Weekly Newsletter

TECHNOLOGY SURVEILLANCE

CONCYTEC

OBJECTIVE: *To provide weekly information about the latest global scientific and technological advancements, as well as the most innovative products and services entering the international market.*

I.   NEWS

1.1   The autism-linked gene SYNGAP1 could impact early stages of human brain development

The gene SYNGAP1, the variants of which are top risk factors for Autism Spectrum Disorder (ASD), has previously unappreciated effects on the developing brain, according to a new study published in Nature Neuroscience. The study shows how disease-causing variants of SYNGAP1, thought primarily to affect synapses between mature neurons, could disrupt early development in a key region of the brain known as the cortex.

Two sculptures representing a human neuron and a radial glia cell, inspired by the findings published by the Quadrato Lab in Nature Neuroscience.
Credit: Sculptures by Kwak; photo by Bianco, Keck School of Medicine of University of Southern California

"Our findings reframe our understanding of the developmental role not only of SYNGAP1, but also of an entire category of ASD risk genes previously thought to be primarily involved in the function of synapses, which are the interfaces that allow nerve cells to communicate with each other," said corresponding author Giorgia Quadrato, an assistant professor of stem cell biology and regenerative medicine at the Keck School of Medicine of USC. *"Ultimately, this points to the importance of pursuing ASD therapies that target not only synapse function, but also early developmental defects."*

For more information, visit the following link:
https://keck.usc.edu/the-autism-linked-gene-syngap1-could-impact-early-stages-of-human-brain-development-usc-study-reveals/

Reference
Lytal, C. (Nov 09, 2023). The autism-linked gene SYNGAP1 could impact early stages of human brain development, USC study reveals. Recovered Nov 14, 2023, Keck School of Medicine of University of Southern California:
https://keck.usc.edu/the-autism-linked-gene-syngap1-could-impact-early-stages-of-human-brain-development-usc-study-reveals/

Information source: (Keck School of Medicine of University of Southern California, 2023)

1.2   Ultrafast lasers on ultra-tiny chips

Lasers have become relatively commonplace in everyday life, but they have many uses outside of providing light shows at raves and scanning barcodes on groceries. Lasers are also of great importance in telecommunications and computing as well as biology, chemistry, and physics research.
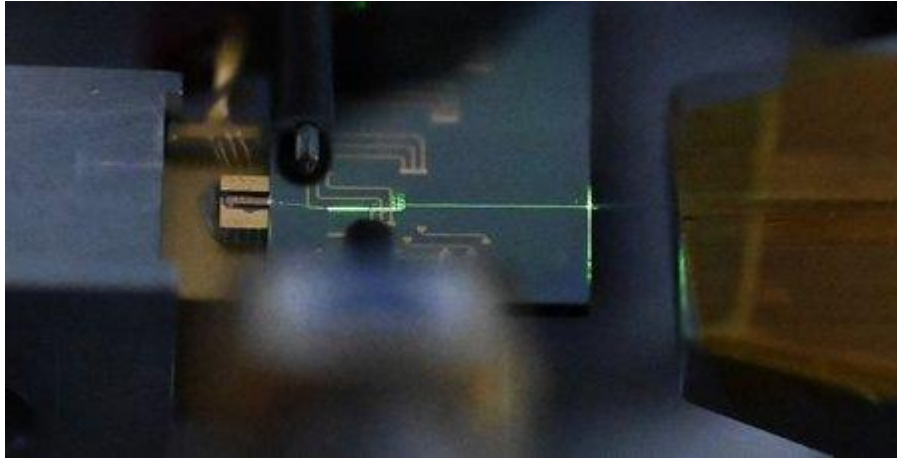
Credit: California Institute of Technology

In those latter applications, lasers that can emit extremely short pulses—those on the order of one-trillionth of a second (one picosecond) or shorter—are especially useful. Using lasers operating on such small timescales, researchers can study physical and chemical phenomena that occur extremely quickly—for example, the making or breaking of molecular bonds in a chemical reaction or the movement of electrons within materials. These ultrashort pulses are also extensively used for imaging applications because they can have extremely large peak intensities but low average power, so they avoid heating or even burning up samples such as biological tissues.

For more information, visit the following link:
https://www.eas.caltech.edu/news/ultrafast-lasers-on-ultra-tiny-chips-1

Reference
Velasco, E. (Nov 09, 2023). Ultrafast lasers on ultra-tiny chips. Recovered Nov 14, 2023, California Institute of Technology:
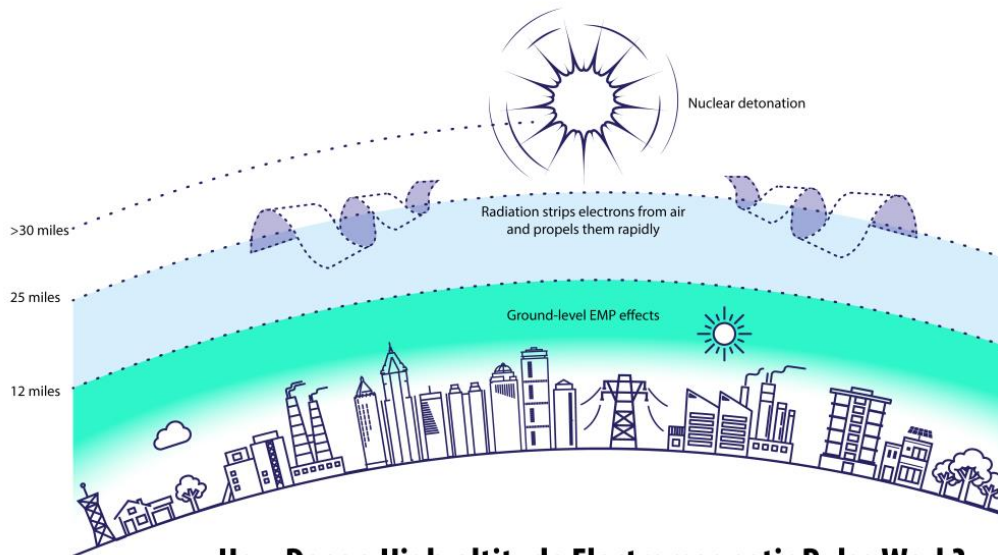https://www.eas.caltech.edu/news/ultrafast-lasers-on-ultra-tiny-chips-1

Information source: (California Institute of Technology, 2023)

1.3   Study probes risks to power plants from electromagnetic pulse

Researchers at the Department of Energy's Oak Ridge National Laboratory have been leading a project to understand how a high-altitude electromagnetic pulse, or EMP, could threaten power plants.

Electromagnetic pulse, or EMP, can be triggered by a nuclear explosion in the atmosphere or by an electromagnetic generator in a vehicle or aircraft. Here's the chain of reactions it could cause to harm electrical equipment on the ground.
Credit: Oak Ridge National Laboratory

A nuclear weapon detonated hundreds of miles in the air emits a brief pulse of gamma rays. At that height, the radiation does not directly harm people on the ground. But the resulting intense EMP energy wave can *"couple"* to power, electronic and communications systems, producing large spikes in voltage or current that destroy the equipment unless it is specially protected. After the initial explosion, the EMP rapidly continues through two more pulse stages that can further impact power transformers, instruments and power system operations. ORNL lead researcher DaHan Liao, said: *"Some estimates indicate that if a nuclear weapon was detonated in the atmosphere above middle America, it could cause widespread, extended blackouts and possibly partial collapse of the grid. So this is really important because it could be a catastrophic, widespread event."*

For more information, visit the following link:
https://www.ornl.gov/news/study-probes-risks-power-plants-electromagnetic-pulse

Reference
Duncan, H. (Nov 09, 2023). Study probes risks to power plants from electromagnetic pulse. Recovered Nov 14, 2023, Oak Ridge National Laboratory:
https://www.ornl.gov/news/study-probes-risks-power-plants-electromagnetic-pulse

Information source: (Oak Ridge National Laboratory, 2023)

1.4   Glasses use sonar, Artificial Intelligence to interpret upper body poses in 3D

PoseSonic is the latest sonar-equipped wearable from Cornell's Smart Computer Interfaces for Future Interactions (SciFi) lab. It consists of off-the-shelf eyeglasses outfitted with micro sonar that can track the wearer's upper body movements in 3D through a combination of inaudible soundwaves and artificial intelligence (AI).

PoseSonic glasses.
Credit: Cornell University

With further development, PoseSonic could enhance augmented reality and virtual reality, and track detailed physical and behavioral data for personal health, the researchers said. *"What's exciting to me about PoseSonic is the potential for its use in detecting fine-grained human activities in the wild,"* said Saif Mahmud, a doctoral student in the field of information science. *"When we have lots of data through body-sensing technology like PoseSonic, it can help us be more mindful of ourselves and our behaviors."*

For more information, visit the following link:
https://news.cornell.edu/stories/2023/11/glasses-use-sonar-ai-interpret-upper-body-poses-3d

Reference
DiPietro, L. (Nov 09, 2023). Glasses use sonar, AI to interpret upper body poses in 3D. Recovered Nov 14, 2023, Cornell University:
https://news.cornell.edu/stories/2023/11/glasses-use-sonar-ai-interpret-upper-body-poses-3d

Information source: (Cornell University, 2023)

1.5   How to use AI for discovery - without leading science astray

Over the past decade, AI has permeated nearly every corner of science: Machine learning models have been used to predict protein structures, estimate the fraction of the Amazon rainforest that has been lost to deforestation and even classify faraway galaxies that might be home to exoplanets.
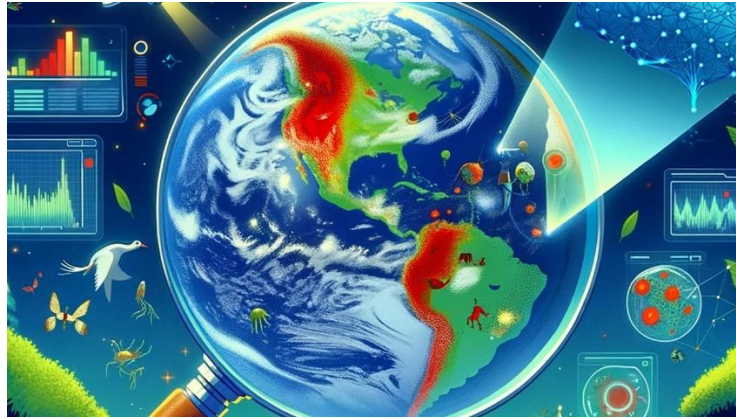
A new statistical technique allows researchers to safely use the predictions obtained from machine learning to test scientific hypotheses. This image shows an artistic interpretation of the technique, called prediction-powered inference, which has been generated by the DALL-E AI system.
Crédito: Courtesy of Michael Jordan, University of California - Berkeley

But while AI can be used to speed scientific discovery — helping researchers make predictions about phenomena that may be difficult or costly to study in the real world — it can also lead scientists astray. In the same way that chatbots sometimes "hallucinate," or make things up, machine learning models can sometimes present misleading or downright false results. Researchers at the University of California, Berkeley, present a new statistical technique for safely using the predictions obtained from machine learning models to test scientific hypotheses. The technique, called prediction-powered inference (PPI), uses a small amount of real-world data to correct the output of large, general models — such as AlphaFold, which predicts protein structures — in the context of specific scientific questions.

For more information, visit the following link:
https://news.berkeley.edu/2023/11/09/how-to-use-ai-for-discovery-without-leading-science-astray

Reference
Manke, K. (Nov 09, 2023). How to use AI for discovery - without leading science astray. Recovered Nov 14, 2023, University of California - Berkeley:
https://news.berkeley.edu/2023/11/09/how-to-use-ai-for-discovery-without-leading-science-astray

Information source: (University of California - Berkeley, 2023)

1.6   Low-cost and multifunctional microprinter for ultrafast piezoelectric material printing

Research team led by the Hong Kong University of Science and Technology (HKUST) has developed a microprinter that can print piezoelectric films 100 times faster for the production of microelectromechanical systems (MEMS) for sensors, wearable or implantable medical devices, offering the possibility to lower the mass production costs.
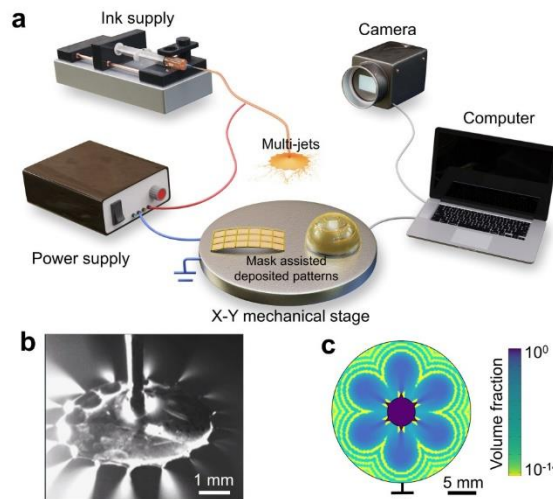
Schematic of electrostatic disc microprinter and multiplexed jetting/tiny droplets from the thin spiny disc.
Credit: The Hong Kong University of Science and Technology

The microprinter, built at a comparatively lower cost as compared with other printers on the market, utilizes an electrostatic field to propel streams of ink onto a platform, allowing for efficient manipulation of thin film patterns and enhanced printing speed to address the challenge of mass production and control of structures and feature sizes. Nanoparticles, films, and patterns are three critical piezoelectric elements with widespread applications in sensing, actuation, catalysis, and energy harvesting. Mass Production of these elements remains a challenge to date as exerting control of these structures and feature sizes on various substrates is a complicated process. Amidst of the ongoing surge in demand for MEMS, wearable/implantable electronics, miniaturized portable devices, and the Internet of Things, the pursuit of piezoelectric materials, thanks to their intrinsical property of coupling mechanical and electrical energy, has become a priority and interest for many.

For more information, visit the following link:
https://seng.hkust.edu.hk/news/20231109/hkust-researchers-develop-low-cost-and-multifunctional-microprinter-ultrafast-piezoelectric-material-printing-0

Reference
The Hong Kong University of Science and Technology. (Nov 09, 2023). HKUST Researchers develop low-cost and multifunctional microprinter for ultrafast piezoelectric material printing. Recovered Nov 15, 2023, The Hong Kong University of Science and Technology:
https://seng.hkust.edu.hk/news/20231109/hkust-researchers-develop-low-cost-and-multifunctional-microprinter-ultrafast-piezoelectric-material-printing-0

Information source: (The Hong Kong University of Science and Technology, 2023)

1.7   *"Indoor solar"* to power the Internet of Things

From Wi-Fi-connected home security systems to smart toilets, the so-called Internet of Things brings personalization and convenience to devices that help run homes. But with that comes tangled electrical cords or batteries that need to be replaced. Now, researchers reporting in ACS Applied Energy Materials have brought solar panel technology indoors to power smart devices. They show which photovoltaic (PV) systems work best under cool white LEDs, a common type of indoor lighting.

Indoor light could someday power smart devices, but traditional solar panel materials aren't necessarily the best options.
Credit: American Chemical Society

Indoor lighting differs from sunlight. Light bulbs are dimmer than the sun, and sunlight comprises ultraviolet, infrared and visible light, whereas indoor lights typically shine light from a narrower region of the spectrum. Scientists have found ways to harness power from sunlight, using PV solar panels, but those panels are not optimized for converting indoor light into electrical energy.

For more information, visit the following link:
https://www.acs.org/pressroom/presspacs/2023/november/indoor-solar-to-power-internet-of-things.html

Reference
American Chemical Society. (Nov 09, 2023). *"Indoor solar"* to power the Internet of Things. Recovered Nov 15, 2023, American Chemical Society:
https://www.acs.org/pressroom/presspacs/2023/november/indoor-solar-to-power-internet-of-things.html

Information source: (American Chemical Society, 2023)

1.8 New Artificial Intelligence noise-canceling headphone technology lets wearers pick which sounds they hear

Most anyone who's used noise-canceling headphones knows that hearing the right noise at the right time can be vital. Someone might want to erase car horns when working indoors, but not when walking along busy streets. Yet people can't choose what sounds their headphones cancel.

A team led by researchers at the University of Washington has developed deep-learning algorithms that let users pick which sounds filter through their headphones in real time.
Credit: University of Washington

Now, a team led by researchers at the University of Washington has developed deep-learning algorithms that let users pick which sounds filter through their headphones in real time. The team is calling the system "semantic hearing." Headphones stream captured audio to a connected smartphone, which cancels all environmental sounds. Either through voice commands or a smartphone app, headphone wearers can select which sounds they want to include from 20 classes, such as sirens, baby cries, speech, vacuum cleaners and bird chirps. Only the selected sounds will be played through the headphones.

For more information, visit the following link:
https://www.washington.edu/news/2023/11/09/ai-noise-canceling-headphones/

Reference
Milne, S. (Nov 09, 2023). New AI noise-canceling headphone technology lets wearers pick which sounds they hear. Recovered Nov 15, 2023, University of Washington:
https://www.washington.edu/news/2023/11/09/ai-noise-canceling-headphones/

Information source: (University of Washington, 2023)

1.9   Failure-finding mission

Massachusetts Institute of Technology (MIT) engineers have developed an approach that can be paired with any autonomous system, to quickly identify a range of potential failures in that system before they are deployed in the real world. What's more, the approach can find fixes to the failures, and suggest repairs to avoid system breakdowns.

MIT engineers have developed a new approach that can be paired with any autonomous system, to quickly identify a range of potential failures in that system. What's more, the approach can find fixes to the failures, and suggest repairs to avoid system breakdowns.
Credit: Massachusetts Institute of Technology

The team has shown that the approach can root out failures in a variety of simulated autonomous systems, including a small and large power grid network, an aircraft collision avoidance system, a team of rescue drones, and a robotic manipulator. In each of the systems, the new approach, in the form of an automated sampling algorithm, quickly identifies a range of likely failures as well as repairs to avoid those failures. The new algorithm takes a different tack from other automated searches, which are designed to spot the most severe failures in a system. These approaches, the team says, could miss subtler though significant vulnerabilities that the new algorithm can catch.

For more information, visit the following link:
https://news.mit.edu/2023/mit-engineers-failure-finding-algorithm-1109

Reference
Chu, J. (Nov 09, 2023). MIT engineers are on a failure-finding mission. Recovered Nov 15, 2023, Massachusetts Institute of Technology:
https://news.mit.edu/2023/mit-engineers-failure-finding-algorithm-1109

Information source: (Massachusetts Institute of Technology, 2023)

1.10   New cooling ceramic can enhance energy efficiency for the construction sector and help combat global warming

A significant breakthrough in developing a passive radiative cooling (PRC) material has been announced by researchers at City University of Hong Kong (CityU). The findings have just been published in the prestigious scientific journal Science titled *"Hierarchically structured passive radiative cooling ceramic with high solar reflectivity."*

Application in a building envelope, with the white cooling ceramic applied on the roof.
Credit: City University of Hong Kong

The material, known as cooling ceramic, has achieved high-performance optical properties for energy-free and refrigerant-free cooling generation. Its cost-effectiveness, durability and versatility make it highly suitable for commercialisation in numerous applications, particularly in building construction. By reducing the thermal load of buildings and providing stable cooling performance, even in diverse weather conditions in all climates, cooling ceramic enhances energy efficiency and can combat global warming.

For more information, visit the following link:
https://www.cityu.edu.hk/research/stories/2023/11/10/new-cooling-ceramic-can-enhance-energy-efficiency-construction-sector-and-help-combat-global-warming-cityu-research

Reference
City University of Hong Kong. (Nov 10, 2023). New cooling ceramic can enhance energy efficiency for the construction sector and help combat global warming—CityU research. Recovered Nov 15, 2023, City University of Hong Kong:
https://www.cityu.edu.hk/research/stories/2023/11/10/new-cooling-ceramic-can-enhance-energy-efficiency-construction-sector-and-help-combat-global-warming-cityu-research

Information source: (City University of Hong Kong, 2023)

1.11   A step closer to making green ammonia a reality

The production of ammonia for fertilisers – which has one of the largest carbon footprints among industrial processes – will soon be possible on farms using low-cost, low-energy and environmentally friendly technology. This is thanks to researchers at UNSW Sydney and their collaborators who have developed an innovative technique for sustainable ammonia production at scale.

Fertiliser for agriculture is largely dependent on ammonia which up until now has had a large carbon footprint.
Credit: Getty Images, University of New South Wales - Sydney

Up until now, the production of ammonia has relied on high-energy processes that leave a massive global carbon footprint – temperatures of more than 400°C and pressures exceeding 200 atmospheres that account for 2 per cent of the world's energy and 1.8 per cent of its CO_2. But the researchers have come up with a method that significantly enhances energy efficiency while making environmentally friendly ammonia economically feasible. The new technique eliminates the requirement for high temperatures, high pressure, and extensive infrastructure in ammonia production.

For more information, visit the following link:
https://newsroom.unsw.edu.au/news/science-tech/unsw-researchers-step-closer-making-green-ammonia-reality

Reference
McAlpine, K. (Nov 14, 2023). UNSW researchers a step closer to making green ammonia a reality. Recovered Nov 15, 2023, The University of New South Wales - Sydney:
https://newsroom.unsw.edu.au/news/science-tech/unsw-researchers-step-closer-making-green-ammonia-reality

Information source: (The University of New South Wales - Sydney, 2023)

1.12   Twisted magnets make brain-inspired computing more adaptable

An international team of researchers used chiral (twisted) magnets as their computational medium and found that, by applying an external magnetic field and changing temperature, the physical properties of these materials could be adapted to suit different machine-learning tasks.
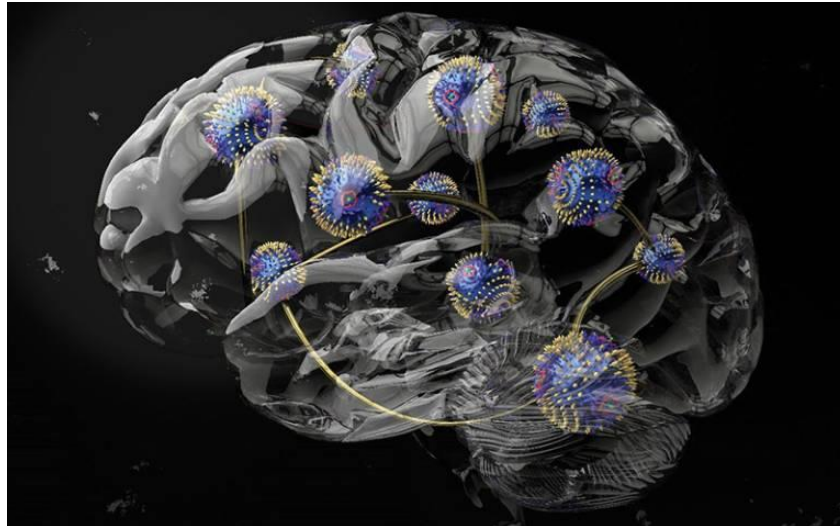
Credit: University College London

Dr Oscar Lee (London Centre for Nanotechnology at UCL and UCL Department of Electronic & Electrical Engineering), the lead author of the paper, said: *"This work brings us a step closer to realising the full potential of physical reservoirs to create computers that not only require significantly less energy, but also adapt their computational properties to perform optimally across various tasks, just like our brains. The next step is to identify materials and device architectures that are commercially viable and scalable."*

For more information, visit the following link:
https://www.ucl.ac.uk/news/2023/nov/twisted-magnets-make-brain-inspired-computing-more-adaptable.

Reference
Woodall, T. (Nov 09, 2023). Twisted magnets make brain-inspired computing more adaptable. Recovered Nov 15, 2023, University College London:
https://www.ucl.ac.uk/news/2023/nov/twisted-magnets-make-brain-inspired-computing-more-adaptable

Information source: (University College London, 2023)

1.13   *"Cooling Glass"* blasts building heat into space

University of Maryland researchers aiming to combat rising global temperatures have developed a new *"cooling glass"* that can turn down the heat indoors without electricity by drawing on the cold depths of space.

Credit: University of Maryland

The new technology, a microporous glass coating, can lower the temperature of the material beneath it by 3.5 degrees Celsius at noon, and has the potential to reduce a mid-rise apartment building's yearly carbon emissions by 10%, according to the research team led by Distinguished University Professor Liangbing Hu in the Department of Materials Science and Engineering. The coating works in two ways: First, it reflects up to 99% of solar radiation to stop buildings from absorbing heat. More intriguingly, it emits heat in the form of longwave infrared radiation into the icy universe, where the temperature is generally around -270 degrees Celsius, or just a few degrees above absolute zero.

For more information, visit the following link:
https://eng.umd.edu/news/story/umd-researchersrsquo-lsquocooling-glassrsquo-blasts-building-heat-into-space

Reference
University of Maryland. (Nov 13, 2023). UMD Researchers' *"Cooling Glass"* blasts building heat into space. Recovered Nov 16, 2023, University of Maryland:
https://eng.umd.edu/news/story/umd-researchersrsquo-lsquocooling-glassrsquo-blasts-building-heat-into-space

Information source: (University of Maryland, 2023)

1.14   To make cheaper fuel cells a reality

The Stanford Linear Accelerator Center team instead used a vacuum chamber for more controlled depositions of their new catalyst onto electrodes. *"This high-vacuum tool is a very "what you see is what you get" type of method,"* said Jaramillo. *"As long as your system is calibrated well, in principle, people can reproduce it readily."*
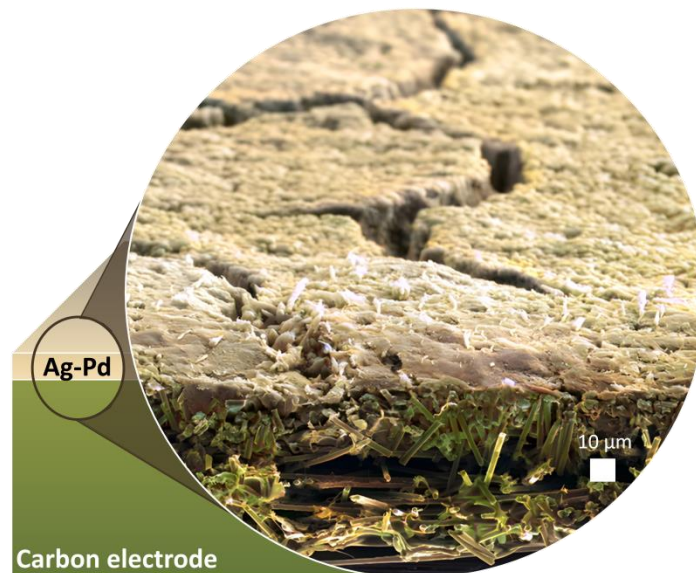
Credit: Stanford Linear Accelerator Center

To ensure that others could reproduce their approach and apply it directly to full-scale fuel cells, the team worked with experts at Technion, who showed that the method worked in a practical fuel cell. *"This project was not set up to do the fuel cell testing here, so we were really fortunate that the lead Stanford graduate student on the project, José Zamora Zeledón, formed a connection with Dario Dekel and his PhD student John Douglin at Technion. They were set up to test the actual fuel cells, so it was a really nice combination of resources to put together,"* said Burke Stevens.

For more information, visit the following link:
https://www6.slac.stanford.edu/news/2023-11-13-researchers-aim-make-cheaper-fuel-cells-reality

Reference
Howlett, J. (Nov 13, 2023). Researchers aim to make cheaper fuel cells a reality. Recovered Nov 16, 2023, Stanford Linear Accelerator Center:
https://www6.slac.stanford.edu/news/2023-11-13-researchers-aim-make-cheaper-fuel-cells-reality

Information source: (Stanford Linear Accelerator Center, 2023)

1.15   Solar-powered device produces clean water and clean fuel at the same time

The device, developed by researchers at the University of Cambridge, could be useful in resource-limited or off-grid environments, since it works with any open water source and does not require any outside power. It takes its inspiration from photosynthesis, the process by which plants convert sunlight into food. However, unlike earlier versions of the "artificial leaf", which could produce green hydrogen fuel from clean water sources, this new device operates from polluted or seawater sources and can produce clean drinking water at the same time.

Device for making solar fuels on the River Cam near the Bridge of Sighs.
Credit: Chanon Pornrungroj, University of Cambridge

Tests of the device showed it was able to produce clean water from highly polluted water, seawater, and even from the River Cam in central Cambridge. The results are reported in the journal Nature Water. *"Bringing together solar fuels production and water purification in a single device is tricky,"* said Dr Chanon Pornrungroj from Cambridge's Yusuf Hamied Department of Chemistry, the paper's co-lead author. *"Solar-driven water splitting, where water molecules are broken down into hydrogen and oxygen, need to start with totally pure water because any contaminants can poison the catalyst or cause unwanted chemical side-reactions."*

For more information, visit the following link:
https://www.cam.ac.uk/research/news/solar-powered-device-produces-clean-water-and-clean-fuel-at-the-same-time

Reference
Collins, S. (Nov 13, 2023). Solar-powered device produces clean water and clean fuel at the same time. Recovered Nov 16, 2023, University of Cambridge:
https://www.cam.ac.uk/research/news/solar-powered-device-produces-clean-water-and-clean-fuel-at-the-same-time

Information source: (University of Cambridge, 2023)

1.16   Bigger datasets might not always be better for Artificial Intelligence models

From ChatGPT to DALL-E, deep learning artificial intelligence (AI) algorithms are being applied to an ever-growing range of fields. A new study from University of Toronto Engineering researchers, suggests that one of the fundamental assumptions of deep learning models - that they require enormous amounts of training data - may not be as solid as once thought.

Credit: University of Toronto

Professor Jason Hattrick-Simpers (MSE) and his team are focused on the design of next-generation materials, from catalysts that convert captured carbon into fuels to non-stick surfaces that keep airplane wings ice-free. One of the challenges in the field is the enormous potential search space. For example, the Open Catalyst Project contains more than 200 million data points for potential catalyst materials, all of which still cover only a tiny portion of the vast chemical space that may, for example, hide the right catalyst to help us address climate change.

For more information, visit the following link:
https://news.engineering.utoronto.ca/u-of-t-engineering-study-finds-bigger-datasets-might-not-always-be-better-for-ai-models/

Reference
Irving, T. (Nov 13, 2023). Staying online in the high speed tube of the future. Recovered Nov 16, 2023, University of Toronto:
https://news.engineering.utoronto.ca/u-of-t-engineering-study-finds-bigger-datasets-might-not-always-be-better-for-ai-models/

Information source: (University of Toronto, 2023)

1.17   The long jump

A team of engineers from the University of Illinois has published the first known study documenting the long-jumping motion of 3D-printed insect-scale robots. The new study, published in the journal Smart Materials and Structures, follows a previous publication that documented the same lab's investigation of vertical jumping in insect-scale robots.

Credit: University of Illinois Urbana-Champaign

The study is led by Professor Sameh Tawfick, an associate professor and Ralph A. Andersen Faculty Scholar in the Department of Mechanical Science and Engineering. His lab, the Kinetic Materials Research Group, studies the development of artificial muscles as part of its focus on bio-inspired materials manufacturing. *"To my knowledge, this is the first time anyone has demonstrated long jumping in insect-scale robots,"* Tawfick said of his lab's accomplishment. *"This is significant because it gives the robot planned mobility, where it can now jump from A to B, traversing terrain rougher than its own size."*

For more information, visit the following link:
https://mechse.illinois.edu/news/stories/60460

Reference
Tucker, T. (Nov 13, 2023). The long jump. Recovered Nov 16, 2023, University of Illinois Urbana-Champaign:
https://mechse.illinois.edu/news/stories/60460

Information source: (University of Illinois Urbana-Champaign, 2023)

1.18   Redefining energy efficiency in data processing

Developed by EPFL researchers, the first large-scale in-memory processor using 2D semiconductor materials could substantially cut the ICT sector's energy footprint. As information and communication technologies (ICT) process data, they convert electricity into heat. Already today, the global ICT ecosystem's CO_2 footprint rivals that of aviation. It turns out, however, that a big part of the energy consumed by computer processors doesn't go into performing calculations. Instead, the bulk of the energy used to process data is spent shuttling bytes between the memory to the processor.
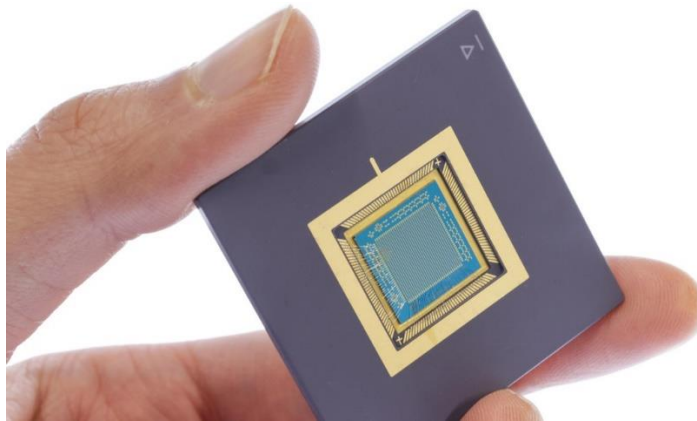
Credit: École Polytechnique Fédérale de Lausanne

Researchers from EPFL's School of Engineering in the Laboratory of Nanoscale Electronics and Structures (LANES) present a new processor that tackles this inefficiency by integrating data processing and storage onto a single device, a so-called in-memory processor. They broke new ground by creating the first in-memory processor based on a two-dimensional semiconductor material to comprise more than 1000 transistors, a key milestone on the path to industrial production.

For more information, visit the following link:
https://actu.epfl.ch/news/redefining-energy-efficiency-in-data-processing/

Reference
Overney, J. (Nov 14, 2023). Redefining energy efficiency in data processing. Recovered Nov 16, 2023, École Polytechnique Fédérale de Lausanne:
https://actu.epfl.ch/news/redefining-energy-efficiency-in-data-processing/

Information source: (École Polytechnique Fédérale de Lausanne, 2023)

1.19   The new frontier in online security: quantum-safe cryptography

A team of experts led by Monash University researchers, in collaboration with Australia's national science agency CSIRO, have created an algorithm that can help strengthen online transactions that use end-to-end encryption against powerful attacks from quantum computers. Cryptography researchers from Monash University's Faculty of Information Technology and CSIRO's data and digital specialist arm Data61 have developed the most efficient quantum-secure cryptography algorithm, called *"LaV"*, to enhance the security of end-to-end encryption, with potential application across instant messaging services, data privacy, cryptocurrency and blockchain systems.

End-to-end encryption is a way to secure digital communication between a sender and receiver using encryption keys. Mobile messaging services like WhatsApp and Signal use end-to-end encryption so that no one, including the communication system provider, telecom providers, internet providers or hackers can access the information being transmitted between the sender and the receiver. It would take millions of years for a normal computer or even a supercomputer to hack into and gain access to data protected by end-to-end encryption. But a large-scale quantum computer could break current encryption within minutes and gain access to encrypted information more easily.

For more information, visit the following link:
https://www.monash.edu/news/articles/the-new-frontier-in-online-security-quantum-safe-cryptography

Reference
Hari, T. (Nov 14, 2023). The new frontier in online security: quantum-safe cryptography. Recovered Nov 16, 2023, Monash University:
https://www.monash.edu/news/articles/the-new-frontier-in-online-security-quantum-safe-cryptography

Information source: (Monash University, 2023)

1.20   Capturing wellhead gases for profit and a cleaner environment

Burning of natural gas at oil and gas wells, called flaring, is a major waste of fossil fuels and a contributor to climate change. But to date, capturing the flared natural gas, estimated at some 140 billion cubic meters per year by the International Energy Agency, has not been economically feasible. University of California, Berkeley, chemists have now come up with a simple and green way to convert these gases — primarily methane and ethane — into economically valuable liquids, mostly alcohols like methanol and ethanol. The liquids are also easier to store.
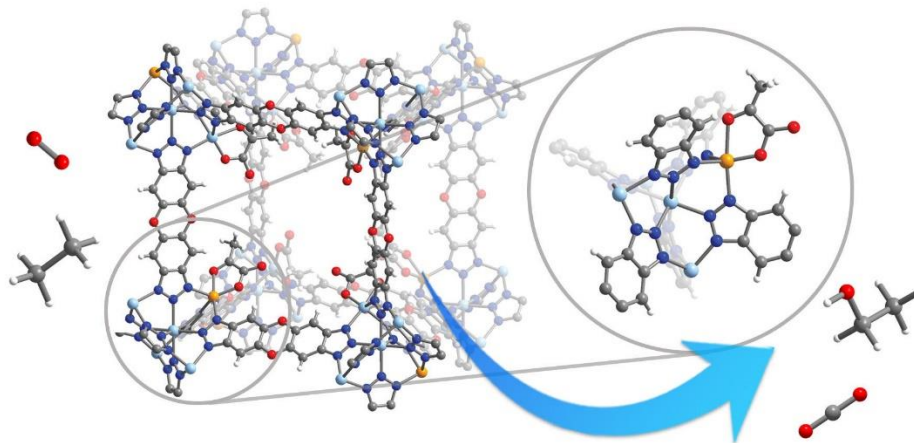
Detail of the porous MOF (left and inside circle at right) showing the metal reactive site where oxygen and hydrocarbons like ethane (molecules at extreme left) are converted into alcohols, such as ethanol, plus carbon dioxide (molecules at extreme right).
Credit: University of California - Berkeley

The alcohols can be used as feedstocks for production of numerous other petrochemical products, providing an additional revenue source for oil and gas companies but also lowering carbon dioxide emissions from flaring. Flaring is used to mitigate the more harmful effects of directly venting natural gas — methane is 34 times more potent as a greenhouse gas than carbon dioxide — into the atmosphere.

For more information, visit the following link:
https://chemistry.berkeley.edu/news/capturing-wellhead-gases-profit-and-cleaner-environment

Reference
Sanders, R. (Nov 13, 2023). Capturing wellhead gases for profit and a cleaner environment. Recovered Nov 16, 2023, University of California - Berkeley:
https://chemistry.berkeley.edu/news/capturing-wellhead-gases-profit-and-cleaner-environment

Information source: (University of California - Berkeley, 2023)

II. PATENTS

2.1.   Intelligent recognition and alert methods and systems

The present disclosure provides a method including receiving a target object for detection and a predetermined area in which the target object is to be detected. The predetermined area is associated with a plurality of content capturing devices.
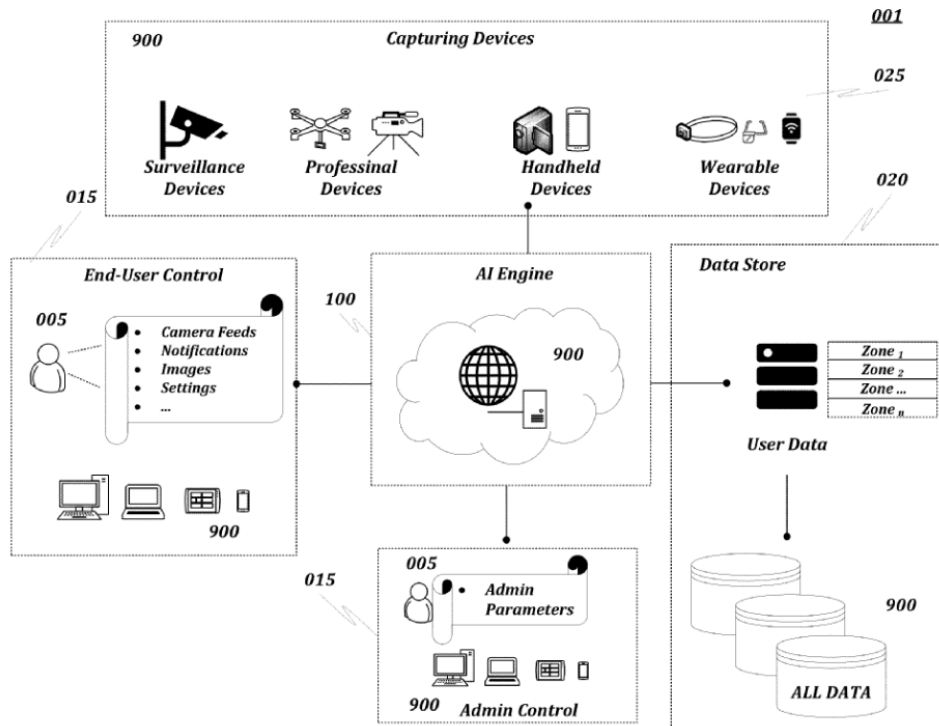
Block diagram of an operating environment consistent with some embodiments of the present disclosure.
Credit: Samples, J., WIPO IP Portal

The target object is detected within one or more frames of video data. Responsive to detecting the target object, detection data is determined, including: a particular content capturing device associated with the one or more frames of video data, a location of the particular content capturing device, a time at which the one or more frames were captured, and/or weather data associated with the geolocation of the particular content capture device at the time. The present detection data is provided to an Artificial Intelligence model to predict a next geolocation at which the target object is likely to be detected and/or a timeframe for detection of the target object.

For more information, visit the following link:
https://patentscope.wipo.int/search/es/detail.jsf?docId=US413452318&_cid=P22-LP1QM2-85913-1

Reference
Samples, J. (Nov 09, 2023). Intelligent recognition and alert methods and systems. Recovered Nov 13, 2023, WIPO IP Portal:
https://patentscope.wipo.int/search/es/detail.jsf?docId=US413452318&_cid=P22-LP1QM2-85913-1

Information source: (WIPO IP Portal, 2023)

2.2. Smart camera system for monitoring remote assets

Embodiments of the present disclosure pertain to a computer-implemented method of insect control that includes: training a source model and a classifier on a source dataset in a source domain; adapting knowledge learned on the source domain to a target domain via unsupervised domain adaptive training; and deploying a model in the target domain in response to the adapting.
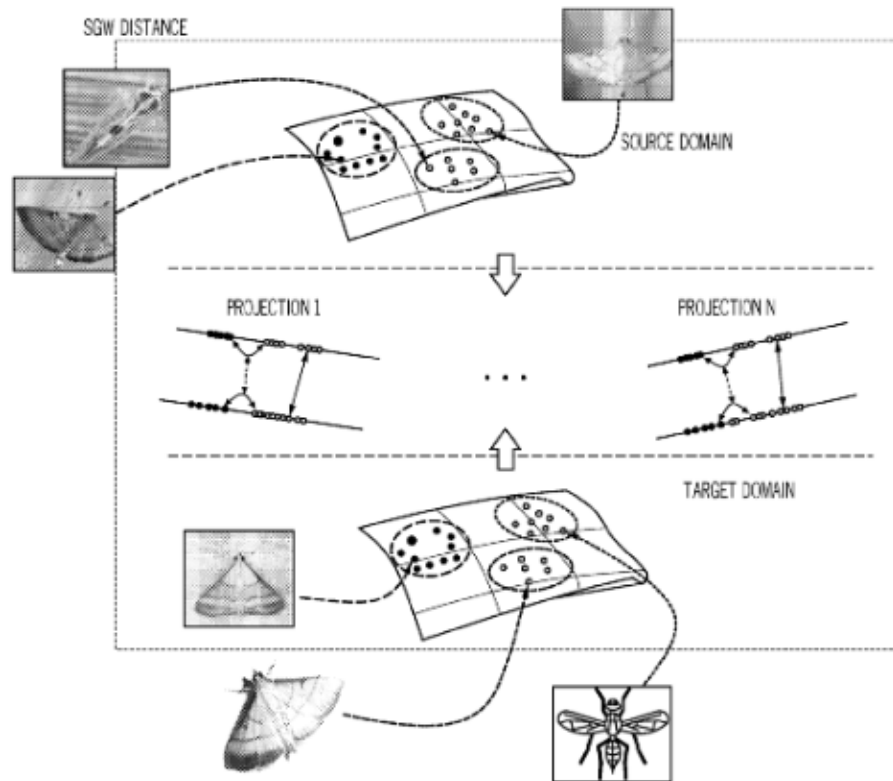
Illustrates an example of a sliced Gromov-Wasserstein distance.
Credit: Luu, K.; Truong, T. & Dowling, A, WIPO IP Portal

The unsupervised adaptive training includes: projecting features that are on at least two domains into one-dimensional space; computing a plurality of Gromov-Wasserstein distances on the one-dimensional space; and determining a sliced Gromov-Wasserstein distance based at least partly on an average of the plurality of Gromov-Wasserstein distances. Additional embodiments pertain to a system for insect control, where the system includes a computing device with programming instructions for implementing the method.

For more information, visit the following link:
https://patentscope.wipo.int/search/es/detail.jsf?docId=WO2023215630&_cid=P22-LP1QM2-85913-1

Reference
Luu, K.; Truong, T. & Dowling, A. (Nov 09, 2023). Smart insect control device via artificial intelligence in real time. Recovered Nov 13, 2023, WIPO IP Portal:
https://patentscope.wipo.int/search/es/detail.jsf?docId=WO2023215630&_cid=P22-LP1QM2-85913-1

Information source: (WIPO IP Portal, 2023)

2.3.   System and method for monitoring activities through portable devices

A device and system are provided for notifying a user contact of the status of a user of a portable device. The status is determined by the portable device collecting user provided information and device collected information relevant to a user of portable device.
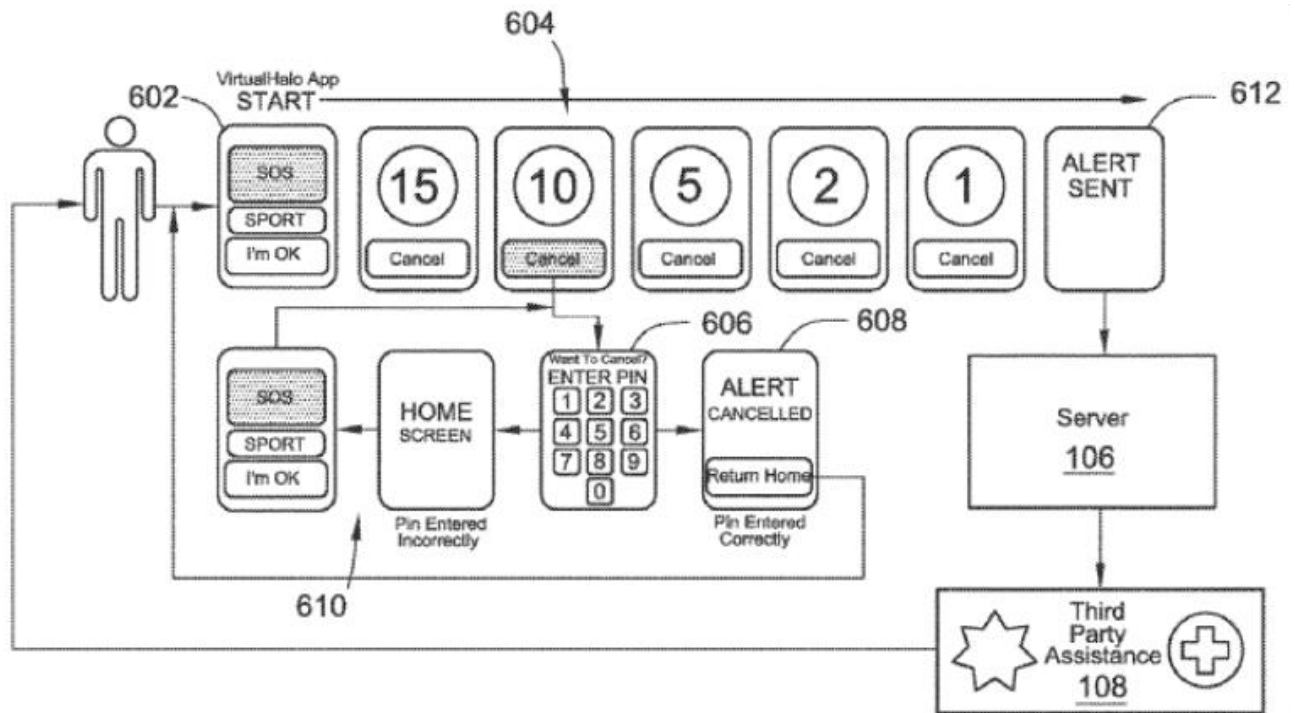
Is a flowchart illustrating the SOS mode according to one embodiment.
Credit: Swank, J., WIPO IP Portal

The portable device may then transmit the device collected information and the user provided information to a server that in turn performs an analysis on the device collected information and the user provided information to determine whether a triggering event has occurred. If it is determined that a triggering event has occurred, the server will proceed to send a status update regarding the user of the portable device to preset user contacts. The triggering event is determined to have occurred based on preset user conditions and algorithms and artificial intelligence being executed at the server.

For more information, visit the following link:
https://patentscope.wipo.int/search/es/detail.jsf?docId=US413453301&_cid=P22-LP1QM2-85913-1

Reference
Swank, J. (Nov 09, 2023). System and method for monitoring activities through portable devices. Recovered Nov 13, 2023, WIPO IP Portal:
https://patentscope.wipo.int/search/es/detail.jsf?docId=US413453301&_cid=P22-LP1QM2-85913-1

Information source: (WIPO IP Portal, 2023)

2.4.   Decentralized procedural digital asset creation in augmented reality applications

Example implementations include a method, apparatus and computer-readable medium for decentralized procedural digital asset creation, comprising receiving a first request to create a digital asset from an application executing an augmented reality effect on a computing device, wherein the first request includes an identifier associated with a user of the application.
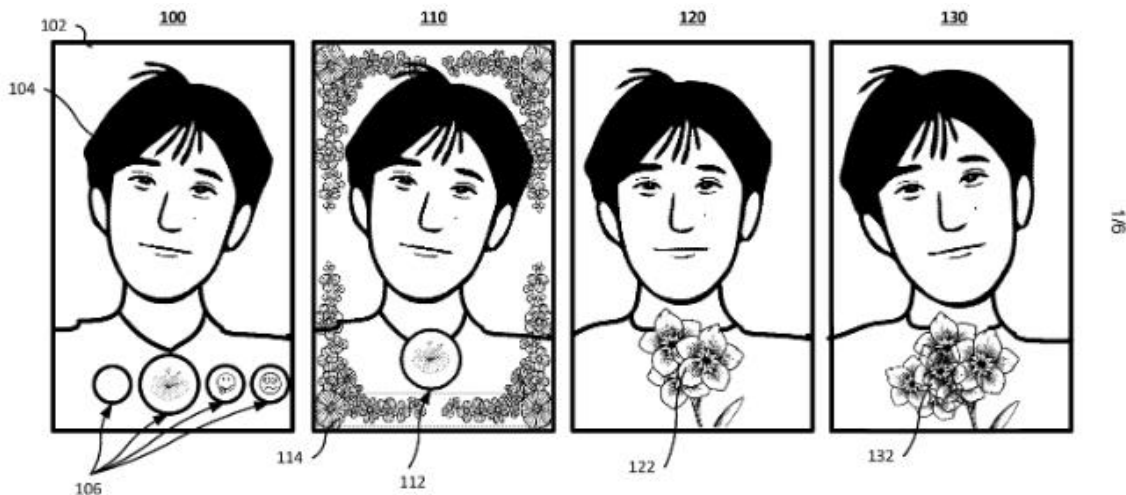
Diagram depicting multiple screens of an augmented reality application as a user interacts with a digital asset, in accordance with exemplary aspects of the present disclosure.
Credit: Newberg, N.; Li, P.; Tian, R.; Schager, N. & Inanc, G., WIPO IP Portal

The implementations further include generating the digital asset and metadata of the digital asset, wherein the metadata includes information about characteristics of the digital asset and ownership of the digital asset by the user. Additionally, the implementations further include storing the metadata on a blockchain. Additionally, the implementations further include receiving a second request to access the digital asset from the application. Additionally, the implementations further include transmitting, to the application for rendering, the metadata stored on the blockchain in response to validating the identifier associated with the user in the second request.

For more information, visit the following link:
https://patentscope.wipo.int/search/es/detail.jsf?docId=US413453301&_cid=P22-LP1QM2-85913-1

Reference
Newberg, N.; Li, P.; Tian, R.; Schager, N. & Inanc, G. (Nov 09, 2023). Decentralized procedural digital asset creation in augmented reality applications. Recovered Nov 13, 2023, WIPO IP Portal: https://patentscope.wipo.int/search/es/detail.jsf?docId=US413453301&_cid=P22-LP1QM2-85913-1

Information source: (WIPO IP Portal, 2023)

2.5.   System and method for evaluating and diagnosing in real time the specific conditions and physical, chemical and microbiological properties of agricultural soil

The present invention relates to a system and method that, by means of a single processing tool, allow integration of the generation of spatial data regarding agricultural soils in order to manage graphical outputs represented as contour maps by analysed variable, wherein the key operating principle of the system is data capture by means of the (manual or automated) recording of field test results, associated in particular with physical, chemical and microbiological properties of the soils, and according to the characteristics of the crop to be evaluated, within the physical environment of a computer application, which forms a log directory.
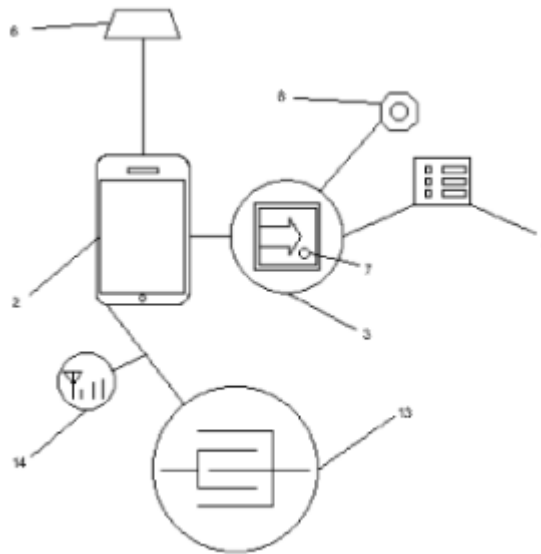
General view of the physical and technological components associated with the system or device of the present invention, where the mobile device, the sensors and the communication between several of these are evidenced.
Credit: Orjuela, H., WIPO IP Portal

The system is formed by a mobile device comprising an installed computer application that has a directory for recording data, wherein the data are temporarily stored on an online platform, with the option of storing the data on the mobile device. The computer application comprises at least five modules provided for inputting data when the user wishes to generate maps in order to prepare the land, schedule irrigation, schedule fertilisation, see reports or seek specialised technical assistance by sending the reports or graphical outputs. The system operates using an Internet connection or data connectivity linked to the mobile device.

For more information, visit the following link:
https://patentscope.wipo.int/search/es/detail.jsf?docId=WO2023214338&_cid=P22-LP1R8D-00546-1

Reference
Orjuela, H. (Nov 09, 2023). System and method for evaluating and diagnosing in real time the specific conditions and physical, chemical and microbiological properties of agricultural soil. Recovered Nov 13, 2023, WIPO IP Portal:
https://patentscope.wipo.int/search/es/detail.jsf?docId=WO2023214338&_cid=P22-LP1R8D-00546-1

Information source: (WIPO IP Portal, 2023)

2.6.   Artificial Intelligence-based posture discrimination device using body pressure sensors and method thereof

An artificial intelligence-based posture discrimination device using body pressure sensors and a method thereof are proposed. The device includes a body pressure sensor module configured to measure body pressure of a user, touching the frame of the bed or the mattress, by using a plurality of body pressure sensors, a sample body pressure distribution data generation module configured to learn and generate the corresponding user's sample body pressure distribution data by using a Generative Adversarial Network (GAN).
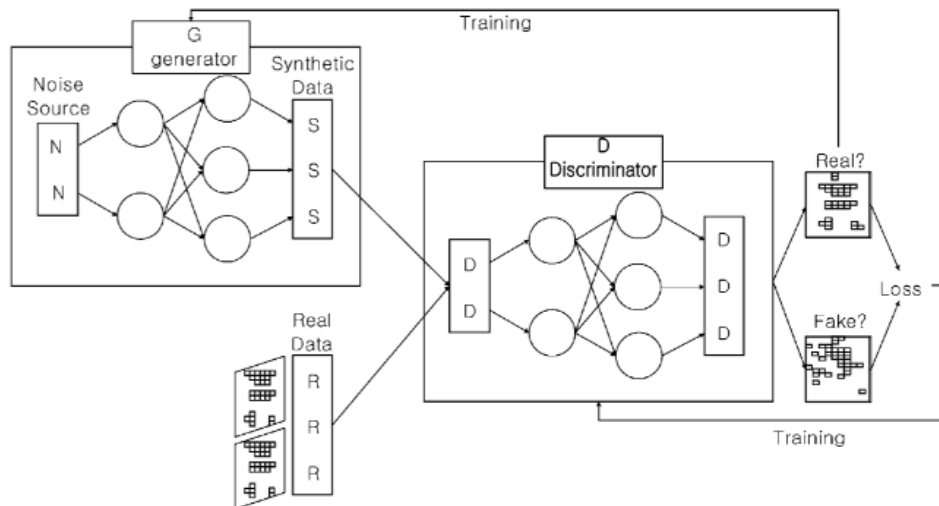
Conceptual view for illustrating a structure of a Generative Adversarial Network (GAN) applied to the exemplary embodiment of the present disclosure.
Credit: Lee, Y.; Choi, J.; Lee, K.; Kim, Min G. & Costello, F., Espacenet Patent Search

And a posture discrimination module configured to analyze the corresponding user's actual body pressure distribution data, and discriminate the corresponding user's lying postures after learning and predicting the time-series body pressure distribution data in the two-dimensional format by using an ensemble artificial intelligence deep learning technique, so that as the user's lying postures are more accurately discriminated, the user's postures may be effectively changed, thereby increasing pressure ulcer prevention functionality and convenience.

For more information, visit the following link:
https://worldwide.espacenet.com/patent/search/family/088647998/publication/US2023355166A1?q=artificial%20intelligence

Reference
Lee, Y.; Choi, J.; Lee, K.; Kim, Min G. & Costello, F. (Nov 09, 2023). Artificial Intelligence-based posture discrimination device using body pressure sensors and method thereof. Recovered Nov 13, 2023, Espacenet Patent Search:
https://worldwide.espacenet.com/patent/search/family/088647998/publication/US2023355166A1?q=artificial%20intelligence

Information source: (Espacenet Patent Search, 2023)

2.7.   Cross-carrier digital ledger for subscriber identification module (SIM) related data

A system can detect a change associated with a subscriber identity module (SIM) of a wireless device and generate a data record indicative of the change.
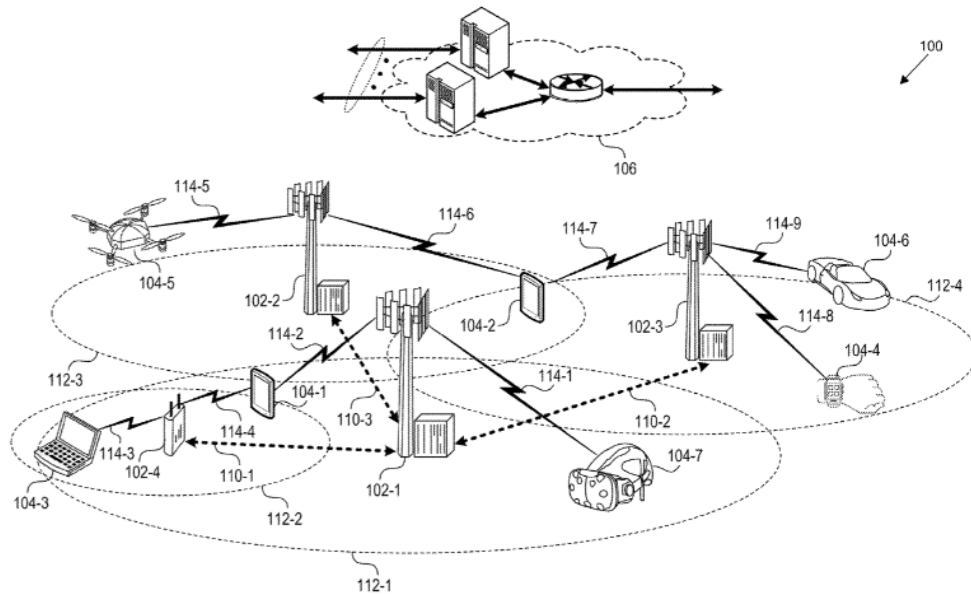
Block diagram that illustrates a wireless communications system that can implement aspects of the present technology.
Credit: Farag, P. & Spanton, C., Espacenet Patent Search

In one example, the data record is stored on a digital ledger residing on a cryptographically secured and distributed peer-to-peer network (e.g., blockchain) that stores multiple data records of changes to SIMs of wireless devices. The system can determine whether a wireless device is impacted by malicious activity based on an age of its data record stored on the distributed ledger. For example, an aged data record indicates a lower probability that the wireless device was the subject of a SIM swap fraud whereas a newer data record indicates a higher probability of a SIM swap fraud.

For more information, visit the following link:
https://worldwide.espacenet.com/patent/search/family/088647830/publication/US2023362655A1?q=blockchain

Reference
Farag, P. & Spanton, C. (Nov 09, 2023). Cross-carrier digital ledger for subscriber identification module (SIM) related data. Recovered Nov 13 2023, Espacenet Patent Search:
https://worldwide.espacenet.com/patent/search/family/088647830/publication/US2023362655A1?q=blockchain

Information source: (Espacenet Patent Search, 2023)

2.8.   Handheld 3D scanner

A handheld scanner is presented for generating 3D data relating to a surface of a target object. The handheld scanner comprises a frame having an outer periphery on which is mounted a set of imaging modules including at least one camera.
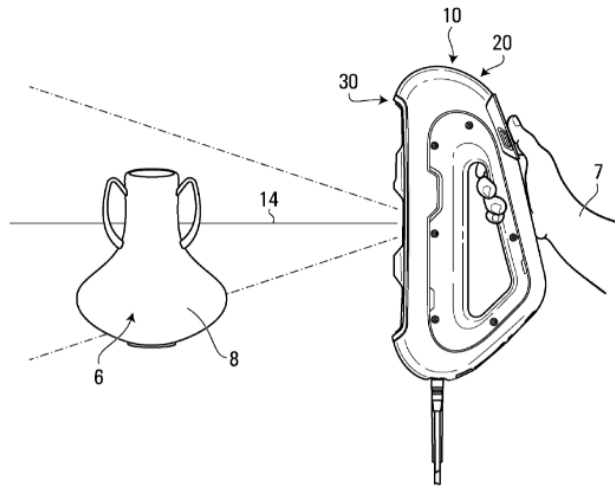
Schematic view of a handheld 3D scanner in accordance with an embodiment of the disclosure in the process of scanning a surface of a target object.
Credit: Lebrun, N., Espacenet Patent Search

According to some aspects, the frame has an inner periphery defining an opening at least partially enclosed by the frame and a plurality of handle regions is provided around the opening, the plurality of handle regions defining regions where the handheld scanner is holdable by a hand of a user and including at least two distinct handle regions having different orientations relative to one another and relative to the set of imaging modules. The two distinct handle regions allow a user of the scanner to easily manipulate and position in the scanner in different orientations by selectively holding the scanner using one or the other handle regions.

For more information, visit the following link:
https://worldwide.espacenet.com/patent/search/family/088646029/publication/WO2023212796A1?q=3d

Reference
Lebrun, N. (Nov 09, 2023). Handheld 3D scanner. Recovered Nov 13, 2023, Espacenet Patent Search: https://worldwide.espacenet.com/patent/search/family/088646029/publication/WO2023212796A1?q=3d

Information source: (Espacenet Patent Search, 2023)

2.9.   System for interactive advertisement

A system to provide an interactive advertisement to a user includes an advertisement server, a user device, and an advertisement application software installed on the user device. The advertisement server includes a database which stores a plurality of questions concerning an advertiser or the advertiser's goods, each question having an answer hint. The advertisement server includes a question selection module, an advertisement assessment module, and a user selection module.
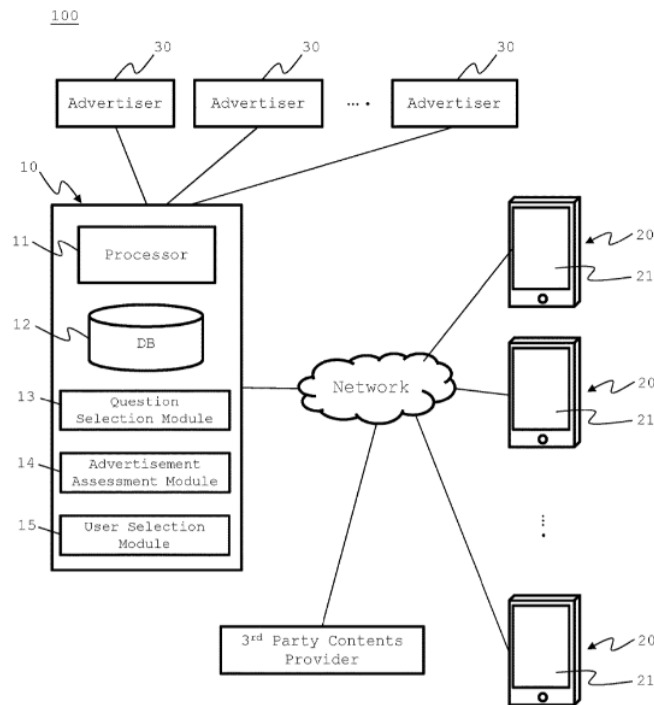
Schematic diagram of an interactive advertisement according to the present invention.
Credit: Lee, H., Espacenet Patent Search

The advertisement application software is configured to: receive a commercial of the advertiser; receive a combination of questions from the advertisement server, and display the combination of questions; and receive answers from the user, and send the answers to the advertisement server. The user is allowed to change the answers, and a reward is given to the user if the number of correct answers exceeds a predetermined number.

For more information, visit the following link:
https://worldwide.espacenet.com/patent/search/family/088648902/publication/US2023360077A1?q=virtual%20reality

Reference
Lee, H. (Nov 09, 2023). System for interactive advertisement. Recovered Nov 14, 2023, Espacenet Patent Search:
https://worldwide.espacenet.com/patent/search/family/088648902/publication/US2023360077A1?q=virtual%20reality

Information source: (Espacenet Patent Search, 2023)

2.10.   Method, system, and computer program product for estimating intracranial pressure using near-infrared spectroscopy

The disclosed method includes generating first waveform data using near-infrared spectroscopy (NIRS) to measure at least one light-based signal in a plurality of patients, wherein each waveform of the plurality of waveforms of the first waveform data is associated with at least one blood attribute. The method also includes training a machine learning model based on the first waveform data to produce a trained machine learning model.
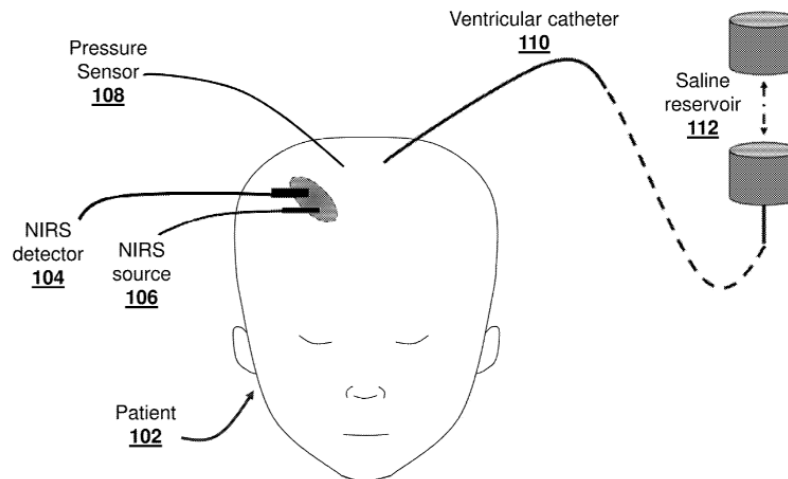
Illustrative diagram of a setup for generating waveform data from a patient, according to some non-limiting embodiments or aspects of the present disclosure..
Credit: Kainerstofer, J.; Relander, F.; Ruesch, A. & Smith, M., Espacenet Patent Search

The method further includes generating second waveform data using NIRS to measure at least one light-based signal in a patient. The method further includes determining an estimated ICP in the patient based on the trained machine learning model. Determining the estimated ICP includes inputting the second waveform data to the trained machine learning model and generating an output from the trained machine learning model including the estimated ICP based on a shape feature of a waveform of the second waveform data.

For more information, visit the following link:
https://worldwide.espacenet.com/patent/search/family/088648236/publication/US2023360767A1?q=machine%20learning

Reference
Kainerstofer, J.; Relander, F.; Ruesch, A. & Smith, M. (Nov 09, 2023). Method, system, and computer program product for estimating intracranial pressure using near-infrared spectroscopy. Recovered Nov 14, 2023, Espacenet Patent Search:
https://worldwide.espacenet.com/patent/search/family/088648236/publication/US2023360767A1?q=machine%20learning

Information source: (Espacenet Patent Search, 2023)