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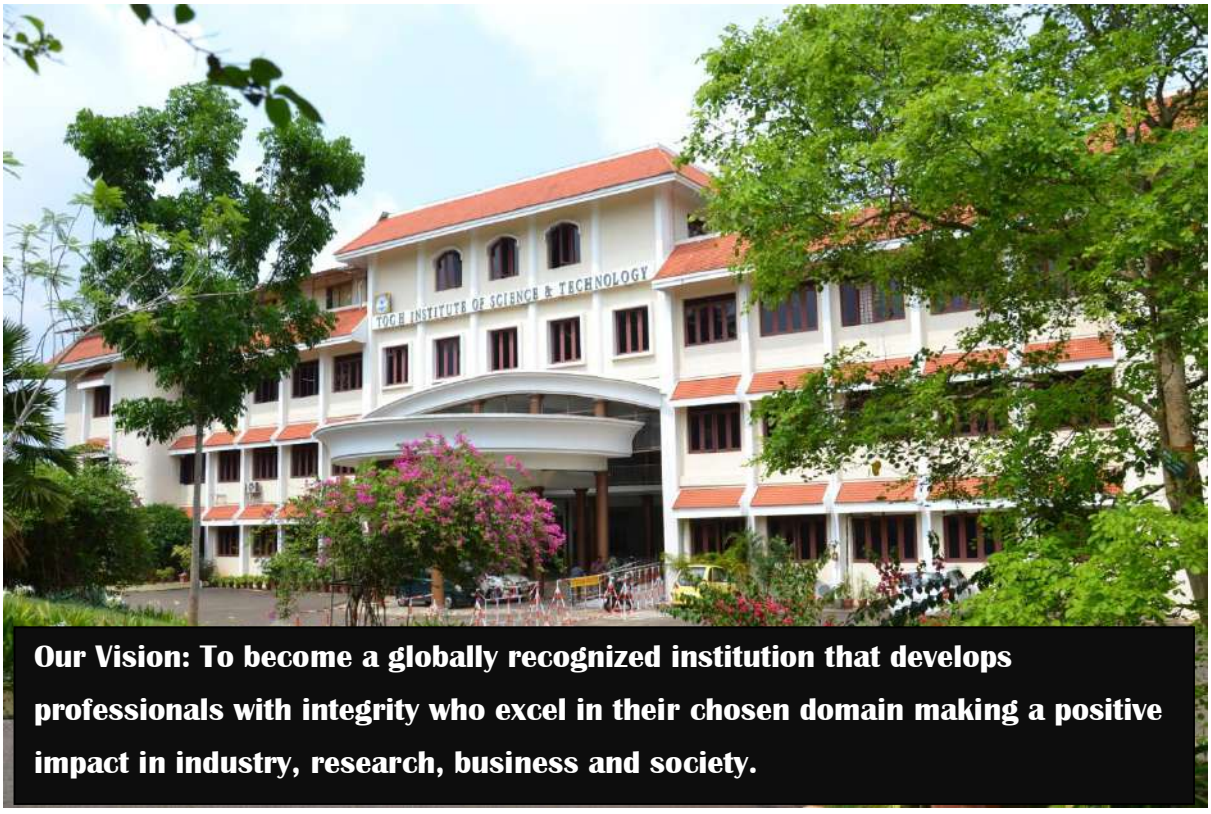
"WE DON'T DO DIFFERENT THINGS, WE DO THINGS DIFFERENTLY"



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

News Desk: The year of the Bitcoin roller coaster

Bitcoin had a similar rise-and-fall story in 2018. Heading into 2018, the cryptocurrency was at the height of its boom, pushing the price of Bitcoin up well over $10,000. But no matter how many crypto enthusiasts and startups repeated the promise, Bitcoin's value never made it back over $10,000. Currently, it hovers just below $4,000, fairly close to where it was in the fall of 2017. The downward trend hasn't stopped though, and the future of crypto feels as uncertain as ever. If there's one thing we've been left behind with, it's **blockchain**, the revolutionary **public ledger system Bitcoin** is based on.....

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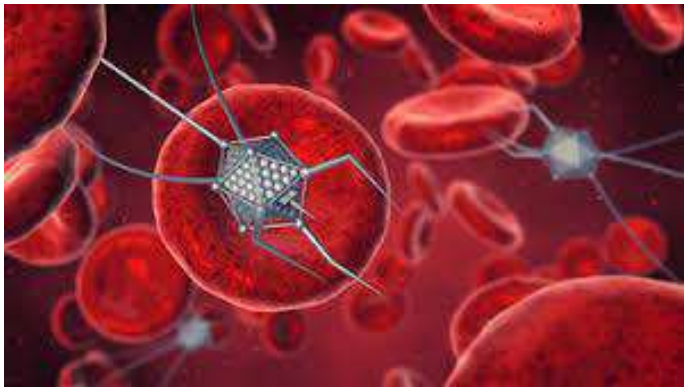
Cancer-fighting nanobots programmed to seek and destroy tumors

ANEENA THEREESA | S7 CSE



In a major advancement in nanomedicine, Arizona State University (ASU) scientists, in collaboration with researchers from the National Center for Nanoscience and Technology (NCNST), of the Chinese Academy of Sciences, have successfully programmed nanorobots to shrink tumors by cutting off their blood supply.

The successful demonstration of the technology, the first-of-its-kind study in mammals utilizing breast cancer, melanoma, ovarian and lung cancer mouse models, was published in the journal *Nature Biotechnology*.

Until now, the challenge to advancing nanomedicine has been difficult because scientists wanted to design, build and carefully control nanorobots to actively seek and destroy cancerous tumors -- while not harming any healthy cells.

The international team of researchers overcame this problem by using a seemingly simple strategy to very selectively seek and starve out a tumor.

This work was initiated about 5 years ago. The NCNST researchers first wanted to specifically cut-off of tumor blood supply by inducing blood coagulation with high therapeutic efficacy and safety profiles in multiple solid tumors using DNA-based nanocarriers. Prof. Hao Yan's expertise has upgraded the nanomedicine design to be a fully programmable robotic system, able to perform its mission entirely on its own.

"These nanorobots can be programmed to transport molecular payloads and cause on-site tumor blood supply blockages, which can lead to tissue death and shrink the tumor," said Baoquan Ding, a professor at the NCNST, located in Beijing, China.

To perform their study, the scientists took advantage of a well-known mouse tumor model, where human cancer cells are injected into a mouse to induce aggressive tumor growth.

Once the tumor was growing, the nanorobots were deployed to come to the rescue.

Each nanorobot is made from a flat, rectangular DNA origami sheet, 90 nanometers by 60 nanometers in size. A key blood-clotting enzyme, called thrombin, is attached to the surface.

Thrombin can block tumor blood flow by clotting the blood within the vessels that feed tumor growth, causing a sort of tumor mini-heart attack, and leading to tumor tissue death.

First, an average of four thrombin molecules was attached to a flat DNA scaffold. Next, the flat sheet was folded in on itself like a sheet of paper into a circle to make a hollow tube. They were injected with an IV into a mouse, then traveled throughout the bloodstream, homing in on the tumors.

Once bound to the tumor blood vessel surface, the nanorobot was programmed, like the notorious Trojan horse, to deliver its unsuspecting drug cargo in the very heart of the tumor, exposing an enzyme called thrombin that is key to blood clotting. The nanorobots worked fast, congregating in large numbers to quickly surround the tumor just hours after injection.

"The nanorobot proved to be safe and immunologically inert for use in normal mice and, also in Bama miniature pigs, showing no detectable changes in normal blood coagulation or cell morphology," said Yuliang Zhao, also a professor at NCNST and lead scientist of the international collaborative team. Most importantly, there was no evidence of the nanorobots spreading into the brain where it could cause unwanted side effects, such as a stroke.

"The nanorobots are decidedly safe in the normal tissues of mice and large animals," said Guangjun Nie, another professor at the NCNST and a key member of the collaborative team.

The treatment blocked tumor blood supply and generated tumor tissue damage within 24 hours while having no effect on healthy tissues. After attacking tumors, most of the nanorobots were cleared and degraded from the body after 24 hours.

Source: Arizona State University

Supercomputers without waste heat

ARAVIND DAS A M | S7 CSE

The miniaturisation of the semiconductor technology is approaching its physical limits. For more than 70 years, information processing in computers has been realized by creating and transferring electrical signals, which requires energy that is then released as heat. This dissipation results in a temperature increase in the

building blocks, which, in turn, requires complex cooling systems. Heat management is one of the big challenges in miniaturization.

A collaboration at the University of Konstanz between the experimental physics group led by Professor Elke Scheer and the theoretical physics group led by Professor Wolfgang Belzig uses an approach based on dissipation-free charge transport in superconducting building blocks. Magnetic materials are often used for information storage. Magnetically encoded information can, in principle, also be transported without heat production by using the magnetic properties of electrons, the electron spin. Combining the lossless charge transport of superconductivity with the electronic transport of magnetic information -- i.e. "spintronics" -- paves the way for fundamentally novel functionalities for future energy-efficient information technologies.

The University of Konstanz researchers address a major challenge associated with this approach: the fact that in conventional superconductors the current is carried by pairs of electrons with opposite magnetic moments. These pairs are therefore nonmagnetic and cannot carry magnetic information. The magnetic state, by contrast, is formed by magnetic moments that are aligned in parallel to each other, thereby suppressing superconducting current.

"The combination of superconductivity, which operates without heat generation, with spintronics, transferring magnetic information, does not contradict any fundamental physical concepts, but just naïve assumptions about the nature of materials," Elke Scheer says. Recent findings suggest that by bringing superconductors into contact with special magnetic materials, electrons with parallel spins can be bound to pairs carrying the supercurrent over longer distances through magnets. This concept may enable novel electronic devices with revolutionary properties.

"It is important to find materials that enable such aligned electron pairs. Ours is therefore not only a physics but also a materials science project," Elke Scheer remarks. Researchers from the Karlsruhe Institute of Technology (KIT) provided the tailor-made samples consisting of aluminium and europiumsulfide. Aluminium is a very well investigated superconductor, enabling a quantitative comparison between theory and experiment. Europiumsulfide is a ferromagnetic insulator, an important material property for the realisation of the theoretical concept, which maintains its magnetic properties even in very thin layers of only a few nanometres in thickness as

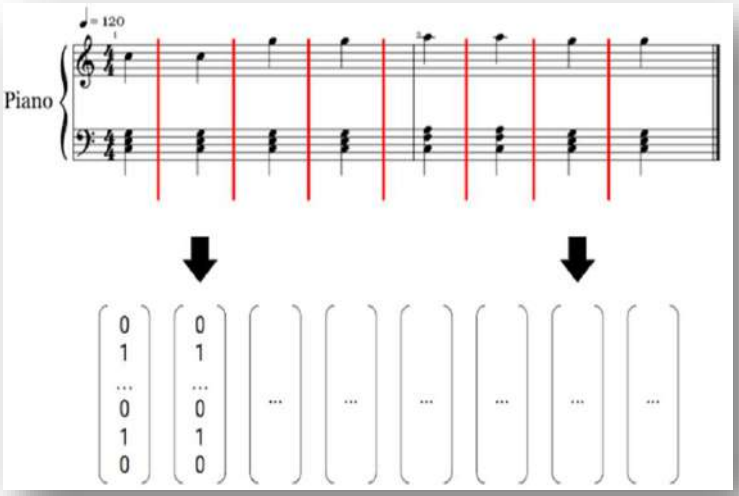
used here. Using a scanning tunnelling microscope developed at the University of Konstanz, spatially and energetically resolved measurements of the charge transport of the aluminium-europiumsulfide samples were performed at low temperatures. Contrary to commercial instruments, the scanning tunnelling microscope based at the Scheer lab has been optimized for ultimate energy resolution and for operation in varying magnetic fields.

Furthermore, the experimental-theoretical collaboration resolved existing contradictions regarding the interpretation of such spectra. With these results, the University of Konstanz physicists hope to reveal the high potential of superconducting spintronics for enhancing or replacing semiconductor technology.

Source: University of Konstanz

Network orchestration: Music to manage networks

KAILAS P A | S7 CSE



Orchestrating traffic is a crucial component of operating a data network. Modern networks may interconnect thousands of servers, storage units or switches that in turn run tasks like device booting and configuration, anomaly and intrusion detection, monitoring and diagnostics. These tasks must be managed to keep the network operating smoothly.

As these networks become increasingly complex, a Saint Louis University researcher turns to sound as a simpler alternative to manage complicated network tasks.

Flavio Esposito, Ph.D., assistant professor of computer science at SLU, together with collaborator, Mary Hogan, a former SLU undergraduate now pursuing her doctoral degree at Princeton University, recently proposed this innovative traffic-

management solution in Proceeding of the 17th ACM Workshop on Hot Topics in Networks.

"For several years, researchers have used the term 'network orchestration' as a metaphor," the authors write. "In this paper, we make the metaphor reality; we describe a novel approach to network orchestration that leverages sounds to augment or replace various network management operations."

Esposito was interested in exploring whether a simpler network management approach could solve common problems. Ideally, Esposito says, an out-of-band management network -- a type of network management that is separate from the data that flows across the network -- should be reliable, able to reach all devices in a datacenter, compatible with existing equipment, simple and inexpensive.

The researchers' answer to this wish list is Music-Defined Networking.

Music-defined networking is a model in which network functions can be programmed in response to specific sound sequences (music), coming from real or virtual devices. The researchers explored both active applications, where network devices were programmed to emit a certain sound, and passive applications, where sounds produced by devices e.g., datacenter fans, are monitored to identify when they may have failed.

Using low-cost speakers, microphones and Raspberry Pi's (small affordable computers designed for users to learn programming), the team augmented existing network components with sound capabilities.

"Unlike light, sound is not high speed but instead travels slowly. So, rather than looking at sound as a means of sending lots of data around a network, we're looking at it for the network management tasks that happen, for example, in the physical space of the datacenter," Esposito said.

In both a real and virtual network test environment, the researchers explored how music could be used for several network tasks, including datacenter server fan failure detection, authentication, load balancing and congestion notification.

"Nobody's incorporating the capabilities of the human ear into network management," Esposito said. "Sound has its limits -- it's noisy and doesn't travel very far -- but it's almost completely underused right now. In addition to the human ear, machines can recognize a tune that serves as a signal."

For instance, music can be used as a security system "doorbell" to warn that someone has accessed the network.

Malicious intruders often operate by trying every single "door" of entry into a network to find a way in. It can be very difficult to prevent, or even detect, such attacks. Using sound, researchers can create a code so that every time someone enters a virtual

door, a human operator or computer would hear a new pattern of music as a warning.

Esposito sees promise in the use of sound and hopes to study music as a means of accomplishing additional network tasks.

"Sound-based network management has potential as an effective and inexpensive network management technique for many applications. Exploring all these sounds fun to me."

Source: Saint Louis University

The big problem of small data: A new approach

SANKAR P G | S7 CSE

Big Data is all the rage today, but Small Data matters too! Drawing reliable conclusions from small datasets, like those from clinical trials for rare diseases or in studies of endangered species, remains one of the trickiest obstacles in statistics. Now, Cold Spring Harbor Laboratory (CSHL) researchers have developed a new way to analyze small data, one inspired by advanced methods in theoretical physics, but available as easy-to-use software.

"Dealing with small datasets is a fundamental part of doing science," CSHL Assistant Professor Justin Kinney explained. The challenge is that, with very little data, it's not only hard to come to a conclusion; it's also hard to determine how certain your conclusions are.

"It's important to not only produce the best guess for what's going on, but also to say, 'This guess is probably correct,'" said Kinney.

A good example is clinical drug trials.

"When each data point is a patient, you will always be dealing with small datasets, and for very good reasons," he said. "You don't want to test a treatment on more

people than you have to before determining if the drug is safe and effective. It's really important to be able to make these decisions with as little data as possible."

Quantifying that certainty has been difficult because of the assumptions that common statistical methods make. These assumptions were necessary back when standard methods were developed, before the computer age. But these approximations, Kinney notes, "can be catastrophic" on small datasets.

Now, Kinney's lab has crafted a modern computational approach called Density Estimation using Field Theory, or DEFT, that fixes these shortcomings. DEFT is freely available via an open source package called SUFTware.

In their recent paper, published in *Physical Review Letters*, Kinney's lab demonstrates DEFT on two datasets: national health statistics compiled by the World Health Organization, and traces of subatomic particles used by physicists at the Large Hadron Collider to reveal the existence of the Higgs boson particle.

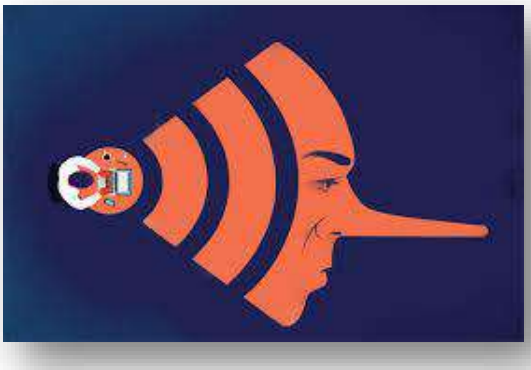
Kinney says that being able to apply DEFT to such drastically diverse "real-world" situations -- despite its computations being inspired by theoretical physics -- is what makes the new approach so powerful.

"Flexibility is a really good thing... We're now adapting DEFT to problems in survival analysis, the type of statistics used in clinical trials," Kinney said. "Those new capabilities are going to be added to SUFTware as we continue developing this new approach to statistics."

Source: Cold Spring Harbor Laboratory

Fake news detector algorithm works better than a human

SREEHARI N P | S7 CSE



An algorithm-based system that identifies telltale linguistic cues in fake news stories could provide news aggregator and social media sites like Google News with a new weapon in the fight against misinformation.

The University of Michigan researchers who developed the system have

demonstrated that it's comparable to and sometimes better than humans at correctly identifying fake news stories.

In a recent study, it successfully found fakes up to 76 percent of the time, compared to a human success rate of 70 percent. In addition, their linguistic analysis approach could be used to identify fake news articles that are too new to be debunked by cross-referencing their facts with other stories.

Rada Mihalcea, the U-M computer science and engineering professor behind the project, said an automated solution could be an important tool for sites that are struggling to deal with an onslaught of fake news stories, often created to generate clicks or to manipulate public opinion.

Catching fake stories before they have real consequences can be difficult, as aggregator and social media sites today rely heavily on human editors who often can't keep up with the influx of news. In addition, current debunking techniques often depend on external verification of facts, which can be difficult with the newest stories. Often, by the time a story is proven a fake, the damage has already been done.

Linguistic analysis takes a different approach, analyzing quantifiable attributes like grammatical structure, word choice, punctuation and complexity. It works faster than humans and it can be used with a variety of different news types.

"You can imagine any number of applications for this on the front or back end of a news or social media site," Mihalcea said. "It could provide users with an estimate of the trustworthiness of individual stories or a whole news site. Or it could be a first line of defense on the back end of a news site, flagging suspicious stories for further review. A 76 percent success rate leaves a fairly large margin of error, but it can still provide valuable insight when it's used alongside humans."

Linguistic algorithms that analyze written speech are fairly common today, Mihalcea said. The challenge to building a fake news detector lies not in building the algorithm itself, but in finding the right data with which to train that algorithm.

Fake news appears and disappears quickly, which makes it difficult to collect. It also comes in many genres, further complicating the collection process. Satirical news, for example, is easy to collect, but its use of irony and absurdity make it less useful for training an algorithm to detect fake news that's meant to mislead.

Ultimately, Mihalcea's team created its own data, crowdsourcing an online team that reverse-engineered verified genuine news stories into fakes. This is how most actual fake news is created, Mihalcea said, by individuals who quickly write them in return for a monetary reward.

Study participants, recruited with the help of Amazon Mechanical Turk, were paid to turn short, actual news stories into similar but fake news items, mimicking the

journalistic style of the articles. At the end of the process, the research team had a dataset of 500 real and fake news stories.

They then fed these labeled pairs of stories to an algorithm that performed a linguistic analysis, teaching itself distinguish between real and fake news. Finally, the team turned the algorithms to a dataset of real and fake news pulled directly from the web, netting the 76 percent success rate.

The details of the new system and the dataset that the team used to build it are freely available, and Mihalcea says they could be used by news sites or other entities to build their own fake news detection systems. She says that future systems could be further honed by incorporating metadata such as the links and comments associated with a given online news item.

Source: University of Michigan

Faster photons could enable total data security

SREELAKSHMI R NAIR | S7 CSE

Researchers at the University of Sheffield have solved a key puzzle in quantum physics that could help to make data transfer totally secure.

The team have developed a way of generating very rapid single-photon light pulses. Each photon, or particle of light, represents a bit of binary code -- the fundamental language of computing. These photons cannot be intercepted without disturbing them in a way that would alert the sender that something was amiss.

Transferring data using light passed along fibre optic cables has become increasingly common over the past decades, but each pulse currently contains millions of photons. That means that, in principle, a portion of these could be intercepted without detection.

Secure data is already encrypted, but if an 'eavesdropper' was able to intercept the signals containing details of the code then -- in theory -- they could access and decode the rest of the message.

Single photon pulses offer total security, because any eavesdropping is immediately detected, but scientists have struggled to produce them rapidly enough to carry data at sufficient speeds to transfer high volumes of data.

In a new study, published in *Nature Nanotechnology*, the Sheffield team have employed a phenomenon called the Purcell Effect to produce the photons very rapidly. A nanocrystal called a quantum dot is placed inside a cavity within a larger crystal -- the semiconductor chip. The dot is then bombarded with light from a laser which makes it absorb energy. This energy is then emitted in the form of a photon.

Placing the nanocrystal inside a very small cavity makes the laser light bounce around inside the walls. This speeds up the photon production by the Purcell Effect. One problem is that the photons carrying data information can easily become confused with the laser light. The Sheffield researchers have overcome this by funnelling the photons away from the cavity and inside the chip to separate the two different types of pulse.

In this way, the team have succeeded in making the photon emission rate about 50 times faster than would be possible without using the Purcell Effect. Although this isn't the fastest photon light pulse yet developed, it has a crucial advantage because the photons produced are all identical -- an essential quality for many quantum computing applications.

Mark Fox, Professor of Optical Physics at the University of Sheffield, explains: "Using photons to transmit data enables us to use the fundamental laws of physics to guarantee security. It's impossible to measure or 'read' the particle in any way without changing its properties. Interfering with it would therefore spoil the data and sound an alarm."

He added: "Our method also solves a problem that has puzzled scientists for about 20 years -- how to use this Purcell Effect to speed up photon production in an efficient way.

"This technology could be used within secure fibre optic telecoms systems, although it would be most useful initially in environments where security is paramount, including governments and national security headquarters."

Source: University of Sheffield

System allows surveillance cameras to 'talk' to the public through individual smartphones

RIA ELIZABETH JOE | S5 CSE

Purdue University researchers have created a technology that allows public cameras to send personalized messages to people without compromising their privacy.

The team developed a real-time end-to-end system called PHADE to allow this process, known as private human addressing. While traditional data transmission protocols need to first learn the destination's IP or MAC address, this system uses motion patterns as the address code for communication. The smartphones then locally make their own decisions on whether to accept a message.

The PHADE system works using a server to receive video streams from cameras to track people. The camera builds a packet by linking a message to the address code and broadcasts the packet. Upon receiving the packet, a mobile device of each of the targets uses sensors to extract its owner's behavior and follow the same transformation to derive a second address code. If the second address code matches with the address code in the message, the mobile device automatically delivers the message to its owner.

"Our technology enables public cameras to send customized messages to targets without any prior registration," said He Wang, an assistant professor in the Purdue Department of Computer Science, who created the technology along with his PhD student, Siyuan Cao. "Our system serves as a bridge to connect surveillance cameras and people and protects targets' privacy."

PHADE protects privacy in two key ways -- it keeps the users' personal sensing data within their smartphones and it transforms the raw features of the data to blur partial details. The creators named the system PHADE because the blurring process "fades" people's motion details out.

PHADE can be used in places such as at a museum, where visitors can receive messages with information about the artifacts or exhibits they are viewing. The technology also could be implemented in shopping malls to provide consumers with digital product information or coupons. In a similar way, PHADE could be valuable for new store prototypes such as Amazon Go, which uses phone technology instead of traditional checkout registers.

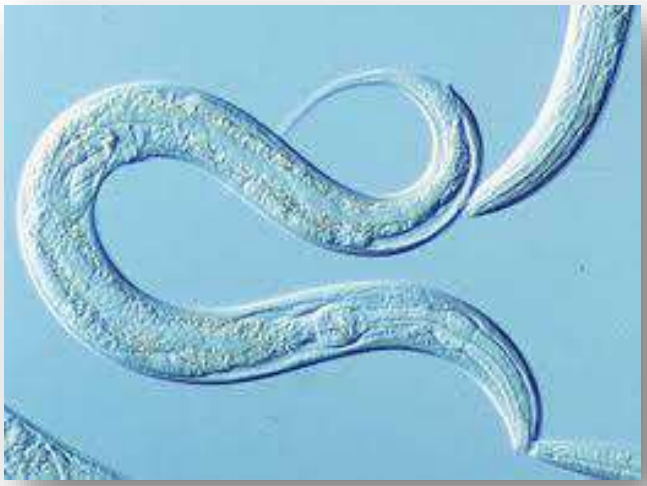
"PHADE may also be used by government agencies to enhance public safety," Cao said. "For example, the government can deploy cameras in high-crime or high-accident areas and warn specific users about potential threats, such as suspicious followers."

Wang said surveillance camera and security companies would also be able to integrate the technology into their products directly as a key feature. He also said this technology has advantages over Bluetooth-based beacons, which have difficulties in adjusting for ranges of transmission and do not allow for context-aware messaging.

Source: Purdue University

Worm 'uploaded' to computer and taught amazing tricks

THARA JOSE | S5 CSE



It is not much to look at: the nematode *C. elegans* is about one millimetre in length and is a very simple organism. But for science, it is extremely interesting. *C. elegans* is the only living being whose neural system has been analysed completely. It can be drawn as a circuit diagram or reproduced by computer software, so that the neural activity of the worm is simulated by a computer program.

Such an artificial *C. elegans* has now been trained at TU Wien (Vienna) to perform a remarkable trick: The computer worm has learned to balance a pole at the tip of its tail.

C. elegans has to get by with only 300 neurons. But they are enough to make sure that the worm can find its way, eat bacteria and react to certain external stimuli. It can, for example, react to a touch on its body. A reflexive response is triggered and the worm squirms away.

This behaviour can be perfectly explained: it is determined by the worm's nerve cells and the strength of the connections between them. When this simple reflex-network is recreated on a computer, then the simulated worm reacts in exactly the same way to a virtual stimulation -- not because anybody programmed it to do so, but because this kind of behaviour is hard-wired in its neural network.

"This reflexive response of such a neural circuit, is very similar to the reaction of a control agent balancing a pole," says Ramin Hasani (Institute of Computer Engineering, TU Wien). This is a typical control problem which can be solved quite well by standard controllers: a pole is fixed on its lower end on a moving object, and it is supposed to stay in a vertical position. Whenever it starts tilting, the lower end has to move slightly to keep the pole from tipping over. Much like the worm has to change its direction whenever it is stimulated by a touch, the pole must be moved whenever it tilts.

Mathias Lechner, Radu Grosu and Ramin Hasani wanted to find out, whether the neural system of *C. elegans*, uploaded to a computer, could solve this problem -- without adding any nerve cells, just by tuning the strength of the synaptic connections. This basic idea (tuning the connections between nerve cells) is also the characteristic feature of any natural learning process.

"With the help of reinforcement learning, a method also known as 'learning based on experiment and reward', the artificial reflex network was trained and optimized on the computer," Mathias Lechner explains. And indeed, the team succeeded in teaching the virtual nerve system to balance a pole. "The result is a controller, which can solve a standard technology problem -- stabilizing a pole, balanced on its tip. But no human being has written even one line of code for this controller, it just emerged by training a biological nerve system," says Radu Grosu.

The team is going to explore the capabilities of such control-circuits further. The project raises the question, whether there is a fundamental difference between living nerve systems and computer code. Is machine learning and the activity of our brain the same on a fundamental level? At least we can be pretty sure that the simple nematode *C. elegans* does not care whether it lives as a worm in the ground or as a virtual worm on a computer hard drive.

Source: Vienna University of Technology

Brain-like computers moving closer to cracking codes

RAICHEL SUSEEL | S7 CSE

U.S. Army Research Laboratory scientists have discovered a way to leverage emerging brain-like computer architectures for an age-old number-theoretic problem known as integer factorization.
By mimicking the brain functions of mammals in computing, Army scientists are opening up a new solution space that moves away from traditional computing architectures and towards devices that are able to operate within extreme size-, weight-, and power-constrained environments.

"With more computing power in the battlefield, we can process information and solve computationally-hard problems quicker," said Dr. John V. "Vinnie" Monaco, an ARL computer scientist. "Programming the type of devices that fit this criteria, for example, brain-inspired computers, is challenging, and cracking crypto codes is just one application that shows we know how to do this."

The problem itself can be stated in simple terms. Take a composite integer N and express it as the product of its prime components. Most people have completed this task at some point in grade school, often an exercise in elementary arithmetic. For example, 55 can be expressed as 5*11 and 63 as 3*3*7. What many didn't realize is they were performing a task that if completed quickly enough for large numbers, could break much of the modern day internet.

The team of researchers have devised a way to factor large composite integers by harnessing the massive parallelism of novel computer architectures that mimic the functioning of the mammalian brain. So called neuromorphic computers operate

under vastly different principles than conventional computers, such as laptops and mobile devices, all based on an architecture described by John von Neumann in 1945.

Neuromorphic computers do not suffer from a von Neumann bottleneck. There is no CPU, memory, or bus. Instead, they incorporate many individual computation units, much like neurons in the brain.

These units are connected by physical or simulated pathways for passing data around, analogous to synaptic connections between neurons. Many neuromorphic devices operate based on the physical response properties of the underlying material, such as graphene lasers or magnetic tunnel junctions. Because of this, these devices consume orders of magnitude less energy than their von Neumann counterparts and can operate on a molecular time scale. As such, any algorithm capable of running on these devices stands to benefit from their capabilities.

Sieving involves searching for many integers that satisfy a certain property called B-smooth, integers that don't contain a prime factor greater than B. Monaco and Vindiola were able to construct a neural network that discovers B-smooth numbers quicker and with greater accuracy than on a von Neumann architecture. Their algorithm leverages the massive parallelism of brain-inspired computers and the innate ability of individual neurons to perform arithmetic operations, such as addition. As neuromorphic architectures continue to increase in size and speed, not limited by Moore's Law, their ability to tackle larger integer factorization problems also grows. In their work, it's estimated that 1024-bit keys could be broken in about a year, a task once thought to be out of reach. For comparison, the current record, a 232 decimal digit number (RSA-768) took about 2,000 years of computing time over the course of several years.

From a broader perspective, this discovery pushes us to question how a shift in computing paradigm might affect some of our most basic security assumptions. As emerging devices shift to incorporate massive parallelism and harness material physics to compute, the computational hardness underlying some security protocols may be challenged in ways not previously imagined. This work also opens the door to new research areas of emerging computer architectures, in terms of algorithm design and function representation, alongside low-power machine learning and artificial intelligence applications.

Source: U.S. Army Research Laboratory

Augmented reality may assist cardiologists plan and perform complex procedures

STEPHY JOHN, RESLI SALAM | S5 CSE

Augmented reality (AR), a technology that superimposes computer-generated information on a user's view of the real world, offers a new platform to help physicians better visualize complex medical data, particularly before and during medical procedures.

A new self-contained AR device aims to provide an immersive AR experience in which surgeons can interactively explore data in three dimensions.

Jihye Jang, a PhD Candidate at the Cardiac Magnetic Resonance (MR) Center at Beth Israel Deaconess Medical Center (BIDMC), and colleagues assessed AR's potential to help cardiologists visualize myocardial scarring in the heart as they perform ventricular tachycardia ablation or other electrophysiological interventions. Myocardial scarring can occur in people who experience a heart attack and also stems from the surgical repair of congenital heart disease. The team's findings, published in *PLOS ONE*, demonstrate that the new augmented reality technology confers a number of advantages.

"Augmented reality allows physicians to superimpose images, such as MRI or CT scans, as a guide during therapeutic intervention," said Jang. "Our report shows exciting potential that having this complex 3D scar information through augmented reality during the intervention may help guide treatment and ultimately improve patient care. Physicians can now use AR to view 3D cardiac MR information with a touchless interaction in sterile environment."

By projecting three dimensional imagery onto a glass screen worn like a diving mask on the surgeon's face, AR provides 3D depth perception and allows surgeons to interact with the medical data without physically touching a screen or computer mouse, maintaining a sterile environment and reducing the risk of infection. In Jang and colleague's pilot study, the researchers applied the augmented reality technique as they generated holographic 3D scar in five animal models that underwent controlled infarction and electrophysiological study.

3D holographic visualization of the scar was performed to assist assessment of the complex 3D scar architecture. An operator and mapping specialist viewed the holographic 3D scar during electrophysiological study, and completed the perceived usefulness questionnaire in the six-item usefulness scale and found it useful to have scar information during the intervention. The user could interactively explore 3D myocardial scar in the augmented reality environment that allows for the combination of holographic 3D LGE data interacting with any real-world environments, such as a surgical suite or patient's body.

Source: Beth Israel Deaconess Medical Center