# 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   Cell-to-cell diversity is key to protecting brain from neurological diseases

A brain's cell makeup may transform the way we understand and treat neuropsychiatric conditions, potentially opening a new treatment path for diseases like epilepsy, autism, schizophrenia, and depression.
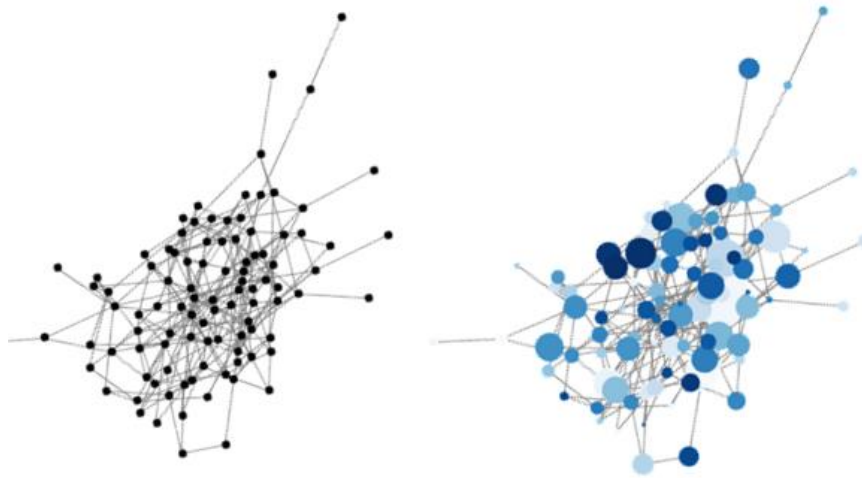
When the cells differ from one another (image right), the network is more resilient and robust to change. If there is no such diversity (left image), these brain ecosystems become fragile and may slip towards pathological states.
Credit: University of Ottawa

The study from the University of Ottawa's Faculty of Science demonstrates how a brain's ecosystem and its diversity of cells can allow it to maintain normal function while better responding to changes, perturbations, or injury. The response to such *"insults"* – as the study coins them – is amplified by cells that are too connected or too alike, which makes them less resilient and unable to maintain the activity needed to preserve brain function. *"Our results demonstrate how diversity is a foundational, essential ingredient in the constitution of brain circuits,"* says Lefebvre, a member of uOttawa's Brain and Mind Research Institute. *"Just like the biodiversity of ecosystems, the diversity of neurons is as important and represents a new way of interpreting certain illnesses, like epilepsy."*

For more information, visit the following link:
https://www.uottawa.ca/about-us/media/news-all/cell-cell-diversity-key-protecting-brain-neurological-diseases-uottawa-study

Reference
Logothetis, P. (Jul 18, 2023). Cell-to-cell diversity is key to protecting brain from neurological diseases: uOttawa study. Recovered Jul 18, 2023, University of Ottawa:
https://www.uottawa.ca/about-us/media/news-all/cell-cell-diversity-key-protecting-brain-neurological-diseases-uottawa-study

Information source: (University of Ottawa, 2023)

1.2   How an *"AI-tocracy"* emerges

Research co-led by a professor at the Massachusetts Institute of Technology (MIT) concludes that, in China, the government has increasingly deployed AI-driven facial-recognition technology to surpress dissent; has been successful at limiting protest; and in the process, has spurred the development of better AI-based facial-recognition tools and other forms of software.

Credit: Massachusetts Institute of Technology

What follows, as the paper notes, is that *"AI innovation entrenches the regime, and the regime's investment in AI for political control stimulates further frontier innovation."* The scholars call this state of affairs an *"AI-tocracy,"* describing the connected cycle in which increased deployment of the AI-driven technology quells dissent while also boosting the country's innovation capacity. To conduct the study, the scholars drew on multiple kinds of evidence spanning much of the last decade. To catalogue instances of political unrest in China, they used data from the Global Database of Events, Language, and Tone (GDELT) Project, which records news feeds globally. The team turned up 9,267 incidents of unrest between 2014 and 2020.

For more information, visit the following link:
https://news.mit.edu/2023/how-ai-tocracy-emerges-0713

Reference
Dizikes, P. (Jul 13, 2023). How an *"AI-tocracy"* emerges. Recovered Jul 14, 2023, Massachusetts Institute of Technology:
https://news.mit.edu/2023/how-ai-tocracy-emerges-0713

Information source: (Massachusetts Institute of Technology, 2023)

1.3   New theory developed for periodically driven quantum dots-cavity system

A team led by Prof. GUO Guoping and Prof. CAO Gang from the University of Science and Technology of China (USTC) of the Chinese Academy of Sciences (CAS), collaborating with Sigmund Kohler from Materials Science Institute of Madrid, developed a response theory applicable to strongly coupled and multiqubit systems.
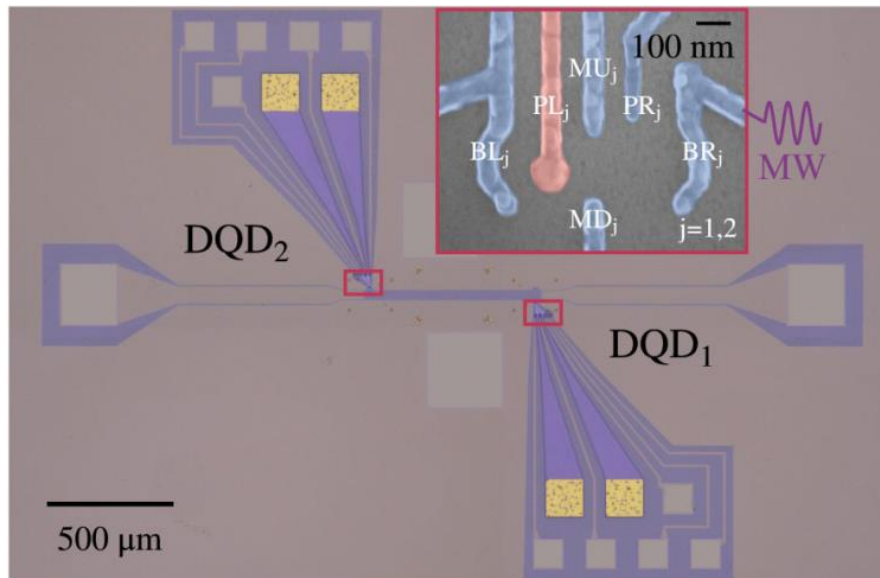
Optical micrograph of the DQD-cavity composite device.
Credit: GU Sisi et al., Chinese Academy of Sciences

In this study, the researchers first prepared a composite device of a high-impedance resonant cavity integrated with two double quantum dots (DQD). By probing the microwave response signal of the DQD-cavity hybrid system under periodic driving, they found that the existing theory for dispersive cavity readout fails due to the enhancement of the coupling strength. Therefore, researchers developed a new response theory that treats the cavity as a part of the driven system, as opposed to the existing theory. Using this theory, they successfully simulated and interpreted the signals in the experiment, and further investigated the case of two-DQD-cavity hybrid system under periodic driving.

For more information, visit the following link:
https://english.cas.cn/newsroom/research_news/phys/202307/t20230714_333589.shtml

Reference
Liu, J. (Jul 14, 2023). New theory developed for periodically driven quantum dots-cavity system. Recovered Jul 14, 2023, Chinese Academy of Sciences:
https://english.cas.cn/newsroom/research_news/phys/202307/t20230714_333589.shtml

Information source: (Chinese Academy of Sciences, 2023)

1.4   Biomaterial-delivered one-two punch boosts cancer immunotherapy

A team of immune-engineers at the Harvard John A. Paulson School of Engineering and Applied Sciences (SEAS) and the Wyss Institute for Biologically Inspired Engineering at Harvard University have developed a novel biomaterials-based immunotherapy approach named SIVET (short for *"synergistic in situ vaccination enhanced T cell"*) that has the potential to break down these barriers.
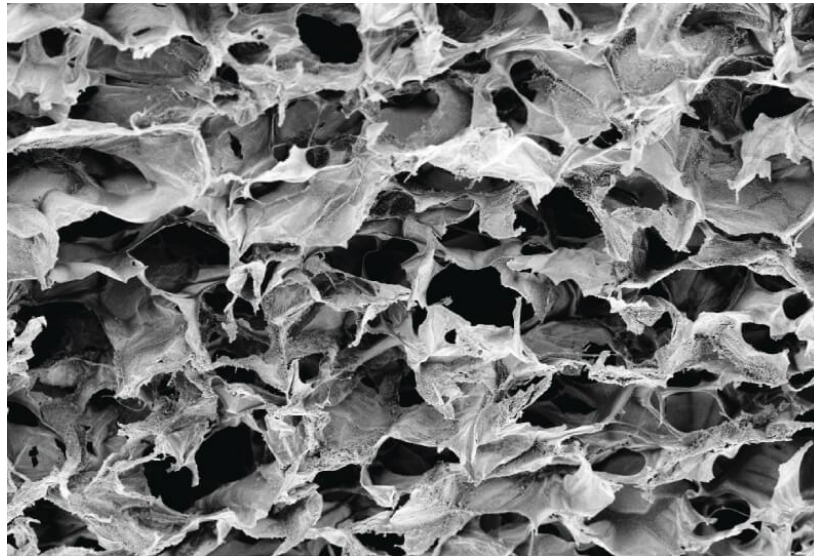
The researchers visualized the cell-permeable porous structure of an injectable SIVET immuno-material using scanning electron microscopy analysis (SEM).
Credit: Wyss Institute at Harvard University

The injectable biomaterial enables both the local delivery of antigen-specific adoptively transferred T cells directly to tumor sites and their prolonged activation, as well as a broader engagement of the host immune system to provide much longer-lasting anti-tumor effects against tumor cells carrying new antigens. Validated in mice carrying melanomas, a particularly aggressive type of solid tumor, SIVET enabled the fast shrinking of tumors and long-term protection against them.

For more information, visit the following link:
https://seas.harvard.edu/news/2023/07/biomaterial-delivered-one-two-punch-boosts-cancer-immunotherapy

Reference
Boettner, B. (Jul 13, 2023). Biomaterial-delivered one-two punch boosts cancer immunotherapy. Recovered Jul 14, 2023, Harvard John A. Paulson School of Engineering and Applied Sciences:
https://seas.harvard.edu/news/2023/07/biomaterial-delivered-one-two-punch-boosts-cancer-immunotherapy

Information source: (Harvard John A. Paulson School of Engineering and Applied Sciences, 2023)

1.5   An easier way to learn quantum processes

The researchers worked on *"quantum neural networks"* (QNNs), a type of machine-learning model designed to learn and process information using principles inspired by quantum mechanics in order to mimic the behavior of quantum systems.

Credit: Ecole Polytechnique Fédérale de Lausanne

Just like the neural networks used in artificial intelligence, QNNs are made of interconnected nodes, or "neurons," that perform calculations. The difference is that, in QNNs, the neurons operate on the principles of quantum mechanics, allowing them to handle and manipulate quantum information. *"Normally, when we teach a computer something, we need a lot of examples,"* says Holmes. *"But in this study, we show that with just a few simple examples called 'product states' the computer can learn how a quantum system behaves even when dealing with entangled states, which are more complicated and challenging to understand."*

For more information, visit the following link:
https://actu.epfl.ch/news/an-easier-way-to-learn-quantum-processes/

Reference
Papageorgiou, N. (Jul 13, 2023). An easier way to learn quantum processes. Recovered Jul 14, 2023, Ecole Polytechnique Fédérale de Lausanne:
https://actu.epfl.ch/news/an-easier-way-to-learn-quantum-processes/

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

1.6   New material could hold key to reducing energy consumption in computers and electronics

A University of Minnesota team has, for the first time, synthesized a thin film of a unique topological semimetal material that has the potential to generate more computing power and memory storage while using significantly less energy. The researchers were also able to closely study the material, leading to some important findings about the physics behind its unique properties.
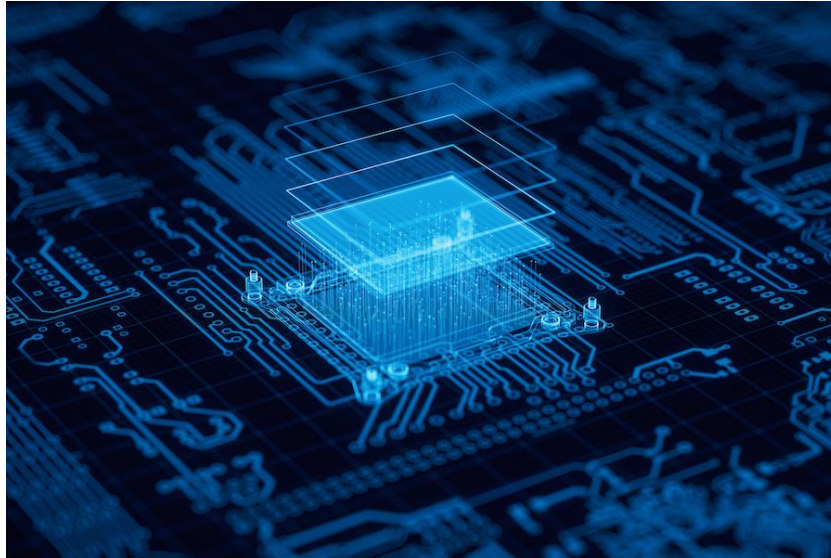
Credit: University of Minnesota

In this new study, an interdisciplinary team of University of Minnesota researchers were able to successfully synthesize such a material as a thin film — and prove that it has the potential for high performance with low energy consumption. *"This research shows that you can transition from a weak topological insulator to a topological semimetal using a magnetic doping strategy,"* said Jian-Ping Wang, a senior author of the paper and a professor in the College of Science and Engineering. *"We're looking for ways to extend the lifetimes for our electrical devices and at the same time lower the energy consumption, and we're trying to do that in non-traditional, out-of-the-box ways."*

For more information, visit the following link:
https://twin-cities.umn.edu/news-events/new-material-could-hold-key-reducing-energy-consumption-computers-and-electronics

Reference
Erdman, S. (Jul 14, 2023). New material could hold key to reducing energy consumption in computers and electronics. Recovered Jul 14, 2023, University of Minnesota:
https://twin-cities.umn.edu/news-events/new-material-could-hold-key-reducing-energy-consumption-computers-and-electronics

Information source: (University of Minnesota, 2023)

1.7 Drexel's titanium oxide material lets sunlight drive green hydrogen production

The discovery offers an alternative to current methods that generate greenhouse gas and require a great deal of energy. Photocatalysis, a process that can split hydrogen from water using only sunlight, has been explored for several decades, but has remained a more distant consideration because the catalyst materials enabling the process can only survive it for a day or two, which limits its long-term efficiency and, as a result, its commercial viability.
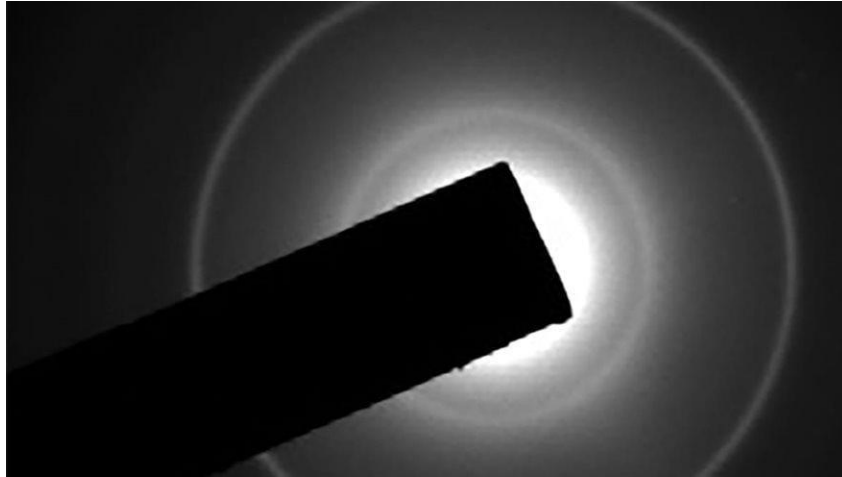
A new photocatalytic titanium oxide-based nanomaterial, discovered at Drexel, could open new pathways for producing green hydrogen.
Credit: Drexel University

Drexel's group, led by College of Engineering researchers Michel Barsoum, PhD, and Hussein O. Badr, PhD, in collaboration with scientists from the National Institute of Materials Physics in Bucharest, Romania, recently reported its discovery of photocatalytic titanium oxide-based, one-dimensional nanofilament material that can help sunlight glean hydrogen from water for months at a time. Their article *"Photo-stable, 1D-nanofilaments TiO2-based lepidocrocite for photocatalytic hydrogen production in water-methanol mixtures,"* published in the journal Matter, presents a sustainable and affordable path for creating hydrogen fuel, according to the authors.

For more information, visit the following link:
https://drexel.edu/news/archive/2023/July/titanium-oxide-photocatalyst-green-hydrogen-production

Reference
Okada, K. (Jul 13, 2023). Drexel's titanium oxide material lets sunlight drive green hydrogen production. Recovered Jul 17, 2023, Drexel University:
https://drexel.edu/news/archive/2023/July/titanium-oxide-photocatalyst-green-hydrogen-production

Information source: (Drexel University, 2023)

1.8   Ferroelectric transistor that stores and computes at scale

This property allows them to serve as non-volatile memory devices as well as computing devices. Able to both store and process data, Ferroelectric field effect transistors (FE-FETs) are the subject of a wide range of research and development projects. A successful FE-FET design would dramatically undercut the size and energy usage thresholds of traditional devices, as well as increase speed.
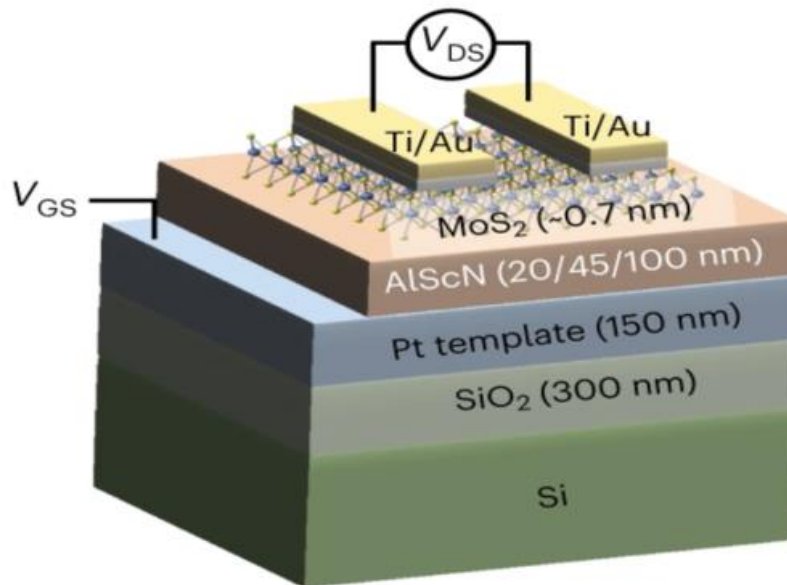
Researchers at the University of Pennsylvania School of Engineering and Applied Science have introduced a new FE-FET design that demonstrates record-breaking performances in both computing and memory.
Credit: University of Pennsylvania

Researchers at the University of Pennsylvania School of Engineering and Applied Science have introduced a new FE-FET design that demonstrates record-breaking performances in both computing and memory. A recent study published in Nature Nanotechnology led by Deep Jariwala, Associate Professor in the Department of Electrical and Systems Engineering (ESE), and Kwan-Ho Kim, a Ph.D. candidate in his lab, debuted the design. They collaborated with fellow Penn Engineering faculty members Troy Olsson, also Associate Professor in ESE, and Eric Stach, Robert D. Bent Professor of Engineering in the Department of Materials Science and Engineering (MSE) and Director of the Laboratory for Research on the Structure of Matter (LRSM).

For more information, visit the following link:
https://blog.seas.upenn.edu/a-ferroelectric-transistor-that-stores-and-computes-at-scale/

Reference
Fischler, D. (Jul 13, 2023). A ferroelectric transistor that stores and computes at scale. Recovered Jul 17, 2023, University of Pennsylvania:
https://blog.seas.upenn.edu/a-ferroelectric-transistor-that-stores-and-computes-at-scale/

Information source: (University of Pennsylvania, 2023)

1.9   Global metric developed for the design of dextrous robots

Researchers Dr Christos Bergeles, from the School of Biomedical Engineering & Imaging Sciences, Dr Konrad Leibrandt, formerly at UCL, and Prof Lyndon da Cruz from Moorfields Eye Hospital, have designed an application that defines both reachability and dexterity. They have introduced a global metric that allows for quantitative comparison of continuum robots.

Credit: King's College London

Continuum robots move like an elephant's trunk, can flex, and alter their shape to avoid critical anatomical regions, and can control the position and orientation of their tip to mimic the dexterity of the human hand. These robots can reach the bottom part of the eye where they can transplant retinal cells to replace damaged ones, ultimately improving the dexterity of the surgeon. Dr Bergeles is utilising the methods outlined in this paper to develop micro-surgical robots that offer opportunities beyond conventional surgery. He aims to implement the design algorithms in robotics for eye surgery, under a new collaborative programme from KCL, UCL and Moorfield.

For more information, visit the following link:
https://www.kcl.ac.uk/news/global-metric-developed-for-the-design-of-dextrous-robots

Reference
Bergeles, C. (Jul 14, 2023). Global metric developed for the design of dextrous robots. Recovered Jul 17, 2023, King's College London:
https://www.kcl.ac.uk/news/global-metric-developed-for-the-design-of-dextrous-robots

Information source: (King's College London, 2023)

1.10   InMotion develops fastest-charging electric race car in the world

InMotion started designing and producing the new battery pack in the race car with more than thirty students in November 2022. What's remarkable is that this battery pack charges in just 3 minutes and 56 seconds, with a charging power of 322 kW, a total capacity of 29.2 kWh, and a range of approximately 250 kilometers. Reducing the charging time for electric cars is important to make electric driving easier and therefore more accessible for consumers. InMotion has taken up that challenge and is now truly getting close to a pit-stop-worthy charging time.

InMotion's electric race car
Credit: Charlie Acuna, Eindhoven University of Technology

The goal of InMotion is to demonstrate that it is indeed possible to reduce the charging time of an electric car, to a level comparable to refueling a gasoline car. In doing so, they hope to make electric driving more appealing to consumers and challenge the industry to make the world greener. If a group of highly motivated students can achieve this, then the industry certainly cannot lag behind.

For more information, visit the following link:
https://www.tue.nl/en/news-and-events/news-overview/13-07-2023-inmotion-develops-fastest-charging-electric-race-car-in-the-world

Reference
Raaijmakers, F. (Jul 13, 2023). InMotion develops fastest-charging electric race car in the world. Recovered Jul 17, 2023, Eindhoven University of Technology:
https://www.tue.nl/en/news-and-events/news-overview/13-07-2023-inmotion-develops-fastest-charging-electric-race-car-in-the-world

Information source: (Eindhoven University of Technology, 2023)

1.11   New high-power thermoelectric device may provide cooling in next-gen electronics

Next-generation electronics will feature smaller and more powerful components that require new solutions for cooling. A new thermoelectric cooler developed by Penn State scientists greatly improves the cooling power and efficiency compared to current commercial thermoelectric units and may help control heat in future high-power electronics, the researchers said.
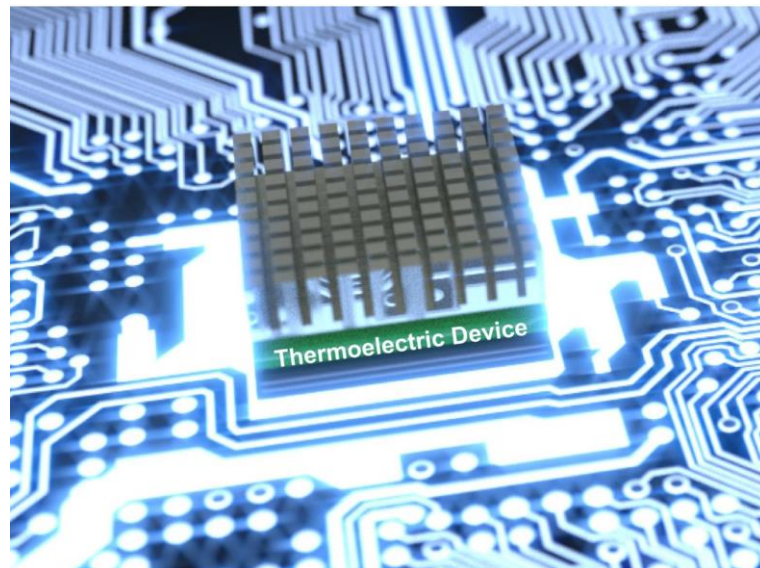
Half-Heusler materials may provide a boost in cooling power density of thermoelectric devices and provide a cooling solution for next generation of high-power electronics.
Credit: Wenjie Li, The Pennsylvania State University

"Our new material can provide thermoelectric devices with very high cooling power density," said Bed Poudel, research professor in the Department of Materials Science and Engineering at Penn State. *"We were able to demonstrate that this new device can not only be competitive in terms of technoeconomic measures but outperform the current leading thermoelectric cooling modules. The new generation of electronics will benefit from this development."*

For more information, visit the following link:
https://www.psu.edu/news/research/story/new-high-power-thermoelectric-device-may-provide-cooling-next-gen-electronics/

Reference
Carroll, M. (Jul 13, 2023). New high-power thermoelectric device may provide cooling in next-gen electronics. Recovered Jul 17, 2023, The Pennsylvania State University:
https://www.psu.edu/news/research/story/new-high-power-thermoelectric-device-may-provide-cooling-next-gen-electronics/

Information source: (The Pennsylvania State University, 2023)

1.12   Artificial Intelligence helps household robots cut planning time in half

It could use PIGINet, a new system that aims to efficiently enhance the problem-solving capabilities of household robots. Researchers from MIT's Computer Science and Artificial Intelligence Laboratory (CSAIL) are using Machine Learning to cut down on the typical iterative process of task planning that considers all possible actions. PIGINet eliminates task plans that can't satisfy collision-free requirements, and reduces planning time by 50-80 percent when trained on only 300-500 problems.
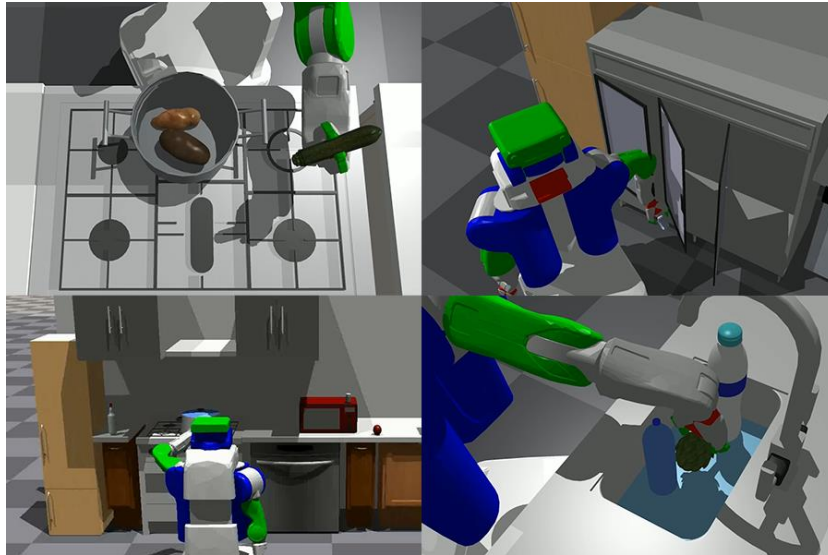
PIGINet predicts the feasibility of a task plan given images of objects, goal description, and initial state descriptions. It reduces the planning time of a task and motion planner by 50-80 percent by eliminating infeasible task plans.
Credit: Alex Shipps/CSAIL, Massachusetts Institute of Technology

Typically, robots attempt various task plans and iteratively refine their moves until they find a feasible solution, which can be inefficient and time-consuming, especially when there are movable and articulated obstacles. Maybe after cooking, for example, you want to put all the sauces in the cabinet. That problem might take two to eight steps depending on what the world looks like at that moment. Does the robot need to open multiple cabinet doors, or are there any obstacles inside the cabinet that need to be relocated in order to make space? You don't want your robot to be annoyingly slow — and it will be worse if it burns dinner while it's thinking.

For more information, visit the following link:
https://news.mit.edu/2023/ai-helps-household-robots-cut-planning-time-half-0714

Reference
Gordon, R. (Jul 14, 2023). AI helps household robots cut planning time in half. Recovered Jul 17, 2023, Massachusetts Institute of Technology:
https://news.mit.edu/2023/ai-helps-household-robots-cut-planning-time-half-0714

Information source: (Massachusetts Institute of Technology, 2023)

1.13 HKUMed discovers a novel molecular mechanism driving chemoresistance and tumour recurrence in gastric cancer, unveiling an actionable target for the disease

The research team discovered an unreported mechanism driving chemoresistance by which dysregulated editing at the RNA level instigates aberration in lipid metabolism to endow chemoresistance and cancer stemness.

"Our findings identified dysregulated editing at the RNA level of lipid metabolic genes as a novel molecular mechanism underlying resistance to chemotherapy in gastric cancer. By targeting edited SCD1, we can reverse chemoresistance and cancer stemness. This research has laid the foundation for the future development of new treatments for this deadly disease," said Professor Stephanie Ma Kwai-yee of the School of Biomedical Sciences, HKUMed, who initiated the study. *"Further, ADAR1 expression and SCD1 may also be good biomarkers for predicting response to chemotherapy in gastric cancer patients. This spares the patients from going through unnecessary chemotherapy and allows them to carry on more effective treatment."*

For more information, visit the following link:
https://hku.hk/press/news_detail_26374.html

Reference
The University of Hong Kong. (Jul 17, 2023). HKUMed discovers a novel molecular mechanism driving chemoresistance and tumour recurrence in gastric cancer, unveiling an actionable target for the disease. Recovered Jul 17, 2023, The University of Hong Kong:
https://hku.hk/press/news_detail_26374.html

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

1.14   New skin-like sensors fit almost everywhere

Researchers from the Munich Institute of Robotics and Machine Intelligence (MIRMI) at the Technical University of Munich (TUM) have developed an automatic process for making soft sensors. These universal measurement cells can be attached to almost any kind of object. Applications are envisioned especially in robotics and prosthetics.

The sensor skin is very flexible and can be attached to many surfaces, including fingers, for example.
Credit: Technical University of Munich

The holy grail in robotics and prosthetics is a realistic emulation of the sensorimotoric skills of a person such as those in a human hand. In robotics, force and torque sensors are fully integrated into most devices. These measurement sensors provide valuable feedback on the interactions of the robotic system, such as an artificial hand, with its surroundings. However, traditional sensors have been limited in terms of customization possibilities. Nor can they be attached to arbitrary objects. In short: until now, no process existed for producing sensors for rigid objects of arbitrary shapes and sizes.

For more information, visit the following link:
https://www.tum.de/en/news-and-events/all-news/press-releases/details/robotik-neue-hautaehnliche-sensoren-passen-fast-immer

Reference
Schmitz, A. (Jul 17, 2023). New skin-like sensors fit almost everywhere. Recovered Jul 17, 2023, Technical University of Munich:
https://www.tum.de/en/news-and-events/all-news/press-releases/details/robotik-neue-hautaehnliche-sensoren-passen-fast-immer

Information source: (Technical University of Munich, 2023)

1.15   Breaking barriers in drug delivery with better lipid nanoparticles

A collaboration between Lawrence Berkeley National Laboratory (Berkeley Lab) and Genentech, a member of the Roche Group, is working to break through some of the drug delivery bottlenecks by designing the most effective lipid nanoparticles (LNPs) – tiny spherical pouches made of fatty molecules that encapsulate therapeutic agents until they dock with cell membranes and release their contents. The first drug to use LNPs was approved in 2018, but the delivery method rose to global prominence with the Pfizer and Moderna mRNA Covid vaccines.

Credit: Lawrence Berkeley National Laboratory

"It's quite a smart system, because if you just deliver the RNA itself to the human body, the RNA is degraded by nucleases and cannot easily cross the cell membrane due to its size and charge, but the LNPs deliver it safely into the cell," explained co-lead author Chun-Wan Yen, a senior Principal Scientist in Genentech's Small Molecule Pharmaceutical Sciences group.

For more information, visit the following link:
https://newscenter.lbl.gov/2023/07/17/breaking-barriers-in-drug-delivery-with-better-lipid-nanoparticles/

Reference
Kovner, A. (Jul 17, 2023). Breaking barriers in drug delivery with better lipid nanoparticles. Recovered Jul 18, 2023, Lawrence Berkeley National Laboratory:
https://newscenter.lbl.gov/2023/07/17/breaking-barriers-in-drug-delivery-with-better-lipid-nanoparticles/

Information source: (Lawrence Berkeley National Laboratory, 2023)

1.16   Bulky size frustrates radical molecules to boost chemical reactions

The project, led by Song Lin, professor of chemistry and chemical biology in the College of Arts and Sciences, emerged from the Lin Group's previous experiments with synthetic electrochemistry. In that process, electrodes pass an electrical current through a chemical reaction to activate inert molecules that will form chemical bonds that otherwise might not be achievable.
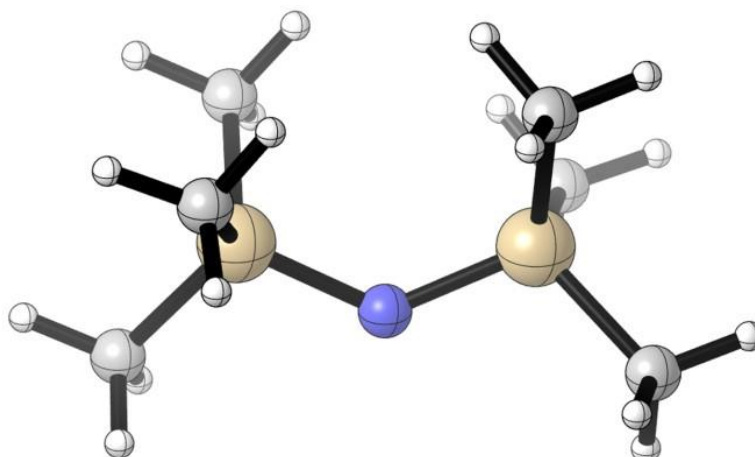
Cornell researchers bulked up highly reactive radical molecules by attaching groups of carbon and hydrogen atoms to their surface, effectively giving each molecule a set of antlers that allowed them to preserve their native reactivity while keeping their partner at a safe distance.
Credit: Cornell University

Electrochemistry also happens to be one of the most efficient ways to generate high reactive radicals from simple chemical feedstocks. *"That's where we thought, hey, when we have these radicals, how can we control them as well? If you can harness them and use them to react with a pharmaceutical, they can do really cool chemistry,"* Lin said. *"It's really our interest in electrochemistry and radical chemistry that allowed us to think about these fundamental problems."*

For more information, visit the following link:
https://news.cornell.edu/stories/2023/07/bulky-size-frustrates-radical-molecules-boost-chemical-reactions

Reference
Nutt, D. (Jul 17, 2023). Bulky size frustrates radical molecules to boost chemical reactions. Recovered Jul 18, 2023, Cornell University:
https://news.cornell.edu/stories/2023/07/bulky-size-frustrates-radical-molecules-boost-chemical-reactions

Information source: (Cornell University, 2023)

1.17   Underwater mass spectrometer developed for deep sea exploration

A research team led by Prof. Chen Chilai from the Hefei Institutes of Physical Science of the Chinese Academy of Sciences developed a deep-sea mass spectrometer. It has completed several sea trials in a specific area of the deep sea.
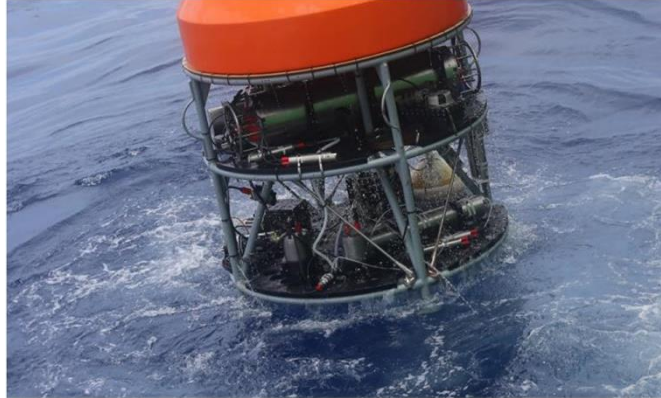
The deep-sea mass spectrometer in experiment.
Credit: Wang Han, Chinese Academy of Sciences

Extreme environment of the deep sea has shaped unique biological processes and harbors significant mineral resources, making their detection a frontier issue in international earth science research. Deep sea in-situ detection technology allows continuous acquisition of information on the components, concentrations, and variations of deep-sea samples in both temporal and spatial dimensions. Therefore, it is increasingly being used in study on extreme deep-sea environments.

For more information, visit the following link:
https://english.cas.cn/newsroom/research_news/phys/202307/t20230717_333626.shtml

Reference
Zhang, N. (Jul 17, 2023). Underwater mass spectrometer developed for deep sea exploration. Recovered Jul 18, 2023, Chinese Academy of Sciences:
https://english.cas.cn/newsroom/research_news/phys/202307/t20230717_333626.shtml

Information source: (Chinese Academy of Sciences, 2023)

1.18   Improving high-temperature stability of perovskite solar cells

Perovskite solar cells (PSCs) have gained attention for their high power-conversion efficiencies and low-cost solution processing. However, ensuring their stability at high temperatures has been a challenge, as the points of contact between their different layers (*"interfaces"*) are susceptible to degradation, leading to energy loss and decreased performance.
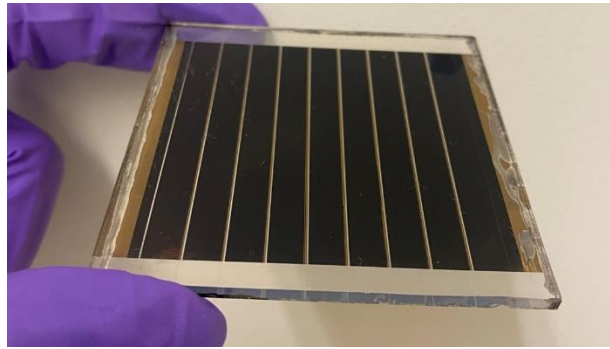
Credit: Ecole Polytechnique Fédérale de Lausanne

In a new study, researchers have found that they can minimize PSC degradation at high temperatures by using fluorinated aniliniums, a class of compounds used in pharmaceuticals, agrochemicals, and materials science. The study was led by Michael Grätzel at EPFL, Edward Sargent at the University of Toronto, and Kenneth Graham at the University of Kentucky. The researchers incorporated fluorinated aniliniums in the *"interfacial passivation"* step of PSC fabrication. Interfacial passivation is a technique used to enhance the stability and performance of interfaces between different layers or materials to minimize defects, reduce charge recombination, and improve overall efficiency and stability.

For more information, visit the following link:
https://actu.epfl.ch/news/improving-high-temperature-stability-of-perovskite/

Reference
Papageorgiou, N. (Jul 18 2023). Improving high-temperature stability of perovskite solar cells. Recovered Jul 18, 2023, Ecole Polytechnique Fédérale de Lausanne:
https://actu.epfl.ch/news/improving-high-temperature-stability-of-perovskite/

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

1.19   Stretchable robotic fabrics

The study, led by Dr Roderich Gross from the University's Department of Automatic Control and Systems Engineering, has demonstrated for the first time how low-power robotic modules - approximately the size of a 50p coin - can connect together via an elastic mesh and move reliably in the same direction, forming an intelligent robotic fabric.

Groups of Kilobots and other small modules usually are not physically linked, but the Sheffield study shows how coupling the modules together in an elastic mesh enables them to move more reliably.
Credit: The University of Sheffield

The Sheffield scientists say the research paves the way for the development of ultra-low-power robotic fabrics that navigate spaces inaccessible to humans such as underground water pipes to look for cracks, or that can shrink and be deployed inside the human body to provide medical monitoring or treatment. The prototype fabrics developed in the study are made up of small robotic modules - known as Kilobots - that are low power and have low processing capabilities due to their limited size. Each Kilobot uses vibration motors to move, but cannot precisely control its own direction. When part of the elastic mesh, it communicates with other nearby modules such that the group collectively decides how best to move and behave.

For more information, visit the following link:
https://www.sheffield.ac.uk/news/stretchable-robotic-fabrics-developed-university-sheffield-scientists

Reference
Barton, S. (Jul 18, 2023). Stretchable robotic fabrics, developed by University of Sheffield scientists. Recovered Jul 19, 2023, The University of Sheffield: https://www.sheffield.ac.uk/news/stretchable-robotic-fabrics-developed-university-sheffield-scientists

Information source: (The University of Sheffield, 2023)

1.20   A new milestone for flexible magnetic sensors

A giant leap of more than an order of magnitude improvement in the sensitivity of flexible magneto-resistive sensors heralds new opportunities for flexible sensors in medical devices, soft robotics and more. This may now change, as a group of researchers from Bar-Ilan University and Ben Gurion University has reported a giant leap of more than an order of magnitude improvement in the sensitivity of flexible magneto-resistive sensors.

Credit: Bar-Ilan University

The sensors, elliptical in shape and grown on a polyimide tape, can detect low-frequency magnetic fields smaller than 200 pico-Tesla, which is more than 200,000 times smaller than the earth's magnetic field. *"These values are not only the best among all types of flexible magnetic sensors reported to date, but they also surpass those of many rigid counterparts,"* says Prof. Lior Klein, of the Department of Physics at Bar-Ilan University, who led the research with Dr. Asaf Grosz from Ben Gurion University. *"The unprecedented sensitivity, accompanied by simple design, low cost and remarkable flexibility, make these sensors particularly attractive for being integrated in the next generation of flexible electronic devices."*

For more information, visit the following link:
https://www.biu.ac.il/en/article/22735

Reference
Bar-Ilan University. (Jul 19, 2023). A new milestone for flexible magnetic sensors. Recovered Jul 19, 2023, Bar-Ilan University:
https://www.biu.ac.il/en/article/22735

Information source: (Bar-Ilan University, 2023)

II. PATENTS

2.1.   Methods for planning garbage cleaning route in smart cities and Internet of Things systems thereof

The embodiments of the present disclosure provide a method for planning a garbage cleaning route in a smart city and an Internet of Things (IoT) system. The method is implemented by the Internet of Things system for planning a garbage cleaning route in a smart city. The IoT system includes a user platform, a service platform, a management platform, a sensor network platform and an object platform.
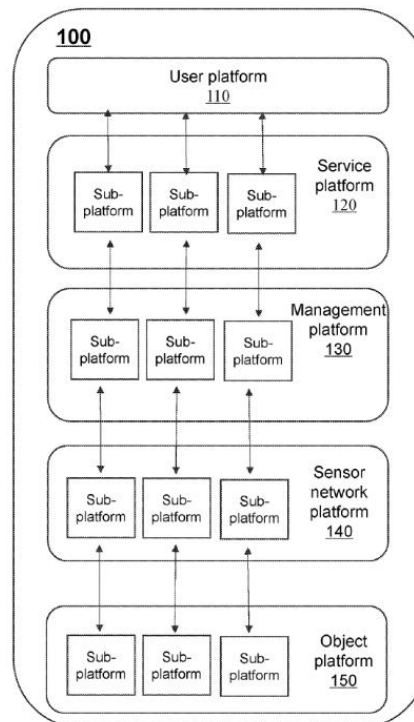
Shows an exemplary system for implementing a method for using Artificial Intelligence and Machine Learning techniques to optimize real estate usage and space planning.
Credit: Shao, Z. et al., WIPO IP Portal

The method is performed by the management platform. The method includes obtaining monitoring information on at least one road in a road network area, and recognizing a garbage accumulation situation on the at least one road; determining at least one target garbage cleaning point based on the garbage accumulation situation; and determining a garbage cleaning route based on the at least one target garbage cleaning point.

For more information, visit the following link:
https://patentscope.wipo.int/search/es/detail.jsf?docId=US401608099&_cid=P20-LK8W5A-14809-1

Reference
Shao, Z. et al. (Jul 13, 2023). Methods for planning garbage cleaning route in smart cities and Internet of Things systems thereof. Recovered Jul 13, 2023, WIPO IP Portal:
https://patentscope.wipo.int/search/es/detail.jsf?docId=US401608099&_cid=P20-LK8W5A-14809-1

Information source: (WIPO IP Portal, 2023)

2.2.   3D semiconductor device and structure with oxide bonding

A semiconductor device, the device including: a first silicon layer including first single crystal silicon; an isolation layer disposed over the first silicon layer.

Are drawing illustrations of techniques to refresh floating body DRAM cells.
Credit: Or-Bach, Z., WIPO IP Portal

A first metal layer disposed over the isolation layer; a second metal layer disposed over the first metal layer; a first level including a plurality of transistors, the first level disposed over the second metal layer, where the isolation layer includes an oxide to oxide bond surface, where the plurality of transistors include a second single crystal silicon region; and a third metal layer disposed over the first level, where a typical first thickness of the third metal layer is at least 50% greater than a typical second thickness of the second metal layer.

For more information, visit the following link:
https://patentscope.wipo.int/search/es/detail.jsf?docId=US401610595&_cid=P20-LK8R1P-53417-1

Reference
Or-Bach, Z. (Jul 13, 2023). Biohazard decision support system and method. Recovered Jul 13, 2023, WIPO IP Portal:
https://patentscope.wipo.int/search/es/detail.jsf?docId=US401610595&_cid=P20-LK8R1P-53417-1

Information source: (WIPO IP Portal, 2023)

2.3. Methods and Internet of Things systems for determining gas leakages based on smart gas

The embodiments of the present disclosure provide methods and Internet of Thing systems for determining a gas leakage based on smart gas.
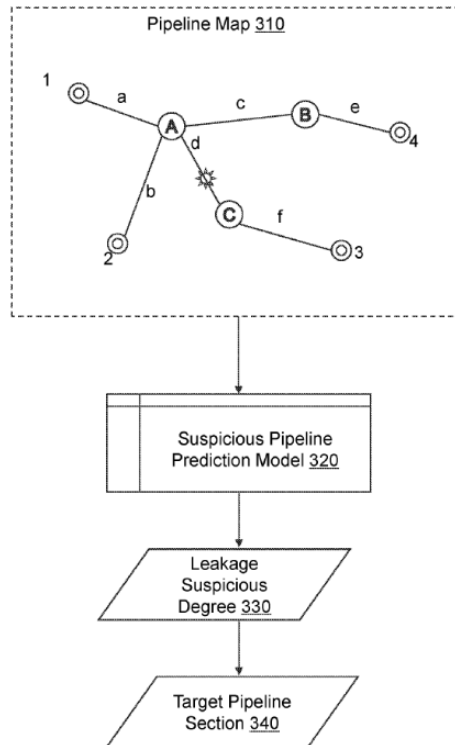
Is a schematic diagram illustrating an exemplary suspicious pipeline prediction model according to some embodiments of the present disclosure.
Credit: Shao, Z. et al., WIPO IP Portal

The method may be implemented by a processor of a smart gas safety management platform based on an Internet of Things system for determining a gas leakage, comprising: obtaining first pipeline data located at a plurality of points of a gas pipeline network; determining a target pipeline section based on the first pipeline data; obtaining second pipeline data at both ends of the target pipeline section; determining a location of a gas leakage of the target pipeline section based on the second pipeline data; and feeding the location of the gas leakage back to a terminal of a gas management user.

For more information, visit the following link:
https://patentscope.wipo.int/search/es/detail.jsf?docId=US401608180&_cid=P20-LK8W5A-14809-1

Reference
Shao, Z. et al. (Jul 13, 2023). Methods and Internet of Things systems for determining gas leakages based on smart gas. Recovered Jul 13, 2023, WIPO IP Portal:
https://patentscope.wipo.int/search/es/detail.jsf?docId=US401608180&_cid=P20-LK8W5A-14809-1

Information source: (WIPO IP Portal, 2023)

2.4.   Method for interconnecting data lake and relational database

The present disclosure provides a method for interconnecting a data lake and a relational database, including the following steps: S1: adding a data source class of a relational database to a data lake; S2: matching and using, by the data lake, a data source class of the relational database; and S3: determining and loading a corresponding driver according to the data source class, so as to connect the corresponding relational database.
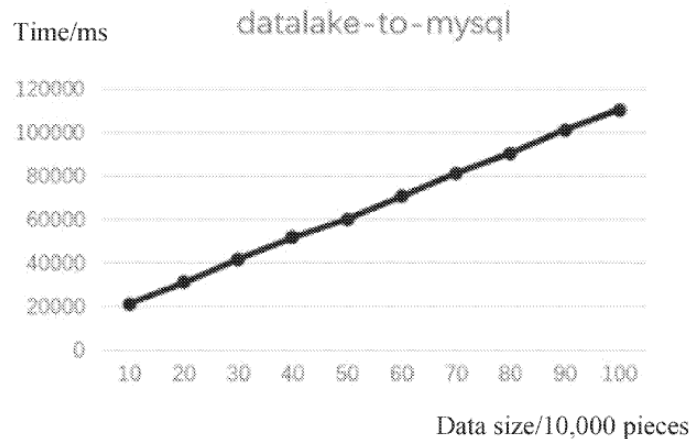
Illustrates experimental time results of data from a data lake to a relational database based on a method for interconnecting a data lake and a relational database in the present disclosure.
Credit: Liu, H. et al., WIPO IP Portal

By cascading a data source registering configuration file, a relational database configuration file and a driver package catalog in a parameter passing method, when the data lake is started, a specific database to be used is designated unnecessarily, but a corresponding database is used directly. The configuration file is also traversed unnecessarily, but the user acquires configuration information as required in the parameter passing method.

For more information, visit the following link:
https://patentscope.wipo.int/search/es/detail.jsf?docId=US401609166&_cid=P20-LK8VVU-12206-1

Reference
Liu, H. et al. (Jul 13, 2023). Method for interconnecting data lake and relational database. Recovered Jul 13, 2023, WIPO IP Portal:
https://patentscope.wipo.int/search/es/detail.jsf?docId=US401609166&_cid=P20-LK8VVU-12206-1

Information source: (WIPO IP Portal, 2023)

2.5.   Methods for setting time of traffic lights in smart city and Internet of Things systems thereof

The embodiment of the present disclosure provides a method for setting time of traffic lights in a smart city and an Internet of Things system. The method is implemented by an Internet of Things system for setting time of traffic lights in a smart city, which includes a user platform, a service platform, a management platform, a sensor network platform, and an object platform.
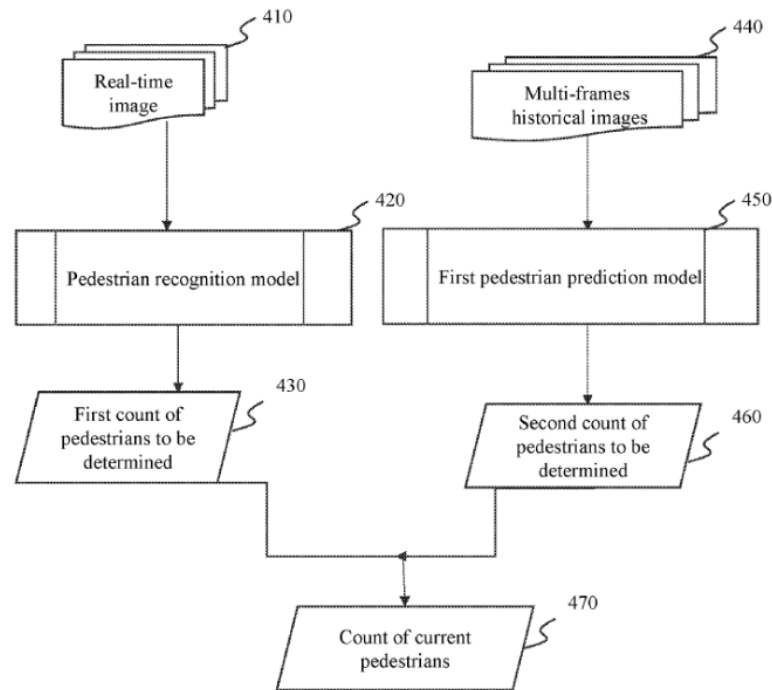
Is a schematic diagram illustrating an exemplary process for determining the count of current pedestrians through a pedestrian recognition model and a first pedestrian prediction model according to some embodiments of the present disclosure.
Credit: Shao, Z. et al., WIPO IP Portal

The method includes: obtaining pedestrian information and intersection information of a target intersection, and the target intersection being an intersection provided with the traffic lights; determining, based on the pedestrian information and the intersection information, the scheme for setting time of the traffic lights at the target intersection; and sending a control instruction corresponding to the scheme for setting the time to the object platform, and in response to the received control instruction, controlling lighting duration of the traffic lights by the object platform.

For more information, visit the following link:
https://patentscope.wipo.int/search/es/detail.jsf?docId=US401609984&_cid=P20-LK8W5A-14809-1

Reference
Shao, Z. et al. (Jul 13, 2023). Methods for setting time of traffic lights in smart city and Internet of Things systems thereof. Recovered Jul 13, 2023, WIPO IP Portal:
https://patentscope.wipo.int/search/es/detail.jsf?docId=US401609984&_cid=P20-LK8W5A-14809-1

Information source: (WIPO IP Portal, 2023)

2.6. Methods and systems for interactive gaming platform scene generation utilizing captured visual data and artificial intelligence-generated environment

Methods and systems are provided for interactive gaming platform scene generation utilizing captured visual data and artificial intelligence-generated environment, with the gaming platform including at least a user device that has or is coupled to a display, with the gaming platform configured to obtain recorded footage associated with an environment pertinent to a game playable via the user device.
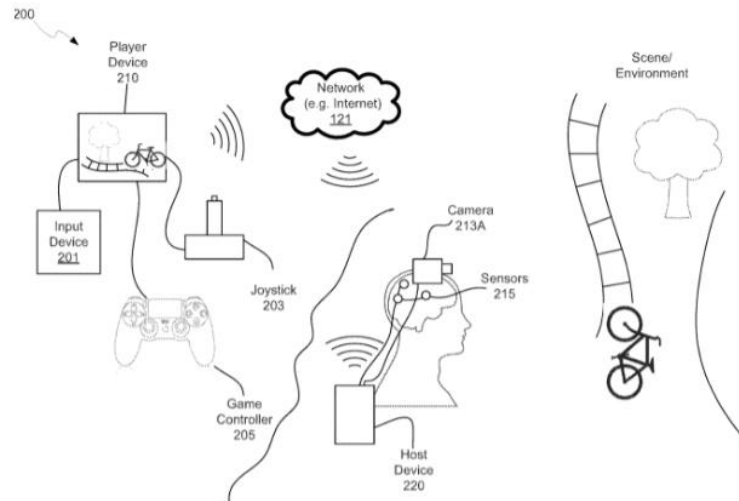
Illustrates an interactive gaming platform, in accordance with an example embodiment of the disclosure.
Credit: Callahan, M., Espacenet Patent Search

To generate, based on the recorded footage, one or more video frames for use during playing of the game via the user device, and to display the one or more video frames via the display during the playing of the game via the user device. The recorded footage may be processed using artificial intelligence, and the one or more video frames may be generated using the artificial intelligence and based on the processing of the recorded footage.

For more information, visit the following link:
https://worldwide.espacenet.com/patent/search/family/087069980/publication/US2023218984A1?q=artificial%20intelligence

Reference
Callahan, M. (Jul 13, 2023). Methods and systems for interactive gaming platform scene generation utilizing captured visual data and artificial intelligence-generated environment. Recovered Jul 13, 2023, Espacenet Patent Search:
https://worldwide.espacenet.com/patent/search/family/087069980/publication/US2023218984A1?q=artificial%20intelligence

Information source: (Espacenet Patent Search, 2023)

2.7.   Predicting a reroute for a planned flight of an aircraft

A method is provided for predicting a reroute for a planned flight of an aircraft. The method includes building a Machine Learning model to predict a reroute on a future date of a planned flight of an aircraft.
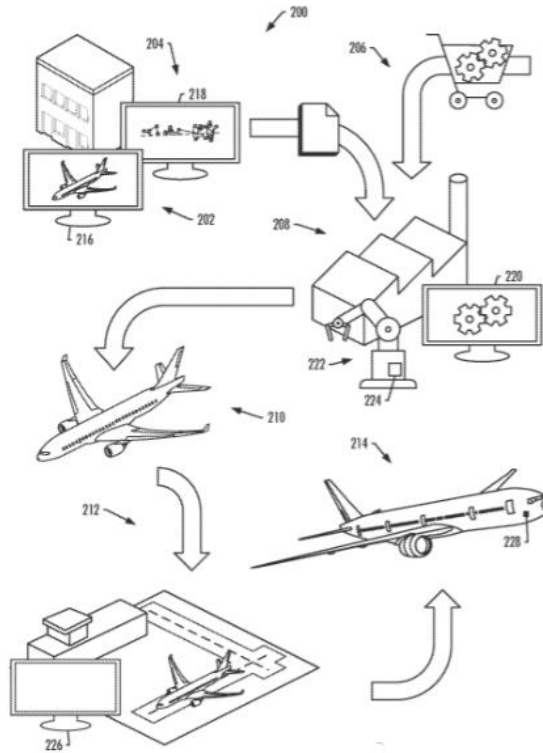
Illustrates an aircraft manufacturing and service method, according to some example implementations; Credit: Ayhan, S.; de Oliveira, I.; Neto, E.; Alvarez, P. & Biglin, M., Espacenet Patent Search

The Machine Learning model is built in a batch process that includes accessing reroute data and weather data, and performing a data wrangling of the reroute data and the weather data to produce a collection of data keyed by date. Candidate Machine Learning models are built using a training set produced from the collection of data. The candidate Machine Learning models are evaluated, and the Machine Learning model is selected from the candidate Machine Learning models based on the evaluation. And the Machine Learning model is output for deployment to classify the future date as having a reroute advisory issued, and predict a reroute on the future date.

For more information, visit the following link:
https://worldwide.espacenet.com/patent/search/family/087069928/publication/US2023222926A1?q=machine%20learning

Reference
Ayhan, S.; de Oliveira, I.; Neto, E.; Alvarez, P. & Biglin, M. (Jul 13, 2023). Predicting a reroute for a planned flight of an aircraft. Recovered Jul 13, 2023, Espacenet Patent Search:
https://worldwide.espacenet.com/patent/search/family/087069928/publication/US2023222926A1?q=machine%20learning

Information source: (Espacenet Patent Search, 2023)

2.8.   Portable blockchain mining systems and methods of use

Portable Blockchain mining means is herein discussed. A Blockchain mining system has a portable housing formed of panels form an enclosure; an air inlet defined in an inlet panel of the panels; an air outlet defined in an outlet panel of the panels; an internal frame within the portable housing defining a cooling air passageway that includes: a labyrinthine inlet conduit to the air inlet; a Blockchain mining processor mounting zone that is connected to the labyrinthine inlet conduit; and a labyrinthine outlet conduit to the Blockchain mining processor mounting zone and the air outlet.
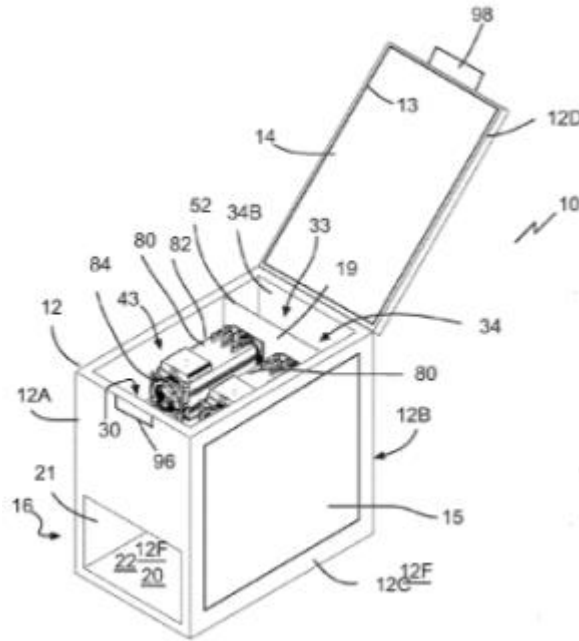
Is a perspective view of a portable Blockchain mining system, with a top lid open.
Credit: Barbour, S. & Rowan, B., Espacenet Patent Search

Methods include operating a Blockchain mining processor of a Blockchain mining system to process Blockchain transactions, while a cooling fan moves cooling air through a labyrinthine inlet conduit, across the Blockchain mining processor, and through a labyrinthine outlet conduit to maintain the plurality of Blockchain mining processors within a respective operating range of temperature.

For more information, visit the following link:
https://worldwide.espacenet.com/patent/search/family/087072780/publication/WO2023130175A1?q=Blockchain

Reference
Barbour, S. & Rowan, B. (Jul 13, 2023). Portable blockchain mining systems and methods of use. Recovered Jul 13, 2023, Espacenet Patent Search:
https://worldwide.espacenet.com/patent/search/family/087072780/publication/WO2023130175A1?q=Blockchain

Information source: (Espacenet Patent Search, 2023)

2.9.   Method and system for providing secure pairing across devices in an internet of thing (IoT) environment

A method for providing secure pairing across devices in an Internet of Thing (IoT) environment, includes identifying presence information of one or more second IoT devices in a vicinity of a first IoT device and positional information of the one or more second IoT devices relative to the first IoT device.
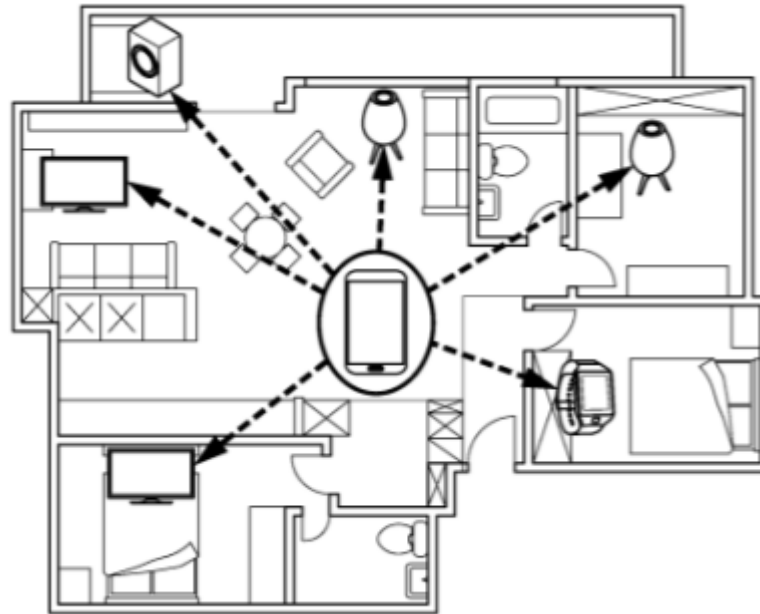
Illustrates an exemplary scenario for monitoring one or more IoT devices, according to an embodiment of the present disclosure.
Credit: Utkarsh, U. et al., Espacenet Patent Search

Identifying transaction context information for one or more pairing transactions between the first IoT device and the one or more second IoT devices, generating a confidence zone based on at least one of the presence information, the positional information or the transaction context information, determining a pairing action between a target IoT device and the first IoT device based on the confidence zone and information for the target IoT device, and executing at least one action to establish or deny a secure paring between the target IoT device and the first IoT device based on the pairing action.

For more information, visit the following link:
https://worldwide.espacenet.com/patent/search/family/087069172/publication/US2023224371A1?q=IoT

Reference
Utkarsh, U. et al. (Jul 13, 2023). Method and system for providing secure pairing across devices in an internet of thing (IoT) environment. Recovered Jul 13, 2023, Espacenet Patent Search:
https://worldwide.espacenet.com/patent/search/family/087069172/publication/US2023224371A1?q=IoT

Information source: (Espacenet Patent Search, 2023)

2.10.   Systems, apparatuses, and methods for endoscopy

A portable endoscopic system comprising an imaging unit for an endoscopic procedure. The imaging unit has an imaging coupler for receiving imaging information from an imaging assembly of an endoscope; a display integrated into a housing of the imaging unit; an image processing unit for processing the received imaging information into images of a time series and to displaying the image in real-time; a motion sensor configured to detect a motion of the housing; and a detection processing unit.
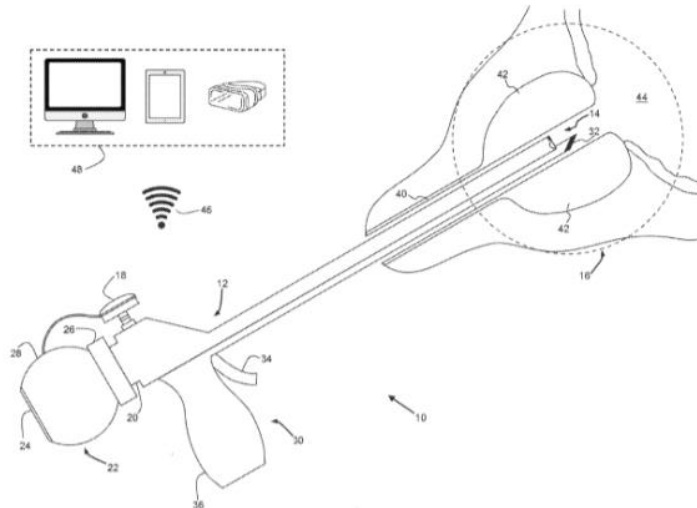
Is a structural diagram of an embodiment of a portable system.
Credit: Patel, N. et al., Espacenet Patent Search

The detection processing unit is configured to classify at least one anatomical feature in each image of the time series based on an artificial intelligence classifier; determine a confidence metric of the classification; determine a motion vector based on the detected motion; and display, concurrently with the corresponding image, the classification of the at least one anatomical feature, the determined confidence metric, and the determined motion vector.

For more information, visit the following link:
https://worldwide.espacenet.com/patent/search/family/085221850/publication/WO2023133339A1?q=artificial%20intelligence

Reference
Patel, N. et al. (Jul 13, 2023). Systems, apparatuses, and methods for endoscopy. Recovered Jul 14, 2023, Espacenet Patent Search:
https://worldwide.espacenet.com/patent/search/family/085221850/publication/WO2023133339A1?q=artificial%20intelligence

Information source: (Espacenet Patent Search, 2023)