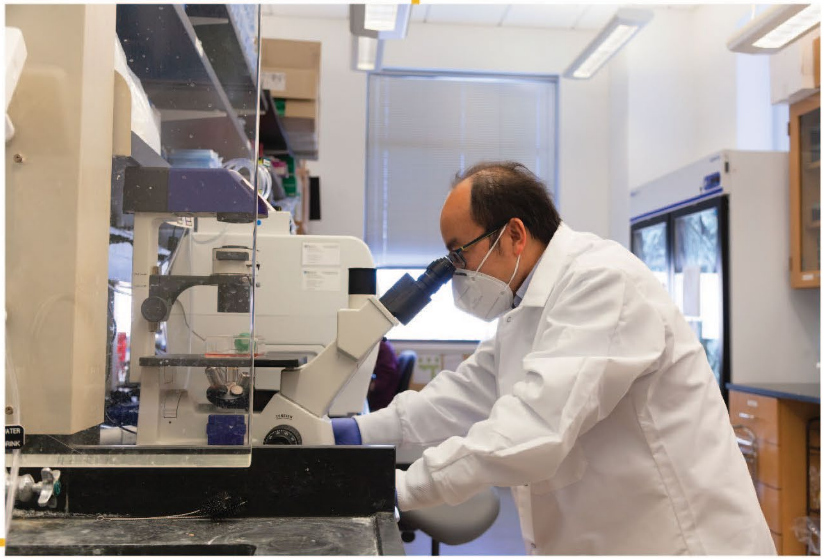
ELECTRICAL ENGINEERING & COMPUTER SCIENCE

2023 Annual Report

College of Engineering
University of Missouri




Kurt J. Lesker
Kurt J. Lesker

INSIDE

MESSAGE FROM THE CHAIR

Dear Friends,

In the Department of Electrical Engineering and Computer Science at the University of Missouri, we infuse innovation into everything we do. From exploring new ways to leverage neural networks and explainable artificial intelligence to developing novel materials and sensors, we are committed to solving grand challenges while ensuring technologies are smart, safe and ethical.

This past year, we tackled problems in areas such as energy efficiency, health care and food security. We've devised new systems and processes, collaborating with partners across disciplines with one goal in mind: to create meaningful change for a better tomorrow. And, as you'll read in this report, our faculty, students and alumni continue to receive recognition for outstanding contributions to the field.

Thank you for taking a few moments to explore our work.

Syed Kamrul Islam
Chair, Professor
Electrical Engineering & Computer Science

OUR NUMBERS

1,120+
Total Electrical Engineering and Computer Science Students

873
Undergraduate Students

249
Graduate Students

60+
EECS and Affiliated Faculty

35
Tenured or Tenure Tracked Faculty

Mizzou is
1 of 34
AAU Members

17 EECS Labs and Research Centers **3** Featured Research Centers **2** Centers and Signature Programs

1st Electrical Engineering Program West of the Mississippi

Electrical Engineering
& Computer Science
University of Missouri

LEVERAGING ARTIFICIAL INTELLIGENCE IN MATERIALS DEVELOPMENT

Team Develops Technique to Segment Carbon Nanotube Forests in Images

Mizzou researchers are another step closer to controlling the properties of carbon nanotubes growing in mass quantities.

Carbon nanotubes (CNTs) are nanoscale cylindrical carbon molecules that have unique electric, mechanical and thermal properties.

While optimal CNT properties are readily observed for an isolated CNT at the nanoscale, properties are significantly degraded when they are synthesized en masse at the microscale. Simultaneously growing CNT populations, known as CNT forests, interact and entangle in ways that are not fully understood with the net effect of modulating their collective properties.

Before engineers can solve that problem, they must first be able to measure and characterize how individual CNTs are assembled within forests.

In a recent study, a team of EECS researchers and collaborators outlined a deep learning technique to segment carbon nanotube forests in scanning electron microscopy (SEM) images. This technique allows them to detect individual CNTs within a forest which can help eventually characterize their properties.

“This technique allows us to quantifiably interpret SEM images of complex and interacting CNT forest structures,” said Matt Maschmann, an associate professor and co-director of the MU Materials Science & Engineering Institute. “My dream for this would be to have an app or plug-in where anyone looking at an SEM image of carbon nanotubes could see histograms representing the distributions of CNT diameters, growth rates and even estimated properties. There’s a lot of work to do to make that happen, but it would be phenomenal. And I think it’s realistic.”

The novelty of the team’s technique is that it’s self-supervised. That’s important because manually tracing hundreds of individual nanotubes within a complex CNT forest image to train a machine learning model would be too time consuming and labor intensive. Furthermore, because nanotubes are so small and because they intertwine and clump together, human annotations would likely vary, resulting in inaccurate training data.

“No previous paper has segmented CNTs at this level.” said Filiz Bunyak, assistant professor. “But the innovation goes beyond this. The proposed approach can be used for analysis of other curvilinear structures such as biological fibers or synthetic fibers.”

Exploding Nanoparticles

A Mizzou Engineering team has provided direct evidence of a localized explosion of an aluminum nanoparticle, a mechanism first theorized in 2006.

Associate Professor Matt Maschmann and Professor Emerita Shubhra Gangopadhyay outlined their observation of spallation of isolated aluminum nanoparticles by rapid heating in the journal of Applied Materials & Interfaces.

Aluminum nanoparticles are about 120 nanometers in diameter and are encapsulated with an aluminum oxide shell that protects the metallic aluminum core from reacting with the outside environment. The key mechanism in this work was rapid (greater than 10,000,000°C per second) thermomechanical expansion and melting of aluminum caused by focused laser heating.

"We're the first to study this under the microscope, to initiate this reaction with fast heating," Gangopadhyay said. "The energy contained in this material amounts to more than traditional explosives like TNT. There's a lot

Mizzou Launches NRT Program

The University of Missouri received a $3 million National Science Foundation Research Traineeship grant to launch a five-year doctoral program with integrated components of materials research, data science and analytics.

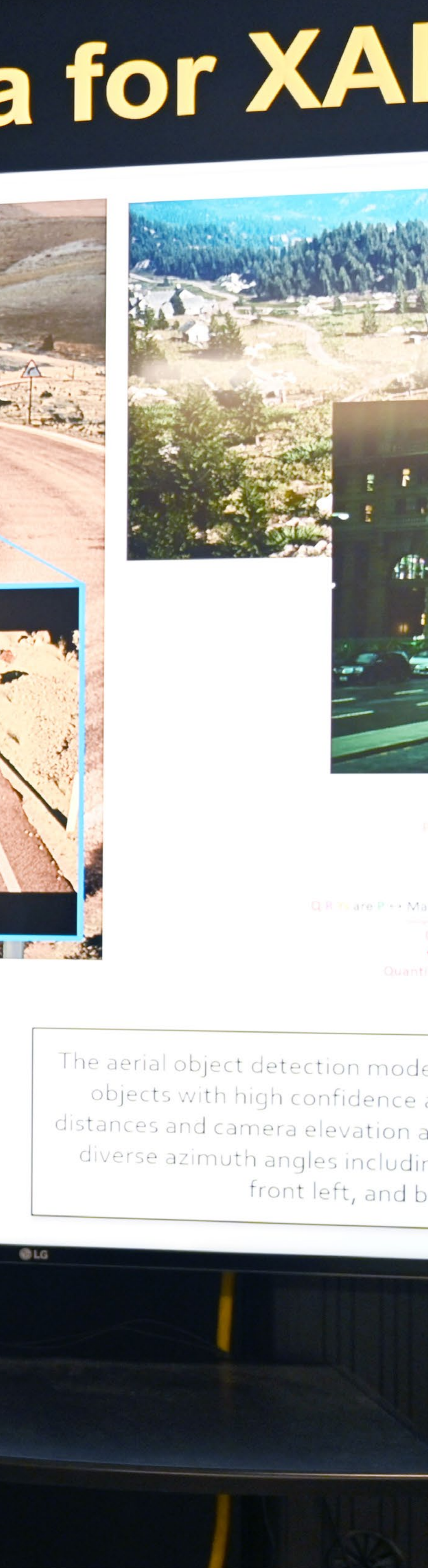
Each trainee will complete a graduate certificate in Data Science and Analytics with an emphasis area devoted to materials.

"Students will have the necessary skills to tackle some of the world's most significant challenges in a wide variety of fields ranging from health care and medicine to energy," said Associate Professor Matt Maschmann, co-principal investigator.

Almasri Awarded Three Patents

Associate Professor Mahmoud Almasri was awarded three patents for work around harvesting energy, improving camera imaging and coming up with a better way to produce microscopic sensors. The first patent improves the performance of thermal cameras. The infrared arrays have a broad range of commercial and military applications. The second patent is for optical fiber-based sensors including applications around measuring refractive index and using surface-enhanced Raman spectroscopy (SERS). The third patent is for wideband electrostatic and electromagnetic based energy harvesters for power generation from low-frequency energy sources.


EECS
Electrical Engineering
& Computer Science
Simulated Data
Person 1
The aerial object detection model has reported many low confidence detections at varying standoff distances (close, far, very far), camera elevation angles (medium, high), and object azimuth angles (left, right, front right, back) across multiple orientations.



EXPLAINING AI

Explainability, Simulation Key to Understanding AI

Professor Derek Anderson has been studying complex issues around artificial intelligence for the past 20 years.

His work in AI has spanned a variety of applications such as drones for humanitarian demining, drones in defense, geospatial analytics, material design. But at the root of it is engineering and understanding how AI algorithms process information and come to conclusion under uncertainty.

Anderson is committed to continuing that foundational research but admitted the launch of ChatGPT and sites like Google's Bard or the New Bing from Microsoft have turned the field upside down.

"We've been almost entirely focused on methodologies to tackle domain specific tasks using datasets that allow AI to go deep," he said. "But this new generative era of AI has been given access to a much larger and diverse set of data, allowing it to go wide. Our field is evolving at an alarming rate. It's exciting, scary and exhaustive."

One solution will be to ensure that future AI systems explain themselves. Anderson has created algorithms to do that, spitting out chains of numeric, text and graphical explanations about the data and decision-making process.

In a recent paper, published and presented at the IEEE Conference on AI, Anderson's team outlined a way to generate succinct natural language explanations of black box AI models, with associated uncertainty.

One key component of Anderson's research has been using simulated images rather than real-world photographs. This helps with respect to ground truth and increasing the size and variety of data to train an AI.

"Simulation is at the heart of everything we're up to, from using AI for material development to autonomous drones and computer vision," he said. "We are not alone. Large companies like Apple, NVIDIA, Microsoft and others have invested billions in producing and using simulated data."

Using Explainable AI to Track Cybersickness

Assistant Professor Khaza Anuarul Hoque is working to develop a personalized approach to identifying cybersickness by focusing on the root causes, which can be different for every person. To factor for those unique triggers, Hoque is using explainable artificial intelligence.

"Typically, machine learning or deep learning algorithms can tell you what the prediction and the decision may be, whereas explainable AI can also tell the user how and why the AI made the decision," Hoque said. "So, instead of imposing a static mitigation technique for all users, it will be more effective if we know why a particular person is developing cybersickness and give that person the right mitigation that they need. Explainable AI can help us do that without hindering the user experience."

AI in Biological Discoveries

Tool Predicts Protein Function

Curators' Distinguished Professor Jianlin "Jack" Cheng has received funding from the National Science Foundation to develop a tool that will predict how a protein functions based on its order of amino acids.

He envisions open source software that would allow a user to enter the sequence, then the system would predict not only how that string of amino acids will form into a structure but also the role it will carry out within a cell. Additionally, the system would pinpoint the specific site of the protein that carries out the function. Because proteins are the building blocks of life, applications span from engineering drought-resistant crops to advanced drug development.

"This will allow researchers to understand what kind of molecular function the protein has," said Cheng, Thompson Professor of Electrical Engineering and Computer Science. "For instance, if a protein is promoting tumor growth in a cancer patient, scientists could design a drug to prohibit the site of that activity and slow or stop it from growing."

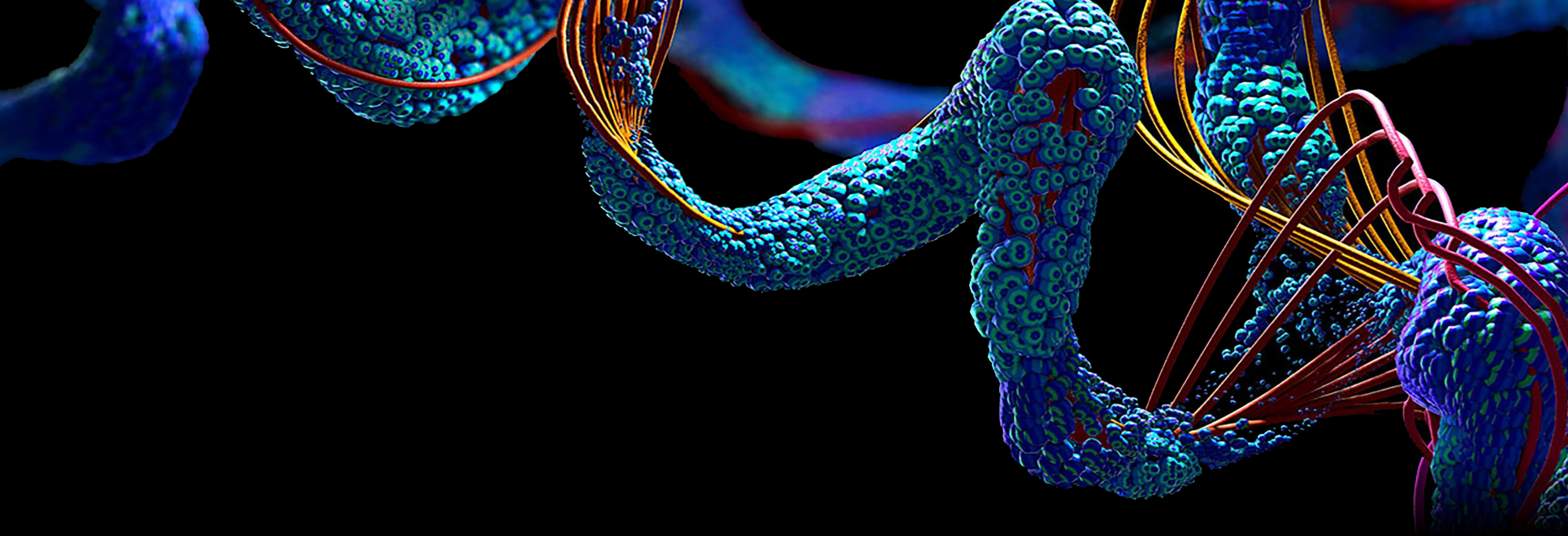
The team is developing three types of deep transformer models. A one-dimensional sequence-based transformer considers the sequence of amino acids. A 2D graph transformer considers how proteins interact with one another, analyzing what these interactions will do. And a 3D-equivariant graph transformer takes into consideration the protein structure and different sites within the protein that carry out specific tasks.

Team Ranks in Top 10 at CASP15

A Mizzou Engineering team ranked within the top 10 in four different categories at CASP (Critical Assessment of Structure Prediction). Nearly 100 teams from academia and industry competed using both human and server techniques.

At CASP15, MULTICOM — led by Curators' Distinguished Professor Jianlin "Jack" Cheng — took the No. 1 spot for estimating global fold accuracy of protein quaternary structures. In other words, the team's system most accurately predicted the global quality of certain protein structures.

The MULTICOM team included Raj Roy, Jian Liu, Zhiye Guo and Nabin Giri, all Ph.D. students in computer science. They also ranked No. 3 among server predictors of predicting protein quaternary structures, No. 3 among server predictors of predicting protein tertiary structures and No. 7 among both human and server predictors of predicting tertiary and quaternary structures.



Predicting Protein Location

Predicting a protein's location within a cell can help researchers unlock a plethora of biological information that's critical for developing future scientific discoveries related to drug development and treating diseases like epilepsy. That's because proteins are the body's "workhorses," largely responsible for most cellular functions.

Curators' Distinguished Professor Dong Xu and colleagues updated their protein localization prediction model, MULocDeep, with the ability to provide more targeted predictions, including specific models for animals, humans and plants. The model was created 10 years ago by Xu and fellow MU researcher Jay Thelen, a professor of biochemistry, to originally study proteins in mitochondria.

"Many biological discoveries need to be validated by experiments, but we don't want researchers to have to spend time and money conducting thousands of experiments to get there," Xu said. "A more targeted approach saves time. Our tool provides a useful resource for researchers by helping them get to their discoveries faster because we can help them design more targeted experiments from which to advance their research more effectively."

By harnessing the power of artificial intelligence through a machine learning technique, the model can help researchers who are studying the mechanisms associated with irregular locations of proteins, known as "mislocalization."

"Some diseases are caused by mislocalization, which causes the protein to be unable to perform a function as expected because it either cannot go to a target or goes there inefficiently," Xu said.

This work is currently supported by National Science Foundation.

AI IN THE NATURAL WORLD

System Automatically Identifies Birds in a Flock

An interdisciplinary Mizzou team received a “Best Paper Award” after developing a system that can automatically identify individual birds in images of waterfowl flocks.

Yang Zhang, a Ph.D. student in computer science, presented the work at the Institute of Electrical and Electronics Engineers (IEEE) International Conference on Cognitive Machine Intelligence in December. Co-authors included Professor Yi Shang and collaborators from the School of Natural Resources and the Missouri Department of Conservation (MDC).

Shang has led the project for the past five years in hopes of helping conservation officials more efficiently track waterfowl populations. Historically, the department has monitored waterfowl by manually counting them in the field. In 2019, MDC awarded Shang funding to develop techniques to autonomously identify and classify birds.

Shang and his students use images captured by drones to train machine learning models to identify waterfowl. While artificial intelligence can recognize a single bird in a photo with ease, it struggles when an aerial photo contains a flock of hundreds of birds along with tree branches, plants and other objects in the background. For this project, MDC also deployed decoys in some cases to evaluate the performance of the AI detectors.

“We use drones to collect images of waterfowl throughout different parts of the state, particularly in some of the parks and conservation areas,” Shang said. “Students have taken a lot of trips, going into the field and flying drones. We developed our own software to plan flight trajectories ahead of time so we can collect images at different altitudes and under different conditions. We’ve collected a pretty extensive data set.”

Engineering Heat-Tolerant Plants

An inter-institutional research team is using the power of computational analysis to pinpoint which plant genes confer resilience against rising temperatures that threaten global food supplies in the coming decades.

Curators' Distinguished Professor Jianlin "Jack" Cheng — one of the first scientists in the world to use deep learning to predict protein structures — adds a unique perspective to the work. Since 2018, he's been collaborating with Dr. Ru Zhang, a plant scientist at the Danforth Plant Science Center in St. Louis, to leverage computational tools in the study of plant genes.

In their joint paper, published in Plant, Cell & Environment, Cheng and Zhang, along with lead author Erin Mattoon, provide targets for engineering heat-tolerant plants. Using a type of green algae called Chlamydomonas, the team determined which genes are required for plants to grow under high temperatures.

The team is essentially systematically taking tools away from cells to see if they can still function. By breaking those genes and then exposing the modified algal cells to high temperatures, they can see which modified algal cells are no longer able to grow, determining which disrupted genes are required for thermotolerance.

AI ACROSS DISCIPLINES

Integrating Automation in Newsrooms

Professor Prasad Calyam and his team are among an elite group of researchers working to integrate automation and artificial intelligence to help local news organizations sort through press releases. The goal of these projects — initiated by the Associated Press and financed by the Knight Foundation — is to narrow the technology gap between national and local newsrooms and support the long-term sustainability of the industry.

"We agreed to do these projects because of their importance and national impact implications," said Calyam, who is Greg L. Gilliom Professor of Cyber Security. "And we are already developing similar techniques in our lab — analyzing data using AI."

The MU team is working on two of the five local newsroom projects the AP has selected to reduce tedious, time-consuming tasks with AI-based solutions. The first project involves using AI to sort and prioritize emails from outside sources, such as news releases and story pitches, and populate them into an electronic news production system.

The second project involves assisting with the development of an AI system that would ingest police blotter items that arrive as PDFs in an email attachment into a database, write a date-driven brief or summary and load the story into an electronic news production system. Additionally, Calyam and his team are using AI to organize the crime data so the news staff can search the database to identify trends, such as where crimes are occurring in the community.

Deciphering Century-Old Scripts

A University of Missouri research team has proved that a machine can be trained to decipher centuries-old scripts. Now, they want to see if that model is smart enough to read other handwritten documents from the era without as much human assistance.

At issue is a collection of 200,000 handwritten notary records from 17th Century Argentina. The deeds, mortgages, marriage licenses and other documents are written in Spanish, but in an ornate script not legible to most historians.

Associate Professors Praveen Rao and Viviana Grieco from UM-Kansas City have been working on translating the documents using machine learning for the past several years. They recently received a second round of funding from the National Endowment for the Humanities for the work.

For the first two phases of the project, Greico's students spent months manually identifying and labeling specific words from scanned images of documents written by a single notary. Rao's graduate students then used that data and open source optical character recognition to train a machine to recognize those words throughout that particular set of documents.

For the most part, that notary's work has been translated into a knowledge graph and a fast document retrieval system. A historian can search for a specific word, then the model highlights and retrieves all records containing the word. Users can also flag any words that the machine might have missed, which will continue to improve the results.

While that process worked well, a more efficient method is needed to decipher the rest of the collection — which includes records written by more than 20 different notaries.

To do that, Rao and his students are using an emerging area of machine learning known as few-shot learning, which requires less training data. Further, they plan to scale the system to manage the entire collection.

HIGH PERFORMANCE COMPUTING

Integrating Cloud, Edge Systems

Professor Prasad Calyam is exploring how cloud and edge systems can work together, ensuring that information can be intelligently and securely transferred from one platform to another in order to complete data-intensive workflows of scientific applications such as bioinformatics and manufacturing.

Calyam — who is Greg L. Gilliom Professor of Cyber Security — has recently received a $600,000 grant from the National Science Foundation for the work.

“The goal is to develop a volunteer edge-cloud architecture and framework to support trusted resource allocation for data-intensive workflows,” said Calyam, who is also director of the Mizzou Center for Cyber Education, Research and Infrastructure.

Specifically, his work builds on latest advances of Kubernetes, an open-source container system that orchestrates and automates software deployment and management across platforms.

“Kubernetes enables us to think about how to get cloud and edge to work together,” Calyam said. “In this project, what we’re trying to do is leverage a lightweight Kubernetes architecture to create containers of smaller pieces of programs that can be distributed between resource-constrained edge nodes and scalable cloud node resources.”

In the new and emerging volunteer edge-cloud computing paradigm, collaborators in a community with various backgrounds contribute their resources to form a distributed infrastructure to execute scientific workflows.

Calyam will first consider what could go wrong when trying to share multiple cloud and volunteer edge resources and how to contain those threats. Then, his team will consider policies and guidelines to ensure dynamic selection of only those volunteer edge resources that are trustworthy, scalable and reliable.

Increasing Computational Storage, Improving Analytics at MU

Prasad Calyam — Greg L. Gilliom Professor of Cyber Security — is the principal investigator of a new National Science Foundation (NSF) grant to significantly increase computational storage and improve data analytics for Mizzou researchers. The storage resources secured by this grant are the latest of what he says has been a decade-long progression to expand Mizzou’s cloud, connecting campus with national science networks and resources.

The Research Instrumentation Science Environment (RISE) grant adds 1.2 Petabytes of storage to the Hellbender, the UM System’s new High-Power Computing infrastructure. That translates to 9.6 million gigabytes of data. Of that, 20% of the storage will be part of a national open science data platform and puts MU on the national map of federated storage locations for open science efforts.

The grant will also allow Calyam and collaborators to develop novel tools that will help researchers better understand data with minimal human intervention.

Improving Access to Research Computing

Associate Professor Grant Scott is leading a project to improve access to research and educational computing resources needed to take advantage of artificial intelligence and machine learning (AI/ML). He has been awarded a $980,000 for the work from the National Science Foundation.

“This award will allow us to accelerate the adoption of advanced computing and data resources in the Great Plains Network region,” Scott said. “This project will increase the number of researchers and students served by both local and national computing resources, strengthen the capabilities of campus research computing professionals and expand the regional capacity for research.”

With the project, researchers will have the opportunity to develop initial ideas and codes into more advanced artificial intelligence/machine learning code using regional computing resources. Researchers will be trained and supported to adapt those workbench codes into high-throughput computing codes that can run on national platforms such as Open Science Grid and the National Research Platform.

“These successes will enhance institutional buy-in for sustainable regional and national research computing systems,” Scott said.

The work will leverage existing collaborations to provide and manage graphic processing unit (GPU) resources in Missouri, North Dakota, South Dakota, Kansas, Oklahoma and Arkansas. It will address computing needs of a diverse range of research within the region, work such as generating 3D protein molecules, using satellite images for deep learning in mapping wildfire burn areas, detecting dark matter and neutrinos, monitoring land surface phenology in real-time, generating cybersecurity attack graphs and implementing intelligent manufacturing through digital twins.

OPEN SOURCE SOFTWARE

Developing an OSS Badging System

Professor Sean Goggins is helping develop a new badging system that will give those in the open source software community an easy way to gauge a project's diversity, equity and inclusivity.

The CHAOSS Badging Initiative will assign badges to individual projects showing potential users and contributors how diverse and inclusive they are, said Goggins, who is co-founder of the Community Health Analytics Open Source Software (CHAOSS) project under the Linux Foundation.

Under the system, projects deemed most inclusive and friendly to all demographics will be assigned a platinum badge. Bronze, silver and gold badges will indicate that project leaders are committed to becoming more inclusive.

The new badging system will provide constructive, written feedback, mapped from the output of machine learning algorithms to help communities flag and address areas where the OSS community can improve, grow and thrive.

The machine will be trained using information from 25 repositories known for building diverse and inclusive communities. Goggins stressed that humans will review the process to prevent bias from entering the training data. By mapping the probabilities generated by machine learning, which are similar to the probabilities in weather reports, to specific, actionable advice, Goggins team follows a philosophy of providing useful information without risking harm.

Over the past year, Goggins has also been working with the "All In" project and its leader, Demetris Cheatem, to further gauge behaviors within different open source communities. He recently received funding from the Linux Foundation to continue survey work.

Making OSS More Accessible

Professor Sean Goggins and a team of researchers from MU and the University of Nebraska-Omaha recently received a three-year, $1.6 million grant from the Alfred P. Sloan Foundation to make the tools and metrics they've already developed for open source software (OSS) — through their work on a Linux Foundation project called CHAOSS — more accessible and understandable to a wider range of people and tech companies. The grant will help them develop better tools, software and methods to measure the long-term viability of OSS and help developers and tech companies alike identify what OSS projects are good to invest in for commercialization.

"OSS communities play a vital role in the technology industry by creating and maintaining software that powers everything from mobile devices to data centers," said Goggins', a co-principal investigator on the project. "The failure of critical OSS communities can result in the implementation of crisis management mechanisms for organizations, including sudden, increased investment of organizational time, or abandonment of OSS communities in crisis. Given these risks, organizations are interested in proactively committing resources to support critical communities, ensuring critical open-source software stability."

AN ENERGY EFFICENT FUTURE

Making Computer Chips Sustainable

A Mizzou Engineering team is devising a method to make computer chips designed to run deep neural networks (DNNs) not only reliable, but also energy efficient and sustainable.

Assistant Professor Khaza Anuarul Hoque recently received collaborative funding as the Lead Principal Investigator from the National Science Foundation Design for Environmental Sustainability in Computing program for the work. Hoque is director of the Dependable Cyber-Physical Systems (DCPS) Lab.

Hardware approximation methods can help in reducing the power consumption in these chips with a slight accuracy loss, and these techniques are gaining lot of attention. However, Hoque and his team have shown that such approximation can also make these chips three times more vulnerable to permanent manufacturing faults.

“A significant number of chips may need to be discarded if they are faulty. These faults can be due to manufacturing issues or simply due to the chips aging,” Hoque said. “We want these chips to not only be energy efficient but also sustainable by prolonging their lifetime.”

He’s doing this by coming up with techniques to detect and correct faults or bypass them. The project has three objectives. First, the team is examining techniques focused on creating approximate DNNs that are dependable and sustainable using new approaches to finding optimal neural network architectures. Second, they’re investigating methods to deal with faults that arise after the creation and deployment of the chips by either repairing or bypassing faulty components or retraining the network to address faults. Finally, they’re creating a tool to show how well approximate DNNs perform when compared to other metrics.

“We want to fix these chips by novel fault mitigation techniques and reuse them so we don’t need to throw away faulty chips,” he said. “We’re optimizing for performance, energy efficiency and sustainability.”

Improving LED Technology

Assistant Professor Peifen Zhu has found a way to improve light-emitting diodes (LEDs), reducing the harsh blue hue associated with LED light fixtures.

Supported with a Faculty Early Career Development (CAREER) Award from the National Science Foundation, Zhu develops materials that can be used to replace incandescent light bulbs, which are not efficient, and florescent lights that use mercury.

In a recent paper, published in Advanced Functional Materials, Zhu and colleagues used computational and experimental methods to study the property of semiconductors to improve LED performance. They found that a compound known as perovskite nanostructures can be used to enhance the color quality, shifting the blue toward green hues, and to improve the stability of emissions.

“The material showed high luminescence stability with excellent color quality and a desired color temperature,” she said. “Ultimately, we hope this will lead to lighting that is very efficient and environmentally friendly.”

HEALTH & WELL-BEING

Studying the Spread of COVID

Curators' Distinguished Professor Xiu-Feng "Henry" Wan has received a $5 million grant from the U.S. Department of Agriculture to investigate how SARS-CoV-2 impacts various species of animals and whether those animals might send new variants of the virus back to us.

"This happened with influenza," said Wan, who has been studying flu transmission for over 15 years. "It can go from humans to animals then get into reservoirs and come back to humans."

Wan is director of the NextGen Center for Influenza and Emerging Infectious Diseases with joint appointments in engineering, medicine and veterinary medicine and is a primary investigator at the Bond Life Sciences Center.

With the three-year grant, Wan and his team will take a closer look at how SARS-CoV-2 affects certain species of wildlife, especially those with potential interactions with humans, such as deer, elk, large cats, swine, birds and rodents.

Different types of animals respond differently to viruses. The problem is when a virus is strong enough to jump from species to species and survive, it can evolve and mutate. Thus, a vaccine designed to protect against one variant may not be effective when a new variant emerges.

"We've seen earlier variants of SARS-CoV-2 disappear in humans, but if they're still in animals, that can be problematic," Wan said. "They can change into new variants and affect us again, and our current vaccines will fail."

Study Shows 7 Symptoms of Long COVID

In a new study, a team of University of Missouri researchers including Professor Chi-Ren Shyu, found that people experiencing long-lasting effects from COVID-19 are susceptible to developing only seven health symptoms for up to a year following the infection. They are: fast-beating heart, hair loss, fatigue, chest pain, shortness of breath, joint pain and obesity.

Shyu, director of the MU Institute for Data Science and Informatics, said the results could benefit ongoing efforts by fellow researchers to study various impacts of COVID-19.

“Going forward we can use electronic medical records to quickly detect subgroups of patients who may have these long-term health conditions,” he said.

Determining Risk for Diabetes

A team lead by department Chair Syed Kamrul Islam developed a smartphone app that lets you determine your risk for diabetes. Unlike other tools available, the system would allow you to enter personal health data securely and ensure it remains private.

The app flags prediabetes, allowing individuals at risk to take steps to reverse the condition before it becomes a disease. Using publicly available data, the team trained the machine learning model to look for specific indicators such as whether a person is experiencing blurred vision or sore muscles.

Islam presented a paper on the system at the IEEE International Symposium on Medical Measurements & Applications in Messina, Italy, in 2022.

Detecting Foodborne Pathogens

Associate Professor Mahmoud Almasri is leading a team to develop new technologies that will quickly detect foodborne pathogens with the goal of improving food safety, especially among lower socioeconomic communities.

The team received a $750,000 award from the National Science Foundation Accelerator program’s food and nutrition security track. In this project, the team is developing a sensor-enabled food supply chain decision-support system to assess and mitigate Salmonella risks and multidimensional threats to the food supply chain to improve health equity. The project brings together 19 investigators across five institutions.

FACULTY SUCCESS

Three EECS Faculty Receive Curators' Professorship Honors

Three electrical engineering and computer science faculty members were honored this fall with Curators' Distinguished Professorships, the highest honor bestowed by the University of Missouri System.

This year's recipients were:

Jianlin "Jack" Cheng was recognized for his groundbreaking work around artificial intelligence (AI)-based protein structure prediction. Cheng is the William and Nancy Thompson Distinguished Professor and a faculty researcher at the Roy Blunt NextGen Precision Health building. Cheng is an internationally recognized leader in predicting how strings of amino acids ultimately fold into three-dimensional (3D) structures, knowledge that is essential to the development of new drugs and vaccines.

Xiu-Feng "Henry" Wan was honored for his ground-breaking studies of Influenza A and other pathogenic viruses used to develop vaccines and understand how viruses emerge and spread. Wan is a professor of molecular microbiology and immunology with joint appointments in the College of Engineering, School of Medicine and College of Veterinary Medicine. He also serves as director of the NextGen Center for Influenza and Emerging Infectious Diseases. Wan has spent most of his career studying influenza with the goal of developing effective vaccines and measures for influenza prevention and control.

Marjorie Skubic has been named a Curators' Distinguished Professor Emerita. She was first named Curators' Distinguished Professor in 2021 for her pioneering work around health care technologies. Skubic is director of the Center to Stream Healthcare in Place (C2SHIP), formerly the Mizzou Center for Eldercare and Rehabilitation Technology (CERT), where she develops sensors and devices that allow older adults to monitor their health from home.

Two Professors Named AAAS Fellows

Two EECS faculty members have been named American Association for the Advancement of Science (AAAS) Fellows for distinguished efforts in advancing their fields.

Professor Emerita **Shubhra Gangopadhyay** was recognized for her “distinguished contributions in bioengineering for the development of plasmonic gratings and nanoelectronic device-based biosensor systems for ultrasensitive detection of biomarkers.”

Curators’ Distinguished Professor **Xiu-Feng “Henry” Wan** was recognized for his “distinguished contributions to the fields of virology, systems biology, and engineering, particularly for studies of highly pathogenic influenza with a focus on transmission, ecology diversity and vaccine development.”

Shyu Named Fellow of ACMI

Chi-Ren Shyu has been named a Fellow of the American College of Medical Informatics (ACMI). Shyu, Paul K. and Dianne Shumaker Professor, was recognized for his sustained record in informatics research developing innovative technologies and explainable AI methods with significant impacts on industry, the research community and federal agencies.

Rao Honored with PLOS One Long Service Award

Praveen Rao has been honored with a Long Service Award from PLOS One, a peer-reviewed open access scientific journal. Rao, an associate professor has been an academic editor of the journal’s editorial board for more than five years. Rao directs the Scalable Data Science (SDS) Lab at Mizzou, where his research focuses on big data management, data science, health informatics and cybersecurity.

STUDENT SUCCESS

Rising Stars in EECS

Omiya Hassan was selected for the Rising Stars in EECS career workshop held at the University of Texas at Austin this past year. Rising Stars began in 2012 at MIT as a way to encourage underrepresented students to pursue faculty careers. As a Ph.D. student at Mizzou, Hassan worked as a research assistant in the Analog/Mixed-Signal VLSI and Devices Laboratory and as a graduate instructor. Her research focused on the design and development of low-power integrated circuits.

Gregory Scholar

Krutika Deshpande, a master's student in data science, was selected to participate in the Gregory Scholars Program this past year. The program allowed students from across campus to couple their areas of interest with applications around strategic communications.

EECS Hosts Two NSF REUs

Students from across the country spent 10 weeks at Mizzou Engineering this summer at two National Science Foundation Research Experiences for Undergraduates (REU) programs specific to EECS.

In the REU in Consumer Networking Technologies, participants studied technologies such as artificial intelligence (AI), computer vision, cybersecurity and large language models like ChatGPT. Prasad Calyam, Gilliom Professor of Cyber Security, is director.

The REU in Computational Neuroscience led by Professor Satish S. Nair allows participants to collaborate with researchers from across MU to use computation and technology to solve a range of neuroscience problems.

NSF Graduate Research Fellowship

Brooke Runge, B.S. ME '21, M.S. EE '23, received a National Science Foundation Graduate Research Fellowship.

ALUMNI ACHIEVEMENTS

Wood Receives Distinguished Service Award

Ron Wood, B.S. EE ’64, received the 2023 Distinguished Service Award from the Mizzou Alumni Association.

Wood retired after a 42-year career at Black & Veatch, one of the world’s largest infrastructure companies providing engineering and construction services for energy, telecommunication, and water projects. As President & CEO of B&V Energy, he was responsible for engineering, procurement and construction services for energy and telecommunication industry infrastructure projects.

Wood’s support and leadership were instrumental to the founding of Tiger Energy Solutions, LLC, now operated as Tiger Enzyme Solutions, LLC— a company that engaged MU faculty members initially focused on biofuel development that evolved into a biotechnical research and development effort. He is a member of the College of Engineering’s Dean’s Advisory Council, the University of Missouri’s Flagship Council, the Chancellor’s Fund for Excellence Committee and the Missouri 100, among others.

Lin Receives Missouri Honor Award

Chih-Hsiang (Thompson) Lin, B.S. ’83, M.S. EE ’90, Ph.D. EE ’93, received a Missouri Honor Award, the highest honor bestowed by the College of Engineering. Lin is Founder, President and Chief Executive Officer of Applied Optoelectronics, Inc. (AOI). He is a member of the University of Missouri’s Chancellor’s Advisory Group and currently serves as co-chair of the Dean’s Advisory Council. He also established the Professor Jon M. Meese, Ph.D./AOI Endowed Fellowship in Engineering at Mizzou.

Dr. Lin has an extensive background in business management, having led AOI from a start-up to a publicly traded company. Under his leadership, AOI has become a leading provider of optical networking products, serving customers in North America, Europe and Asia.

In addition to his role at AOI, Dr. Lin has also served as a research associate professor and senior research scientist at the University of Houston.

Electrical Engineering
& Computer Science
University of Missouri

416 S 6th Street
Columbia, MO
65211

EECS research areas:

- AI, Machine Learning, Image & Video Processing, Computer Vision
- Bioinformatics, Biomedical Imaging and Systems, Computational Biology
- Cloud Computing, Networking, High Performance Computing
- Communications, Signal Processing
- Computer Architectures, Cyber-Physical Systems
- Computing Theory and Algorithms, Scientific Computing
- Cybersecurity
- Database, Data Science, Information Retrieval
- Nano/Micro Technology
- Neuroscience, Neural Engineering
- Physical Electronics and Applied Physics
- Power Electronics and Power Systems
- Social Computing, Human-Computer Interaction
- Software Engineering, Programming Languages
- System Modeling, Control and Robotics

engineering.missouri.edu/eecs