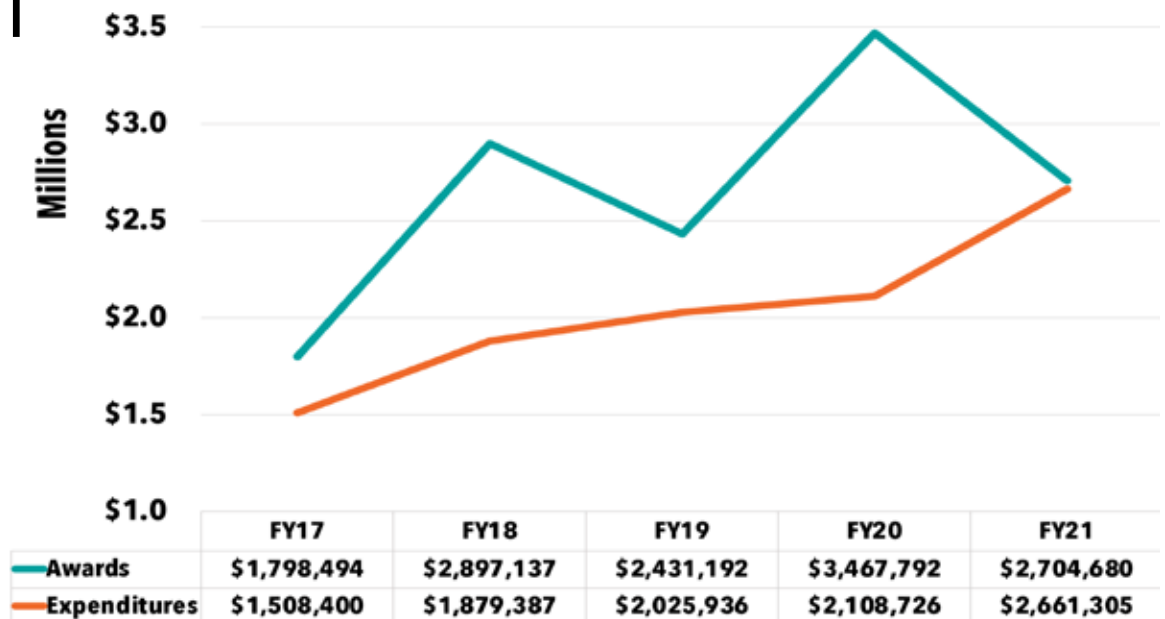
ICC by the Numbers

40 Active Awards **$8.96M**
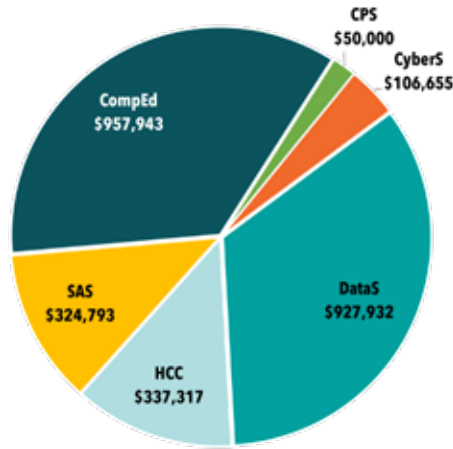
$2.67M Research Expenditures

21 New in FY21 **$2.7M**

Research Activities	FY17 Results	FY18 Results	FY19 Results	FY20 Goal	FY20 Results	FY21 Results
New Research Awards	$1.8M	2.9M	2.4M	2.8M	3.5M	2.7M
Research Expenditures	1.5M	1.9M	2.0M	2.6M	2.1M	2.67M
No. of New Research Awards	17	21	25	10	30	21
No. of Proposals Submitted	56	21	37	47	25	76

Awards and Expenditures
FY17-FY21

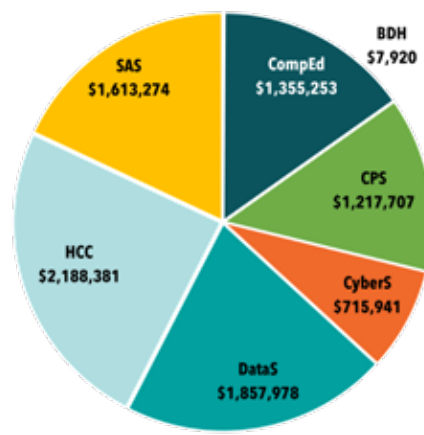|	FY17	FY18	FY19	FY20	FY21
Awards	$1,798,494	$2,897,137	$2,431,192	$3,467,792	$2,704,680
Expenditures	$1,508,400	$1,879,387	$2,025,936	$2,108,726	$2,661,305

ICC OBJECTIVE 1: BRING FACULTY AND STUDENTS TOGETHER TO DISCOVER INNOVATIVE AND NEW KNOWLEDGE IN THE FIELD OF COMPUTING.

New Awards
by ICC Center
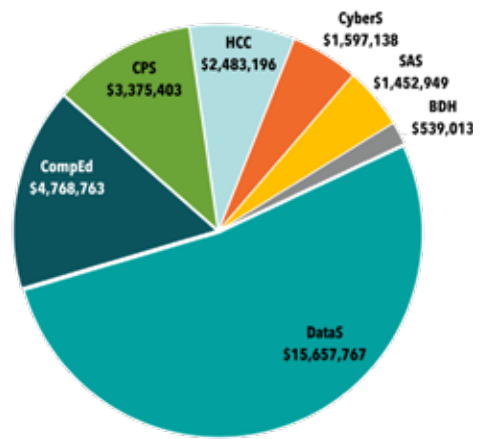
CPS
$50,000

CyberS
$106,655

CompEd
$957,943

SAS
$324,793

HCC
$337,317

DataS
$927,932

Active Awards
by ICC Center
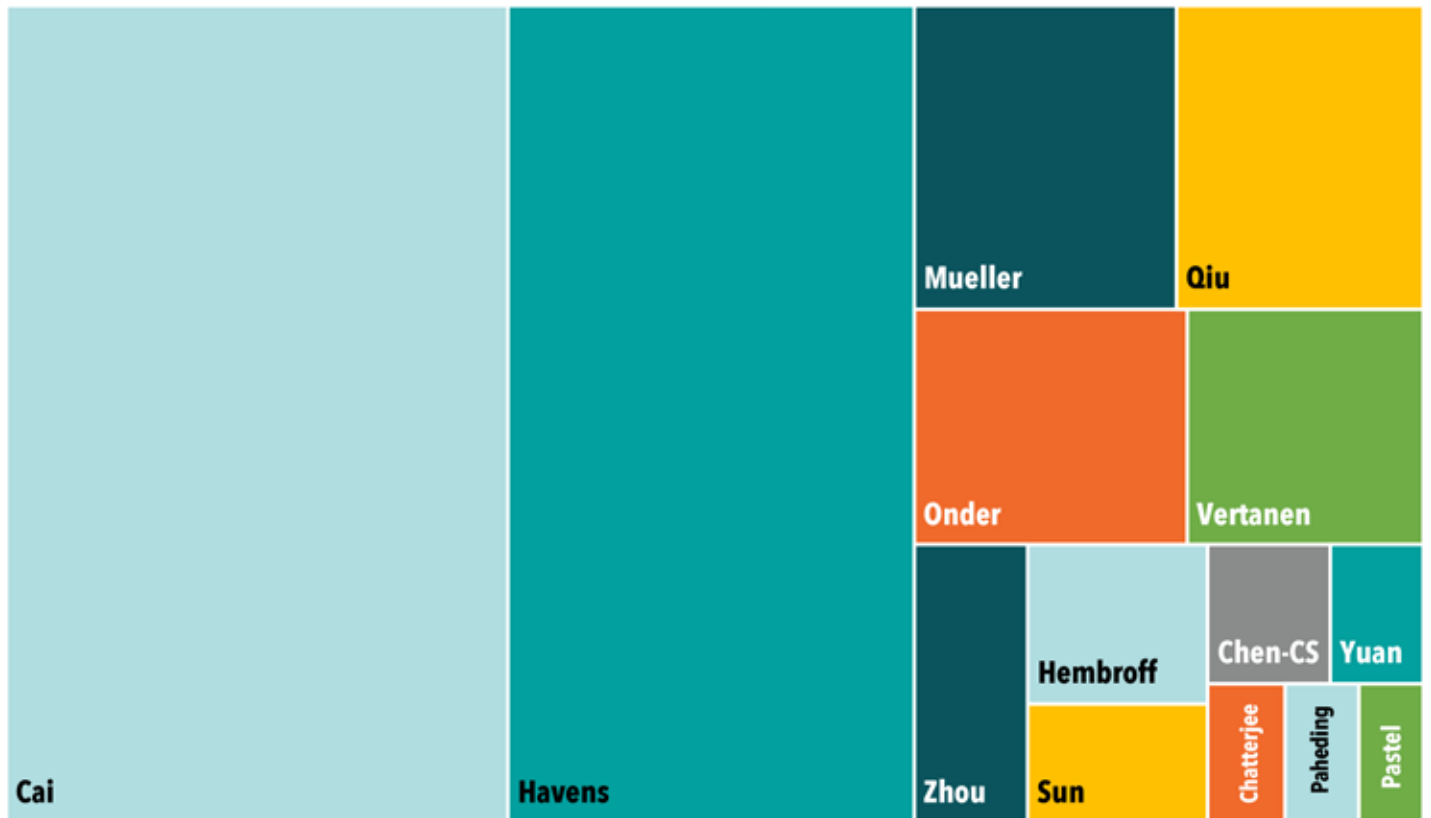
BDH
$7,920

CompEd
$1,355,253

SAS
$1,613,274

CPS
$1,217,707

HCC
$2,188,381

CyberS
$715,941

DataS
$1,857,978

Proposals
by ICC Center

CyberS
$1,597,138

HCC
$2,483,196

CPS
$3,375,403

SAS
$1,452,949

BDH
$539,013

CompEd
$4,768,763

DataS
$15,657,767

New Awards by PI

Cai

Havens

Mueller

Qiu

Onder

Vertanen

Zhou

Sun

Hembroff

Chatterjee

Chen-CS

Paheding

Yuan

Pastel

Member Professional Activities

External Visibility	FY16 Results	FY17 Results	FY18 Results	FY19 Results	FY20 Results	FY21 Results
Conferences, Workshops, Demos	7	8	2	7	1	3
ICC-Hosted Talks, Seminars, Demos	7	26	17	19	0	24
Publications[1]	150+	118	183	130	200	210
Member Leadership[2]	18	24	57	15	26	28
Member Keynote and Invited Talks	5	10	45	6	16	0
Students Supported	32	27	20	24	20	8

[1]Books, Book Chapters, Journal Articles, Reports, Conference Papers   [2]Technical Committees, Journal Editorships, Conference Chairs

ICC OBJECTIVE 3: CREATE A PLATFORM FOR BROAD SETS OF NATIONAL AND INTERNATIONAL COLLABORATIONS TO MAKE VALUABLE CONTRIBUTIONS TO THE FIELD

New FY21 ICC grants and contracts number **21**, with total awards of $**2,704,640**

New Awards, FY21

PI: YU CAI, CompEd, (AC)
"CyberCorps: Scholarship for Service Program at Michigan Tech"
NSF | $957,943 | 5 Years

PI: SNEHAMOY CHATTERJEE, DataS, (GMES)
"Simultaneous simulation of material grades and material type by using multiple-point and two-point geostatistics"
Industry | $25,000 | 1 Year

PI: BO CHEN, CyberS, (CS)
"SaTC: CORE: Small: Collaborative: Hardware-assisted Plausibly Deniable System for Mobile Devices"
NSF | $15,900 | 3 Years

PI: BO CHEN, CyberS, (CS)
"REF-RS: Towards Secure and Reliable Decentralized Cloud Storage"
MTU | $23,800 | 1 Year

PI: TIMOTHY HAVENS, DataS, (CC)
"DURIP: Acoustic Sensing System and High-Throughout Computing for Environment and Threat
DOD | $243,169 | 1 Year

"NPT-03|04: Localization Tracking and Classification of On-Ice Underwater Noise Sources Using Machine Learning"
DOD | $103,098 | 1 Year

Restricted | $428,707 | 2 Years

PI: GUY HEMBROFF, CyberS, (AC)
"State of Michigan K-12 Cybersecurity Outreach"
CCISD | $40,000 | 1 Year
Restricted | $26,955 | 0.5 Years

PI: SHANE MUELLER, HCC, (CLS)
"DARPA XAI"
DOD-FPT | $186,282 | 4.5 Years

PI: SONER ONDER, SAS, (CS)
"IRES: Track I: Collaborative Research: Supporting FSU and MTU Student Research with NTNU Faculty on Automatic Improvement of Application Performance"
NSF | $149,996 | 3 Years

PI: SIDIKE PAHEDING, DataS, (AC)
"Cybersecurity Modules Aligned with Undergraduate Computer Science and Engineering Curricula"
FPT-Purdue | $19,037 | 2 Years

"Monitoring Martian landslides using deep learning and data fusion"
NASA-U of Mich. | $5,000 | 1 Year

PI: ROBERT PASTEL, HCC, (CS)
"SCC: Community-Based Automated Information for Urban Flooding"
NSF-Ariz. St. Univ. | $21,148 | 4 Years

PI: JUNQIAO QIU, SAS, (CS)
"CRII: SHF: GPU-accelerated FSM computations with advanced speculation"
NSF | $174,797 | 1 Year

PI: YE (SARAH) SUN, CPS, (ME-EM)
"CAREER: System-on-Cloth: A Cloud Manufacturing Framework for Embroidered Wearable Electronics"
NSF | $50,000 | 5 Years

PI: KEITH VERTANEN, HCC, (CS)
"CHS: Small: Rich Surface Interaction for Augmented Environments"
NSF | $15,840 | 3 Years

"CAREER: Technology Assisted Conversations"
NSF | $114,047 | 5 Years

PI: XIAOYONG (BRIAN) YUAN, DataS, (AC)
"REF-RS: HuskyPerception: Enabling AI-based Vehicle Perception for Autonomous Driving Safety in Adverse Weather Conditions"
MTU | $29,966 | 1 Year

PI: WEIHUA ZHOU, DataS, (AC)
"Trans-omics integration of multi-omics studies for male osteoporosis"
DHHS-Tulane Univ. | $48,995 | 1 Year

"REF-PHF-RS: Deep learning applied to eletrical activation propagation from a website ECG device to improve cardiac resynchronization therapy for patients with heart failure"
MTU | $25,000 / 1 Year

ICC members are faculty mentors for the following groups. AI: Tracks as Sea Team **l** Archery Club **l** Assoc. for Psychological Science Student Chapter **l** Assoc. of Information Technology Professionals (AITP) **l** Bangladeshi Student Assoc. **l** BASIC (Building Adult Skills in Computing) **l** Breaking Digital Barriers **l** Chinese Students and Scholars Assoc. **l** Copper Country Programmers **l** CS Reading Group on Cybersecurity **l** DevOps Club **l** Epison Pi Tau Honor Society **l** General Motors/SAE AutoDrive Challenge **l** Human Factors and Ergonomics Society Student Chapter **l** Humane Interface Design Enterprise **l** Husky Game Development Enterprise **l** Lutheran Campus Ministry **l** Michigan Tech Archery Club **l** Michigan Tech ITE Student Chapter **l** MTU Epsilon Pi Tau **l** MTU Linux Users Group **l** MTU Open Source Club **l** MTU RedTeam on Cybersecurity **l** NCL (National Cyber League) Cyber Competition Team **l** Networking and Computing Student Assoc. **l** Organization for Information Systems at Michigan Tech **l** Pistol Club **l** Psi Chi (International Honors Society) **l** Robotics Systems Enterprise **l** Society of Hispanic Professional Engineers (SHPE) **l** Summer Youth Program **l** The Pokemon League at Michigan Tech **l** University Liason to the International Consortium of Political and Science Research (ICPSR) **l** Upsilon Pi Epsilon **l** Women in Computing Sciences

Kanwal and Ben Rekhi Help Grow the ICC

Kanwal Rekhi

Michigan Tech alumnus Kanwal Rekhi '69 EE, has a long history of philanthropy and his tireless support of the University is extraordinary. Every student on the Michigan Tech campus has taken classes or worked in the labs of Kanwal and Ann Rekhi Computer Science Hall, dedicated in April 2015.

A new gift from Kanwal Rekhi, and his son, Ben Rekhi, has generously seed-funded two new ICC research staff positions. The first, an Assistant Director for Research Development, will provide pre- and post-award support to institute researchers, assist with the financial processes for the institute, and help to lead the Institute's daily administrative functions. The second, a Research Scientist, will assist faculty with their research agendas and lead new research programs. The two positions are part of a larger 5-year plan to grow ICC research staff.

"These new ICC staff members will give students new opportunities to work side-by side with full-time researchers, as they will in their careers following graduation," notes ICC director Tim Havens.

Kanwal Rekhi developed and funds the ongoing Rekhi Innovation Challenge, a crowdfunding competition to help promote and support student innovation. He has provided major funding for the Silicon Valley Experience, an annual immersive spring break tour of San Francisco area companies that includes meetings with entrepreneurs and Michigan Tech alumni, and he is a sponsor of the 14 Floors Entrepreneur Alumni Mentoring Sessions. In 2020 the Michigan Tech Board of Trustees awarded Kanwal Rekhi the Melvin Calvin Medal of Distinction, the University's highest honor. Ben Rekhi is an American director, producer, and screenwriter, and owner of Ben Rekhi Productions, Santa Monica, CA.

New Computing Faculty Bring Research, Teaching Expertise

Rapid growth of the College of Computing, launched July 1, 2019, led to the hiring of eight new tenure-track faculty members.

Briana Bettin, Assistant Professor, Computer Science and Cognitive and Learning Sciences, completed her PhD in Computer Science at Michigan Tech in spring 2020. Research interests: user experience, human factors, and human-computer interactions. (Fall 2020)

Dukka KC, Associate Professor, Computer Science, comes to Michigan Tech from Wichita State University. Research interests: applied deep learning and bioinformatics. (Fall 2021)

Xinyu Lei, Assistant Professor, Computer Science, joins the College directly following completion of his PhD at Michigan State. Research interest: cybersecurity. (Fall 2021)

Sidike Paheding, Assistant Professor, Applied Computing, joined Michigan Tech from Purdue University Northwest. Research interests: image/video processing, machine learning, deep learning, computer vision, and remote sensing. (Fall 2020)

Junqiao Qiu, Assistant Professor, Computer Science, completed his PhD in computer science and engineering at Univ. of California Riverside. Research interests: parallel computing, programming systems, and compiler optimization. (Fall 2020)

Ashraf Saleem, Assistant Professor, Applied Computing, comes to Michigan Tech from Sultan Qaboos University. Research interests: autonomous systems, vision-based unmanned vehicles, and AI. (Fall 2021)

Brianna Bettin

Dukka KC

Xinyu Lei

S. Paheding

Junqiao Qiu

Ashraf Saleem

Leo Ureel

Brian Yuan

Leo Ureel, Assistant Professor, Computer Science, completed his PhD in computer science at Michigan Tech in spring 2021. Research interests: software engineering, computer science education, and intelligent tutoring systems. (Fall 2020)

Brian Yuan, Assistant Professor, Applied Computing and Computer Science, earned his PhD in computer science from University of Florida. Research interests: machine learning, security and privacy, and cloud computing. (Fall 2020)

Dennis Livesay, Dave House Dean of Computing

D r. Dennis Livesay brings to the Michigan Tech College of Computing more than 20 years of experience in administration, teaching, and research. And while his PhD is in physical chemistry, an overarching theme of his career is definitely computing.

So, how did Livesay blend a career in chemistry and computing? It began with a change of plans and a fascination for molecular science.

A life-changing choice.
The first in his family to pursue higher education, as a high school senior Livesay had planned to attend Purdue University. Instead, life led him to Ball State University in what turned out to be a life-changing choice. It was there that he discovered his love of research, and he began to recognize the emerging importance of computing and simulation in the research realm.

Livesay's research spans biophysics, chemistry, computing, and data science, with the goal of understanding protein family sequence/structure/ function relationships. He brings this multi-disciplinary mindset to his administrative roles, along with an extensive portfolio of professional achievements and a commitment to advancing Computing within the academic sphere.

The parallels are many.
These are qualities and activities well-matched to the aspirations of the Michigan Tech College of Computing. The parallels are many, giving Livesay the insight and depth of experience to lead Michigan Tech's College of Computing into the future.

As dean of the College of Engineering at Wichita State, from 2016 to 2021, Livesay's leadership led to a number of milestones, including creation of a School of Computing, new undergraduate degree programs in computer science and applied computing, and master's degree programs in data science and computing, which are based on stackable certificates in cybersecurity, software engineering, computer networks, and data science. He also served as dean of the WSU graduate school, and he was a tenured full professor of both biomedical engineering and chemistry.

Also during Livesay's tenure, Wichita State was designated a National Center of Academic Excellence in Cyber Defense Education (CAE-CDE); the WSU College of Engineering joined the AI Institute for Foundations of Machine Learning (IFML), which was established with a $20 million grant from the National Science Foundation; and the college set a record for externally funded research.

Livesay's success advancing the computing disciplines started well before his substantial success at Wichita State. At University of North Carolina at Charlotte, from 2008 to 2014, Livesay was a founding member of the Department of Bioinformatics and Genomics within the College of Computing and Informatics, where he was a tenured full professor. He was the founding director of the Bioinformatics and Computational Biology PhD program and established the university's Charlotte Research Scholars program, a campus-wide undergraduate research program.

Empowering researchers.
"The digital transformation of academia--and our world--is well underway," Livesay says. "My overarching goal is to address the widespread disruption caused by the data revolution through programs and initiatives to empower students and researchers to succeed within this new paradigm."

"Michigan Tech grads have gained a reputation as professionals ready to hit the ground running," Livesay notes. "Higher education needs to stay ahead of the curve. In today's workplace, this is more important than ever."


Dennis Livesay, Dave House Dean of Computing

"Dean Livesay has an ambitious vision for the College of Computing-- growing enrollment, advancing our research stature, forming new and innovative relations with industry, and increasing our awareness of and action towards a diverse, equitable, and inclusive future. The ICC has an important role in this, and I'm very pleased to be working with Dennis in advancing the college and university," says ICC director Tim Havens.

"Digital transformation is impacting every enterprise in every industry, meaning every discipline is now a computing discipline," notes Livesay. "The breadth of the ICC perfectly exemplifies this point and is the ideal conduit for us to broaden our impact."

Joint Center for
Biocomputing and Digital Health
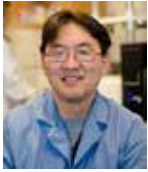
Jingfeng Jiang

The ICC and the Health Research Institute (HRI) have established the Joint Center of Biocomputing and Digital Health (BDH). The new research center was co-founded by HRI member Jingfeng Jiang (BME) and ICC member Jinshan Tang (CC). The mission of new center is to conduct research, develop innovative solutions, and provide educational opportunities in the areas of biocomputing and digital health, thereby enhancing Michigan Tech's ability to recruit and retain high-quality researchers and students, elevating Michigan Tech's presence in developing technologies for healthcare delivery, and increasing knowledge sharing in the global community. (Feb. 2021)

College of Computing Seed Grants Fund Pandemic Research

The College of Computing awarded five faculty seed grants to provide immediate funding in support of research projects addressing critical needs during the global pandemic. The faculty seed grants are enabling progress in new research. (May 2020)

Guy Hembroff (AC) "Development of a Novel Hospital Use Resource Prediction Model to Improve Local Community Pandemic Disaster Planning"

Leo Ureel (CS) and Charles Wallace (CS) "Classroom Cyber-Physical Simulation of Disease Transmission"

Bo Chen (CS) "Mobile Devices Can Help Mitigate Spreading of Coronavirus"

Nathir Rawashdeh (AC) "A Tele-Operated Mobile Robot for Sterilizing Indoor Space Using UV Light." A special thanks to Paul Williams, whose generous gift to support AI and robotics research made this grant possible.

Weihua Zhou (AC) and Jinshan Tang (AC) "KD4COVID19: An Open Research Platform Using Feature Engineering and Machine Learning for Knowledge Discovery and Risk Stratification of COVID-19"

Weihua Zhou   Jinshan Tang

Guy Hembroff   Leo Ureel III   Charles Wallace   Bo Chen   N. Rawashdeh

Computing
Education Center

Yu Cai

The ICC has announced the addition of the Computing Education Center, a research group that promotes research and learning related to computing education.

Professor Yu Cai, Applied Computing, is director of the new center.

"A special thanks to Yu Cai for stepping forward to lead this effort," said Tim Havens, director of the ICC. "This has been discussed for a few years, and I'm excited about the group of people that has come together in this center," Havens added. "I look forward to hearing about their successes." (Oct. 2020)

GenCyber Teacher Camp

In summer 2021, 18 K-12 STEM teachers from across the Upper Peninsula participated in a week-long GenCyber Teacher Camp on the Michigan Tech campus. The free, residential camp covered cybersecurity knowledge and safe online behavior, and presented innovative teaching methods for delivery of K-12 cybersecurity content. The professional development opportunity was presented with hopes that participants will return to their home schools with contagious enthusiasm about teaching cybersecurity. The teachers received a modest stipend for attending and completing camp activities.

Yu Cai (AC) is PI of the two-year National Security Agency GenCyber project award that made the camp possible. Tim Van Wagner (AC) and Bo Chen (CS) are co-PIs. (July 2021)

Yu Cai (CompEd, CyberS)
NSF CyberCorps: Scholarship for Service

Michigan Tech has joined the National Science Foundation CyberCorps: Scholarship for Service (SFS) program, a nationwide program focused on recruiting and training the next generation of information technology professionals, industrial control system security professionals, and security managers.

The five-year, $3.3 million NSF grant provides up to three years of full scholarship support for 20 undergraduate and graduate students.

In return, following graduation, recipients must 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 U.S. is facing a significant shortage of well-trained and well-prepared cybersecurity professionals," says Yu Cai, professor of applied computing at Michigan Tech and the principal investigator of the grant. "Michigan Tech has developed a national and international reputation in cybersecurity education, research, and outreach activities. We are thrilled to be part of the solution to the nation's cybersecurity workforce challenge."

Four students were selected to receive the NSF CyberCorps scholarship in fall 2021.

The degree programs included in the CyberCorps scholarship are the BS in Cybersecurity, Computer Network and System Administration, Computer Science, Software Engineering, Computer Engineering, Electrical Engineering, and Management Information Systems; and the MS in Cybersecurity.

Multiple programs and departments are involved in the SFS program at Michigan Tech, including the College of Computing and its Departments of Applied Computing and Computer Science, the College of Engineering's Department of Electrical and Computer Engineering, and the College of Business's Management Information Systems BS program.

The SFS program also partners with the Pavlis Honors College to engage SFS scholars in a blend of faculty mentoring, peer mentoring, and customized pathways.
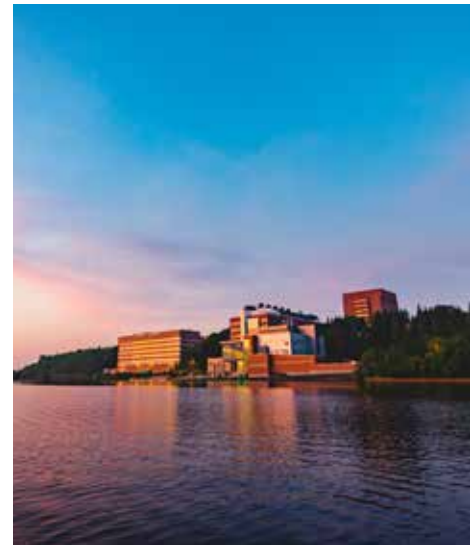
"Creating new knowledge through research is a major priority for us, and I look forward to working with Dr. Havens and the rest of the ICC members to grow computing research at Michigan Tech."
Dr. Dennis Livesay
Dave House Dean of Computing

Michigan Tech joins 78 CyberCorps: Scholarship for Service universities across the country. The project PI is Professor Yu Cai (AC). Co-PIs and other key personnel are Jean Mayo (CS), Todd Arney (AC), Bo Chen (CS), Chee-Wooi (ECE), Kedmon Hungwe (CLS), and Laura Kasson Fiss (PHC).

"I received travel support from the ICC in 2018 and 2019, which allowed me to participate in a few NSF events, including 2019 NSF CISE CAREER Workshop and a MTU DC trip in May 2021. In addition, I received a small seed fund award from the ICC Center for Cybersecurity in summer 2019, which helped me collect some necessary preliminary results for my NSF proposals. In 2019, I received two NSF grants as PI, with total funding of $464,893. The grants would not be possible without support from the ICC. I have witnessed the growth of ICC, and I believe that it will help more faculty members–especially junior faculty–towards their success." —Bo Chen (CS), CyberS, CompEd, BDH

ICC Distinguished Lectures

James Keller, IEEE Life Fellow, "Soft Streaming Classification." Keller received the IEEE Frank Rosenblatt Award for his fundamental work on fuzzy pattern recognition, fuzzy clustering, and fuzzy technologies in computer vision. (Oct. 2020)

Richard E. Ladner, Accessible Design Expert, "Accessible K-12 Computer Science Education." His research is in accessible computing, a subarea of human-computer interaction; much focused on accessible educational technology. (Nov. 2020)

James Bezdek, University of Melbourne, Australia, "Streaming Data Analysis: Old Clothes Don't Fit." Bezdek's interests include clustering in big data, woodworking, optimization, data visualization, fishing, anomaly detection, blues music, poker. (Jan. 2021)

Alina Zare, University of Florida, "Multiple Instance Learning for Plant Root Phenotyping." Dr. Zare teaches and conducts research in pattern recognition and machine learning. (Apr. 2021)

More ICC-Sponsored Talks

Theda Daniels-Race, Louisiana State University, "Deposition, Characterization, and Developments in Hybrid Electronic Materials for Next-Generation Nanoelectronics." (Sep. 2019)

Theda Daniels-Race

George Anderson, Sally Sutherland, US Naval Undersea Warfare Center, Anderson presented, "Classification of Personnel and Vehicle Activity Using a Sensor System With Numerous Array Elements." Sutherland spoke about the Navy's Naval Engineering Education Consortium (NEEC). Co-hosted by the Great Lakes Research Center. (Sep. 2019)

Anna Little, Michigan State University, Computational Mathematics, Science, and Engineering, "Robust Statistical Procedures for Clustering in High Dimensions." (Oct. 2019)

Kun Zhu, MISO, "Power Grid Operations – Beyond Physics, a high level introduction to how regional operators manage the power grid in the US." Co-sponsored by the ECE department. (Mar. 2020)

Laura Monroe, Ultrascale Systems Research Center, Los Alamos National Laboratory, "The Mathematical Analysis of Faults and the Resilience of Applications." (Sep. 2020)

Timothy Wilkin, Deakin Univ., "Adventures of a Cyber-Physical Cow." (Oct. 2020)

Robert West, DePauw University, "Why Josh Stole the Password: A Decision Neuorscience Approach to Insider Threat in Information Security." Co-hosted by the Human-Centered Computing group and the Cognitive and Learning Sciences department. (Feb. 2021)

Tomorrow Needs Seminar Series

A seminar series to bring advanced PhD students and postdoctoral scholars to Michigan Tech was launched in 2020 by the ICC, in partnership with the Colleges of Computing and Engineering, and the Great Lakes Research Center.

The seminar series is intended to build connections with up-and-coming researchers, recruit and retain top talent at Michigan Tech, and provide opportunities for these promising scholars to learn more about Michigan Tech and the University's excellent resources for research and education. Applications to nominate scholars from around the globe are sought from all areas of the university. Also encouraged are nominations of advanced PhD candidates and postdoctoral scholars currently at Michigan Tech. Find the nomination form at mtu.edu/icc/seminars.

Homin Song, Argonne Nat'l Lab

Tomorrow Needs Seminar
Dr. Homin Song presented the first Tomorrow Needs seminar in January 2020. Homin's research interests lie in nondestructive evaluation (NDE) and structural health monitoring (SHM) based on ultrasonic wave motion. Co-hosted by the ICC and the ME-EM Graduate Seminar Speaker Series.

Computer Science Lecture Series

Richard Ladner, Univ. of Washington, "Accessible K-12 Computer Science Education." (Nov. 2020)

Junqiao Qiu, Computer Science, "Speculative Parallelization for FSM-centric Computations. (Nov. 2020)

Joel LeBlanc, MTRI, "Testing the Validity of Physical (Software) Models in Inverse Problems." (Dec. 2020)

Sidike Paheding, Applied Computing, "Deep Neural Networks for UAV and Satellite Remote Sensing Image Analysis." (Dec. 2020)

Shane Mueller, Psychology, Cognitive and Learning Sciences, "Explainable AI, and principles for building human-centered XAI systems." (Jan. 2021)

Lan Zhang, Electrical and Computer Engineering, "Augmenting Radio Environments for Better Wireless Ecosystems." (Jan. 2021)

Vijay Garg, University of Texas Austin, "Applying Predicate Detection to Discrete Optimization Problems" (Feb. 2021)

Meryl Spencer, Michigan Tech Research Institute, "Advancing Robotics through Competition." (Feb. 2021)

Beth Veinott, Cognitive and Learning Sciences, "Beyond the system interface: Using human-centered design to support better collaborative forecasting." (Feb. 2021)

Hongyu An, Electrical and Computer Engineering, "Designing an Energy-Efficient Neuromorphic System through Two-Layer Memristive Synapses." (Mar. 2021)

Kelly Steelman, Cognitive and Learning Sciences, "Keeping Up with Tech." (Mar. 2021)

Tim Frick, Mightybytes, "People, Planet, Pixels: Toward Sustainable Digital Products and Practices." (Apr. 2021)

Qun Li, William & Mary, "Byzantine Fault Tolerant Distributed Machine Learning" (Apr. 2021)

Conference on Applied Cryptography

The 2021 EAI International Conference on Applied Cryptography in Computer and Communications (AC3 2021) took place May 15-16, 2021. Bo Chen (CS), founding general chair of the new conference, says the conference brought together researchers, developers and practitioners from around the world for focused discussion and exploration in the area of applied cryptography in computer and communication systems. Conference topics included symmetric cryptography, public-key cryptography, cryptographic protocols, cryptographic implementations, cryptographic standards and practices, and using cryptography to solve real-world problems.

"The ICC connects me with a community of researchers who have a similar research focus, hence it helps to connect to other members at MTU. It will help me to form teams for bigger, interdisciplinary proposals. The ICC's focus is on team building and promoting open calls for proposals, which is great.
—Susanta Ghosh, DataS, BDH

Peter Larsen, Director for Research Development
Research Is a Team Enterprise

Peter Larsen, director for research development at Michigan Tech, makes it easier for faculty researchers to submit funding proposals, and to submit higher quality proposals when they do.

Peter Larsen

Larsen notes that with the recent growth in campus-wide research, "we are now 'too small' to be a large research institution, yet too large to be a small research institution."

"As we pursue the goal of transitioning to 'R1' research status, we are working through our growing pains by providing administrative support with a hybrid mix of departmental, college, and center/institute level staff and central research administrators," he says.

"As we all know, research is—more often than not—a team enterprise," Larsen continues. "I view the pre-award stage of research in much the same way: How can I team with faculty members to make their jobs easier? That looks different for each relationship."

"As Pete says, 'research is a team enterprise,'" echoes ICC director Tim Havens. "He epitomizes all the qualities of an excellent team member. He has a gift for creating an atmosphere where positive collaboration occurs among groups of people; it's quite amazing."

From working through the required elements of a first-time proposal submission to the National Science Foundation, to discussions about where to focus the next proposal, Larsen's goal is to help faculty be as efficient and successful as possible in their research.

"I view my role as doing everything I can to help make the jobs of researchers easier, while at the same time doing everything I can to stay out of their way when they don't need help," he says.

"Generally speaking, the more difficult the proposal is the more I rely on Pete," says Weihua Zhou, Applied Computing. "I need to remain highly dedicated to the science documents and his role as a gatekeeper greatly reduces my stress. I don't need to repeatedly confirm if my proposals meet the requirements of the grant programs."

Much of Larsen's help focuses on helping gather institutional facts, proofreading, formatting, sharing reminders about the many requirements of grant submissions, and referrals to additional resources.

"Pete also often provides valuable 'outsider' suggestions about the presentation of research proposals," Zhou adds. "It's very important to effectively present our proposed studies to the layman."

"Pete's experience working with researchers all across campus, in numerous disciplines, is invaluable," Havens confirms. "Although he is now back to his normal duties in the research office, I'm glad that we will continue to work together to build the research enterprise at Michigan Tech."

"Not only am I glad that Pete worked with us, leaving a lasting impact on the institute, but I am also glad that we have had the chance to build a lasting friendship," Havens adds.

The hybrid arrangement.
In FY20 Larsen provided dedicated part-time research support to researchers in the Institute of Computing and Cybersystems (ICC). His emphasis was on developing individual and team strategic research plans, planning and executing research development events, helping members search for funding opportunities and engage with external agencies, among other research support activities.

In the hybrid arrangement, Larsen's "time" was collaboratively funded through a Vice President for Research seed grant and contributions from the ICC and its research centers. He occupied an office in Rekhi Hall, adjacent to a number of College of Computing research labs.

"My work has focused on getting to know ICC faculty and their research interests, encouraging them in their research pursuits, and helping them to plan, find collaborators, and submit proposals," Larsen says.

Day to day, much of Larsen's work with ICC researchers was in the form of one-on-one discussions, he says. And although face-to-face time was cut short by the pandemic, he says one of the most valuable things he learned—and enjoyed—in his dedicated time with ICC researchers was the importance and value of being physically present with researchers, and in particular the regular informal interactions fostered by the arrangement. It's something he will try to recreate when things return to 'normal.'

Larsen helped researchers with proposal editing, individual funding searches, and making connections with agencies and program directors. Additional activities included research strategy discussions and working with researchers on revisions and resubmissions and responses to reviewers' comments.

One of the things Larsen likes most about Michigan Tech is interacting with the campus community. "It has been a pleasure to get to know ICC researchers on both the professional and personal levels through project work, informal interactions, and ICC events."

A great team of researchers doing what they do best.
Larsen says it's difficult to attribute recent ICC award growth to a single thing, but he believes that, "the number one reason for any of Michigan Tech's research success is the great team of researchers doing what they do best on a day-to-day basis."

Ye "Sarah" Sun, CPS
The Lou and Herbert Wacker Professorship

Ye Sun

Ye "Sarah" Sun (ME-EM) has accepted the Lou and Herbert Wacker Professorship in Mechanical Engineering, which was created to retain and attract high-quality faculty who are at the top of their profession.

Sun is recognized as a rising star and outstanding researcher in the areas of wearable sensors, systems, and robotics and she is a respected member of the smart health community.

Among her research honors is the prestigious National Science Foundation CAREER Research Award, "System-on-Cloth: A Cloud Manufacturing Framework for Embroidered Wearable Electronics."

In recognition of her innovative research in wearable sensors, Sun's NSF CAREER award was selected for presentations to congressional offices in April 2019.

Sun will use this recognition and support to enhance her research in wearable and soft robotics. Her goal is to develop flexible textile robotics by leveraging the physical understanding and modeling of textile materials and dynamics and the recent advances of morphological computing.

Textile robotics are not only able to enhance human capabilities via wearable design but they can also achieve autonomous locomotion. The controllable structures of textiles directly provide a unified platform that is capable of integrating sensing and actuating into textile robotics itself. The positioning support will be used to recruit graduate students and to set up the manufacturing platform. (Dec. 2020)

Chee-wooi Ten, CPS
Ten Writing Two Books with CRC Press

Chee-wooi Ten

Chee-Wooi Ten (ECE) has finalized contracts to write two books for CRC Press, a major publisher of humanities, social science, and STEM books and textbooks. The first book is Electric Power Distribution System Engineering, 4th edition. Ten has been teaching EE5250 Distribution Engineering I at Michigan Tech for 10 years.

The second book, Modern Power System Analysis, 3rd Edition, is used to accompany a senior-level power engineering elective. Both books are tentatively scheduled for publication in January 2022.

Ten's book contract negotiations were initiated by Nora Konopka, editorial director of engineering at CRC Press/Taylor & Francis. Konopka worked with Ten on a previous book published by the company.

The new editions continue the work of the late Professor Turan Gönen, a leading expert and popular professor of electrical engineering at California State University, Sacramento.

Gönen devoted his life to the writing of four textbooks. "Electric Power Distribution System Engineering," published in 2013, is still taught in college classrooms worldwide. Ten notes that it is one of only a few Distribution Engineering textbooks that remains highly regarded by the international research community.

And although Ten did not personally know Prof. Gönen, he has used Gönen's books in his courses. Ten says he believes Konopka contacted him because she has confidence that he will do an excellent job in carrying on Gönen 's work and legacy.

"As a course instructor, especially when you've just started, you explore the textbook and master the materials while teaching," Ten reflects. "Written and revised throughout his long career, the contents of Gönen's books are enriched from his decades of experience in pedagogy."

Konopka's original proposal was for Ten to write four new editions of books by Prof. Gönen. Ten told her, "I cannot do four books, but I can find two other authors who have the expertise to complete those books."

So, with collaborators at University of Hong Kong and Virginia Tech, all four books will be completed and published.

"My colleagues on this project are research-active faculty, and I am very proud to have an opportunity to collaborate with them," Ten says, noting that they represent two of the best engineering programs in the world.

"These books are collaborative, and we will work together to ensure the next editions of these textbooks reflect today's industrial and academic knowledge and best practices," Ten says.

"For the next year, I'll focus on qualitative development of the content," Ten predicts. "I plan to 'test drive' some of the new content in the power engineering courses I have been teaching."

CRC Press is an imprint of Taylor & Francis Group, part of Informa PLC, one of the world's leading business intelligence and academic publishing businesses. The company publishes more than 2,700 journals and 5,000 new books each year. CRC Press specializes in Science, Technology and Medical books.

Kevin Trewartha, HCC, Shane Mueller, HCC

NIH Project: Motor Learning as a Sensitive Behavioral Marker of Mild Cognitive Impairment and Early Alzheimer's Disease

Kevin Trewartha

Kevin Trewartha (CLS, KIP) is principal investigator of a $455,884 research and development grant from the U.S. Department of Health and Human Services/ National Institutes of Health. The three-year project, "Motor Learning as a Sensitive Behavioral Marker of Mild Cognitive Impairment and Early Alzheimer's Disease," was awarded in June 2018. The project's co-PI is Shane Mueller (CLS, ACSHF).

A researcher with the Human-Centered Computing (HCC) group, Trewartha specializes in the cognitive neuroscience of aging with a focus on the cognitive mechanisms of motor behavior. The overarching goal of his research is to understand the cognitive, computational, and neural basis of motor behavior, and to identify age-related changes in these factors.

Trewartha directs the Aging, Cognition, and Action Lab at Michigan Tech, where his research falls into two main streams: 1) identifying the changes in neurocognitive mechanisms in healthy aging and dementia that contribute to motor performance impairments in later adulthood, and 2) developing interventions aimed at improving cognitive and motor function in older populations.

We recently asked Dr. Trewartha about his research, his students, and the ICC. Here are his replies.

What questions are you seeking to answer?

Alzheimer's disease is a debilitating condition that has no cure and is the sixth leading cause of death in the United States. It is critical for research to identify alternative behavioral markers that can help with early diagnosis so that physicians can maximize the benefits of available treatment options that slow the progression of the disease.

Our research aims to identify subtle changes in motor skill learning that could improve the reliability of existing methods for distinguishing healthy aging from early stages of Alzheimer's disease.

We use a robotic device to implement two common motor learning tasks with younger adults and healthy older adults, then compare their performance with participants with mild cognitive impairment (MCI) and early stages of Alzheimer's disease.

In our first study, we completed data collection with our younger adult control participants, half of our healthy older adults, and a number of patients with MCI and early Alzheimer's disease. A handful of our younger participants have completed the second study. We look forward to our data collection initiatives in the next year or two.

How has the award supported Michigan Tech students?

This award has supported a number of paid and volunteer students at all levels. In particular, for two years the grant supported one PhD student as the lead graduate student on the project. In the first year of the project, two additional PhD students contributed to data collection initiatives and undergraduate student training. The project also supported four undergraduates in my lab, who contributed to data collection initiatives for course credit or as part of the Undergraduate Research Internship Program (URIP), administered by Michigan Tech's Pavlis Honors College. Finally, this research has supported a training opportunity for a MiCUP Scholars Program student from Wayne County Community College.

What kinds of research activities do your students pursue?

All students complete ethical conduct of research (CITI) training. Undergraduate students engage in participant recruitment and data collection initiatives, and they have also presented preliminary findings at local conferences. The graduate students take on a larger role, coordinating participant recruitment, scheduling, data collection, analyses, and training of undergraduate researchers. Our graduate students have presented preliminary findings at both regional and international conferences.

### What are your next steps in pursuit of this research?

Due to the pandemic, we anticipate asking for at least a one-year no cost extension. Unfortunately, because our project involves in-person testing with high-risk older adult populations, all of our data collection initiatives have been on hold since the beginning of March 2020.

We look forward to completing these projects so that we can establish the utility of measures of motor learning for improving the identification of subtle changes in cognitive function in the earliest stages of Alzheimer's disease.

What are some of the benefits of ICC affiliation?

My research program is broadly motivated by the desire to use a multidisciplinary approach to understanding the aging process, and developing ways to improve functional independence in later adulthood. Affiliation with the ICC has provided a conduit through which I can explore new ideas for broadening my interdisciplinary approach to studying human movement and cognition. I feel fortunate to be able to engage with members of the HCC/ICC and to learn from their expertise in technology and computing. Conversations with these colleagues has led to new collaborative efforts that we have begun to pursue this year. I am excited to continue to explore new collaborations with the ICC in the future.

Weihua Zhou, DataS, BDH
Jinshan Tang, CPS, BDH

KD4COVID19: An Open Research Platform
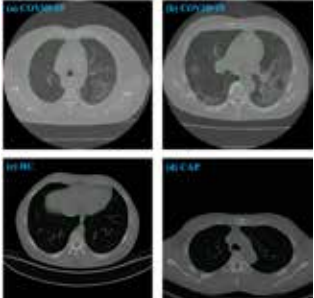
Segmentation Results Example

"KD4COVID19: An Open Research Platform Using Feature Engineering and Machine Learning for Knowledge Discovery and Risk Stratification of COVID-19"

In their seed grant-funded research, Weihua Zhou, Jinshan Tang, and PhD student Chen Zhao have developed a new automatic method to detect COVID-19 lung infection from chest CT images, an approach that improves the computer-aided diagnosis with high accuracy and interpretability.

"We have proposed a new deep-learning-based method which integrates a 3D V-Net with shape priors (SP-V-Net), which can extract pulmonary parenchyma from chest CT images," Zhou explains.

"To improve interpretability of the automatic diagnosis model, our approach has two modules," he continues. "The first, image segmentation, extracts lung regions; and the second, feature engineering, is based on texture analysis to discover significant features and predict the infection."

"The platform achieves promising results in both lung segmentation and automatic detection of COVID-19," Zhou says. "We believe it has a great promise for clinical use in facilitating automatic diagnosis of COVID-19 infection on chest CT images. We sincerely appreciate the support of the College of Computing and Institute of Computing and Cybersystems (ICC) in enabling our pursuit of this timely research."

Research Highlights

• A new deep-learning-based method which integrates a 3D V-Net with shape priors (SP-V-Net) is proposed to extract pulmonary parenchyma from chest CT images. The shape prior was used to optimize the model weights in both V-Net input and output, which significantly improved the model performance. Compared with manually delineated lung contours, the proposed segmentation method achieved a dice similarity coefficient of 0.9796, a sensitivity of 0.9840, a specificity of 0.9954 and a mean surface distance error of 0.0318 mm.

• A classification model using statistical analysis with high interpretability is proposed for differentiating COVID-19 infection from community-acquired pneumonia and healthy controls. The model using texture features from our segmentation results achieved an area under curve (AUC) of 0.9470, a sensitivity of 0.9670, and a specificity of 0.9270.

• The proposed approach achieves promising results in both lung segmentation and automatic detection of COVID-19. It has a great promise for clinical use in facilitating automatic diagnosis of COVID-19 infection on chest CT images.

The research results have been published in the journal, Pattern Recognition, Volume 119, November 2021, Elsevier.

Record Number of FRA Proposals Submitted

As part of their 2021 Broad Agency Announcement, the Federal Railroad Administration (FRA) requested from Michigan Tech researchers a record number of eight concept papers for proposed research projects. Michigan Tech is a subcontractor for two additional FRA concept paper proposals.

Among the principal investigators who submitted papers are ICC members Thomas Oommen (GMES), Ricardo Eiris, (CEGE), and Beth Veinott (CLS). The paper submittal was coordinated by the Michigan Tech Rail Transportation Program. The range of topics concept paper topics speaks to the diversity of Michigan Tech's expertise in the rail transportation research arena. The PIs are awaiting FRA decisions on which of these papers advance to full proposals.

CS Faculty Awarded Best Poster at ITiCSE

Computer Science faculty and students presented two posters, a paper, and chaired a session at the Conference on Innovation and Technology in Computer Science Education (ITiCSE), online June 26 to July 1, 2021.

"A Visualization for Teaching Integer Coercion," a poster presented by James Walker (CS) with Steven Carr (CS), Jean Mayo (CS), Ching-Kuang Shene (CS), and others, was one of three that received the conference's Best Poster Award. The poster describes the Expression Evaluation (EE) visualization tool, designed to aid students in understanding type conversions that take place implicitly in C.

An additional paper and poster were presented at the conference, and Linda Ott (CS) chaired a conference session on "Students: Diversity."

Meet Paul-222: The Better Robot

Assistant Professor Nathir Rawashdeh, Applied Computing, has developed a mobile robot disinfector with the help of a seed grant from Michigan Tech alumnus Paul Williams '61 EE.

"Building a multidisciplinary robot like this, one that contains mechanical, electrical, and computational components, is an example of applied mechatronics at work, says Nathir Rawshdeh, Applied Computing.

Paul-222

"Today's robots are just carts, they drive into room to irradiate it, then leave the room," he adds," They don't have the intelligence for detecting humans or deciding what to disinfect. Several companies are now developing intelligent disinfection robots, but I am convinced that the 254 UVC will remain too dangerous, and that the application of the 222 nm wavelength is much more suitable".

Rawashdeh has developed what he calls "Paul-222," a tele-operated mobile robot disinfector with first-person-view and two wavelengths: a standard 254 nanometer UVC light side and a 222 nanometer Far-UVC side as a prototype to compare the disinfection efficiency of the two technologies relative to power requirements, radiation intensity, and disinfection times.

"The next version of this prototype will be an autonomous and collaborative robot," says Rawashdeh. "It will be aware of human presence and disinfect while the room is occupied. This doesn't exist today."

The prototype was designed and built at Michigan Tech during the COVID-19 quarantine in summer 2020.

There was an emergency call for Institute of Computing and Cybersystems (ICC) seed grant proposals in May 2020 to address COVID-19, and Rawashdeh had only two weeks to apply. But in less than a month, he had won the funding—as did several colleagues in the College of Computing—received access to the funds, and started building and testing.

"This was a very generous gift from Paul Williams through the ICC," Rawashdeh said.

Rawashdeh completed the disinfector as a solo project while the labs were closed for group work, with help from EET undergraduate Austin Kucharski, who helped build the remote-control components.

A camera in the front of the unit provides first-person view for remote operation. Flashing lights alert those in the vicinity, and remote operation means it can be controlled from a distance only when it's safe.

Rawashdeh is looking to develop this idea further and is searching for collaborators, such as those studying human-centered computing and intelligent algorithms. And he's looking for public facilities interested in helping test the Paul-222 robot, including libraries, grocery stores, and health clinics.

"There will likely be a next pandemic, and such robots can be deployed at outbreak hot spots" Rawashdeh says. "Fighting pathogens will continue to be a priority."

Rawashdeh plans to present his invention at a future technical conference. He also expects to demonstrate the protype at future campus events and technology exhibits.

"The ICC is always encouraging and supporting us to write proposals and collaborate," Rawashdeh says. "The results of this research are a great example of what the ICC can do in a short time. I'm grateful to Paul Williams, the ICC, and ICC director Tim Havens for their support."

Nathir Rawashdeh and student test Paul-222

Elena Semouchkina, CPS
Beyond Metamaterials and the Invisible Cloak

Elena
Semouchkina

The science of transformation optics (TO) provides a new and powerful tool for creating electromagnetic devices with unprecedented functionalities, which could bring advances to various areas of human life.

The first TO media were built from metamaterials (MMs), artificial materials composed of tiny metallic resonators instead of atoms. Semouchkina explains that MM employment, however, demanded solving problems with homogenization of the media, inter-resonator coupling, extremely narrow frequency band, and increased losses at higher frequencies. The latter seriously restricted MM operation in optical range and extending TO approaches to photonic devices."

In Semchouchkina's NSF project, "Developing Anisotropic Media for Transformation Optics by Using Dielectric Photonic Crystals," another type of artificial material–dielectric Photonic Crystals (PhCs)–is investigated as alternative media for TO-based devices.

"Transformation media composed of PhCs can be free from major limitations of MM media, since, in difference from MMs, the electromagnetic responses of PhCs are defined by their periodicity and not by resonances in their 'atoms,'" Semouchkina notes.

In pursuit of their research, Semouchkina and her team have modeled and analyzed the properties of crystals and designed the media of invisibility cloaks and collimator lenses, which comprise fragments of anisotropic PhCs with rectangular lattices; fabricated first prototypes; and restored an experimental field mapping set-up. The team's main focus in this, the project's final year, is performing experiments in the microwave range.

In addition to investigating 3D artificial media, as initially planned, the project led to exploration of 2D dielectric metasurfaces, which are perspective for developing flat devices. Semouchkina says that her studies revealed and explained an unusual phenomenon of electromagnetically induced transparency (EIT) occurring in these structures in conditions when the medium should be opaque.

During the course of this interdisciplinary research project, four PhD-level graduate research assistants (GRA) were supported. The major portion of project activity is simulation modeling and numerical experiments, and the GRAs are using full-wave electromagnetic solvers, CST Studio Suite, and COMSOL Multiphysics to complete their work.

"Students also perform theoretical work and are proficient in electromagnetics, physics, and materials science," she adds. "They fabricate prototypes of artificial materials and structures and perform proof-of-concept experiments at microwaves using a unique, in-home made field-mapping system. Using their simulations, structures are re-scaled for operating at optical frequencies and incorporating in photonic devices."

Based on the unexpected findings of this project, Semouchkina plans to submit a new proposal to study 2D dielectric metasurfaces.

In February 2021 project findings were published in the Journal of Applied Physics. The paper was listed among the most read on the American Institute of Physics (AIP) website for several months following. A second paper, published this July in Applied Physics Letters, also appeared among the most read on the AIP website.

Bo Chen, CyberS, CompEd, BDH
Mobile Devices Can Help Mitigate Spread of Coronavirus

The impact of the coronavirus pandemic has been felt around the world. To mitigate its spreading, Dr. Bo Chen's (CS) research proposes a fundamental strategy to reduce the chance that healthy people will be exposed to it.

"Most viruses are transmitted by droplets released by the coughing, sneezing, and runny noses of infected individuals, this research proposes to detect such symptom events via mobile devices," Chen explains. "Today, most people have access to smartphones and other IoT devices, which can be used to instantly broadcast locations where the symptoms have been observed, significantly reducing the risk of healthy people being exposed to the viruses."

What makes this proposal feasible, Chen says, are the many sensors available on mobile devices today, such as a microphone, accelerometer, GPS, as well as widely accessible network connections through 4G, LTE, and Wi-Fi. Evaluation shows that coronavirus-like symptoms can be detected by the app with around 90% accuracy; and the differentiation between a dry and a wet cough can be measured with high accuracy, Chen says.

This project, and other projects in the Security and Privacy (SnP) lab, have been supported by seed grants from the ICC, the College of Computing, and the Michigan Tech Research Excellence Fund (REF).

MTU Selected for DoE Competition

Michigan Tech is among 17 top institutions nationwide selected to compete in the 2021-22 Marine Energy Collegiate Competition: Powering the Blue Economy. The event is hosted by the U.S. Department of Energy's (DOE) Office of Energy Efficiency and Renewable Energy (EERE).

The "blue economy" describes the sustainable use of ocean resources for economic growth, improved livelihoods and jobs, and ocean ecosystem health. The student competitors are poised to become the next blue economy innovators as they gain real-world experience and make industry connections to prepare for future careers in marine energy.

The competition challenges interdisciplinary teams of undergraduate and graduate students to explore opportunities for marine energy technologies via real-world concept development experiences, and to propose unique solutions to the burgeoning marine energy industry. The team's faculty advisors are Andrew Barnard (ME-EM, GLRC), Gordon Parker (ME-EM), and Tim Havens (CS).

The challenge is intended to advance the marine energy industry, a sector with the potential to provide reliable power to the blue economy but one for which further work is needed to optimize designs and reduce costs.

Competition elements include 1) development of a market-research-supported business plan, which will include a design of a system that could be commercialized to address power needs for a chosen sector of the blue economy; 2) pitching the plan to a panel of judges and hypothetical investor; 3) Optionally, build and test a device to achieve energy production; and 4) engage with the community through outreach and educational activities.

Grad Students Take 6th Place in Navy's AI: Tracks at Sea Challenge

Four Michigan Tech graduate students recently took 6th place in the U.S. Navy's Artificial Intelligence (AI): Tracks at Sea Challenge, receiving a $6,000 prize as one of six winning teams.

The Challenge solicited software solutions to automatically generate georeferenced tracks of maritime vessel traffic based on data recorded from a single electro-optical camera imaging the traffic from a moving platform.

Each Challenge team was presented with a dataset of recorded camera imagery of vessel traffic, along with the recorded GPS track of a vessel that is seen in the imagery.

Graduate students involved in the challenge were Zach DeKraker and Nicholas Hamilton, both Computer Science majors advised by Tim Havens (CS); Evan Lucas, Electrical Engineering, advised by Zhaohui Wang; and Steven Whitaker, Electrical Engineering.

Zach
DeKraker

Evan
Lucas

Nicholas
Hamilton

Steven
Whitaker

"The problem presented was to find a particular boat in a video taken of a harbor, and track its GPS coordinates.," says DeKraker. "We were provided with samples of other videos along with the target boat's GPS coordinates for that video, which we were able to use to come up with a mapping from pixels to GPS coordinates."

"Basically, we wanted to track boats with a video camera," adds Whitaker. "Our team used machine learning and computer vision to do this."

The team knew that there were two primary issues at hand. First, how can the pixel coordinates be translated into GPS coordinates? And second, how can the boat be located so that GPS pixel coordinates can be determined?

"Once we broke it down into these two subproblems, it became clear how to solve each half," says DeKraker.

To identify the boat and track its movement, the team used a simple neural network and a computer vision technique called optical flow, which made the analysis much faster and cleaner. They used a pre-built algorithm, adding a bit of optical flow so that the boat's position didn't have to be verified every time.

"These two tools allowed us to find the pixel coordinates of the boat and turn them into GPS coordinates," says DeKraker.

Whitaker sums up the team's division of responsibilities like this: "Evan detects all the boats in the picture; Nik detects which of those boats is our boat; Steven takes our boat position and converts it to GPS coordinates, Zach glued all of our pieces together."

"The end result is that our solution could run nearly in real-time," he says. "The accuracy wasn't the best, but given a little bit more time and more training data, the neural network could be significantly improved."

The Challenge was sponsored by the Naval Information Warfare Center Pacific and the Naval Science, Technology, Engineering, and Mathematics (STEM) Coordination Office, and managed by the Office of Naval Research. Its goal was to engage with the workforce of tomorrow on challenging and relevant naval problems, with the immediate need to augment unmanned surface vehicles' maritime contact tracking capability.

Daniel Byrne Awarded Fellowship

Daniel Byrne

The Graduate Dean Awards Advisory Panel and dean awarded a Summer 2021 Finishing Fellowship to PhD student Daniel Byrne (CS). Byrne received full support for the semester.

"The panel was impressed with your research, publication record, and contribution to the mission of Michigan Tech," says the award letter. "The intent of this fellowship is to allow you to focus your time on your dissertation so that you can complete your degree requirements during the fellowship period."

Byrne's research centers around the modeling and optimization of memory systems, which are found in today's datacenters. He explains that data caching helps improve the speed and efficiency of front-end cloud applications, such as websites and video streaming.

In collaboration with researchers at the University of Rochester, Byrne has developed a new data caching system. "Our system uses intelligent data replication and allocation across multiple memory devices to maximize performance while reducing overall operating costs," Byrne says.

"Specifically, we focus on utilizing new memory technologies to lower operational costs while meeting performance targets," Byrne adds. "Even small increases in performance and energy savings have significant impact over an entire deployment of servers."

His improvements to caching systems have already been adopted outside the lab as a widely-used open-source caching system called "memcached."

"Daniel's research focuses on modeling and designing a hybrid memory system where the conventional DRAM (faster, but more expensive) and the emerging non-volatile memory (NVM, cheaper but slower) are combined to host a key-value store," says Zhenlin Wang (CS), Byrne's faculty advisor, along with Nilufer Onder (CS).

Wang expects that Byrne's research will have a long term impact on design and implementation of a hybrid key-value store. "His work explores the theoretical properties of and interactions between inclusive and exclusive caches, a design space which has never been investigated before," he says.

Byrne began his Michigan Tech PhD studies in computer science in fall 2016. "I am grateful for the amount of support from my advisors, the Computer Science department, and the Graduate School during my PhD program," he says.

"I am also incredibly grateful for my PhD committee's support as I finish my dissertation over the summer. It has been a wonderful journey." (April 2021)

Mechatronics System Topic of New Video

Chimnay Kondekar

Alex Sergeyev (AC) and Chinmay Kondekar, '21 (MS, ECE/Mechatronics) discuss the Mechatronics degree programs and Kondekar's system design project in a video produced by the Applied Computing department. The system machines patterns on blocks of foam using various robotic attachments, a tricky process to program and one of the more challenging applications for an industrial robot.

The interconnected system is flexible, reconfigurable, and controlled from a central control interface to emulate a production process. Correct dimensions are assured using machine vision, and by transporting the workpiece between different stations.

A number of industrial applications are employed by the system, and most industrial robotic work cells have similar control and communication layouts. Manufacturing system layouts like this one are commonly found in the automotive, pharmaceutical, and food industries. Other potential applications include use in data acquisition and analytics, cybersecurity, and future projects requiring interconnected systems. (June 2021)

Watch the video on the College of Computing YouTube Channel.

The Mechatronics Playground

Dylan Gaines Awarded NSF Research Fellowship

Dylan Gaines

Computer Science PhD student Dylan Gaines is one of three Michigan Tech students recently awarded a multi-year National Science Foundation (NSF) Graduate Research Fellowship.

The oldest STEM-related fellowship program in the United States, the prestigious NSF Graduate Research Fellowship Program (GRFP) recognizes exceptional graduate students in science, technology, engineering and mathematics (STEM) disciplines early in their career and supports them through graduate education.

The fellowship provides three years of financial support, including a $34,000 annual stipend for each fellow and a $12,000 cost-of-education allowance for the fellow's institution. In addition to financial support, the GRFP provides opportunities for research in national laboratories and international research.

Four years, two degrees
Gaines, who arrived as a first-year student in fall 2016, was awarded the Bachelor of Science in Computer Science in spring 2019, also completing a concentration in Game Development. He completed his master's in December 2020, and he has begun working on his PhD in Computer Science at Michigan Tech, which he anticipates completing in spring 2023.

Commenting on Gaines' award, Department of Computer Science Chair Dr. Linda Ott says, "All of us in the Department of Computer Science are very excited that Dylan is being awarded an NSF Graduate Research Fellowship. This is clear affirmation that Dylan is an excellent student. Even as an undergraduate he demonstrated strong research skills."

"I am very thankful for this award, and for everyone that supported me through the application process and helped to review my essays" Gaines says.

Early interest, a first-year research assistant
Ott notes that it is also a tribute to Gaines's advisor, Keith Vertanen (CS), who has established a very successful research group in intelligent interactive systems.

"Dr. Ott encouraged the pursuit of research in her CS 1000 class by bringing in faculty like Dr. Vertanen to present what they were working on," Gaines says. "Because of this, I started doing research with Dr. Vertanen my first semester at Michigan Tech, and he has been nothing but supportive the whole time," adding, "all of the faculty and staff at Michigan Tech are very supportive of students and make teaching a priority."

Vertanen recalls that in fall 2017, Gaines approached him following a talk about Vertanen's research in the CS department's first-year seminar class.

"I was so impressed by him that I subsequently hired him as an undergraduate research assistant, something I would normally not do with a first-year student," Vertanen says. "Since then, he has been a key contributor to my research group."

"It became quickly clear to me he was a talented, hard-working, and curious researcher," Vertanen says. I was pleased to learn NSF recognized this, as well, by awarding him a GRF. I'm excited to see what he'll accomplish during his PhD"

Text entry techniques
Gaines's research with Vertanen focuses on text entry techniques for those with visual impairments. His doctoral research is continuing this work. He also plans to develop assistive technologies for use in Augmented Reality.

His aim is to make smartphones–and technology in general–more accessible for people with visual impairments. Looking ahead, Gaines definitely wants to continue to pursue research, but he's unsure yet if it will be in academia or in industry. "At this time, I am open to both possibilities," he says.

"Dylan is one of the strongest and easiest to work with students I have encountered in over ten years of advising undergraduate research students," Vertanen says. "I have no doubt he will produce an exciting and impactful portfolio of research during his PhD studies."

Students Capture Lead in CTF Competitions

Michigan Tech students are setting records in cybersceurity capture the flag (CTF) competitions, in which students to prepare and test themselves against practical cybersecurity knowledge and skills, such as identifying hackers from forensic data, pentesting and auditing vulnerable websites, and recovering from ransomware attacks. The competitions place hidden "flags" in various computer systems, programs, images, messages, network traffic and other computing environments, and each individual or team is tasked with finding these flags. The RedTeam is advised by Yu Cai (AC) and Bo Chen (CS).

RedTeam Achieves NCL Breakthrough, Ranked #3

Twenty-three members of the Michigan Tech RedTeam achieved a historic breakthrough in the Spring 2021 National Cyber League (NCL) biannual competition. The primary team finished the CTF team competition in 3rd Place in the overall ranking (tied for 1st Place in score). Further, of the 4,180 individual players competing, four MTU RedTeam players ranked in the Top 100. More than 900 college and high school teams from across the country participated in individual and team challenges. (Apr. 2021)

National Media Attention for RedTeam

MTU's RedTeam was mentioned by Yahoo Finance and IT News Online in stories on the competition leaderboard for the spring season of the National Cyber League (NCL). RedTeam is in third place out of 922 teams. (May 2021)

Great Lakes Security Conference

The 2021 Great Lakes Security Conference CTF competition was hosted at Michigan Tech by the Michigan Tech Networking and Computing Student Association, the MTU RedTeam, and WolvSec of the University of Michigan. CTF categories included reversing, PWN, web application exploitation, cryptography, and misc. challenges. The Great Lakes Security Conference was sponsored by GRIMM, Lockheed Martin, Amazon AWS, Aunalytics, and PolyVerse. (Apr. 2021)

Team Takes 3rd in Lockheed CTF Competition

Two RedTeam students were part of a team that finished 3rd in an invitation-only Lockheed Martin Advanced Technologies Laboratories Capture the Flag competition. The multi-day virtual event involved 200 students on 40 teams for a 48-hour contest.

The team, GoBlue!, trailed the 2nd Place team by only 14 points. MTU RedTeam members on the team were Dakoda Patterson (CS) and Trevor Hornsby (Cyber), who joined three University of Michigan students.

"We were lucky to be one of the 40 teams invited," said Cai. "This was no small task, as the CTF included a large number of points in reversing and "pwning" challenges, which proved to be fairly difficult." (Jan. 2021)

RedTeam NCL CyberLeague Rankings in Top 2%

Of the 27 Michigan Tech RedTeam students who successfully completed the NCL individual games in fall 2020, seven ranked in the top 100, out of 6,011 participants. In team play, two teams ranked in the top 100, out of 957 teams. (Nov. 2020)

RedTeam Achievements at Cybar OSINT CTF

The MTU RedTeam ranked 13th of 162 teams in a 24-hour online Cybar OSINT Capture The Flag (CTF) cybersecurity competition, starting June 6, 2020 . The team finished tied for 5th place, completing all the challenges presented by the competition. (June 2020)

The MTU RedTeam

Joint Center for Biocomputing and Digital Health

BDH

RESEARCH AREAS

- **BIOCOMPUTING**
- **DIGITAL HEALTH**

AWARDS AND HONORS
Hoda Hatoum, Honorable Mention, ACC 2021 Young Investigator Award, American College of Cardiology (FY21); SB3C Diversity Participation Awardee for Young Faculty, Georgia Tech Parker H Petit Institute for Bioengineering and Biosciences (FY21); Biomedical Engineering Society Career Development Award (FY21)

JOURNAL EDITOR
Qiuying Sha, Editorial Board, Scientific Reports, Nature (FY21)

PROFESSIONAL SERVICE
Hoda Hatoum, Session Chair, Summer Biomechanics, Bioengineering, and Biotransport Conference (FY21)

PUBLICATIONS AND TALKS
Listings of researcher publications and talks can be found on the ICC website at mtu.edu/icc/research.

Hatti and Team Win Startup Competition

Nagesh Hatti

Nagesh Hatti (ECE) was the lead of a startup team that took first place in the virtual Techstars StartUp Weekend, an entrepreneurial startup event focused hosted by São Judas University, Brazil.

Hatti and his team pitched "Inter-Self" a mobile-based app that focuses on the emotional health of students, combined with their interaction with fellow students, during projects and assignments.

Hatti said the objective of their idea is to provide a feedback mechanism so instructors are aware of the overall emotional health of students, and then use that as an input to their instruction.

Techstars Startup Weekend, in partnership with Google for Startups, is a 54-hour event created for entrepreneurs of all kinds.

Hairong Wei, DataS, BDH
$2.39M Plant Genome Project

Hairong Wei

"ECA-PGR: Under the Hood: The Genetic Components of Maize Transformation;" $2,398,61; Five-year potential; Kansas State University

Maize (corn) is a staple crop in the US and worldwide, and it serves as an important model for fundamental research. In this project, the genome of a maize line amenable to culture will be sequenced to facilitate the identification of the genetic elements that regulate culturability.

Novel approaches will be developed for genetic decoding on the complex maize genome. In particular, a designable bacterial system specifically interacting with genes of interest in the maize genome will be utilized to study gene function and manipulate cell development.

The project will provide training for undergraduate, graduate and postdoctoral students in both genetics and computation, with an emphasis on large data education. In addition, the project will collaborate with the Kansas Louis Stokes Alliance for Minority Participation to encourage involvement of historically underrepresented students in STEM fields.

Weihua Zhou, DataS
Multi-Disciplinary

How can the cost-effectiveness of healthcare be improved, especially for complicated chronic diseases? This is the overarching question Weihua Zhou (AC) is seeking to answer with his research. The multi-disciplinary solutions he is investigating merge the fields of medical imaging and informatics, computer vision, and machine learning.

Weihua Zhou

An assistant professor in Michigan Tech's Health Informatics program, and an affiliated associate professor for the Biomedical Engineering department, Zhou is working with students on a number of research projects in Michigan Tech's Medical Imaging and Informatics Lab, which he directs.

He says his research is driven by clinical significance, and he is especially interested in developing practical solutions to improve the cost-effectiveness of treating complicated chronic diseases, such as coronary artery disease, heart failure, and senile dementia.

Zhou is excited about his career and his international research. "We have a very productive team, including dedicated PhD students, self-motivated graduate and undergraduate students, and a lot of experienced clinical and technical collaborators," he says of his colleagues at Michigan Tech and around the world.

Zhou feels that he can be dedicated to both his research and teaching at Michigan Tech. "I joined the Health Informatics program at Michigan Tech both because health informatics is my research focus, and because Michigan Tech's leading reputation among engineering schools opens opportunities to find new and respected technical collaborators.

Chatterjee Named to State Mining Council

Snehamoy Chatterjee (GMES) has been appointed to a new state panel on mining, the Committee on Michigan's Mining Future. Michigan Tech's Dr. Timothy Eisele (ChE) was also appointed to the new panel.

Chatterjee, an associate professor in the Department of Geological and Mining Engineering and Sciences, was chosen to represent current or former research faculty members who hold a master's or doctorate degree in mining or geology at a university in Michigan.

Snehamoy Chatterjee

Chatterjee said he's "overwhelmed and very excited" to serve on the committee, which is charged with evaluating government policies that affect the mining and minerals industry, recommending public policy strategies to enhance the growth of the mining and minerals industry, and advising on the development of partnerships between industries, institutions, environmental groups, funding groups, and state and federal resources.

Michigan Tech's Mining Engineering academic major, suspended in 2004, has returned this summer with a new multidisciplinary degree program.

The committee appointments will also benefit the Mining Engineering program. "This appointment will not only help me professionally but also it will improve the visibility of our reinstated program, both to the potential employers and prospective students," he explains.

Chatterjee's research specializes in ore reserve estimation, short- and long-range mine planning, mining machine reliability analysis, mine safety evaluation, and the application of image analysis and artificial intelligence in mining problems.

Sangyoon Han (BDH, DataS)
Applying Computer Vision

Sangyoon Han

Sangyoon Han's (BmE) research goals include applying computer vision to microscopic images to capture meaningful information. His teaching interests include computer vision for microscopic images, fluid mechanics, cell biomechanics and mechanobiology, and soft tissue mechanics. He instructs courses including Computer Vision for Microscopic Images and Fluid Mechanics.

Han enjoys teaching and interacting with students, "and feeling their energy, too." And he makes a deliberate effort in his classes to pause from time to time so that his students can ask questions.

Han advises two Biomedical Engineering PhD students, Nikhil Mittal and Mohanish Chandurkar. "Nik is working on finding myosin-independent mechanosensitivity mechanism for stiffness sensing, and Mohanish works on the project finding mechano-transmission for fluid shear stress sensing by endothelial cells," he notes.

Computing Education Center

CompEd

RESEARCH AREAS

- **CYBER-PHYSICAL SYSTEMS**
- **INTERNET-OF-THINGS**
- **SMART HOME, BUILDING, COMMUNITY, AND GRID**
- **SMART TRANSPORTATION**
- **SMART HEALTH**
- **UNDERWATER COMMUNICATIONS AND NETWORKS**

ADVISOR TO STUDENT CLUBS/ORGS
Todd Arney, Association of Information Technology Professionals (AITP), DevOps Club, MTU Epsilon Pi Tau, MTU Linux Users Group, MTU Open Source Club

Briana Bettin, The Pokemon League at Michigan Tech

Yu Cai, Chinese Students and Scholars Association, MTU RedTeam on Cybersecurity

Aurenice Oliveira, Epison Pi Tau Honor Society, Society of Hispanic Professional Engineers (SHPE)

AWARDS AND HONORS
Todd Arney, Provost's Award for Sustained Teaching Excellence, Center for Teaching and Learning (FY21); Top 10% in Teaching Evaluations, Provost (FY21); Recognition for Transition to Online Teaching (COVID19), Pavlis Honor's College/Center for Teaching and Learning (FY21)
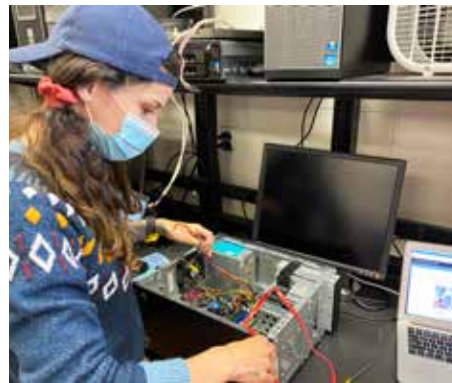
Briana Bettin, Exceptional Average of Seven Dimensions Student Evaluation Score, MTU Provost (FY21)

EARNED MEDIA
Yu Cai, WLUC-TV6, "GenCyber cybersecurity training camp comes to Michigan Tech" ; Keweenaw Report, WOLV Radio, "Teachers Learn How To Include Cybersecurity In Their Lessons" (FY20)

PUBLICATIONS AND TALKS
Listings of researcher publications and talks can be found at mtu.edu/icc/research.

Summer 2021 GenCyber Teacher Camp

Leo Ureel Receives Teaching Award

The 2020-2021 CTL Instructional Award for Innovative or Out of Class Teaching was presented to Leo Ureel (CS) in recognition of his "student-centric efforts which have increased retention and diversified the cohort of first-year computing students."

Leo Ureel

Ureel's lecture, "Three course innovations to support communication," was presented February 18, 2021, as part of the CTL Instructional Award Presentation Series.

Lecture Abstract: Three innovations to support introductory courses present many communication challenges between faculty and first year students. In this context, we discuss three innovations used in our introductory computer science courses.

The first is the use of Snap, a high-level, visual programming language, as a form of pseudocode during the first five weeks of the course to build student vocabulary and problem solving skills before tackling programming in Java.

The second is a Code Critiquer developed as a Canvas plugin to provide immediate guidance and feedback to students when they submit their programming assignments.

And third is a grade visualization tool that helps students understand their current performance in the course and project a range that will contain their final grade. While not everyone teaches introductory computer science, we discuss how these or similar innovations and tools might apply to other courses.

Todd Arney Receives Teaching Award, Featured in Showcase

Todd Arney

The Office of the Provost and the William G. Jackson Center for Teaching and Learning (CTL) awarded Todd Arney the Provost's Award for Sustained Teaching Excellence, new faculty recognition that celebrates the work of individuals whose teaching consistently and dramatically benefits students.

Had this been a normal year, Arney would have again qualified as a finalist for the annual Distinguished Teaching Award, which he has done three times. But because this was his fourth nomination, the provost, academic deans, and the CTL agreed that Arney deserves special recognition. Arney teaches courses in Linux system administration, Microsoft system administration, infrastructure system administration, scripting administration and automation, data center engineering, cybersecurity, and cyber ethics.

Arney was also featured as a spring 2020 Deans' Teaching Showcase member, which recognized his behind-the-scenes efforts to modernize Applied Computing curricula, and to enhance the use of state-of-the-art computing resources across campus through the use of the College of Computing's new Virtual Cluster.

Applied Computing chair Dan Fuhrmann calls Arney an "evangelist" for the Virtual Cluster and notes that in addition to its implementation within the CNSA and Cybersecurity programs, Arney has made special efforts to reach out to the Civil and Environmental Engineering department, bringing a modern computing framework to one of their senior/graduate-level courses.

Briana Bettin (CompEd)
Mental Models of Computing

Briana Bettin

New Michigan Tech PhD graduate Briana Bettin (CS), an assistant professor, is among six new faculty members the College of Computing welcomed in fall 2021. In August 2020, Bettin successfully defended her dissertation, "The Stained Glass of Knowledge: On Understanding Novice Mental Models of Computing," which aims to better understand how novice programmers approach learning programming, and how their construction of programming ideas might be better facilitated.

"I'm excited to begin my faculty journey and I look forward to helping our students continue to learn skills that will allow them to create the future," Bettin says. "Michigan Tech has always been an amazing place for me–the opportunity to continue to give back to this place that has given me so much is something I'm very grateful for."

Bettin says that she is excited about several interesting research projects already being planned, and she looks forward to helping the College advance its educational and research visibility and standing.

Bettin's research interests include user experience, human factors, and human-computer interactions. "I delve into mental models research and explore theories for how students might construct knowledge," she explains. "Specifically, the major studies in my dissertation explore how prior applicable knowledge might allow for transfer to programming concepts, which can feel very novel to students who have never programmed before."

Bettin is also exploring methods for designing programming analogies, testing their application in the classroom, and observing how their use may impact student understanding of specific topics. "I take a very user experience-oriented approach, and work to apply methods and ideas from user-experience research in the CS classroom space," she says.

Center for Cyber-Physical Systems

RESEARCH AREAS

- **CYBER-PHYSICAL SYSTEMS**
- **INTERNET-OF-THINGS**
- **SMART HOME, BUILDING, COMMUNITY, AND GRID**
- **SMART TRANSPORTATION**
- **SMART HEALTH**
- **UNDERWATER COMMUNICATIONS AND NETWORKS**

ADVISOR TO STUDENT CLUBS/ORGS
Kuilin Zhang, Michigan Tech ITE Student Chapter

AWARDS AND HONORS
Jung Bae, Most Downloaded Article, International Journal of Precision Engineering and Manufacturing (FY 20)

Sajjad Bigham, DOE Solar Desalination Prize for Innovation, Solar Energy Technologies Office (SETO), US Department of Energy (FY21)

Bo Chen, Student Paper Award, 2019 IEEE PES Asia-Pacific Power and Energy Engineering Conference (FY 20); ASME Fellow, The American Society of Mechanical Engineers (FY 20)

EARNED MEDIA
Kuilin Zhang, Michigan Tech News, "Cloud Sourcing Electricity Usage" (FY 20)

Kuilin Zhang, Green Car Congress, "MTU researchers develop optimization model to fill in the gaps in connected vehicle data" (FY20)

JOURNAL EDITOR
Jung Bae, Assoc. Editor, IEEE International Conference on Robotics and Automation (FY 20)

Jeremy Bos, Assoc. Editor, Applied Optics, Optical Society of America (FY 20)

Bo Chen, Assoc. Editor, IEEE Transactions on Intelligent Transportation Systems, ITS Society (FY 20)

Zhen Liu, Assoc. Editor, Journal of Cold Regions Engineering, American Society of Civil Engineers (FY 20)

Elena Semouchkina, Assoc. Editor, IEEE Antenna and Wireless Propagation Letters

Ye Sun, Assoc. Editor, Elsevier Smart Health Journal (FY 20); Assoc. Editor, IEEE EMBS International Conference on Biomedical and Health Informatics (FY 20)

Jinshan Tang, Academic Editor, Journal of Healthcare Engineering, Hindawi (FY 20); Assoc. Editor, 2020 IEEE International Conference on Systems, Man, and Cybernetics (FY20); Editorial Board Member, Translational Oncology, Elsevier (FY 20); Guest Editor, Pattern Recognition, Elsevier (FY 20)

Chee-Wooi Ten, Assoc. Editor, IEEE Transactions on Smart Grid; Assoc. Editor, the Journal of Sustainable Energy, Grids and Networks, Elsevier (FY20)

Zhaohui Wang, Assoc. Editor, Editorial Board, IEEE Open Journal of the Communications Society (FY 20)

Kuilin Zhang, Editorial Board, Transportation Research Part E: Logistics and Transportation Review (FY 20)

Lan Zhang, Editor, Transactions on Vehicular Technology, IEEE (FY21); Editorial Board, NeurIPS-20 Workshop on Scalability, Privacy, and Security in Federated Learning, Neural Information Processing Systems Foundation (FY21)

PROFESSIONAL SERVICE
Elena Semouchkina, Organizer, Women in Electromagnetics Workshop (FY 20)

Jinshan Tang, Co-Chair, IEEE SMC Technical Committee on Information Assurance and Intelligent Multimedia-Mobile Communications (FY 20); Session Chair, IEEE International Conference on Systems, Man, and Cybernetics (FY20)

Zhaohui Wang, Co-Chair, Technical Program, ACM International Conference on Underwater Networks and Systems (FY20)

Kuilin Zhang, Member, Key Stakeholders Team, Michigan Mobility 2045, Michigan Department of Transportation (FY 20)

PUBLICATIONS AND TALKS
Listings of researcher publications and talks can be found on the ICC website at mtu.edu/icc/research.

Bo Chen Named ASME Fellow

Bo Chen (ME-EM), the Michigan Tech Dave House Professor of Mechanical Engineering and Electrical Engineering, has received the designation of Fellow from the American Society of Mechanical Engineers (ASME). The Fellow level of membership is conferred by the ASME Committee of Past Presidents to recognize their outstanding engineering achievements. Nominated by ASME Members and Fellows, an ASME Fellow nominees must have 10 or more years of active practice, and at least 10 years of active corporate membership in ASME.

Bo Chen

Chen is the director of Michigan Tech's Intelligent Mechatronics and Embedded Systems (IMES) lab. She conducts interdisciplinary research in the areas of mechatronics and embedded systems, agent technology, connected and autonomous vehicles, electric vehicle-smart grid integration, cyber-physical systems, and automation.

William Predebon, chair of the the Department of Mechanical Engineering-Engineering Mechanics says, "Dr. Chen has made major contributions in her field of embedded systems with application to hybrid-electric and electric autonomous systems. Her course in Model-based Embedded Control System Design is regularly in high demand by not only ME students but also EE students. This is a testament to the importance of the topic and her teaching ability."

Sajjad Bigham, CPS
Quarterfinalist in DOE Solar Desalination Prize Contest

Sajjad Bigham (ME-EM) and his team have advanced to the second phase of the American-Made Challenges Solar Desalination Prize contest for their project, "Sorption-Based ZLD Technology." The contest is sponsored by the Solar Energy Technologies Office at the US Department of Energy.

Sajjad Bigham

Bigham is one of 19 quarterfinalists. Each receives a $50,000 cash prize. Selected from among 162 applicants, the quarterfinalists now advance to the second, Teaming phase of the competition, for which each research team will develop and successfully validate an operational prototype of their solar-thermal desalination system.

Bigham is a heat transfer and energy systems specialist studying the scientific and engineering challenges at the intersection of thermal-fluid, material, and energy sciences. His Michigan Tech research lab, Energy-X, is focused on understanding the fundamental transport science of important energy carriers at micro, nano, and molecular scales.

The Solar Desalination Prize is a multi-stage prize competition intended to accelerate the development of low-cost desalination systems that use solar-thermal power to produce clean drinking water from saltwater. It is intended to help achieve the goals of the Water Security Grand Challenge.

Each stage of the competition has increasing prize amounts, totaling millions of dollars.

Chee-wooi Ten is CPS Director

Chee-wooi Ten (ECE) has been appointed director of the ICC's Center for Physical Systems (CPS). Ye (Sarah) Sun (ME-EM), director of the CPS center since it's founding in 2015, is on sabbatical.

"Dr. Ten has been instrumental in building collaborations at Michigan Tech and beyond in the areas of power systems security and engineering," says Tim Havens.

Chee-wooi Ten

Cyber-physical systems continues to grow in prominence as everything, from automobiles to thermostats to sauce pans, is connected to the internet, and the CyberS research portfolio reflects this.

"Chee-wooi's knowledge of the cyber-physical area of research and successes in securing external funding, as well his experience building teams to solve big, difficult problems, prepare him to lead the strategic activities of CPS members," Havens adds. (July 2021)

MTU Joins PSERC

Michigan Tech has joined the Power Systems Engineering Research Center (PSERC), a collaboration of university and industry partners, including DTE, Consumers Energy, and Hubbell Power Systems.

"The overall goal of joining PSERC is to catalyze transdisciplinary research by teaming up with other institutions and relevant industry partners for national grant competition," says Chee-Wooi Ten (ECE) who serves as Michigan Tech's PSERC site director.

PSERC member expertise includes power systems, applied mathematics, complex systems, computing, control theory, power electronics, operations research, nonlinear systems, economics, industrial organization, and public policy. (June 2021)

Center for Cybersecurity

CyberS

RESEARCH AREAS

- **BIOMETRICS**
- **CYBERSECURITY**
- **INFORMATION SECURITY**
- **PRIVACY PROTECTION**
- **SECURITY IN MOBILE COMPUTING**
- **TRUSTED SOFTWARE ENGINEERING**
- **WIRELESS COMMUNICATIONS**

ADVISOR TO STUDENT CLUBS/ORGS
Bo Chen, CS Reading Group on Cybersecurity, MTU RedTeam on Cybersecurity, National Cyber League Cyber Competition Team
Guy Hembroff, Networking and Computing Student Association
Jeffrey Wall, Organization for Information Systems at Michigan Tech

AWARDS AND HONORS
Jeffrey Wall, SIGSEC Best Reviewer Award, Workshop for Information Security and Privacy, Special Interest Group in Information Security and Privacy (FY20)

EARNED MEDIA
Bo Chen, WalletHub, "2019's States Most Vulnerable to Identity Theft and Fraud," (Oct. 2019)
Guy Hembroff, The Hill, "Your virtual doctor is in," (Nov. 2019)

JOURNAL EDITOR
Bo Chen, Editor, IEEE Communications (FY 20); Editor, Cybersecurity Thematic Series: Applied Cryptography in Computer and Communications, Springer (FY21)

Guy Hembroff, Editorial Board Member, Brazilian Journal of Medicine and Human Health (FY 20, FY21)
Jeffrey Wall, Editorial Board, Workshop on Information Security and Privacy; Editorial Board Member, Workshop on Information Security and Privacy (FY 20)

INVITED TALKS
Bo Chen, "Enabling Data Recovery from Malicious Attacks in Mobile Devices," Ocean University of China, Qingdao, China (FY 20)
Bo Chen, "Enabling Data Recovery from Malicious Attacks in Mobile Devices," Qingdao University, China (FY 20)

PROFESSIONAL SERVICE
Bo Chen, Chairperson, EAI International Conference on Applied Cryptography in Computer and Communications (FY20)

PUBLICATIONS AND TALKS
Listings of researcher publications and talks can be found on the ICC website at mtu.edu/icc/research.

ROTC Cybersecurity Training for Tomorrow's Officers

The U.S. Department of Defense, Office of Naval Research, has awarded Michigan Tech faculty researchers a $249K grant that supports the creation of an ROTC undergraduate science and engineering research program at Michigan Tech. The primary goal of the DoD program is to supply prepared cadets to all military branches to serve in Cyber commands.

Project PI is Andrew Barnard (ME-EM). Co-PIs are Timothy Havens (CS), Laura Brown (CS), and Yu Cai, (AC). The title of the project is, "Defending the Nation's Digital Frontier: Cybersecurity Training for Tomorrow's Officers."

The program curriculum was developed in summer 2020, with instruction associated with the award beginning in fall 2020.

Initially, the program focuses on topics in cybersecurity, machine learning and artificial intelligence, data science, and remote sensing systems, all critical to the The Naval Science and Technology (S&T) Strategic Plan and the Navy's Force of the Future, and with equal relevance in all branches of the armed forces.

The project's plan of work focuses on engaging ROTC students in current and on-going Cyber research, and supports recruitment of young ROTC engineers and scientists to serve in Navy cybersecurity and cyber-systems commands.

"Our approach develops paid, research-based instruction for ROTC students through the existing Michigan Tech Strategic Education Naval Systems Experiences (SENSE) program," says Barnard,

Barnard says the cohort-based program enriches student learning through deep shared research experiences. The program is designed for flexibility and agility in order to quickly adapt to new and emerging Navy science and technology needs in the Cyber domain.

Placement of officers in Cyber commands is of critical long-term importance to the Navy (and other DoD branches) in maintaining technological superiority, says the award abstract, noting that technological superiority directly influences the capability and safety of the warfighter.

Also closely involved in the project are Michigan Tech Air Force and Army ROTC officers Lt. Col. John O'Kane and LTC Christian Thompson, respectively.

"Unfortunately, many ROTC cadets are either unaware of Cyber related careers, or are unprepared for problems facing Cyber officers," said Lt. Col. O'Kane. "This proposal aims to provide a steady flow of highly motivated and trained uniformed officers to the armed-services, capable of supporting the warfighter on day-one."

Bo Chen, CyberS, CompEd Research Excellence Fund Awards

Bo Chen

The Vice President for Research Office awarded a Fall 2020 REF Research Seed Grant to Bo Chen (CS) for his project, "Towards Secure and Reliable Decentralized Cloud Storage." Funding for the 12-month, $25,800 award began January 1, 2021.

"This grant will provide significant help to advance my current research," says Chen. "This is really exciting news for me."

As a recipient of the REF seed grant, Chen will participate in review and feedback for the next round of REF proposals.

Sajjad Bigham (ME-EM), and four additional university faculty members also received the fall 2020 seed grant award. (Nov. 2020)

MEDC Cyber and Mobility Division Visits Campus

The ICC's Center for Cybersecurity and MTEC SmartZone hosted representatives of the Michigan Economic Development Corporation's Cyber and Mobility Division Dec. 2, 2019. Michigan Tech faculty conducting research in the cyber and mobility space presented talks, the group engaged in strategic economic development discussions, and tours of Michigan Tech cyber and mobility labs were conducted.

Karl Heimer, senior technical advisor for cybersecurity at the MEDC Automotive office, spoke with students and shared information and opportunities in MEDC-affiliate CyberAuto and CyberTruck student competitions.

Niusen Chen Wins Best Paper Award

A paper by a PhD student Niusen Chen (CS) received the Best Paper Award at the First EAI International Conference on Applied Cryptography in Computer and Communications, which took place virtually May 15-16, 2021. The paper, "MobiWear: A Plausibly Deniable Encryption System for Wearable Mobile Devices," discusses the design of MobiWear, the first PDE system specifically for wearable mobile devices. It is co-authored by Bo Chen (ME-EM), and Weisong Shi, Wayne State University, a professor of computer science and one of the world leaders in the edge computing research community.

Center for Data Sciences

DataS

RESEARCH AREAS

- **DATA SCIENCES**
- **BIG DATA**
- **DATA-INTENSIVE COMPUTING**
- **ARTIFICIAL INTELLIGENCE**
- **MACHINE LEARNING**
- **PATTERN RECOGNITION**
- **SIGNAL AND IMAGE PROCESSING**
- **SENSOR AND DATA FUSION**

ADVISOR TO STUDENT CLUBS/ORGS

Jeremy Bos, General Motors / SAE AutoDrive Challenge, Robotics Systems Enterprise
Laura Brown, Women in Computing Sciences
Timothy Havens, AI: Tracks as Sea Team
Nilufer Onder, Upsilon Pi Epsilon, Women in Computing Sciences
Michael Roggemann, Archery Club, Pistol Club
Mark Rouleau, University liason to the International Consortium of Political and Science Research
Aleksandr Sergeyev, Michigan Tech Archery Club

AWARDS AND HONORS

Jeremy Bos, Senior Member, Institute of Electrical and Electronics Engineers (FY 20)
Susanta Ghosh, Most Watched Poster/ Prerecorded Video, Advances in Nanomechanics Category, Society of Engineering Science (FY21)
Thomas Oommen, Michigan Tech Nominee for 2020 Curtis W. McGraw Research Award, American Society for Engineering Education (FY 20)
Sidike Paheding, Best Paper Award, MDPI Electronics Journal (FY21)
Nathir Rawashdeh, Outstanding Teaching Performance During COVID Transition, MTU Provost (FY21)
Timothy Schulz, Fellow,International Society for Optical Engineering; Fellow, Optical Society of America; Member, Tau Beta Pi (FY 20); Fellow, Interrnational Society for Optics and Photonics (FY20)
Aleksandr Sergeyev, "Mosaic Project" Award, Journal of Measurement Science and Technology (FY 20)
Xiaoyong (Brian) Yuan, Student Registration Award, IEEE Symposium on Security and Privacy (FY21)

EARNED MEDIA

Jeremy Bos, SPIE Professional Magazine, interview about autonomous vehicle research at Michigan Tech and SPIE's LiDAR benchmarking activity at a conference (FY 20)
Susanta Ghosh, Michigan Tech Unscripted Research Blog, "The Secret Strength of Gnashing Teeth" (FY 20); American Association for the Advancement of Science (AAAS), "The secret strength of gnashing teeth" (FY 20)
Timothy Havens, The Enterprisers Project "How to Explain AI in Plain English" (Sep. 20); "How to make a career switch into AI: 8 tips" (FY 20); "Artificial Intelligence (AI): 9 things IT pros wish the CIO knew" (FY 20); "Artificial Intelligence (AI) for beginners" (FY 20); "Artificial intelligence (AI) vs. natural language processing (NLP): What are the differences?" (FY20); Credit Donkey: "Best Robo Advisor" (FY 20); "Data science vs. machine learning: What's the difference?" (Mar. 2020); "Artificial intelligence (AI) vs. machine learning (ML): 8 common misunderstandings" (May 2020)
Mark Rouleau, Daily Mining Gazette, Houghton, MI, "Good ideas: Tech holds open house for IDEA Hub" (Nov. 2019)
Thomas Oommen, Michigan Tech Unscripted Research Blog, "Geohazards on the Horizon" (Sep. 2019)
Alex Sergeyev, Manufacturing Matters, Chamber of Commerce Grand Haven, "Donald Engineering Supports Mechatronics Playground at Michigan Tech" (Feb. 2021); Grand Rapids Business Journal, "Robotics key to Michigan's economy" (Nov. 2019); WOLV-FM, Copper Country Today, Electrical Engineering Technology Senior Design Project (May 2021)
Jeremy Bos, Nat'l Public Radio, "Town wants ghost busting scholars to stop spoiling their fun" (Mar. 2020); WXPR.org, "Mysterious light still attracts tourists to Upper Peninsula despite explanation" (Mar. 2020)

The ICC helps me to grow my research development continuously by providing vision, guidance, resources, and cost-share support, which I greatly appreciate. **Sidike Paheding, DataS**

Tim Havens Is 1st IEEE CIS Conference Publication Editor

Tim Havens was appointed the first Conference Publication Editor of the IEEE Computational Intelligence Society (IEEE CIS). In this role, Havens serves as editor-in-chief for all publications of IEEE CIS conferences, including the flagship IEEE International Joint Conference on Neural Networks (IJCNN), IEEE International Conference on Fuzzy Systems (FUZZ-IEEE), IEEE Congress Evolutionary Computation (IEEE CEC), IEEE World Congress Computational Intelligence (WCCI), and IEEE Symposium Series on Computational Intelligence (SSCI). (Jan. 2021)

Thomas Oommen, Tim Havens, Michigan Ag Connection, a re-posting of the Michigan Tech Unscripted article, "Found in Translation, published July 12, 2019. (Aug. 2019)

JOURNAL EDITOR

Laura Brown, Feature Editor, AI Magazine, Association for the Advancement of Artificial Intelligence (FY20)

Mari Buche, Editorial Board, Journal of the Midwest Association for Information Systems (FY20); Editorial Board, Journal of Information Technology Management, Association of Management (FY20)

Timothy Havens, Associate Editor, IEEE Transactions on Fuzzy Systems (FY20); Editor, Proceedings of IEEE Computational Intelligence Society (CIS) Conferences (FUZZ-IEEE, CEC, IJCNN, WCCI, DSAA, CoG, ICDL, CAI), IEEE (FY21); Guest Editor, Journal of Applied Remote Sensing: Adversarial Machine Learning and Explainable Artificial Intelligence in Remote Sensing, SPIE (FY21)

Benjamin Ong, Editor, 9th Parallel-in-Time Conference Proceedings, Springer In Preparation; Not Yet Submitted (FY21)

Thomas Oommen, Associate Editor, ASCE Journal of Materials in Civil Engineering (FY 20); Associate Editor, AIMS Geoscience (FY 20); Associate Editor, International Journal of Geotechnical Earthquake Engineering (FY 20); Editorial Board Chair, Journal of Environmental and Engineering Geoscience, Association of Environmental and Engineering Geologists (FY20, FY21); Editorial Board, Geomatics, Natural Hazards and Risk (FY 20); Editorial Board, Environmental and Engineering Geoscience, GeoScienceWorld (FY20); Assoc. Editor, Journal of Materials in Civil Engineering, ASCE (FY20);

Sidike Paheding, Assoc. Editor, Photogrammetric Engineering and Remote Sensing, American Society for Photogrammetry and Remote Sensing (FY21); Editorial Board, Remote Sensing, MDPI (FY21)

Hairong Wei, Editor, Frontiers in Plant Science, Plant Physiology (FY20); Assoc. Editor, aBiotech, Springer (FY21); Editorial Board, Forestry Research, Maximum Academic Press (FY21)

Jeremy Bos, Associate Editor, Applied Optics, Optical Society of America (FY20)

PROFESSIONAL SERVICE

Jeremy Bos, Chair and Program Organizer, Laser Communication and Propagation through the Atmosphere and Oceans; Program Organizer, Autonomous Systems: Sensors, Processing and Security for Vehicles & Infrastructure 2020 (FY 20)

Sang Yoon Han, Session Chair, Annual Meeting of the Biomedical Engineering Society (FY20)

Thomas Oommen, Co-Chair, Association of Environmental and Engineering Geologists (FY20); Member, AFS20: Committee on Geotechnical Instrumentation and Modeling, The National Academies of Sciences Engineering Medicine: Transportation Research Board (FY20); Secretary/Treasurer, Geological Society of America, Environmental and Engineering Division (FY 20); Vice-Chair, ASCE Geo-Institute Engineering Geology and Site Characterization Committee (FY20)

INVITED TALKS

Weihua Zhou, Panelist/Keynote, "Machine Learning in SPECT MPI Applications," American Society of Nuclear Cardiology (FY20)

PUBLICATIONS AND TALKS

Listings of researcher publications and talks can be found on the ICC website at mtu.edu/

Sidike Paheding, DataS
Innovative, Active, Effective

S. Paheding

Be Innovative. Be Active. Be Effective. This is Sidike Paheding's teaching philosophy.

New to the Department of Applied Computing in fall 2020, Paheding's teaching interests include digital image processing and machine learning. Paheding's research seeks to develop novel AI-driven technologies, and his primary interests are image/video processing, machine learning, deep learning, computer vision, and remote sensing.

Paheding comes to Michigan Tech from Purdue University Northwest, where he was a visiting assistant professor in the ECE department. From 2017-2019 he was a postdoctoral research associate and assistant research professor in the Remote Sensing Lab at Saint Louis University.

Paheding is an associate editor of the journals, Signal Image and Video Processing (Springer) and Photogrammetric Engineering and Remote Sensing (ASPRS), and topic editor for the journal, Remote Sensing.

Tim Havens, DataS, Andrew Barnard, GLRC
Ford Mobility Funds AI, Acoustics Research

I magine if your car could tell you when you are passing by an area occupied by rare migratory birds, or if it could listen to roads and bridges to determine when infrastructure repairs need to be made. A recent gift from Mobility Research at Ford recently provided a $149,518 gift to fund research that could make this possible.

Tim Havens

Tim Havens (CS) and Andrew Barnard (ME-EM) are leading this exploration of how future connected vehicles could use AI and acoustics to detect, classify, and localize external sound events, and evaluate and monitor transportation infrastructure. The gift funds a PhD fellowship, a team of undergraduate students in the SENSE Enterprise, and the development and building of a mobile acoustics test bed.

Michigan Tech thanks Chad Esselink '94 CS, and Tavan Eftekhar at Ford Mobility Research for making this endeavor possible. (May 2020)

Accolades and Awards

Timothy Schulz Named 2019 University Professor
The Provost and Senior Vice President for Academic Affairs named Dr. Timothy Schulz (ECE) a 2019 University Professor, an honor that recognizes outstanding scholarly contributions to the University and to the awardees' discipline over a substantial period of time. (May 2021)

Sidike Paheding Wins MDPI Electronics Best Paper Award
A paper co-authored by Sidike Paheding is one of two to receive the 2020 Best Paper Award from the MDPI journal, Electronics. The paper presents a brief survey of advances in Deep Learning. "A State-of-the-Art Survey on Deep Learning Theory and Architectures" appeared in Vol. 8 (3) of the journal. (Feb. 2021)

Alex Sergeyev Wins ASEE Best Paper Award
For his paper and presentation, "University, Community College and Industry Partnership: Revamping Robotics Education to Meet 21st Century Workforce Needs – NSF Sponsored Project Final Report," Alex Sergeyev won the Best Paper Award in the Engineering Technology Division at the 2019 American Society of Engineering Education (ASEE) conference, June 16-19, 2020. The paper was published in the fall 2020 issue of the prestigious Journal of Engineering Technology. (Jun. 2020)

Sergeyev, Students Earn ASEE Conference Awards
Alex Sergeyev and students presented two papers at the American Society for Engineering Education (ASEE) Gulf-Southwest Annual conference, Apr. 23-24, 2020. Both received awards: The Faculty Paper Award for, "Pioneering Approach for Offering the Convergence MS Degree in Mechatronics and Associate Graduate Certificate," by Sergeyev, John Irwin (MMET), and Adrienne Minerick (BmE); and the Student Paper Award for, "Efficient Way of Converting outdated Allen Bradley PLC-5 System into Modern ControlLogix 5000 suit", by students Spencer Thompson, Larry Stambeck, and Andy Posa; and Sergeyev and Paniz Hazaveh (AC). (Jun. 2020)

Benjamin Ong Awarded Kliakhandler Fellowship
Benjamin Ong was awarded the Michigan Tech Department of Mathematics 2019-2020 Kliakhandler Fellowship, which supported two parallel-in-time conferences at Michigan Tech in June 2020. The Kliakhandler Fellowship aims to stimulate research activity in the Math department. (Oct. 2019)

Signature Research, MTU Win $1M NGA Award

S ignature Research, Inc. has partnered with Michigan Tech to accomplish a SPhase II STTR project sponsored by the National Geospatial-Intelligence Agency. The two-year, $1 million project is titled, "Algorithms for Look-Down Infrared Target Exploitation-Phase II." Michigan Tech's portion of the contract is $400K.

Timothy Havens is PI of the project. Co-PI is Matt Blanck, program manager for Signature Research, who will lead the SGR side of the project. At Michigan Tech, Havens will work with research scientist Adam Webb, Michigan Tech Research Institute, and CS PhD student Nicholas Hamilton to accomplish the goals of the contract.

The project will identify physics-based novel signatures and data processing techniques to exploit overhead infrared (IR) imagery using machine learning algorithms.

The SGR/MTU Team will generate, collect, and label a wide body of data, implement learning algorithms, develop use cases and tests on those data, and perform a comprehensive study to determine ways in which learning algorithms can automate IR imagery recognition tasks.

"And while this effort is focused on overhead IR imagery," adds Havens, "The methods and software developed will have applicability to other sensing modalities, leading to investigations of multi-modal fusion of all-source data."

Signature Research, Inc. provides solutions to DoD and intelligence community clients, and specializes in Signature Phenomenology, Analysis and Modeling of items of military interest covering the breadth of the electromagnetic spectrum. (June 2020)

Anthony Pinar, DataS
Teaching Is Like a Puzzle

Tony Pinar

Tony Pinar (ECE) says teaching is like a is like a puzzle: one takes a difficult concept, reduces it to several digestible pieces, then delivers them to fresh minds in a way to maximize understanding and insight.

"That challenge is what drives me to be a better teacher," he says.

Pinar believes that to be a good teacher one must understand the topics very well, and he strives for the most effective delivery. "This keeps me on my toes, forces me to constantly identify holes in my knowledge, and drives me to continuously strive to learn new things," he explains.

Pinar's research interests are in applied machine learning and data fusion, and his teaching interests include machine learning, signal processing, and electronic design.

On research, Pinar says it is rewarding to work on open-ended and novel problems in their infancy, and at the cutting edge of today's technology.

"It is also exciting to watch the cutting edge move forward, see what sticks and what doesn't, and observe how the direction(s) of the field evolve," he adds.


Thomas Oommen (L) and James Bialas

Thomas Oommen, DataS, James Bialis, PhD Student
Remotely Sensed Image Classification

With close to 2,000 working satellites orbiting the Earth, and about a third of them engaged in observing and imaging our planet, the sheer volume of remote sensing imagery being collected and transmitted to the surface is astounding. Add to this images collected by drones, and the estimation grows quite possibly beyond the imagination.

In the old days, say around the 1970s, a simpler pixel-by-pixel approach was used to decipher satellite imagery data. Since then, increasingly higher resolution has become the norm. A new approach was needed. Enter GEOBIA—–Geographic Object-Based Image Analysis—–a processing framework of machine-learning computer algorithms that automate much of the process of translating all that data
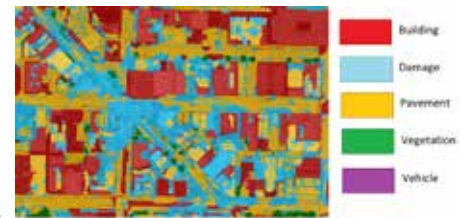
Geographic Object-Based Image Analysis

into a map useful for, say, identifying damage to urban areas following an earthquake.

The refinement of GEOBIA methods has engaged scientists and others for several decades. Among them are Michigan Tech doctoral student James Bialas and his faculty advisors, Thomas Oommen and Timothy Havens. The team's research started with aerial imagery of Christchurch, New Zealand, following the 2011 earthquake there.

"The specific question we looked at was, how do we translate the information we get from the crowd into labels that are coherent for an object-based image analysis?" Bialas said, adding that they specifically looked at the classification of city center buildings, then the researchers started looking at how the image segmentation size affects the accuracy of the results.

"The big finding of this research is that, completely independent of the labeled data sets we used, our classification results stayed consistent across the different image segmentation levels," Bialas says. "And more importantly, within a fairly large range of segmentation values, there was pretty much no impact on results. In the past several decades a lot of work has done trying to figure out this optimum segmentation level of exactly how big to make the image objects."

"As the GEOBIA problem becomes bigger and bigger–there are companies that are looking to image the entire planet earth per day–a massive amount of data is being collected," Bialas noted, and in the case of natural disasters where response time is critical, for example, "there may not be enough time to calculate the most perfect segmentation level, and you'll just have to pick a segmentation level and hope it works."

This research is part of a larger project that is investigating how crowdsourcing can improve the outcome of geographic object-based image analysis.

Center for Human-Centered Computing

RESEARCH AREAS

- **MULTIMODAL INTERACTIONS**
- **HUMAN-AGENT INTERACTIONS**
- **ASSISTIVE TECHNOLOGIES**
- **INTELLIGENT HEALTH**
- **SOFTWARE EDUCATION**
- **NOVEL INTERFACES**
- **COMPUTATIONAL MODELING**
- **EXPLANATION IN SYSTEMS**
- **COLLABORATION AND TRUST**
- **DECISION MAKING AND ADAPTIVE LEARNING**

ADVISOR TO STUDENT CLUBS/ORGS

Scott Kuhl, Husky Game Development, Campus Ministry, Summer Youth Program

Shane Mueller, Bangladeshi Student Assoc.

Robert Pastel, Humane Interface Design Enterprise

Kelly Steelman, Association for Psychological Science Student Chapter, BASIC (Building Adult Skills in Computing), Human Factors and Ergonomics Society Student Chapter, Psi Chi International Honors Society

Elizabeth Veinott, Husky Games Enterprise

Charles Wallace, Breaking Digital Barriers, Copper Country Coders

EARNED MEDIA

Beth Veinott, Channel 3 News interview, "Remote Learning Strategies," Marquette, MI (Mar. 2021)

Charles Wallace, The Verge, "Older adults struggle to access COVID-19 vaccine appointment websites" (Jan. 2021); TV6 UPsides, feature story about the free tutoring program, Building Adult Skills in Computing (BASIC) (Nov. 2019)

AWARDS

Hongyu An, Blackwell Award, Virginia Tech (FY21)

Ricardo Eiris, Idea Competition for Symposium on Imagining the Future of Undergraduate STEM Education, National Academies of Sciences, Engineering, and Medicine (FY21)

Scott Kuhl, Enterprise Award, MTU Design Expo (FY21)

Samantha Smith, Top 10% in Teaching Evaluations (FY20), Provost (FY21); Call for IDEAs Award, IDEA Hub (FY21)

JOURNAL EDITOR

Hongyu An, Editor, International Conference on Very Large-Scale Integration, IEEE (FY21); Editor, International Symposium on Quality Electronic Design 2020, IEEE (FY21)

Robert Pastel, Editor, Human Factors and Ergonomics Society Conference (FY20)

Elizabeth Veinott (CLS), Assoc. Editor, User Experience Track, ACM International Conference on Human Factors in Computing Systems, ACM (FY21)

Keith Vertanen, Associate Editor, International Journal of Human Computer Studies (FY20); Editor, ACM SIGACCESS Conference on Computers and Accessibility (FY20); Editor, ACM International Conference on Human Factors in Computing Systems (FY20); Editor, Workshop on Speech and Language Processing for Assistive Technologies, ACL, (FY20); Subcommittee Chair, Editor, CHI '21: ACM International Conference on Human Factors in Computing Systems (FY21)

PROFESSIONAL SERVICE

Scott Kuhl, Chairperson, ACM Symposium on Spatial User Interaction (FY20)

Kelly Steelman, Science Policy Fellow, Human Factors and Ergonomics Society (FY20); Vice Chair, 2021 International Society of Aviation Psychology Conference (FY20); Session Chair, Perception and Safety on the Roads, Human Factors and Ergonomics Society Annual Meeting (FY20)

Kevin Trewartha, Councilor at Large, Michigan Society for Neuroscience (FY20);

Elizabeth Veinott, Organizing Committee Member and Doctoral Consortium Chair, ACM CHI Play 2019 (FY20)

Keith Vertanen, Organizer, Women in Computing Science (WiCS) Summer Youth Program (FY20); Subcommittee Chair, User Experience and Usability, ACM CHI 2020 (FY20); Program Committee, ASSETS 2020 (FY20); Panelist, National Science Foundation (FY20); Instructor, ACM SIGCHI Summer School, Write a Paper for CHI 2021, IIT Bombay (FY20); Organizer, Explore Computer Science Research Workshop (FY20)

Charles Wallace, Organizer, Breaking Digital Barriers and Copper Country Programmers

Charles Wallace Is Associate Dean

Charles Wallace was appointed Associate Dean for Curriculum and Instruction for the College of Computing in October 2019. In this new role, Wallace will help build campus collaborations to create

Charles Wallace

additional pathways for Michigan Tech students to engage with computing curricula, and facilitate conversations within the College of Computing that enable creative, agile options for students.

Robert West, DePauw University

Why Josh Stole the Password: A Decision Neuorscience Approach to Insider Threat in Information Security," a lecture by Robert West, DePauw University, was hosted by the HCC in February 2021. The lecture was co-hosted by the ICC and the Department of Cognitive and Learning Sciences.

Kelly Steelman Named HFES Science Policy Fellow, CLS Chair

Kelly Steelman

Kelly Steelman (CLS) was selected to participate in the Human Factors and Ergonomics Society (HFES) Science Policy Fellowship (SPF) program. The SPF program provides opportunities for HFES

members to learn how to successfully advocate for human factors and ergonomics on the national stage. They receive training in public affairs and advocacy, and participate in an annual spring Capitol Hill Day in Wshington DC.

The HFES SPF participants and graduates form the basis of a brain trust to create a pipeline of politically engaged members within HFES. (Jun. 2019)

Steelman Named Chair

Michigan Tech
Cognitive and
Learning Sciences

Kelly Steelman has been named chair of the Cognitive and Learning Sciences department. David Hemmer, dean of the College

of Sciences and Arts, cites Steelman's work developing Michigan Tech's new bachelor's degree in human factors as one reason he's happy to see her in the role as chair.

"A human factors program is a particularly good fit for Michigan Tech, as it blends foundational coursework in psychology with courses in systems engineering, human-computer interaction, usability, business, and design," Steelman says. (Jun. 2021)

HCC Research Expo Hosted in VR-Huskies

The Human-Centered Computing group hosted its 3rd annual HCC Research Expo, Nov. 12-13, 2020, in conjunction with World Usability Day. The venue for the 48-hour event was VR-Huskies, an exciting virtual social platform that leverages 360-degree panorama technology. Research projects, brief research talks, and lab tours were available on demand to browse at leisure.

Ricardo Eiris

The HCC Expo concluded with a keynote from accessible computing and design researcher Dr. Richard E. Ladner titled, "Accessible K-12 Computer Science Education." Ladner is professor emeritus in the Paul G. Allen School of Computer Science and Engineering at the University of Washington.

The annual HCC Expo showcases interdisciplinary research across campus, and provides a forum for Michigan Tech students to explore HCC research opportunities, tour labs, and

engage in virtual discussions. VR-Huskies is an active research project led by faculty member, Ricardo Eiris (CEE) and sponsored by the College of Engineering. It is a custom implementation of Mozilla Hubs®, an open-source platform which creates custom dynamic representations of information. Eiris says that the goal of VR-Huskies is to deliver in-depth learning in a multitude of contexts, such as field trips, outreach events, and entrepreneurial activities.

VR-Huskies Social Platform

Center for Scalable Architectures and Systems

SAS

RESEARCH AREAS

- **SCALABLE COMPUTER ARCHITECTURE AND SYSTEMS**
- **HETEROGENEOUS PARALLEL AND DISTRIBUTED COMPUTING FOR INFORMATION PROCESSING**
- **EMBEDDED SYSTEMS**
- **DEPENDABLE COMPUTING**
- **FORMAL METHODS**
- **FAULT TOLERANT SYSTEMS**
- **VLSI DESIGN AND CAD**
- **ARCHITECTURES FOR SECURE SYSTEMS**
- **VIRTUALIZATION**
- **SCALABLE ALGORITHMS**

AWARDS AND HONORS
Ali Ebnenasir, Best Paper Award, International Conference on Fundamentals of Software Engineering (FY20)

EARNED MEDIA
Dan Fuhrmann, Automation Alley's 2020 Technology in Industry Report: Seeing Industry 4.0 Through a 2020 Lens," "Michigan Tech Launches New College of Computing"

Tim Havens, BizWatchNigeria, "Time to Harness Artificial Intelligence" (Jan. 2020)

Alex Sergeyev, Grand Rapids Business Journal, "Robotics key to Michigan's economy," (Nov. 2019); Spartan News Service, Michigan State University, " Robotics manufacturing shows Michigan's automation leadership" (Nov. 2019)

JOURNAL EDITOR

Ali Ebnenasir, Editor, MDPI Journal, Special Issue on Dependable Cyber Physical Systems (FY20); Editor, Special Issue on Privacy Preserving IoT Environments, Hindawi Journal (FY20)

Zhenlin Wang, Editorial Board, Computer Languages, Systems and Structures Journal, Elsevier (FY20); Editor, International Symposium on Memory Management (FY21)

PROFESSIONAL SERVICE
Daniel Fuhrmann, Tutorials Chair, 2021 IEEE Radar Conference (FY20)

PUBLICATIONS AND TALKS
Listings of researcher publications and talks can be found at mtu.edu/icc/research.

Soner Onder, SAS, Dave Whalley, FSU
$1.2M NSF SCALE Project

Soner Onder

Dave Whalley

Soner Onder (CS) and David Whalley, Florida State University, are working to make computer processors execute applications in a more energy-efficient manner with the help of a $1.2 million grant from the National Science Foundation titled, "SHF: Medium: Collaborative Research: Statically Controlled Asynchronous Lane Execution (SCALE)." Michigan Tech is the lead institution on the project, and will receive $600,000.

This project develops a Statically Controlled Asynchronous Lane Execution (SCALE) approach that has the potential to meet or exceed the performance of a traditional superscalar processor while approaching the energy efficiency of a very long instruction word (VLIW) processor, according to the project abstract.

"In general, VLIW processors are more energy efficient but cannot approach the performance of OoO processors except in limited domains, such as digital signal processing," Whalley explains. This project is designed to overcome these current limitations.

"The general goal is to increase performance but to do it in a manner that is more energy efficient than the dominant computer processors that are in use today," Whalley says.

The toolset and designs developed in the project will be available as open-source.

Hongyu An, HCC, SAS
Curious, Exploring the Unknown

Hongyu An

Exploring science and technology is always exciting for Hongyu An. And he says he's pleased to have the chance to mentor the next generation and share his knowledge and experience with undergraduate and graduate students.

"The excellent professors, smart students, and supportive environment are the main reasons I joined Michigan Tech," he says. "As a new faculty member, I am facing a lot of new challenges. There is great support in my department and through the ICC."

An's primary research area is hardware design for AI and neuromorphic systems. He believes that AI is probably one of the most challenging research topics in science, noting that recent work in deep learning and artificial neural networks is demonstrating great progress in approaching artificial intelligence.

"But the traditional computers under von Neumann architecture cannot keep up with the development of neural networks and deep learning," he cautions. "My research is addressing this challenge by using a new hardware design, from device to architecture."

"As a new faculty member, I am facing a lot of new challenges. I deeply appreciate the great support from the ICC to help overcome these challenges. Specifically, I'd like to express my gratitude for the support and suggestions from Tim Havens and Peter Larsen on my first NSF proposal this year."

Daniel Fuhrmann Named Chair of Applied Computing Department

Daniel R. Fuhrmann, Dave House Professor of Computer Engineering, was appointed chair of the Department of Applied Computing in June 2021. Fuhrmann has been interim chair of the department since its founding in 2020. Prior, he was chair of the Michigan Tech Department of Electrical and Computer Engineering (ECE) from 2008 to 2019.

Dan Fuhrmann

"I couldn't be more excited," said Dr. Dennis Livesay, the Dave House Dean of Computing. "Dan was instrumental in the creation of the College, and I know that his leadership will help the department achieve its promise. Computing is transforming every discipline and it's hard to imagine any unit on campus reflecting that more than Applied Computing."

"I'm excited about doing what I can to help build this new department," says Fuhrmann. "There are a lot of synergies that may not be immediately apparent within traditional academic structures, but they reflect what is happening in industry today. For example, computer networks and cybersecurity are playing an increasingly important role in industrial control and automation, and robotics and the Internet of Things is highly relevant for the evolving field of health informatics."

Automation Alley
Technology in Industry Report 2020

How should companies prepare for worldwide digital transformation and position themselves for long-term strategic success? Automation Alley's 2020 Technology in Industry Report, "Seeing Industry 4.0 Through a 2020 Lens," explores this question in a series of case studies and white papers about trends in Industry 4.0. The articles in the report were written in collaboration with academic and industry leaders.

Dan Fuhrmann contributed his paper, "Michigan Tech Launches New College of Computing." which shares the history and rationale for Michigan Tech's new College of Computing, and discusses College outreach that encourages and facilitates a holistic vision of computing across the disciplines that mirrors the reality of today's Industry 4.0 workplace.

"I am impressed by Automation Alley's vision to bring Industry 4.0 thinking to manufacturers in Michigan and the upper Midwest," notes Fuhrmann. "They have identified eight key technologies that they believe will revolutionize business as we know it: artificial intelligence, big data, cloud computing, cybersecurity, modeling and simulation, robotics, the Internet of Things, and additive manufacturing."

"Many of these topics are being pursued in the College of Computing and elsewhere at Michigan Tech," Fuhrmann notes. "The opportunities associated with Industry 4.0 are enourmous."

Automation Alley is a World Economic Forum Advanced Manufacturing Hub (MHUB) and a nonprofit Industry 4.0 knowledge center located in Troy, MI. Michigan Tech is a member of Automation Alley. (Sep. 2020)

A paper by Dan Fuhrmann, Dennis Livesay, Tim Havens, Alex Sergeyev, and Yu Cai, titled "Digital Transformation and Industry 4.0: Michigan Tech Forges New Industry Connections," is included in the 2021 WEF Automation Alley Technology in Industry Report.

Impact

Your gifts support multidisciplinary research and education in the fields of cyber-physical systems, cybersecurity, data sciences, human-centered computing, and scalable architectures and systems for the benefit of Michigan Tech and society at large.
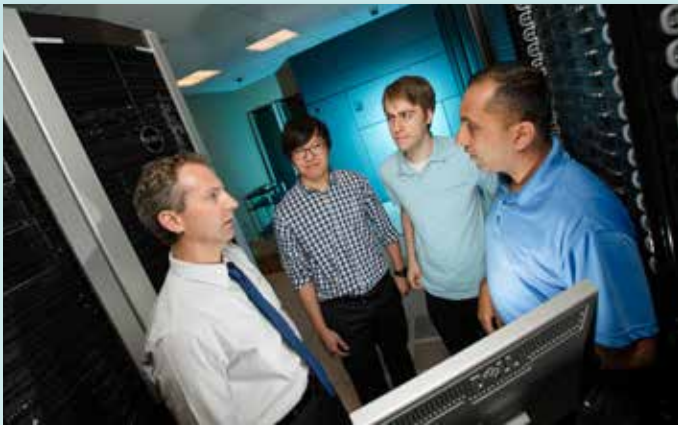
- **GRADUATE FELLOWSHIPS** to grow and sustain a diverse body of smart, promising graduate students.
- **UNDERGRADUATE RESEARCH FELLOWSHIPS** to support and retain talented students with financial need, students from diverse backgrounds, and women and underrepresented students.
- **SEED GRANTS** to stimulate and encourage opportunities for original research and provide students with valuable, hands-on experience.
- **OUTREACH SUPPORT** to 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.

ICC RESEARCH CENTERS

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

Computing Education Center
Brings together researchers and practitioners to foster collaborations and develop interventions that encourage adoption of computer technology across campus.

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

Center for 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 and intelligent health, software education, computational modeling, collaboration and trust, decision making and adaptive learning.

Scalable Architectures and Systems
Heterogeneous parallel and distributed computing for information processing, embedded systems, dependable computing, formal methods, fault tolerant systems, VLSI design and CAD, 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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