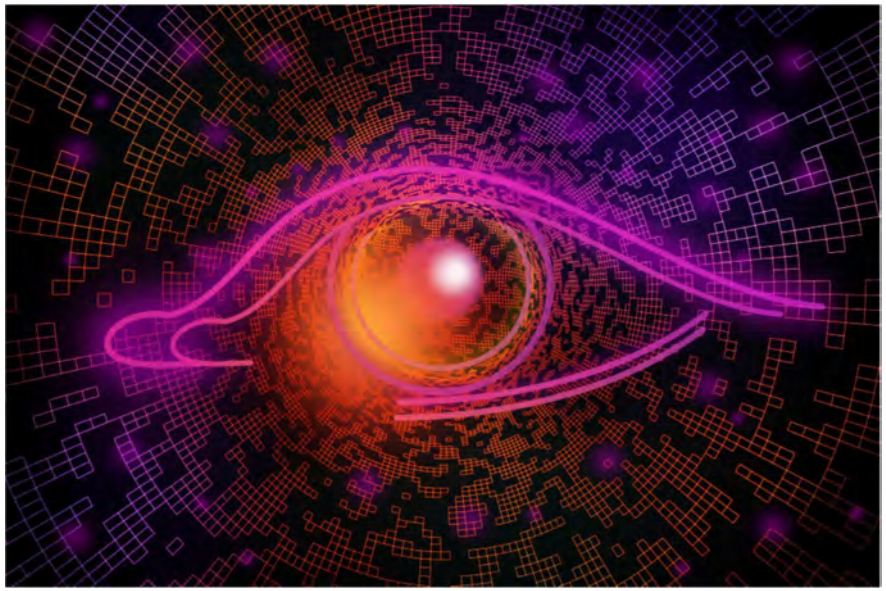


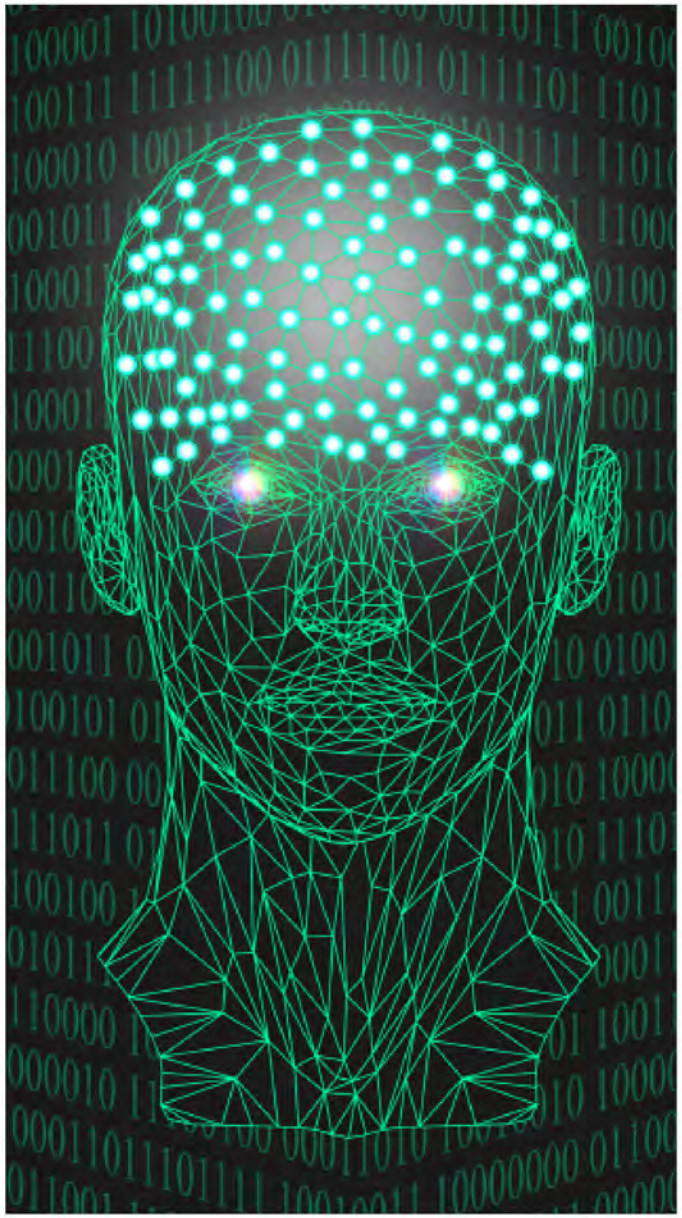
2021
ANNUAL REPORT
CENTER FOR HUMAN-AWARE AI (CHAI)

RIT

Center for
Human-aware
Artificial
Intelligence

CHAI

CONTENTS



A WORD FROM THE CHAI DIRECTOR

Dear Colleagues, Collaborators and Friends,

It is a great pleasure to present the 2021 CHAI annual report, highlighting our faculty and their research. The last two years have been an extraordinary time that affected the nature of all academic activities. I want to thank our faculty and students for demonstrating creativity, resilience, commitment to their academic mission and enthusiasm for their research. I would also like to thank our staff, administrators and leaders for their constant support.

The number of CHAI faculty continues to grow and so does the number of our sponsored research projects. We now have faculty from six colleges across RIT and an all-time high level of research expenditures contributing to a healthy financial outlook for hiring and new initiatives. I am very pleased to introduce Susan Brightman, the first CHAI Senior Staff Assistant supporting our center operations.

There are many opportunities for collaborations, both internal and external, to grow research and raise RIT's AI profile. A success story is the NSF project AWARE-AI: Awareness for Sensing Humans Responsibly with AI. The multidisciplinary AWARE-AI team is led by Dr. Cecilia Alm (PI) and includes Dr. Reynold Bailey, Dr. Matt Huenerfauth, Dr. Ferat Sahin and Dr. Esa Rantanen. I look forward to working with our faculty and administration, as we continue to grow AI at RIT and create a diverse and inclusive environment with opportunities for our faculty and students to thrive.

Andreas Savakis
CHAI Director

ABOUT THE CENTER

To improve the quality of human life with breakthrough research in AI and to comprehensively equip future AI practitioners and scientists.

THE CHAI MISSION IS TO

1. Conduct transformative research on computing systems capable of tasks that ordinarily require human intelligence or that enable humans to perform optimally
2. Work toward the development of AI computing systems that are continually learning, trustworthy, and capable of solving complex tasks with minimal resources

CHAI'S GOAL IS TO PROPEL RIT FORWARD IN THE FOLLOWING WAYS

1. Advance research in AI
2. Grow AI research output and investment at scale
3. Be a magnet for attracting top-tier faculty and graduate students in AI
4. Increase collaboration within RIT
5. Position RIT to participate in AI's Grand Challenges

THE CENTER ACTIVITIES ARE FOCUSED ON FOUR RESEARCH PILLARS DESCRIBED BELOW

Human-Centered AI	Machine Learning and Perception	Brain-Inspired Computing	Automation
How can we develop and design usable AI based cognitive technologies for interacting with human users, including understanding behavior, experiences, and negotiating users' trust?	How can we extend and transform AI methods to address challenging tasks in understanding natural language, images, video, and multi-modal data?	Can our understanding of human neural processing and perception lead to new AI algorithms and hardware advances?	How can AI technologies lead to new innovations and efficiencies in domains where intelligent systems or robots collaborate in future workplaces?

CHAI FACULTY & STAFF

CECILIA O. ALM CORE FACULTY

Associate Professor, College of Liberal Arts
Research Interests: Human-centered AI, Affective Computing, Multimodal Human Sensing, Interactive and Resource-Efficient ML, Computational Linguistics (Natural Panguage processing, Speech, Dialogue)

https://people.rit.edu/coagla

REYNOLD BAILEY CORE FACULTY

Professor and Associate Undergraduate Program Coordinator, Computer Science
Research Interests: Applied Visual Perception In Computer Graphics And Multi-Modal Human Sensing

https://www.cs.rit.edu/~rjb/

TRAVIS DESELL CORE FACULTY

Associate Professor, Software Engineering, Graduate Program Director for RIT's Masters in Data Science
Research Interests: Evolutionary Algorithms And Bio-Inspired Computing, Neural Networks, Neuroevolution/Neural Architecture Search, Machine Learning, High Performance And Distributed Computing, Data Science

http://www.se.rit.edu/~travis/index.php

MATT HUENERFAUTH CORE FACULTY

Professor and Director, School of Information
Research Interests: Design Of Technology To Benefit People Who Are Deaf Or Hard Of Hearing Or Who Have Low Written-Language Literacy, Especially Imperfect Ai Technologies For Speech And Language Processing, To Provide Greater Access To Information Or Communication

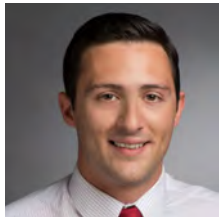
https://huenerfauth.ist.rit.edu/

CHRISTOPHER KANAN CORE FACULTY

Associate Professor, Chester F. Carlson Center for Imaging Science, Associate Director, CHAI
Research Interests: Deep Learning, Lifelong Machine Learning, Self-Supervised Learning, Bias Detection And Mitigation In Deep Neural Networks, Cognitive Science

https://chriskanan.com/

CHAI FACULTY



PANOS MARKOPOULOS CORE FACULTY

Assistant Professor, Department of Electrical and Microelectronic Engineering
Research Interests: Machine Learning, Data Science, Robust And Trustworthy Artificial Intelligence, Efficient Artificial Intelligence

https://www.milos|ab.org/

IFEOMA NWOGU CORE FACULTY

Assistant Professor, Computer Science Department
Research Interests: Multimodal Machine Learning: Probabilistic Modeling Of Acoustic, Visual, And Other Sensory Measurements; Human Communication Dynamics: Analyzing The Latent, Non-Verbal, Human Behaviors Occurring During Social Interactions; Health Behavior Analysis

https://www.cs.rit.edu/~ion/

RAYMOND PTUCHA CORE FACULTY

Associate Professor, Department of Computer Engineering, KGCOE
Research Interests: Deep Learning For Vision, Audio, And Natural Language Processing. Machine Learning Theory, Computer Vision, Robotics, And Image Science

https://www.rit.edu/mil

FERAT SAHIN CORE FACULTY

Professor, Department of Electrical and Microelectronic Engineering
Research Interests: Dynamic Speed And Separation Monitoring For Industrial Hrc, Human Comfort Index Estimation Through Physiological Signal, One-Class Classifiers For Novelty/Anomaly Detection

http://mabl.rit.edu

ANDREAS SAVAKIS CORE FACULTY

Professor, Department of Computer Engineering
Director, Center for Human-aware Artificial Intelligence (CHAI)
Research Interests: Computer Vision, Deep Learning, Machine Learning

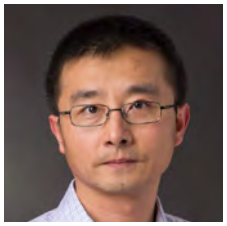
https://www.rit.edu/directory/axseec-andreas-savakis

CHAI FACULTY

LINWEI WANG CORE FACULTY

Professor, Ph.D. Program in Computing and Information Sciences
Research Interests: Artificial Intelligence, Data Science, Health Informatics

https://pht180.rit.edu/cblwang/



QI YU CORE FACULTY

Professor, School of Information
Research Interests: Machine Learning

https://www.rit.edu/mining

JAMISON HEARD AFFILIATED FACULTY

Assistant Professor, Department of Electrical and Microelectronic Engineering
Research Interests: Reinforcement Learning, Deep-Learning, Human-Robot Collaboration, Game Theory, Shared-Control

https://ahrtlab.github.io

CLARK HOCHGRAF AFFILIATED FACULTY

Associate Professor, Electrical and Computer Engineering Technology
Research Interests: Social Interaction With Machine Intelligence Agents, Human-Autonomous Robot Interaction, Intelligent Material Handling Systems

https://www.rit.edu/directory/cghiee-clark-hochgraf

YU KONG AFFILIATED FACULTY

Assistant Professor, Ph.D. Program in Computing and Information Sciences
Research Interests: Computer Vision, Machine Learning

https://www.rit.edu/directory/yukics-yu-kong

CHAI FACULTY

ANDRES KWASINSKI AFFILIATED FACULTY

Professor, Department of Computer Engineering
Research Interests: Cognitive Radios And Networks, Smart Infrastructures

https://people.rit.edu/axkeec/

XUMIN LIU AFFILIATED FACULTY

Assistant Professor, Department of Computer Science
Research Interests: Data Science, Service Science, Applied Machine Learning, Computing Education

https://www.cs.rit.edu/~xl/

ALEXANDER LOUI AFFILIATED FACULTY

Lecturer, Department of Computer Engineering
Research Interests: Computer Vision, Machine Learning, Image/Video Processing and Understanding, Applications in AI

https://www.rit.edu/directory/acleec-alexander-loui

GUOYU LU AFFILIATED FACULTY

Assistant Professor, Center for Imaging Science
Research Interests: Computer Vision

CORY MERKEL AFFILIATED FACULTY

Assistant Professor, Department of Computer Engineering
Research Interests: Neuromorphic Computing, Integrated Circuit Design, Artificial Intelligence, Machine Learning

www.rit.edu/brainlab

CHAI FACULTY & STAFF

VICTOR PEROTTI AFFILIATED FACULTY

Department Chair, Department of MIS, Marketing, and Digital Business
Research Interests: Data Analysis, Web Development, Entrepreneurship

https://people.rit.edu/vjpbbu/

ESA RANTANEN AFFILIATED FACULTY

Associate Professor, Department of Psychology
Research Interests: Human factors in complex systems, human performance measurement and modeling, mental workload, decision-making, and human error and reliability

https://www.cis.rit.edu/~glpci/

ZHE YU AFFILIATED FACULTY

Assistant Professor, Department of Software Engineering
Research Interests: Human-AI Collaboration, Machine Learning, ML Fairness, Software Engineering

https://github.com/hil-se/hil-se

ZHI ZHENG AFFILIATED FACULTY

Assistant Professor, Department of Biomedical Engineering
Research Interests: Human-AI Collaboration, Machine Learning, ML Fairness, Software Engineering

https://sites.google.com/view/iirl/

SUSAN A BRIGHTMAN STAFF

Senior Staff Assistant, CHAI

RESEARCH PROJECTS

NRT-AI: AWARE-AI: AWAREness for Sensing Humans Responsibly with AI
Cecilia O. Alm (PI); Co-PIs **Reynold Bailey, Matthew Huenerfauth, Esa Rantanen, Ferat Sahin**
National Science Foundation
2021-2026

Project Abstract: Sensing-based artificial intelligence (AI) systems use information gathered from humans to make predictions and respond to humans in numerous applications. As these systems become more widespread, enormous research challenges are emerging. These AI systems must react responsibly and flexibly, respect diversity and privacy, and achieve trustworthiness to avoid unintended consequences at a larger societal scale. To address these challenges, gaps in graduate education programs related to AI will need to be bridged to create a growing and sustainable pipeline of well-rounded AI scientists and engineers who understand software, hardware, human-computer interaction, and human cognitive aspects of this technology, as well as ethical considerations. To ensure AI technology is well-designed to improve all citizens' productivity, welfare, and safety, it is also vital to build an inclusive research workforce. This National Science Foundation Research Traineeship (NRT) award to the Rochester Institute of Technology will provide unique training to a diverse student body, whose members will be future research leaders in developing responsible, human-aware AI technologies. The project anticipates training 75 master's and Ph.D. students, including 25 funded trainees, from computing and information sciences, engineering, mathematics, psychology, and imaging science. The Awareness for Sensing Humans Responsibly with AI (AWARE-AI) NRT project will enhance U.S. competitiveness in AI and help develop a diverse workforce by providing funded traineeships to Deaf and Hard of Hearing, female, African American, Latino/a American, and Native American students.

Faculty Mentors: SP Bosworth, Gabriel Diaz, Christopher Kanan, Kristen Shinohara; Affiliated: Alex Ororbia, Roshan Peiris, Garreth Tigwell, Marcos Zampieri

Participating Students: Trainees in the initial pilot cohort start Jan 2022 (14-17 graduate students, mostly PhD level)

REU Site: Computation Sensing for Human-centered AI
Cecilia O. Alm (PI), **Reynold Bailey** (Co-PI)
National Science Foundation
2019-2023

Project Abstract: We propose a 3-year REU Site on Computational Sensing for Human-Centered Artificial Intelligence. With the boundaries between HCI and AI blurring, and AI growing

increasingly agile and pervasive, the next generation of computational scientists must be capable of responsibly and effectively leveraging a spectrum of multisource sensing data from human beings. REU students will gain experience with sensing hardware and software towards transformative advances in intelligent systems. We will address two limitations in AI: first, that underserved populations are at risk of being ignored with the present focus on big data AI and, second, that AI trainees often lack experience with human subjects data collection and the fostering of critical thinking about human-elicited datasets. Enabling diverse stakeholders early in their careers agency in discovering how to collect, fuse, make inferences with and visualize multimodal human data helps nurture a workforce that can transform how humans and machines presently engage and collaborate. For our Site's next iteration, we set ambitious and attainable goals: (1) to advance fundamental research in multimodal computational sensing for human-centered AI in team-based research projects that couple human study with sound AI experimentation focused on modestly-sized and inclusive datasets, (2) to develop our programmatic mechanisms for aiding students to transition confidently from being taught to being research mentored by high-profile research faculty, with the aim to ensure students' readiness for entering computer science PhD programs, and (3) to enhance strategies aimed at doubling the representation of Native American or Latina/o students and students with disabilities among our applicant pool, and reach even more demanding selection targets for exceptionally diverse cohorts.

Faculty Mentors: Jamison Heard, Alexander Ororbia, Roshan Peiris, Kristen Shinohara, Zhi Zheng

Participating Students: 1 GRA (PhD student) and 10 REU students + 1 part-time student (NSF supplement)

Improved Semantic Segmentation with Natural Gaze Dynamics
Gabriel Diaz, Reynold Bailey (Co-PI), and **Jeff Pelz**
Meta Reality Labs
2020-2022

RESEARCH PROJECTS

Project Abstract: Graphic project engages undergraduate, masters, and PhD students including in independent studies and full-time paid co-ops.

Participating Students: UG, MS, and PhD students including in independent studies and full-time paid co-ops.

The National General Aviation Flight Information Database (NGAFID)
Mark Dusenbury (PI, UND), **Brandon Wild** (Co-PI, UND), and **Travis Desell** (Co-PI, RIT)
Federal Aviation Administration and the MITRE Corporation
2018-2022

Project Abstract: The purpose of this work is to maintain and further develop the National General Aviation Flight Information Database (NGAFID) and its integration within the Federal Aviation Administration's Aviation Safety Information Analysis and Sharing (ASIAS) System. The NGAFID provides a free to use interface for institutions and private pilots to upload flight data, which can be analyzed to track trends in exceedances (potential flight issues), reanimate flights for educational purposes, and provide more advanced interfaces to determine flight safety at fleet level.

Participating Students: Farhad Akhbardeh (PhD), Joshua Karns (PhD), Aidan LaBella (UGRA), Dan Castellarin (UGRA)

Collaborative Research: Multimethod Investigation of Articulatory and Perceptual Constraints on Natural Language Evolution
Matthew Dye (PI); **Andreas Savakis, Matt Heunerfauth, and Corrine Occhino** (Co-PIs)
National Science Foundation

Project Abstract: The evolution of language is something that appears to be unique to the human species. Viewed as a cognitive tool, language is a powerful system responsible for the cultural and technological advance of human civilization. Like physical tools, such as the wheel or fire, cognitive tools have the power to shape their user. That is, languages need not only evolve by change within linguistic systems themselves, but also through changes in the organisms (humans) that use those languages. The research proposed here will focus upon one particular type of human linguistic system - signed languages - and on one aspect of human organisms - spatial visual attention. It will ask the fundamental question: to what extent have signed languages evolved over generations to conform to the human visual and articulatory systems, and to what extent is the human visual attention system shaped by the use of a signed language within the lifetime of an individual signer?

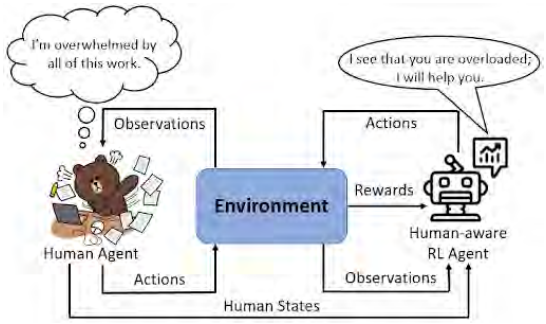
Participating Students: Bruno Artacho, PhD student Electrical and Computer Engineering, Divyansh Gupta, MS student Computer Engineering, Udit Sharma, MS student Computer Engineering

A49 - UAS Flight Data. Research in Support of ASIAS (Aviation Safety Information and Analysis Sharing)
Ryan Guthridge (**PI**, UND), **Travis Desell** (Co-**PI**, **RIT**) and others
Federal Aviation Administration
2021-2023

Project Abstract: This research will aggregate high quality unmanned aircraft systems (UAS) flight data with commercial and general aviation flight data and surveillance data, in order to develop enhanced safety analyses for the national airspace (NAS) stakeholders and to support UAS integration in the NAS. This will involve incorporating/ this UAS data into the National General Aviation Flight Information Database (NGAFID) and developing algorithms to detect proximity alerts between unmanned and manned aircraft.

Participating Student: Hong Yang (PhD)

Adaptive Human-Robot Teaming
Jamison Heard
RIT
2020-2021



Project Abstract: Human-robot teams are deployed in various dynamic and extreme environments (e.g., manufacturing, space exploration). Achieving high task performance in such environments is critical, as a mistake may lead to significant monetary loss. Task performance may be augmented by adapting the robot's interactions or autonomy levels based on the human's workload level, as workload is related to task performance. Typical adaptive human-robot teaming systems rely solely on the human's overall or cognitive workload state to select what adaptation strategy to implement; however, overall workload encompasses many dimensions (i.e., cognitive, auditory, speech, visual, and physical) called workload components. Selecting an appropriate adaptation strategy based on a complete human workload state (rather than a single workload dimension) may allow for more impactful adaptations that ensure high task performance. Previous work has developed an adaptive human-robot teaming architecture capable of adapting task autonomy levels and interactions for a supervisory-based environment. This proposal seeks to expand the architecture to a collaborative manufacturing robotics setting

and apply control theory to determine when and how to invoke or revoke autonomy. The funding will pay for two necessary human-subjects experiments.

Participating Student: Saurav Singh, PhD student

High-fidelity scene modeling and vehicle tracking using hyperspectral video
Matthew Hoffman (PI); **Chris Kanan** and Anthony Vodacek (Co-PIs)
US Air Force Materiel Command
2018-2021

Project Abstract: This project will develop methods that exploit big data (hyperspectral tracking), high fidelity modeling (terrain and sensor phenomenology) and user needs (user defined operating picture). These three elements constitute a DDDAS capability. Specifically, the ability to persistently track vehicles and pedestrians in complex environments is of crucial importance to increasing the autonomy of aerial surveillance for the Air Force, Department of Defense, homeland security, and disaster relief coordination. Non-visual surveillance is particularly beneficial for when dealing with airborne collections, where the number of pixels on a target is relatively small and thus spatial features are not sufficient to identify a target. Spectral cameras have the ability to leverage additional phenomenological features to enhance robustness across varying environments. RIT has been advancing sensor technology, modeling, and exploitation for the past two decades delivering products to AFRL and the DOD. This project will 1) collect and annotate novel hyperspectral datasets of vehicle and pedestrian movement that will be released to the community through the DDDAS website, 2) Develop a DDDAS framework for efficiently extracting and exploiting information from this large dataset to facilitate different applications, including real-time tracking and understanding actions at a meet up of different targets of interest and 3) develop a new capacity for DIRSIG to support dynamic, online construction of physics-based scene models.

Participating Students: Navya Nagananda, Abu Taufique; Sadman Jahan, Imaging Science PhD Student; Reaga Madappa, Computer Engineering MS Student

Twenty-First Century Captioning Technology, Metrics and Usability
Matt Huenerfauth
Department of Health and Human Services
2018-2023

Project Abstract: Captioning plays an important role in making video and other media accessible for many people who are Deaf or Hard of Hearing. This collaborative research project with Gallaudet University will investigate the design of metrics that can predict the overall quality of text captions provided during video for people who are Deaf or Hard of Hearing (DHH). In addition, this project will study the presentation, display, and user experience of people who are DHH viewing captions. This project will include focus groups, interviews, surveys, and experimental studies with several thousand DHH participants across the U.S., with studies occurring at Gallau-

det, at RIT, and at other U.S. locations, to obtain input and feedback from a diverse cross-section of the U.S. DHH population. Through this work, we will identify key requirements from stakeholders as to the quality of captions, identify factors that can be used to implement software-based automatic metrics for evaluating caption quality, and identify new methods for modifying the presentation and display of captions, to boost the overall user experience of DHH users. This project will create software tools, as well as a captioned video collection, which will serve as a critical research infrastructure for empirical research on caption quality and accessibility. Outcomes of this project include the creation of information materials and outreach to the DHH community about captioning technologies, as well as software and standards for how to best evaluate captions of videos for these users.

Participating Students: Akhter Al Amin and Abraham Glasser, CIS PhD Students; Matthew Watkins, Human Computer Interaction, MS Student; Alexis Gordon, Web and Mobile Computing and Human Centered Computing Undergraduate Student

Data & AI Methods for Modeling Facial Expressions in Language with Applications to Privacy for the Deaf, ASL Education & Linguistic Research
Matt Huenerfauth
National Science Foundation
2020-2022

Project Abstract: This multi-university research project investigates robust artificial-intelligence methods for facial analytics that can be widely used across domains, applications, and language modalities (signed and spoken languages). This proposed work includes (1) extensions to ASL-based tools, AI methods, and data sharing; (2) an application to enable researchers to contribute video clips for to help ASL learners produce more accurately the types of facial analysis of facial expressions and head gestures that convey essential grammatical information in signed languages; and (4) a tool for real-time anonymization of ASL video communications, to preserve essential grammatical information expressed on the face/head in sign languages (SL) while de-identifying the signer in videos to be shared anonymously. Experimental user studies to assist in the design of (3) and (4) will be conducted by Huenerfauth at RIT. Individuals who are Deaf and Hard of Hearing will be actively involved in the research, including perceptual experiments to test comprehensibility and to investigate factors that

influence acceptance of the ASL animations. This Phase I project lays the groundwork for a future Phase II proposal to the NSF Convergence Accelerator program.

Participating Students: Sooyeon Lee, Postdoctoral Research Associate; Saad Hassan, Computing and Information Sciences PhD Student; Abraham Glasser, Computing and Information Sciences PhD Student; Becca Dingman, Human Computer Interaction MS Student; Alexis Gordon, Human Computer Interaction Undergraduate Student

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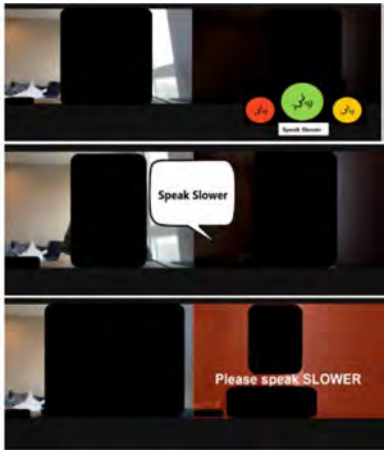
Critical Factors for Automatic Speech Recognition in Supporting Small Group Communication Between People who are Deaf or Hard of Hearing and Hearing Colleagues
Matthew Huenerfauth
National Science Foundation
2020-2023



Project Abstract: To promote inclusion and success of D/HH employees in workplace communication, we investigate the use of Automatic Speech Recognition (ASR) technology for automatically providing captions for impromptu small-group interaction. We will conduct interviews with D/HH users, employers, and hearing co-workers; participatory design sessions and prototype usability testing with users; lab-based studies investigating how the presentation of ASR text output may influence the speaking behavior of hearing colleagues; experimental sessions with pairs or small groups of D/HH and hearing individuals collaborating on a problem solving-task while using a prototype ASR communication system; and observations of the use of prototype designs in real workplace settings. The project will result in human-computer interaction design and evaluation guidelines for the use of ASR in small group communication; broader impacts include societal benefits and STEM research opportunities for DHH students.

Participating Students: Sooyeon Lee, Postdoctoral Research Associate; Matthew Seita and Caluã Pataca, Computing and Information Sciences PhD Students

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Scalable Integration of Data-driven and Model-based Methods for Large Vocabulary Sign Recognition and Search
Matt Huenerfauth
National Science Foundation
2018-2022

Project Abstract: Sign recognition from video is still an open and difficult problem because of the nonlinearities involved in recognizing 3D structures from 2D video, as well as the complex

linguistic organization of sign languages. Purely data-driven approaches are ill-suited to sign recognition given the limited quantities of available, consistently annotated data and the complexity of the linguistic structures involved, which are hard to infer. Prior research has, for this reason, generally focused on selective aspects of the problem, often restricted to limited vocabulary, resulting in methods that are not scalable. We propose to develop a new hybrid, scalable, computational framework for sign identification from a large vocabulary, which has never before been achieved. This research will strategically combine state-of-the-art computer vision, machine-learning methods, and linguistic modeling. Looking up an unfamiliar word in a dictionary is a common activity in childhood or foreign-language education, yet I there is no easy method for doing this in ASL. The above framework will enable us to develop a user-friendly, video-based sign-lookup interface, for use with online ASL video dictionaries and resources, and for facilitation of ASL annotation. This research will (1) revolutionize how deaf children, students learning ASL, or families with deaf children search ASL dictionaries; (2) accelerate research on ASL linguistics and technology, by increasing efficiency, accuracy, and consistency of annotations of ASL videos through video-based sign lookup; and (3) lay groundwork for future technologies to benefit deaf users, e.g., English-to-ASL translation, for which sign-recognition is a precursor. The new linguistically annotated video data and software tools will be shared publicly.

Participating Students: Saad Hassan, Abraham Glasser, and Oliver Alonzo, Computing and Information Sciences PhD Students; Max Shengelia, Web and Mobile Computing Undergraduate Student; Ben Leyer, ASL-English Interpretation Undergraduate Student

Automatic Text-Simplification and Reading-Assistance to Support Self-Directed Learning by Deaf and Hard-of-Hearing Computing Workers
Matt Huenerfauth
National Science Foundation
2018-2022

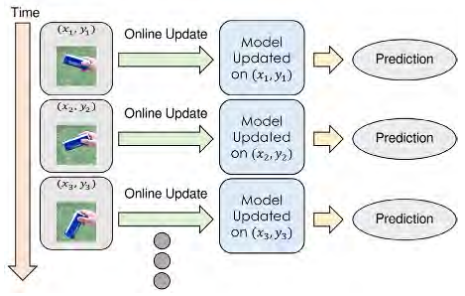
Project Abstract: While there is a shortage of computing and information technology professionals in the U.S., there is underrepresentation of people who are Deaf and Hard of Hearing (DHH) in such careers. Low English reading literacy among some DHH adults can be a particular barrier to computing professions, where workers must regularly "upskill" to learn about rapidly changing technologies throughout their career, often through heutagogical (self-directed)

learning, outside of a formal classroom setting. There has been little prior research on self-directed learners with low literacy nor on automatic text-simplification reading-assistance systems for DHH readers, who have a unique literacy profile. Our interdisciplinary team includes researchers and educators with expertise on DHH computing education, natural language processing researchers with expertise in text simplification technologies, and accessibility researchers with expertise in conducting empirical studies with large numbers of DHH users evaluating assistive technologies. RIT is an ideal setting for this study, as it is home to the National Technical Institute for the Deaf, including DHH computing students who engage in workplace experiences as part of a senior capstone course, in which they must heutatogogically learn about new technologies for work projects. As a research vehicle for this study, we will implement a web-browser plug-in that provides automatic English text simplification (on-demand) for DHH individuals, including providing simpler synonyms or sign-language videos of complex English words or simpler English paraphrases of sentences or entire documents. By embedding this prototype for use by DHH students as they learn about new computing technologies for workplace projects, we will evaluate the efficacy of our new technologies.

Participating Students: Oliver Alonzo and Abraham Glasser, Computing and Information Sciences PhD Students; Matthew Watkins, Computer Interaction MS Student

CAREER: Brain-inspired Methods for Continual Learning of Large-scale Vision and Language Tasks
Christopher Kanan
National Science Foundation
2021-2026

Project Abstract: The goal of this research project is to create deep neural networks that excel in a broad set of circumstances, are capable of learning from new data over time, and are robust to dataset bias. Deep neural networks can now perform some tasks as well as humans, such as identifying faces, recognizing objects, and other perception tasks. However, existing approaches have limitations, including the inability to effectively learn over time when data is structured without forgetting past information, learning slowly by looping over data many times, and amplification of pre-existing dataset bias which results in erroneous predictions for groups with less data. To overcome these problems, this research project aims to incorporate memory consolidation processes inspired by the mammalian memory system that occur both when animals are awake and asleep. The new methods developed in this project could lead to machine learning systems that 1) are more power efficient, 2) can learn on low-powered mobile devices and robots, and 3) can overcome bias in datasets. In addition, a significant educational component involves training the next generation of scientists and engineers in deploying machine learning systems that are safe, reliable, and well tested via new courses and programs.



In greater technical detail, this project will develop new measures for neural networks to 1) test for biases, 2) assess the acquisition of robust concepts, and 3) study forward transfer in neural networks trained over time. New brain-inspired algorithms are proposed that learn online but then have downtime periods in which they engage in greater levels of memory consolidation, which are informed by findings in neuroscience for the neural activities that occur during the wake-sleep cycles of humans and other mammals. The proposed algorithms are based on the brain's complementary learning systems for memory formation, storage, and retrieval. The models are evaluated on large-scale incremental image classification tasks as well as tasks involving multi-modal scene understanding and abstract reasoning. This research will provide building blocks that others can use to create new algorithms and applications. All code and datasets will be made publicly available.

Participating Students: Tyler Hayes, Kushal Kafle, Robik Shrestha; Jhair Gallardo, Imaging Science PhD Student

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L2M TA2 Multi-Stage, Multi-Task Memory Transfer (M3T)
Christopher Kanan
DARPA/SRI International
2021-2022

This is Phase 2 of the DARPA project that the lab received, where in Phase 2, Kanan's lab teamed with SRI, Georgia Tech, and American University to integrate RIT's algorithms into SRI's Starcraft AI, which learns over time to play the game. This project was only recently initiated.

Participating Students: Tyler Hayes, Robik Shrestha; Jhair Gallardo, Imaging Science PhD Student

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RI: Small: Lifelong Multimodal Concept Learning
Christopher Kanan
National Science Foundation
2019-2022

Project Abstract: While machine learning and artificial intelligence has greatly advanced in recent years, these systems still have significant limitations. Machine learning systems have distinct learning and deployment phases. If new information is acquired, the entire system is often rebuilt rather than having only the new information being learned because otherwise the system will forget a large amount of its past knowledge. Systems cannot learn autonomously and often require strong supervision. This project aims to address these issues

by creating new multi-modal brain-inspired algorithms capable of learning immediately without excess forgetting. These algorithms can enable learning with fewer computational resources, which can facilitate learning on devices such as cell phones and home robots. Fast learning from multimodal data streams is critical to enabling natural interactions with artificial agents. Autonomous multimodal learning will reduce reliance on annotated data, which is a huge bottleneck in increasing the utility of artificial intelligence, and may enable significant gains in performance. This research will provide building blocks that others can use to create new algorithms, applications, and cognitive technologies.

The algorithms are based on the complementary learning systems theory for how the human brain learns quickly. The human brain uses its hippocampus to immediately learn new information and then this information is transferred to the neocortex during sleep. Based on this theory, streaming learning algorithms for deep neural networks will be created, which will enable fast learning from structured data streams without catastrophic forgetting of past knowledge. The algorithms will be assessed based on their ability to classify large image databases containing thousands of categories. These systems will be leveraged to pioneer multimodal streaming learning for visual question answering and visual query detection, enabling language.

In Gallardo, Hayes, and Kanan (2021), we showed that self-supervised learning can greatly enhance online continual learning compared to supervised systems. This plot shows a REMIND system being updated with new data over time using self-supervised initialization. It learns 900 object categories incrementally in an online manner. It is orders of magnitude faster than other approaches, while also achieving state of the art results in terms of accuracy.

Participating Students: Tyler Hayes, Kushal Kafle, Robik Shrestha; Jhair Gallardo, Imaging Science PhD Student

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Using Artificial Intelligence on Street View Imagery to Detect Five Key Invasive Plant Species in New York State. NY Department of Environmental Conservation
Christopher Kanan
NYS DEC
2019-2022

Project Abstract: Invasive plants are a significant economic and ecological problem globally, but manual monitoring is time consuming and resource intensive. We aim to use artificial intelligence (AI) to automatically detect the presence of target high-priority species in street level imagery. In preliminary work, we developed AI algorithms that excel at detecting two species that are invasive to New York State (NYS). In this project, we are proposing to extend the system to additional high-priority invasive species (e.g., Tree of Heaven) that pose significant economic and

ecological risks to NYS. We propose to integrate our algorithms with NYSDEC's iMap Invasives system as a publicly available data layer to improve the ability to map out previously unknown infestations, track changes over time, and develop priority targets for containment and control efforts.

Participating Students: Manoj Acharya, IMGS PhD Student; Frank Cwitkowitz, CE MS Student; Deepak Sharma, Computer Science BS Student; Liam Megraw, Environmental Science BS Student

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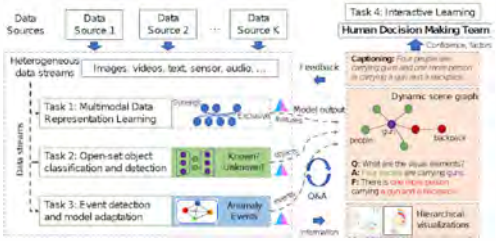
Dynamic Scene Graphs for Extracting Activity-based Intelligence
Yu Kong (PI); **Qi Yu** (Co-PI)
DoD/ARO
2021-2024



Project Abstract: Activity-based Intelligence (ABI) is an analysis methodology, which rapidly integrates data from multiple intelligence sources around the interactions of people, events, and activities, in order to discover relevant patterns, determine and identify change, and characterize those patterns to drive collection and create decision advantage. In this project, we plan to develop Dynamic Scene Graphs over large-scale multimodal time series data for representation learning. The new representation will enable learning from complex and dynamic environment, where a variety of vision tasks can be achieved including open-set object classification and detection, event detection, question-answering, and dense captioning.

Participating Students: Junwen Chen, Wentao Bao, Xinmiao Lin

Effective and Efficient Driving for Material Handling
Michael E. Kuhl (PI); Amlan Ganguly, **Clark Hochgraf**, and **Andres Kwasinski** (Co-PIs)
Raymond Corporation
In collaboration with Intelligent Material Handling Systems lab
2021-2022

Project Abstract: In warehousing operations involving a mix of autonomous and human-operated material handling equipment and people, effective and efficient driving is critical. We propose to address a set of integrated areas of research to enable improved real-time decision making leading to improved productivity, information, and communication. These include human-robot interaction/collaboration – avoiding incidents and improving

predicted actions; and robust, low latency, secure vehicle to vehicle and system communication.

Participating Students: Anton Bogovik, Sriparvathi Bhattathiri, Andrew Pasek, Dylan Lebedin, Ankita Tondwalkar, Rahul Gulia

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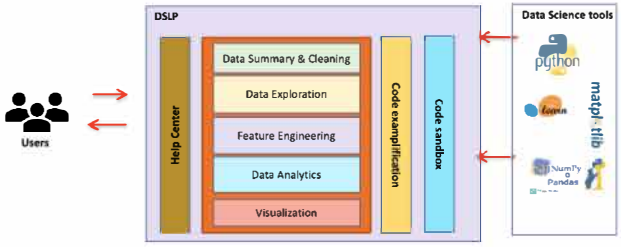
IUCRC: Planning Grant RIT: Center for Smart Spaces Research (CSSR)
Mohan Kumar (PI); **Victor Perotti** and Ferat Sahin (Co-PIs)
National Science Foundation
2021-2023

Project Abstract: Creation of a vibrant multi-university center for smart spaces research and development under the National Science Foundation's (NSF) Industry University Collaborative Research Center (IUCRC) program. Led by the Rochester Institute of Technology (RIT) in partnership with the University of California Irvine (UCI) and the Stony Brook University (Stony Brook), as well as a number of industry partners, this center proposal will create a platform through meetings, discussions and workshops (both virtual and in-person if the pandemic situation permits), to identify critical research and development problems in the fertile area of smart spaces. In broad terms, the center's focus will be on four main areas of relevance to industry, university, and society: 1) Creation of adaptive computing and communications infrastructure; 2) Trustworthy acquisition, processing, interpretation and sustainability, of spatio-temporally constrained data and knowledge; 3) Applications that span all aspects of life and the environment; and 4) creation of diverse and competent workforce.

IUSE:EHR: A Data Science Learning Platform and Curricular Module for Non-Computing Majors Xumin Liu (PI); Erik Golen (Co-PI)
National Science Foundation
2022-2023



Project Abstract: Data science has become inherent across the spectrum and ramped up the demand for data science education across diverse disciplines. However, it is challenging for non-computing majors to access data science curriculum due to the long prerequisite chain of courses in programming, data structures, and introductory databases, as well as relevant mathematics. To address this challenge, this project proposes two deliverables, a web-based platform and an appropriate curriculum, to make hands-on data science accessible for non-computing majors, regardless of their programming and mathematical background. More importantly, these students will learn to use data science techniques in the context of their own disciplines, rather than first

become computer scientists and subsequently data scientists. The non-computing majors covered by the project are those might have taken a high school AP Computer Science Principles (CSP) class or an equivalent CSP course increasingly offered in many colleges, and will take a follow-on Data Science Principles (DSP) course with materials developed by the project.

Participating Students: Eduardo Lima, Liyi Zhang, Sophie Hou, Xiaoyu Zhang, and Vivek Gupta, PhD Students; Maggie Long, Undergraduate Student

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Facial Understanding for Kiosk
Alexander Loui
Kodak Alaris
2020-2022

Project Abstract: Research and develop facial image understanding algorithms for Biometric ID applications. The main objective is to develop advanced machine and deep learning algorithms for kiosk and imaging applications such as face detection and recognition, red eye detection, and facial expression recognition.

Participating Students: Pradumna Suryawanshi, Ritesh Jain, and Karan Manghi

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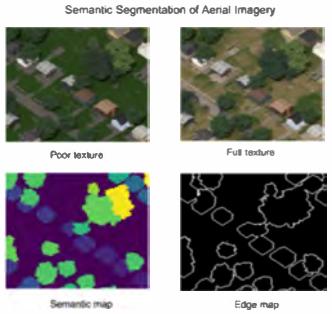
Trilobyte – Autonomous Learning for Full-Spectrum Sims
Alexander Loui (PI) and Carl Salvaggio (Co-PI)
L3Harris Technologies
2020-2022



Project Abstract: This multi-year project aims to develop an end-to-end deep learning solution to generate representative full-spectrum 3D point clouds from single-band imagery, thereby improving the efficiency and accuracy in building full-spectrum synthetic scenes using Digital Imaging and Remote Sensing Image Generation (DIRSIG). The scope of the project includes multimodal data collection as well as development of deep learning based 3D registration and semantic segmentation algorithms.

Participating Students: Rajiv Mandya Nagaraju, Jacob Irizarry

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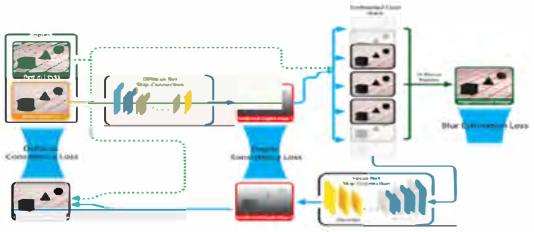
Collaborative Research: SHF: Small: Enabling Efficient 3D Perception: An Architecture-rAlgorithm Co-Design Approach
Guoyu Lu

RESEARCH PROJECTS

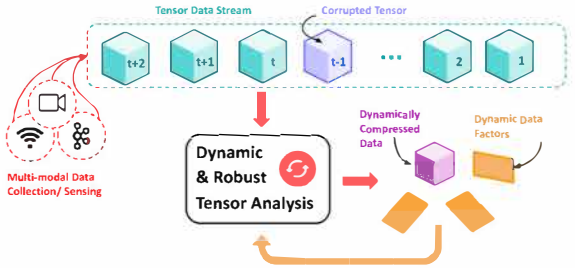
National Science Foundation
2021-2024



Project Abstract: The objective of the proposed research is to rethink the systems stack, from algorithms to hardware, for 3D perception, i.e., point cloud processing, so as to enable 3D perception as a fundamental building block in emerging domains such as autonomous driving, Augmented/Virtual Reality, and smart agriculture.

Participating Student: Yawen Lu

Young Investigator Program (YIP) Award: Theory and Efficient Algorithms for Dynamic and Robust L1-norm Analysis of Tensor Data
Panos Markopoulos
Air Force Office of Scientific Research
2020-2023



Project Abstract: The main objective of this project is to develop theory and efficient algorithms for dynamic and robust analysis of multimodal (tensor) data, based on LI-norm formulations. Specifically, we will first formulate Stochastic L1-norm principal-component analysis (L1-PCA) and investigate for the first time its theoretical underpinnings (graph of metric function, connection to batch formulations, connection to standard stochastic principal component analysis, etc.) Then, we will develop efficient online algorithms for the solution of this problem, based on solid stochastic approximation theory. Next, we will expand these methods for the analysis of tensor data, in the form of dynamic robust decomposition. In addition, emphasis will be placed on the development of scalable algorithms that can be used in systems with limited computational resources.

Participating Students: Dimitris Chachlakis, Mayur Dhanaraj, Ian Tomeo, and Mahsa Mozaffari, PhD Students; Matt Kroll and Duc Le, BS/MS Students

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Efficient Radar Imaging and Machine Learning for Concealed Object Detection
Panos Markopoulos
NYSTAR / UR CoE in Data Science
2021-2022

RESEARCH PROJECTS

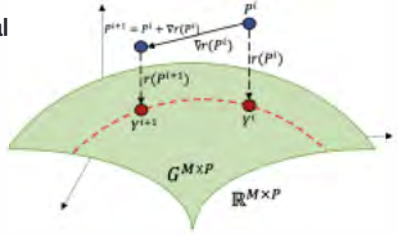
Project Abstract: The ability to detect concealed objects is of critical importance in many civil and military applications. A variety of imaging technologies exist today for the detection of concealed objects, including x-ray, infrared, millimeter-wave, and radar imaging. Most of the existing methods can be impractical in challenging real-world applications either due to their cumbersome non-portable hardware or due to their inefficient signal processing algorithms that need dense time-consuming sensing in order to produce useful results. In this project, we focus on designing efficient algorithms for MIMO radar imaging that can produce results competitive to those of the current state-of-the-art, at a fraction of the sensing/processing time. Our methods will be coded, deployed, and tested in real-world settings.

Continual and Incremental Learning with Tensor-Factorized Neural Networks
Panos Markopoulos
Air Force Research Laboratory/Griffiss Institute
2021

Project Abstract: In this project we will investigate the capability of tensor-based network factorization to allow for incremental and continual learning.

Participating Student: Matt Kroll (BS/MS)

Collaborative Research: CDS&E: Theoretical Foundations and Algorithms for L1-Norm-Based Reliable Multi-Modal Data Analysis
Panos Markopoulos (PI); **Andreas Savakis** (Co-PI)
National Science Foundation
2018-2021

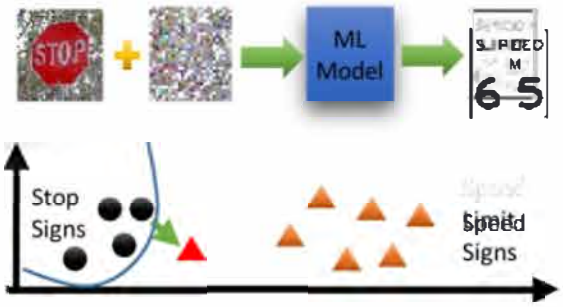


Project Abstract: This project focuses on providing theoretical foundations and algorithmic solutions for reliable, L1-norm-based analysis of multi-modal data (tensors). The proposed research is organized in three main thrusts. In Thrust 1, we will focus on investigating theoretically (e.g., hardness and connections to known problems) and solving L1-norm-based Tucker and Tucker2 decompositions (L1-TUCKER and L1-TUCKER2, respectively). In Thrust 2, we will focus on developing efficient (i.e., low-cost, near-optimal) and distributed solvers for L1-TUCKER and L1-TUCKER2, appropriate for the analysis of big data and data in the cloud. In Thrust 3, we will investigate the application of the developed algorithms to tensor analysis paradigms from the fields of computer vision, deep learning, and social-network and stock-content data analytics. Overall, this project aspires to provide algorithmic solutions that will support reliable data-enabled research in a plethora of disciplines across science and engineering.

Participating Student: Navya Nagananda, PhD student Imaging Science

RESEARCH PROJECTS

Towards Adversarially Robust Neuromorphic Computing
Cory Merkel
Air Force Research Laboratory
2020-2023



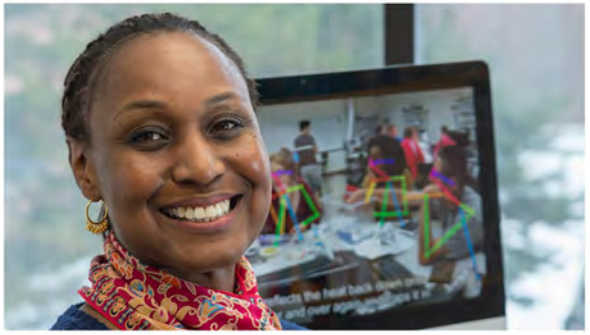
Project Abstract: The recent artificial intelligence (AI) boom has created a growing market for AI systems in size, weight, and power (SWaP)-constrained application spaces such as wearables, mobile phones, robots, unmanned aerial vehicles (UAVs), satellites, etc. In response, companies like IBM, Intel, and Google, as well as a number of start-ups, universities, and government agencies are developing custom AI hardware (neuromorphic computing systems) to enable AI at the edge. However, many questions related to these systems' security and safety vulnerabilities still need to be addressed. Since the early 2000's a number of studies have shown that AI and especially deep learning algorithms are susceptible to adversarial attacks, where a malicious actor is able to cause high-confidence misclassifications of data. For example, an adversary may easily be able to hide a weapon from an AI system in plain sight by painting it a particular color. A number of defense strategies are being created to improve AI algorithm robustness, but there has been very little work related to the impact of hardware-specific characteristics (especially noise in the forms of low precision, process variations, defects, etc.) on the adversarial robustness of neuromorphic computing platforms. To fill this gap, we propose the following research objectives: Objective 1. Evaluate and model the effects of noise on the susceptibility of neuromorphic systems to adversarial attacks. Objective 2. Design adversarially-robust training algorithms for neuromorphic systems. Objective 3. Develop novel adversarial attacks that leverage hardware-specific attributes of neuromorphic systems.

Participating Students: Andrew Meyer (CE BS/MS), Sophie Kotok (Math Modeling Ph.D.), Justin Sostre (Math Modeling Ph.D.), Anusha Holavanahali (CE BS/MS)

CAREER: A Computational Approach to the Study of Behavior and Social Interaction
Ifeoma Nwogu
National Science Foundation
2019-2024

Project Abstract: In this work, the classical social challenge of studying the interactive behaviors of humans in a group is cast as one of computationally modeling the collective properties of multiple interacting, dynamic multimodal signals in a network. We aim to develop a comprehensive set of network analysis methods that use Bayesian trained neural networks to learn the constantly changing structural patterns of a social network, which itself is made up

RESEARCH PROJECTS



of interact-ing temporal signals. In this five-year pro-posal, our integrated research, education and outreach goals aim to: (i) collect and collate data generated in small face-to-face, complex, real-life contexts; (ii) develop new, interpretable, dynamic neural network mod-els, to evaluate the collective properties of constantly changing graphs that represent how people in small social groups interact with one another over time; (iii) form a global consortium of academic participants (researchers, graduate and undergraduate students) that have a set of core competencies in arti-ficial intelligence, computer vision and human language research, with the specific goal of sup-porting underrepresented STEM groups.

Demonstration of Multi-gamma Based Sensor Technology for As-Fired Coal Property Measurement
Shuchita Patwardhan (PI, Microbeam Technologies Inc.), Travis Desell (Co-PI, RIT), David Swindell (Energy Technologies, Inc., Co-PI)
Department of Energy, High Fidelity Field Testing of Technologies
2019-2022

Project Abstract: This work focuses on incorporating data from an advanced multi-gamma attenuation (MGA) sensor into neuro-evolution algorithms designed to automate the design of recur-rent neural networks (RNNs) to predict time series data generated by coal fired power plants. This work will be incorporated within CoalTracker, software developed Microbeam Technologies, Inc. (MTI) to help manage the operations of coal fired power plants. Points of study include determin-ing if the RNNs can gain more predictive ability through online training after being initially trained and developed, can they be further refined as they predict incoming data); etc); incorporation of non-time series categorical data into the prediction process (which could include other infor-mation about the plant state); and studying how far into the future accurate predictions can be made.

Participating Student: Zimeng Lyu (PhD)

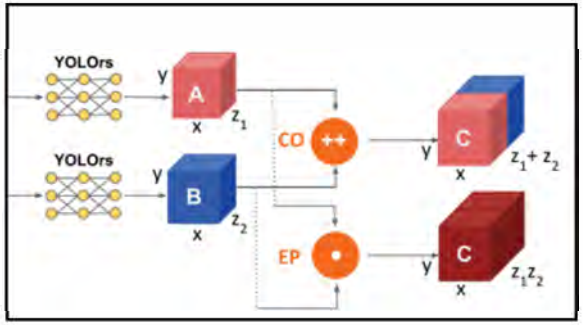
AOI 1A - Improving Coal Fired Plant Performance through Integrated Predictive and Condition-Based Monitoring Tools
Shuchita Patwardhan (PI, Microbeam Technologies Inc.), Steve Benson (Co-PI, Microbeam Technologies Inc.), and Travis Desell (Co-PI)
Department of Energy

2018-2021

Project Abstract: The overall proposed project goal is to demonstrate at a full-scale coal-fired power plant the ability to improve boiler operations through the use of condition based monitoring to optimize coal properties and boiler operations. Microbeam working with the University or North Dakota (UND), Rochester Institute of Technology (RIT) and project partners propose to develop an advanced tool for coal-fired power plants to actively monitor and manage overall boiler health, maximize availability and maintain generating capacity while saving cost. The tool will be used to alert plant operators and engineers about poor boiler conditions which may occur as a result of incoming coal and/or current power plant parameters. The tool is built on Microbeam's current tools that includes a Combustion System Performance Indices (CSPI) and coal tracker (CT). The CSPI uses coal composition on delivered fuel properties derived from full stream elemental analyzers based on prompt gamma neutron activation analysis (PGNAA) or delivered coal properties to calculate coal quality impacts on the fireside performance or the plant including slagging, fouling, erosion, and corrosion. This software is currently in operation at a coal fired power plant but is not integrated with sensors. During this project the CSPI-CT will be integrated with fireside sensors such as temperature, gas composition, burner operation, heat flux sensors, and soot blower cycling, In addition, to the integration of the sensors to enable condition based monitoring the information derived from testing will be used in an artificial neural network to improve predictions and decision making. The ultimate goal of this program is to automate the operations of the CSPI-CT into the plant control systems.

Participating Students: Zimeng Lyu (PhD), AbdElRahman ElSaid (PhD - graduated 2021)

Target Detection/Tracking and Activity Recognition from Multimodal Data
Eli Saber (PI); **Panos Markopoulos** and **Raymond Ptucha** (Co-PIs)
National Geospatial-Intelligence Agency
2019-2024

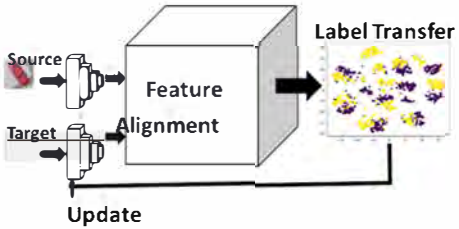


Project Abstract: Our primary objectives in this proposal are to develop operational target detection/tracking techniques and activity recognition/understanding methods that possess the capability to leverage multimodal data in a fusion framework using deep learning algorithms and coupled tensor techniques while providing accurate and near real-time performance. The proposed methodology is divided into four major stages: (1) pre-processing, (2) co-registration and fusion, (3) target detection and tracking, and (4) activ-ity recognition and scene understanding. The aforementioned algorithms will be benchmarked against existing state of the art techniques to highlight their advantages and distinguish their abilities. The above is

intended to assist analysts to effectively and efficiently ingest large volumes of data, or perform object detection and tracking in real-time under dynamic settings.

Participating Students: Manish Sharma (PHD)

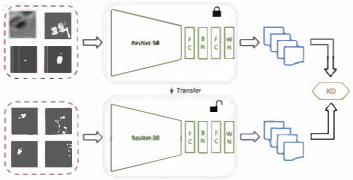
Data-Driven Adaptive Learning for Video Analytics
Andreas Savakis, PI; **Chris Kanan** and **Panos Markopoulos**, Co-PIs
Air Force Office of Scientific Research
2018-2021



Project Abstract: The objective of this research project is to design a Data Driven Adaptive Learning framework for visual recognition. The adaptive nature of this framework is suitable for recognition in new domains, that are different from those used for training, and in data starved environments where the number of available training samples is small. We design classification engines that learn incrementally, without full retraining, using continuous updating methods as new data become available. These adaptive learners will incorporate weakly labeled data as well as human in the loop to facilitate annotation of previously unseen data, and will adapt to new environments dynamically in cooperation with multimodal sensors and a dynamic control unit. We design, implement and test the following classifier engines as they have high potential to operate effectively within our framework: a) incremental subspace learning using robust techniques and related applications to classification and adaptation to new domains; b) adaptive deep learning and applications to recognition of people, vehicles, etc.

Participating Students: Abu Taufique, PhD student Imaging Science, Navya Nagananda, PhD student Imaging Science

Multimodal Sensing, Domain Adaptation and Transfer Learning
Andreas Savakis
USAF SBIR (with IFT)
2021-2023



Project Abstract: The proposed project is to extend basic research in contemporary areas that supports the vision of artificial intelligence (AI) autonomy for real time operational support. AI for computer vision consists of Deep Learning and Machine Learning from which typical examples focus on multi-media content such as imagery; but basic research theory elements of joint multimodal DL have yet to be realized for intelligence, surveil-

lance, and reconnaissance applications such as electro-optical (EO) and synthetic aperture radar (SAR). Additionally, there is a need to transfer from one domain (e.g., SAR) to another domain (e.g. EO) in contexts where data availability is limited.

Participating Students: Abu Taufique and Chowdury Sadman Jahan, PhD Students Imaging Science

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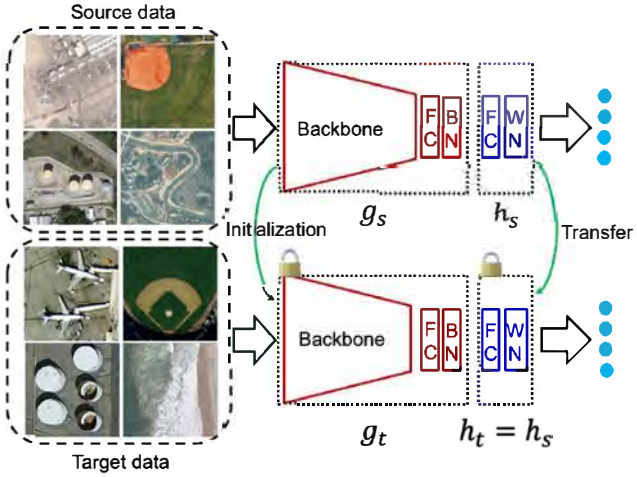
Global Surveillance Augmentation Using Commercial Satellite Imaging Systems
Andreas Savakis
USAF SBIR (with Kitware Inc.)
2020-2023 and
NYS/UR Center for Emerging and Innovative Systems (CEIS)
2021



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Participating students: Abu Taufique, PhD student Imaging Science, Chowdury Sadman Jahan

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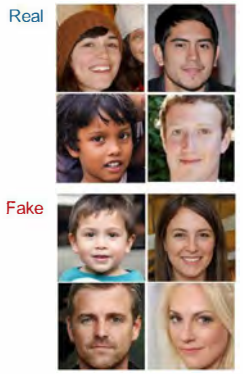
MANFID: Multiple Attribution Network based Fake Imagery Detection
Andreas Savakis
USAF SBIR (with IFT)
2021
We propose a novel deep learning approach for the detection of GAN generated fake images. A multiple attribution network is proposed for the detection of GAN fingerprints in images in order

to determine whether an image is real or fake. The method will be trained and tested for robustness to noise, geometric transformations and compression.



Participating Students: Sadman Jahan, PhD student Imaging Science, Raaga Madappa, MS student Computer Engineering

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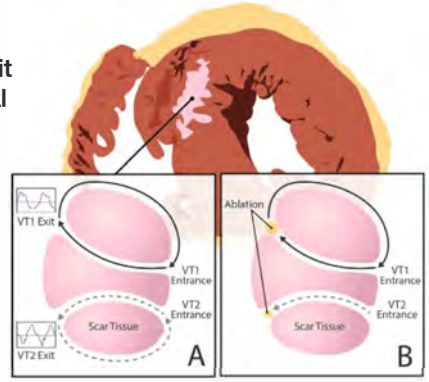
Peri-procedural transmural electrophysiological imaging of scar-related ventricular tachycardia
Linwei Wang
DHHS/National Institutes of Health
2018-2022

The majority of life-threatening ventricular arrhythmia episodes are caused by an electrical "short circuit", formed by a narrow channel of surviving tissue inside myocardial scar. An important treatment is to target and destroy these culprit slow-conducting channels. Unfortunately, with conventional catheter mapping, up to 90% of the VT circuits are too short-lived to be mapped. For the 10% "mappable" VTs, their data are available only during ablation and limited to one ventricular surface. This inadequacy of functional VT data largely limits our current ablation strategies. The goal of this proposal is to develop a novel technique to provide pre- and post-ablation functional arintrhythmia data – integrated with LGE-MRI scar data in 3D – to improve ablation with pre-procedural identification of ablation targets and post-procedural mechanistic elucidation of ablation failure. Its specific objectives include: 1) To develop and validate a peri-procedural electrocardiographic imaging (ECGi) technique for mapping scar-related VT circuits. 2) To integrate LGE-MRI scar into ECGi for improved electroanatomical investigations of VT circuits. 3) To perform clinical evaluation of pre-ablation and post-ablation MRI-ECGi of scar-related VT. This project is carried out in collaboration with Siemens Healthineers, Nova Scotia Health Authority, and University of Pennsylvania.



Participating Students: Prashnna Kumar Gyawali, Md Shakil Zaman, o.gharbia gharbia, and Ryan Missel, PhD Students; Jaideep Vitthal Murkute and Swapnil Shah, MS Students

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Collaborative Research: SaTC: CORE: Small: DeFake: Deploying a Tool for Robust Deepfake Detection
Matthew Wright (PI); **Yu Kong** (Co-PI)
National Science Foundation
2021-2024

RESEARCH PROJECTS

Project Abstract: Deepfakes can be used to take misinformation and deception to new and dangerous levels, as videos can be made – with relatively little time or expertise – that show anyone saying anything. In this project, we will combat this threat by developing a tool that can help detect deepfakes. There are three key areas that we will work on in this project to make the tool robust and useful for journalists and other users. First, we will make the tool capable of detecting a broad range of deepfakes in a variety of real-world conditions. Second, we will harden the tool against the threat of adversarial examples that could render an otherwise accurate tool ineffective by confusing our algorithms. Third, we will extend our outreach to journalists by per-forming usability tests with the developed tool, offering webinars and training at conferences for journalists, and helping to build a community of journalists and technologists for understanding the state of research and practice in deepfakes. This project will thus take our prototype tool and make it a powerful part of the fight against misinformation.

BaitBuster 2.0: Keeping Users Away From Clickbait
Matthew Wright (PI); **Yu Kong** (Co-PI)
National Science Foundation
2020-2024

Project Abstract: Social networking sites (SNS) like Facebook are popular platforms for spreading clickbait, which often directs users to fraudulent websites containing spyware, malware, and phishing sites. In this project, we propose to explore ways to protect users online by detecting clickbait and providing effective warnings to keep users from clicking them. As more of the Web is moving to video, it has become more im portant to detect and stop video-based clickbait. We will begin by collecting the first dataset of video click bait, and then leverage both the textual and video content of this dataset to explore ways of identifying vid eo clickbait. We will also study the clicking behavior and corresponding mental security models of users to have a clear under-standing of their vulnerability to clickbait, and finally build these findings to design and evaluate warning systems to protect users from clicking on clickbait, integrate the top-performing warning scheme into BaitBuster, and perform an evaluation of the complete system's usability and effica-cy. We will make our BaitBuster API available so that services like NewsCheck.com (which uses the current BaitBuster APIs), SNS platforms, and web browsers can easily deploy our techniques. In our educational efforts, we will design a comic-based online security training to help users securely navigate SNS and make it publicly available. The project has strong potential to engage underrepresented groups, and we will leverage that via a series of outreach efforts and a set of videos to encourage girls to consider cybersecurity as a career.

Participating Student: Junwen Chen

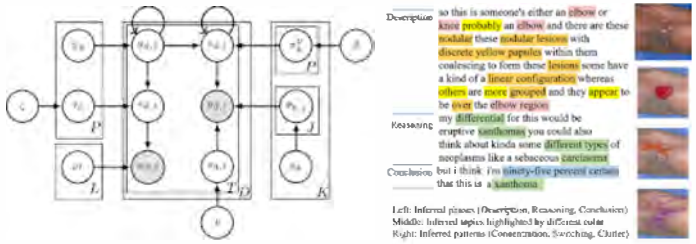
DeFake Detection Tool
Matthew Wright (PI); Yu Kong (Co-PI)
Knight Foundation
2020-2022

RESEARCH PROJECTS

Project Abstract: Deepfake video technology drastically erodes the knowledge barrier required to generate high-quality modifications to speeches in videos. It could become a potent tool in the hands of motivated adversaries to create disinformation campaigns that threaten democracies as well as personal lives, harming reputations and potentially the faith of the public in news media. This project addresses the problem through a user-centric approach to develop a robust deepfake detection tool that would aid the journalists in video verification. Alongside the development, the project aims to build and guide a collaborative community to counter malicious deepfake-related content.

Participating Student: Xinmiao Lin

Utilizing Synergy between Human and Computer Information Processing for Complex Visual Information Organization and Use
Qi Yu
National Science Foundation
2018-2022



Project Abstract: This project will research computational models to represent different elements in human knowledge, aiming to understand how their interaction with image data underlies human image understanding. The modeling outcomes will inform algorithmic fusion of human knowledge with image content to create novel representations of image semantics as a result of human-machine synergy.
Participating Students: Weishi Shi, Minxun Zheng

Using Novel Scientific Learning to Revolutionize Computational Methods for High-Energy Density Physics
Qi Yu
Department of Energy/University of Rochester
2021-2022

Project Abstract: The overall goal of the proposed project is to develop a novel scientific machine learning framework to infer a universal non-interacting free-energy density functional from large-scale Kohn-Sham Density-Functional Theory (KS-OFT) data. It will enable orbital-free OFT (OF-OFT) for accurate and efficient understanding of dynamic material properties and provide essential scientific tools for discovery of function materials at extreme conditions.

RESEARCH PROJECTS

A Multimodal Dynamic Bayesian Learning Framework for Complex Decision-making
Qi Yu (PI), Yu Kong (Co-PI)
Office of Naval Research
2018-2022

Project Abstract: The overall goal of this project is to explore a multimodal dynamic Bayesian learning framework to facilitate complex decision-making in various highly complicated battle-field scenarios and military tasks. The proposed framework aims to provide comprehensive decision support in four innovative and connected ways to maximize the overall effectiveness of complex decision-making: (1) to analyze large-scale, heterogeneous, and dynamic data streams from multiple sources and extract high-level and meaningful features, (2) to algorithmically fuse multimodal data streams and provide decision recommendations with interpretable justifications, uncertainty evaluation, and estimated costs to prioritize/coordinate multiple missions (3) to iden-tify sources of uncertainty and offer informative guidance for cost-effective information gathering, and (4) to visualize model outcome and allow intuitive interactions with the human team for col-laborative learning and continuous model improvement to achieve high-quality decisions.

Participating Student: Wentao Bao

Measurement and relationship of physiological arousal and stress in children with ASD and caregivers
Zhi Zheng (PI); Peter Bajorski (Co-PI)
NIH/UR Center for Emerging and Innovative Systems (CEIS)
2021-2022

The proposed research is a cross-sectional evaluation of the bidirectional relationship between parent and child arousal in dyads that include a child with autism spectrum disorder (ASD) and their primary caregiver. We propose the use of a wearable device that captures physiological stress data in parent/child dyads. Caregivers will complete diaries to provide context to specific events during which arousal and stress are likely to be high. The focus on the multiple factors that influence caregiver health will help meet both current and future health care needs in this population, which to date are largely unexplored. RIT researchers will be responsible for the configuration of physiological sensors, physiological data processing and analysis, as well as statistical analysis for the whole project.

Participating Students: Zhiwei Yu, Shida Li

AWARDS & RECOGNITIONS

Cecilia Alm, Reynold Bailey, and their team of faculty mentors' three undergraduate students -- Anisa McKenzie Callis, Adriel Juarez, and Rachel Miller, collaborating with other students and faculty and participating in the NSF REU Site in Computational Sensing for Human-centered AI -- present at the national CUR REU Symposium, online, 2021.

Matt Huenerfauth and Akhter Al Amin are finalists for Best Poster Award for "Perspectives of Deaf and Hard-of-Hearing Viewers on Live-TV Caption Quality," in iConference 2021: Diversity, Divergence, Dialogue, Poster Presentation, 2021.

Matt Huenerfauth and his colleagues are nominees for the best paper award (top 7% of submissions) for "American Sign Language Video Anonymization to Support Online Participation of Deaf and Hard of Hearing Users" presented at the 23rd International ACM SIGACCESS Conference on Computers and Accessibility ASSETS'21). Matt Huenerfauth is a five-time winner of the Best Paper Award at ASSETS, which is more than any other individual in the history of the conference, 2021.

Christopher Kanan is awarded the prestigious Faculty Early Career Development (CAREER) Program Award from the National Science Foundation (NSF) for the project entitled "Brain-inspired Methods for Continual Learning of Large-scale Vision and Language Tasks." 2021-2026.

Christopher Kanan's PhD advisee, Manoj Acharya, receives 2nd Place Solution (2nd in competition] for SODA10M Challenge 2021 – Continual Detection Track. In: ICCV 2021 Workshop: Self-supervised Learning for Next-Generation Industry-level Autonomous Driving, 2021.

Christopher Kanan wins W&B Best Library Award, Avalanche with V. Lomonaco, L. Pellegrini, A. Cossu, A. Carta, G. Graffieti, T. Hayes, M. De Lange, M. Masana, J. Pomponi, G. Ven, M. Mundt, Q. She, K. Cooper, J. Forest, E. Belouadah, S. Calderara, G. Parisi, F. Cuzzolin, A. Tolias, S. Scardapane, L. Antiga, S. Ahmad, A. Popescu, J. Weijer, T. Tuytelaars, D. Bacciu, and D. Maltoni: An End-to-End Library for Continual Learning. CVPR Workshop on Continual Learning in Computer Vision (CLVISION), 2021.

Panos Markopoulos' PhD advisee, Dimitris Chachlakis, is the first student awarded a doctoral degree from the new RIT program PhD in Electrical and Computer Engineering (2021) as a member of Dr. Markopoulos' MILOS lab.

Ferat Sahin is elevated to Senior Member status of the IEEE Robotics and Automation Society (Rochester section, 2021).

Panos Markopoulos is awarded the prestigious Young Investigator Program (YIP) Award from the Air Force Office of Scientific Research (AFOSR) for the project entitled "Theory and Efficient Algorithms for Dynamic and Robust L1-norm Analysis of Tensor Data." 2020-2023.

SPONSORS & PARTNERS

PUBLICATIONS

Cecilia O. Alm

Cecilia O. Alm, Reynold Bailey, and Hannah Miller. 2022. Remote early research experiences for undergraduate students in computing. In Proceedings of the SIGCSE Technical Symposium 2022, 43-49, Providence, Rhode Island.

Trent Rabe, Anisa Callis, **Zhi Zheng, Jamison Heard, Reynold Bailey**, and **Cecilia O. Alm**. Forthcoming. Theory of mind assessment with human-human and human-robot interactions. Accepted to appear in HCII 2022, online.

Nikhil Kaushik, **Reynold Bailey**, Alexander Ororbia and **Cecilia O. Alm**. 2021. Eliciting confusion in online conversational tasks. In Proceedings of the 9th International Conference on Affective Computing and Intelligent Interaction Workshops and Demos (at ACII 2021), 1-5, Nara, Japan (online). doi: 10.1109/ACIIW52867.2021.9666351.

Subhra Tewari, Renos Zabounidis, Ammina Kothari, **Reynold Bailey**, and **Cecilia O. Alm**. 2021. Perceptions of human and machine-generated articles. Journal of Digital Threats: Research and Practice, 2(2): 1-16.
Cecilia O. Alm and **Reynold Bailey**. 2021. Transitioning from teaching to mentoring: Supporting students to adopt mentee roles. Journal for STEM Education Research, 4(1), 95-114. doi:10.1007/s41979-020-00045-9.
Saad Hassan, **Matt Huenerfauth,** and **Cecilia O. Alm**. 2021. Unpacking the interdependent systems of discrimination: Ableist bias in NLP systems through an intersectional lens. Findings of the Association for Computational Linguistics: EMNLP 2021, 3116-3123, Punta Cana, Dominican Republic.

Farhad Akhbardeh, **Cecilia O. Alm**, Marcos Zampieri, and **Travis Desell**. 2021. Handling extreme class imbalance in technical logbook datasets. In Proceedings of the 59th Annual Meeting of the Association for Computational Linguistics and the 11th International Joint Conference on Natural Language Processing (Long Papers), pages 4034-4045, online.

Cecilia O. Alm and Alex Hedges. 2021. Visualizing NLP in undergraduate students' learning about natural language. In Proceedings of the AAAI Conference on Artificial Intelligence, 35(17), pages 15480-15488, EAAI-21, online.

Cecilia O. Alm and **Reynold Bailey**. 2021. REU mentoring engagement: Contrasting perceptions of administrators and faculty. Proceedings of the 52nd ACM Technical Symposium on Computer Science Education, page 1257, online. Poster.

Additional Publications

Reynold Bailey

Cecilia Ovesdotter Alm, Reynold Bailey, and Hannah Miller, "Remote early research experiences for undergraduate students in computing", Proceedings of the SIGCSE 2022 Technical Symposium, to appear.

Trent Rabe, Anisa Callis, **Zhi Zheng, Jamison Heard, Reynold Bailey,** and **Cecilia Alm**, "Theory of Mind Assessment with Human-Human and Human-Robot Interactions", Proceedings of HCI International 2022, to appear.

Rakshit Kothari, Aayush Chaudhary, **Reynold Bailey**, Jeff Pelz, Gabriel Diaz, "Ellseg: An Ellipse Segmentation Framework for Robust Gaze Tracking", IEEE Transactions on Visualization and Computer Graphics (TVCG) -

special issue on IEEE Virtual Reality and 3D User Interfaces, Vol. 27, No. 5, pp. 2757-2767, 2021.

Subhra Tewari, Renos Zabounidis, Ammina Kothari, **Reynold Bailey**, and **Cecilia Ovesdotter Alm**, "Perceptions of human and machine-generated articles", Journal of Digital Threats: Research and Practice (DTRAP), Vol. 2, No. 2, Ar. 12, pp. 1-16, 2021.

Cecilia Ovesdotter Alm and **Reynold Bailey**, "Transitioning from teaching to mentoring: Supporting students to adopt mentee roles", Journal for STEM Education Research, Vol. 4, No. 1, pp. 95-114, 2021.

Nikhil Kaushik, Reynold Bailey, Alexander Ororbia, and **Cecilia Ovesdotter Alm**, "Eliciting Confusion in Online Conversational Tasks", Proceedings of the International Conference on Affective Computing & Intelligent Interaction ACII – Fifth International Workshop on Multimodal Analyses enabling Artificial Agents in Human-Machine Interaction, 2021.

Cecilia Ovesdotter Alm and **Reynold Bailey**, "REU mentoring engagement: Contrasting perceptions of administrators and faculty", Proceedings of the 52nd ACM Technical Symposium on Computer Science Education, pp. 1257, 2021.

Additional Publications

Travis Desell

Farhad Akhbardeh, **Cecilia Ovesdotter Alm**, Marcos Zampieri and **Travis Desell**. Handling Extreme Class Imbalance in Technical Logbook Datasets. In Proceedings of the 59th Annual Meeting of the Association for Computational Linguistics and the 11th International Joint Conference on Natural Language Processing (ACL-IJCNLP 2021). Bangkok, Thailand. August 2-4, 2021.

Zimeng Lyu, Shuchita Patwardhan, David Stadem, James Langfeld, Steve Benson, and **Travis Desell**. Neuroevolution of Recurrent Neural Networks for Time Series Forecasting of Coal-Fired Power Plant Data. ACM Workshop on NeuroEvolution@Work (NEWK@Work}, held in conjunction with ACM Genetic and Evolutionary Computation Conference (GECCO). Lille, France. July 10-14, 2021.

Joshua Karns and **Travis Desell**. Improving the Scalability of Distributed Neuroevolution Using Modular Congruence Class Generated Innovation Numbers. The 1st Workshop on Evolutionary Algorithms and High Performance Computing (EAHPC), held in conjunction with ACM Genetic and Evolutionary Computation Conference (GECCO). Lille, France. July 10-14, 2021.
AbdElRahman ElSaid, Joshua Karns, Zimeng Lyu, Alexander Ororbia and Travis Desell. Continuous Ant-Based Neural Topology Search. The 24th International Conference on the Applications of Evolutionary Computation (EvoStar: EvoApps 2021). Online. April 7-9, 2021.

Zimeng Lyu, AbdElRahman ElSaid, Joshua Karns, Mohamed Mkaouer and **Travis Desell**. An Experimental Study of Weight Initialization and Lamarckian Inheritance on Neuroevolution. The 24th International Conference on the Applications of Evolutionary Computation (EvoStar: EvoApps 2021). Online. April 7-9, 2021.

Zimeng Lyu, AbdElRahman ElSaid, Joshua Karns, Mohamed Mkaouer and **Travis Desell**. Improving Distributed Neuroevolution Using Island Extinction and Repopulation. The 24th International Conference on the Applications of Evolutionary Computation (EvoStar: EvoApps 2021). Online. April 7-9, 2021.

Additional Publications

PUBLICATIONS

Jamison Heard

Prakash Baskaran, **Jamison Heard**, and Julie A. Adams. Emergency Clinical Detection via Wearable Sensors. In Press for Conference for the Human Factors and Ergonomics Society, 2021.

Patent:
Fabbri, Daniel, Joseph Coco, Cheng Ye, Deirdre Scully, Candace McNaughton, Jesse Ehrenfeld, Christopher Simpson, Laurie Novak, Sean Bloos, Robert Bodenheimer, Richard Paris, Julie A. Adams, and **Jamison Heard**. "Automatic Sensing for Clinical Decision Support." U.S. Patent Application 17/203,204, filed September 16, 2021.

Additional Publications

Clark Hochgraf

R. S. Gulia, S. A. Mamun, A. Vashist, A. Ganguly, **C. Hochgraf, A. Kwasinski**, M. Kuhl (2022) "Evaluation of Wireless Connectivity in an Automated Warehouse at 60 GHz," Proceedings - 2022 IEEE International Conference on Consumer Electronics (ICCE).

A. Vashist, M.-P. Li, A. Ganguly, **C. Hochgraf, R. Ptucha, A. Kwasinski**, M. E. Kuhl. "KF-Loc: A Kalman Filter and Machine Learning Integrated Localization System Using Consumer-Grade Millimeter-wave Hardware." IEEE Consumer Electronics Magazine, doi: 10.1109/MCE.2021.3101060.

Additional Publications

Matt Huenerfauth

Sushant Kafle, Becca Dingman, **Matt Huenerfauth**. 2021. "Deaf and Hard-of-Hearing Users Evaluating Designs for Highlighting Key Words in Educational Lecture Videos." ACM Transactions on Accessible Computing, 14, 4, Article 20 (December 2021), 24 pages. DOI: https://doi.org/10.1145/3470651

Saad Hassan, Oliver Alonzo, Abraham Glasser, and **Matt Huenerfauth**. 2021. "Effect of Sign-recognition Performance on the Usability of Sign-language Dictionary Search." ACM Transactions on Accessible Computing, 14, 4, Article 18 (December 2021), 33 pages. DOI: https://doi.org/10.1145/3470650

Danielle Bragg, Naomi Caselli, Julie A. Hochgesang, **Matt Huenerfauth**, Leah Katz-Hernandez, Oscar Koller, Raja Kushalnagar, Christian Vogler, Richard E. Ladner. 2021. "The FATE Landscape of Sign Language AI Datasets: An Interdisciplinary Perspective." ACM Transactions on Accessible Computing, 14, 2, Article 7 (July 2021), 45 pages. DOI: https://doi.org/10.1145/3436996

Akhter Al Amin, Abraham Glasser, Raja Kushalnagar, Christian Vogler, **Matt Huenerfauth**. 2021. "Preferences of Deaf or Hard of Hearing Users for Live-TV Caption Appearance." In: Antona M., Stephanidis C. (eds) Universal Access in Human-Computer Interaction. Access to Media, Learning and Assistive Environments. HCII 2021. Lecture Notes in Computer Science, vol 12769. Springer, Cham. https://doi.org/10.1007/978-3-030-78095-1_15

Akhter Al Amin, Saad Hassan, **Matt Huenerfauth**. 2021. "Effect of Occlusion on Deaf and Hard of Hearing

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Users' Perception of Captioned Video Quality." In: Antona M., Stephanidis C. (eds) Universal Access in Human-Computer Interaction. Access to Media, Learning and Assistive Environments. HCII 2021. Lecture Notes in Computer Science, vol 12769. Springer, Cham. https://doi.org/10.1007/978-3-030-78095-1_16

Saad Hassan, **Matt Huenerfauth, Cecilia Ovesdotter Alm**. 2021. "Unpacking the Interdependent Systems of Discrimination: Ableist Bias in NLP Systems through an Intersectional Lens." In Findings of the Association for Computational Linguistics: EMNLP 2021, Punta Cana, Dominican Republic, November 2021. Pages 3116-3123. Association for Computational Linguistics. https://aclanthology.org/2021.findings-emnlp.267 [34.9% aggregate acceptance rate for EMNLP and Findings of EMNLP]

Sooyeon Lee, Abraham Glasser, Becca Dingman, Zhaoyang Xia, Dimitris Metaxas, Carol Neidle, **Matt Huenerfauth.** 2021. "American Sign Language Video Anonymization to Support Online Participation of Deaf and Hard of Hearing Users." In The 23rd International ACM SIGACCESS Conference on Computers and Accessibility (ASSETS'21). Association for Computing Machinery, New York, NY, USA, Article 22, 1–13. DOI: https://doi.org/10.1145/3441852.3471200. [29% paper acceptance rate]
Conference Award: Best Paper Nominee, ASSETS 2021. (Top 7% of submissions were nominees.)

Sedeeq Al-khazraji, Becca Dingman, Sooyeon Lee, **Matt Huenerfauth.** 2021. "At a Different Pace: Evaluating Whether Users Prefer Timing Parameters in American Sign Language Animations to Differ from Human Signers' Timing." In The 23rd International ACM SIGACCESS Conference on Computers and Accessibility (ASSETS'21). Association for Computing Machinery, New York, NY, USA, Article 40, 1–12. DOI: https://doi.org/10.1145/3441852.3471214 [29% paper acceptance rate]

Oliver Alonzo, Jessica Trussell, Becca Dingman, **Matt Huenerfauth.** 2021. "Comparison of Methods for Evaluating Complexity of Simplified Texts among Deaf and Hard-of-Hearing Adults at Different Literacy Levels." In Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems (CHI '21). Association for Computing Machinery, New York, NY, USA, Article 279, 1–12. DOI: https://doi.org/10.1145/3411764.3445038 [23% paper acceptance rate]

Vaishnavi Mande, Abraham Glasser, Becca Dingman, **Matt Huenerfauth.** 2021. "Deaf Users' Preferences Among Wake-Up Approaches during Sign-Language Interaction with Personal Assistant Devices." In Extended Abstracts of the 2021 CHI Conference on Human Factors in Computing Systems. Association for Computing Machinery (CHI'21), New York, NY, USA, Article 370, 1–6. DOI: https://doi.org/10.1145/3411763.3451592 [27% paper acceptance rate]

Abraham Glasser, Vaishnavi Mande, **Matt Huenerfauth.** 2021. "Understanding Deaf and Hard-of-Hearing Users' Interest in Sign-Language Interaction with Personal-Assistant Devices." In Proceedings of the 18th International Web for All Conference - Accessibility and Crisis (W4A'21). ACM, New York, NY, USA. DOI: https://doi.org/10.1145/3430263.3452428 [53% paper acceptance rate]

Akhter Al Amin, Saad Hassan, **Matt Huenerfauth.** 2021. "Caption-Occlusion Severity Judgments across Live-Television Genres from Deaf and Hard-of-Hearing Viewers." In Proceedings of the 18th International Web for All Conference - Accessibility and Crisis (W4A'21). ACM, New York, NY, USA. DOI: https://doi.org/10.1145/3430263.3452429 [53% paper acceptance rate]

Matthew Seita, Sarah Andrew, **Matt Huenerfauth.** 2021. "Deaf and Hard-of-Hearing Users' Preferences for Hearing Speakers' Behavior during Technology-Mediated In-Person and Remote Conversations." In Proceedings of the 18th International Web for All Conference - Accessibility and Crisis (W4A'21). ACM, New York, NY, USA. DOI: https://doi.org/10.1145/3430263.3452429 [53% paper acceptance rate]

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Matt Huenerfauth. 2021. “Human-Computer Interaction and Automatic Text Simplification: Understanding the Perspective of Deaf and Hard of Hearing Users.” In: Saggion, H., Štajner, S. and Ferrés, D. (Eds). Proceedings of the First Workshop on Current Trends in Text Simplification (CTTS 2021), co-located with SEPLN 2021. Spanish Society for Natural Language Processing. September 21st, 2021 (Online). http://ceur-ws.org/Vol-2944/abstract1.pdf

Akhter Al Amin, **Matt Huenerfauth.** 2021. “Perspectives of Deaf and Hard-of-Hearing Viewers on Live-TV Caption Quality.” In iConference 2021: Diversity, Divergence, Dialogue. Poster Presentation. Conference Award: Finalist for Best Poster Award, iConference 2021.

Additional Publications

Christopher Kanan

Gallardo, J., Hayes, T.L., **Kanan, C.** (2021) Self-Supervised Training Enhances Online Continual Learning. In: British Machine Vision Conference (BMVC). [36% accept rate]

Acharya, M., **Kanan, C.** (2021) 2nd Place Solution for SODA10M Challenge 2021 – Continual Detection Track. In: ICCV 2021 Workshop: Self-supervised Learning for Next-Generation Industry-level Autonomous Driving. [Placed 2nd in competition]

Hayes, T.L., Krishnan, G.P., Bazhenov, M., Siegelmann, H.T., Sejnowski, T.J., **Kanan, C.** (2021) Replay in deep learning: Current approaches and missing biological elements. Neural Computation. doi:10.1162/neco_a_01433

Mahmood, U., Shrestha, R., Bates, D., Mannelli, L., Corrias, G., Erdi, Y., **Kanan, C.** (2021) Detecting Spurious Correlations with Sanity Tests for Artificial Intelligence Guided Radiology Systems. Frontiers in Digital Health. doi:10.3389/fdgth.2021.671015

Mahmood, U., Apte, A., **Kanan, C.**, Bates, D., Corrias, G., Manneli, L., Oh, J., Erdi, Y., Nguyen, J., Deasy, J., Shukla-Dave, A. (2021) Quality control of radiomic features using 3D printed CT phantoms. Journal of Medical Imaging. 8(3), 033505. doi: 10.1117/1.JMI.8.3.033505.

Khanal, B., **Kanan, C.** (2021) How does heterogeneous label noise impact generalization in neural networks? International Symposium on Visual Computing (ISVC).

Hayes, T., **Kanan, C.** (2021) Selective Replay Enhances Learning in Online Continual Analogical Reasoning. CVPR Workshop on Continual Learning in Computer Vision (CLVISION). [Oral]

Lomonaco, V., Pellegrini, L., Cossu, A., Carta, A., Graffieti, G., Hayes, T., De Lange, M., Masana, M., Pomponi, J., Ven, G., Mundt, M., She, Q., Cooper, K., Forest, J., Belouadah, E., Calderara, S., Parisi, G., Cuzzolin, F., Tolias, A., Scardapane, S., Antiga, L., Ahmad, S., Popescu, A., **Kanan, C.**, Weijer, J., Tuytelaars, T., Bacciu, D., Maltoni, D. (2021) Avalanche: An End-to-End Library for Continual Learning. CVPR Workshop on Continual Learning in Computer Vision (CLVISION). [W&B Best Library Award Winner]

Additional Publications

PUBLICATIONS

Yu Kong

Wentao Bao, Qi Yu, and **Yu Kong**. OpenTAL: Towards Open Set Temporal Action Localization. IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR), 2022.

Junwen Chen, Gaurav Mittal, Ye Yu, **Yu Kong**, and Mei Chen. GateHUB: Gated History Unit with Background Suppression for Online Action Detection. IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR), 2022.

Krishna Prasad Neupane, Ervine Zheng, **Yu Kong**, and **Qi Yu**. A Dynamic Meta-Learning Model for Time-Sensitive Cold-Start Recommendations. AAAI Conference on Artificial Intelligence (AAAI), 2022.

Xinmiao Lin, Wentao Bao, Matthew Wright, and **Yu Kong**. Gradient Frequency Modulation for Visually Explaining Video Understanding Models. British Machine Vision Conference (BMVC), 2021.

Wentao Bao, **Qi Yu**, and **Yu Kong**. Evidential Deep Learning for Open Set Action Recognition. International Conference on Computer Vision (ICCV), 2021. Oral

Wentao Bao, **Qi Yu**, and **Yu Kong**. DRIVE: Deep Reinforced Accident Anticipation with Visual Explanation. International Conference on Computer Vision (ICCV), 2021.

Junwen Chen and **Yu Kong**. Explainable Video Entailment with Grounded Visual Evidence. International Conference on Computer Vision (ICCV), 2021.

Additional Publications

Andres Kwasinski

Rahul Singh Gulia, Sayed Ashraf Mamun, Abhishek Vashist, Amlan Ganguly, **Clark Hochgraf, Andres Kwasinski**, and Michael E Kuhl. “Evaluation of Wireless Connectivity in an Automated Warehouse at 60 GHz,” 2022 IEEE International Conference on Consumer Electronics (ICCE), 1-6, 2022.

Abhishek Vashist, Maojia Patrick Li, Amlan Ganguly, **Clark Hochgraf, Raymond Ptucha, Andres Kwasinski**, and Michael E Kuhl. “KF-Loc: A Kalman Filter and Machine Learning Integrated Localization System Using Consumer-Grade Millimeter-wave Hardware,” in IEEE Consumer Electronics Magazine, 2021. doi: 10.1109/MCE.2021.3101060.

Bruce Hartpence and **Andres Kwasinski**. “CNN and MLP neural network ensembles for packet classification and adversary defense.” Intelligent and Converged Networks 2.1 (2021): 66-82, 2021.

D.-T. Do, M. -S. Van Nguyen, M. Voznak, **A. Kwasinski** and J. N. de Souza, “Performance Analysis of Clustering Car-Following V2X System with Wireless Power Transfer and Massive Connections,” in IEEE Internet of Things Journal, doi: 10.1109/JIOT.2021.3070744, 2021.

Sayed Ashraf Mamun, Amlan Ganguly, **Panos P Markopoulos,** Minseo K Kwon, and **Andres Kwasinski**. “NASCon: Network-Aware Server Consolidation for server-centric wireless datacenters.” Sustainable Computing: Informatics and Systems 29, 100452, 2021.

PUBLICATIONS

Fatemeh Shah-Mohammadi, Hatem Hussein Enaami, and **Andres Kwasinski**. "Neural network cognitive engine for autonomous and distributed underlay dynamic spectrum access." IEEE Open Journal of the Communications Society 2, 719-737, 2021.

Patent:
Andres Kwasinski and Fatemeh Shah Mohammadi. "Radio spectrum sharing leveraging link adaptation in primary network." U.S. Patent No. 11,032,826. 8 Jun. 2021.

Additional Publications

Xumin Liu

Eduardo Lima (PhD advisee), **Xumin Liu**: A Structure Alignment Deep Graph Model for Mashup Recommendation. International Conference on Service Oriented Computing (ICSOC: CORE A conference), 2021: 682-690 (Short paper)

Dingrong Wang, Hitesh Sapkota, **Xumin Liu, Qi Yu**: Deep Reinforced Attention Regression for Partial Sketch Image Retrieval, International Conference on Data Mining (ICDM: CORE A* conference), 2021. (Regular research paper)

Xumin Liu, Erik Golen, Rajendra Raj: DSLP: A Web-based Data Science Learning Platform to Support DS Education for Non-Computing Majors, ACM Special Interest Group on Computer Science Education Conference (SIGCSE: CORE A conference), 2021, Demo track.

Xumin Liu, Erik Golen, Rajendra Raj: Introducing Data Science Topics to Non-Computing Majors, ACM Special Interest Group on Computer Science Education Conference (SIGCSE: CORE A conference), 2021, Workshop track.

Additional Publications

Alexander Loui

R. Yeh, and **A. Loui**, "Synthesizing and manipulating natural videos using image-to-image translation," Proceedings IEEE Western NY Image & Signal Processing Workshop, Rochester NY, Oct. 2021.

Patents:
Raymond William Ptucha, Alexander C. Loui, Mark D. Wood, David K. Rhoda, David Kloosterman, and Joseph Anthony Manico. "Imaging workflow using facial and non-facial features." U.S. Patent 11,182,590, issued November 23, 2021.

Chi Zhang, **Raymond Ptucha, Alexander Loui**, and Carl Salvaggio. "System and method for batch-normalized recurrent highway networks." U.S. Patent Application 17/126,745, filed April 8, 2021.

Additional Publications

PUBLICATIONS

Guoyu Lu

Yawen Lu, Yuxing Wang, Devarth Parikh, Awais, Khan, **Guoyu Lu**, Simultaneous Direct Depth Estimation and Synthesis Stereo for Single Image Plant Root Reconstruction, IEEE Transactions on Imaging Processing, 2021

Yawen Lu, **Guoyu Lu**, SuperThermal: Matching Thermal As Visible Through Thermal Feature Exploration, IEEE Robotics and Automation Letters, 2021

Yawen Lu, **Guoyu Lu**, Self-supervised Single-image Depth Estimation From Focus and Defocus Clues, IEEE Robotics and Automation Letters, 2021

Zhihua Xie, Jieyi Niu, Yi Li, **Guoyu Lu**, Regularization and Attention Feature Distillation base on Light CNN for Hyperspectral Face Recognition, Journal of Multimedia Tools and Applications, 2021

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