Coordinated Science Lab Newsletter
GRAINGER COLLEGE OF ENGINEERING

SPRING 2021

CONNECT

CSL AI research to transform everyday life

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Coordinated Science Lab

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SPRING 2021

COORDINATED SCIENCE LAB
Grainger College of Engineering
University of Illinois Urbana-Champaign

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MANAGING EDITOR
Kim Gudeman

CONTRIBUTING WRITERS
Kim Gudeman
Allison Arp

DESIGN
Wes Moore

Comments & suggestions are welcome!
Please send them to kgudeman@illinois.edu

Director's Message | Klara Nahrstedt

For many of us, the COVID-19 pandemic has been one of the worst events we have lived through, underscoring how precious life is. 2020 was a difficult year, with many of us having to adjust to telecommuting (perhaps with children at home), adhering to rigorous testing requirements, and seeing colleagues only virtually, foregoing the energy that comes from vigorous in-person discussions. I want to thank each faculty, student, and staff member who continued to work hard through the pandemic. Thank you for your patience, your work ethic, and your commitment to keep CSL as safe as possible while continuing to make strides in advancing science and engineering. I am deeply grateful for all your efforts and sacrifices.

Despite the COVID pandemic, CSL had a tremendously successful 2020. Researchers were productive and advanced their work. We saw CSL faculty launch several new initiatives, such as the C3.ai Digital Transformation Institute, a research consortium dedicated to accelerating the benefits of artificial intelligence for business, government, and society. (CSL's R. Srikant co-directs the institute, and Tandy Warnow serves as its co-chief scientist.) In addition, not only have CSL faculty made major contributions to the body of research that has helped combat the pandemic, but their translational research contributions were instrumental to keeping the University open and giving first responders tools to address the pandemic.

CSL also made changes to its core structure in order to evolve for the future. As the world's computing needs have changed, diverse applications have sprung up to meet them. As a result, we have launched four new research groups to better address next-generation computing challenges; in addition, we hope this will enable us to be better organized to pursue new grant opportunities. These groups, which came out of the Reliable & High-Performance Computing group, are:

- Security & Privacy
- Computer Systems and Architecture
- Technology and Societal Impacts
- Intelligent Sensing, Networking, and Cyber physical Systems

I hope you will take the opportunity to learn more about these research groups in this issue of Connect.

In 2021, I look forward to celebrating CSL's 70th anniversary. While the pandemic necessitates a low-key celebration, we will commemorate our 70th year with monthly social media features and in the Uplink newsletter. I encourage you to watch for it and enjoy learning about the impact CSL has made over the past seven decades.

While 2021 will continue to have challenges, I am optimistic that better days are soon to come. CSL has persevered through difficult times over the past 70 years, and we will continue to do so for the next 70.

FACULTY HONORS

William Gropp voted IEEE CS 2022 president

CSL faculty member William "Bill" Gropp has been voted IEEE Computer Society 2021 president-elect and will serve as president in 2022. The IEEE CS is the world's preeminent organization for computer science, engineering, and technology. Gropp, who holds the Thomas M. Siebel Chair in the Department of Computer Science and is NCSA's Director and Chief Scientist, is currently IEEE CS Vice President for Technical and Conference Activities and has been an IEEE CS Board of Governors member since 2017.

New CSL faculty member Mehr brings autonomy research experience to Illinois

CSL's newest faculty member has won the IEEE ITSS Best Ph.D. Dissertation Award. Negar Mehr, a member of Illinois' Aerospace Engineering faculty, won the award for her dissertation entitled "Smart Traffic Operation: From Human-Driven Cars to Mixed Vehicle Autonomy." Mehr received her PhD. in mechanical engineering from the University of California, Berkeley and then worked as a postdoctoral scholar at Stanford University before coming to Illinois.

Alleyne honored with Air Force Public Service Award

CSL Professor Andrew Alleyne was honored this year with the Chief of Staff of the Air Force Exceptional Public Service Award. It is the most prestigious award granted by the U.S. Air Force to non-employee civilians. The award recognizes sustained, unselfish, and exceptional dedication to and support for the Air Force. Alleyne, a professor in mechanical science and engineering, was recognized for his service from 2016 to 2020.

FACULTY HONORS

Abdelzaher named 2021 IEEE Fellow

CSL's Tarek Abdelzaher was selected as a Fellow of the IEEE in recognition of his extraordinary contributions to cyber-physical systems and real-time computing. Abdelzaher, the Sohaib and Sara Abbasi Professor in Computer Science, is a prolific researcher with more than 350 publications. He is particularly known for his work on social sensing, which involves analyzing and measuring media in which social signals interact with complex physical and information environments.

Leburton wins legacy award in nanotechnology

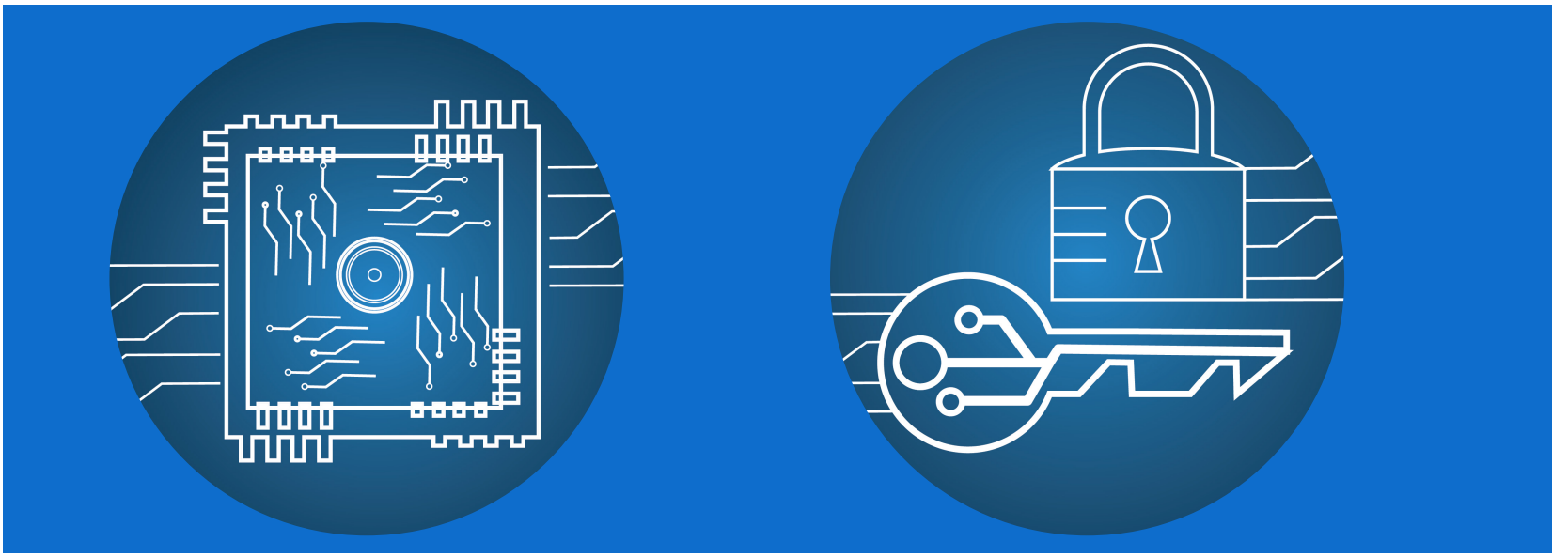
The Pioneer Award of the IEEE Nanotechnology Council (NTC) is equivalent to a lifetime achievement award. It is given annually to a scientist or engineer who has distinguished himself or herself in a prolific career with a significant impact on the field. The winner of the 2021 NTC Pioneer Award in Nanotechnology is CSL's Jean-Pierre Leburton (ECE). The NTC award committee recognized Leburton for "pioneering contributions to the theory and simulation of semiconductor nanostructures and low dimensional nanoscale devices."

Noted faculty entrepreneur Andrew Singer to lead OVCRI efforts in entrepreneurship and innovation

CSL faculty member Andrew Singer has been named Faculty Fellow for Research Innovation and Entrepreneurship Strategies in the Office of the Vice Chancellor for Research and Innovation. Singer, the Fox Family Professor of Electrical and Computer Engineering, has started several companies and regularly teaches courses on entrepreneurship. He has been a substantial contributor to and participant in the vibrant innovation and entrepreneurship ecosystem for more than two decades at Illinois.

CSL LAUNCHES FOUR NEW RESEARCH GROUPS

To create more focused communities of researchers across CSL, four new research groups have been formed. The idea is to bring together veteran and up-and-coming faculty with similar research interests to improve opportunities for interdisciplinary work. Below is an overview of the new research groups.



Computer Systems and Architecture

Various research areas, centers, and laboratories across campus are working in the computer systems and architecture space. The goal of this group is to bring all those researchers together to reshape the future of computing systems and architecture through innovations across the entire hardware and software stack. The work will span everything from the underlying hardware architecture to upper-level application algorithms, with the ultimate goal of significantly improving system performance, energy efficiency, scalability, reliability, and security.

Security & Privacy

Internet infrastructure is a major technological backbone of various application sectors that require secure, trustworthy, and private information delivery among machines. This group will work to address security threats and privacy concerns for current computing systems. Current systems are often large, distributed, and complex, consisting of applications, software, hardware, and networks used by diverse user groups. This group will work to embed security and privacy into the design, implementation, and deployment of computer systems.

Technology and Societal Impacts

The core belief of this research group is that engineering leaders should promote cultures of ethics in their organizations. The technologies developed by engineers affect how people live and work, bringing both benefits and harms. When engineers build artificial intelligence for decision-making into, for example, self-driving cars and patient-monitoring medical devices, the quality and reliability of the systems' decisions make the difference between saving lives and injuring people. Further, since different people can experience different benefits and harms, technologies raise questions of ethics and social justice. In consequence, engineers need to understand the ethics of technological development and research.

Using mathematical, computational, and social science research methods, the faculty in the Technology and Societal Impacts group conduct research on the social impacts of artificial intelligence, technology and inclusion, and access to healthcare through technology, among other topics.

Intelligent Sensing, Networking, and Cyberphysical Systems (InSinc)

The InSinc group focuses on theoretical and experimental research on a wide range of topics in this area. The researchers aim to develop foundational algorithms and translate them to practical systems for societal applications, guided by data science and artificial intelligence.

Application areas include new Internet technologies, 5G networks, IoT, robotics, autonomous cars, healthcare, social networks, and manufacturing, among others.

This group's work will have major implications for components of the healthcare ecosystem, smart grids, and cloud software, among other application areas.

CSL AI RESEARCH TO TRANSFORM EVERYDAY LIFE

By Allie Arp

In the 1970s, then CSL Director Robert Chien led an interdisciplinary research team that conducted some of the first work on artificial intelligence (AI) on the University of Illinois Urbana-Champaign (UIUC) campus. Since those early contributions, CSL has continued to lead the way in the field of AI.

Today, the interdisciplinary environment CSL provides makes it the perfect place for researchers from a wide variety of UIUC units to conduct AI research.

“Many of the novel AI algorithms and innovative AI frameworks, systems, and applications developed by CSL researchers follow the CSL tradition of excellence,” said Klara Nahrstedt, CSL director. “The strong intersection between AI theory and AI system research, collaboration of AI researchers from across campus, and the constant curiosity and dedication of our researchers to solve hard AI problems are all factors leading to the high-impact AI innovations coming out of CSL.”

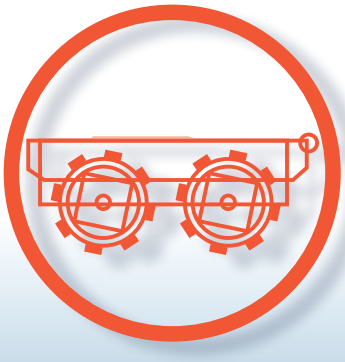
The uses and applications of AI have reached into nearly every aspect of modern-day life. From agricultural equipment to medical treatments to electronic devices and much more, CSL researchers are pushing the boundaries of AI research.

Agriculture

In 2020, the National Science Foundation and the US Department of Agriculture announced seven new AI institutes across the country. Two of them are located in UIUC's Grainger College of Engineering, and one is led by CSL faculty member Vikram Adve. The AI Institute for Future Agricultural Resilience, Management, and Sustainability (AIFARMS) has the goal of advancing research in computer vision, machine learning, soft object manipulation, and intuitive human-robot interaction. The institute is intended to solve major agricultural challenges including labor shortages, efficiency and welfare in animal agriculture, environmental resilience of crops, and the need to safeguard soil health.

One location where AIFARMS research will be carried out is the Illinois Autonomous Farm led by Girish, led by CSL's Girish Chowdhary, professor of agricultural and biological engineering. The working farm will give AI researchers a place to evaluate their methods and build up the infrastructure needed for their research.

"The overall goal of our work is to improve sustainability in agriculture by replacing chemicals with mechanical alternatives where we can, reducing chemicals where we can, and increasing diversity and productivity of Illinois agriculture by using robots," said Chowdhary.



Personalized medicine

Currently, patients are often prescribed medical treatments based on what has worked for the majority of other patients with the same ailment. That approach is less than ideal, because each individual will respond to medications and therapies differently. The use of AI to diagnose and treat a variety of diseases and ailments through individualized medicine would be a paradigm shift for the entire healthcare sector, and would greatly improve the success and efficacy of treatments. CSL faculty member Ravi Iyer and his students have investigated the use of AI and machine learning to develop individualized medicine for a number of maladies, including epilepsy, depression, and even cancer.

Recent reductions in the cost of analyzing the human genome have made individualized medicine a more realistic possibility. Genetics and other factors, such as patient history, can be used by AI tools to generate predictions of treatment efficacy that serve as actionable intelligence, helping medical providers select the best treatment option for each individual patient.

"Innovations in artificial intelligence methodologies capable of harnessing the power of clinical and genomic data have shown early success in fulfilling pharmacogenomic promises of individualized medicine," said Iyer, professor of electrical and computer engineering (ECE). "Methods embodying artificial intelligence play a crucial role in the generation of actionable intelligence and personalized medicine."

COVID-19

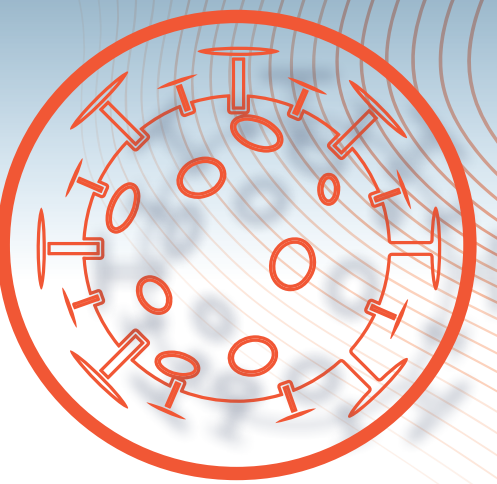
When the pandemic first broke out in the spring of 2020, a number of CSL faculty jumped into action to come up with AI solutions to combat COVID-19. The C3.ai Digital Transformation Institute (DTI), co-led by CSL's R. Srikant, funded 26 projects on the topic, five of which were led by CSL researchers.

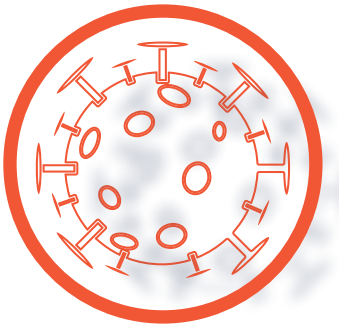
"I am delighted to see the interdisciplinary nature of the projects led by the CSL faculty members," said Srikant, professor of ECE. "The collaboration between engineers, computer scientists, epidemiologists, and medical/healthcare professionals will produce both immediate and lasting benefits to society."

The projects being led by CSL faculty are focused on helping hospital systems, improving patient treatment, controlling the virus, and keeping patient data safe. The specific topics are:

- Developing a best practices guidance system to address hospital staff shortages.
- Using AI and machine learning on audio-visual data to predict whether a patient's condition will deteriorate or improve, saving hospital space for those who need it most.
- Developing algorithms to combine real-time testing data with epidemiological models to better inform decision-makers on what effect control strategies have on the spread of the coronavirus.
- Using AI, machine learning, and cryptography to protect private patient medical data.
- Studying the virus's genomic information to determine what separates SARS-CoV-2 from other viruses that haven't caused global pandemics, to better prepare for future outbreaks.

Srikant is joined on the C3.ai DTI leadership team by CSL's Tandi Warnow, who is a professor of computer science and the Institute's co-chief scientist.





CSL professors Sayan Mitra and Katie Driggs-Campbell with their students from their autonomous safety course

Electronic devices

Enhancing so-called "edge" devices, which can include cell phones, smart watches, and other IoT devices, with AI capabilities is a major goal for researchers in both industry and academia. These devices generate huge volumes of sensory data from their built-in sensors in the form of cameras, microphones, gyroscopes, and other technology. Processing that data is challenging due to the limited computational resources and constrained energy supplies of edge devices. A team from CSL led by Naresh Shanbhag is working to improve the energy efficiency and functionality of these devices.

"These data-generating devices can be made a lot smarter if they could be AI-enabled," said Shanbhag, professor of ECE. "The mainstream method of using AI today is via deep neural networks (DNNs). Bringing DNNs into devices such as cell phones is extremely challenging due to the need to operate on a tight energy budget with severely limited storage and computational capacity."

Unfortunately, when energy efficiency and accuracy are increased in these devices, their networks are more easily compromised. Finding out why this happens is one of the main goals of Shanbhag's research team.

Autonomous driving

Geir-Dullerud

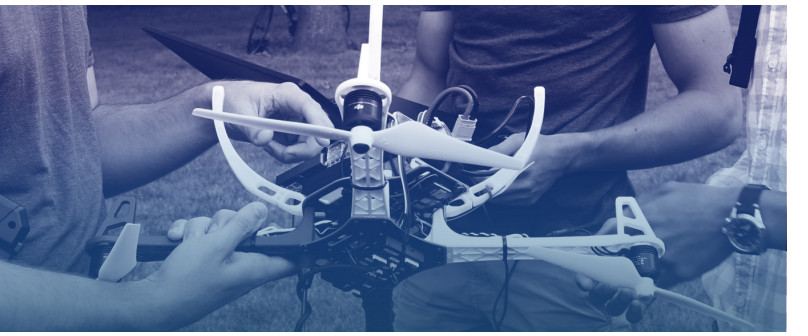
One of the most famous applications of AI technology is in autonomous vehicles. In early 2020, CSL introduced the High Bay, a new space for research in this area. The High Bay is located in the University of Illinois Urbana-Champaign Research Park and includes space for autonomous vehicles, along with access to areas that allow researchers to drive in a road-like environments.

These additions were crucial to the expansion of the Center for Autonomy (CfA), a research group run out of CSL.

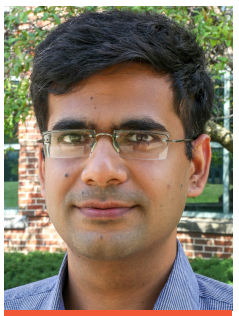
"Previously, we just didn't have space for many of these activities — they just didn't happen on our campus — and creating the space has provided significant support for our faculty to develop an autonomous driving program," said CSL's Geir Dullerud, CfA director and professor of mechanical science and engineering.

In addition to the space, CfA added a second vehicle to its autonomous fleet, an off-road vehicle donated by John Deere. Both vehicles in the fleet are being used by a number of classes taught by CSL/CfA faculty.

ROBOTICS



CSL researcher works to program common sense into robots



Saurabh Gupta

Personal robots have long been a staple in science fiction but have yet to emerge in the real world. One of the major roadblocks is that robots lack a key trait: common sense. CSL Assistant Professor Saurabh Gupta (ECE) has a research project entitled "Scaling Up Robot Learning by Understanding Internet Videos of Humans," which will explore the possibility of using videos to provide robots with a basis for intuitive decision-making.

Humans can draw on prior experiences while interacting with unfamiliar surroundings. For instance, if a person has been in a few shopping malls, he or she would likely be able to find the bathrooms or a drinking fountain efficiently in a new one; similarly, upon entering an unfamiliar kitchen, most people will intuitively understand how to open different types of drawers. Gupta would like to introduce such an ability in robots.

Describing his research as "the intersection of computer vision and robotics," Gupta is combining classical techniques for robot learning with techniques for understanding videos from computer vision.

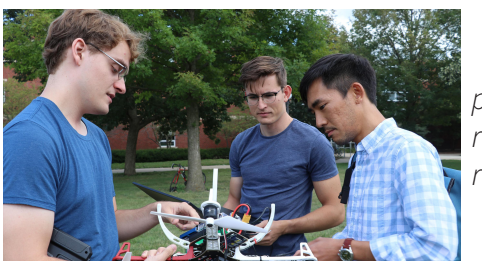
Robots deciding their next move need help prioritizing

Girish Chowdhary

As robots replace humans in dangerous situations, such as search and rescue missions, they must be able to assess situations quickly and make decisions—in other words, to react and adapt like a human being would. Researchers at the University of Illinois Urbana-Champaign, led by CSL's Girish Chowdhary (ACES), used a model based on the game Capture the Flag to develop a new take on deep reinforcement learning that helps robots evaluate their next move.

The team of researchers chose Capture the Flag because it's played with two teams, each with multiple teammates, and both teams must make decisions. The robots learn to react in a competitive game environment by using a kind of trial-and-error process called "reinforcement learning."

They learn what actions to take in a given situation by playing the game, and how to adapt to new situations that come up.



prioritizing robotics research team

Hauser, Ramos paving the way for robotic search-and-rescue capability

Kris Hauser

CSL Associate Professor Kris Hauser (CS) and MechSE assistant professor João Ramos were recently awarded a three-year NSF grant to investigate the teleoperation of wheeled humanoid robots.

Funded through the National Robotics Initiative, the research team will investigate the development of a human-like robot, complete with manipulatable arms, that locomotes on wheels and can perform physically demanding tasks like pushing or lifting of heavy payloads. The robot will be controlled remotely using teleoperation, meaning that the operator will use full-body haptics to communicate input and receive multisensory feedback.

The duo has proposed a bilateral teleoperation framework in which the operator can direct the robot's locomotion by leaning forward and send actionable input to its arms using his or her own upper body gestures. The robot will be designed to address Dynamic Mobile Manipulations, which are physical tasks that require a combination of forceful manipulation and agile locomotion.

teleoperated wheeled humanoid robots

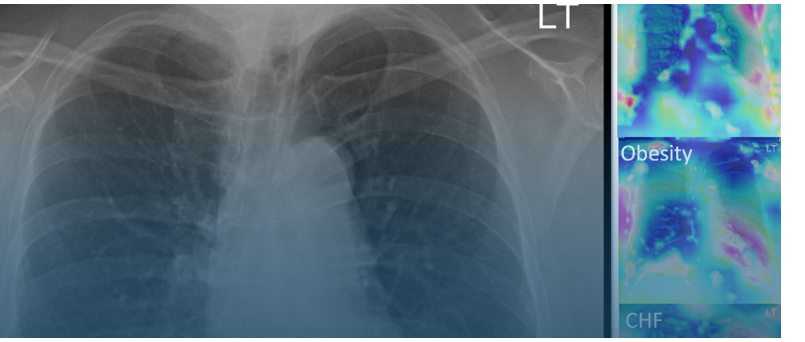
CSL TURNS 70

In 2021, CSL will celebrate 70 years of research and innovation. Throughout the year, the inventions, accomplishments, and people central to the success of CSL will be celebrated in a variety of ways including in newsletters, social media, and on the website. Follow along on CSL's Facebook, Twitter, Instagram, or LinkedIn pages.

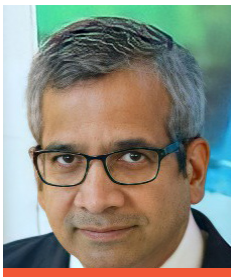
70 ANNIVERSARY

1951 CSL 2021

COVID-19



CSL professors study COVID-19 statistical analysis and group testing


Venugopal Veeravalli


Lav Varshney

Through their research project "Efficient Strategies for Pandemic Monitoring and Recovery," CSL professors Venugopal Veeravalli and Lav Varshney (both of ECE) are seeking to improve the efficiency of current COVID-19 tests.

Their research is looking for ways to test more efficiently by combining test samples from several people and processing them together in a single test. If the result is negative, then everyone whose sample was included is considered negative. If the result is positive, individual testing can then be performed to determine which of the contributing individuals are infected. Group testing is already being used to monitor COVID-19 cases in other countries, such as India, Germany, and Israel, and has been approved by the FDA for wide use in the United States.

While Veeravalli and Varshney's work will make a timely contribution to the fight against the COVID-19 pandemic, their findings will be applicable to future epidemics and pandemics as well.

Collaborative research better predicts COVID-19 severity


Sanmi Koyejo

A team including Sloan Fellowship Award winner and CSL faculty member Sanmi Koyejo (CS) and CSL's Alex Schwing (ECE) have created a tool that uses AI to evaluate an X-ray and account for six health variables including diabetes, cardiac arrhythmia, vascular disease, and others. Understanding comorbidities allows medical experts to more accurately predict the severity of a patient's COVID-19 case.

When Koyejo and his students plugged this data into their model, they found discrepancies between symptom severity predicted by doctors versus the AI model. They assumed the model made a mistake, but further inspection revealed that the discrepancies reflected healthcare providers' failures to diagnose some patient conditions.

To prove the worth of their AI-based model, the researchers have started to implement it with data from a patient population at the University of Illinois Chicago. Thus far, findings have shown promising results in offering more accurate predictions of COVID-19 infection severity.

Disposable surgical masks best for acoustic performance, study finds

Ryan Corey, a postdoctoral researcher under Professor Andrew Singer (ECE), leads a team at the CSL Augmented Listening Laboratory that studies audio signal processing, especially for listening devices like hearing aids. The results of the team's new study evaluating the acoustic effects of face masks on speech have been published in The Journal of the Acoustical Society of America.

The team tested medical masks, disposable surgical masks, masks with clear plastic windows around the mouth, and homemade and store-bought cloth masks made of different fabric types and numbers of layers. They tested the masks on a head-shaped loudspeaker and on a mask-wearing human speaker.

The study found that disposable surgical masks offer the best acoustic performance among all tested. The good news is that most masks do not completely block sound; they simply deflect it away from the mouth. Simple amplification devices can therefore make masked speech more audible to everyone.

University of Illinois Urbana-Champaign develops autonomous robot to kill COVID-19

Ultraviolet light is a form of radiation that can be used for sterilization and disinfection. With people beginning to meet in person again in schools and offices, easy, low-cost sterilization strategies are necessary to curb the spread of the COVID-19 virus. To meet this demand, a Health Care Engineering Systems Center (HCESC) team led by CSL's Kesh Kesavadas (ISE) has developed the UVBot, a robot that can be built out of easily accessible objects and programmed to clean spaces using UV light, which kills COVID-19.

A patent application for the UVBot has been filed. Made from a Roomba robot, a UV lamp, and 3D-printed parts, the UVBot can be controlled via a mobile app over Wi-Fi or Bluetooth. The team conducted a successful test inside HCESC's facilities to demonstrate the prototype's feasibility as a solution for disinfection.

While the UVBot has proven to be successful at inactivating 99% of the virus present, the team is still eager to improve the design with better collision detection, autonomous detection of humans so the dangerous UV light can be automatically shut off when a human is present, and software to support functioning of multiple UVBots in the same environment.

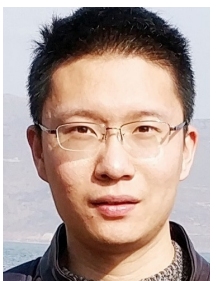
Earable computing: A new research area in the making

Romit Roy Choudhury

CSL's Systems and Networking Research Group (SyNRG) is defining a new sub-area of mobile technology that they call "earable computing." The team believes that earphones will be the next significant milestone in wearable devices, and that new hardware, software, and apps will all run on this platform.

"The leap from today's earphones to 'earables' would mimic the transformation that we had seen from basic phones to smartphones," said Romit Roy Choudhury, professor in electrical and computer engineering (ECE). "Today's smartphones are hardly a calling device anymore, much like how tomorrow's earables will hardly be a smartphone accessory."

Instead, the group believes tomorrow's earphones will continuously sense human behavior, run acoustic augmented reality, have Alexa and Siri whisper just-in-time information, track user motion and health, and offer seamless security, among many other capabilities.



Zhijian Yang

Yu-Lin Wei

Liz Li

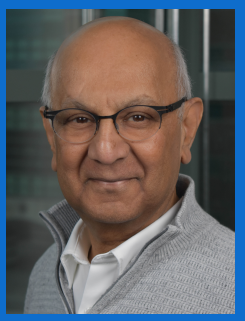
The research questions that underlie earable computing draw from a wide range of fields, including sensing, signal processing, embedded systems, communications, and machine learning. The SyNRG team is on the forefront of developing new algorithms while also experimenting with them on real earphone platforms with live users.

PhD student Zhijian Yang and other members of the SyNRG group, including his fellow students Yu-Lin Wei and Liz Li, are leading the way. They have published a series of papers at multiple Association for Computing Machinery conferences on the topics of hollow noise cancellation, facial motion sensing, acoustic augmented reality, and voice localization for earphones.

CSL professors lead multidisciplinary efforts to improve computing platforms

Klara Nahrstedt

Large-scale computing platforms, like clouds and supercomputers, are becoming more common and more complex. As a result, these platforms are becoming extremely expensive to build and operate. Distinguished Professor Ravi Iyer (ECE), Director Klara Nahrstedt (CS), and Professor Emeritus Wen-mei Hwu (ECE) have teamed up in an NSF-funded grant to proactively plan for the need to automate resource and resiliency management in such systems by leveraging machine learning (ML) to tackle problems such as scheduling, distributed failure detection, real-time intrusion detection, and power management, among other management functions.



Ravi Iyer

Wen-mei Hwu

In the project, called "Inflight Analytics to Control Large-Scale Heterogeneous Systems," the notable trio are building an ensemble of ML models that will use domain-knowledge-driven artificial intelligence techniques to make better decisions that can directly incorporate dynamic and contextual measurements made within the large systems. This approach will alleviate the need to painstakingly build human-engineer-derived static policies or heuristics for current and future datacenters. The ML algorithms the team hopes to develop would automate such decision-making and significantly ease the integration of heterogeneous computing elements such as accelerators, nonvolatile memories, and high-speed interconnects into these computing platforms.

Using ML, the group plans to build a next generation of large-scale computing systems that will allow for use of monitoring data collected throughout the system stack to automatically generate real-time decisions for a variety of system resource management tasks.

Waldrop leads $75 million NASA mission to investigate Earth's atmosphere


Lara Waldrop

Lara Waldrop, CSL assistant professor and Y. T. Lo Fellow in Electrical and Computer Engineering, has been selected by NASA to develop a Solar Terrestrial Probes (STP) Science Mission of Opportunity, with a budget of $75 million. Her mission, entitled "Global Lyman-alpha Imager of the Dynamic Exosphere," or "GLIDE" for short, was chosen for implementation after a competitive selection process and is expected to launch in 2025. GLIDE will make unprecedented measurements of the far ultraviolet light emitted by hydrogen atoms in Earth's outermost atmospheric layer, known as the "exosphere," which extends more than 100,000 miles above Earth's surface—about halfway to the moon.

Only a few observations of Earth's exosphere have been made from far enough away to capture its structure and behavior on a global scale. GLIDE would fill this longstanding measurement gap by acquiring wide-field images of Earth's global exospheric emission from its vantage point.

Quantum mechanics offers improved communication possibilities


Eric Chitambar

CSL Associate Professor Eric Chitambar (ECE) is looking at how to enhance communication between devices by using quantum particles, rather than classical particles. A common communication scenario involves two, three, or even hundreds of parties who simultaneously attempt to send messages to a single receiver. This can be formally modeled by a multiple access channel, and the performance of such a channel depends on whether it was built using classical or quantum particles. Chitambar and his students have recently identified fundamental advantages of using quantum, even in the extreme case in which only a single quantum particle is used.

At the heart of their idea is the fact that quantum particles can behave like waves. In the multiple access scenario, such a wave can be sent simultaneously to all senders; then, as the senders react, their responses can be packaged together and sent to a central receiving station. In addition to allowing for larger communication capacity, quantum particles also provide cryptographic opportunities because any attempt to eavesdrop on the transmitted messages can be detected.

Chitambar is one of the Illinois representatives in the $25 million Institute for Hybrid Quantum Architectures and Networks (HQAN), a collaborative effort involving the Illinois Quantum Information Science and Technology Center (IQUIST), the University of Chicago, and the University of Wisconsin.

Electrophysiological correlates of brain health help diagnose epilepsy and lateralize seizure focus


Yoga Varatharajah

Epilepsy is a neurological disease that causes unprovoked seizures and affects approximately 1% of the world's population. Currently, clinicians visually interpret scalp electroencephalograms (EEGs) and MRI scans to diagnose epilepsy. These EEG recordings typically take between 20 and 60 minutes, which may not be enough time to record any epileptiform activity or subtle abnormalities in the brain.

Led by CSL alum and current Illinois Bioengineering faculty member Yoga Varatharajah, CSL researchers have collaborated with the Mayo Clinic to develop a machine-learning-based approach that uses alpha-rhythm-related features to determine the potential for epilepsy and identify the seizure-generating side of the patient's brain. The results were reported in a paper entitled "Electrophysiological correlates of brain health help diagnose epilepsy and lateralize seizure."

Doctors may achieve more timely epilepsy diagnoses and ultimately provide better care to patients.

Through this approach of identifying subtle abnormalities by using signal processing methods and machine learning, doctors may achieve more timely epilepsy diagnoses and ultimately provide better care to patients. The paper on this research was named a finalist in the 2020 Engineering in Medicine and Biology Society Student Paper Competition.

Grainger College of Engineering
Coordinated Science Lab

1308 West Main Street
Urbana, IL 61801

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