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INFOLINE

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TAP-N-CHARGE: WIRELESS CHARGER

The most convenient way to charge the mobile devices with wireless charger TapNCharge.

About Tap-N-Charge

Imagine, you come back home, your phone battery is low, you simply place your phone on the shelf, desk or table and calmly settle down while your phone charges on its own. Seems like a scene from a science fiction movie? But it's not! Thanks to wireless charging technology, you no longer have to scramble trying to find a charger cord, simply put your device on a sleek, circular wireless charger and it will fully charge hassle-free. No more getting tangled in cables nor yanking off the plug by accident with TapNCharge you'll never need countless cords again.

How Does It Work?

There's nothing complicated about using TapNCharge. In fact, using regular cords requires more effort than this device. All you have to do is put your phone on the charging pad and that's it! If you wanted to use your phone or answer a call all you'll need to do is pick it up. No unplugging and no hassle. And your phone doesn't even have to be new or made especially with this sort of charging in mind TapNCharge comes with its own adapter that allows you to transform your old phone into a wireless-charging one. While it's true that most cordless chargers are quite slow, that is not the case with this one. You'll be amazed by how fast it can charge your phone, not to mention, how long your battery lasts after.

Tap-N-Charge Features

- **Fast charging**: forget all that you've known about wireless charging, for this device is much faster and long-lasting than many similar ones.
- **100% wireless**: meaning, you won't need to plug in your phone to it, ever. All modern smart phones allow you to charge them this way, and if you have an older one then you can take advantage of an adapter.
- **Supports all Apple and Android smart phones**: It supports all android and smart phones that include even the old ones. With the handy adapter that comes with the set, you'll even be able to charge your old phone as effectively as you would with a cord.
- **Modern design**: TapNCharge is sleek and thin so you can keep it in your handbag or even your pocket. Take it with you on trips for maximum comfort.
- **Very easy to use**: TapNCharge can be used right out of the box and all you have to do is simply place your phone on it and it will charge. It also supports 1cm charging distance, so you won't even need to take the phone case off.
- **Affordable**: most wireless chargers can cost a pretty penny, but not this one. For a decent price, you can get an excellent quality item that will prove very handy.

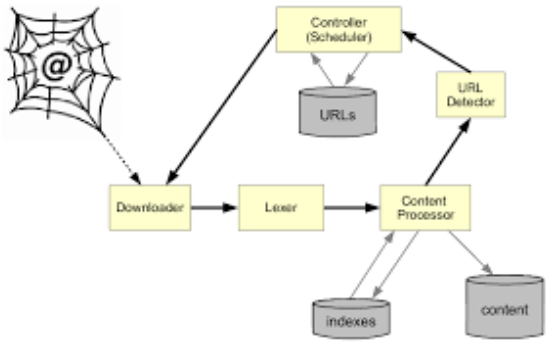
Who Can Use TapNCharge?

Everyone can use it. You can simply have it at home and every member of the family who has an Apple or Samsung smart phone will be able to charge their device by simply placing it on TapNCharge. It is particularly handy to people with vision impairment, for they will no longer have to try to fit the cable in a tiny plug, but simply place their phone down.

B. A. AKSHAYA SHREE
III B.Sc. (COMPUTERTECHNOLOGY)

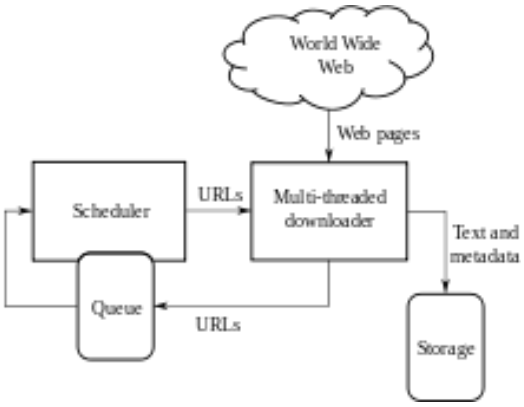
WEB CRAWLER

A web crawler (also known as a web spider or web robot) is a program or automated script which browses the World Wide Web in a methodical, automated manner. This process is called Web crawling or spidering. Many legitimate sites, in particular search engines, use spidering as a means of providing up-to-date data.



Web crawlers are mainly used to create a copy of all the visited pages for later processing by a search engine that will index

the downloaded pages to provide fast searches. Crawlers can also be used for automating maintenance tasks on a Web site such as checking links or validating HTML code. Also, crawlers can be used to gather specific types of information from Web pages such as harvesting e-mail addresses (usually for spam).



Crawlers consume resources on visited systems and often visit sites without approval. Issues of schedule, load, and "politeness" come into play when large collections of pages are accessed. Mechanisms exist for public sites not wishing to be crawled to make this known to the crawling agent. For example, including a robots.txt file can request bots to index only parts of a website or nothing at all.

The number of Internet pages is extremely large; even the largest crawlers fall short of making a complete index. For this reason, search engines struggled to give relevant search results in the early years of the World Wide Web, before 2000. Today, relevant results are given almost instantly.

Crawling policy

The behavior of a Web crawler is the outcome of a combination of policies:

- **re-visit policy** which states when to check for changes to the pages,
- **politeness policy** that states how to avoid overloading websites.
- **parallelization policy** that states how to coordinate distributed web crawlers.

While most of the website owners are keen to have their pages indexed as broadly as possible to have strong presence in search engines, web crawling can also have unintended consequences and lead to a compromise or data breach if a search engine indexes resources that shouldn't be publicly available or pages revealing potentially vulnerable versions of software.

Apart from standard web application security recommendations website owners can reduce their exposure to opportunistic hacking by only allowing search engines to index the public parts of their websites (with robots.txt) and explicitly blocking them from indexing transactional parts (login pages, private pages, etc.).

Crawler Identification

Web crawlers typically identify themselves to a Web server by using the User-agent field of an HTTP request. Web site administrators typically examine their Web servers' log and use the user agent field to

determine which crawlers have visited the web server and how often. The user agent field may include a URL where the Web site administrator may find out more information about the crawler. Examining Web server log is tedious task and therefore some administrators use tools to identify track and verify Web crawlers. Spambots and other malicious Web crawlers are unlikely to place identifying information in the user agent field, or they may mask their identity as a browser or other well-known crawler.

It is important for Web crawlers to identify themselves so that Web site administrators can contact the owner if needed. In some cases, crawlers may be accidentally trapped in a crawler trap or they may be overloading a Web server with requests and the owner needs to stop the crawler. Identification is also useful for administrators that are interested in knowing when they may expect their Web pages to be indexed by a particular search engine.

Crawling the deep web

A vast amount of web pages lie in the deep or invisible web.[43] These pages are typically only accessible by submitting queries to a database, and regular crawlers are unable to find these pages if there are no links that point to them. Google's Sitemaps protocol and mod oai are intended to allow discovery of these deep-Web resources.

Deep web crawling also multiplies the number of web links to be crawled. Some crawlers only take some of the URLs in `<a href="URL">` form. In some cases, such as the Googlebot, Web crawling is done on all text contained inside the hypertext content, tags, or text.

Strategic approaches may be taken to target deep Web content. With a technique called screen scraping, specialized software may be customized to automatically and repeatedly query a given Web form with the intention of aggregating the resulting data. Such software can be used to span multiple Web forms across multiple Websites. Data extracted from the results of one Web form submission can be taken and applied as input to another Web form thus establishing continuity across the Deep Web in a way not possible with traditional web crawlers.

Pages built on AJAX are among those causing problems to web crawlers. Google has proposed a format of AJAX calls that their bot can recognize and index.

Visual Vs Programmatic crawler

There are a number of visual web scraper/crawler products available on the web which will crawl pages and structure data into columns and rows based on the users requirements. One of the main difference between a classic and a visual crawler is the level of programming ability required to set up a crawler. The latest generation of "visual

scrapers" remove the majority of the programming skill needed to be able to program and start a crawl to scrape web data.

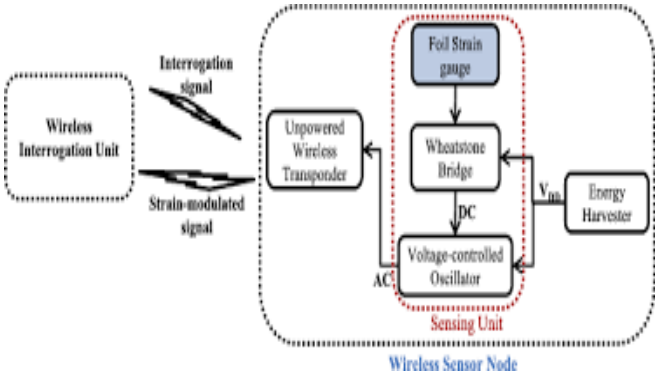
The visual scraping/crawling method relies on the user "teaching" a piece of crawler technology which then follows patterns in semi-structured data sources. The dominant method for teaching a visual crawler is by highlighting data in a browser and training columns and rows. While the technology is not new, for example it was the basis of needlebase which has been bought by Google, there is continued growth and investment in this area by investors and end-users.

K.SURESHKUMAR

III B.Sc. (COMPUTER TECHNOLOGY)

WIRELESS, ULTRA-THIN AND BATTERY-FREE STRAIN SENSORS

Fabricated using flexible, stretchable, and electrically conductive nano materials called MXenes, these novel strain sensors developed by the NUS team are ultra-thin, battery-free and can transmit data wirelessly. With these desirable properties, the novel strain sensors can potentially be used for a wide range of applications.



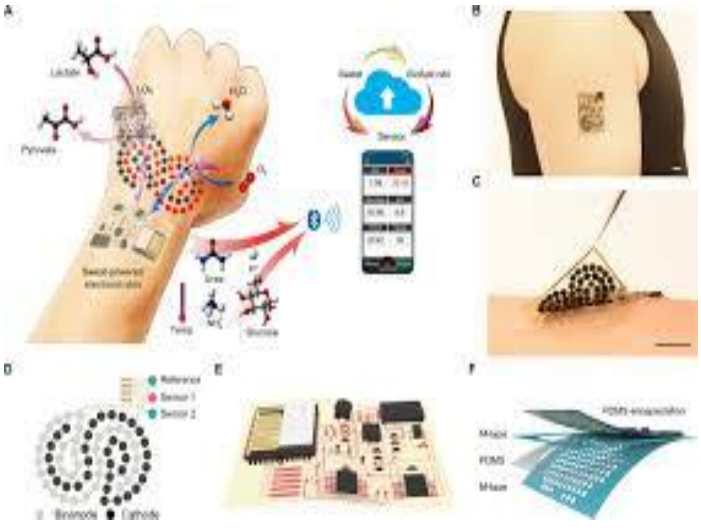
Assistant Professor Chen who is from the NUS Department of Chemical and Biomolecular Engineering explained "Performance of conventional strain sensors has always been limited by the nature of sensing materials used, and users have limited options of customising the sensors for specific applications. we have developed a facile strategy to control the surface textures of MXenes, and this enabled us to control the sensing performance of strain sensors for various soft exoskeletons. The sensor design principles developed in this work will significantly enhance the performance of electronic skins and soft robots."

Precision manufacturing

One area where the novel strain sensors could be put to good use is in precision manufacturing, where robotic arms are used to carry out intricate tasks, such as fabricating fragile products like microchips. These strain sensors developed by NUS researchers can be coated on a robotic arm like an electronic skin to measure subtle movements as they are stretched. When placed along the joints of robotic arms, these strain sensors allow the

system to understand precisely how much the robotic arms are moving and their current position relative to the resting state. Current off-the-shelf strain sensors do not have the required accuracy and sensitivity to carry out this function.

Conventional automated robotic arms used in precision manufacturing require external cameras aimed at them from different angles to help track their positioning and movement. The ultra-sensitive strain sensors developed by the NUS team will help improve the overall safety of robotic arms by providing automated feedback on precise movements with an error margin below one degree and remove the need for external cameras as they can track positioning and movement without any visual input.



Customisable, ultra-sensitive sensors

The technological breakthrough is the development of a production process that allows NUS researchers to create highly customizable ultra-sensitive sensors over a wide working window with high signal-to-noise ratios. A sensor's working window determines how much it can stretch while maintaining its sensing qualities and having a high signal-to-noise ratio means greater accuracy as the sensor can differentiate between subtle vibrations and minute movements of the robotic arm.

This production process allows the team to customize their sensors to any working window between 0 to 900 per cent, while maintaining high sensitivity and signal-to-noise ratio. Standard sensors can typically achieve a range of up to 100 per cent. By combining multiple sensors with different working windows, NUS researchers can create a single ultra-sensitive sensor that would otherwise be impossible to achieve.

The research team took two years to develop this breakthrough and have since published their work in the scientific journal ACS Nano in September 2020. They also have a working prototype of the application of soft exoskeletons in a soft robotic rehabilitation glove.

"These advanced flexible sensors give our soft wearable robots an important capability in sensing patient's motor performance, particularly in terms of their range of motion. This will ultimately enable the soft robot to better understand the patient's ability and provide the necessary assistance to their hand movements," said Associate

Professor Raye Yeow who heads a soft robotics lab in NUS Department of Biomedical Engineering, and leads the Soft and Hybrid Robotics programme under the National Robotics R&D Programme Office.

Robotic surgery

The team is also looking to improve the sensor's capabilities and work with the Singapore General Hospital to explore the application in soft exoskeleton robots for rehabilitation and in surgical robots for transpolar robotic surgery.

S.HARITHA
III B.Sc. (INFORMATION TECHNOLOGY)

USING CELLULAR NETWORKS TO DETECT AT-RISK AREAS FOR SPREAD OF COVID-19

In the fight against COVID-19, researchers at Colorado State University have developed a new non-invasive strategy to identify areas at greatest risk for spreading the disease.

Corona virus and Crowds

Knowing that COVID-19 is easily spread by individuals in close proximity, Chong and his team developed a method that helps them identify the most crowded areas with hustle and bustle such as a city center, where asymptomatic carriers have a higher probability of coming into close contact with large numbers of healthy people.

Because practically everyone carries a cell phone nowadays, they aim to understand how mobile device users move and gather over time in an area by leveraging what are known as handover and cell (re)selection protocols the cellular network technologies that allow us to move about freely with our mobile devices without losing service. Using data collected through these networks, Chong's team measures handover and cell (re)selection activity, called HO/CS rates, to calculate localized population density and mobility. Offering real-time updates, the data allow them to flag at-risk areas for further monitoring. Their method builds on the premise that the higher the HO/CS rates, which means higher density and mobility, the higher the risk of spreading infectious diseases.

"Our findings could help risk managers with planning and mitigation," said Chong, a leading researcher in cellular wireless networks who has expertise in risk management. "It might prompt them to cordon off a busy plaza, or implement stricter social distancing measures to slow the spread of the virus." Chong said their approach could also be used to estimate the percentage of people staying home to determine whether communities are following recommended public health policies.

Protecting security and privacy

While Chong refers to mobile devices as "always-on human trackers," he is sensitive to and concerned with privacy and security issues. Unlike contact tracing applications that are often difficult to deploy and require widespread adoption, his approach protects the privacy and anonymity of individuals without needing active participation from device users.

With cyber security one of the nation's top security concerns and billions of people affected by breaches last year, government and businesses are spending more time and money defending against it. Researchers at the U.S. Army Combat Capabilities Development Command's Army Research Laboratory, the Army's corporate research laboratory also known as ARL and Towson University may have identified a new way to improve network security.

Many cyber security systems use distributed network intrusion detection that allows a small number of highly trained analysts to monitor several networks at the same time, reducing cost through economies of scale and more efficiently leveraging limited cyber security expertise; however, this approach requires data be transmitted from network intrusion detection sensors on the defended network to central analysis severs. Transmitting all of the data captured by sensors requires too much bandwidth, researchers said.

Because of this, most distributed network intrusion detection systems only send alerts or summaries of activities back to the security analyst. With only summaries, cyber-attacks can go undetected because the analyst did not have enough information to understand the network activity or alternatively, time may be wasted chasing down false positives. Working on the theory that malicious network activity would manifest its maliciousness early, the researchers developed a tool that would stop transmitting traffic after a given number of messages transmitted. The resulting compressed network traffic was analyzed and compared to the analysis performed on the original network traffic.

As suspected, researchers found cyber attacks often do manifest maliciousness early in the transmission process. When the team identified malicious activity later in the transmission process, it was usually not the first occurrence of malicious activity in that network flow.

"This strategy should be effective in reducing the amount of network traffic sent from the sensor to central analyst system," said Sidney Smith, an ARL researcher and the study's lead author. "Ultimately, this strategy could be used to increase the reliability and security of Army networks."

For the next phase, researchers want to integrate this technique with network classification and lossless compression techniques to reduce the amount of traffic that needs to be transmitted to the central analysis systems to less than 10% of the original traffic volume while losing no more than 1% of cyber security alerts.

"The future of intrusion detection is in machine learning and other artificial intelligence techniques," Smith said. "However, many of these techniques are too resource intensive to run on the remote sensors, and all of them require large amounts of data. A cyber security system incorporating our research technique will allow the data most likely to be malicious to be gathered for further analysis."

D.KRISHNAKUMAR

APP ANALYZES CORONAVIRUS GENOME ON A SMARTPHONE

A new mobile app has made it possible to analyse the genome of the SARS-CoV-2 virus on a smartphone in less than half an hour. Cutting-edge nanopore devices have enabled scientists to read or 'sequence' the genetic material in a biological sample outside a laboratory, however analysing the raw data has still required access to high-end computing power until now.

Genopo

The advent of portable nanopore sequencing devices has enabled DNA and RNA sequencing to be performed in the field or the clinic. However, advances in situ genomics require parallel development of portable, offline solutions for the computational analysis of sequencing data. Here to introduce Genopo, a mobile toolkit for nanopore sequencing analysis. Genopo compacts popular bioinformatics tools to an Android application,

enabling fully portable computation. To demonstrate its utility for in situ genome analysis, we use Genopo to determine the complete genome sequence of the human corona virus SARS-CoV-2 in nine patient isolates sequenced on a nanopore device with Genopo executing this workflow in less than 30 min per sample on a range of popular smart phones. We further show how Genopo can be used to profile DNA methylation in a human genome sample, illustrating a flexible, efficient architecture that is suitable to run many popular bioinformatics tools and accommodate small or large genomes. As the first ever smartphone application for nanopore sequencing analysis, Genopo enables the genomics community to harness this cheap, ubiquitous computational resource.

Portable DNA-sequencing devices, such as the MinION device developed by Oxford Nanopore Technologies (ONT)1, can be used for rapid analysis of genetic material in the field or the clinic. Pioneering studies have demonstrated the utility of in situ DNA and RNA sequencing with a MinION in a variety of contexts, including for Ebola virus surveillance in West Africa, profiling microbial communities in the Arctic and genome/transcriptome sequencing on the International Space Station. ONT sequencing has also been widely used to study viral transmission and evolution in real-time during the corona virus pandemic.

Despite these successes, the full potential of the MinION and related ONT devices for in situ genomics has yet to be realised. This owes partly to the current lack of portable, offline solutions for the analysis of the sequencing data that they generate.

ONT devices measure the displacement of ionic current as a DNA or RNA strand passes through a biological nanopore. The device periodically outputs a group of reads in the form of raw current signals (packed into a .fast5 file) that are subsequently base-called into sequences (a .fastq file). After base-calling, which can be run on a laptop or a portable MinIT device, analysis of the resulting sequence reads is typically performed using dedicated high-end server computers or cloud services (the latter requiring data upload over a high-bandwidth network). This can be an obstacle to ONT field applications. During Ebola surveillance in West Africa, for example, researchers regularly encountered Internet connectivity issues where 3G signals dropped to 2G, massively increasing data upload times.

Therefore, while sequencing and base-calling processes are now portable, the computational resources required for downstream bioinformatic analyses, such as sequence alignment and genome assembly, remain prohibitive to in situ genome analysis.

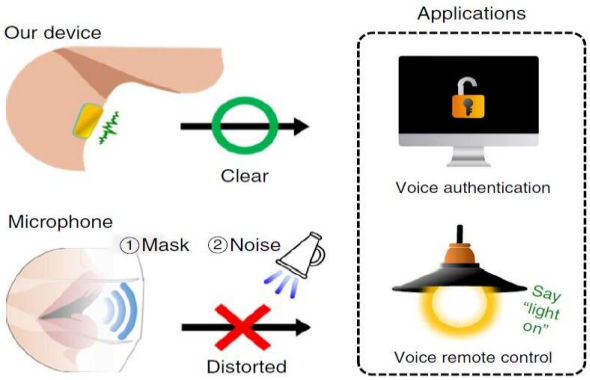
M.BHAVAN

II B.SC. (COMPUTER TECHNOLOGY)

A WEARABLE VIBRATION SENSOR FOR ACCURATE VOICE RECOGNITION

A voice-recognition feature can be easily found on mobile phones these days. Often times, we experience an incident where a speech recognition application is activated in the middle of a meeting or a conversation in the office. Sometimes, it is not activated at all regardless of numbers of times we call out the application. It is because a mobile phone uses a microphone which detects sound pressure to recognize voice, and it is easily affected by surrounding noise and other obstacles.

Professor Kilwon Cho of Chemical Engineering and Professor Yoonyoung Chung of Electronic and Electric Engineering from POSTECH successfully developed a flexible and wearable vibration responsive sensor. When this sensor is attached to a neck, it can precisely recognize voice through vibration of the neck skin and is not affected by ambient noise or the volume of sound.



The conventional vibration sensors recognize voice through air vibration and the sensitivity decreases due to mechanical resonance and damping effect, therefore are not capable of measuring voices quantitatively. So, ambient sound or obstacles such as mouth mask can affect its accuracy of voice recognition and it cannot be used for security authentication. Voice pressure is proportional to the acceleration of neck skin vibration at various sound pressure levels from 40 to 70 dBSPL and they developed a vibration sensor utilizing the acceleration of skin vibration. The device, which is consisted of an ultrathin polymer film and a diaphragm with tiny holes, can sense voices quantitively by measuring the acceleration of skin vibration. They also successfully exhibited that the device can accurately recognize voice without vibrational distortion even in the noisy environment and at a very low voice volume with a mouth mask worn.

This research can be further extended to various voice-recognition applications such as an electronic skin, human-machine interface,

wearable vocal healthcare monitoring device. This research is very meaningful in a way that it developed a new voice-recognition system which can quantitively sense and analyze voice and is not affected by the surroundings. It took a step forward from the conventional voice-recognition system that could only recognize voice qualitatively.

R.SHOBIKA

II B.SC. (COMPUTER TECHNOLOGY)

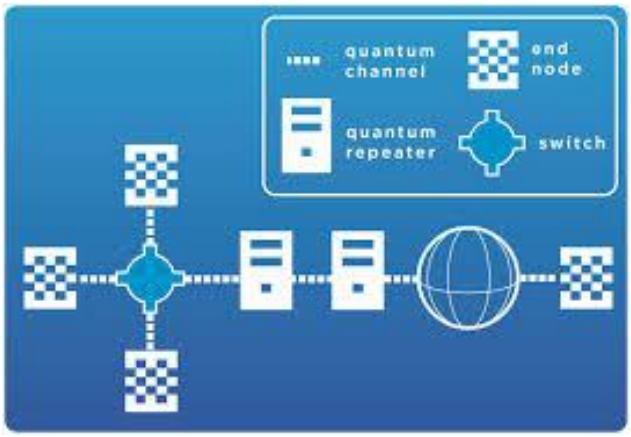
ROADMAP FOR QUANTUM INTERNET DEVELOPMENT

A quantum internet may very well be the first quantum information technology to become reality. Researchers at QuTech in Delft, The Netherlands, today published a comprehensive guide towards this goal in Science. It describes six phases starting with simple networks of qubits that could already enable secure quantum communications a phase that could be reality in the near future. The development ends with networks of fully quantum-connected quantum computers. In each phase, new applications become available such as extremely accurate clock synchronization or integrating different telescopes on Earth in one virtual supertelescope. This work creates a common language that unites the highly interdisciplinary field of quantum networking towards achieving the dream of a world-wide quantum internet.

A quantum internet will revolutionize communication technology by exploiting phenomena from quantum physics, such as entanglement. Researchers are working on technology that enables the transmission of quantum bits between any two points on earth. Such quantum bits can be '0' and '1' at the same time, and can be 'entangled': their fates are merged in such a way that an operation on one of the qubits instantly affects the state of the other.

This brings two features which are provably out of reach for the Internet that we know today. The first is that entanglement allows improved coordination between distant sites. This makes it extremely suitable for tasks such as clock synchronization or the linking of distant telescopes to obtain better images. The second is that entanglement is inherently secure. If two quantum bits are maximally entangled then nothing else in the universe can have any share in that entanglement. This feature makes entanglement uniquely suitable for applications that require security and privacy.

Many other applications of a quantum internet are already known and more are likely to be discovered as the first networks come online. Researchers at QuTech, a collaboration between Delft University of Technology and the Netherlands organisation for applied scientific research TNO have now set forth stages of quantum internet development distinguished by technological capabilities and corresponding applications.



The lowest stage of a true quantum network a prepare and measure network allows the end-to-end delivery of quantum bits between any two network nodes, one quantum bit at a time. This is already sufficient to support many cryptographic applications of a quantum network. The highest stage is the long-term goal of connecting large quantum computers on which arbitrary quantum applications can be executed.

The first true quantum networks allowing the end-to-end transmission of quantum bits, are expected to be realized in the coming years, heralding the dawn of a large-scale quantum internet.

S.P VISHVA

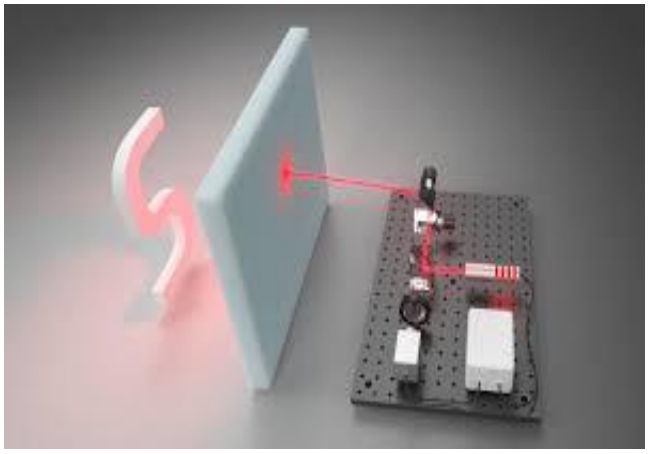
II B.SC. (INFORMATION TECHNOLOGY)

SEEING OBJECTS THROUGH CLOUDS AND FOG

A lot of imaging techniques make images look a little bit better, a little bit less noisy, but this is really something to make the invisible visible, This technique complements other vision systems that can see through barriers on the microscopic scale for applications in medicine because it's more focused on large-scale situations such as navigating self-driving cars in fog or heavy rain and satellite imaging of the surface of Earth and other planets through hazy atmosphere.

Supersight from scattered light

In order to see through environments that scatter light every-which-way, the system pairs a laser with a super-sensitive photon detector that records every bit of laser light that hits it. As the laser scans an obstruction like a wall of foam, an occasional photon will manage to pass through the foam, hit the objects hidden behind it and pass back through the foam to reach the detector. The algorithm-supported software then uses those few photons and information about where and when they hit the detector to reconstruct the hidden objects in 3D.



This is not the first system with the ability to reveal hidden objects through scattering environments, but it circumvents limitations associated with other techniques. For example, some require knowledge about how far away the object of interest is. It is also common that these systems only use information from ballistic photons, which are photons that travel to and from the hidden object through the scattering field but without actually scattering along the way.

In order to make their algorithm amenable to the complexities of scattering, the researchers had to closely co-design their hardware and software, although the hardware components they used are only slightly more advanced than what is currently found in autonomous cars. Depending on the brightness of the hidden objects, scanning in their tests took anywhere from one minute to one hour, but the algorithm reconstructed the obscured scene in real-time and could be run on a laptop.

Space and fog

Someday, a descendant of this system could be sent through space to other planets and moons to help see through icy clouds to deeper layers and surfaces. In the nearer term, the researchers would like to experiment with different scattering environments to simulate other circumstances where this technology could be useful.

These sensing systems are devices with lasers, detectors and advanced algorithms which puts them in an interdisciplinary research area between hardware and physics and applied math.

N.R SHARMILA

II B.Sc. (INFORMATION TECHNOLOGY)

SCIENTIFIC VISUALIZATION

Scientific and Information visualization are branches of computer graphics and user interface design that are concerned with presenting data to users by means of images. The goal of this area is usually to improve understanding of the data being presented. For example, scientists interpret potentially huge quantities of laboratory or simulation data or the results from sensors out in the field to aid reasoning, hypothesis building and cognition.

The field of data mining offers much abstract visualization related to these visualization types. They are active research areas, drawing on theory in information

graphics, computer graphics, human-computer interaction and cognitive science. Desktop programs capable of presenting interactive models of molecules and microbiological entities are becoming relatively common (Molecular graphics).

The field of Bioinformatics and the field of Cheminformatics make a heavy use of these visualization engines for interpreting lab data and for training purposes. Medical imaging is a huge application domain for scientific visualization with an emphasis on enhancing imaging results graphically, e.g. using pseudo-coloring or overlaying of plots. Real-time visualization can serve to simultaneously image analysis results within or beside an analyzed (e.g. segmented) scan.

R.JANANI

I B.Sc. (COMPUTER TECHNOLOGY)

A NEW WAY TO THINK ABOUT MACHINE LEARNING

Machine learning has delivered amazing results, but there also have been failures ranging from the harmless to potentially deadly. New work suggests that common assumptions about the cause behind these supposed malfunctions may be mistaken, information that is crucial for evaluating the reliability of these networks. Deep neural networks, multilayered systems built to process images and other data through the use of mathematical modelling, are a cornerstone of artificial intelligence.

They are capable of seemingly sophisticated results, but they can also be fooled in ways that range from relatively harmless misidentifying one animal as another to potentially deadly if the network guiding a self-driving car misinterprets a stop sign as one indicating it is safe to proceed.

As machine learning and other forms of artificial intelligence become more embedded in society, used in everything from automated teller machines to cyber security systems, Cameron Buckner, Associate Professor of philosophy at UH, said it is critical to understand the source of apparent failures caused by what researchers call "adversarial examples," when a deep neural network system misjudges images or other data when confronted with information outside the training inputs used to build the network. They're rare and are called "adversarial" because they are often created or discovered by another machine learning network a sort of brinksmanship in the machine learning world between more sophisticated methods to create adversarial examples and more sophisticated methods to detect and avoid them.

Some of these adversarial events could instead be artifacts, and we need to better know what they are in order to know how reliable these networks are, Buckner said. In other words, the misfire could be caused by the

interaction between what the network is asked to process and the actual patterns involved. That's not quite the same thing as being completely mistaken.

Understanding the implications of adversarial examples requires exploring a third possibility: that at least some of these patterns are artifacts, Buckner wrote. Thus, there are presently both costs in simply discarding these patterns and dangers in using them naively. A security system based upon facial recognition technology could be hacked to allow a breach, for example, or decals could be placed on traffic signs that cause self-driving cars to misinterpret the sign, even though they appear harmless to the human observer.

Previous research has found that, counter to previous assumptions, there are some naturally occurring adversarial examples times when a machine learning system misinterprets data through an unanticipated interaction rather than through an error in the data. They are rare and can be discovered only through the use of artificial intelligence. But they are real and Buckner said that suggests the need to rethink how researchers approach the anomalies or artifacts.

These artifacts haven't been well understood; Buckner offers the analogy of a lens flare in a photograph a phenomenon that isn't caused by a defect in the camera lens but is instead produced by the interaction of light with the camera. The lens flare potentially offers useful information the location of the sun, for example if you know how to interpret it. That, he said, raises the question of whether adverse events in machine learning that are caused by an artifact also have useful information to offer.

Equally important, Buckner said, is that this new way of thinking about the way in which artifacts can affect deep neural networks suggests a misreading by the network shouldn't be automatically considered evidence that deep learning isn't valid.

D.UDHAYAKUMAR
I B.Sc. (COMPUTER TECHNOLOGY)

ROBOTS SENSE HUMAN TOUCH USING CAMERA AND SHADOWS

Researchers have created a low-cost method for soft, deformable robots to detect a range of physical interactions without relying on touch at all. Instead, a USB camera located inside the robot captures the shadow movements of hand gestures on the robot's skin and classifies them with machine-learning software. Soft robots may not be in touch with human feelings, but they are getting better at feeling human touch.

Cornell University researchers have created a low-cost method for soft, deformable robots to detect a range of physical interactions, from pats to punches to hugs, without relying on touch at all. Instead, a USB camera located inside the robot captures the shadow movements of hand gestures on the robot's skin and classifies them with machine-learning software.

Rather than installing a large number of contact sensors which would add weight and complex wiring to the robot and would be difficult to embed in a deforming skin the team took a counterintuitive approach. In order to gauge touch, they looked to sight. By placing a camera inside the robot, it can infer how the person is touching it and what the person's intent is just by looking at the shadow images. There is interesting potential there, because there are lots of social robots that are not able to detect touch gestures.

The prototype robot consists of a soft inflatable bladder of nylon skin stretched around a cylindrical skeleton, roughly four feet in height, that is mounted on a mobile base. Under the robot's skin is a USB camera, which connects to a laptop. The researchers developed a neural-network-based algorithm that uses previously recorded training data to distinguish between six touch gestures touching with a palm, punching, touching with two hands, hugging, pointing and not touching at all with an accuracy of 87.5 to 96% depending on the lighting.

The robot can be programmed to respond to certain touches and gestures such as rolling away or issuing a message through a loudspeaker. And the robot's skin has the potential to be turned into an interactive screen. By collecting enough data, a robot could be trained to recognize an even wider vocabulary of interactions, custom-tailored to fit the robot's task.

The robot doesn't even have to be a robot. ShadowSense technology can be incorporated into other materials such as balloons turning them into touch-sensitive

devices. In addition to providing a simple solution to a complicated technical challenge and making robots more user-friendly to boot ShadowSense offers a comfort that is increasingly rare in these high-tech times privacy. If the robot can only see you in the form of your shadow, it can detect what you're doing without taking high fidelity images of your appearance.

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SMARTPHONE APP TO CHANGE YOUR PERSONALITY

Personality traits such as conscientiousness or sociability are patterns of experience and behavior that can change throughout our lives. Individual changes usually take place slowly as people gradually adapt to the demands of society and their environment. However, it is unclear whether certain personality traits can also be psychologically influenced in a short-term and targeted manner.

Researchers from the universities of Zurich, St. Gallen, Brandeis, Illinois, and ETH Zurich have now investigated this question using a digital intervention. In their study, around 1,500 participants were provided with a specially developed smartphone app for three months and the researchers then assessed whether and how their personalities had changed. The five major personality traits of openness, conscientiousness, sociability (extraversion), considerateness (agreeableness), and emotional vulnerability (neuroticism) were examined. The app included elements of knowledge transfer, behavioral and resource activation, self-reflection, and feedback on progress. All communication with the digital coach and companion (a chatbot) took place virtually. The chatbot supported the participants on a daily basis to help them make the desired changes.

Changes after three months

The majority of participants said that they wanted to reduce their emotional vulnerability, increase their conscientiousness, or increase their extraversion. Those who participated in the intervention for more than three months reported greater success in achieving their change goals than the control group who took part for only two months. Close friends and family members also observed changes in those participants who wanted to increase expression of a certain personality trait. However, for those who wanted to reduce expression of a trait, the

people close to them noticed little change. This group mainly comprised those participants who wanted to become less emotionally vulnerable, an inner process that is less observable from the outside.

The participants and their friends alike reported that three months after the end of the intervention, the personality changes brought about by using the app had persisted, says Mathias Allemand, professor of psychology at UZH. These surprising results show that we are not just slaves to our personality, but that we can deliberately make changes to routine experience and behaviour patterns.

The Smartphone App PEACH (PErsonality coACH)

The smartphone application PEACH was developed as part of a project funded by the Swiss National Science Foundation (SNSF) to study personality change through a digital intervention. The application provides scalable communication capabilities using a digital agent that mimics a conversation with a human. The PEACH app also includes digital journaling, reminders of individual goals, video clips, opportunities for self-reflection and feedback on progress. Weekly core topics and small interventions aim to address and activate the desired changes and thus the development of personality traits.

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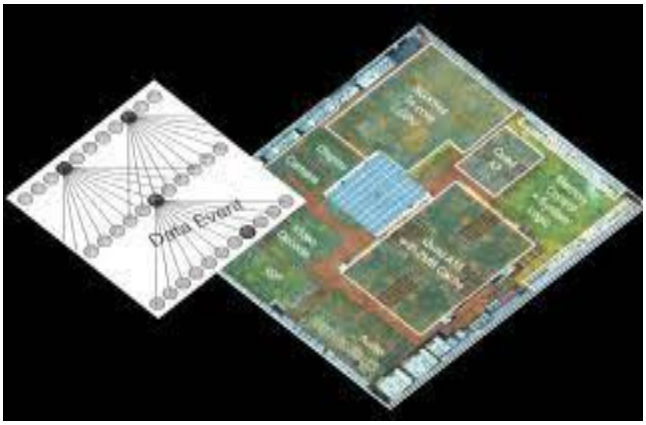
WORLD'S FASTEST OPTICAL NEUROMORPHIC PROCESSOR

An international team of researchers led by Swinburne University of Technology has demonstrated the world's fastest and most powerful optical neuromorphic processor for artificial intelligence (AI), which operates faster than 10 trillion operations per second (TeraOPs/s) and is capable of processing ultra-large scale data.



Artificial neural networks, a key form of AI, can 'learn' and perform complex operations with wide applications to computer vision, natural language processing, facial recognition, speech translation, playing strategy games, medical diagnosis and many other areas. Inspired by the biological structure of the brain's visual cortex system, artificial neural networks extract key features of raw data to predict properties and behaviour with unprecedented accuracy and simplicity.

Optical neuromorphic processor operating more than 1000 times faster than any previous processor with the system also processing record-sized ultra-large scale

images enough to achieve full facial image recognition, something that other optical processors have been unable to accomplish. This breakthrough was achieved with 'optical micro-combs', as was our world-record internet data speed reported in May 2020," says Professor Moss, Director of Swinburne's Optical Sciences Centre and recently named one of Australia's top research leaders in physics and mathematics in the field of optics and photonics by The Australian.

While state-of-the-art electronic processors such as the Google TPU can operate beyond 100 TeraOPs/s, this is done with tens of thousands of parallel processors. In contrast, the optical system demonstrated by the team uses a single processor and was achieved using a new technique of simultaneously interleaving the data in time, wavelength and spatial dimensions through an integrated micro-comb source.

Micro-combs are relatively new devices that act like a rainbow made up of hundreds of high-quality infrared lasers on a single chip. They are much faster, smaller, lighter and cheaper than any other optical source. Micro-combs offer enormous promise for us to meet the world's insatiable need for information. This processor can serve as a universal ultrahigh bandwidth front end for any neuromorphic hardware optical or electronic based bringing massive-data machine learning for real-time ultrahigh bandwidth data within reach.

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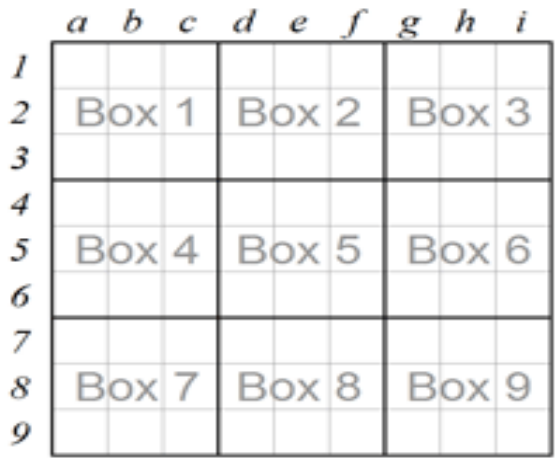
SUDOKU SOLVING TECHNIQUES

Sudoku grid consists of 81 squares divided into nine columns marked a through i, and nine rows marked 1 through 9. The grid is also divided into nine 3x3 sub-grids named boxes which are marked box 1 through box 9.

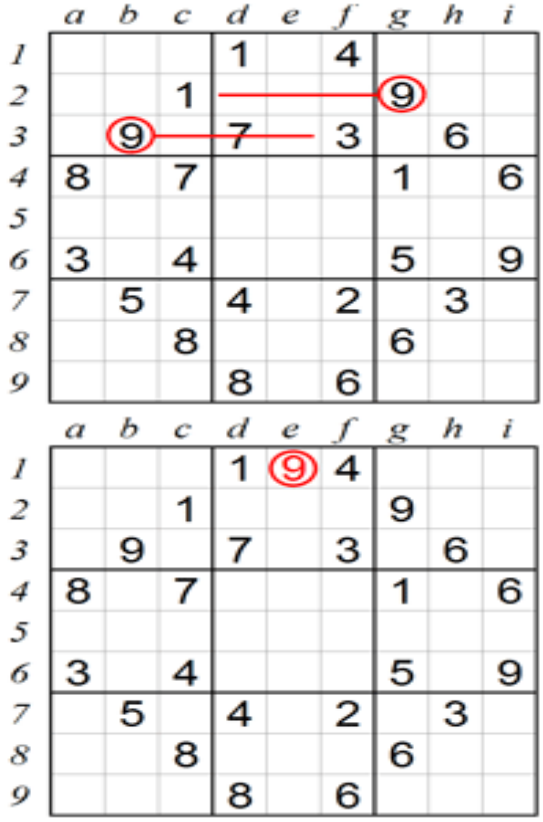


Scanning techniques

The easiest way starting a Sudoku puzzle is to scan rows and columns within each triple-box area eliminating numbers or squares and finding situations where only a single number can fit into a single square. The scanning technique is fast and usually sufficient to solve easy puzzles all the way to the end. The scanning technique is also very useful for hard puzzles up to the point where no further progress can be made and more advanced solving techniques are required. Here are some ways of using scanning techniques:

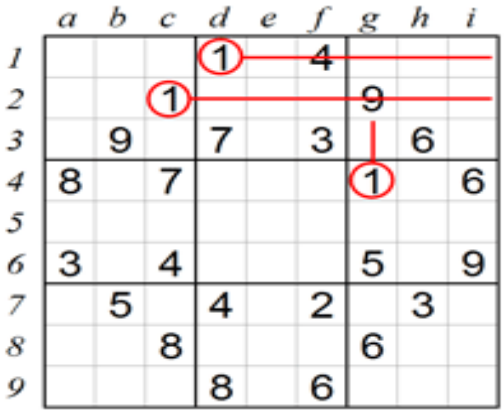
1. Scanning in one direction

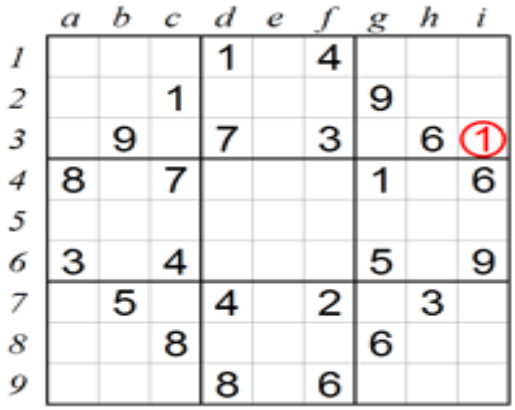
First example will focus on box 2, which like any other box in Sudoku must contain 9. Looking at box 1 and box 3 we can see there are already 9s in row 2 and in row 3, which excludes the two bottom rows of box 2 from having 9. This leaves square e1 as the only possible place into which 9 can fit in.



2. Scanning in two directions

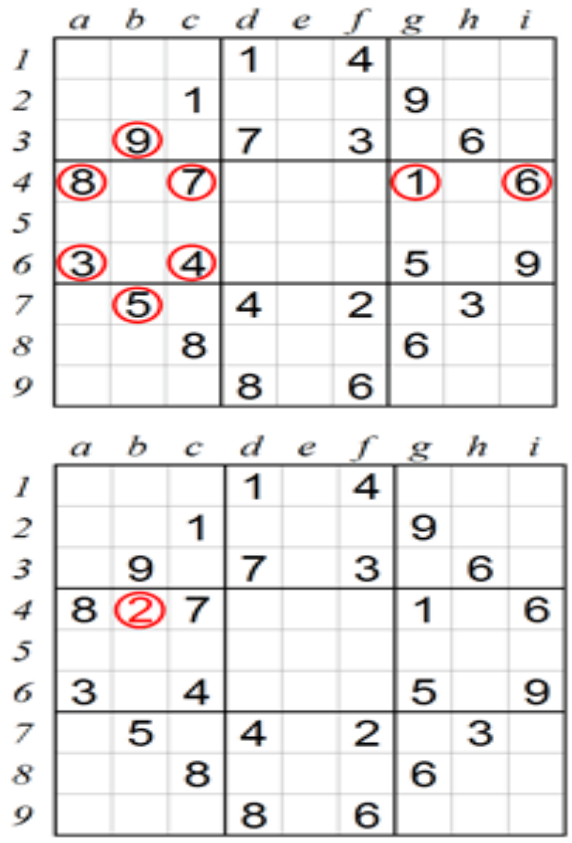
The same technique can be expanded by using information from perpendicular rows and columns. Let's see where to place 1 in box 3. In this example, row 1 and row 2 contain 1s, which leaves two empty squares in the bottom of box 3. However, square g4 also contains 1, so no additional 1 is allowed in column g. This means that square i3 is the only place left for 1.

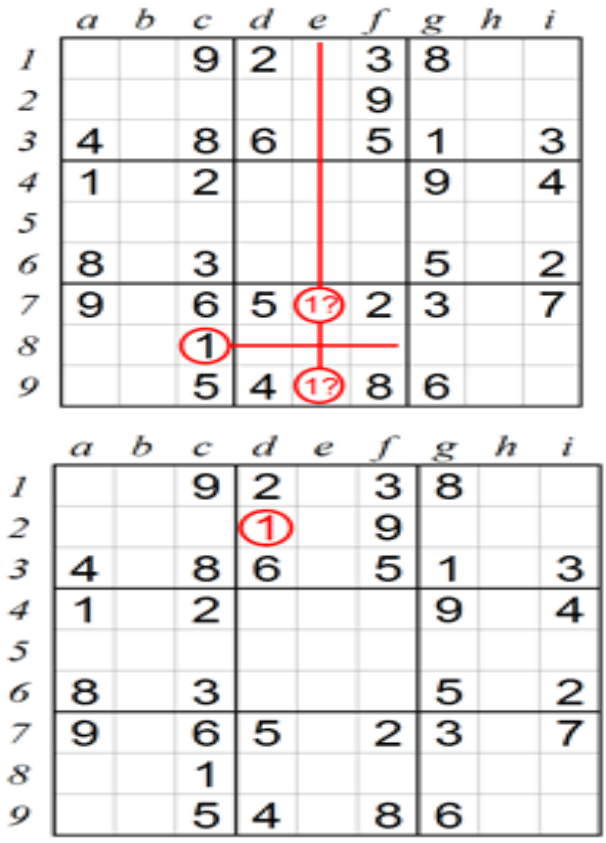




3. Searching for Single Candidates

Often only one number can be in a square because the remaining eight are already used in the relevant row, column and box. Taking a careful look at square b4 to see that 3, 4, 7 and 8 are already used in the same box, 1 and 6 are used in the same row, and 5 and 9 are used in the same column. Eliminating all the above numbers leaves 2 as the single candidate for square b4.



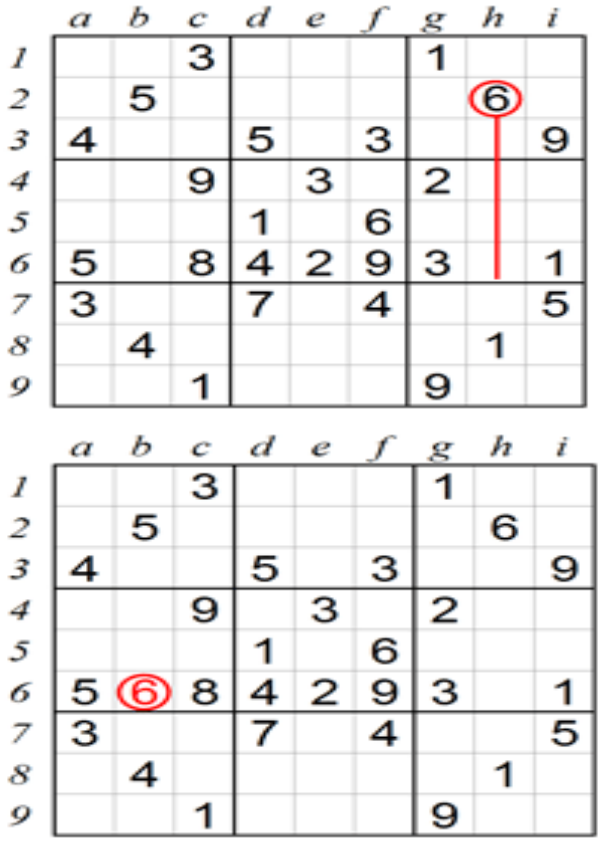


4. Eliminating numbers from rows, columns and boxes

There are more complex ways to find numbers by using the process of elimination. In this example the 1 in square c8 implies that either square e7 or square e9 must contain 1. Whichever the case may be the 1 of column e is in box 8 and it is therefore not possible to have 1 in the centre column of box 2. So the only square left for 1 in box 2 is square d2.

5. Searching for missing numbers in rows and columns

This method can be particularly useful when rows (and columns) are close to completion. Let's take a look at row 6. Seven of the nine squares contain the numbers 1, 2, 3, 4, 5, 8 and 9 which means that 6 and 7 are missing. However, 6 cannot be in square h6 because there is already 6 in that column. Therefore the 6 must be in square b6.

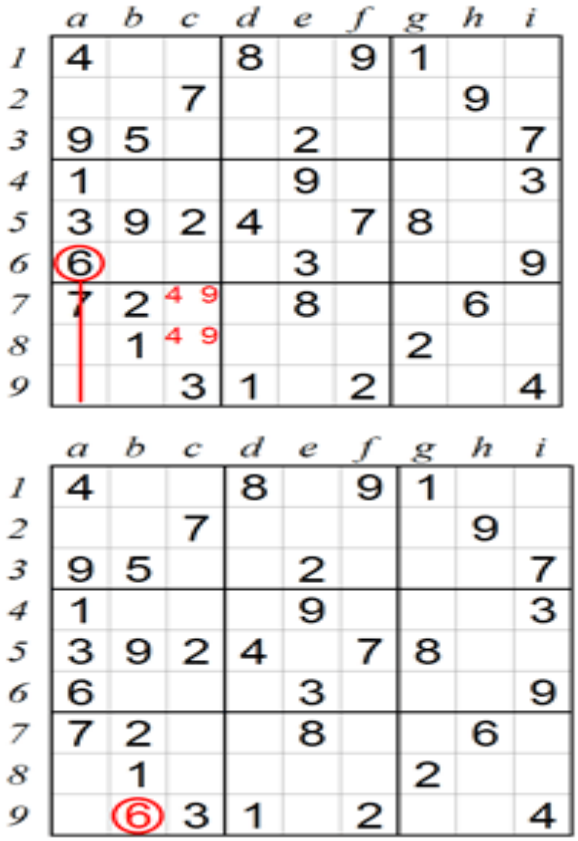


Analyzing techniques

As Sudoku puzzle levels get harder you will find the simple scanning methods described above are not enough and more sophisticated solving techniques must be used. Hard puzzles require deeper logic analysis which is done with the aid of pencil marks. Sudoku pencil marking is a systematic process writing small numbers inside the squares to denote which ones may fit in. After pencil marking the puzzle, the solver must analyze the results, identify special number combinations and deduce which numbers should be placed where. Here are some ways of using analyzing techniques:

1. **Eliminating squares using Naked Pairs in a box**

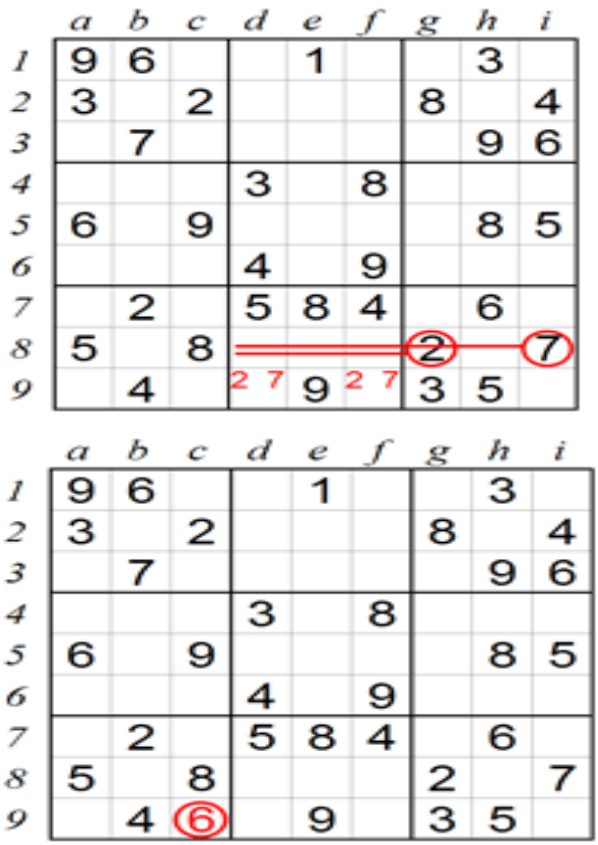
In this example, squares c7 and c8 in box 7 can only contain 4 and 9 as shown with the red pencilmarks below. We don't know which is which, but we do know that both squares are occupied. In addition, square a6 excludes 6 from being in the left column of box 7. As a result the 6 can only be in square b9. Such cases where the same pair can only be placed in two boxes is called Disjoint Subsets, and if the Disjoint Subsets are easy to see then they are called Naked Pairs.



2. Eliminating squares using Naked Pairs in rows and columns

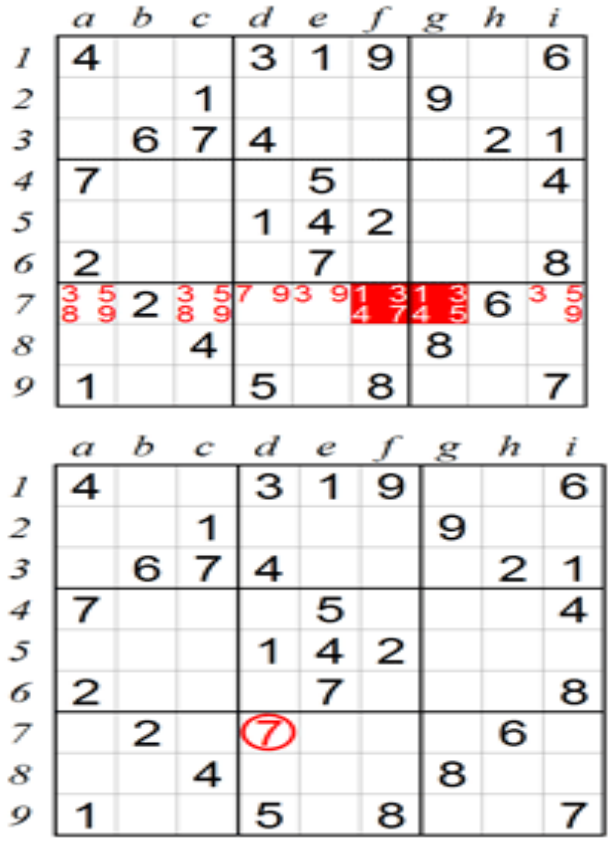
The previous solving technique is useful for deducing a number within a row or column

instead of a box. In this example we see that squares d9 and f9 in box 8 can only contain 2 and 7. Again we don't know which is which, but we do know that both squares are occupied. The numbers which remain to be placed in row 9 are 1, 6 and 8. However, 6 can't be placed in square a9 or in square i9, so the only possible place is square c9.



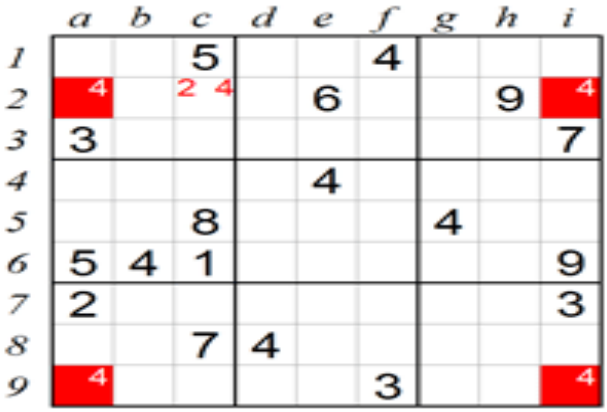
3. Eliminating squares using Hidden Pairs in rows and columns

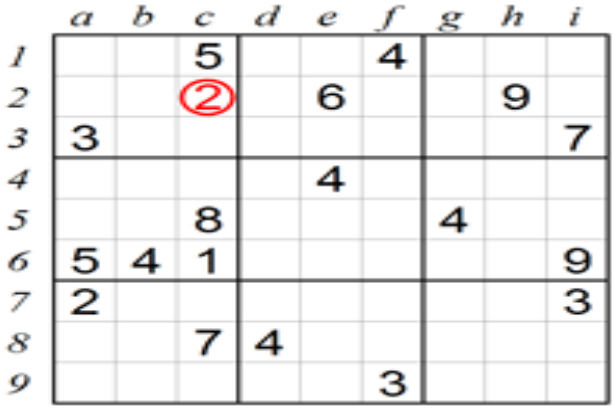
Disjoint Subsets are not always obvious to see at first sight, in which case they are called Hidden Pairs. If we take a very close look at the pencilmarks in row 7 we can see that both 1 and 4 can only be in square f7 and square g7. This means that 1 and 4 are a Hidden Pair, and that square f7 and square g7 cannot contain any other number. Using the scanning technique we see that 7 can only be in square d7.



4. Eliminating squares using X-Wing

The X-Wing technique is used in rare situations which occur in some extremely difficult puzzles. Scanning column a we see that 4 can only be in square a2 or square a9. Similarly, 4 can only be in square i2 or square i9. Because of the X-Wing pattern where boxes are in the same row (or column), a new logic constraint occurs: it is obvious that in row 2 the 4 can only be either in square a2 or in square i2, and it cannot be in any other square. Therefore 4 is excluded from square c2, and square c2 must be 2.





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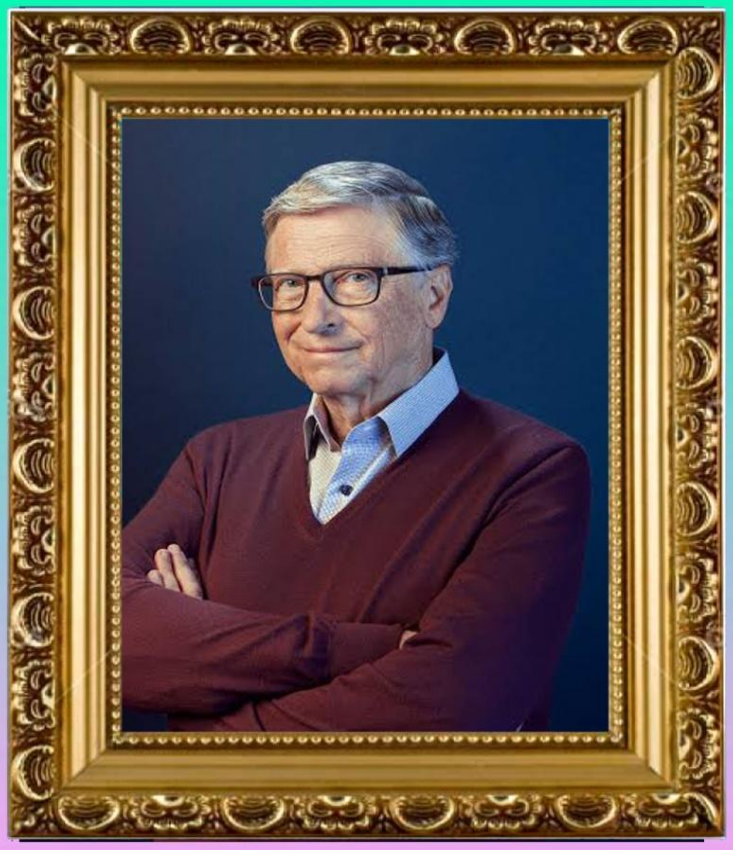

We are Changing the World with Technology

- Bill Gates