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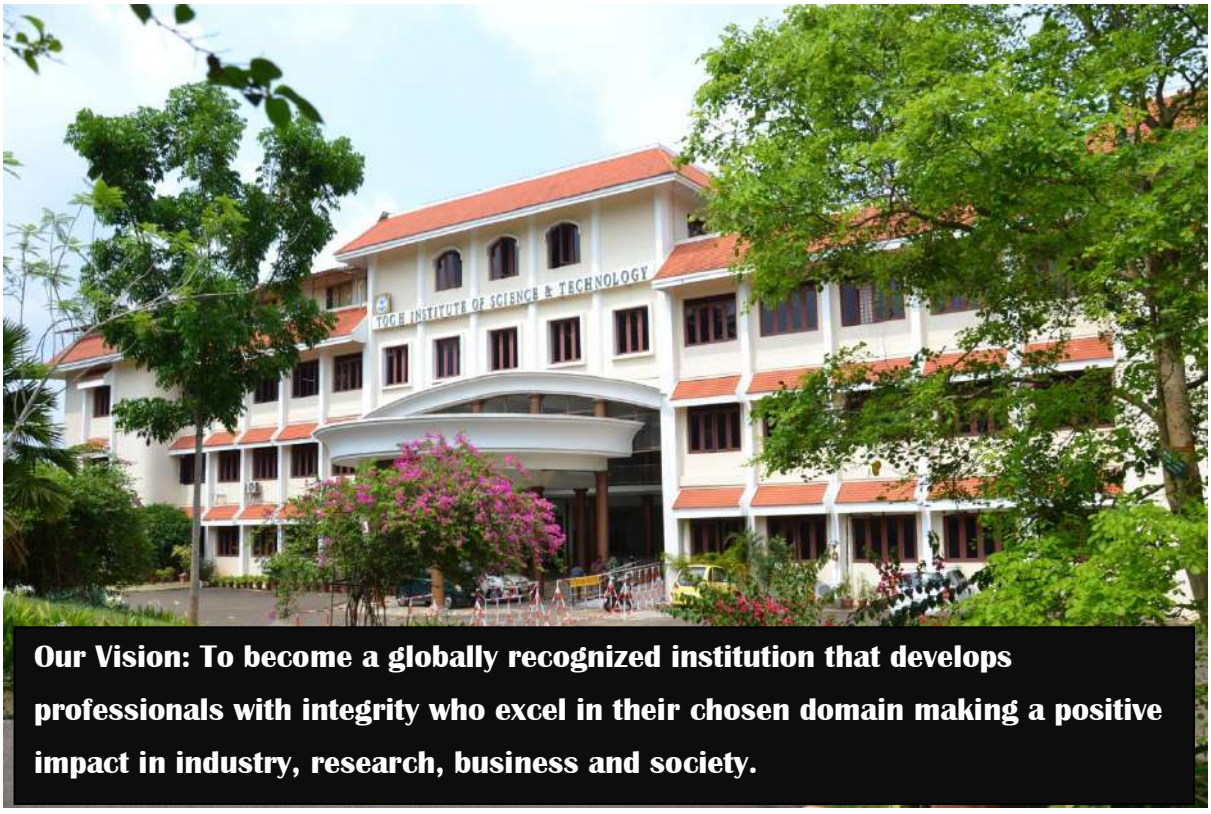
"WE DON'T DO DIFFERENT THINGS, WE DO THINGS DIFFERENTLY"



Our Vision: To become a globally recognized institution that develops professionals with integrity who excel in their chosen domain making a positive impact in industry, research, business and society.

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

VISION OF CSE DEPARTMENT

To acquire global excellence in the field of Computer Science and Engineering, nurturing in professionals, technical competence, innovative skills, professional ethics and social commitment.

MISSION OF CSE DEPARTMENT

- To equip students with a strong foundation in the area of Computer Science and Engineering using effective teaching -learning practices.
- To provide state-of-the-art infrastructure to suit academic, industry and research needs at the global level.
- To engage students and faculty in interdisciplinary research that promotes innovative ideas for sustainable development.
- To incorporate skill enhancement programmes for students and faculty to cope with the contemporary developments in technology.
- To inculcate effective communication skills, professional ethics and social commitment among professionals through value added programs.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

Graduates of Computer Science & Engineering will

1. Evolve as globally competent computer professionals, researchers and entrepreneurs possessing collaborative and leadership skills, for developing innovative solutions in multidisciplinary domains.
2. Excel as socially committed computer engineers having mutual respect, effective communication skills, high ethical values and empathy for the needs of society.
3. Involve in lifelong learning to foster the sustainable development in the emerging areas of technology.

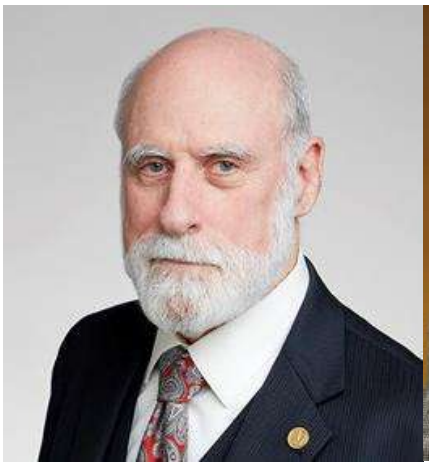
PROGRAM SPECIFIC OUTCOMES (PSOs)

Student of the Computer Science and Engineering program will:

- **PSO1**: **Professional Skills:** Attain the ability to design and develop hardware and software based systems, evaluate and recognize potential risks and provide creative solutions.
- **PSO2**: **Successful Career and Entrepreneurship:** Gain knowledge in diverse areas of Computer Science and experience an environment conducive in cultivating skills for successful career, entrepreneurship and higher studies.

Editorial

Meet the personalities



Widely known as the "Fathers of the Internet", Vint Cerf & Bob Kahn are the designers of the TCP/IP protocols and the architecture of the Internet.

https://history-computer.com/Internet/Maturing/TCPIP.html

CONTENTS

Face recognition' for galaxies: Artificial intelligence brings new tools to astronomy

JOEL JOHN | S7 CSE

A machine learning method called "deep learning," which has been widely used in face recognition and other image- and speech-recognition applications, has shown promise in helping astronomers analyze images of galaxies and understand how they form and evolve.

In a new study, accepted for publication in *Astrophysical Journal* and available online, researchers used computer simulations of galaxy formation to train a deep learning algorithm, which then proved surprisingly good at analyzing images of galaxies from the Hubble Space Telescope.

The researchers used output from the simulations to generate mock images of simulated galaxies as they would look in observations by the Hubble Space Telescope. The mock images were used to train the deep learning system to recognize three key phases of galaxy evolution previously identified in the simulations. The researchers then gave the system a large set of actual Hubble images to classify.

The results showed a remarkable level of consistency in the neural network's classifications of simulated and real galaxies.

"We were not expecting it to be all that successful. I'm amazed at how powerful this is," said coauthor Joel Primack, professor emeritus of physics and a member of the Santa Cruz Institute for Particle Physics (SCIPP) at UC Santa Cruz. "We know the simulations have limitations, so we don't want to make too strong a claim. But we don't think this is just a lucky fluke."

In the new study, the researchers were particularly interested in a phenomenon seen in the simulations early in the evolution of gas-rich galaxies, when big flows of gas into the center of a galaxy fuel formation of a small, dense, star-forming region called a "blue nugget." (Young, hot stars emit short "blue" wavelengths of light, so blue indicates a galaxy with active star formation, whereas older, cooler stars emit more "red" light.)

In both simulated and observational data, the computer program found that the "blue nugget" phase only occurs in galaxies with masses within a certain range. This is followed by quenching of star formation in the central region, leading to a compact "red nugget" phase. The consistency of the mass range was an exciting finding, because it suggests the deep learning algorithm is identifying on its own a pattern that results from a key physical process happening in real galaxies.

The researchers used state-of-the-art galaxy simulations (the VELA simulations) developed by Primack and an international team of collaborators, including Daniel Ceverino (University of Heidelberg), who ran the simulations, and Avishai Dekel (Hebrew University), who led analysis and interpretation of them and developed new physical concepts based on them. All such simulations are limited, however, in their ability to capture the complex physics of galaxy formation.

For the observational data, the team used images of galaxies obtained through the CANDELS project (Cosmic Assembly Near-infrared Deep Extragalactic Legacy Survey), the largest project in the history of the Hubble Space Telescope. First author Marc Huertas-Company, an astronomer at the Paris Observatory and Paris Diderot University, had already done pioneering work applying deep learning methods to galaxy classifications using publicly available CANDELS data.

Koo, a CANDELS co-investigator, invited Huertas-Company to visit UC Santa Cruz to continue this work. Google has provided support for their work on deep learning in astronomy through gifts of research funds to Koo and Primack, allowing Huertas-Company to spend the past two summers in Santa Cruz, with plans for another visit in the summer of 2018.

"This project was just one of several ideas we had," Koo said. "We wanted to pick a process that theorists can define clearly based on the simulations, and that has something to do with how a galaxy looks, then have the deep learning algorithm look for it in the observations. We're just beginning to explore this new way of doing research. It's a new way of melding theory and observations."

According to Koo, deep learning has the potential to reveal aspects of the observational data that humans can't see. The downside is that the algorithm is like a "black box," so it is hard to know what features in the data the machine is using to make its classifications. Network interrogation techniques can identify which pixels in an image contributed most to the classification, however, and the researchers tested one such method on their network.

"Deep learning looks for patterns, and the machine can see patterns that are so complex that we humans don't see them," Koo said. "We want to do a lot more testing of this approach, but in this proof-of-concept study, the machine seemed to successfully find in the data the different stages of galaxy evolution identified in the simulations."

In the future, he said, astronomers will have much more observational data to analyze as a result of large survey projects and new telescopes such as the Large Synoptic Survey Telescope, the James Webb Space Telescope, and the Wide-Field Infrared Survey Telescope. Deep learning and other machine learning methods could be powerful tools for making sense of these massive datasets.

Source: University of California- Santa Cruz

AI software assists design of new material for solar cells

SHARON ALEX | S7 CSE

Solar cells will play a key role in shifting to a renewable economy. Organic photovoltaics (OPVs) are a promising class of solar cells, based on a light-absorbing organic molecule combined with a semiconducting polymer.

OPVs are made from inexpensive, lightweight materials, and benefit from good safety as well as easy production. However, their power conversion efficiencies (PCEs) -- the ability to convert light into electricity -- are still too low for full-scale commercialization.

The PCE depends on both the organic and the polymer layer. Traditionally, chemists have experimented with different combinations of these by trial-and-error, leading to a lot of wasted time and effort.

Now, a team of Osaka University researchers has used computer power to automate the search for well-matched solar materials. In the future, this could lead to vastly more efficient devices. The study was reported in *The Journal of Physical Chemistry Letters*.

"The choice of polymer affects several properties, like short-circuit current, that directly determine the PCE," study first author Shinji Nagasawa explains. "However, there's no easy way to design polymers with improved properties. Traditional chemical knowledge isn't enough. Instead, we used artificial intelligence to guide the design process."

Informatics can make sense of large, complex datasets by detecting statistical trends that elude human experts. The team gathered data on 1,200 OPVs from around 500 studies. Using Random Forest machine learning, they built a model combining the band gap, molecular weight, and chemical structure of these previous OPVs, together with their PCE, to predict the efficiency of potential new devices.

Random Forest uncovered an improved correlation between the properties of the materials and their actual performance in OPVs. To exploit this, the model was used to automatically "screen" prospective polymers for their theoretical PCE. The list of top candidates was then whittled down based on chemical intuition about what can be synthesized in practice.

This strategy led the team to create a new, previously untested polymer. In the event, a practical OPV based on this first try proved less efficient than expected. However, the model provided useful insights into the structure-property relationship. Its predictions could be improved by including more data, such as the polymers' solubility in water, or the regularity of their backbone.

"Machine learning could hugely accelerate solar cell development, since it instantaneously predicts results that would take months in the lab," co-author Akinori Saeki says. "It's not a straightforward replacement for the human factor -- but it could provide crucial support when molecular designers have to choose which pathways to explore."

Source: Osaka University

Alexa: Amazon's virtual assistant becomes a personal assistant to software developers

SRUTHY S PRAKASH | S7 CSE

UBC computer scientists have turned Amazon Alexa into a tool for software engineers, tasking the virtual assistant to take care of mundane programming tasks, helping increase productivity and speed up workflow.

Software engineers use many different tools for any one project. They work with millions of lines of computer code and run their code through various independent tools to help edit, build and test systems and for project management to get their programs running smoothly.

"It can be quite complicated to switch between the different tools because they each use a unique syntax and you have to understand how to put them together," said Nick Bradley, who led this work during his master's research in computer science at UBC. "The idea to use Alexa came out of my frustration from using these different tools and having to spend so much time looking up how to do it and use those tools together."

Bradley and computer science professors Reid Holmes and Thomas Fritz decided to test whether Amazon's virtual assistant could help with this process. They wanted software engineers to use simple, conversational language to ask Alexa to complete some of their tasks, the same way we ask it to give us the weather forecast or play our favourite songs.

Researchers said it was more than just a matter of teaching Alexa some key phrases and mapping different commands to the work, they also had to figure out common multi-step tasks engineers were performing and build a system that could automate those tasks. They then asked 21 engineers from local Vancouver software companies to test out their system and evaluate it. While the engineers found the tool useful and provided lots of positive feedback, there was one challenge.

"The biggest problem was using voice commands in an office environment -- they found it distracting to their neighbours," said Bradley.

The computer scientists' next development will be to create a chat bot to fulfill a similar function so engineers can type minimal requests and have the system perform their multi-step tasks so they can focus on the more important parts of their jobs.

Holmes says this research is part of a larger effort to understand how software engineers do their jobs.

"The pace of change in the software field is so fast that engineers don't have time to be introspective and think about the way they work," he said. "Our job in academia is to step back and really think about how we can better support engineers to quickly and correctly build the kinds of software we depend upon in our modern society. Systems keep getting larger and more complex and using personal assistants could be one way to help developers be more effective within this fast-paced environment."

The researchers also recognize that these virtual assistants could be programmed for a variety of occupations including medicine, law, or accounting.

"You can imagine a situation where a lawyer is reading a legal brief and asks Alexa to find relevant cases on similar topics to help with research," said Holmes.

Source: University of British Columbia

AI detects patterns of gut microbes for cholera risk

SONY SEBASTIAN | S7 CSE

Researchers from Duke University, Massachusetts General Hospital and the International Centre for Diarrheal Disease Research in Dhaka, Bangladesh have used machine learning algorithms to spot patterns within communities of bacteria living in the human gut that no human would ever be able to pick out. These patterns could indicate who among the approximately one billion people around the globe at risk of cholera infection will get sick with the diarrheal disease.

"These are patterns that even the most sophisticated scientist couldn't detect by eye," said Lawrence A. David, Ph.D., a senior author of the study and assistant professor of molecular genetics and microbiology at Duke School of Medicine. "While some people are warning about

artificial intelligence leading to killer robots, we are showing the positive impact of AI in its potential to overcome disease."

The research, published this week in the *Journal of Infectious Diseases*, suggests that a focus on gut microbes may be important for developing improved vaccines and preventive approaches for cholera and other infectious diseases.

"Our study found that this 'predictive microbiota' is as good at predicting who gets ill with cholera as the clinical risk factors that we've known about for decades," said Regina C. LaRocque, M.D., MPH, of the Massachusetts General Hospital Division of Infectious Diseases, a senior author of the study and assistant professor of medicine at Harvard Medical School. "We've essentially identified a whole new component of cholera risk that we did not know about before."

Cholera can spread rapidly in areas with unsafe drinking water and inadequate sanitation, causing millions of cases of acute watery diarrhea every year. Despite its global impact, scientists still do not completely understand why some people who come into contact with the cholera bacterium become sick while others do not. Some studies have pinpointed a few risk factors, such as age, blood type and previous infections, but these only partially explain the differences in clinical outcomes after exposure to the pathogen.

In this study, David and LaRocque teamed up with Firdausi Qadri, Ph.D., a leader in cholera vaccine research in Bangladesh, to see whether the gut's trillions of resident bacteria -- collectively known as the gut microbiota -- might also play a role in cholera risk.

The researchers collected rectal swab samples from residents of Dhaka who lived in the same household with a patient hospitalized with cholera, and thus were at imminent risk of developing the disease. Of 76 household contacts studied, about a third went on to develop cholera during the follow-up period and about two-thirds remained uninfected.

The researchers profiled the microbiota from the household contacts' rectal swab samples using sequencing technology and then loaded all the data into a computer for analysis. They trained the machine to scan the results from 4000 different bacterial taxa in each of the samples, looking for patterns that distinguished those who got sick from those who didn't. Eventually, the machine hit on a set of 100 microbes associated with susceptibility to cholera.

"Normally, you have to eyeball the data, studying one bacterial species at a time in hopes of finding a signal that is associated with infection," said Firas S. Midani, a lead author of the study and a graduate student in David's lab. "Machines have the ability to look at a hundred species at a time, and amalgamate them into one signal."

The team showed that the model generated by artificial intelligence could predict illness even better than models previously built by infectious disease experts. The model also suggested hypotheses that might explain why the patterns identified by the computer are associated with disease. For example, when the researchers picked a bacterial species identified by their model and studied it in the laboratory, they found that the bacteria promoted the growth of cholera in test tubes. Their findings indicate that the composition of the gut microbiota could create an environment that is more or less hospitable to pathogens.

"Scientists have long had a hunch that gut bacteria might affect a person's susceptibility to diarrheal diseases, but our study is among the first to show this in a real-world setting," LaRocque said.

Source: Duke University, Massachusetts

Atomically thin magnetic device could lead to new memory technologies

ARAVIND MOHAN M | S7 CSE

Magnetic materials are the backbone of modern digital information technologies, such as hard-disk storage. A University of Washington-led team has now taken this one step further by encoding information using magnets that are just a few layers of atoms in thickness. This breakthrough may revolutionize both cloud computing technologies and consumer electronics by enabling data storage at a greater density and improved energy efficiency.

In a study published online May 3 in the journal *Science*, the researchers report that they used stacks of ultrathin materials to exert unprecedented control over the flow of electrons based on the direction of their spins -- where the electron "spins" are analogous to tiny, subatomic magnets. The materials that they used include sheets of chromium tri-iodide (CrI3), a material described in 2017 as the first ever 2-D magnetic insulator. Four sheets -- each only atoms thick -- created the thinnest system yet that can block electrons based on their spins while exerting more than 10 times stronger control than other methods.

"Our work reveals the possibility to push information storage based on magnetic technologies to the atomically thin limit," said co-lead author Tiancheng Song, a UW doctoral student in physics.

In related research, published April 23 in *Nature Nanotechnology*, the team found ways to electrically control the magnetic properties of this atomically thin magnet.

"With the explosive growth of information, the challenge is how to increase the density of data storage while reducing operation energy," said corresponding author Xiaodong Xu, a UW professor of physics and of materials science and engineering, and faculty researcher at the UW Clean Energy Institute. "The combination of both works points to the possibility of engineering atomically thin magnetic memory devices with energy consumption orders of magnitude smaller than what is currently achievable."

The new *Science* paper also looks at how this material could allow for a new type of memory storage that exploits the electron spins in each individual sheet.

The researchers sandwiched two layers of CrI3 between conducting sheets of graphene. They showed that, depending on how the spins are aligned between each of the CrI¬¬3 sheets, the electrons can either flow unimpeded between the two graphene sheets or were largely blocked from flowing. These two different configurations could act as the bits -- the zeroes and ones of binary code in everyday computing -- to encode information.

"The functional units of this type of memory are magnetic tunnel junctions, or MTJ, which are magnetic 'gates' that can suppress or let through electrical current depending on how the spins align in the junction," said co-lead author Xinghan Cai, a UW postdoctoral researcher in physics. "Such a gate is central to realizing this type of small-scale data storage."

With up to four layers of CrI3, the team discovered the potential for "multi-bit" information storage. In two layers of CrI3, the spins between each layer are either aligned in the same direction or opposite directions, leading to two different rates that the electrons can flow through the magnetic gate. But with three and four layers, there are more combinations for spins between each layer, leading to multiple, distinct rates at which the electrons can flow through the magnetic material from one graphene sheet to the other.

"Instead of your computer having just two choices to store a piece of data in, it can have a choice A, B, C, even D and beyond," said co-author Bevin Huang, a UW doctoral student in physics. "So not only would storage devices using CrI3 junctions be more efficient, but they would intrinsically store more data."

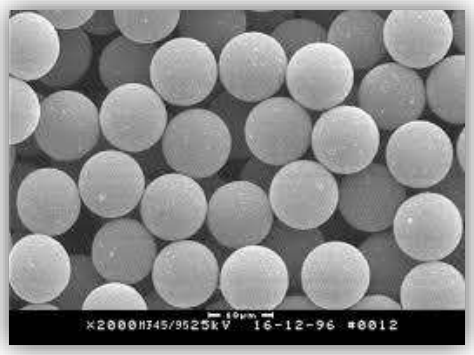
The researchers' materials and approach represent a significant improvement over existing techniques under similar operating conditions using magnesium oxide, which is thicker, less effective at blocking electrons and lacks the option for multi-bit information storage.

"Although our current device requires modest magnetic fields and is only functional at low temperature, infeasible for use in current technologies, the device concept and operational principle are novel and groundbreaking," said Xu. "We hope that with developed electrical control of magnetism and some ingenuity, these tunnel junctions can operate with reduced or even without the need for a magnetic field at high temperature, which could be a game changer for new memory technology."

Source: University of Washington

Custom silicon microparticles dynamically reconfigure on demand

ANCIYA T A | S7 CSE



Researchers at Duke University and North Carolina State University have demonstrated the first custom semiconductor microparticles that can be steered into various configurations repeatedly while suspended in water.

With an initial six custom particles that predictably interact with one another in the presence of alternating current (AC) electric fields of varying frequencies, the study presents the first steps toward realizing advanced applications such as artificial muscles and reconfigurable computer systems.

The study appears online on May 3 in the journal *Nature Communications*.

"We've engineered and encoded multiple dynamic responses in different microparticles to create a reconfigurable silicon toolbox," said Ugonna Ohiri, a recently graduated electrical engineering doctoral student from Duke and first author of the paper. "By providing a means of controllably assembling and disassembling these particles, we're bringing a new tool to the field of active matter."

While previous researchers have worked to define self-assembling systems, few have worked with semiconductor particles, and none have explored the wide range of custom shapes, sizes and coatings that are available to the micro- and nanofabrication industry. Engineering particles from silicon presents the opportunity to physically realize electronic devices that can self-assemble and disassemble on demand. Customizing their shapes and sizes presents opportunities to explore a wide-ranging design space of new motile behaviors.

"Most previous work performed using self-assembling particles has been done with shapes such as spheres and other off-the-shelf materials," said Nan Jokerst, the J. A. Jones Professor of Electrical and Computer Engineering at Duke. "Now that we can customize whatever arbitrary shapes, electrical characteristics and patterned coatings we want with silicon, a whole new world is opening up."

In the study, Jokerst and Ohiri fabricated silicon particles of various shapes, sizes and electrical properties. In collaboration with Orlin Velev, the INVISTA Professor of Chemical and Biomolecular Engineering at NC State, they characterized how these particles responded to different magnitudes and frequencies of electric fields while submerged in water.

Based on these observations, the researchers then fabricated new batches of customized particles that were likely to exhibit the behaviors they were looking for, resulting in six different engineered silicon microparticle compositions that could move through water, synchronize their motions, and reversibly assemble and disassemble on demand.

The thin film particles are 10-micron by 20-micron rectangles that are 3.5 microns thick. They're fabricated using Silicon-on-Insulator (SOI) technology. Since they can be made using the same fabrication technology that produces integrated circuits, millions of identical particles could be produced at a time.

"The idea is that eventually we're going to be able to make silicon computational systems that assemble, disassemble and then reassemble in a different format," said Jokerst. "That's a long way off in the future, but this work provides a sense of the capabilities that are out there and is the first demonstration of how we might achieve those sorts of devices."

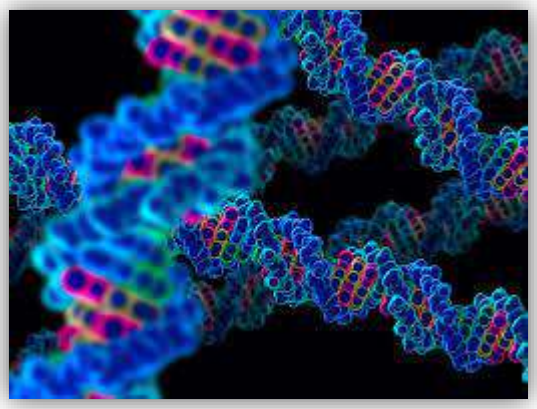
That is, however, only the tip of the proverbial iceberg. Some of the particles were fabricated with both p-type and n-type regions to create p-n junctions -- common electrical components that allow electricity to pass in only one direction. Tiny metal patterns were also placed on the particles' surfaces to create p-n junction diodes with contacts. In the future, researchers could even engineer particles with patterns using other electrically conductive or insulating materials, complex integrated circuits, or microprocessors on or within the silicon.

"This work is just a small snapshot of the tools we have to control particle dynamics," said Ohiri. "We haven't even scratched the surface of all of the behaviors that we can engineer, but we hope that this multidisciplinary study can pioneer future studies to design artificial active materials."

Source: Duke University

Protecting confidentiality in genomic studies

ASHRIN M A | S7 CSE



Genome-wide association studies, which look for links between particular genetic variants and incidence of disease, are the basis of much modern biomedical research.

But databases of genomic information pose privacy risks. From people's raw genomic data, it may be possible to infer their surnames and perhaps even the shapes of their faces. Many people are reluctant to contribute their genomic data to biomedical research projects, and an organization hosting a large repository of genomic data might conduct a months-long review before deciding whether to grant a researcher's request for access.

In a paper appearing today in *Nature Biotechnology*, researchers from MIT and Stanford University present a new system for protecting the privacy of people who contribute their genomic data to large-scale biomedical studies. Where earlier cryptographic methods were so computationally intensive that they became prohibitively time consuming for more than a few thousand genomes, the new system promises efficient privacy protection for studies conducted over as many as a million genomes.

"As biomedical researchers, we're frustrated by the lack of data and by the access-controlled repositories," says Bonnie Berger, the Simons Professor of Mathematics at MIT and corresponding author on the paper. "We anticipate a future with a landscape of massively distributed genomic data, where private individuals take ownership of their own personal genomes, and institutes as well as hospitals build their own private genomic databases. Our work provides a roadmap for pooling together this vast amount of genomic data to enable scientific progress."

At the core of the system is a technique called secret sharing, which divides sensitive data among multiple servers. To store the number x, for instance, a secret-sharing system might send the random number r to one server and x-r to the other.

If both servers are hacked, of course, the attacker could reconstruct all the x's. But so long as one server is trustworthy, the system is secure. Furthermore, that principle generalizes to multiple servers. If data are divided among, say, four servers, an attacker would have to infiltrate all four; hacking any three is insufficient to extract any data.

Finding useful disease correlations requires filtering out misleading correlations, a process known as population stratification correction. East Asians, for instance, are frequently lactose intolerant, but they also tend to be shorter than Northern Europeans. A naïve investigation of the genetic correlates of lactose intolerance might instead end up identifying those for height.

Population stratification correction typically relies on an algorithm called principal component analysis, which requires repeated multiplications involving the whole SNP-versus-genome

matrix. If every entry in the matrix needed its own set of Beaver triples for each of those multiplications, analyzing a million genomes would be prohibitively time consuming.

But Cho, Berger, and Wu found a way to structure that sequence of multiplications so that many of the Beaver triples can be calculated only once and reused, drastically reducing the complexity of the computation.

They also use a couple other techniques to speed up their system. Because the Beaver triples must be shared secretly, each number in the Beaver triple has an associated random number: In the two-server scenario, one server would get the random number and the other would get the Beaver number minus the random number.

Based on these techniques, Cho, Berger, and Wu's system accurately reproduced three published genome-wide association studies involving 23,000 individual genomes. The results of those analyses suggest that the system should scale efficiently to a million genomes.

Source: Massachusetts Institute of Technology

A surprising new superconductor

MERIN PETER | S7 CSE

Last September, CIRES chemist and instrument designer Don David and colleagues Dave Pappas and Xian Wu at the National Institute of Standards and Technology discovered a powerful new plated metal combination that superconducts at easily attained temperatures -- paving the road for the next critical steps in the development of cutting-edge supercomputers. David and his colleagues just published the new recipe: an ultrathin layer of rhenium sandwiched between layers of gold, each measuring 1/1000th the diameter of a human hair that can superconduct at critical temperature over 6 Kelvin.

"The sheer magnitude of the critical temperature was unexpected," said Don David, director of the CIRES Integrated Instrument Development Facility and coauthor on a paper published this week in *Applied Physics Letters*. "We had been thinking for a while about ways to impart superconducting properties to gold and copper films, and we were surprised at how robust and effective the thin layer of electroplated Re was."

A superconductor is a material with zero electrical resistance when cooled to a critical temperature. This temperature is usually strikingly low and expensive to obtain. The team's electroplated rhenium meets ideal characteristics desired for use in circuit boards for ultrafast, next-generation computing applications: superconducting at higher, easier-to-achieve critical temperatures, easy to work with mechanically, non-toxic, and melts at high temperatures. The new finding is already drawing attention from international computing giants.

Electroplating, the process passing an electrical current through an aqueous solution of a dissolved metal to create a metal coating on a submerged object, is something David does almost daily. David's work is in high demand in the research community: He and his team support science by plating instruments like charged-particle optics and components for cryogenics applications, and in this case, circuit boards for a team at NIST. They were looking for a metal plating that might be superconducting for the Pappas's Quantum Processing Group at NIST. The team had unsuccessfully tried a number combinations, then one day David's NIST colleague Xian Wu suggested they try rhenium: a hard, trace metal, with a high melting point, often used in the construction of jet engine turbines.

The team tested for electrical resistance, and were happy to see it superconduct up to 6K, well above the boiling temperature of liquid helium (4.2 K). The team is now investigating the role of hydrogen incorporation, interfaces, and strain on the enhanced superconducting temperature. But whatever the reason for the enhancement, being able to electroplate a superconductor is a giant step forward in the creation of tomorrow's high-performance, superconducting computers.

Inside every computer there is a circuit board: a layered, electronic plank etched with thousands of conductive pathways. Pulses of electrical information called "bits" speed across the board, carrying out the computer's functions. In regular computers, these electrical pulses are hindered by the material that comprises the board -- electrical resistance slows down the electrons scurrying about the circuitry, and the wasted energy becomes heat. But with a superconductor, there is literally zero electrical resistance, so there is no heating. This efficiency will result in exceedingly fast and powerful computer systems.

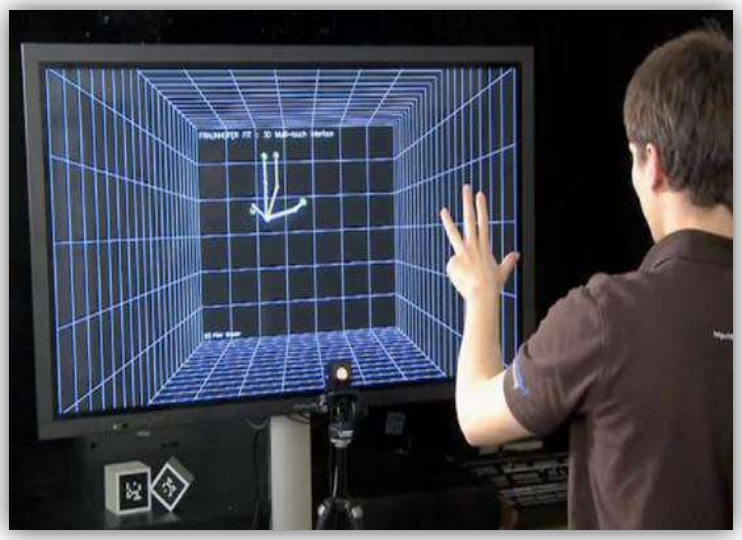
Superconductors aren't new, but the new paper presents evidence that electroplated rhenium may be the best material found to date for superconductive computer circuit board construction. Many other superconductive materials, like mercury or lead, are difficult to work with mechanically, have poor soldering properties, or melt at too-low temperatures. Even more impressively, the electroplating process would be easily scaled-up to mass-production, David said.

The team has applied for a provisional patent, and their work has already sparked interest from several technology giants and government sponsors.

Source: University of Colorado at Boulder

Touchless Touchscreen

Adarsh VS | S4 CSE



Touch screen displays are ubiquitous worldwide.Frequent touching a touchscreen display with a pointing device such as a finger can result in the gradual de-sensitization of the touchscreen to input and can ultimately lead to failure of the touchscreen.

To avoid this a simple user interface for Touchless control of electrically operated equipment is being developed. EllipticLabs innovative technology lets you control your gadgets like Computers, MP3 players or mobile phones without touching them.

A simple user interface for Touchless control of electrically operated equipment. Unlike other systems which depend on distance to the sensor or sensor selection this system depends on hand and or finger motions, a hand wave in a certain direction, or a flick of the hand in one area, or holding the hand in one area or pointing with one finger for example. The device is based on optical pattern recognition using a solid state optical matrix sensor with a lens to detect hand motions. This sensor is then connected to a digital image processor, which interprets the patterns of motion and outputs the results as signals to control fixtures, appliances, machinery, or any device controllable through electrical signals.

The touch less touch screen sounds like it would be nice and easy, however after closer examination it looks like it could be quite a workout. This unique screen is made by TouchKo , White Electronics Designs , and Groupe 3D. The screen resembles the Nintendo Wii without the Wii Controller. With the touchless touch screen your hand doesn't have to come in contact with the screen at all, it works by detecting your hand movements in front of it. This is a pretty unique and interesting invention, until you break out in a sweat. Now this technology doesn't compare to the hologram-like IO2 Technologies Heliodisplay M3 , but thats for anyone that has $18,100 laying around.

You probably wont see this screen in stores any time soon. Everybody loves a touch screen and when you get a gadget with touch screen the experience is really exhilarating. When the I-phone was introduced,everyone felt the same.But gradually,the exhilaration started fading. While using the phone with the finger tip or with the stylus the screen started getting lots of finger prints and scratches. When we use a screen protector; still dirty marks over such beautiful glossy screen is a strict no-no. Same thing happens with I-pod touch. . Most of the time we have to wipe the screen to get a better unobtrusive view of the screen.

Thanks to EllipticLabs innovative technology that lets you control your gadgets like Computers, MP3 players or mobile phones without touching them. Simply point your finger in the air towards the device and move it accordingly to control the navigation in the device. They term this as "Touchless human/machine user interface for 3D navigation ".

Many personal computers will likely have similar screens in the near future. But touch interfaces are nothing new witness ATM machines.How about getting completely out of touch? A startup called LM3Labs says it's working with major computer makers in Japan, Taiwan and the US to incorporate touch less navigation into their laptops, Called Airstrike; the system uses tiny charge-coupled device (CCD) cameras integrated into each side of the keyboard to detect user movements.

You can drag windows around or close them, for instance, by pointing and gesturing in midair above the keyboard.You should be able to buy an Airstrike-equipped laptop next year, with high-end stand-alone keyboards to follow. Any such system is unlikely to replace typing and mousing. But that's not the point. Airstrike aims to give you an occasional quick break from those activities. Today's thoughts are again around user interface. Efforts are being put to better the technology day-in and day-out. The Touchless touch screen user interface can be used effectively in computers, cell phones, webcams and laptops. May be few years down the line, our body can be transformed into a virtual mouse, virtual keyboard and what not??, Our body may be turned in to an input device!

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Ingestible 'bacteria on a chip' could help diagnose disease

Ria Elizabeth Joe | S4 CSE

MIT researchers have built an ingestible sensor equipped with genetically engineered bacteria that can diagnose bleeding in the stomach or other gastrointestinal problems. This "bacteria-on-a-chip" approach combines sensors made from living cells with ultra-low-power electronics that convert the bacterial response into a wireless signal that can be read by a smartphone.

"By combining engineered biological sensors together with low-power wireless electronics, we can detect biological signals in the body and in near real-time, enabling new diagnostic capabilities for human health applications," says Timothy Lu, an MIT associate professor of electrical engineering and computer science and of biological engineering.

In the new study, appearing in the May 24 online edition of *Science*, the researchers created sensors that respond to heme, a component of blood, and showed that they work in pigs. They also designed sensors that can respond to a molecule that is a marker of inflammation.

Lu and Anantha Chandrakasan, dean of MIT's School of Engineering and the Vannevar Bush Professor of Electrical Engineering and Computer Science, are the senior authors of the study. The lead authors are graduate student Mark Mimee and former MIT postdoc Phillip Nadeau.

In the past decade, synthetic biologists have made great strides in engineering bacteria to respond to stimuli such as environmental pollutants or markers of disease. These bacteria can be designed to produce outputs such as light when they detect the target stimulus, but specialized lab equipment is usually required to measure this response.

To make these bacteria more useful for real-world applications, the MIT team decided to combine them with an electronic chip that could translate the bacterial response into a wireless signal.

"Our idea was to package bacterial cells inside a device," Nadeau says. "The cells would be trapped and go along for the ride as the device passes through the stomach."

For their initial demonstration, the researchers focused on bleeding in the GI tract. They engineered a probiotic strain of E. coli to express a genetic circuit that causes the bacteria to emit light when they encounter heme.

They placed the bacteria into four wells on their custom-designed sensor, covered by a semipermeable membrane that allows small molecules from the surrounding environment to diffuse through. Underneath each well is a phototransistor that can measure the amount of light produced by the bacterial cells and relay the information to a microprocessor that sends a wireless signal to a nearby computer or smartphone. The researchers also built an Android app that can be used to analyze the data.

The sensor, which is a cylinder about 1.5 inches long, requires about 13 microwatts of power. The researchers equipped the sensor with a 2.7-volt battery, which they estimate could power the device for about 1.5 months of continuous use. They say it could also be powered by a voltaic cell sustained by acidic fluids in the stomach, using technology that Nadeau and Chandrakasan have previously developed.

"The focus of this work is on system design and integration to combine the power of bacterial sensing with ultra-low-power circuits to realize important health sensing applications," Chandrakasan says.

The researchers tested the ingestible sensor in pigs and showed that it could correctly determine whether any blood was present in the stomach. They anticipate that this type of sensor could be either deployed for one-time use or designed to remain the digestive tract for several days or weeks, sending continuous signals.

Currently, if patients are suspected to be bleeding from a gastric ulcer, they have to undergo an endoscopy to diagnose the problem, which often requires the patient to be sedated.

"The goal with this sensor is that you would be able to circumvent an unnecessary procedure by just ingesting the capsule, and within a relatively short period of time you would know whether or not there was a bleeding event," Mimee says.

To help move the technology toward patient use, the researchers plan to reduce the size of the sensor and to study how long the bacteria cells can survive in the digestive tract. They also hope to develop sensors for gastrointestinal conditions other than bleeding.

In the *Science* paper, the researchers adapted previously described sensors for two other molecules, which they have not yet tested in animals. One of the sensors detects a sulfur-containing ion called thiosulfate, which is linked to inflammation and could be used to monitor patients with Crohn's disease or other inflammatory conditions. The other detects a bacterial signaling molecule called AHL, which can serve as a marker for gastrointestinal infections because different types of bacteria produce slightly different versions of the molecule.

"Most of the work we did in the paper was related to blood, but conceivably you could engineer bacteria to sense anything and produce light in response to that," Mimee says. "Anyone who is trying to engineer bacteria to sense a molecule related to disease could slot it into one of those wells, and it would be ready to go."

The researchers say the sensors could also be designed to carry multiple strains of bacteria, allowing them to diagnose a variety of conditions.

"Right now, we have four detection sites, but if you could extend it to 16 or 256, then you could have multiple different types of cells and be able to read them all out in parallel, enabling more high-throughput screening," Nadeau says.

Source: Massachusetts Institute of Technology

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