Weekly Newsletter
TECHNOLOGY SURVEILLANCE

N° 12-2023

MARCH 24TH, 2023

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 3D-printed food technology

Cooking devices that incorporate three-dimensional (3D) printers, lasers, or other software-driven processes may soon replace conventional cooking appliances such as ovens, stovetops, and microwaves. Columbia mechanical engineers are working to address these challenges in Professor Hod Lipson's Creative Machines Lab. In a new Perspective article published today by NPJ Science of Food, lead author Jonathan Blutinger, a postdoctoral fellow in the lab, explores these questions and more, discussing with Professor Christen Cooper, Pace University Nutrition and Dietetics, the benefits and drawbacks of 3D-printed food technology, how 3D-printed food compares to the *"normal"* food we eat, and the future landscape of our kitchens.

3D-printing system that constructs a dish comprising seven ingredients, cooked in situ using a laser.
Credit: Jonathan Blutinger, Columbia University in the City of New York

Blutinger's team broke away from this limitation by printing a dish comprising seven ingredients, cooked in situ using a laser. For the paper, the researchers designed a 3D-printing system that constructs cheesecake from edible food inks — including peanut butter, Nutella, and strawberry jam. The authors note that precision printing of multi-layered food items could produce more customizable foods, improve food safety, and enable users to control the nutrient content of meals more easily.

For more information, visit the following link:
https://www.engineering.columbia.edu/news/honey-the-3d-print-i-mean-dessert-is-ready

Reference
Evarts, H. (March 21, 2023). Honey, the 3D print–I mean, dessert–is ready! Recovered March 21, 2023, Columbia University in the City of New York:

https://health.ucdavis.edu/news/headlines/uc-davis-study-uncovers-age-related-brain-differences-in-autistic-individuals/2023/03

Information source: (Columbia University in the City of New York, 2023)

1.2 ¿Was this written by a human or Artificial Intelligence?

New research shows we can only accurately identify Artificial Intelligence (AI) writers about 50% of the time. Scholars explain why (and suggest solutions). AI-generated text is increasingly making its way into our daily lives. Auto-complete in emails and ChatGPT-generated content are becoming mainstream, leaving humans vulnerable to deception and misinformation. Even in contexts where we expect to be conversing with another human - like online dating - the use of AI-generated text is growing. A survey from McAfee indicates that 31% of adults plan to or are already using AI in their dating profiles.

What are the implications and risks of using AI-generated text, especially in online dating, hospitality, and professional situations, areas where the way we represent ourselves is critically important to how we are perceived?. Jeff Hancock, professor of communication at Stanford School of Humanities and Sciences, founding director of Stanford's Social Media Lab, and a Stanford Institute for Human-Centered AI faculty member. Hancock and his collaborators set out to explore this problem space by looking at how successful we are at differentiating between human and AI-generated text on OKCupid, AirBNB, and Guru.com. What Hancock and his team learned was eye-opening: participants in the study could only distinguish between human or AI text with 50-52% accuracy, about the same random chance as a coin flip.

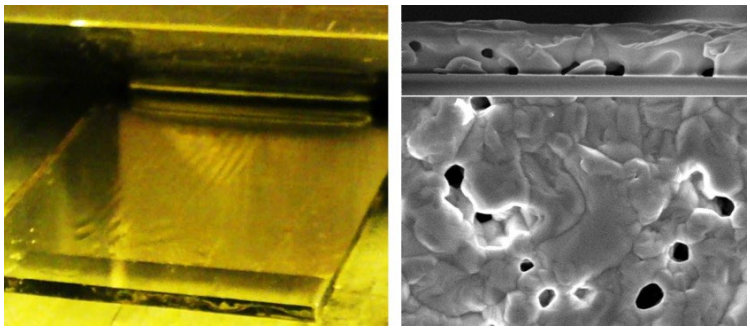
For more information, visit the following link:
https://hai.stanford.edu/news/was-written-human-or-ai-tsu

Reference
Kannan, P. (March 16, 2023). ¿Was this written by a human or Artificial Intelligence? Recovered March 17, 2023, Stanford University Human-Centered Artificial Intelligence: https://hai.stanford.edu/news/was-written-human-or-ai-tsu

Information source: (Stanford University Human-Centered Artificial Intelligence, 2023)

1.3 Perovskite solar cells from the slot die coater

Metal halide perovskites are considered to be a particularly low-cost and promising class of materials for next-generation solar modules. Perovskite solar cells can be produced with coating processes using liquid inks made from precursor materials and various solvents. After coating, the solvents evaporate and the perovskites crystallise to form a more or less homogeneous layer. Prof. Dr. Eva Unger's team at Helmholtz-Zentrum Berlin has extensive expertise in solution-based processing methods and is investigating options for upscaling. *"Perovskite photovoltaics is the best solution-processable PV technology available,"* says Eva Unger, *"but we are only just beginning to understand how the complex interaction of the solvent components affects the quality of the perovskite layers."*



The wet coating with a standard ink composition: the wet perovskite thin films (left) has a rib-like structure. The corresponding SEM image (right) of the annealed perovskite film shows inhomogeneities.
Credit: Helmholtz-Zentrum Berlin für Materialien und Energie

Dr Carolin Ulbrich's team tested the optimised solar cells at PVcomB's outdoor test facility for a whole year: In the process, the efficiency remained almost stable in winter and spring, and only dropped in the warmer summer months. *"These tests of larger modules under real conditions give us valuable information on degradation mechanisms to then further improve the long-term stability of halide perovskite photovoltaics,"* says Eva Unger.

For more information, visit the following link:
https://www.helmholtz-berlin.de/pubbin/news_seite?nid=24747&sprache=en&seitenid=1

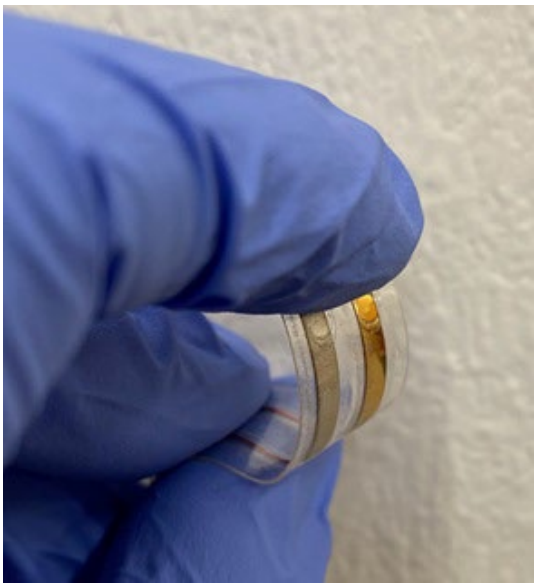
Reference

Helmholtz-Zentrum Berlin für Materialien und Energie (March 16, 2023). Perovskite solar cells from the slot die coater - a step towards industrial production. Recovered March 17, 2023, Helmholtz-Zentrum Berlin für Materialien und Energie: https://www.helmholtz-berlin.de/pubbin/news_seite?nid=24747&sprache=en&seitenid=1

Information source: (Helmholtz-Zentrum Berlin für Materialien und Energie, 2023)

1.4 Tiny pH sensor could be next-gen freshness predictor for packaged food

A graduate student at SMU (Southern Methodist University) has developed a miniature pH sensor that can tell when food has spoiled in real time. The flexible pH sensor is only 2 millimeters in length and 10 millimeters wide, making it possible to incorporate the sensor into current food packaging methods, such as plastic wrapping. Industries typically use much bulkier meters – roughly 1 inch long by 5 inches tall – to measure pH levels, so they are not suitable to be included in every package of food to monitor its freshness in real time.



Miniature pH sensor that can tell when food has spoiled in real time. Credit: Southern Methodist University

"The pH sensors we developed work like a small wireless radio-frequency identification device – similar to what you find inside your luggage tag after it has been checked at airports or inside your SMU IDs. Every time a food package with our device passes a checkpoint, such as shipping logistics centers, harbors, gates or supermarkets' entrances, they could get scanned and the data could be sent back to a server tracking their pH levels," said Khengdauliu Chawang, PhD student at SMU's Lyle School of Engineering and lead creator of the device. *"Such configuration would allow continuous pH monitoring and accurately detect freshness limits along the entire journey -- from farms to consumers' houses."*

For more information, visit the following link:
https://www.smu.edu/News/Research/Food-spoilage-sensor

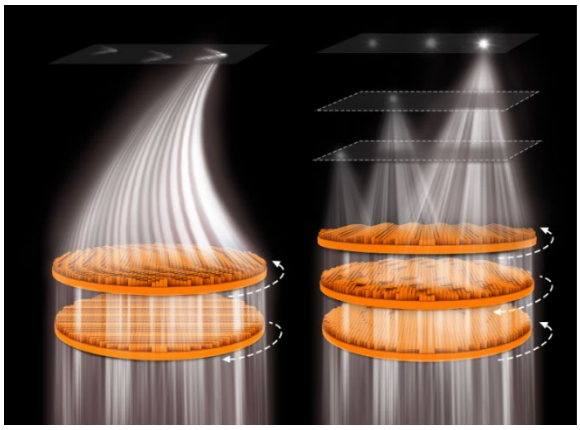
Reference

Southern Methodist University (March 16, 2023). Skeptical about the "use by" date on your groceries? Recovered March 17, 2023, Southern Methodist University: https://www.smu.edu/News/Research/Food-spoilage-sensor

Information source: (Southern Methodist University, 2023)

1.5 Scientists develop energy-saving, tunable meta-devices for high-precision, secure 6G communications

The future of wireless communications is set to take a giant leap with the advent of sixth-generation (6G) wireless technology. A research team at City University of Hong Kong (CityU) invented a groundbreaking tunable terahertz (THz) meta-device that can control the radiation direction and coverage area of THz beams. By rotating its metasurface, the device can promptly direct the 6G signal only to a designated recipient, minimizing power leakage and enhancing privacy. It is expected to provide a highly adjustable, directional and secure means for future 6G communications systems.



Schematic of the varifocal meta-devices: doublet (left) and triplet (right) meta-devices. Credit: Zhang, J. et al., City University of Hong Kong

With the joint effort of two research teams at CityU, led by Professor Tsai Din-Ping, Chair Professor in the Department of Electrical Engineering, and Professor Chan Chi-hou, Acting Provost and Director of the State Key Laboratory of Terahertz and Millimeter Waves (SKLTMW), a novel, tunable meta-devices that can fully control the THz beam's propagation direction and coverage area was recently developed to overcome these challenges. *"The advent of a tunable THz meta-device presents exciting prospects for 6G communications systems,"* said Professor Tsai, who is an expert in the field of metasurfaces and photonics. *"Our meta-device allows for signal delivery to specific users or detectors and has the flexibility to adjust the propagating direction, as needed."*

For more information, visit the following link:
https://www.cityu.edu.hk/research/stories/2023/03/16/cityu-scientists-develop-energy-saving-tunable-meta-devices-high-precision-secure-6g-communications

Reference

City University of Hong Kong (March 16, 2023). CityU scientists develop energy-saving, tunable meta-devices for high-precision, secure 6G communications. Recovered March 17, 2023, City University of Hong Kong: https://www.cityu.edu.hk/research/stories/2023/03/16/cityu-scientists-develop-energy-saving-tunable-meta-devices-high-precision-secure-6g-communications

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

1.6 3D-printed revolving devices

A new system enables makers to incorporate sensors into gears and other rotational mechanisms with just one pass in a 3D printer. Massachusetts Institute of Technology (MIT) engineers have now developed a way to easily integrate sensors into these types of mechanisms, with 3D printing. Even though advances in 3D printing enable rapid fabrication of rotational mechanisms, integrating sensors into the designs is still notoriously difficult. Due to the complexity of the rotating parts, sensors are typically embedded manually, after the device has already been produced.

However, manually integrating sensors is no easy task. Embed them inside a device and wires might get tangled in the rotating parts or obstruct their rotations, but mounting external sensors would increase the size of a mechanism and potentially limit its motion. Instead, the new system the MIT researchers developed enables a maker to 3D print sensors directly into a mechanism's moving parts using conductive 3D printing filament. This gives devices the ability to sense their angular position, rotation speed, and direction of rotation. With their system, called MechSense, a maker can manufacture rotational mechanisms with integrated sensors in just one pass using a multi-material 3D printer. These types of printers utilize multiple materials at the same time to fabricate a device. To streamline the fabrication process, the researchers built a plugin for the computer-aided design software SolidWorks that automatically integrates sensors into a model of the mechanism, which could then be sent directly to the 3D printer for fabrication.

For more information, visit the following link:
https://news.mit.edu/2023/3d-printing-revolving-devices-sensors-0316

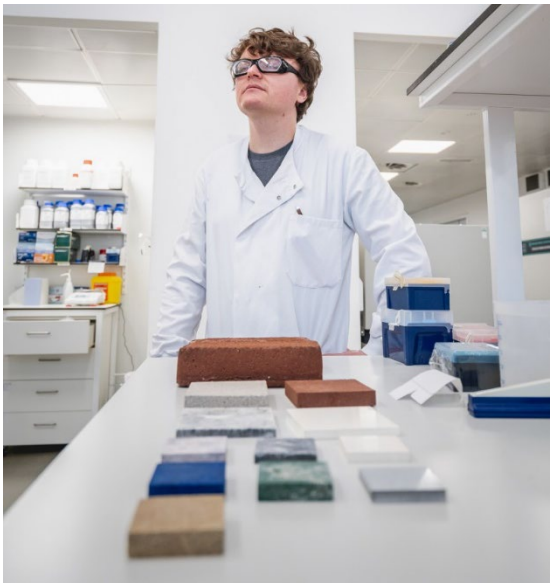
Reference

Zewe, A. (March 16, 2023). 3D-printed revolving devices can sense how they are moving. Recovered March 17, 2023, Massachusetts Institute of Technology: https://news.mit.edu/2023/3d-printing-revolving-devices-sensors-0316

Information source: (Massachusetts Institute of Technology, 2023)

1.7 Scientists develop a *"cosmic concrete"* that is twice as strong as regular concrete

University of Manchester scientists have created a new material, dubbed *"StarCrete"* which is made from extra-terrestrial dust, potato starch, and a pinch of salt and could be used to build homes on Mars. Building infrastructure in space is currently prohibitively expensive and difficult to achieve. Future space construction will need to rely on simple materials that are easily available to astronauts, StarCrete offers one possible solution. The scientists behind the invention used simulated Martian soil mixed with potato starch and a pinch of salt to create the material that is twice as strong as ordinary concrete and is perfectly suited for construction work in extra-terrestrial environments.



Credit: The University of Manchester

In an article published in the journal Open Engineering, the research team demonstrated that ordinary potato starch can act as a binder when mixed with simulated Mars dust to produce a concrete-like material. When tested, StarCrete had a compressive strength of 72 Megapascals (MPa), which is over twice as strong as the 32 MPa seen in ordinary concrete. Starcrete made from moon dust was even stronger at over 91 MPa.

For more information, visit the following link:
https://www.manchester.ac.uk/discover/news/scientists-develop-a-cosmic-concrete-that-is-twice-as-strong-as-regular-concrete/

Reference

The University of Manchester (March 16, 2023). Scientists develop a 'cosmic concrete' that is twice as strong as regular concrete. Recovered March 17, 2023, The University of Manchester: https://www.manchester.ac.uk/discover/news/scientists-develop-a-cosmic-concrete-that-is-twice-as-strong-as-regular-concrete/

Information source: (The University of Manchester, 2023)

1.8 New study identifies how Artificial Intelligence fails to reproduce human vision

Unsurprisingly, computers may be able to do this faster, but are they as accurate as humans in the real world? Not always, and that's a problem, according to a study led by Western neuroimaging expert Marieke Mur. Computers can be taught to process incoming data, like observing faces and cars, using Artificial Intelligence known as deep neural networks or deep learning. This type of Machine Learning process uses interconnected nodes or neurons in a layered structure that resembles the human brain. The key word is 'resembles' as computers, despite the power and promise of deep learning, have yet to master human calculations and crucially, the communication and connection found between the body and the brain, specifically when it comes to visual recognition.

Selection of object images shown to human observers and deep neural networks. Credit: Marieke Mur, Western University

The team used a non-invasive medical test called magnetoencephalography (MEG) that measures the magnetic fields produced by a brain's electrical currents. Using MEG data acquired from human observers during object viewing, Mur and her international collaborators detected one key point of failure. They found that readily nameable parts of objects, such as eye, wheel, and face, can account for variance in human neural dynamics over and above what deep learning can deliver.

For more information, visit the following link:
https://news.westernu.ca/2023/03/deep-learning-human-vision/

Reference

Renaud, J. (March 16, 2023). New study identifies how AI fails to reproduce human vision. Recovered March 20, 2023, Western University: https://news.westernu.ca/2023/03/deep-learning-human-vision/

Information source: (Western University, 2023)

1.9 Biomarkers promise for identifying early risk of pancreatic cancer

A research team at Duke Health has identified a set of biomarkers that could help distinguish whether cysts on the pancreas are likely to develop into cancer or remain benign. If successful, the biomarker-based approach could address the biggest impediment to decreasing the chance of developing pancreatic cancer, which is on the rise and is notorious for silently growing before being discovered, often incidentally, during abdominal scans.

Credit: Sara Avery, Duke University Health System

"Even when pancreas cancer is detected at its earliest stage, it almost always has shed cells throughout the body, and the cancer returns," said senior author Peter Allen, M.D., chief of the Division of Surgical Oncology at in the Department of Surgery at Duke University School of Medicine. *"That's why we shifted our focus to these precancerous cysts, known as intraductal papillary mucinous neoplasms, or IPMNs,"* Allen said. *"Most IPMNs will never progress to pancreas cancer, but by distinguishing which ones will progress, we are creating an opportunity to prevent an incurable disease from developing."* Allen and colleagues used a sophisticated molecular biology tool called digital spatial RNA (Ribonucleic Acid) profiling to home in on specific areas of the cyst with high- and low-grade areas of abnormal cell growth. The team also identified markers for discriminating between the two leading variants of IPMN and found distinct markers for defining a third common variant that generally results in less aggressive disease.

For more information, visit the following link:
https://corporate.dukehealth.org/news/biomarkers-show-promise-identifying-early-risk-pancreatic-cancer

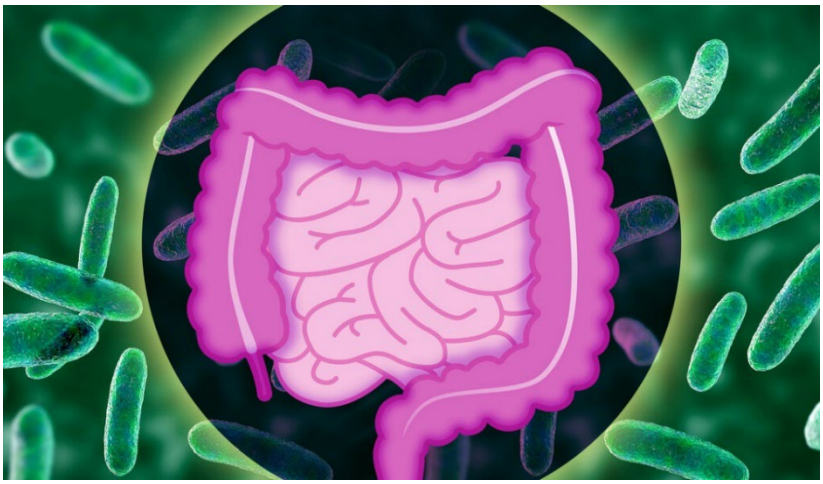
Reference

Avery, S. (March 16, 2023). Biomarkers show promise for identifying early risk of pancreatic cancer. Recovered March 20, 2023, Duke University Health System: https://corporate.dukehealth.org/news/biomarkers-show-promise-identifying-early-risk-pancreatic-cancer

Information source: (Duke University Health System, 2023)

1.10 Boosting survival of a beneficial bacterium in the human gut

Yale researchers uncovered a novel mechanism by which *"good"* bacteria colonize the gut. The finding could help spur the development of new probiotic therapies. The microbes that inhabit the gut are critical for human health, and understanding the factors that encourage the growth of beneficial bacterial species — known as *"good"* bacteria — in the gut may enable medical interventions that promote gut and overall human health. In a new study, Yale researchers have uncovered a novel mechanism by which these bacteria colonize the gut. Specifically, the Yale team discovered that one of the most abundant beneficial species found in the human gut showed an increase in colonization potential when experiencing carbon limitation — a finding that could yield novel clinical interventions to support a healthy gut.



Credit: stock.adobe.com, Yale University

The Yale team, based in the lab of geneticist Eduardo Groisman, the Waldemar Von Zedtwitz Professor of Microbial Pathogenesis, found that the beneficial gut bacterium Bacteroides thetaiotaomicron responded to starvation for carbon — a main building block for all cells — by sequestering a portion of the molecules for an essential transcription factor within a membrane-less compartment. The team established that sequestration of the transcription factor increased its activity, which modified the expression of hundreds of bacterial genes, including several that promote gut colonization and control central metabolic pathways in the bacterium. These findings reveal that *"good"* bacteria use sequestration of molecules into membrane-less compartments as a vital strategy to colonize the mammalian gut.

For more information, visit the following link:
https://news.yale.edu/2023/03/17/boosting-survival-beneficial-bacterium-human-gut

Reference

Waldman, L. (March 17, 2023). Boosting survival of a beneficial bacterium in the human gut. Recovered March 20, 2023, Yale University: https://news.yale.edu/2023/03/17/boosting-survival-beneficial-bacterium-human-gut

Information source: (Yale University, 2023)

1.11 Artificial Intelligence systems now can determine how to detect breast cancer

While there are currently a dozen approved Artificial Intelligence (AI) systems for breast cancer screening, it has been difficult to evaluate their clinical performance objectively. Now, however, there is a Swedish validation platform ready to compare how well AI systems detect signs of breast cancer – and its development has been led by researchers at Karolinska Institutet. *"It is important to evaluate the diagnostic accuracy of the AI algorithms that might be used clinically,"* says project leader Fredrik Strand, researcher at the Department of Oncology-Pathology, Karolinska Institutet, and radiologist at Karolinska University Hospital. *"Even if they meet the regulatory requirements, it doesn't mean they work in all contexts."*

Researchers at KI, together with other parties, have developed a validation platform for AI algoritms screening for breast cancer.
Credit: Claes Lundström, Karolinska Institutet

There is currently no established evaluation procedure on designated datasets to assess how accurate AI algorithms are in medical diagnostics. Manufacturers of AI systems have trained and tested their algorithms on disparate datasets, and those results are used for regulatory approval. In the platform, all algorithms process the same images and the results are compared with data on actual cancer diagnoses extracted from the National Quality Register for Breast Cancer (NKBC), revealing differences in the algorithms. Since today's AI algorithms have been trained on the specific population groups to which the developers have had access, they may contain biases that should be identified. *"The platform will be able to show an algorithm's bias, particularly when it comes to age, geographical origin and socioeconomic status of the screened individual,"* says Fredrik Strand.

For more information, visit the following link:
https://news.ki.se/now-local-hospitals-can-determine-how-ai-systems-would-detect-breast-cancer

Reference
Sternudd, K. (March 20, 2023). Now local hospitals can determine how AI systems would detect breast cancer. Recovered el March 21, 2023, Karolinska Institute:

https://news.ki.se/now-local-hospitals-can-determine-how-ai-systems-would-detect-breast-cancer

Information source: (Karolinska Institutet, 2023)

1.12 Plant, microbe matchmaking for better bioenergy crops

Oak Ridge National Laboratory researchers have identified specific proteins and amino acids that could control bioenergy plants' ability to identify beneficial microbes that can enhance plant growth and storage of carbon in soils. These proteins, called LysM receptor-like kinases, regulate signaling between plants and microbes, a process that influences biomass production, root performance and carbon storage. The study showed these kinases potentially help poplar trees differentiate between helpful and disease-causing microbes.

One of the proteins identified through a new ORNL-developed approach could be key to communications between poplar trees and beneficial microbes that can help boost poplar trees' growth, carbon storage and climate resilience.
Credit: Andy Sproles, Oak Ridge National Laboratory

With this information, scientists can better target bioengineering efforts aimed at promoting plant-microbe symbiosis to boost poplar trees' growth and sustainability in future climates. The novel method used computational structural biology in a multipronged approach that can accelerate gene function identification in a variety of plants.

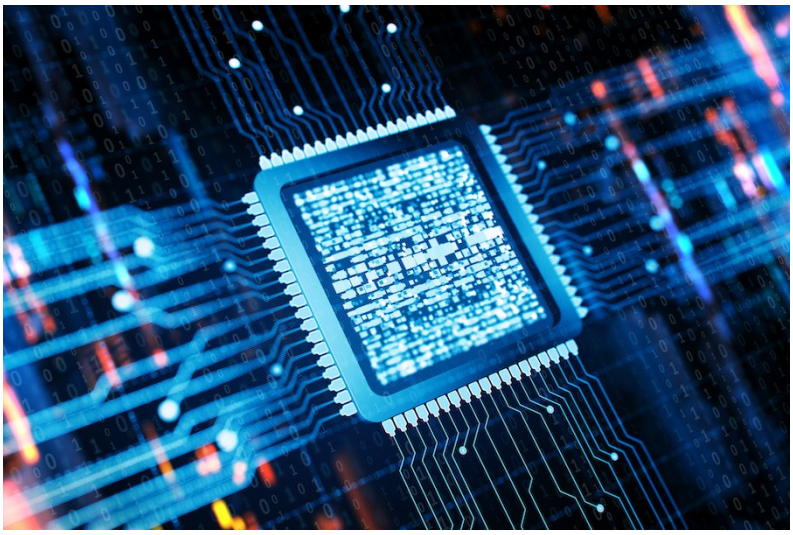
For more information, visit the following link:
https://www.ornl.gov/news/plant-microbe-matchmaking-better-bioenergy-crops

Reference
Kalluri, U.; Teixeira, E.; Demerdash, O.; Miller, J.; Kainer, D.; Sullivan, K.; Tschaplinski, T. & Jacobson, D. (March 20, 2023). Plant, microbe matchmaking for better bioenergy crops. Recovered March 20, 2023, Oak Ridge National Laboratory: https://www.ornl.gov/news/plant-microbe-matchmaking-better-bioenergy-crops?page=1

Information source: (Oak Ridge National Laboratory, 2023)

1.13 Researchers create breakthrough spintronics manufacturing process

University of Minnesota researchers, along with a team at the National Institute of Standards and Technology (NIST), developed a breakthrough process for making spintronic devices that has the potential to become the new industry standard for semiconductors chips that are essential to computers, smartphones and many other electronics. The new process will allow for faster, more efficient spintronics devices that can be scaled down smaller than ever before.



Credit: iStock, University of Minnesota

"We believe we've found a material and a device that will allow the semiconducting industry to move forward with more opportunities in spintronics that weren't there before for memory and computing applications," said Jian-Ping Wang, senior author of the paper and professor in the College of Science and Engineering. The semiconductor industry is constantly trying to develop smaller and smaller chips that can maximize energy efficiency, computing speed and data storage capacity in electronic devices. Spintronic devices, which leverage the spin of electrons rather than the electrical charge to store data, provide a promising and more efficient alternative to traditional transistor-based chips. These materials also have the potential to be non-volatile, meaning they require less power and can store memory and perform computing even after you remove their power source.

For more information, visit the following link:
https://twin-cities.umn.edu/news-events/researchers-create-breakthrough-spintronics-manufacturing-process-could-revolutionize

Reference

Erdman, S. (March 20, 2023). Researchers create breakthrough spintronics manufacturing process that could revolutionize the electronics industry. Recovered March 20, 2023, University of Minnesota: https://twin-cities.umn.edu/news-

events/researchers-create-breakthrough-spintronics-manufacturing-process-could-revolutionize

Information source: (University of Minnesota, 2023)

1.14 Mind-control robots

New technology is making mind reading possible with positive implications for the fields of healthcare, aerospace and advanced manufacturing. Researchers from the University of Technology Sydney (UTS) have developed biosensor technology that will allow you to operate devices, such as robots and machines, solely through thought-control. The advanced brain-computer interface was developed by Distinguished Professor Chin-Teng Lin and Professor Francesca Iacopi, from the UTS Faculty of Engineering and IT, in collaboration with the Australian Army and Defence Innovation Hub.

The technology was recently demonstrated by the Australian Army, where soldiers operated a Ghost Robotics quadruped robot using the brain-machine interface. Credit: Australian Army, University of Technology Sydney

"The hands-free, voice-free technology works outside laboratory settings, anytime, anywhere. It makes interfaces such as consoles, keyboards, touchscreens and hand-gesture recognition redundant," said Professor Iacopi. *"By using cutting edge graphene material, combined with silicon, we were able to overcome issues of corrosion, durability and skin contact resistance, to develop the wearable dry sensors,"* she said. The technology was recently demonstrated by the Australian Army, where soldiers operated a Ghost Robotics quadruped robot using the brain-machine interface. The device allowed hands-free command of the robotic dog with up to 94% accuracy.

For more information, visit the following link:
https://www.uts.edu.au/news/tech-design/mind-control-robots-reality

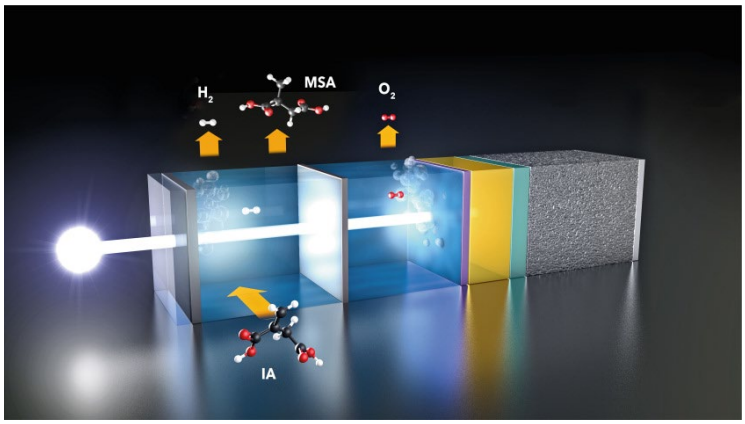
Reference

Erdman, S. (March 20, 2023). Mind-control robots a reality. Recovered March 20, 2023, University of Technology Sydney: https://www.uts.edu.au/news/tech-design/mind-control-robots-reality

Information source: (University of Technology Sydney, 2023)

1.15 Green hydrogen: ¿How photoelectrochemical water splitting may become competitive?

Sunlight can be used to produce green hydrogen directly from water in photoelectrochemical (PEC) cells. So far, systems based on this *"direct approach"* have not been energetically competitive. However, the balance changes as soon as some of the hydrogen in such PEC cells is used in-situ for a catalytic hydrogenation reaction, resulting in the co-production of chemicals used in the chemical and pharmaceutical industries. The energy payback time of photoelectrochemical *"green"* hydrogen production can be reduced dramatically, the study shows.



The photoelectrochemical cell: Sunlight generates a photovoltage in the catalyst-coated solar cell (right), which splits water molecules. Hydrogen is produced at the left electrode, oxygen at the right. A part of the H2 reacts further with itaconic acid (IA) to form valuable methyl succinic acid (MSA).
Credit: M. Künsting, Helmholtz Zentrum Berlin

Hydrogen can be produced by electrolysis of water, ideally with solar cells or wind power providing the electrical energy required. This *"green"* hydrogen is expected to play an important role in the energy system of the future. Over the past decade, solar water splitting has made considerable progress: the best electrolysers, which draw the required voltage from PV modules or wind power, already achieve efficiencies of up to 30%. This is the indirect approach.

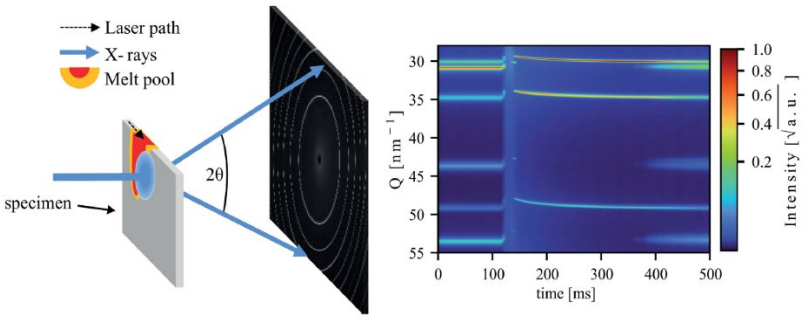
For more information, visit the following link:
https://www.helmholtz-berlin.de/pubbin/news_seite?nid=24748&sprache=en&seitenid=

Reference
Helmholtz-Zentrum Berlin für Materialien und Energie (March 20, 2023). Green hydrogen: How photoelectrochemical water splitting may become competitive. Recovered March 20, 2023, Helmholtz-Zentrum Berlin für Materialien und Energie: https://www.helmholtz-berlin.de/pubbin/news_seite?nid=24748&sprache=en&seitenid=

Information source: (Helmholtz-Zentrum Berlin für Materialien und Energie, 2023)

1.16 Researchers propel the technology toward widespread application by cracking a metal 3D-Printing

Researchers have not yet gotten the additive manufacturing, or 3D printing, of metals down to a science completely. Gaps in our understanding of what happens within metal during the process have made results inconsistent. But a new breakthrough could grant an unprecedented level of mastery over metal 3D printing. Using two different particle accelerator facilities, researchers at the National Institute of Standards and Technology (NIST), KTH Royal Institute of Technology in Sweden and other institutions have peered into the internal structure of steel as it was melted and then solidified during 3D printing. The findings, published in Acta Materialia, unlock a computational tool for 3D-printing professionals, offering them a greater ability to predict and control the characteristics of printed parts, potentially improving the technology's consistency and feasibility for large-scale manufacturing.



Researchers used high-speed X-ray diffraction to identify the crystal structures that form within steel as it is 3D-printed. The angle at which the X-rays exit the metal correspond to types of crystal structures within.
Credit: H. König et al., National Institute of Standards and Technology

A common approach for printing metal pieces involves essentially welding pools of powdered metal with lasers, layer by layer, into a desired shape. During the first steps of printing with a metal alloy, wherein the material rapidly heats up and cools off, its atoms — which can be a smattering of different elements — pack into ordered, crystalline formations. The crystals determine the properties, such as toughness and corrosion resistance, of the printed part. Different crystal structures can emerge, each with their own pros and cons.

For more information, visit the following link:
https://www.nist.gov/news-events/news/2023/03/cracking-metal-3d-printing-conundrum-researchers-propel-technology-toward

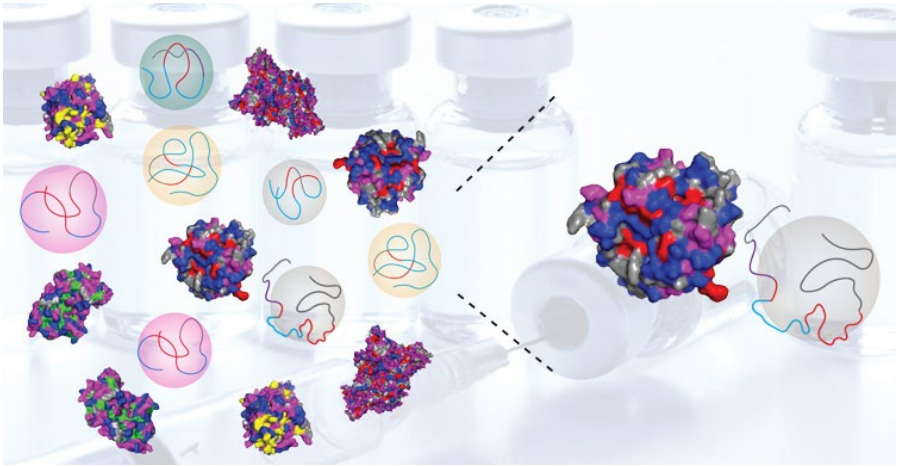
Reference
National Institute of Standards and Technology U.S. Department of Commerce (March 20, 2023). By cracking a metal 3D-printing conundrum, researchers propel the technology toward widespread application. Recovered March 21, 2023, National Institute

of Standards and Technology U.S. Department of Commerce: https://www.helmholtz-berlin.de/pubbin/news_seite?nid=24748&sprache=en&seitenid=

Information source: (National Institute of Standards and Technology, 2023)

1.17 ¿Can synthetic polymers replace the body's natural proteins?

Most life on Earth is based on polymers of 20 amino acids that have evolved into hundreds of thousands of different, highly specialized proteins. They catalyze reactions, form backbone and muscle and even generate movement. But is all that variety necessary? Could biology work just as well with fewer building blocks and simpler polymers? Ting Xu, a University of California, Berkeley, polymer scientist, thinks so. She has developed a way to mimic specific functions of natural proteins using only two, four or six different building blocks — ones currently used in plastics — and found that these alternative polymers work as well as the real protein and are a lot easier to synthesize than trying to replicate nature's design.



UC Berkeley polymer scientists are trying to create artificial fluids composed of random heteropolymers (threads inside spheres) with much less complexity, but which mimic many of the properties of the natural proteins (right), such as stabilizing fragile molecular markers. Credit: Zhiyuan Ruan and Ting Xu lab, University of California, Berkeley

As a proof of concept, she used her design method, which is based on Machine Learning or Artificial Intelligence, to synthesize polymers that mimic blood plasma. The artificial biological fluid kept natural protein biomarkers intact without refrigeration and even made the natural proteins more resistant to high temperatures — an improvement over real blood plasma. The protein substitutes, or random heteropolymers (RHP), could be a game-changer for biomedical applications, since a lot of effort today is put into tweaking natural proteins to do things they were not originally designed to do, or trying to recreate the 3D structure of natural proteins. Drug delivery of small molecules that mimic natural human proteins is one hot research field.

For more information, visit the following link:
https://news.berkeley.edu/2023/03/20/can-synthetic-polymers-replace-the-bodys-natural-proteins/

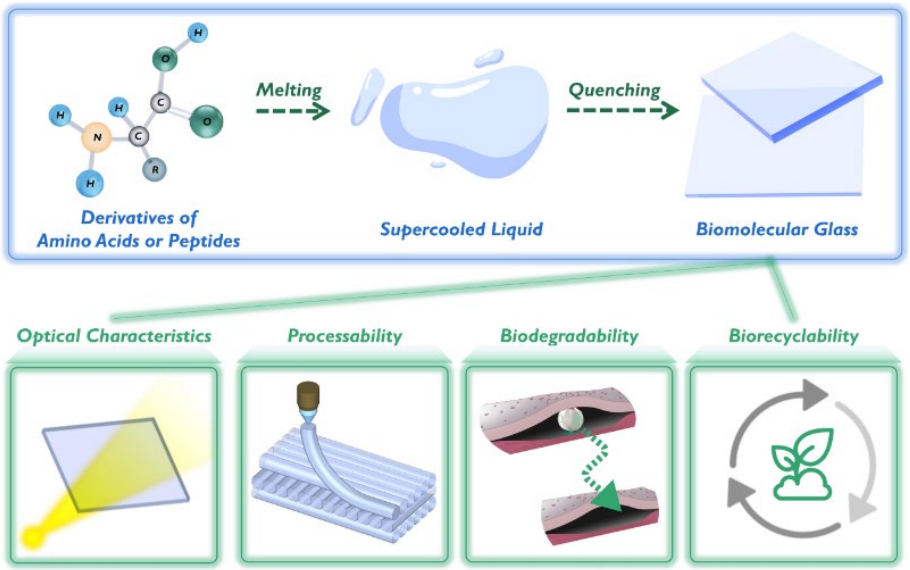
Reference

Sanders, R. (March 20, 2023). Can synthetic polymers replace the body's natural proteins? Recovered March 21, 2023, University of California, Berkeley: https://www.helmholtz-berlin.de/pubbin/news_seite?nid=24748&sprache=en&seitenid=

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

1.18 Researchers develop biodegradable, biorecyclable glass

Everyone is familiar with glass—from putting on eyeglasses, pushing open the window, standing in front of a mirror, to holding a water glass. Glass is ubiquitous in nature and essential to human life. But the widespread use of persistent, non-biodegradable glass that cannot be naturally eliminated causes long-term environmental hazards and social burdens. To solve this problem, a research group led by Prof. YAN Xuehai from the Institute of Process Engineering (IPE) of the Chinese Academy of Sciences has developed a family of eco-friendly glass of biological origin fabricated from biologically derived amino acids or peptides. The proposed glass is biodegradable and biorecyclable.



Schematic diagram of the construction of biomolecular glass and its unique properties. Credit: XING Ruirui, Chinese Academy of Science

In this study, the researchers used chemically modified amino acids and peptides to fabricate biomolecular glass with biodegradability and biorecyclability features through the classic *"heating-quenching"* procedure. The researchers tracked the glass-forming ability, glass-transition-related kinetic and thermodynamic parameters of the material, as well as glass performance in vitro and in vivo.

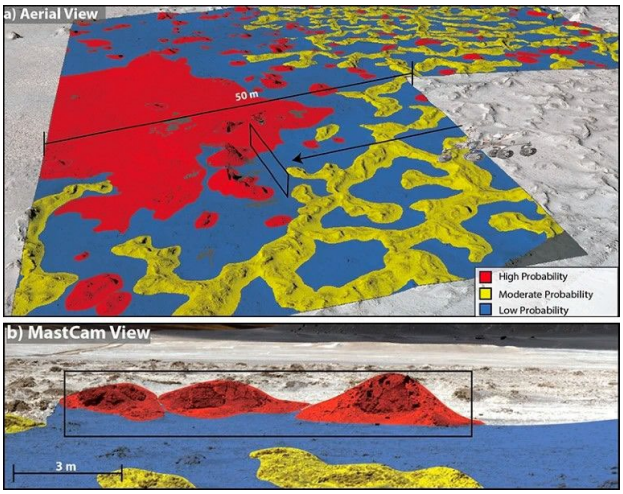
For more information, visit the following link:
https://english.cas.cn/newsroom/research_news/chem/202303/t20230317_328392.shtml

Reference
Yuan, L. (March 20, 2023). Researchers Develop Biodegradable, Biorecyclable Glass. Recovered March 21, 2023, Chinese Academy of Sciences: https://english.cas.cn/newsroom/research_news/chem/202303/t20230317_328392.shtml

Information source: (Chinese Academy of Sciences, 2023)

1.19 New study shows Artificial Intelligence could help locate life on Mars

A new study involving University of Oxford researchers has found that Artificial Intelligence could accelerate the search for extraterrestrial life by showing the most promising places to look. In the search for life beyond Earth, researchers have few opportunities to collect samples from Mars or elsewhere. This makes it critical that these missions target locations that have the best chance of harbouring life. In this new study, researchers demonstrated that Artificial Intelligence (AI) and Machine Learning methods can support this by identifying hidden patterns within geographical data that could indicate the presence of life.



Aerial view (above) and ground view (below) from a rover of a biosignature probability map of the same area.
Credit: M. Phillips, K. A. Warren-Rhodes & F. Kalaitzis, University of Oxford

Led by Dr Kimberley Warren-Rhodes at the SETI Institute and involving an international team of over 50 researchers, the first part of the study was an ecological survey of a 3 km² area in the Salar de Pajonales basin, at the boundary of the Chilean Atacama Desert and Altiplano in South America. This mapped the distribution of photosynthetic microorganisms and used techniques such as gene sequencing and infrared spectroscopy to reveal distinct markers of life, called *"biosignatures"*. These data were then combined with aerial images captured by drones to train a Machine Learning model to predict which macro- and microhabitat types would be associated with biosignatures that could indicate life.

For more information, visit the following link:
https://www.ox.ac.uk/news/2023-03-20-new-study-shows-artificial-intelligence-could-help-locate-life-mars

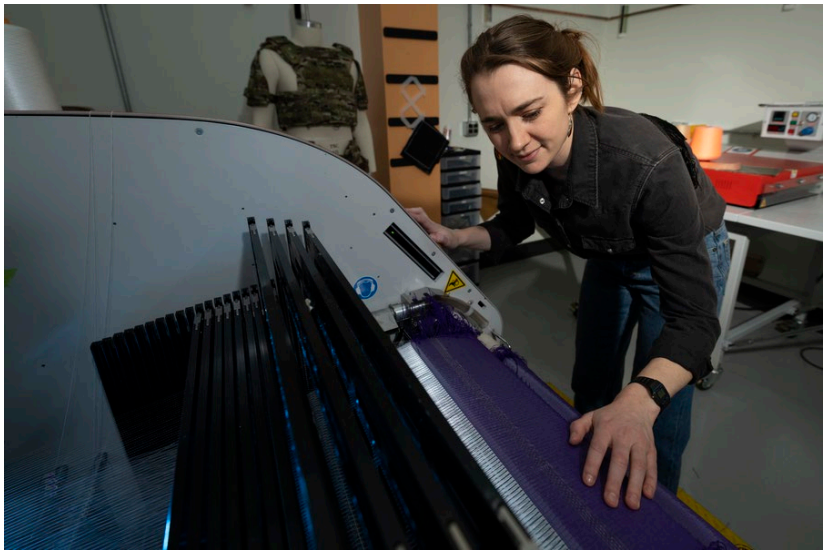
Reference
University of Oxford (March 20, 2023). New study shows Artificial Intelligence could help locate life on Mars. Recovered March 21, 2023, University of Oxford:

https://www.ox.ac.uk/news/2023-03-20-new-study-shows-artificial-intelligence-could-help-locate-life-mars

Information source: (University of Oxford, 2023)

1.20 Fiber *"barcodes"* can make clothing labels that last

Drawing inspiration from butterfly wings, reflective fibers woven into clothing could reshape textile sorting and recycling. A team from Massachusetts Institute of Technology Lincoln Laboratory (MIT) Lincoln Laboratory and the University of Michigan offer a new way to label fabrics: by weaving fibers with engineered reflectivity into them. This fiber is only reflective under certain infrared light. Depending on the wavelengths of light that the fiber reflects when scanned, recyclers would know which type of fabric the fiber represents. In essence, the fiber works like an optical barcode to identify a product.



Credit: Kylie Foy, Massachusetts Institute of Technology Lincoln Laboratory

Doran is a textile specialist at the Defense Fabric Discovery Center (DFDC) at Lincoln Laboratory. There, she works with researchers in the Advanced Materials and Microsystems Group to make *"fabrics of the future"* by integrating fibers ingrained with tiny electronics and sensors. *"Having a way to easily identify fabric types and sort them as they're coming through could help make recycling processes scale up. We want to find ways to identify materials for another use after the life cycle of the garment,"* says Erin Doran.

For more information, visit the following link:
https://news.mit.edu/2023/fiber-barcodes-can-make-clothing-labels-that-last-0321

Reference

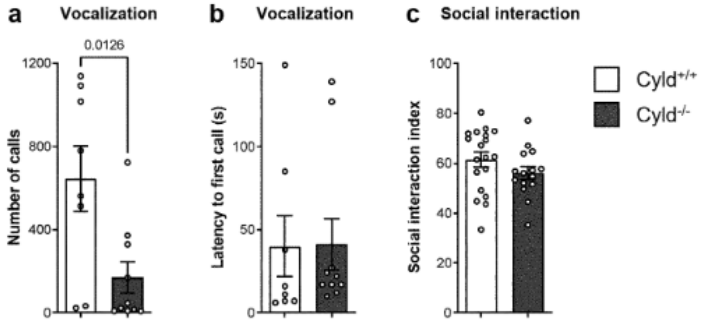
Foy, K. (March 21, 2023). Fiber "barcodes" can make clothing labels that last. Recovered March 21, 2023, Massachusetts Institute of Technology: https://news.mit.edu/2023/fiber-barcodes-can-make-clothing-labels-that-last-0321

Information source: (Massachusetts Institute of Technology, 2023)

2 PATENTS

2.1 Method for the diagnosis and treatment of autism spectrum disorders based on the detection and modulation of a Deubiquitinase

The invention is based on the detection of the involvement of the K63-specific deubiquitinase CYLD in the manifestation of autism spectrum disorder in a mouse model. The invention therefore provides methods for the diagnosis of such a disorder as well as methods for the development of new autism diagnostics. Further provided are means and methods for use in therapeutically modulating any manifestation of an autism spectrum disorder in a mammal or associated neuropsychiatric manifestations.



Cyld-/- mice display autism-like phenotypes including an impairment of social communication, increased repetitive behavior and cognitive dysfunction, a-b Vocalization analysis of number of calls emitted in the presence of a female mouse, and latency to first call, c Social index of social interaction analysis in the three-chamber test.
Credit: Schmeisser Michael and Waisman Ari, WIPO IP Portal

CYLD is a deubiquitinating (DUB) enzyme first identified as being mutated in familial cylindromatosis, an autosomal dominant genetic predisposition to multiple tumors, called cylindromas. CYLD is located in the cytoplasm and its C-terminal catalytic domain mediates the cleavage of tetra-ubiquitin to tri-, di-, and mono-ubiquitin, with a preference for Lys63- or Meti-linked polyubiquitin chains from several substrates. The N-terminus comprises three cytoskeletal-associated protein-glycine-rich (CAP-Gly) domains, which can bind microtubules facilitating cytoskeleton formation.

For more information, visit the following link:
https://patentscope.wipo.int/search/en/detail.jsf?docId=WO2023036962&_cid=P22-LFIPL8-48307-1

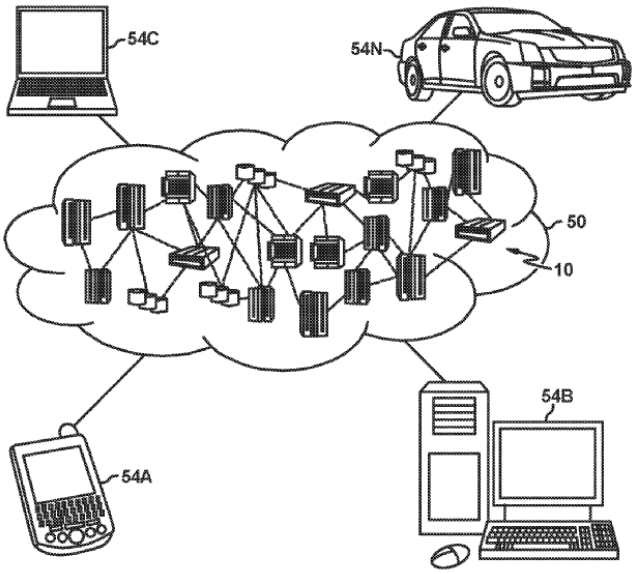
Reference
Schmeisser, M. & Waisman, A. (March 16, 2023). Means and method for the diagnosis and treatment of autism spectrum disorders based on the detection and modulation of a deubiquitinase. Recovered March 16, 2023, WIPO IP Portal:

https://patentscope.wipo.int/search/en/detail.jsf?docId=WO2023036962&_cid=P22-LFIPL8-48307-1

Information source: (WIPO IP Portal, 2023)

2.2 Identifying upgrades to an edge network by Artificial Intelligence

In various examples, sensor data may be received that represents a field of view of a computer-implemented method upgrades an edge network based on analysis by a learning model.



Depicts a cloud computing environment according to an embodiment of the present invention.
Credit: Partho Ghosh, Sarbajit Rakshit and Saswata Banerjee, WIPO IP Portal

The method includes identifying, in a network, a plurality of devices, where each device in the network is configured to provide data on at least one other device in the network. The method also includes determining capabilities of each device of the plurality of devices. The method further includes monitoring, for each device, capacity information and tasks performed during operation of the network. The method includes analyzing, based on the monitoring, each use of each device. The method also includes recommending, in response to the analyzing and by a learning model, a first upgrade to the network. The method further includes implementing the first upgrade.

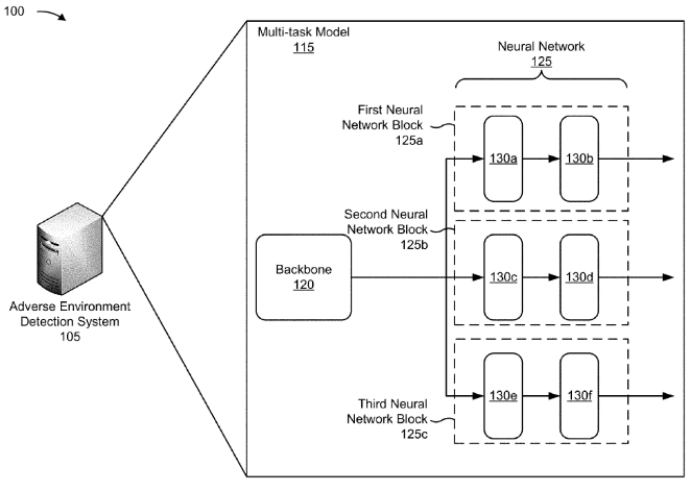
For more information, visit the following link:
https://patentscope.wipo.int/search/en/detail.jsf?docId=US392427535&_cid=P20-LFHUU8-63959-1

Reference
Ghosh, P.; Rakshit, S. & Banerjee, S. (March 16, 2023). Identifying upgrades to an edge network by Artificial Intelligence. Recovered March 16, 2023, WIPO IP Portal: https://patentscope.wipo.int/search/en/detail.jsf?docId=US392427535&_cid=P20-LFHUU8-63959-1

Information source: (WIPO IP Portal, 2023)

2.3 Systems and methods for utilizing Machine Learning for vehicle detection of adverse conditions

In some implementations, an adverse environment detection system may receive an image of a road scene associated with a vehicle.



Are diagrams of an example associated with utilizing Machine Learning for vehicle detection of adverse conditions.
Credit: t. Bianconcini, l. Sarti, l taccari, f. Sambo, f. Schoen, e. Civitelli and s. Magistri, WIPO IP Portal

The adverse environment detection system may determine a set of features associated with the image based on providing the image to an initial portion of a model. The adverse environment detection system may determine a first condition associated with the image based on providing the set of features to a first processing layer of the model, a second condition associated with the image based on providing the set of features to a second processing layer of the model, and a third condition associated with the image based on providing the set of features to a third processing layer of the model. The first processing layer, the second processing layer, and the third processing layer may process the set of features in parallel.

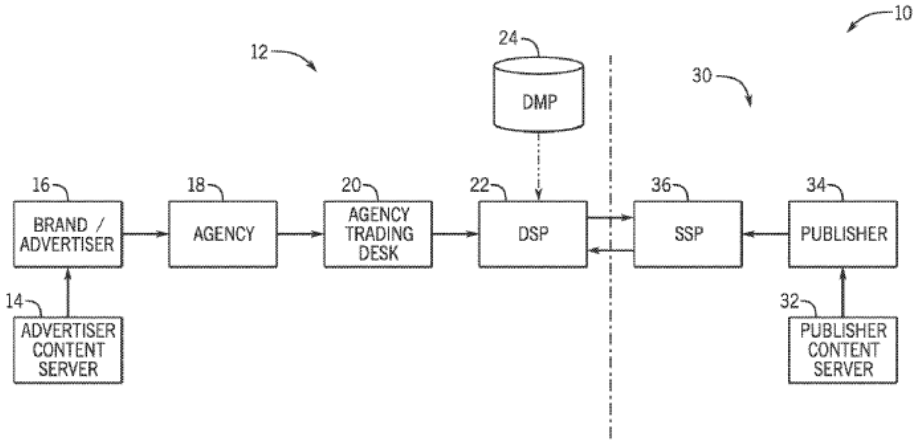
For more information, visit the following link:
https://patentscope.wipo.int/search/en/detail.jsf?docId=US393703648&_cid=P20-LFI8GN-27388-1

Reference
Bianconcini, T.; Sarti, L.; Taccari, L.; Sambo, F.; Schoen, F.; Civitelli, E. & Magistri, S. (March 16, 2023). Systems and methods for utilizing Machine Learning for vehicle detection of adverse conditions. Recovered March 16, 2023, WIPO IP Portal: https://patentscope.wipo.int/search/en/detail.jsf?docId=US393703648&_cid=P20-LFI8GN-27388-1

Information source: (WIPO IP Portal, 2023)

2.4 Systems and methods for programmatic quality control

Systems and methods for controlling quality of content are provided. Programmatic ad buying may facilitate and expedite ad buying via an automated process.



Is a diagram illustrating a programmatic content buying and provisioning system, in accordance with an embodiment of the present disclosure.
Credit: M. Levin, A. Paige, T. Stepanov, C. Lynn, D. Cacciatore, C. Costa, R. Mason and J. Navea, WIPO IP Portal

However, quality control via a conventional ad buying process is done with manual intervention. A confidence tool may request, from a programmatic content library of a content provider, to analyze a content tag associated with programmatic content. The confidence tool may determine whether the content tag meets confidence criteria (e.g., specifications of a content presentation service). The confidence tool may notify the content provider of whether the content tag meets the confidence criteria. Based on this notification, the content provider may approve the content to be run or reject the content to prevent problematic content from running on the content presentation service.

For more information, visit the following link:
https://patentscope.wipo.int/search/en/detail.jsf?docId=US393702800&_cid=P20-LFI8N3-30915-4

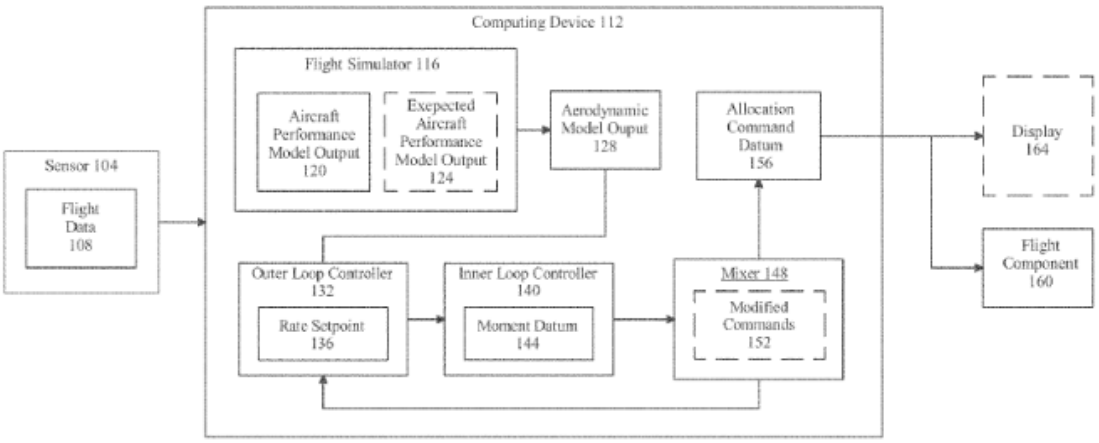
Reference

Levin, M.; Paige, A.; Stepanov, T.; Lynn, C.; Cacciatore, D.; Costa, C.; Mason, R. & Navea, J.. (March 16, 2023). Systems and methods for programmatic quality control of content. Recovered March 16, 2023, WIPO IP Portal: https://patentscope.wipo.int/search/en/detail.jsf?docId=US393702800&_cid=P20-LFI8N3-30915-4

Information source: (WIPO IP Portal, 2023)

2.5 Systems and methods for flight control system using simulator data

A system for flight control system using simulator data for an electric aircraft is presented.



Is an exemplary embodiment of a system for flight control system using simulator data for an electric aircraft.
Credit: Herman Wiegman, WIPO IP Portal

The system includes a computing device, the computing device configured to receive a plurality of measured flight data, simulate a plurality of aircraft performance model outputs as a function of a flight simulator and the plurality of measured flight data, determine a moment datum as a function of the plurality of measured flight data and the plurality of aircraft performance model outputs, generate an allocation command datum as a function of the moment datum and the plurality of aircraft performance model outputs, and perform a torque allocation on a flight component of a plurality of flight components as a function of the allocation command and the moment datum.

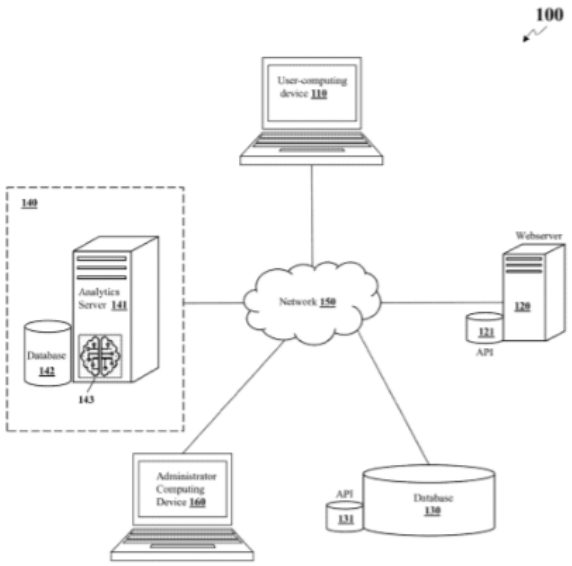
For more information, visit the following link:
https://patentscope.wipo.int/search/en/detail.jsf?docId=US392424811&_cid=P20-LFI8ZF-37326-1

Reference
Wiegman, H. (March 16, 2023). Systems and methods for flight control system using simulator data. Recovered March 16, 2023, WIPO IP Portal: https://patentscope.wipo.int/search/en/detail.jsf?docId=US392424811&_cid=P20-LFI8ZF-37326-1

Information source: (WIPO IP Portal, 2023)

2.6 Machine Learning modeling to identify sensitive data

Described herein are methods and systems to identify and redact personally identifiable information (PII). A PII sensitivity detection framework includes multiple layers where each layer corresponds to a computer model.



Illustrates a computer system for a PII sensitivity detection framework, in accordance with an embodiment.
Credit: G. Shubhanshu, A. Ashish, D. Amaruvi and P. Mallapu, Espacenet Patent Search

The disclosed framework analyzes data stored within different data tables and predicts whether a data column includes PII. The first layer corresponds to an Artificial Intelligence model that analyzes each column metadata and predicts a first score indicative of a first likelihood of PII existence. The second layer corresponds to a rule-based computer model that uses various rules to determine a second score indicative of a second likelihood of PII existence for each column. The third layer corresponds to a column content model that analyzes content of each column using various natural language processing techniques to generate a third score indicative of a third likelihood of PII existence. The framework masks data being presented to a user based on the scores generated via execution of one or more of the layers.

For more information, visit the following link:
https://worldwide.espacenet.com/patent/search/family/085479128/publication/US2023080686A1?q=machine%20learning

Reference
Gupta, S.; Awasthi, A.; Devanathan, A. & Prakash, M. (March 16, 2023). Machine Learning modeling to identify sensitive data. Recovered March 16, 2023, Espacenet Patent Search: https://worldwide.espacenet.com/patent/search/family/085479128/publication/US2023080686A1?q=machine%20learning

Information source: (Espacenet Patent Search, 2023)

2.7 Artificial Intelligence service providing device, and operation method

An Artificial Intelligence service providing device, and an operation method therefor are provided.

A device according to one embodiment of the present disclosure is capable of: identifying the purpose of providing Artificial Intelligence services, and neural network requirements related to the device's execution environment; selecting at least one neural network model that satisfies the neural network requirements on the basis of neural network model information about a plurality of neural network models; obtaining a neural network model for providing Artificial Intelligence services by combining the at least one selected neural network model; and providing Artificial Intelligence services through the obtained neural network model.

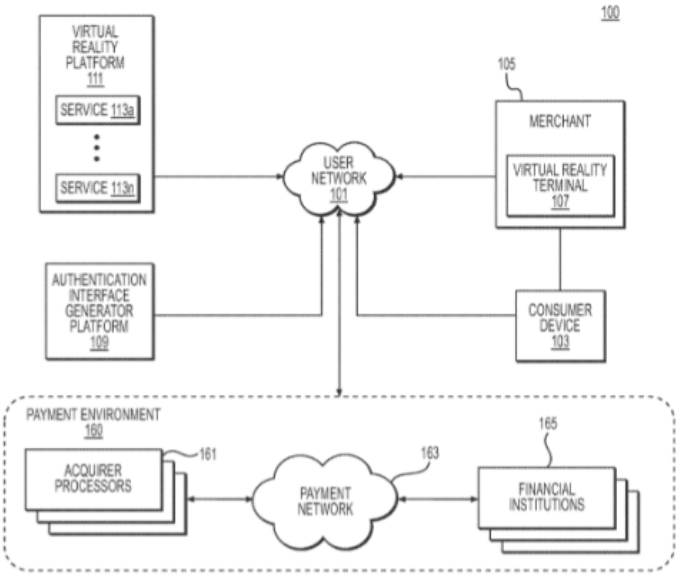
For more information, visit the following link:
https://worldwide.espacenet.com/patent/search/family/085506708/publication/WO2023038300A1?q=artificial%20intelligence

Reference
Song, M.; Ryu, J.; Talipov, E.; Ka, K.; Park, K.; Yang, J. & Lee, J. (March 16, 2023). Artificial Intelligence service providing device, and operation method therefor. Recovered March 16, 2023, Espacenet Patent Search: https://worldwide.espacenet.com/patent/search/family/085506708/publication/WO2023038300A1?q=artificial%20intelligence

Information source: (Espacenet Patent Search, 2023)

2.8 Methods and systems for secure authentication in a virtual or augmented reality environment using an interactive icon

Methods and systems are disclosed for providing secure authentication in a virtual or augmented reality environment using an interactive icon.



Depicts a block diagram of an environment and user network for authenticating payment transactions in virtual reality environments, according to one or more embodiments. Credit: Kuneva Antoniya, Espacenet Patent Search

One method comprises: receiving, over a computer network, a request for payment authorization; identifying, based on the request for payment authorization, a virtual reality interface; generating an icon in the virtual reality interface, the icon having a randomized display of authentication characters; receiving user input associated with at least one character of the of payment authentication characters in the virtual reality interface; and generating a payment authorization response to the request for payment authorization based on the received user input.

For more information, visit the following link:
https://worldwide.espacenet.com/patent/search/family/085478835/publication/US2023085183A1?q=virtual%20reality

Reference
Kuneva, A. (March 16, 2023). Methods and systems for secure authentication in a virtual or Augmented Reality environment using an interactive icon. Recovered March 16, 2023, Espacenet Patent Search: https://worldwide.espacenet.com/patent/search/family/085478835/publication/US2023085183A1?q=virtual%20reality

Information source: (Espacenet Patent Search, 2023)

2.9 System and method for engineering drawing extrapolation and feature automation

The present invention is a system and method for 3D engineering drawing extrapolation and automation incorporating Machine Learning (ML).

The instant innovation receives a 3D computer model of a part to be manufactured, and automatically breaks the model into labelled surfaces capable of being attributed, assigned and represented by 2D drawings. One or more sub-processes receives data defining attributes of the 2D drawings and performs calculations to pre-determine drill-hole locations on a machine-ready part. The system then determines if there are unintended gaps, interferences, or other irregularities resident thereupon. The system creates a list of any irregularities and returns a punch list to a human user for correction. The system utilizes Amazon Web Services (AWS) to both perform data extracting and flattening of the 3D model and to select optimally-sized machine stock and optimize its orientation in relation to the manufacturing machine head.

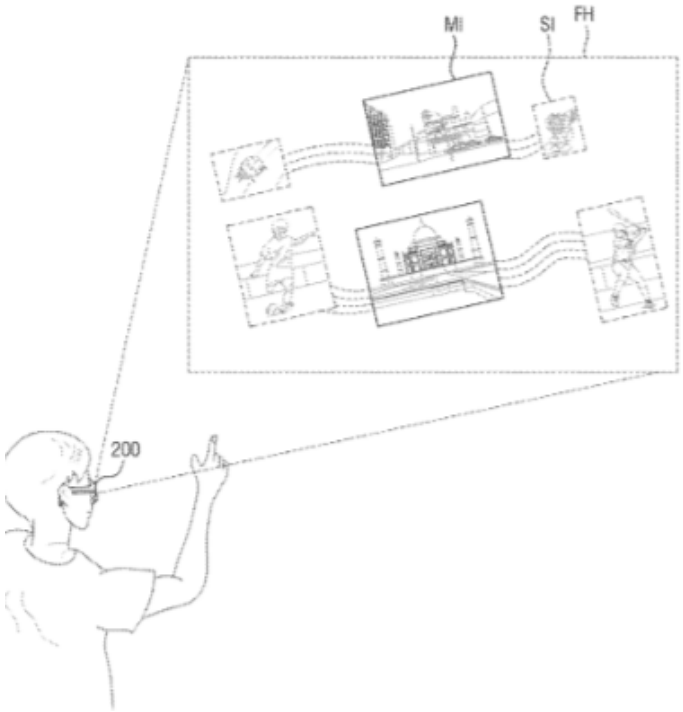
For more information, visit the following link:
https://worldwide.espacenet.com/patent/search/family/085478731/publication/US2023084639A1?q=3d

Reference
Kettay, V.; Kanth, P.; Mukherjee, A.; Varma, K.; S., K. Shanmugam; M., A.; Rajan, S.; Reddy, S; Perry, R.; Menon, A. & Ramesh, R. (March 16, 2023). System and method for engineering drawing extrapolation and feature automation. Recovered March 17, 2023, Espacenet Patent Search: https://worldwide.espacenet.com/patent/search/family/085478731/publication/US2023084639A1?q=3d

Information source: (Espacenet Patent Search, 2023)

2.10 Augmented Reality content providing device

The present disclosure relates to an Augmented Reality (AR)-content-providing device that can further increase user satisfaction and its utilization by realizing AR content of a 3D image.



Is a view illustrating an augmented reality (AR)-content-providing device according to some embodiments of the present disclosure.
Credit: Lee Tae Hee, Yang Byung Choon, Cho Joo Woan, Choi Byeong Hwa and Choi Hae Yun, Espacenet Patent Search

An AR-content-providing device comprises at least one display module configured to separately display a background image and a main image, and at least one optical member including respective display light paths of the background image and the main image so that the background image and the main image are superimposed on each other to be perceived as a three-dimensional (3D) image by a user's eyes.

For more information, visit the following link:
https://worldwide.espacenet.com/patent/search/family/085479511/publication/US20230082737A1?q=3d

Reference
Lee, T.; Yang, B.; Cho, J.; Choi, B. & Choi, H. (March 16, 2023). Augmented reality content providing device. Recovered March 17, 2023, Espacenet Patent Search: https://worldwide.espacenet.com/patent/search/family/085479511/publication/US20230082737A1?q=3d

Information source: (Espacenet Patent Search, 2023)