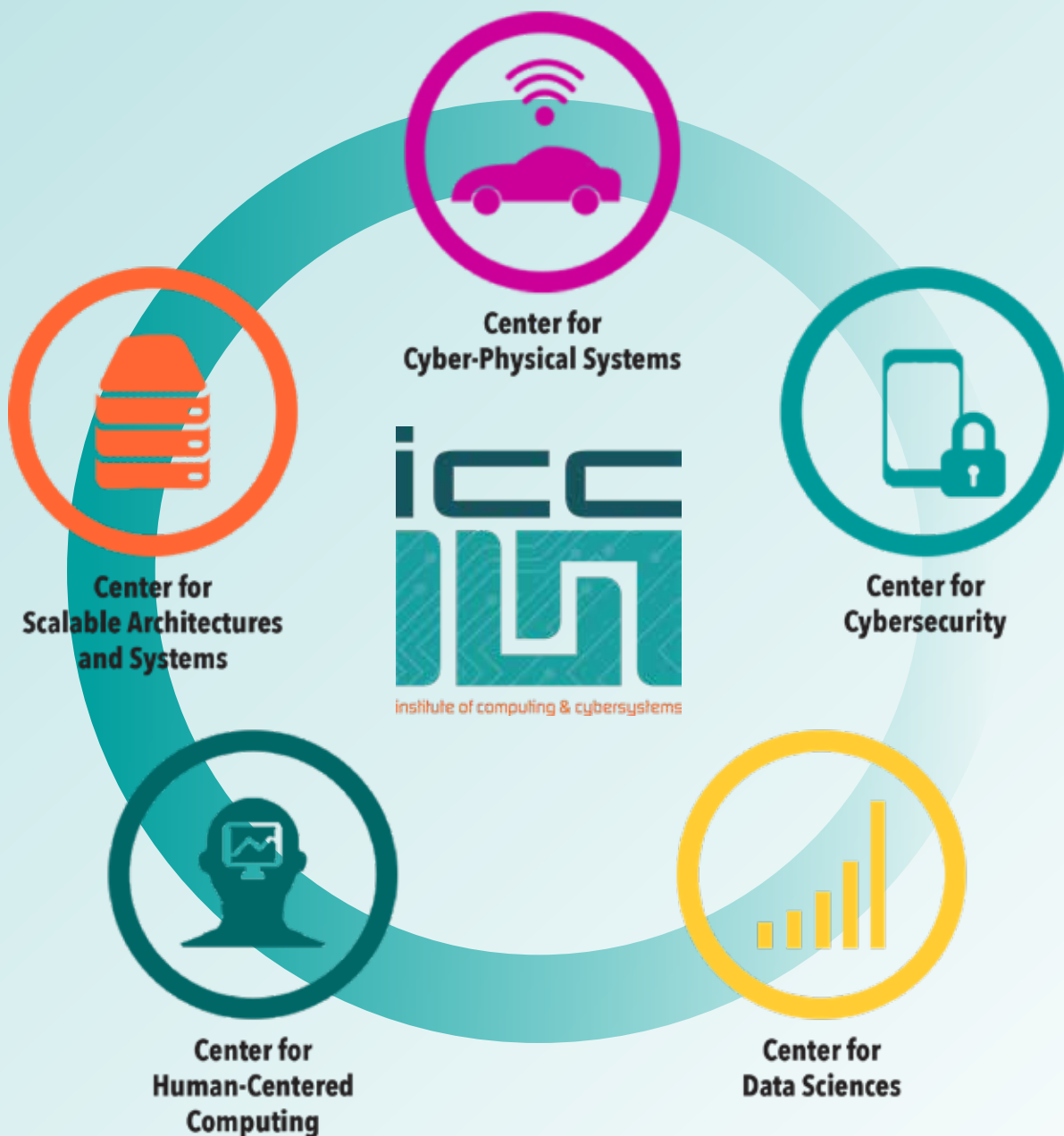
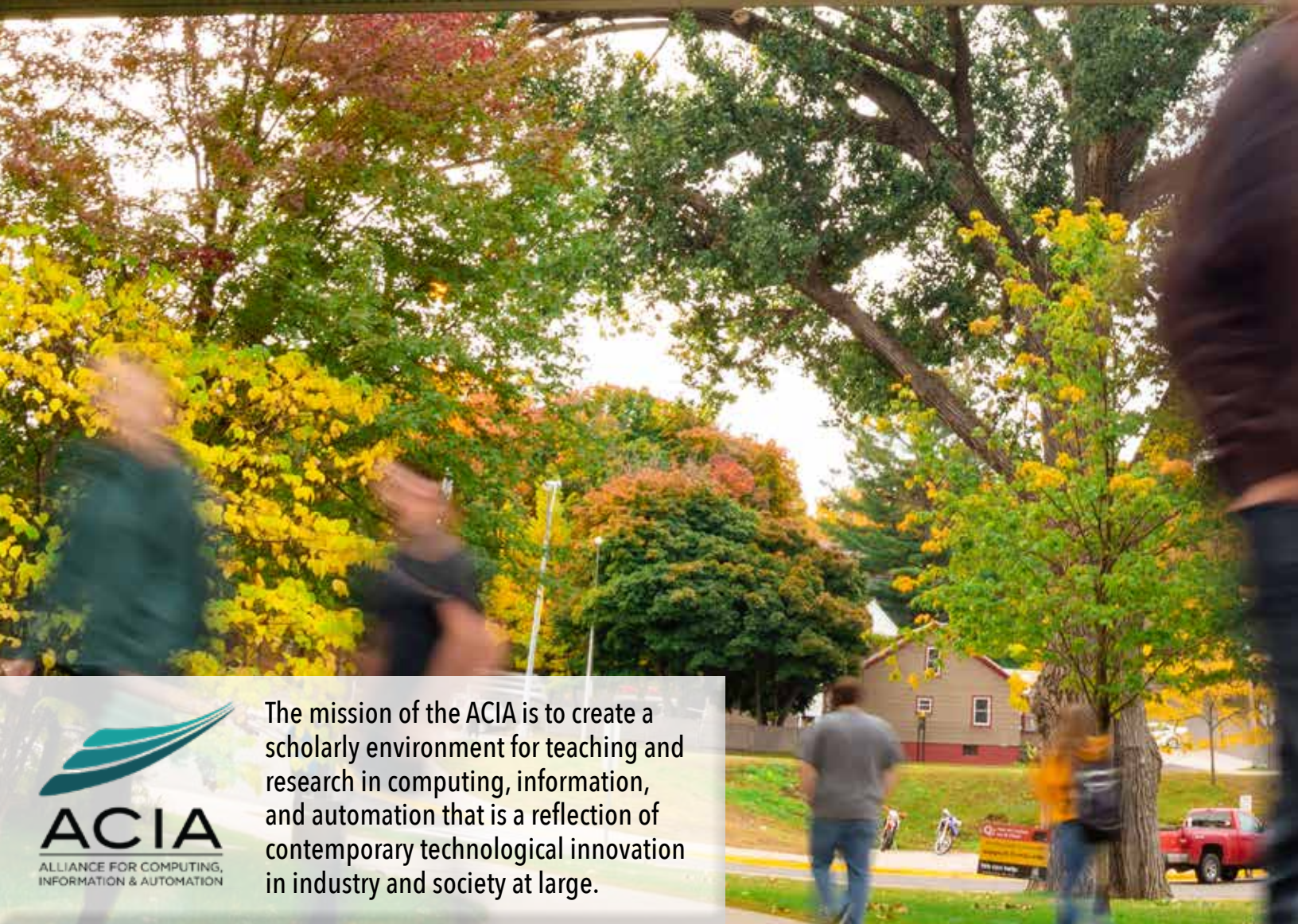


Annual Report **FY19**

INSTITUTE OF COMPUTING AND CYBERSYSTEMS



**CHALLENGE OF
MORROW NEEDS**



The mission of the ACIA is to create a scholarly environment for teaching and research in computing, information, and automation that is a reflection of contemporary technological innovation in industry and society at large.



institute of computing & cybersystems

Annual Report

July 1, 2018 to June 30, 2019

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From the Director



Dear Friends,

I hope that 2020 is turning out to be as electrifying for you as it has been for the computing researchers at MTU. The Michigan Tech College of Computing is officially open for business and, as a result, there is a lot of excitement at MTU surrounding computing and cybersystems. The ICC has been designated as the research arm for the new college and, with that integration, there is already growing interest in ICC members' research as external stakeholders learn more about what we are building here at MTU in all things computing. I am eager to see the new college bloom and grow to meet the future needs of our students.

I would like to congratulate our members for a very productive year; FY19 was a success. Research expenditures eclipsed \$2 million for the first time in our existence, and new awards figures support a trend in future growth. FY20 also began with a bang; as of October, 2019, we have already secured over \$1.8 million in new awards. ICC members are now supporting nearly \$9 million in active research projects.

These financial successes ensure that we can continue to grow the research support available to our members and their research teams. In that regard, Pete Larsen, Director for Research Development at Michigan Tech, will be supporting the ICC part-time in FY20. His focus in the ICC will be to develop individual and team strategic research plans, plan and execute research development events, help members search for funding opportunities, help the ICC engage with external agencies, among other research support duties.

The ICC will also be hiring a full-time Assistant Director for Research Development, whom will provide significant support for our members as they seek to achieve their research goals. These personnel resources are part of a larger 5-year plan to grow the research staff in the ICC, with the overall aim of enabling world-class research experiences for the faculty and students at MTU.

In conclusion, please join me in welcoming the new College of Computing to Michigan Tech, and all the excitement and enthusiasm that it brings. I very much look forward to continuing to grow the activities that support our mission to promote research and learning experiences in computing and cybersystems. To FY20 being a productive and fulfilling year!

A handwritten signature in black ink, appearing to read 'TCH', with a stylized flourish at the end.

Timothy C. Havens
Director, Institute of Computing and Cybersystems
Associate Dean for Computing, College of Computing
William and Gloria Jackson Associate Professor of Computer Systems

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

FY19

FY19 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 the 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 Institute of Computing and Cybersystems (ICC) was launched.

ICC Organization

The ICC comprises five research centers, each pursuing research in a broad computing discipline. A director and co-director provide Institute leadership, associate directors lead the Centers.

ICC Membership

The ICC's 50 members are from 25 departments/ academic disciplines.

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.

Active Awards¹

ICC active grants number 39, with awards totaling \$8.9M, an increase of 22% over FY18 year-end numbers. FY19 research expenditures total \$2.03 million.

Proposal Activity¹

In FY19 ICC researchers submitted 63 proposals totaling \$27.2 million. 26 proposals were new projects. 25% of all FY19 proposals were awarded, nearly \$3 million.

Scholarship and Service

As detailed later in this report, ICC members are leaders among their research and academic peers, on and off campus. In FY19 ICC members collectively attended dozens of national and international academic meetings and conferences; published more than 400 journal articles, conference papers, book chapters, and books; presented

dozens of papers, talks, and seminars; and provided prodigious professional service of many kinds to both Michigan Tech and professional and scientific societies and organizations of all kinds.

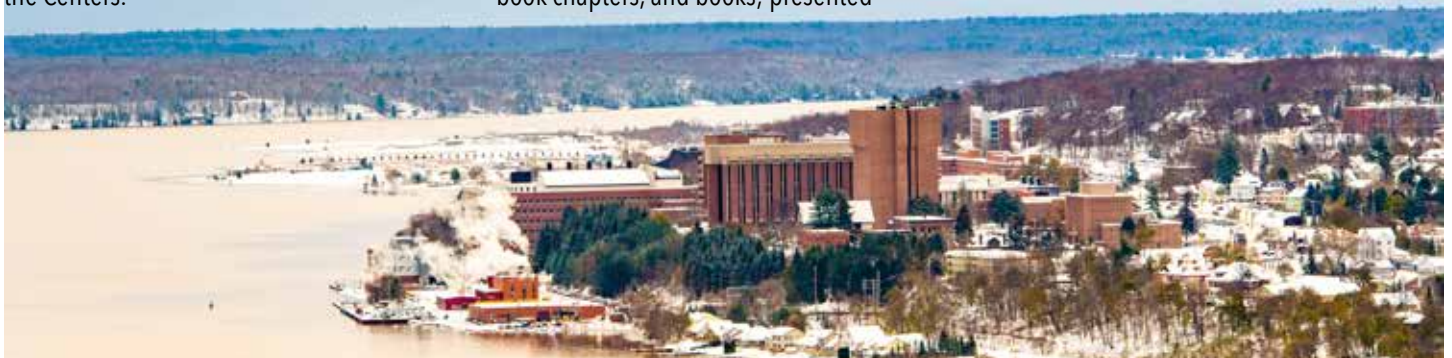
Education and Outreach Activities

ICC members continue to be leaders in outreach, delivering close to 100 invited talks, keynotes, and conference presentations; publishing more than 400 books, journal articles, and conference papers; and chairing or serving on the organizing committees of 49 academic conferences.

From the Editor

This report highlights the activities of the Institute of Cybersystems and Cybersecurity (ICC) for the period July 1, 2018 to June 30, 2019. The data and other information in this report were gathered from a number of sources, including reports from Michigan Tech Sponsored Operations, the Department of Computer Science, ASPIRE, Digital Measures, Banner, information shared by ICC Center directors and researchers, and Internet searches. Every effort has been made to ensure the completeness and accuracy of this document. This report was prepared in its entirety by Karen S. Johnson, Communications Director for the ACIA/ICC.

¹as of 6/30/19



ICC by the Numbers

39 Active Grants
\$8.9M

\$2.03M
Research Expenditures

17 New in FY19 Grants
\$2.4M

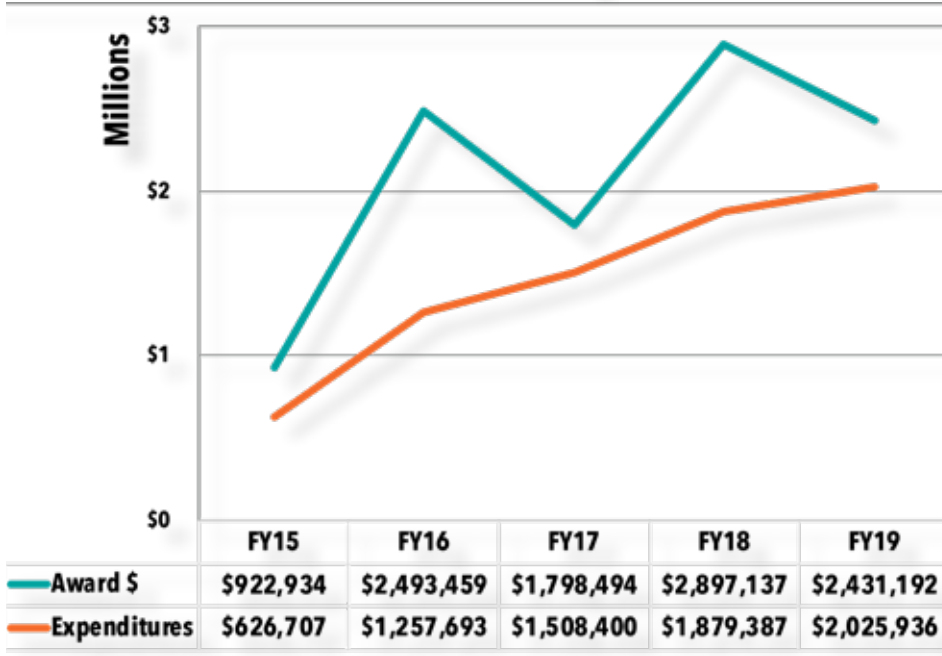
Research Activities	FY16 Results	FY17 Results	FY18 Results	FY19 Goal	FY19 Results	FY20 Goal
New Research Awards	\$2.5M	\$1.8M	2.9M	2.5M	2.4M	2.8M
Research Expenditures	\$1.3M	1.5M	1.9M	2.2M	2.0M	2.6M
No. of New Research Awards	15	17	21	9	25	10
No. of Proposals Submitted	32	56	21	43	37	47

External Visibility	FY16 Results	FY17 Results	FY18 Results	FY19 Goal	FY19 Results	FY20 Goal
Conferences, Workshops, Demos	7	8	2	7	1	8
ICC-Hosted Talks, Seminars, Demos	7	26	17	19	0	22
Publications ¹	150+	118	183	130	410	140
Member Leadership ²	18	24	57	15	26	20
Member Keynote Lectures Invited Talks	5	10	45	6	16	6
Students Supported	32	27	20	24	20	27

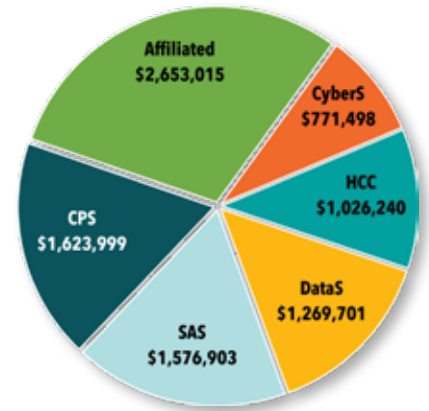
¹Books, Book Chapters, Journal Articles, Reports, Conference Papers ²Technical Committees, Journal Editorships, Conference Chairs

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

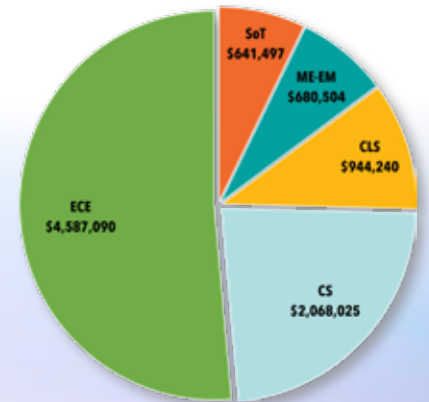
ICC Awards and Expenditures



Active Awards with ICC Member PI



Active Awards by PI Department



ICC MEMBER ACTIVITY	TOTAL
Advisors to Student Clubs	33
Awards and Honors	9
Books and Book Chapters	5
Conference Chairs	3
Conference Committees	56
Conference Presentations	77
Conference Proceedings	146
Earned Media	12
Invited Talks	14
Journal Articles	187
Journal Editorships	15
Sponsorships	2
Technical Committees	33



Active Grants and Contracts

Active ICC grants and contracts number **39**, with total awards of **\$8,921,356**.

PI: SUSAN L. AMATO-HENDERSON, CLS

Title: Development of the Safety Assessment Technique for Take-Over in Automated Vehicles

Co-PI: Myoungsoon Jeon

Sponsor: Industry (Korea Automobile Testing and Research Institute)

Amount / Duration: \$61,269 / 1.5 Years

PI: JEREMY P. BOS, DataS, ECE

Title: Imaging Theory and Mitigation in Extreme Turbulence-Induced Anisoplanatism

Sponsor: DOD (Air Force)

Amount / Duration: \$459,894 / 4 Years

Title: Robust Terrain Identification and Path Planning for Autonomous Ground Vehicles in Unstructured Environments

Co-PI: Darrell L. Robinette

Sponsor: DOD (Army)

Amount / Duration: \$191,964 / 1 Year

PI: YU CAI, CyberS, CMH

Title: Developing Hands-on Cybersecurity Curriculum with Real-world Case Analysis

Sponsor: DOD (NSA)

Amount / Duration: \$149,184 / 1.5 Years

Title: The Development and Assessment of Advanced Cybersecurity Curriculum

Co-PI: Kedmon N. Hungwe

Sponsor: DOD (NSA)

Amount / Duration: \$322,002 / 2 Years

Title: Innovative GenCyber Learning Experience for K-12 Teachers Through Storytelling + Teaching + Gaming + Doing

Co-PIs: Bo Chen, Guy Hembroff, Tim Van Wagner

Sponsor: DOD (NSA and NSF)

Amount / Duration: \$87,895 / 1 Year

Title: Innovative GenCyber Learning Experience for High School Students Through Storytelling + Teaching + Gaming + Doing

Co-PIs: Bo Chen, Guy Hembroff, Tim Van Wagner

Sponsor: DOD (NSA and NSF)

Amount / Duration: \$82,416 / 1 Year

PI: ZHUO FENG, SAS, ECE

Title: CAREER: Leveraging Heterogeneous Manycore Systems for Scalable Modeling, Simulation and Verification of Nanoscale Integrated Circuits

Sponsor: NSF

Amount / Duration: \$400,000 / 6 Years

Title: SHF: Small: Scalable Spectral Sparsification of Graph Laplacians and Integrated Circuits

Sponsor: NSF

Amount / Duration: \$450,000 / 4 Years

Title: SHF: Small: Spectral Reduction of Large Graphs and Circuit Networks

Sponsor: NSF

Amount / Duration: \$500,000 / 3 Years

PI: DANIEL R. FUHRMANN, SAS, CMH

Title: Trailer Angle Detection Using Multiple Automotive Radars

Co-PI: Saeid Nooshabadi

Sponsor: Industry (Ford Motor Co.)

Amount / Duration: \$202,567 / 2 Years

PI: TIMOTHY HAVENS, DataS, Computing
Title: Heterogeneous Multisensor Buried Target Detection Using Spatiotemporal Feature Learning

Co-PI: Timothy J. Schulz

Sponsor: DOD (Army)

Amount / Duration: \$381,200 / 3 Years

Title: Distributed Array Processing for Aperture Level STAR

Co-PI: Timothy J. Schulz

Sponsor: DOD (Air Force)

Amount / Duration: \$50,000 / 2 Years

Title: Algorithms for Look-Down Infrared Target Exploitation

Sponsor: DOD (National Geospatial-Intelligence Agency)

Amount / Duration: \$40,000 / 1 Year

Title: Duty Cycle Aggregation and Warranty Mitigation using Customer Usage Data

Sponsor: Industry (Ford Motor Co)

Amount / Duration: \$50,000 / 1 Year

Title: NPT-03/04: Localization, Tracking, and Classification of On-Ice Underwater Noise Sources Using Machine Learning

Co-PI: Andrew Barnard

Sponsor: DOD (Navy)

Amount / Duration: \$96,643 / 1 Year

PI: PHILART JEON, Affiliated

Title: ThinkTank: Doct. Consort. at ICAD 2018

Sponsor: NSF

Amount / Duration: \$20,000 / 1 Year

PI: JEAN MAYO, CyberS, CS

Title: EDU: Collaborative: VACCS-Visualization and Analysis for C Code Security

Co-PI: Ching-Kuang Shene

Sponsor: NSF

Amount / Duration: \$130,001 / 3 Years

PI: SHANE T. MUELLER, HCC, CLS

Title: DARPA XAI

Sponsor: DOD (DARPA)

Amount / Duration: \$254,823 / 4 Years

PI: SAEID NOOSHABADI, ECE, Affiliated

Title: Collaborative Research: ACI-CDS&E: Highly Parallel Algorithms and Architectures for Convex Optimization for Realtime Embedded Systems (CORES)

Sponsor: NSF

Amount / Duration: \$349,988 / 3 Years

Title: Machine Vision Trailing

Sponsor: Ford Motor Co

Amount / Duration: \$120,000 / 1 Year

PI: SONER ONDER, SAS, CS

Title: FoMR: Collaborative Research: Dependent ILP: Dynamic Hoisting and Eager Scheduling of Dependent Instructions

Sponsor: NSF

Amount / Duration: \$230,744 / 3 Years

Title: XPS:FULL:FP: Collaborative Research: Sphinx: Combining Data & Instruction Level Parallelism through Demand Driven Execution of Control Flow Programs

Sponsor: NSF

Amount / Duration: \$560,000 / 5 Years

Title: XPS: Full: FP: Collaborative Research: Sphinx: Combining Data and Instruction Level Parallelism through Demand Driven Execution of Imperative Programs

Sponsor: NSF

Amount / Duration: \$15,876 / 5 Years

ICC OBJECTIVE 2: FOSTER INTERDISCIPLINARY COLLABORATIONS AND ENABLE FACULTY TO DEVELOP MULTI-DISCIPLINARY PROPOSALS AND CONDUCT IMPACTFUL RESEARCH WHICH OTHERWISE MAY NOT BE POSSIBLE.

Active

PI: ROBERT PASTEL, HCC, CS

Title: SCC: Community-Based Automated Information for Urban Flooding
Sponsor: NSF
Amount / Duration: \$20,035 / 1 Year

Title: COLLABORATIVE RESEARCH: MSB-FRA: Scaling Climate, Connectivity, and Community Structure in Streams
Sponsor: NSF
Amount / Duration: \$116,561 / 4 Years

PI: SUMIT PAUDYAL, CPS, ECE

Title: Packetized Energy Management: Coordinating Transmission and Distribution
Sponsor: DOE
Amount / Duration: \$351,339 / 3 Years

PI: ELENA SEMOUCHKINA, CPS, ECE

Title: Collaborative Research: IDBR: TYPE A: Unconventional Antenna Probes for Ultra-High Resolution Magnetic Resonance Imaging
Sponsor: NSF
Amount / Duration: \$257,412 / 4 Years

Title: Developing Anisotropic Media for Transformation Optics by Using Dielectric Photonic Crystals
Sponsor: NSF
Amount / Duration: \$337,217 / 3 Years

PI: MIN SONG, Affiliated

Title: EAGER: NeTS: Under-Ice Mobile Networking: Exploratory Study of Network Cognition and Mobility Control
Co-PI: Zhaohui Wang
Sponsor: NSF
Amount / Duration: \$299,716 / 3 Years

PI: YE SUN, CPS, ME-EM

Title: Understanding and Mitigating Triboelectric Artifacts in Wearable Electronics by Synergic Approaches
Co-PI: Shiyuan Hu / Sponsor: NSF
Amount / Duration: \$330,504 / 3 Years
Title: CAREER: System-on-Cloth: A Cloud Manufacturing Framework for Embroidered Wearable Electronics
Sponsor: NSF
Amount / Duration: \$350,000 / 5 Years

CHEE-WOOI TEN, ECE, CPS

Title: CPS: Medium: Collaborative Research: An Actuarial Framework of Cyber Risk Management for Power Grids
Co-PI: Yeonwoo Rho, Math
Sponsor: NSF
Amount / Duration: \$348,866 / 3 Years

PI: KEVIN TREWARTHA, CLS, HCC

Title: Motor Learning as a Sensitive Behavioral Marker of Mild Cognitive Impairment and Early Alzheimer's Disease
Co-PI: Shane T. Mueller, CS, HCC
Sponsor: U.S. DHHS, NIH
Amount / Duration: \$455,884 / 3 Years

PI: ELIZABETH S. VEINOTT, CLS, HCC

Title: Forecasting Counterfactuals in Uncontrolled Settings (FOCUS)
Co-PI: Shane T. Mueller, CS, HCC
Sponsor: FPT-Industry, Office of the Director of National Intelligence
Amount / Duration: \$51,561 / 1 Year

PI: KEITH D. VERTANEN, CS, HCC

Title: CAREER: Technology Assisted Conversations
Sponsor: NSF
Amount / Duration: \$96,108 / 5 Years

Title: REF-RS: Automatic Speech Recognition using Deep Neural Networks
Co-PI: NA
Sponsor: Michigan Tech VPR
Amount / Duration: \$31,268 / 1 Year

PI: ZHENLIN WANG, CS, SAS

Title: CSR: Small: Effective Sampling-Based Miss Ratio Curves: Theory and Practice
Co-PI: NA
Sponsor: NSF
Amount / Duration: \$390,876 / 4 Years

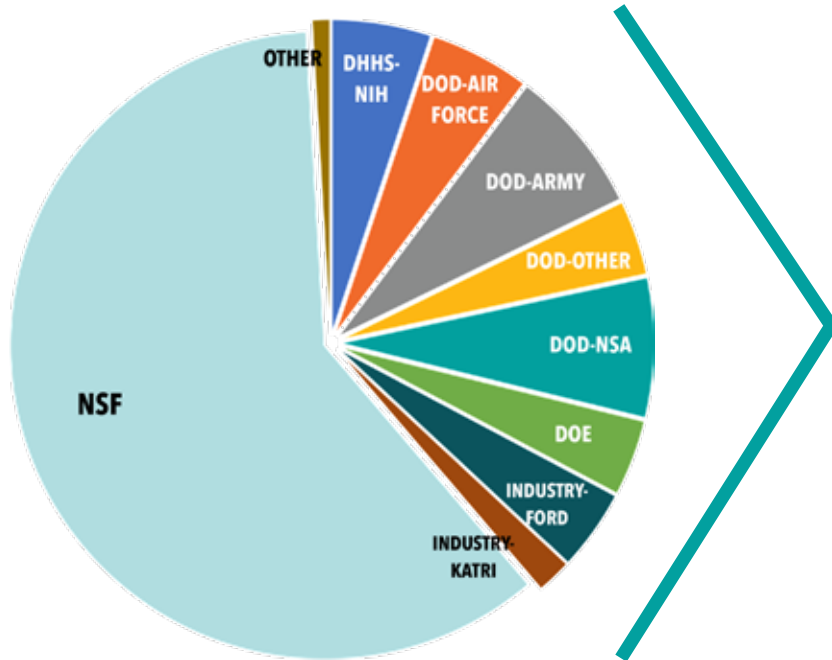
PI: JIANHUI YUE, CS, SAS

Title: SHF: SMALL: Collaborative Research: Improving Reliability of In-Memory Storage
Co-PI: NA
Sponsor: NSF
Amount / Duration: \$192,716 / 3 Years



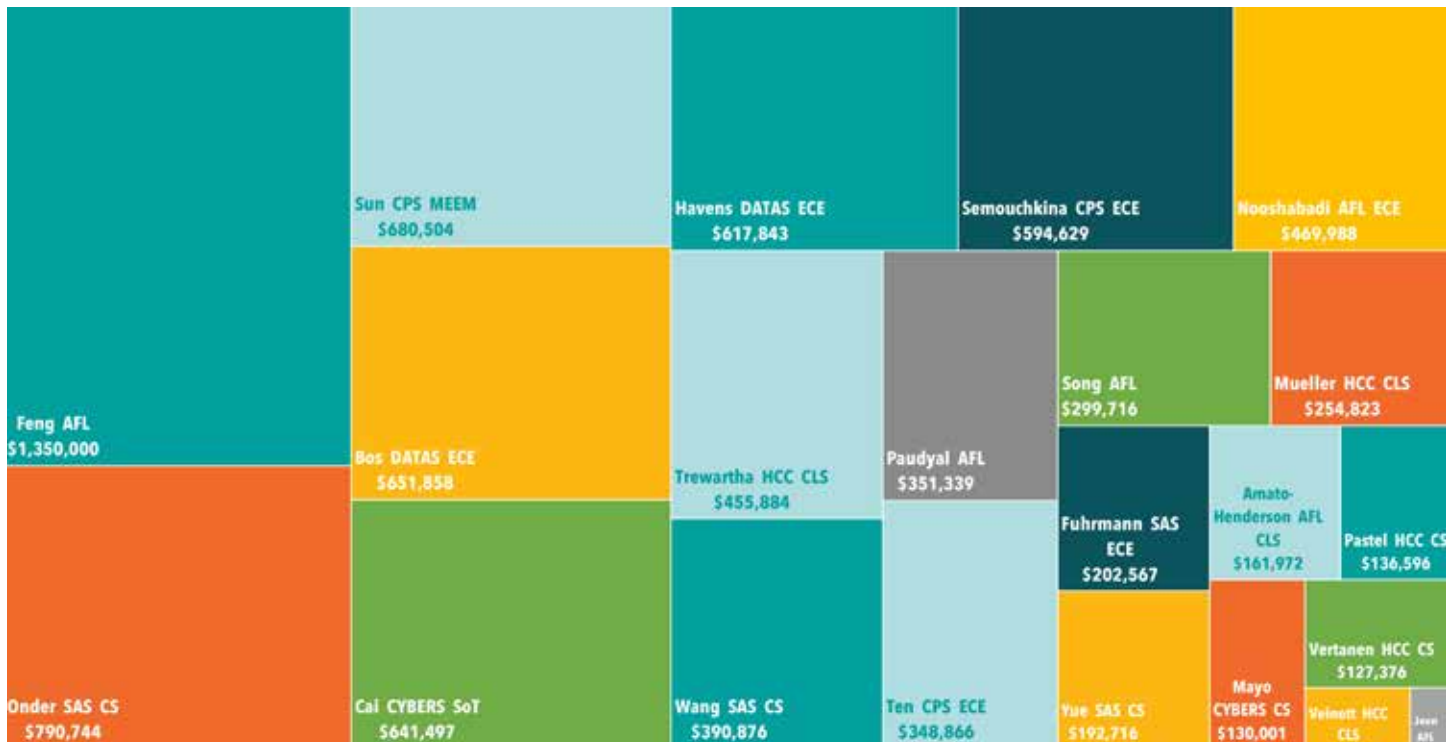
ICC OBJECTIVE 3: FOSTER INTERDISCIPLINARY COLLABORATIONS AND ENABLE FACULTY TO DEVELOP MULTI-DISCIPLINARY PROPOSALS AND CONDUCT IMPACTFUL RESEARCH WHICH OTHERWISE MAY NOT BE POSSIBLE.

Active Awards by Sponsor



Sponsor	Awards
DHHS-NIH	\$455,884
DOD-AIR FORCE	\$459,894
DOD-ARMY	\$669,807
DOD-OTHER	\$344,823
DOD-NSA	\$641,497
DOE	\$351,339
INDUSTRY-FORD	\$372,576
INDUSTRY-KATRI	\$161,972
NSF	\$5,380,744
OTHER	\$82,829
TOTAL	\$8,921,365

Active Awards by PI



Proposal Activity

In FY19 ICC researchers submitted 33 proposals totaling \$27.2 million. 26 proposals were new projects; 3 were pre-proposals; 4 were supplements to existing awards. 25% of all FY19 proposals were awarded, nearly \$3 million.

Three proposals remained pending on June 30, 2019.

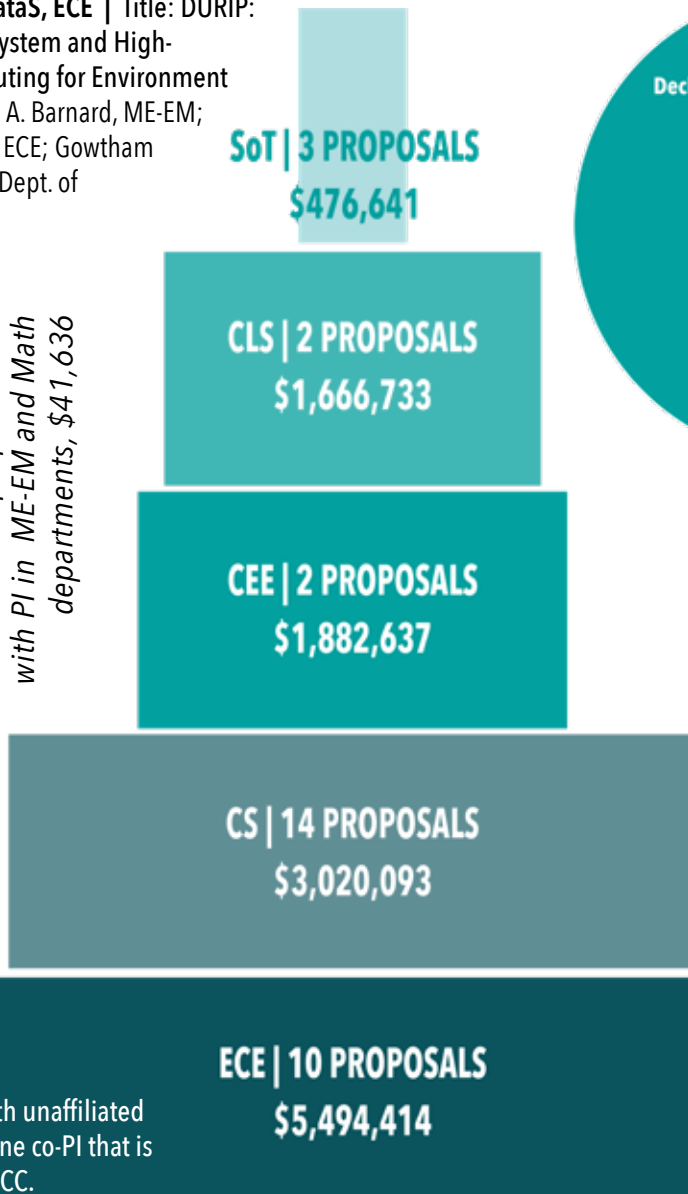
PI: Zhen Liu, CPS, CEE | Title: FW-HTF-RM: Future Winter Road Maintenance: Transition from Model-Driven to Data-Driven Decision Making by Leveraging Artificial Intelligence and User Resistance Understanding | Sponsor: NSF | New

PI: Saeid Nooshabadi, Affiliated, ECE | Title: Machine Learning Graph to RTL (GtoRTL) Compiler | Co-PI: Wang, SAS, CS | Sponsor: Dept. of Defense | New

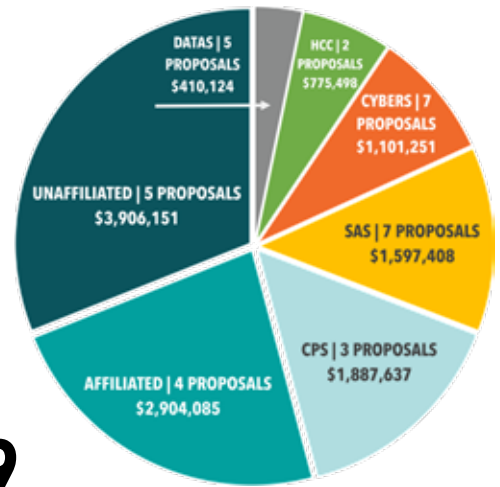
PI: Tim Havens, DataS, ECE | Title: DURIP: Acoustic Sensing System and High-Throughput Computing for Environment and Threat | Co-PIs: A. Barnard, ME-EM; G. Meadows, GLRC, ECE; Gowtham Sh, ECE | Sponsor: Dept. of Defense

FY19 Proposals ACADEMIC DEPT

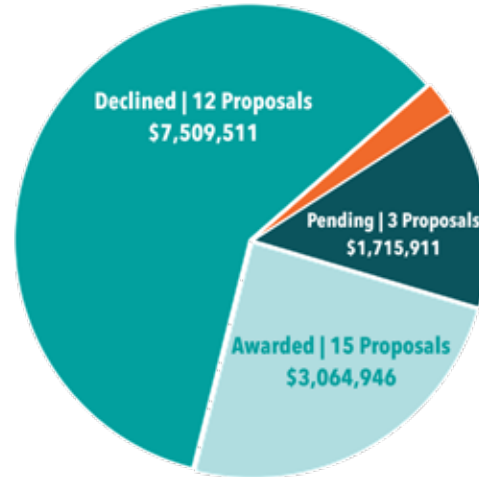
Not included: one proposal each with PI in ME-EM and Math departments, \$41,636



¹ICC proposals with unaffiliated PIs have at least one co-PI that is a member of the ICC.

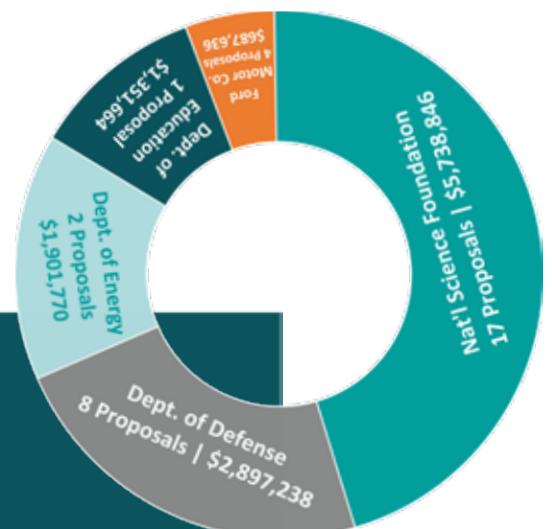


FY19 Proposals BY ICC CENTER



FY19 Proposals BY STATUS

FY19 Proposals BY SPONSOR



ICC Achievement Awards

At the annual ICC Awards Dinner, held April 12, 2019, ICC Achievement Awards were presented to three ICC members for their outstanding contributions to research and learning in the fields of computing.

Soner Onder (SAS, CS), director of the ICC's Center for Scalable Architectures and Systems and professor of computer science, was recognized for his research in next-generation architectures. Onder is principal investigator of three National Science Foundation (NSF) grants, and three additional NSF grant proposals are under review.



Soner Onder

"Soner is one of our very top researchers in terms of research expenditures and new awards," said ICC director **Tim Havens**. "He is also active in developing and implementing the ICC vision."

Assistant Professor **Kevin Trewartha** (HCC, CLS, KIP) was recognized for his interdisciplinary and collaborative research at the intersection of technology and human motor movement. "Kevin encompasses the best of the ICC vision," said **Beth Veinott** (HCC, CLS), director of the ICC Center for Human-Centered Computing and associate professor of cognitive and learning sciences.



Kevin Trewartha

Trewartha is co-principal investigator, with **Shane Mueller** (HCC, CS), of a new, three-year, interdisciplinary and collaborative project funded by the National Institutes of Health (NIH). For this research, Trewartha and Mueller are working with UP Health Systems Portage, and five graduate and three undergraduate students, to investigate how technology supports earlier diagnosis of the neurodegenerative diseases.



Shane Mueller

Assistant Professor **Bo Chen** (CyberS, CS) was recognized for his teaching and research in cybersecurity of mobile devices. Chen is co-PI of two external cybersecurity grants from the National Science Administration (NSA), and he has submitted numerous cybersecurity proposals to National Science Foundation, NSA, Microsoft, and Google.



Bo Chen

"Dr. Bo Chen has demonstrated achievements and contributions to the mission of the ICC since coming to Michigan Tech as a tenure-track CS faculty member in fall '17," said ICC members **Guy Hembroff** (CyberS, CMH) and **Yu Cai** (CyberS, CMH) in their nomination, adding that during that short time, Chen has published one book, five journal papers, and 10 conference papers, and in 2017 he was awarded a Distinguished Paper Award from the prestigious Computer Security Application Conference (ACSAC). Chen is the co-advisor for Michigan Tech's National Cyber League (NCL) cyber competition team. His leadership has

led to exceptional success for the Michigan Tech teams. Chen was also recognized for receiving an exceptional "average of seven dimensions" student evaluation score for his teaching, among additional student accolades.

ICC, COLLEGE OF COMPUTING WELL-REPRESENTED AT ITiCSE '19

The ICC and the College of Computing were well represented at the 24th Annual Conference on Innovation and Technology in Computer Science Education (ITiCSE 19), July 14-17, 2019, at University of Aberdeen, Scotland.

Senior Lecturer and Ph.D. candidate **Leo Ureel** (CS), with **James Heliotis**, professor of computer science at Rochester (New York) Institute of Technology, led the working group, "Towards an Ability to Direct College Students to an Appropriately Paced Introductory Computer Science Course."



Briana Bettin

Professor **Linda Ott** (CS) and Associate Professor **Charles Wallace** (HCC, CS) participated in the working group, "1.5 Degrees of Separation: Computer Science Education in the Age of the Anthropocene." PhD candidate **Briana Bettin** (CS) presented her paper, "More Effective Contextualization of CS Education Research: A Pair-Programming Example," co-authored with Ott and Ureel.

Charles Wallace presented his poster, "A Prototype MATLAB Code Critiquer," co-authored with Ureel and undergraduate student **Marissa Walther** (CS).

Associate professor **Jean Mayo** (CyberS, CS) presented, "Teaching Integer Security Using Simple Visualizations," co-authored with Lecturer **James Walker** (CS), recent Ph.D. graduate **Man Wang** (CS), Professor **Ching-Kuang Shene** (CS), undergraduate **Miriam Eikenberry-Ureel** (CS), and **Steven Carr**, professor and chair of computer science at Western Michigan University.



Jean Mayo

TIM HAVENS NAMED ICC DIRECTOR

Following an internal nomination and recommendation process, Timothy



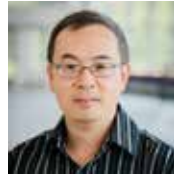
Tim Havens

Havens was selected to lead the Institute of Computing and Cybersystems. His term as ICC director extends through Dec. 31, 2021.

Havens's technical areas of expertise include machine learning, computational intelligence, data science, and signal and image processing.

Dean's Teaching Showcase

Todd Arney, Guy Hembroff, Yu Cai featured in February 2019



Yu Cai

College of Computing faculty Todd Arney (CMH), Guy Hembroff (CyberS, CMH), and Yu Cai (CyberS, CMH) were recognized by Dean

Minerick and the Dean's Teaching Showcase in February 2019 for their collaborative, creative efforts in developing a new course, SAT 4411, Data Center Engineering.

Along with former faculty member Xinli Wang, the three responded in Fall 2014 to a request from the Computer Network and Systems Administration Industrial Advisory Board to provide students with more exposure and practical hands-on experience with virtualization, cloud



Guy Hembroff

computing and data center engineering for both physical and virtual data centers.

Course topics included during initial planning included data center

planning, disaster recovery, virtualization methods, and cloud computing services that provide business continuity.

The inclusion of real-world data center technicians and experts was very popular with students. Responses on course evaluations emphasized the interesting stories, the "real-life feel of the classroom," and best practices "backed by examples that you have run into in your job."

One student's end-of-term comment went further, emphasizing the value of instruction directly from the data technician, "He did a great job telling us the information, and it wasn't your typical class where you go in and sit for 55 minutes and just listen. It was more real-world, like we were in a training session for a job. It was awesome."

Exploring CSR

The Michigan Tech Computer Science Department hosted a three-day Google-sponsored "Exploring Computer Science Research" workshop April 5-7, 2019, one of



15 such workshops Google sponsored in the U.S. in 2019.

The aim of the workshop, for undergraduates from underrepresented groups, was to explore research and graduate school opportunities in computer science.

The event was organized by Computer Science faculty members Leo Ureel (CS), Linda Ott (CS), **Jean Mayo** (CyberS, CS), and **Laura Brown** (DataS, CS).

Twenty-six attendees from six universities and colleges across Michigan and Wisconsin participated. Each student engaged in investigating a research question with a faculty mentor.

Topics included Machine Vision, led by **Robert Pastel** (HCC, CS); Data Science in Energy Systems, **Laura Brown**; Cybersecurity and Privacy in Storage Systems, **Bo Chen** (CyberS, CS); Agent-based Simulations in Education, Leo Ureel (CS); and Human Computer Interactions: Natural Language Processing for Assistive Technologies, **Keith Vertanen** (HCC, CS).

After learning about and working on their research topics, the students presented out to the group. The attendees also explored the

greater range of job opportunities following completion of graduate school, and how to apply for a graduate school degree or certificate program. Current Michigan Tech graduate students discussed the graduate school experience and their research.

Guest speakers included Google employees Niloofar Gheissari and Anja Gruenheid, Pushpalatha Murthy, dean of the Michigan Tech Graduate School, and Robin Hunicke, the keynote speaker, co-founder and CEO of the game studio, Funomena.



Workshop sponsors were Google, the College of Computing, the Michigan Tech Grad School, and the State of Michigan's Martin Luther King, Jr., César Chávez, Rosa Parks Initiative (KCP).



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

PROFESSIONAL SERVICE

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AWARDS AND HONORS

Zhaohui Wang (CPS, ECE) was named Outstanding Reviewer of the IEEE Journal of Oceanic Engineering, 2018.

INVITED TALKS

Sumit Paudyal (CPS, ECE) "Optimization Applications in Power Systems," Seminar, Harbin Institute of Technology, Harbin, China, July 2018.

Ye "Sarah" Sun (CPS, ME-EM) Workshop Panelist, "Digital Twin Technology: A Key Enabler of Smart Manufacturing" at NSF CPS PI Meeting, Washington DC, Nov. 2018.

Jinshan Tang (CPS, CMH) "Object Recognition Based on 3D Shapes Extracted from 3D Imaging and Applications," Keynote speaker, International Conference on Urban Intelligence and Applications, Wuhan, China, May 2019.

Jinshan Tang "Computer Aided Breast Cancer Detection With Mammography: from Shallow Learning to Deep Learning, from Small Size Data to Big Data," Seminar at Wuhan University of Science and Technology, " Wuhan, China, May 2019.

Kuilin Zhang (CPS, CEE) presented, "A Best-Case Rosenthal Equilibrium based Coordination Mechanism for N-person Online Routing Games of Connected and Automated Vehicles," April 17, 2019, at a meeting of the Transportation Research Board (TRB).

BOOKS PUBLISHED

Zhen Liu (CPS, CEE) "Multiphysics in Porous Materials," Springer, 2018.

Sumit Paudyal, "Asynchronous coordination of distributed energy resources with packetized energy management," Energy Markets and Responsive Grids, 333-361, 2018, co-authors: M. Imassalkhi, L.D. Espinosa, P.D.H. Hines, J. Frolik, M. Amini.

Elena Semouchkina (CPS, ECE) "Dielectric Metamaterials in Transformation Optics and Photonics," Book contract, Elsevier, Oct. 2020.

EARNED MEDIA

The work of **Bo Chen** (CPS, ME-EM) was the subject of an article on the Michigan Tech blog Unscripted: Science and Engineering Research, published May 6, 2019. "Power Grid, Powertrain and the Models that Connect Them" tells of graduate students Chong Cao and Joe Oncken's work with ME-EM'S Bo Chen in the Intelligent Mechatronics and Embedded Systems lab, where they develop Simulink models for smart city technology—and show how the models shift into real-life testing.

Zhen Liu was interviewed in August 2018 for an article in the Daily Mining Gazette, Houghton, MI, regarding porous pavement, which could be a permanent solution to the natural hazards such as the flash flood that hit the Upper Peninsula in June 2018.

Ye "Sarah" Sun, Twitter News: "CAREER: System-on-cloth: a cloud manufacturing framework for embroidered wearable electronics," 25th CNSF Capitol Hill Exhibition, hosted by Coalition for National Science Funding, Washington, D.C., Apr. 2019.

An article about **Ye Sun's** Underwater Acoustic Communications research, funded by a Paul Williams Seed Grant, was featured in an ICC blog post, Apr. 2019.

Research by **Kuilin Zhang** was featured in the story "MTU Researchers develop optimization model to fill in the gaps in connected vehicle data," in the April 26, 2019, issue of *Green Car Congress*.

Kuilin Zhang's research on transportation planners was the subject of a story covered in *Auto World News* titled, "Filling in the gaps of connected car data helps transportation planners," published May 6, 2019.

Kuilin Zhang, "Filling in the Gaps of Connected Car Data Helps Transportation Planners, Michigan Tech News, Apr. 2019.

Kuilin Zhang, "Kuilin Zhang Wins CAREER Award for Connected and Autonomous Vehicles," Michigan Tech News, Apr. 2019.

JOURNAL EDITORSHIPS

Jinshan Tang, "Academic Editor, *Journal of Healthcare Engineering* (2017-present)

Jinshan Tang, Guest Editor, Special issue, "Deep Learning for Computer Aided Cancer Detection and Diagnosis with Medical Imaging," *Pattern Recognition* (2017-2018)

Kuilin Zhang, Editorial Advisory Board, *Transportation Research Part E*

TECHNICAL COMMITTEES

Sumit Paudyal, Member, IEEE PES Smart Buildings, Loads and Customer Systems (SBLCS) Technical Committee.

Jinshan Tang, International Technical Committee, 19th International Conference on Communication Technology, Oct. 2019.

Kuilin Zhang, Member, Michigan Department of Transportation Key Stakeholders Team for the 2045 State Long-Range Transportation Plan (SLRTP), also known as Michigan Mobility 2045.

Kuilin Zhang, Member, Standing Committees, Transportation Research Board, (TRB) Transportation Network Modeling (ADB30), and Freight Transportation Planning and Logistics (AT015)

CONFERENCE PRESENTATIONS

Bo Chen, "Optimal Map-Based Mode Selection and Powertrain Control for a Multi-Mode Plug-in Hybrid Electric Vehicle," 2018 IEEE/ASME International Conference on Mechatronic and Embedded Systems and Applications, Oulu, Finland, July 2018.

Bo Chen, "Leveraging vehicle connectivity to optimize vehicle mode selection, and powertrain energy management for connected multi-mode PHEVs," 2018 ASME Dynamic Systems and Control Conference, Atlanta, GA, Sep. 2018.

Zhen Liu, "Data-Driven Predictions of Freezing and Thawing Depths with 3D Models," TRB Annual Conference Washington, DC, Jan. 2019.

Zhen Liu, A. Biniyaz, "Prediction of Freezing and Thawing Depths via Deep Learning with Long Short-Term Memory," Engineering Mechanics Meeting, American Society of Civil Engineers, Pasadena, CA, June 2019.

Zhen Liu, B. Azmoon, "Slope Stability Analysis using Convolutional Neural Networks," Engineering Mechanics Meeting, American Society of Civil Engineers, Pasadena, CA, June 2019.

Elena Semouchkina, N. Gandji, G.B. Semouchkin, "Electromagnetic Responses from Planar Arrays of Dielectric Nano-Disks at Overlapping Dipolar Resonances," 2018 IEEE Research and Applications of Photonics In Defense Conference (RAPID), Miramar Beach, FL, Aug. 2018.

Elena Semouchkina, S. Jamilan, G.B. Semouchkin, "Implementing Photonic Crystals, Instead of Metamaterials, in the Media of Transformation Optics- based Devices," 2018 IEEE Research and Applications of Photonics In Defense Conference (RAPID), Miramar Beach, FL, Aug. 2018.

Ye Sun, H. Huang, "A new approach for ECG denoising in dry contact wearable sensor node," IEEE-CHASE'18, Washington, DC, Sep. 2018. X. Li, "A wearable system for situational awareness estimation in underground mine," IEEE-CHASE'18, Washington, DC, Sep. 2018.

Ye Sun, "CAREER: System-on-cloth: a cloud manufacturing framework for embroidered wearable electronics," 25th CNSF Capitol Hill Exhibition, hosted by Coalition for National Science Funding, Washington, DC, Apr. 2019.

Jinshan Tang, "An Image contrast enhancement algorithm in the wavelet domain with visual feature for visually impaired," Oral Presentation, Seventh IEEE International Conference on Healthcare Informatics (ICHI 2019), June 2019.

Zhaohui Wang,

"Online Learning and Adaptation in Long-term Operating Underwater Acoustic Communication Networks," Workshop on Underwater Wireless Infrastructure, NSF, Washington, DC, Nov. 2018.

Zhaohui Wang, L. Wei, W. Sun, Y. Zhang, "Dory is Twittering Underwater!" Lake Superior Water Festival, Michigan Tech, Houghton, MI, Oct. 2018.

Zhaohui Wang, "Online Learning and Adaptation in Long-term Operating Underwater Acoustic Communication Systems," ECE Department Seminar, Michigan Tech, Oct. 2018.

Kuilin Zhang, "A data-driven predictive control model for cooperative connected and automated driving under traffic uncertainties," Research Seminar, Department of Civil Engineering, Case Western Reserve University, Cleveland, OH, May 2019.



ICC MEMBERS WHO ARE ADVISORS TO STUDENT CLUBS | Zhang, CPS, Michigan Tech ITE Student Chapter | Zhang, CPS, MTU Summer Youth Program | Paudyal, CPS, Bangladeshi Students Association | Paudyal, CPS, Nepalese Students' Organization | Cai, CyberS, International Fellowship Association | Cai, CyberS, K-12 Outreach, Stop the Hackers Workshop, GenCyber Summer Camp, Women in Computing Program | Cai, CyberS, Chinese Students and Scholars Association | Cai, CyberS, RedTeam on Cybersecurity | Hembroff, CyberS, Campus Representative, USENIX | Hembroff, CyberS, Networking and Computing Student Association | Chen-CS, CyberS, CS Cybersecurity Reading Group | Chen-CS, NCL CyberCompetition Team | Chen-CS, CyberS, RedTeam | Sergeyevev, DataS, Faculty Senior Design Teams | Bos, DataS, General Motors / SAE AutoDrive Challenge | Bos, DataS, Robotics Systems Enterprise | Brown, DataS, BonzAI Brawl | Brown, DataS, Women in Computing Sciences (WiCS) | Brown, DataS, Volunteer, Computer Science Student Organization, Hackathons, Programming Contests | Buche, DataS, Rotaract Student Organization | Louks, DataS, Practical Pistol Club | Sergeyevev, DataS, Michigan Tech Archery Club | Sergeyevev, DataS, Photonics Group | Kuhl, HCC, BonzAI Programming Contest | Steelman, HCC, Association of Psychology Students | Steelman, HCC, Building Adult Skills in Computing (BASIC) | Steelman, HCC, Human Factors and Ergonomics Society, Student Chapter | Steelman, HCC, Psi Chi International Honor Society in Psychology | Veinott, HCC, Husky Games Enterprise | Kuhl, HCC, Lutheran Campus Ministry | Kuhl, HCC, Husky Game Development Enterprise |



The Next Generation of Cyber Stars

We live in a world where pretty much everything and everybody—individuals, companies, governments, critical infrastructure—are increasingly dependent on connected systems, networks, and devices. And, those systems may be insecure and vulnerable to hackers.



Yu Cai

"Nowadays, everybody is using computers, and more and more things are connected. That provides convenience, flexibility, a lot of great things, but it also opens the doors for hackers," says Associate Professor Yu Cai, program chair for the Michigan Tech Computer Network and System

Administration undergraduate program.

"The world has increasingly become a combination of the physical world and the cyber world," Cai adds. "That's why cybersecurity is important, because you want to protect yourself. As human beings, we evolved over thousands of years to take care of our security in the physical world. But in the cyber world, many don't have a very good idea of how to protect themselves."

Cai is principal investigator on two grant awards, each for about \$85K, which made possible two free, non-residential, week-long GenCyber summer camps on Michigan Tech's campus. The first camp, for middle school and high school students, was held the week of June 17, 2019. The second camp, for K-12 STEM teachers, was the week of August 12, 2019. All camp activities and learning materials, including a Raspberry Pi mini-computer, were provided at no cost to camp participants.



Funded jointly by the National Security Agency (NSA) and the National Science Foundation (NSF), the goals of the nationwide GenCyber program are to increase interest in cybersecurity careers and diversity in the national cybersecurity workforce, help students understand correct and safe on-line behavior and how they can be good digital citizens, and improve methods for delivery of cybersecurity content in K-12 curricula.

"This is part of our picture to make Michigan Tech a leader in cybersecurity research and education," Cai says of this summer's GenCyber camps. "We have been awarded other cybersecurity curriculum development grants that focus on college education, now we want to outreach to K-12 students and teachers."

In both camp sessions, participants explored the world of cybersecurity through real-world case studies, hands-on learning activities and games, interactive lectures, career exploration, and field trips. Topics included safe online behavior, cyber ethics, fundamental computer and network knowledge, and information about career options and educational opportunities.

"We also covered common vulnerabilities and weaknesses of computer systems," Cai adds. "Such as how hackers get into the systems, and how systems can be strengthened to defeat hackers against the hundreds of vulnerabilities."

Article by Karen S. Johnson, ICC Communications Director



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

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AWARDS AND HONORS

Mari Buche (DataS, CoB), Selectee, HERS Leadership Institute, Nov. 2018.

Thomas Oommen (DataS, GMES), First GIAN Fellow of the Department of Geology, University of Kerala, India, 2018.

EARNED MEDIA

Jeremy Bos (DataS, ECE) was interviewed for the WLUC-TV 6 story, "Mobility Experts Use New Traffic Signals in Houghton," in Nov. 2018.

In Nov. 2018, the magazine *EnsembleIQ* interviewed **Jeremy Bos** as a technology expert for a potential writing project on autonomous cars. Bos discussed how they work, how they're programmed for shipping various products, and how to prevent hacking and make them secure for delivery.

Jeremy Bos was quoted in a Jan. 2019 *National Guard Magazine* article discussing how emerging robots will impact that branch of service.

Jeremy Bos was one of five researchers interviewed for the article, "May the Fourth Be With You: The Science of Star Wars," which appeared in the UMC *Unscripted: Science and Engineering Research* blog in May 2019. From the article, "Who hasn't thought of how to make a lightsaber, how tall is Chewbacca, really, and why are droids so charming? Here's what our researchers say about the science behind Star Wars."

Thomas Oommen was mentioned in "US experts to tour Kerala to study landslide," an article in the *Indian Express*. Oommen traveled to India in Sept. 2018 to study landslide damage in Kerala, India. The story was also covered in the *Times of India*.

The article, "NSF-Sponsored Professor Travels to Kerala, India to Document Floods and Landslides," by **Oommen** and Allison Mills, was published on the Michigan Tech News Blog in Aug. 2019. Sajin Kumar K.S., University of Kerala, coordinated the visit.

Thomas Oommen was mentioned in the

Hindu Business Line article, "Researchers warn Kerala of more landslides," in Oct. 2018, which references a survey by a team headed by Oommen that looked at the damage from that year's August floods in the Kerala region of India.

Oommen was referenced in the Apr. 2019 *Hindu Business Line* article, "Kerala proposes tough steps to tide over water crisis." The story looks at concerns for fresh water in the India state of Kerala.

In Sept. 2018, **Oommen** was quoted in the *News Minute* article, "Idukki landslides purely a manmade disaster say scientists studying the region." Oommen and Rick Coffman, University of Arkansas, led a five-day study in Idukki, India, to study the aftermath of flooding in Kerala.

Also in Sept. 2018, **Oommen** was quoted in the *New Indian Express* story, "Rampant constructions in Munnar can lead to catastrophe, say US experts."

The Michigan Tech M.S. in Mechatronics was the subject of the Aug. 2018 Michigan Tech News article, "Community College Collaboration Preps Students For Industry," which extensively quoted **Alex Sergejev**.

BOOK

Thomas Oommen and K.S. Sajinkumar, "Landslide Atlas of Kerala," Geological Society of India, 2019.

INVITED TALKS

Jeremy Bos, Keynote Address, Workshop on Information Optics, "The Air We See: Light, the Atmosphere, and the Fly," University of Laval, Quebec City, Canada, July 2018.

ICC director **Tim Havens** (DataS, CC) presented, "Explainable Deep Fusion," at the Technological University of Eindhoven, The Netherlands, May 7, 2019. A summary of the talk follows: "Like a winning trivia team, sensor fusion systems seek to combine cooperative and complementary sources to achieve an optimal inference

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MARIE BUCHE ATTENDS HERS INSTITUTE



Mari Buche

Mari Buche (DataS, CoB) attended the HERS Leadership Institute, July 8-20, 2019, at Bryn Mawr College, PA, with 63 women from colleges and universities across the country. Buche participated in professional development sessions focused on fine-tuning leadership skills unique to higher education. The HERS Leadership Institute is a transformational, leadership development program for women in higher education, founded to fill leadership pipelines across the United States with dynamic women, each capable of ushering their respective institutions into a more inclusive and equitable future, according to hersnetwork.org.

ADVISORY GROUP NAMED FOR HIGH-PERFORMANCE COMPUTING SHARED FACILITY



Gowtham

ICC director **Tim Havens** (DataS, CC) is one of four faculty members on the faculty advisory group for the new High-Performance Computing (HPC) Shared Facility, of which Gowtham Sh, director of computing research, was recently appointed director. The Faculty Advisory Group will meet with Gowtham regularly and will help prioritize the annual request to the VPR shared facilities grant program. Additional members of the Faculty Advisory Group are Greg Odegard (ME-EM), Adrienne Minerick (CC), and Ravi Pandey (Physics).

TIM HAVENS CO-CHAIR OF FUZZ-IEEE CONFERENCE

Tim Havens was general co-chair, with Jim Keller, University of Missouri, for the 2019 FUZZ-IEEE International Conference on Fuzzy Systems, New Orleans, LA, June 23-26, 2019. At the conference, Havens presented his paper, "Machine Learning of Choquet Integral Regression with Respect to a Bounded Capacity (or Non-monotonic Fuzzy Measure)" and served on the panel, "Publishing in IEEE Transactions on Fuzzy Systems." Three additional papers authored by Havens were published in the conference's proceedings: "Transfer Learning for the Choquet Integral," "The Choquet Integral Neuron, Its PyTorch Implementation and Application to Decision Fusion," and "Measuring Similarity Between Discontinuous Intervals — Challenges and Solutions."



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from pooled evidence." Havens introduced data-, feature-, and decision- level fusions and discussed in detail two innovations he has made in his research: non-linear aggregation learning with Choquet integrals and their applications in deep learning and Explainable AI (XAI).

In Sept. 2018, John Gierke, GMES chair and professor, and **Thomas Oommen** presented collaborative work on "Field Data Collection and Slope Stability Analysis in the Vicinity of the Enguri Dam" and "External Loadings and Landslide Hazards at Enguri," at the culminating meeting for the international project, "SfP G4934 Security Against Geohazards at the Major Enguri Hydroelectric Scheme in Georgia," funded by NATO's Science for Peace and Security, Tbilisi, Georgia. Additional Michigan Tech projects presented at the meeting included work from MS Geology alumna Maria Diletta Acciaro and BS Geological Engineering alumni Carolyn Lucca, Zack Fleming, Nicole Bird, and Erica Anderson.

Tim Havens was keynote speaker for the Michigan Tech ECE department's annual ECE Academy induction ceremony, Aug. 1, 2019. His address was titled "Computing at Michigan Tech."

Havens presented his paper, "SPFI: Shape-Preserving Choquet Fuzzy Integral for Non-Normal Fuzzy Set-Valued Evidence," at the IEEE World Congress on Computational Intelligence, Rio de Janeiro, Brazil, July 2018. Co-authors are **Tony Pinar** (ECE, DataS), Derek Anderson (U. Missouri), and **Christian Wagner** (ICC Affiliated, U. Nottingham, UK). Havens co-authored two additional papers presented at the conference. WCCI is the biennial meeting of the three leading computational intelligence conferences: International Conference on Fuzzy Systems, International Joint Conference on Neural Networks, and Congress on Evolutionary Computation.

Havens presented an invited seminar, "How to Win on Trivia Night: Sensor Fusion Beyond the Weighted Average," at MIT Lincoln Laboratory, July 2018.

Thomas Oommen presented an invited talk, "Computational Geosciences: Data to Information to Decision," in July 2018, speaking as the First GIAN Fellow, an honor organized by University of Kerala, Dept. of Geology, Kariavattom, Kerala.

Jeremy Bos presented, "Robust Terrain Identification and Path Planning for Autonomous Ground Vehicles in Unstructured Environments," at TARDEC, Warren, MI., Nov. 2018.

Bos presented, "Unreal as a platform for the design, testing, and validation of algorithms for AGVs," at the NATO AVT Panel Business Meeting, Athens, Greece, Dec. 2018.

Bos presented a talk for the Automotive Research Center Seminar Series titled, "Robust Terrain Identification and Path Planning for Autonomous Ground Vehicles in Unstructured Environments," TARDEC/Univ. of Michigan, Warren, Mich., April 2018.

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Center for Data Sciences

DataS



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Jeremy Bos presented, "Imaging theory and mitigation in extreme anisoplanatism," SPIE Security + Defence Conference, Berlin, Germany, Dec. 2018. The event is for engineers, scientists, program managers, and policy makers. Its topics include the latest developments in sensing, data and signal analysis, optronics, quantum science, optical technologies, and funding programs.

CONFERENCE CHAIRS

Jeremy Bos was General Chair, Laser Communication and Propagation through the Atmosphere and Oceans, SPIE Optics and Photonics, Aug. 2019.

Timothy Havens was General Co-Chair of the 2019 IEEE International Conference on Fuzzy Systems, New Orleans, LA, June 2019.

NEW FUNDING

Thomas Oommen is PI on a one-year, \$40K R & D grant from the US Department of State. The project, "Developing and Improving Disaster Management Studies Course in India," was awarded in July 2019.

Timothy Havens is PI on a potential three-year, \$299.5K R & D project from the Naval Surface Warfare Center. Andrew Barnard (ME-EM) is co-PI. The project, "Localization, Tracking, and Classification of On-Ice and Underwater Noise Sources Using Machine Learning," was awarded in Mar. 2019.

Mark Rouleau (DataS, SS) is PI on a potential four-year, \$125.7K project from Florida International University. The project, "Collaborative Research: Design and Development of a K-12 STEM Observation Protocol," was awarded in Mar. 2019.

CONFERENCE PRESENTATIONS

Bouali, E.H., **T. Oommen**, R. Escobar-Wolf, "Landslide mapping using GPS, optical, and radar data: A case study in the Portuguese Bend Landslide Complex, California, between 2007 and 2017," *Eos Trans*, American Geophysical Union (AGU), Fall Meet. Suppl., Dec. 10-14, 2018.

Chatterjee S., C. Kumar, **T. Oommen**, "The area to point geostatistical simulation-based resolution improvement of GRS instrument data of MARS Odyssey orbiter," *Eos Trans*, American Geophysical Union (AGU), Fall Meet. Suppl., Dec 10-14, 2018.

Escobar-Wolf, R., J. Sanders, **T. Oommen**, K.S. Sajinkumar, "Developing a GIS Tool for Infinite Slope Stability Analysis (GIS-TISSA)," 61st Meeting of Assoc. of Environmental & Engineering Geologists and XIII IAEG Congress, San Francisco, , Sep. 15-23, 2018.

Kendrick J.E., L.N. Schaefer, A. Hughes, G. Chigna, **T. Oommen**, Y. Lavallee, "Constraining geomechanical properties for assessing volcanic instability," Cities on Volcanoes 10 Meeting, Naples, Italy, Sep. 2018.

Kumar, C., S. Chatterjee, **T. Oommen**, "Hyperspectral based mapping of hydrothermal altered minerals using AVIRIS-NG data and machine learning algorithms in Hutti-Maski gold deposit region, India," *Eos Trans*, American Geophysical Union (AGU), Fall Meet. Suppl., Dec 10-14, 2018.

Kumar, C., S. Chatterjee, **T. Oommen**, "Hydrothermal alteration mineral mapping using AVIRIS-NG hyperspectral remote sensing data," 61st Annual Meeting of the Association of Environmental & Engineering Geologists and XIII IAEG Congress, San Francisco, CA, Sep 15-23, 2018.

Oommen, T., P. Addison, "Synthetic aperture radar for burn severity estimation," *Eos Trans*, American Geophysical Union (AGU), Fall Meet. Suppl., Dec 10-14, 2018.

Weidner L., K. DePrekel, T. Cook, L. Meek, M. Sprague, **T. Oommen**, "Investigating large landslides along the Ontonagon River, Michigan, using combined physical, statistical, and hydrologic modeling," 61st Meeting of the Association of Environmental & Engineering Geologists and XIII IAEG Congress, San Francisco, CA, Sep. 15-23, 2018.

Kendrick J.E., L.N. Schaefer, A. Hughes A. Lamur, G. Chigna, **T. Oommen**, Y. Lavallee, "Assessing volcanic flank instability using geomechanical properties: A case study from Pacaya volcano (Guatemala)," European Geophysical Union (EGU) General Assembly, Vienna, Austria, Apr. 7-12, 2019.

Kumar, C., S. Chatterjee, **T. Oommen**, W.H. Farrand, "Detecting Hydrated Minerals in Libya Montes, Mars using MRO CRISM Hyperspectral Data," 50th Lunar and Planetary Science Conference, Woodlands, TX, Mar. 18-22, 2019.

Oommen, T., "Computational Geosciences: Data to Information to Decision," as First GIAN Fellow, organized by University of Kerala, Geology Dept., Kariavattom, Kerala, India.

Sergeyev, A., S.A. Kuhl, J.B. Hookeer, M.V. Druschke, "Implementation of the Robotic Vision into the Simulation Environment," 17th Annual International Conference on Education, 17th Annual Hawaii International Conference on Education, Honolulu, HI, Jan. 5-12, 2019.

JOURNAL EDITORSHIPS

Mari Buche, Editorial Board Member, *Journal of Midwest AIS*, Basic or Discovery Scholarship (2014-present).

Mari Buche, Editorial Board Member, *Journal of Information Technology Management*, Applied or Integration/ Application Scholarship (2011-present)

Thomas Oommen, Editorial Board Member, *ASCE Journal of Materials in Civil Engineering* (2018-present)

Thomas Oommen, Editorial Board Member for Geomatics, *Natural Hazards and Risk* (2017-present)

Thomas Oommen, Editorial Board Member, *Environmental & Engineering Geoscience* (2015-present)

Thomas Oommen, Associate Editor, *International Journal of Geotechnical Earthquake Engineering* (2017-present)

Thomas Oommen, Associate Editor, *AIMS Geosciences* (2017-present)

Hairong Wei, Editor, *Scientific Reports*, (2018-present)

Hairong Wei, Editor, *aBIOTECH* (Springer Nature) (2018-present)

COMPLETED PROJECT

Daisuke Minakata (CEE) and **Mark Rouleau** (DataS, SS) completed their multi-year project that began in 2014, "Coupling Experimental and Theoretical Molecular-Level Investigations to Visualize the Fate of Degradation of Organic Compounds in Aqueous Phase Advanced Oxidation Systems."

The final report, submitted in late 2018, was accepted by NSF. The project generated six paper publications in peer-reviewed journals; nine invited talks at international symposiums, workshops and seminars; 13 conference talks at international conferences; and six poster presentations. It also supported three graduate students and provided ten K12 outreach activities sessions for high school students and teachers.

TECHNICAL COMMITTEES

Jeremy Bos, Committee Chair, SPIE Scholarship Committee

Jeremy Bos, Committee Member, SPIE Information Technology Committee

Jeremy Bos, Committee Member, NATO AVT-ET-194 Panel, an exploratory team charged with exploring standards for mobility of off-road autonomous vehicles.

Jeremy Bos, Liaison, University of Michigan Automotive Research Center

Thomas Oommen, Member, AFS20, Committee on Geotechnical Instrumentation and Modeling, The National of Sciences Engineering Medicine: Transportation Research Board (2018-present)



TIMOTHY SCHULZ NAMED UNIVERSITY PROFESSOR



Timothy Schulz (DataS, ECE) was named a University Professor by the Office of the Provost and Senior Vice President for Academic Affairs in May 2019. The University Professor title recognizes faculty members who have made outstanding scholarly contributions to the University and their discipline over a substantial period of time.

TIM SCHULZ FEATURED IN APRIL 2019 DEANS' SHOWCASE

In April 2019, College of Engineering Dean Janet Callahan selected Tim Schulz as the final member of the 2019 Deans' Teaching Showcase.

"As a teacher he is widely acknowledged as one of the ECE department's best, with his friendly, humorous style and his devotion to his students' learning," said Dean Callahan. But Schulz's selection here is, according to Associate Dean Leonard Bohmann, for his "leadership in using technology to deliver technical material in electrical and computer engineering."

Starting in 2012, Schulz created a series of ten- to fifteen-minute YouTube videos collectively titled "Electric Circuits." And though created the videos with his EE2111, Electric Circuits I, class in mind, they are reaching a much wider audience. One of them, "Introduction to Thevenin Equivalent Circuits," has received over 152,000 views. Schulz also developed a phone app of randomized electric circuit problems to use in the course. As one student noted, "The videos and the infinite practice problems were the most helpful. As much as I hate to say this, the quizzes were also helpful."



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

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AWARDS AND HONORS

In June 2019 **Kelly Steelman** (HCC, CLS) was selected from a competitive pool of applicants to participate in the Human Factors and Ergonomics Society (HFES) Science Policy Fellowship program. HFES Science Policy Fellows (SPF) learn how to successfully advocate for human factors and ergonomics on the national stage. Participants receive extensive training in public affairs, advocacy, and outreach and will participate in an annual spring Capitol Hill Day in Washington, DC, which includes a Hill visit training session and a policy-related speaker prior to the visit day.

BOOK CHAPTER

Shane Mueller (HCC, CS), "A Cognitive Examination of Skill and Expertise in Word Games and Puzzles," *The Oxford Handbook of Expertise*, Oxford University Press, 2019.

JOURNAL EDITORSHIPS

Keith Vertanen (HCC, CS) Associate Editor, *International Journal of Human Computer Studies* (2014-present)

TECHNICAL COMMITTEE

Kevin Trewartha (HCC, CS), Councilor at Large, Michigan Society for Neuroscience

INVITED TALKS

Shane Mueller presented, "Explaining Explanation for 'Explainable' AI," ACSHF Forum, Michigan Tech, Sep. 17, 2019. The report focuses on synthetic modeling activities and the development of measures for the evaluation of explainability in human-machine work systems.

Kelly Steelman and **Charles Wallace** (HCC, CS) presented the seminar, "Building Adult Skills in Computing: A Library Based Tutoring Program for Older Adults: Addressing Technology-Related Anxiety in Mobile Interfaces," Upper Peninsula Region of Library Cooperation Annual Meeting, Escanaba, MI, Sep. 2018.

Keith Vertanen presented, "VelociWatch: Designing and Evaluating a Virtual Keyboard for the Input of Challenging Text," CHI '19: ACM International Conference on Human Factors in Computing Systems, May 2019.

CONFERENCE CHAIR

Keith Vertanen was associate chair for CHI: ACM International Conference on Human Factors in Computing Systems, May 4-9, 2019, Glasgow, UK.

CONFERENCE PRESENTATIONS

Sergeyev, A., S. Kuhl, V. Druschke, J. Hooker, "Implementation of Robotic Vision into the Simulation Environment," International Conference on Engineering and Technology, 2018.

Steelman, K.S., C.L. Tislar, "Measurement of Tech Anxiety in Older and Younger Adults," 5th International Conference on Human Aspects of IT for the Aged Population (HCI International 2019), Orlando, FL, July 2019.

Riegner, K.L., J. Ammori, B.E. O'Hearn, Steelman, K.S., "Ground Vehicle Driving Aids: Assessing Driver Workload and Performance in Degraded Visual Environments," 62nd Meeting of the Human Factors and Ergonomics Society, Philadelphia, PA, Oct. 2018.

Rajeshkumar, L., K.M. Trewartha, "Effect of Eccentric Exercise on Motor Learning and Emotional intelligence in Older Adults," Poster, Michigan Society for Neuroscience Conference, Kalamazoo, MI, May 13, 2019.

Davis, M., E. Veinott (HCC/CLS) "Cognitive Play: Exploring differences in sensemaking in games," Meaningful Play 2018, Michigan State University, Lansing, MI, Oct. 2018.

Khaewrantana, W., S. Mueller, E. Veinott, "Wait until tomorrow: Exploring the size of delay on the effectiveness of crossword games for learning scientific vocabulary," Meaningful Play 2018, Michigan State University, Lansing, MI, Oct. 11-13, 2018.

Roose, K., **E. Veinott, S. Mueller**, "I've got you in my sights: Developing a novel method combining cognitive task analysis and eye-tracking," Meaningful Play 2018, Michigan State University, Lansing, MI, Oct. 11-13, 2018.

Veinott, E. K. Roose, "Thinking outside the box: Video game play as warm up for creative thinking," Meaningful Play 2018, Michigan State University, Lansing, MI, Oct. 11-13, 2018.

Vertanen, K. D., "The Impact of Word, Multiple Word, and Sentence Input on Virtual Keyboard Decoding Performance," CHI '18: ACM Conference on Human Factors in Computing Systems, Montreal, Can., Apr. 21-26, 2018.

Adhikary, J., R. Watling, C. Fletcher, A. Stanage, **K. Vertanen**, "Investigating

Speech Recognition for Improving Predictive AAC," Proc. of the Workshop on Speech and Language Processing for Assistive Technologies (SLPAT), Minneapolis, MN, June 2019.

Walther, M., L.C. Ureel II, **C. Wallace**, "A Prototype MATLAB Code Critiquer," a poster presented at the 2019 ACM Conference on Innovation and Technology in Computer Science Education, Aberdeen, UK, July 2, 2019.

EARNED MEDIA

Research by **Kevin Trewartha** was featured in the story, "Motor Skills Research Could Help Detect Alzheimer's," on WLUC-TV6, in Oct. 2018.

Trewartha was quoted in the Dec. 2018 article "New project explores how technology can assist in earlier diagnosis of Alzheimer's," in *Medical Life Sciences News*.



VERTANEN CO-FACILITATES BEST PRACTICES WORKSHOP ON WRITING CONFERENCE PAPERS

Keith Vertanen (HCC, CS), traveled to Mumbai, India, in July 2019 to co-facilitate a three-day workshop on best practices for writing conference papers. Presented by ACM SIGCHI and its Asian Development Committee, the workshop's aim was to encourage researchers from Asia to submit papers for the ACM CHI 2021 Conference on Human Factors in Computing Systems.

Vertanen presented lectures on paper writing and experimental design to 20 PhD candidates from universities in India, Sri Lanka, and South Korea. He also presented a talk on his text entry research and served on an advisory panel that offered the PhD students feedback on their research. Also co-facilitating the workshop were faculty from University of Central

Lancashire, UK, KAIST University, South Korea, and Georgia Institute of Technology, Atlanta. Learn more at indiahci.org.sigchischool/paperCHI2021. Pictured: CHI 2021 workshop participants and teachers; Vertanen is in the back row.



2019 MICHIGAN TECH RESEARCH MAGAZINE



These ICC members were recognized in the 2019 Michigan Tech Research Magazine for receiving National Science Foundation Faculty Career Awards: **Sumit Paudyal**, for "Operation of Distribution Grids in the Context of High-Penetration Distributed Energy Resources and Flexible Loads," **Ye Sun** (CPS, ME-EM) for "System-on-Cloth: A Cloud Manufacturing Framework for Embroidered Wearable Electronics," and **Keith Vertanen** (HCC, CS) for "Technology Assisted Technology Assisted Conversations." Also,

Keith Vertanen's Alzheimer's research, "H-STEM Engineering and Health Technologies Complex" was included as a "Research in Brief" item.

KEWEENAW TIME TRAVELER and THE COPPER COUNTRY HISTORICAL SPATIAL DATA INFRASTRUCTURE



In 2015, Don Lafreniere, associate professor of geography and geospatial information sciences (GIS), and Sarah

Fayen Scarlett, assistant professor of history, traveled through time.

Lafreniere, Scarlett, collaborator associate professor **Robert Pastel** (HCC, CS), and other colleagues and local heritage partners, embarked on a journey to create the first deep map of the Copper Country.



Robert Pastel

They have, and it's called the Keweenaw Time Traveler, the public-facing application of the Copper Country Historical Spatial Data Infrastructure. The application, allows users to contribute to an online interactive historical atlas of the Keweenaw Peninsula. The atlas explores the people and places of the Keweenaw Peninsula. One can participate by sharing local knowledge, and connecting with others. Visit keweenawhistory.com for more info.



Center for Scalable Architectures and Systems



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EARNED MEDIA

Dan Fuhrmann (SAS, CMH) was quoted in a Feb. 11, 2019, article in the Houghton *Daily Mining Gazette* about the new College of Computing. Fuhrmann explained that the college idea had come out of a Computing Information Sciences working group last year, which identified a need to address the rise of cybertechnology in degree programs at Michigan Tech.

INVITED TALKS

Soner Onder (SAS, CS) presented a keynote address, "Form follows function: The Case for Homogeneous Computer Architectures," at the International Conference on Embedded Computer Systems: Architectures, Modeling and Simulation (SAMOS XIX), Samos Island, Greece, July 7, 2019.

Soner Onder presented an invited talk, "Program semantics meets architecture: What if we did not have branches?" at a workshop in honor of the 80th birthday of Prof. Yale Patt of University of Texas, Austin.

Zhenlin Wang, "HUB: hugepage ballooning in kernel-based virtual machines," 2018 International Symposium on Memory Systems, Washington, DC, Oct. 1-4, 2018.

IN PRINT

In June 2019, the article "Topology-Specific Synthesis of Self-Stabilizing Parameterized Systems With Constant-Space Processes," by **Ali Ebneenasir** (SAS, CS) and student Alex Klinkhamer, was accepted for publication in *IEEE Transactions on Software Engineering*.

CONFERENCE PRESENTATIONS

Ebneenasir, Ali, "Swarm Synthesis of Convergence for Symmetric Protocols," European Dependable Computing Conference (EDCC), Sibiu, Romania.

Wang, Zhenlin, "HUB: hugepage ballooning in kernel-based virtual machines," 2018 International Symposium on Memory Systems, Washington, DC, Oct. 1-4, 2018.

SONER ONDER PRESENTS INVITED TALK AT YALE:80

Soner Onder presented an invited talk at "Yale:80: Pushing the Envelope of Computing for the Future," July 1-2, 2019, in Barcelona, Spain. The workshop was organized by Universitat Politècnica de Catalunya in honor of the 80th birthday of Yale Patt, a prominent computer architecture researcher. One of 23 to give a talk, Onder's was titled, "Program semantics meets architecture: What if we did not have branches?"

Yale Patt is a professor in the ECE department at The University of Texas at Austin, where he holds the Ernest Cockrell, Jr. Centennial Chair in Engineering and the title of University Distinguished Teaching Professor. View the slides from Onder's talk and learn more at blogs.mtu.edu/computing.

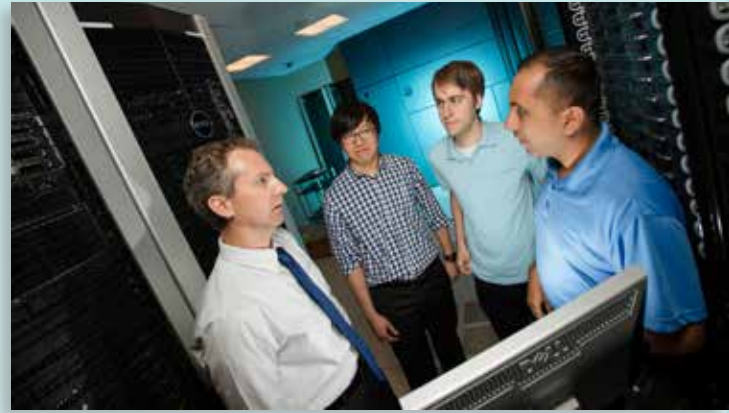


Yale:80 workshop participants. Soner Onder is at front, right.

ICC Giving Opportunities

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.
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- **HONORARIUMS, TRAVEL FUNDS** to host seminars and distinguished lecturers and to 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.
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ICC CENTERS

Cyber-Physical Systems

Cyber-physical systems, internet of-things, smart homes, buildings, communities and grids, smart transportation, smart health, underwater communications and networks.

Center for Cybersecurity

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

Data Sciences

Data sciences, big data and data-intensive computing, artificial intelligence and machine learning, pattern recognition, signal and image processing, sensor and data fusion.

Human-Centered Computing

Multimodal interactions, human-agent interactions, assistive technologies and intelligent health, software education, novel interfaces, computational modeling, explanation in systems, 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.

“**T**here 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.”

—**Timothy C. Havens, Ph.D.**
Director, Institute of Computing and Cybersystems
Associate Dean for Research,
College of Computing



Michigan Tech
College of Computing

icc@mtu.edu | mtu.edu/icc
blogs.mtu.edu/icc
mtu.edu/computing



MEMBER DIRECTORY



**Center for
Cyber-Physical Systems**

Ye Sun | Director, Center for Cyber-Physical Systems | Assistant Professor, Mechanical Engineering-Engineering Mechanics | Affiliated Asst. Prof., Biomedical Engineering | yes@mtu.edu

Jung Yun Bae | Assistant Professor, Mechanical Engineering-Engineering Mechanics | Asst. Prof., College of Computing | bae@mtu.edu

Bo Chen | Dave House Associate Professor of Mechanical Engineering and Electrical Engineering | bochen@mtu.edu

Zhen Liu | Associate Professor, Civil and Environmental Engineering | Affiliated Assoc. Prof., Geological and Mining Engineering and Sciences | zhenli@mtu.edu

Elena Semouchkina | Associate Professor, Electrical and Computer Engineering | Affiliated Prof., Physics | esemouch@mtu.edu

Jinshan Tang | Professor, Applied Computing / Affiliated Prof., Electrical and Computer Engineering, Computational Science and Engineering, Data Science | jinshant@mtu.edu

Chee-Wooi Ten | Associate Professor, Electrical and Computer Engineering | ten@mtu.edu

Zhaohui Wang | Assistant Professor, Electrical and Computer Engineering | zhaohuiw@mtu.edu

Kuilin Zhang | Assistant Professor, Civil and Environmental Engineering | klzhang@mtu.edu



**Center for
Cybersecurity**

Guy Hembroff | Director, Center for Cybersecurity | Associate Professor, Applied Computing | Affiliated Assoc. Prof., Data Science | Director, Health Informatics Graduate Program | hembroff@mtu.edu

Yu Cai | Professor, Applied Computing | Affiliated Prof., Computational Science and Engineering | cai@mtu.edu

Bo Chen | Assistant Professor, Computer Science | bchen@mtu.edu

Steven Goldsmith | Research Professor and Instructor, Mechanical Engineering-Engineering Mechanics | Affiliated Research Prof., Computer Science | sygoldsm@mtu.edu

Jean Mayo | Associate Professor, Computer Science | Graduate Program Director, Computer Science | jmayo@mtu.edu

Jeffrey Wall | Assistant Professor, Management Information Systems | jdwall@mtu.edu



**Center for
Data Sciences**

Timothy Havens | Director, Institute of Computing and Cybersystems and Center for Data Sciences | Associate Dean for Research, College of Computing | William and Gloria Jackson Assoc. Professor of Computer Systems | thavens@mtu.edu

Jeremy Bos | Assistant Professor, Electrical and Computer Engineering | jpbos@mtu.edu

Laura Brown | Associate Professor, Computer Science | Director, Data Science Graduate Program | lebrown@mtu.edu

Mari Buche | Associate Professor, Management Information Systems | mwbuche@mtu.edu

Susanta Ghosh | Assistant Professor, Mechanical Engineering-Engineering Mechanics | susantag@mtu.edu

Sangyoon Han | Assistant Professor, Biomedical Engineering | Affiliate Asst. Prof., Mechanical Engineering-Engineering Mechanics | sjhan@mtu.edu

Nilufer Onder | Associate Professor, Computer Science | Associate Chair, Computer Science | Undergraduate Program Director, Computer Science | nilufer@mtu.edu

Benjamin Ong | Assistant Professor, Mathematical Sciences | ongbw@mtu.edu

Thomas Oommen | Associate Professor, Geological and Mining Engineering and Sciences | Adj. Assoc. Prof., Civil and Environmental Engineering | toommen@mtu.edu

Tony Pinar | Lecturer, Senior Design Coordinator, Electrical and Computer Engineering | Research Engineer, Advanced Power Systems Research Center | ajpinar@mtu.edu

Nathir Rawashdeh | Assistant Professor, Applied Computing | narawash@mtu.edu





Michael Roggemann | Professor, Electrical and Computer Engineering | mroggema@mtu.edu

Mark Rouleau | Assistant Professor, Social Sciences | mdroulea@mtu.edu

Timothy Schulz | Professor, Electrical and Computer Engineering | schulz@mtu.edu

Alex Sergejev | Professor, Applied Computing | Director, Mechatronics Graduate Program and FANUC Certified Industrial Robotics Training Center | avsergue@mtu.edu

Hairong Wei | Professor, College of Forest Resources and Environmental Science | Affiliated Prof., Computer Science, Mathematical Sciences | hairong@mtu.edu

Weihua Zhou | Assistant Professor, CMH Division | whzhou@mtu.edu

Elizabeth Veinott | Director, Center for Human-Centered Computing | Associate Professor, Applied Cognitive Science and Human Factors, Cognitive and Learning Sciences | eveinott@mtu.edu

Scott Kuhl | Associate Professor, Computer Science | Affiliated Assoc. Prof., Cognitive and Learning Sciences | Faculty Advisor, Husky Game Development Enterprise | kuhl@mtu.edu

Shane Mueller | Associate Professor of Psychology, Cognitive and Learning Sciences | shanem@mtu.edu

Robert Pastel | Associate Professor, Computer Science | Affiliated Assoc. Prof., Cognitive and Learning Sciences | Faculty Advisor, Humane Interface Design Enterprise | pastel@mtu.edu

Samantha Smith | Assistant Professor, Cognitive and Learning Sciences | slsmith1@mtu.edu

Kelly Steelman | Assistant Professor, Cognitive and Learning Sciences | Affiliated Asst. Prof., Mechanical Engineering-Engineering Mechanics | steelman@mtu.edu

Kevin Trewartha | Assistant Professor, Cognitive and Learning Sciences | Asst. Prof., Kinesiology and Integrative Physiology | kmtrewar@mtu.edu

Keith Vertanen | Associate Professor, Computer Science | vertanen@mtu.edu

Charles Wallace | Associate Professor, Computer Science | Associate Dean for Curriculum and Instruction, College of Computing | Affiliated Assoc. Prof., Cognitive and Learning Sciences | wallace@mtu.edu

Soner Onder | Director, Center for Scalable Architectures and Systems | Professor, Computer Science | Affiliated Prof., Electrical and Computer Engineering | soner@mtu.edu

Ali Ebnenasir | Associate Professor, Computer Science | aebenas@mtu.edu

Dan Fuhrmann | Chair, Department of Applied Computing | Dave House Professor in Computer Engineering | fuhrmann@mtu.edu

Yakov Nekrich | Associate Professor, Computer Science | yakov@mtu.edu

Zhenlin Wang | Professor, Computer Science | zlwang@mtu.edu

Jianhui Yue | Assistant Professor, Computer Science | jyue@mtu.edu



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