



Weekly Newsletter
TECHNOLOGY
SURVEILLANCE

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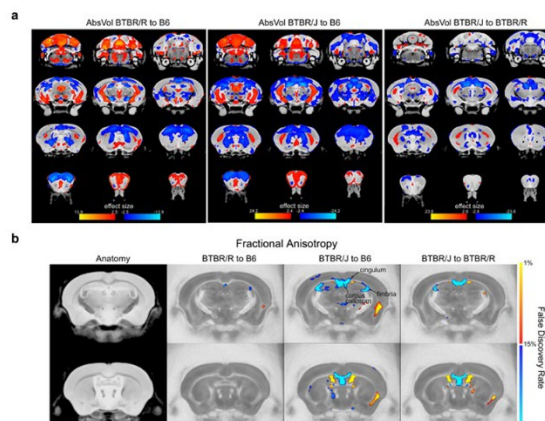


OBJECTIVE: To provide weekly information about the latest global scientific and technological advancements, as well as the most innovative products and services entering the international market.

I. NEWS

1.1 ¿Ancient virus genome drives autism?

Although autism is a common neurodevelopmental disorder, the multiple factors behind its onset are still not fully understood. Animal models of idiopathic autism, especially mice, are often used to help researchers understand the complicated mechanisms behind the disorder, with BTBR/J being the most commonly used mouse model in the world. Now, an international research collaboration including Kobe University's Professor TAKUMI Toru and Researcher Chia-wen Lin, have made new discoveries regarding autism onset in mouse models. In their detailed series of experiments and analyses of BTBR/J mice and the other subspecies BTBR/R, they revealed that endogenous retrovirus activation increases a fetus's susceptibility to autism.



MRI scans showing brain structure differences in BTBR/J and BTBR/R mouse models of autism.
Credit: Kobe University

First of all, the researchers conducted MRI scans on BTBR/J and BTBR/R mice to investigate structural differences in each region of the brain. The results revealed that there were differences between BTBR/J and BTBR/R mice in 33 regions including the amygdala. A particularly prominent difference discovered was that even though BTBR/J's corpus callosum is impaired, BTBR/R's is normal as shown in the figure.

For more information, visit the following link:

https://www.kobe-u.ac.jp/research_at_kobe_en/NEWS/news/2023_03_10_01.html

Reference

Kobe University. (March 10, 2023). Ancient virus genome drives autism? Recovered March 10, 2023, Kobe University: https://www.kobe-u.ac.jp/research_at_kobe_en/NEWS/news/2023_03_10_01.html

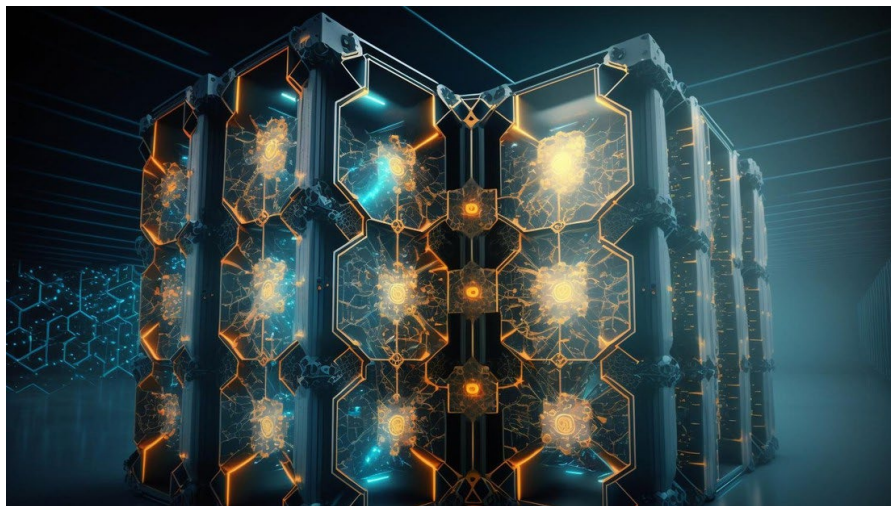


Information source: (Kobe University, 2023)



1.2 New Artificial Intelligence model transforms research on metal-organic frameworks

¿How does an iPhone predict the next word you're going to type in your messages? The technology behind this, and also at the core of many Artificial Intelligence (AI) applications, is called a transformer; a deep-learning algorithm that detects patterns in datasets. Now, researchers at Ecole Polytechnique Fédérale de Lausanne (EPFL) and Korea Advanced Institute of Science & Technology (KAIST) have created a transformer for Metal-Organic Frameworks (MOFs), a class of porous crystalline materials. By combining organic linkers with metal nodes, chemists can synthesize millions of different materials with potential applications in energy storage and gas separation.



Credit: École Polytechnique Fédérale de Lausanne

The “MOFtransformer” is designed to be the ChatGPT for researchers that study MOFs. Its architecture is based on an AI called Google Brain that can process natural language and forms the core of popular language models such as GPT-3, the predecessor to ChatGPT. The central idea behind these models is that they are pre-trained on a large amount of text, so when we start typing on an iPhone, for example, models like this “know” and autocomplete the most likely next word.

For more information, visit the following link:

<https://news.epfl.ch/news/new-ai-model-transforms-research-on-metal-organic/>

Reference

Papageorgiou, N. (March 14, 2023). New AI model transforms research on metal-organic frameworks. Recovered March 14, 2023, École Polytechnique Fédérale de Lausanne: <https://news.epfl.ch/news/new-ai-model-transforms-research-on-metal-organic/>

Information source: (Carnegie Mellon University, 2023)



1.3 New breakthrough enables perfectly secure digital communications

A team led by University of Oxford researchers has achieved a breakthrough in secure communications by developing an algorithm that conceals sensitive information so effectively that it is impossible to detect that anything has been hidden.



A conceptual illustration of generative steganographic visual secret sharing schemes. Here, an image of a treasure map is hidden within an image of a cat. The treasure map can be extracted from the cat image, for instance by entering a password. The cat image itself looks entirely unsuspecting, thus providing plausible deniability to users. Credit: Christian Schroeder, Hippopx and publicdomainvectors.org

Working in close collaboration with Carnegie Mellon University, the researchers developed a new method which they envisage may soon be used widely in digital human communications, including social media and private messaging. In particular, the ability to send perfectly secure information may empower vulnerable groups, such as dissidents, investigative journalists, and humanitarian aid workers. The algorithm applies to a setting called steganography: the practice of hiding sensitive information inside of innocuous content. Steganography differs from cryptography because the sensitive information is concealed in such a way that this obscures the fact that something has been hidden. An example could be hiding a Shakespeare poem inside an AI-generated image of a cat.

For more information, visit the following link:

<https://www.ox.ac.uk/news/2023-03-09-new-breakthrough-enables-perfectly-secure-digital-communications>

Reference

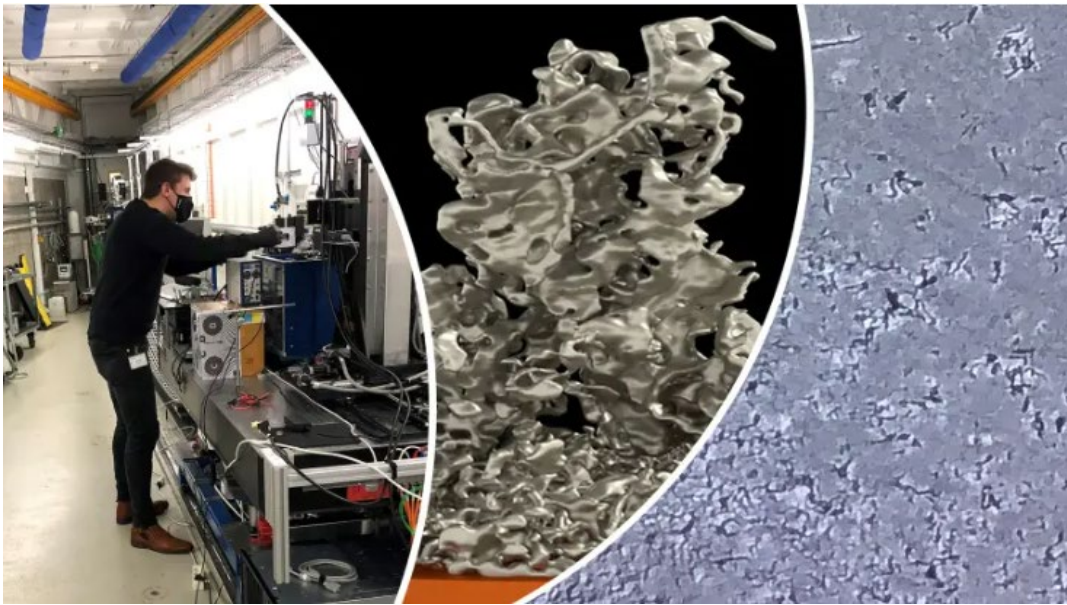
University of Oxford. (March 09, 2023). New breakthrough enables perfectly secure digital communications. Recovered March 10, 2023, University of Oxford: <https://www.ox.ac.uk/news/2023-03-09-new-breakthrough-enables-perfectly-secure-digital-communications>

Information source: (University of Oxford, 2023)



1.4 3D battery imaging reveals the secret real-time life of lithium cells

Battery researchers have long wanted to study lithium metal in a working lithium metal battery. Now researchers from Chalmers have developed a method to follow how the lithium in the battery cell behaves while cycling. With a specially designed cell and using X-ray tomographic microscopy, the researchers can observe the inner workings of the battery in real time in 3D. The new method may contribute to batteries with higher capacity and increased safety in our future cars and devices.



Credit: Chalmers University of Technology

Innovative battery researchers have cracked the code to creating real-time 3D images of the promising but temperamental lithium battery as it cycles. A team from Chalmers University of Technology, Sweden. Have succeeded in observing how the lithium in the cell behaves as it charges and discharges. The new method may contribute to batteries with higher capacity and increased safety in our future cars and devices.

For more information, visit the following link:

<https://www.chalmers.se/en/current/news/f-3d-battery-imaging-reveals-the-secret-real-time-life-of-lithium-metal-cells/>

Reference

Halleröd, M. (March 09, 2023). 3D battery imaging reveals the secret real-time life of lithium metal cells. Recovered March 10, 2023, Chalmers University of Technology: <https://www.chalmers.se/en/current/news/f-3d-battery-imaging-reveals-the-secret-real-time-life-of-lithium-metal-cells/>

Information source: (Chalmers University of Technology, 2023)



1.5 Virtual reality games can be used as a tool in personnel assessment

Fast gamers are more intelligent, intelligence can be predicted through virtual reality games. Virtual reality gamers (VR game) who finished it faster than their fellow gamers also have higher levels of general intelligence and processing capacity. This was the result of a study conducted by the University of Cologne, the University of Liechtenstein and Vorarlberg University of Applied Sciences. The results also indicate that virtual reality games can be useful supplementary human resource management tools in companies for predicting the job performance of an applicant. The study *"Intelligence at play: game-based assessment using a virtual-reality application"* by Markus Weinmann of the University of Cologne and his fellow scientists was published in the journal *"Virtual Reality."*

Several studies have already shown that video games may indicate or even help to develop intellectual and cognitive abilities. As intelligence is one of the most commonly used predictors for job performance, video games could be interesting for the human resource management. Although many companies are increasingly using VR technology to recruit candidates, only few studies have specifically investigated whether and how VR games can be used to draw conclusions about intelligence in this area. The study by Markus Weinmann and his colleagues contributes to bridging the gap between research and practice.

For more information, visit the following link:

<https://portal.uni-koeln.de/en/universitaet/aktuell/press-releases/single-news/virtual-reality-games-can-be-used-as-a-tool-in-personnel-assessment>

Reference

Weinmann M. (March 09, 2023). Virtual Reality games can be used as a tool in personnel assessment. Recovered March 10, 2023, University of Cologne: <https://portal.uni-koeln.de/en/universitaet/aktuell/press-releases/single-news/virtual-reality-games-can-be-used-as-a-tool-in-personnel-assessment>

Information source: (University of Cologne, 2023)



1.6 Engineering breakthrough in Softbotics

The newest development in softbotics will have a transformative impact on robotics, electronics and medicine. Carmel Majidi, a professor of mechanical engineering at Carnegie Mellon University, has engineered a soft material with metal-like conductivity and self-healing properties that, for the first time, can support power-hungry devices. *"Softbotics is about seamlessly integrating robotics into everyday life, putting humans at the center,"* explained Majidi. Engineers work to integrate robots into everyday life with the hope of improving mobility, health and well-being. For example, patients might one day recover from surgery at home thanks to a wearable robot monitoring aid. To integrate robots seamlessly, they need to be able to move with people, withstand damage and have electrical functionality without being encased in a hard structure.

Majidi's material, a liquid metal-filled organogel composite with high electrical conductivity, low stiffness, high stretchability and self-healing properties, is foundational to bringing these softbotics to life. The team introduced the material in three applications: a damage resistant snail-inspired robot, a modular circuit for powering a toy car, and a reconfigurable bioelectrode for measuring muscle activity on different locations of the body. *"This is the first soft material that can maintain a high enough electrical conductivity to support digital electronics and power-hungry devices,"* said Majidi. *"We have demonstrated that you can actually power motors with it."* The material can also act as a modular building block for reconfigurable circuits.

For more information, visit the following link:

<https://www.cmu.edu/news/stories/archives/2023/march/softbotics-breakthrough.html>

Reference

Landram K. (March 09, 2023). Engineering breakthrough in Softbotics. Recovered March 10, 2023, Carnegie Mellon University: <https://www.cmu.edu/news/stories/archives/2023/march/softbotics-breakthrough.html>

Information source: (Carnegie Mellon University, 2023)



1.7 Researchers say Data Science may eventually help predict a film's success

From the sepia tones of a Coen brothers film set in the Dust Bowl to a child's red coat in Schindler's list, filmmakers have long known the power of colour in movies. Now, computer scientists have analyzed 60 years of films to paint a picture of the past six decades in film. Researchers at the University of Waterloo used a technique called k-means clustering to analyze the trailers for more than 29,000 North American movies released between 1960 and 2019.



*Eight- and 15-colour palettes from films of different genres and eras.
Credit: Media relations, University Waterloo*

“We chose to analyze trailers because they typically include many key moments from a film while also being short and accessible to the public,” said Andreea Pocol, a PhD candidate in computer science at Waterloo and co-author of the study. “Trailers give us a reliable snapshot of a film, so we can extract a lot of data efficiently.” Their technique produced both more general eight-colour palettes and more detailed 15-colour palettes, demonstrating the dominant colours for different data sets, which included specific films, genres and decades. They used the method to generate palettes for individual films—The Shining or The Matrix, for example—as well as groups of films, such as science fiction films or those released between certain dates.

For more information, visit the following link:

<https://uwaterloo.ca/news/computer-scientists-paint-picture-six-decades-movies>

Reference

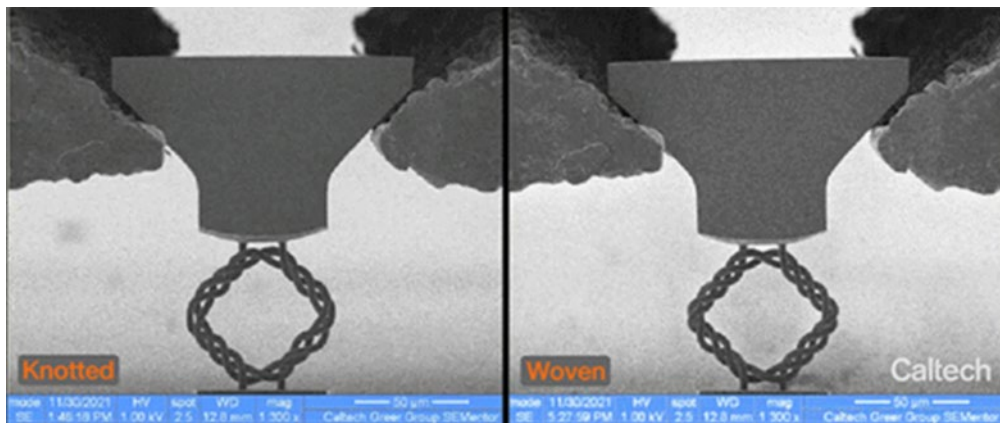
The University of Waterloo. (March 09, 2023). Computer scientists paint a picture of six decades of movies. Recovered March 10, 2023, The University of Waterloo: <https://uwaterloo.ca/news/computer-scientists-paint-picture-six-decades-movies>

Information source: (University of Waterloo, 2023)



1.8 Knots Smaller Than Human Hair Make Materials Unusually Tough

In the latest advance in nano- and micro-architected materials, engineers at California Institute of Technology (Caltech) have developed a new material made from numerous interconnected microscale knots. The knots make the material far tougher than identically structured but unknotted materials: they absorb more energy and are able to deform more while still being able to return to their original shape undamaged. These new knotted materials may find applications in biomedicine as well as in aerospace applications due to their durability, possible biocompatibility, and extreme deformability.



The tensile strength of a material constructed with microscale knots (left), compared to that of a material that lacks knots but is otherwise structurally identical (right).

Credit: Robert Perkins, California Institute of Technology

The knotted materials, which were created out of polymers, exhibit a tensile toughness that far surpasses materials that are unknotted but otherwise structurally identical, including ones where individual strands are interwoven instead of knotted. When compared to their unknotted counterparts, the knotted materials absorb 92 percent more energy and require more than twice the amount of strain to snap when pulled. The knots were not tied but rather manufactured in a knotted state by using advanced high-resolution 3D lithography capable of producing structures in the nanoscale. The samples detailed in the *Science Advances* paper contain simple knots—an overhand knot with an extra twist that provides additional friction to absorb additional energy while the material is stretched. In the future, the team plans to explore materials constructed from more complex knots.

For more information, visit the following link:

<https://www.caltech.edu/about/news/knots-smaller-than-human-hair-make-materials-unusually-tough>

Reference

Perkins R. (March 09, 2023). Knots smaller than human hair make materials unusually tough. Recovered March 10, 2023, California Institute of Technology:



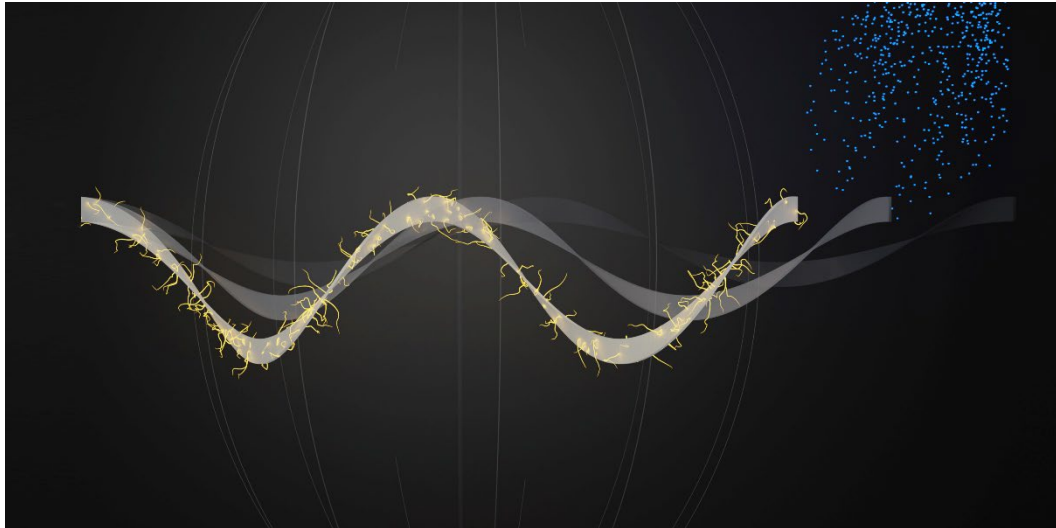
<https://www.caltech.edu/about/news/knots-smaller-than-human-hair-make-materials-unusually-tough>

Information source: (California Institute of Technology, 2023)



1.9 Shape memory for nano-sized objects

Researchers at Eidgenössische Technische Hochschule Zürich (ETH Zurich) achieved a shape memory effect for the first time with objects that are only a few nanometers in size. This can be used to manufacture tiny machinery and robotic devices on the nanoscale.



For the first time, ETH Zurich researchers have produced objects with shape memory that are only twenty nanometres thick.

Credit: Minsoo Kim, Eidgenössische Technische Hochschule Zürich

Researchers led by Salvador Pané, Professor of Materials of Robotics at ETH Zurich, and Xiang-Zhong Chen, a senior scientist in his group, were able to circumvent this limitation using ceramic materials. In a study, published in the journal *Nature Communications*, they demonstrate the shape-memory effect on a layer which is around twenty nanometers thick and made of materials called ferroic oxides. This achievement now makes it possible to apply the shape-memory effect to tiny nanoscale machines. Alloys that can return to their original structure after being deformed have a so-called shape memory. This phenomenon and the resulting forces are used in many mechanical actuating systems, for example in generators or hydraulic pumps. However, it has not been possible to use this shape-memory effect at a small nanoscale: Objects made of shape-memory alloy can only change back to their original shape if they are larger than around 50 nanometers.

For more information, visit the following link:

<https://ethz.ch/en/news-and-events/eth-news/news/2023/03/shape-memory-for-nano-sized-objects.html>

Reference

Engler V. (March 09, 2023). Shape memory for nano-sized objects. Recovered March 10, 2023, Eidgenössische Technische Hochschule Zürich: <https://ethz.ch/en/news-and-events/eth-news/news/2023/03/shape-memory-for-nano-sized-objects.html>



Information source: (Eidgenössische Technische Hochschule Zürich, 2023)



1.10 New research uses geothermal energy to slash emissions

A University of Canterbury (UC) PhD student has identified a renewable and affordable energy source with the ability to remove carbon dioxide (CO₂) from the atmosphere. The research, from UC Civil and Natural Resources Engineering PhD student Karan Titus, investigates taking hot water from geothermal reservoirs and burning forestry waste to superheat it – generating electricity. The geothermal water is then injected back underground along with the CO₂ produced from the burning wood.

Karan says the process, known as Geothermal-Bioenergy and Carbon Capture and Sequestration, or BECCS, has significant benefits. *“We are creating cleaner, renewable energy, while indirectly removing CO₂ from the atmosphere – Geothermal-BECCS plants could store 1 million tonnes of usable CO₂ each year in underground geothermal reservoirs.”* And *“We can also generate significantly more renewable energy using this process when compared to traditional geothermal power. The BECCS system is also more cost-effective per tonne of CO₂ than other common climate change mitigation strategies due to decarbonisation on two fronts: more renewable power and the secure storage of CO₂.”*

For more information, visit the following link:

<https://www.canterbury.ac.nz/news/2023/new-research-uses-geothermal-energy-to-slash-emissions.html>

Reference

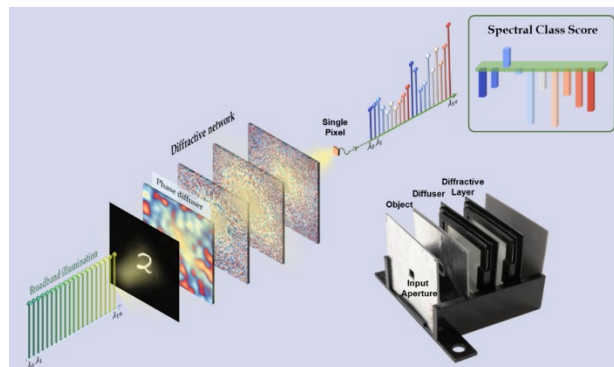
University of Canterbury. (March 10, 2023). New research uses geothermal energy to slash emissions. Recovered March 10, 2023, University of Canterbury: <https://www.canterbury.ac.nz/news/2023/new-research-uses-geothermal-energy-to-slash-emissions.html>

Information source: (University of Canterbury, 2023)



1.11 Optical computing for object classification through diffusive random media

Researchers at University of California, Los Angeles (UCLA) have recently developed an all-optical method that enables objects to be classified through unknown random diffusers using diffractive deep neural networks (D2NNs). D2NNs form a free-space optical computing platform that attracted growing research interest in recent years. D2NNs compute a given task by modulating the light diffraction through a series of spatially structured surfaces, collectively forming an all-optical computer that can operate at the speed of light. Such an all-optical computing framework has the benefits of high speed, parallelism and low power consumption and could be useful in many computing tasks, such as object classification, quantitative phase imaging, microscopy, universal linear transformations, etc.



The single-pixel broadband diffractive neural network classifies handwritten digits through unknown random diffusers. A broadband single-pixel diffractive optical network maps the spatial information of input objects behind an unknown random diffuser into the power spectrum at the output pixel aperture.

Credit: Ozcan Lab,

In their simulations, this single-pixel broadband diffractive network successfully recognized handwritten digits through randomly selected unknown phase diffusers with a blind testing accuracy of 87.74%. Furthermore, the researchers experimentally demonstrated the feasibility of this single-pixel broadband classifier using a 3D-printed diffractive network and a terahertz time-domain spectroscopy system.

For more information, visit the following link:

<https://cnsi.ucla.edu/project/march-10-2023-optical-computing-for-object-classification-through-diffusive-random-media/>

Reference

California Nanosystems Institute. (March 10, 2023). Optical Computing for Object classification through diffusive random media. Recovered March 10, 2023, University of California, Los Angeles: <https://cnsi.ucla.edu/project/march-10-2023-optical-computing-for-object-classification-through-diffusive-random-media/>



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Information source: (University of California, Los Angeles, 2023)



1.12 New LiDAR system pinpoints pedestrian behavior to improve efficiency and safety at intersections

Pedestrian safety is critical to improving walkability in cities. To that end, National Institute for Transportation and Communities (NITC) researchers have developed a system for collecting pedestrian behavior data using LiDAR sensors. Tested at two intersections in Texas and soon to be tested at another in Salt Lake City, Utah. The new software created by a multi-university research team is able to reliably observe pedestrian behavior and can help reduce conflicts between pedestrians and vehicles at signalized intersections. The Utah Department of Transportation (UDOT) is already working on implementing this new system to improve data collection at intersections.



Credit: Lacey Friedly, Portland State University

The LiDAR system can especially improve multimodal travel at intersections with permissive left turns, which are indicated by a flashing yellow arrow. Previous research has shown that where a flashing yellow arrow, or FYA, is present, cars searching for a gap in traffic may not look for pedestrians. To remove the risk to people walking, some signals are programmed to turn off the FYA when a walk button is pushed. But, ¿What if the walk button is pushed and the pedestrian isn't really crossing there, or crosses very quickly and then leaves the crosswalk clear? Left-turning vehicles would still have to wait out the rest of the cycle.

For more information, visit the following link:

<https://www.pdx.edu/research/news/new-lidar-system-pinpoints-pedestrian-behavior-improve-efficiency-and-safety-intersections>

Reference

Friedly L. (March 10, 2023). New LIDAR system pinpoints pedestrian behavior to improve efficiency and safety at intersections. Recovered March 13, 2023, Portland State University: <https://www.pdx.edu/research/news/new-lidar-system-pinpoints-pedestrian-behavior-improve-efficiency-and-safety-intersections>

Information source: (Portland State University, 2023)



1.13 New method shows promise for locating deposits of critical metals

A new technique developed by University of Oxford researchers could help locate new deposits of critical metals needed to enable the green-energy transition. In this new study, led by the University of Oxford's Department of Earth Sciences, researchers developed a novel approach which proved capable of mapping both the location and composition of subsurface fluids. For the first time, this combined two different geological measurements: seismic attenuation tomography and seismic anisotropy.



*Accurately pinpointing the position of metal-rich deposits is important for reducing the risks and environmental impacts associated with drilling and mining.
Credit: Shutterstock, University of Oxford*

Lead researcher Dr Thomas Hudson (Department of Earth Sciences, University of Oxford) explained: “Seismic attenuation measures the loss of energy of a seismic wave as it propagates through a medium. Seismic anisotropy, meanwhile, measures how the speed of seismic waves varies depending on the direction that the wave is travelling. Attenuation tomography images where fluids are (a little like a CT scan in a hospital) and whether the rock is partially saturated (contains gas) or fully saturated (no gas). Seismic anisotropy then tells us how the fluids travel and accumulate along faults.”

For more information, visit the following link:

<https://www.ox.ac.uk/news/2023-03-10-new-method-shows-promise-locating-deposits-critical-metals>

Reference

University of Oxford. (March 10, 2023). New method shows promise for locating deposits of critical metals. Recovered March 13, 2023, University of Oxford: <https://www.ox.ac.uk/news/2023-03-10-new-method-shows-promise-locating-deposits-critical-metals>

Information source: (University of Oxford, 2023)



1.14 First wiring map of insect brain

Researchers have built the first ever map showing every single neuron and how they're wired together in the brain of the fruit fly larva. This will help scientists to understand the basic principles by which signals travel through the brain at the neural level and lead to behaviour and learning. An organism's nervous system, including the brain, is made up of neurons that are connected to each other via synapses. Information in the form of chemicals passes from one neuron to another through these contact points.



Credit: Jacqueline Garget, University of Cambridge

The map of the 3016 neurons that make up the larva of the fruit fly *Drosophila melanogaster*'s brain, and the detailed circuitry of neural pathways within it, is known as a 'connectome'. This is the largest complete brain connectome ever to have been mapped. It is a huge advance on previous work to map very simple brain structures including the roundworm *Caenorhabditis elegans*, which only has several hundred neurons. Imaging entire brains has until recently been extremely challenging. Now, technological advances allow scientists to image the entire brain of the fruit fly larvae relatively quickly using electron microscopy, and reconstruct the brain circuits from the resulting data.

For more information, visit the following link:

<https://www.cam.ac.uk/research/news/first-wiring-map-of-insect-brain-complete>

Reference

Garget J. (March 10, 2023). First wiring map of insect brain complete. Recovered March 13, 2023, University of Cambridge: <https://www.cam.ac.uk/research/news/first-wiring-map-of-insect-brain-complete>

Information source: (University of Cambridge, 2023)



1.15 New “Traffic Cop” algorithm helps a drone swarm stay on task

Massachusetts Institute of Technology (MIT) engineers, they’ve developed a method to tailor any wireless network to handle a high load of time-sensitive data coming from multiple sources. Their new approach, called WiSwarm, configures a wireless network to control the flow of information from multiple sources while ensuring the network is relaying the freshest data.



*MIT engineers have developed a method to tailor any wireless network to handle a high load of time-sensitive data coming from multiple sources.
Credit: Christine Daniloff, Massachusetts Institute of Technology*

The team used their method to tweak a conventional Wi-Fi router, and showed that the tailored network could act like an efficient traffic cop, able to prioritize and relay the freshest data to keep multiple vehicle-tracking drones on task. The team’s method, which they will present in May at IEEE’s International Conference on Computer Communications (INFOCOM), offers a practical way for multiple robots to communicate over available Wi-Fi networks so they don’t have to carry bulky and expensive communications and processing hardware onboard.

For more information, visit the following link:

<https://news.mit.edu/2023/new-traffic-cop-algorithm-drone-swarm-wireless-0313>

Reference

Chu, J. (March 13, 2023). New “traffic cop” algorithm helps a drone swarm stay on task. Recovered March 13, 2023, Massachusetts Institute of Technology: <https://news.mit.edu/2023/new-traffic-cop-algorithm-drone-swarm-wireless-0313>

Information source: (Massachusetts Institute of Technology, 2023)



1.16 Ultrathin phosphorus semiconductors sets the pace in high-performance transistors

A newly discovered blue form of ultrathin phosphorus — with electronic properties that can be tuned to enhance the injection of charge carriers (negatively and positively charged) into transistors — are set to push next-generation electronic devices forward. Two-dimensional semiconductors, such as graphene and transition metal dichalcogenides, are expected to drive the miniaturization of electronic devices by providing ultrathin active channels for charge-carrier transport in field effect transistors (FETs). Essential to modern circuitry, FETs are used to influence the flow of current through their channels by applied voltage and behave like electronically controlled switches or amplifiers.

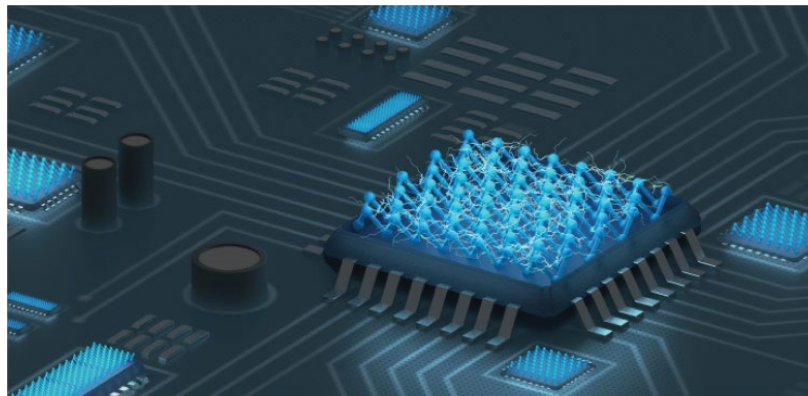


Illustration of field effect transistors based on the recently discovered blue form of ultrathin phosphorus.

Credit: Heno Hwang, King Abdullah University of Science and Technology

Now, Schwingenschlögl's team has designed a junction-free FET using the recently discovered two-dimensional blue phosphorene as the single electroactive material. Blue phosphorene itself is a semiconductor but becomes a metal when stacked into a bilayer. "The ability of blue phosphorene to change its electronic properties based on stacking is crucial for our device," Tyagi says. "Once we obtained a crystal orientation that delivers high carrier mobility through the channel, we were confident that we would achieve positive results because the contact resistance is addressed by the junction-free design."

For more information, visit the following link:

<https://discovery.kaust.edu.sa/en/article/1325/phosphorus-sets-the-pace-in-high-performance-transistors>

Reference

Tyagui, S. (March 13, 2023). Phosphorus sets the pace in high-performance transistors. Recovered March 13, 2023, King Abdullah University of Science and Technology: <https://discovery.kaust.edu.sa/en/article/1325/phosphorus-sets-the-pace-in-high-performance-transistors>



Information source: (King Abdullah University of Science and Technology, 2023)



1.17 New process could capture carbon dioxide

New research suggests that around 0.5% of global carbon emissions could be captured during the normal crushing process of rocks commonly used in construction, by crushing them in CO₂ gas. The materials and construction industry accounts for 11% of global carbon emissions. More than 50 billion tonnes of rock are crushed worldwide every year and current crushing processes - standard in construction and mining – do not capture CO₂.



Credit: University of Strathclyde

Principal investigator Professor Rebecca Lunn, from the Department of Civil & Environmental Engineering, said: *"The hope is that the sector could reduce the emissions by adapting the current setups to trap carbon from polluting gas streams such as those from cement manufacture or gas-fired power stations."*

For more information, visit the following link:

<https://www.strath.ac.uk/whystrathclyde/news/2023/newprocesscouldcapturecarbondioxideequivalenttoforestthesizeofgermany/>

Reference

The University of Strathclyde. (March 13, 2023). New process could capture carbon dioxide equivalent to forest the size of Germany. Recovered March 13, 2023, The University of Strathclyde:

<https://www.strath.ac.uk/whystrathclyde/news/2023/newprocesscouldcapturecarbondioxideequivalenttoforestthesizeofgermany/>

Information source: (University of Strathclyde, 2023)



1.18 Crab shells could help power the next generation of rechargeable batteries

Lithium-ion batteries have become ubiquitous in recent years, powering phones, cars and even toothbrushes. But because the amount of lithium metal in the world is limited, some researchers have turned their attentions to its “*Chemical Cousins*” instead. Previously, researchers created a biodegradable zinc-ion battery using the chitin in crab shells. But these wastes could alternatively be turned into “*Hard Carbon*,” a material that has been explored as a possible anode for sodium-ion batteries. Though chemically similar to lithium, sodium ions are larger, and thus incompatible with a lithium-ion battery’s anode, which is typically made of graphite. When hard carbon is combined with metallic semiconductor materials, such as the Transition Metal Dichalcogenides (TMDs), the material can become a feasible battery anode.



Crab shells, like the one pictured here, could be “upcycled” to help make new battery materials.
Credit: ACS Omega, American Chemical Society

To make their “*Crab Carbon*,” the researchers heated crab shells to temperatures exceeding 1000 F. They then added the carbon to a solution of either tin sulfide (SnS_2) or iron sulfide (FeS_2), then dried them to form anodes. The porous, fibrous structure of the crab carbon provided a large surface area, which enhanced the material’s conductivity and ability to transport ions efficiently. When tested in a model battery, the team found that both composites had good capacities and could last for at least 200 cycles. The researchers say that this work could provide a route to upcycle other wastes and help develop more sustainable battery technologies.

For more information, visit the following link:

<https://www.acs.org/pressroom/presspacs/2023/march/crab-shells-could-help-power-the-next-generation-of-rechargeable-batteries.html>

Reference

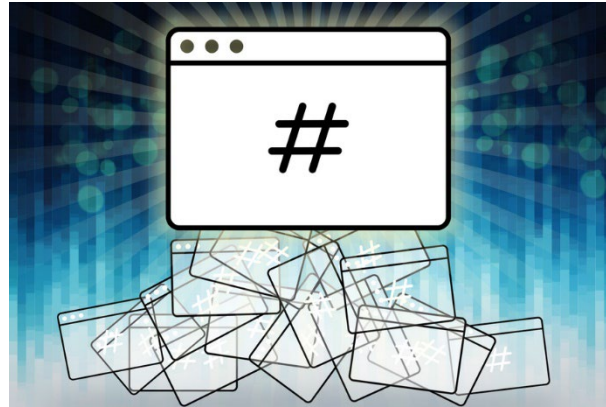
American Chemical Society (March 13, 2023). Crab shells could help power the next generation of rechargeable batteries. Recovered March 13, 2023, American Chemical Society Chemistry for life: <https://www.acs.org/pressroom/presspacs/2023/march/crab-shells-could-help-power-the-next-generation-of-rechargeable-batteries.html>

Information source: (American Chemical Society Chemistry for life, 2023)



1.19 New method accelerates data retrieval in huge databases

Researchers used Machine Learning to build faster and more efficient hash functions, which are a key component of databases.



Researchers from MIT and elsewhere set out to see if they could use Machine Learning to build better hash functions.

Credit: Christine Daniloff, Massachusetts Institute of Technology

Hashing is a core operation in most online databases, like a library catalogue or an e-commerce website. A hash function generates codes that directly determine the location where data would be stored. So, using these codes, it is easier to find and retrieve the data. Since hashing is used in so many applications, from database indexing to data compression to cryptography, fast and efficient hash functions are critical. So, researchers from Massachusetts Institute of Technology (MIT) and elsewhere set out to see if they could use Machine Learning to build better hash functions. They found that, in certain situations, using learned models instead of traditional hash functions could result in half as many collisions. These learned models are created by running a machine-learning algorithm on a dataset to capture specific characteristics. The team's experiments also showed that learned models were often more computationally efficient than perfect hash functions.

For more information, visit the following link:

<https://news.mit.edu/2023/new-method-hash-function-online-databases-0313>

Reference

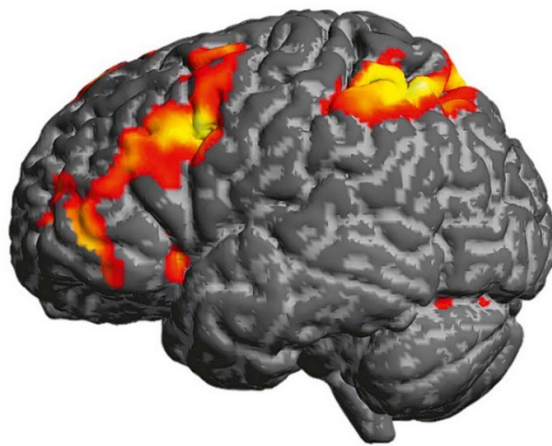
Zewe, A. (March 13, 2023). New method accelerates data retrieval in huge databases. Recovered March 13, 2023, Massachusetts Institute of Technology: <https://news.mit.edu/2023/new-method-hash-function-online-databases-0313>

Information source: (Massachusetts Institute of Technology, 2023)



1.20 Detecting hidden brain states

Mental health disorders can only be diagnosed on the basis of symptoms – and individual outcomes cannot be accurately predicted. An Eidgenössische Technische Hochschule Zürich (ETH) scientist hopes to change that with the help of mathematical models. Why do we have emotions? Klaas Enno Stephan, a professor at ETH Zurich and the University of Zurich, considers the question carefully before answering: *“It seems very plausible that the purpose of the emotions is to make us aware of unconscious processes in the body.”* As a doctor and researcher, Stephan is particularly interested in the interaction between brain and body. He cites the example of how insulin is released at the mere sight of food, before we even take a bite and our blood sugar rises. *“Yet we have no conscious control over this physiological response,”* says Stephan.



*Functional magnetic resonance imaging (fMRI) is used to study brain activity.
Credit: Sandra Iglesias, Eidgenössische Technische Hochschule Zürich*

Our brain is constantly interpreting and updating information from the world around us. *“The brain constructs models of the world and uses them to make predictions,”* says Stephan. These predictions then serve as a basis for taking anticipatory corrective action, such as releasing insulin prior to eating. *“Maintaining homeostasis is the brain’s ultimate goal here,”* he explains. Homeostasis is the internal balance that the body tries to achieve by regulating parameters such as blood sugar levels, core body temperature, blood pressure and acid-base balance. When this equilibrium is disrupted, the brain acts to correct it – generally without us even noticing.

For more information, visit the following link:

<https://ethz.ch/en/news-and-events/eth-news/news/2023/03/detecting-hidden-brain-states.html>

Reference

Swiss Federal Institute of Technology Zurich. (March 14, 2023). Detecting hidden brain states. Recovered March 14, 2023, Eidgenössische Technische Hochschule Zürich: <https://ethz.ch/en/news-and-events/eth-news/news/2023/03/detecting-hidden-brain-states.html>



Information source: (Eidgenössische Technische Hochschule Zürich, 2023)



2 PATENTS

2.1 System and method for performing Machine vision recognition of dynamic objects

A method for performing machine vision recognition activities for a dynamic object is disclosed, which includes the steps of:

(i) creating a digital image series that includes a seed digital image set including digital images and at least one subsequent digital image set including digital images; (ii) creating an object detector series, said creating step (iii) comprising: (a) creating a seed object detector from the seed digital image set, the seed object detector comprising an architecture and a set of weights directed to recognition of target objects; and (b) creating at least one deep learning object detector from the at least one subsequent digital image set and derived from said seed object detector, the deep learning object detector including a deep learning architecture and a set of weights trained for recognition of the evolution of the target objects over time.

For more information, visit the following link:

https://patentscope.wipo.int/search/en/detail.jsf?docId=US393380216&_cid=P11-LF8B11-85901-1

Reference

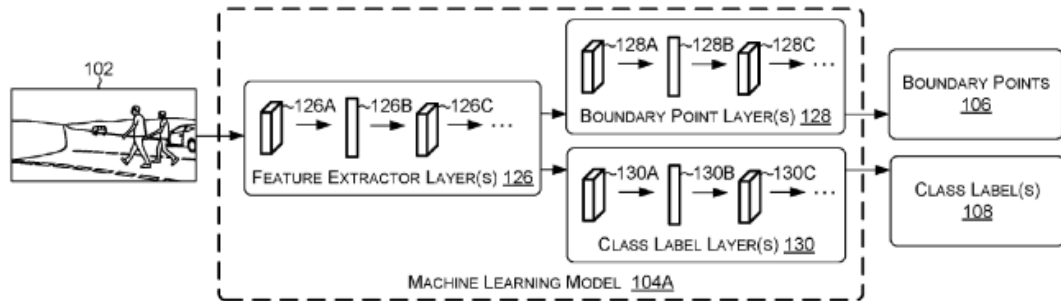
Charles, M. (March 09, 2023). System and method for performing Machine vision recognition of dynamic objects. Recovered March 09, 2023, WIPO IP Portal: https://patentscope.wipo.int/search/en/detail.jsf?docId=US393380216&_cid=P11-LF8B11-85901-1

Information source: (WIPO IP Portal, 2023)



2.2 Determining drivable free-space for autonomous vehicles

In various examples, sensor data may be received that represents a field of view of a sensor of a vehicle located in a physical environment.



*Is an illustration of an example Machine Learning model for boundary identification, in accordance with some embodiments of the present disclosure.
Credit: Mansi Rankawat, Jian Yao, Dong Zhang and Chia-Chih Chen, WIPO IP Portal*

The sensor data may be applied to a Machine Learning model that computes both a set of boundary points that correspond to a boundary dividing drivable free-space from non-drivable space in the physical environment and class labels for boundary points of the set of boundary points that correspond to the boundary. Locations within the physical environment may be determined from the set of boundary points represented by the sensor data, and the vehicle may be controlled through the physical environment within the drivable free-space using the locations and the class labels.

For more information, visit the following link:

https://patentscope.wipo.int/search/en/detail.jsf?docId=US393381135&_cid=P11-LF8B11-85901-1

Reference

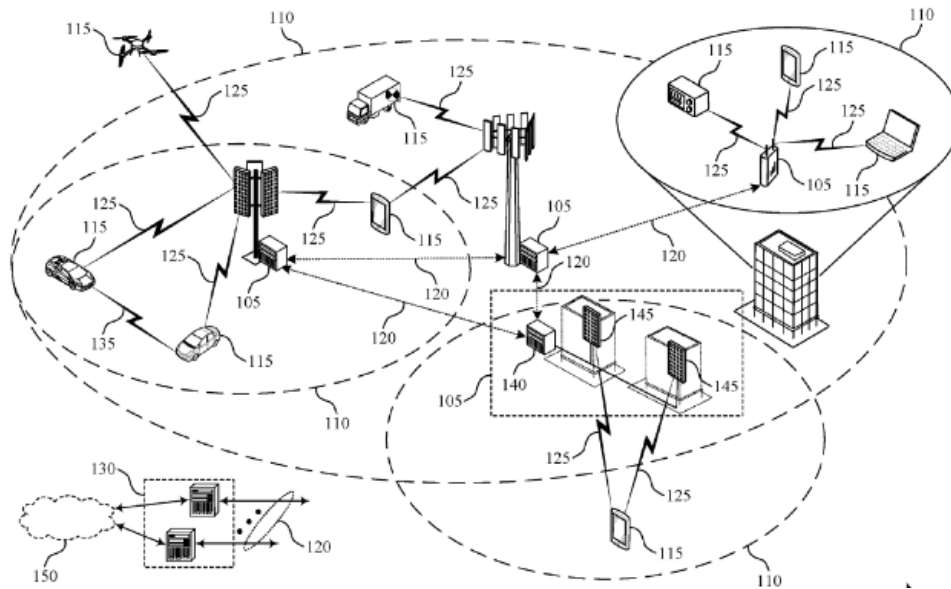
Rankawat, M.; Yao, J.; Zhang, D. & Chih, C. (March 09, 2023). Determining drivable free-space for autonomous vehicles. Recovered March 09, 2023, WIPO IP Portal: https://patentscope.wipo.int/search/en/detail.jsf?docId=US393381135&_cid=P11-LF8B11-85901-1

Information source: (WIPO IP Portal, 2023)



2.3 Configuring a user equipment for Machine Learning

Methods, systems, and devices for wireless communications are described. In some examples, a wireless communications system may support Machine Learning and may configure a User Equipment (UE) for Machine Learning.



Illustrates an example of a wireless communications system that supports configuring a user equipment (UE) for Machine Learning in accordance with aspects.
Credit: Zhu, X., Bernard, G., Aravamudhan, V., Dalmiya, V., Krishnan, S., Kumar, R., Yoo, T., Balevi, E., Gholmieh, A., Prakash, R., WIPO IP Portal

The UE may transmit, to a base station, a request message that includes an indication of a Machine Learning model or a neural network function based at least in part on a trigger event. In response to the request message, the base station may transmit a Machine Learning model, a set of parameters corresponding to the Machine Learning model, or a configuration corresponding to a neural network function and may transmit an activation message to the UE to implement the Machine Learning model and the neural network function.

For more information, visit the following link:

https://patentscope.wipo.int/search/en/detail.jsf?docId=US393382144&_cid=P11-LF8B11-85901-3

Reference

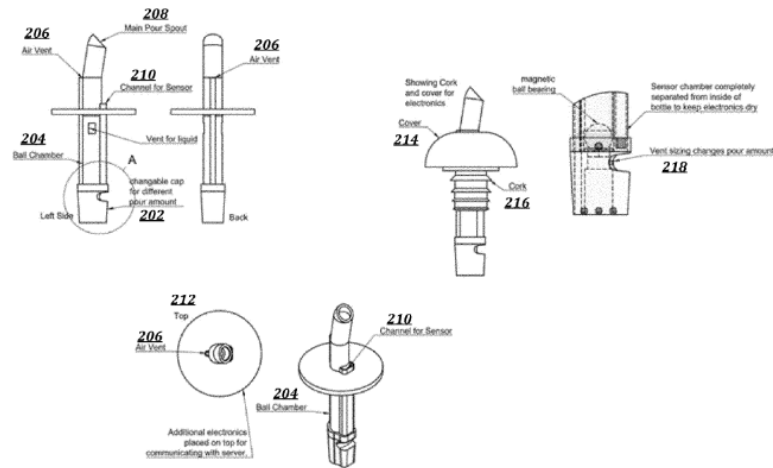
Zhu, X.; Bernard, G.; Aravamudhan, V.; Dalmiya, V.; Krishnan, S.; Kumar, R.; Yoo, T.; Balevi, E.; Gholmieh, A. & Prakash, R. (March 09, 2023). Configuring a user equipment for Machine Learning. Recovered March 09, 2023, WIPO IP Portal: https://patentscope.wipo.int/search/en/detail.jsf?docId=US393382144&_cid=P11-LF8B11-85901-3

Information source: (WIPO IP Portal, 2023)



2.4 Methods, systems, and devices for beverage consumption and inventory control and tracking

In one aspect, the present disclosure provides systems and methods for automatic detection and/or assignment of liquid pouring devices used in connection with inventory tracking.



Illustrates the invention, displaying various perspectives and views that include, but are not limited to, cross sections, individual parts independently viewed and various angles of the embodiment.

Credit: Vince Anido and Justin Park, WIPO IP Portal

A system and associated method may comprise: affixing an identifying device, to a liquid dispensing container, the identifying device being associated with the liquid dispensing container; attaching a liquid pouring device to an opening of the liquid dispensing container; identifying the liquid dispensing container responsive to the liquid pouring device being within a predetermined proximity to the identifying device; and associating data collected from the liquid pouring device with the liquid dispensing container.

For more information, visit the following link:

https://patentscope.wipo.int/search/en/detail.jsf?docId=US393380003&_cid=P11-LF8BTV-91812-2

Reference

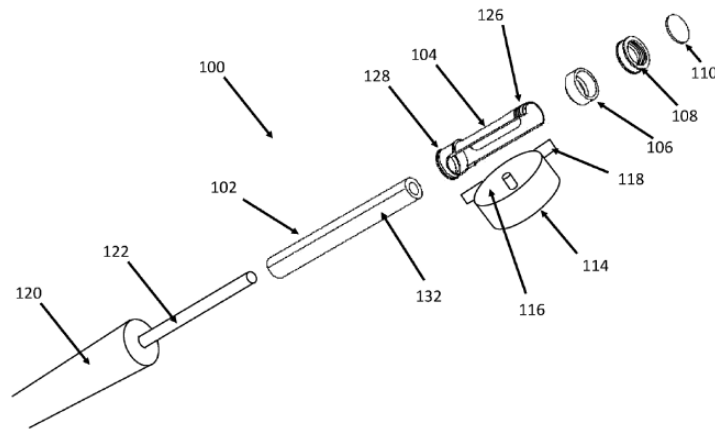
Anido, V. & Park, J. (March 09, 2023). Methods, systems, and devices for beverage consumption and inventory control and tracking. Recovered March 09, 2023, WIPO IP Portal: https://patentscope.wipo.int/search/en/detail.jsf?docId=US393380003&_cid=P11-LF8BTV-91812-2

Information source: (WIPO IP Portal, 2023)



2.5 System and method for attaching fishing reel to fishing rod

Systems and methods are disclosed herein for providing a fishing rod and reel assembly with a single-hand adjustable rod balance point.



Is an exploded isometric illustration of a fishing rod/reel system according to an illustrative embodiment of the invention.

Credit: Karl B. Webber, WIPO IP Portal

The system includes a fishing rod having a handle section supporting a reel seat frame and spool. The reel seat frame and spool are positionable along the handle section to achieve the desired rod balance. The various components are then held in place by a friction fit and a locking nut. Also, the system and method include securely mounting and holding a reel to the rod at any position along the reel seat body to achieve any desired balance point location. Thus, a fisherperson may change reels, spools, line weights, bait, lures, or the like and quickly rebalance the rod and reel assembly for an optimal fishing experience singlehandedly.

For more information, visit the following link:

https://patentscope.wipo.int/search/en/detail.jsf?docId=US393381687&_cid=P11-LF8C8S-00261-1

Reference

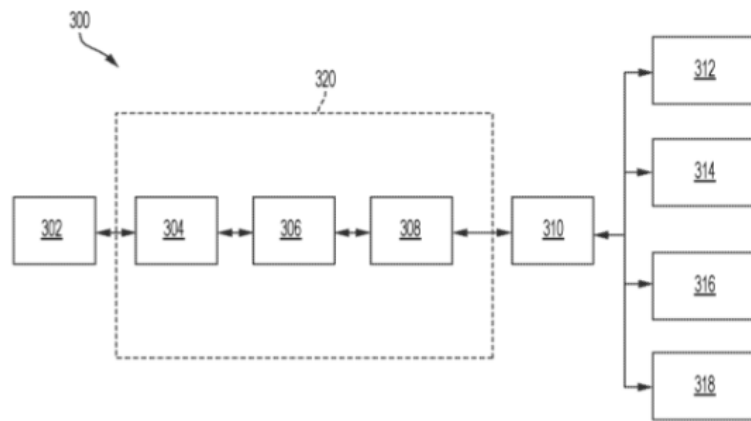
Webber, K. (March 09, 2023). System and method for attaching fishing reel to fishing rod and selectively positioning the reel along the axis of the fishing rod. Recovered March 09, 2023, WIPO IP Portal: https://patentscope.wipo.int/search/en/detail.jsf?docId=US393381687&_cid=P11-LF8C8S-00261-1

Information source: (WIPO IP Portal, 2023)



2.6 Methods and systems for codeless Chatbot development

Embodiments include implementing an iterative process to automatically develop a chatbot conversation for a conversation designer by receiving a conversation design input of one or more conversation design inputs from the conversation designer, identifying an intent based on the conversation design input, generating a development event based on the intent, retrieving a conversation chat flow from a set of conversation chat flows of a code sheet based on the development event.



Depicts a code sheet with a conversation chat flow of a conversation, according to one or more embodiments shown and described herein.

Credit: Shepal Chinmayee, Espacenet Patent Search

The code sheet comprising a set of conversations, the set of conversation chat flows, and a set of rules for code retrieval based on the set of conversations and the set of conversation chat flows, retrieving a chatbot computer program code based on the conversation chat flow and the set of rules from the code sheet, and repeating the iterative process until the chatbot computer program code is automatically retrieved from a code repository for each conversation design input.

For more information, visit the following link:

<https://worldwide.espacenet.com/patent/search/family/083507581/publication/US2023076767A1?q=artificial%20intelligence>

Reference

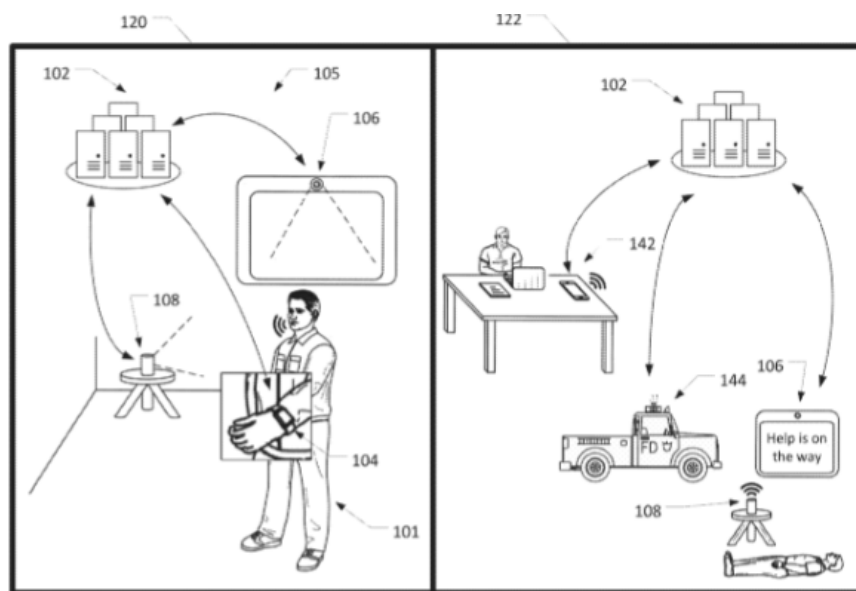
Shepal, C. (March 09, 2023). Methods and systems for codeless Chatbot development. Recovered March 09, 2023, Espacenet Patent Search: <https://worldwide.espacenet.com/patent/search/family/083507581/publication/US2023076767A1?q=artificial%20intelligence>

Information source: (Espacenet Patent Search, 2023)



2.7 Systems and methods for automated medical monitoring and/or diagnosis

Systems and methods are provided involving various medical monitoring and/or diagnostic systems. The monitoring and diagnostic systems may involve one or more connected devices (e.g., a smart watch and/or other sensor device) and may continuously monitor an individual and analyze physiological and other data to determine a medical diagnosis, condition or event has occurred.



Illustrates an exemplary continuous monitoring system for determining a medical diagnosis, in accordance with some aspects of the present invention.

Credit: Seguin Jacques, Espacenet Patent Search

The monitoring and diagnostic systems may be a guided self-examination system for determining a medical diagnosis, condition or event. The medical monitoring and diagnostic systems may even be specific to a family or individuals in a certain geographic location. The systems may determine treatment based on a medical diagnosis or event and may cause the treatment to be delivered to a location of the user or a medical facility.

For more information, visit the following link:

<https://worldwide.espacenet.com/patent/search/family/083355182/publication/US2023070895A1?q=blockchain>

Reference

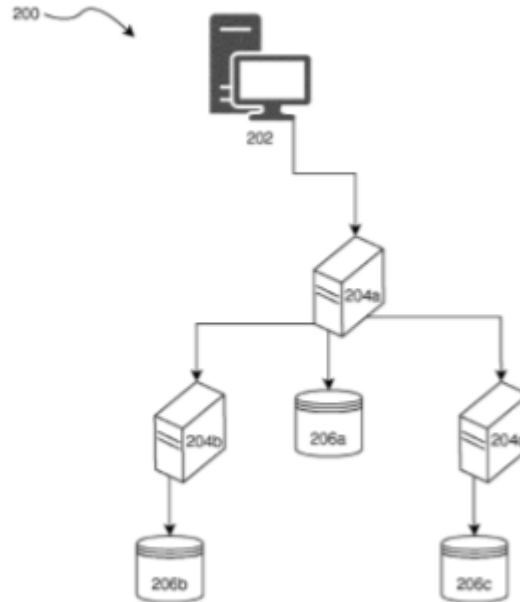
Seguin, J. (March 09, 2023). Systems and methods for automated medical monitoring and/or diagnosis. Recovered March 09, 2023, Espacenet Patent Search: <https://worldwide.espacenet.com/patent/search/family/083355182/publication/US2023070895A1?q=blockchain>

Information source: (Espacenet Patent Search, 2023)



2.8 Federated, decentralized data sharing

Methods and systems for secure, federated, and decentralized ownership, storage, sharing and usage of Big Data are provided.



Is a block diagram of a networked ecosystem for secure, federated, and decentralized sharing of data in accordance with example of the present specification.

Credit: Shtern Mark, Le Justin Ngo, Vytas Paul Darius and Karar Fahad, Espacenet Patent Search

According to one example, a first server maintains access to a plurality of federated data sources including at least one local database and at least one remote database. The local database is subject to a first data policy controlled by the first server and the remote database is subject to a second data policy controlled by a remote server. The first server receives a query from a user electronic device and verifies at least one permission attribute of the user electronic device relative to the data policies. After the federated data operation query has been approved, the first server generates results of the query including data fields from the local and remote databases in compliance with the first and second data policies.

For more information, visit the following link:

<https://worldwide.espacenet.com/patent/search/family/085410646/publication/WO2023028694A1?q=big%20data>

Reference

Shtern, M., Le, J. N., Vytas, P. D., & Karar, F. (March 09, 2023). Federated, decentralized data sharing. Recovered March 09, 2023, Espacenet Patent Search: <https://worldwide.espacenet.com/patent/search/family/085410646/publication/WO2023028694A1?q=big%20data>



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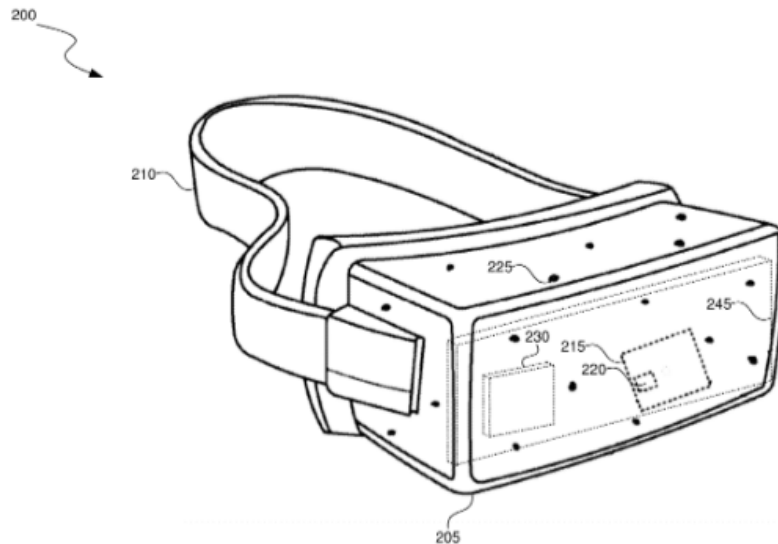


Information source: (Espacenet Patent Search, 2023)



2.9 Parallel video call and Extended Reality spaces

Aspects of the present disclosure are directed to a video call/ artificial or extended reality (VC/XR) connection system that can establish and administer an XR space for a video call. The VC/XR connection system allows users to easily transition from a typical video call experience to the XR space, simply by putting on her artificial reality device.



Is a wire diagram illustrating a virtual reality headset which can be used in some implementations of the present technology.

Credit: Lebeau Michael, Wanbo Björn, Resende Fábio, Rabkin Mark and Rantanen Vesa, Espacenet Patent Search

The VC/XR connection system can identify calendared video call events, establish corresponding XR spaces, and create a link between the video call and the XR space. Invitees to the video call that don an artificial reality device can be automatically taken into the XR space. The XR space can A) connect to the video call as a call participant, allowing the video call participants to see into the XR space and B) show a feed of the video call in the XR space, allowing users in the XR space to see the video call participants.

For more information, visit the following link:

<https://worldwide.espacenet.com/patent/search/family/083457048/publication/US2023071584A1?q=virtual%20reality>

Reference

Lebeau, M. J., Wanbo, B., Resende, F., Rabkin, M., & Rantanen, V. P. (March 09, 2023). Parallel video call and Artificial Reality spaces. Recovered March 09, 2023, Espacenet Patent Search:
<https://worldwide.espacenet.com/patent/search/family/083457048/publication/US2023071584A1?q=virtual%20reality>



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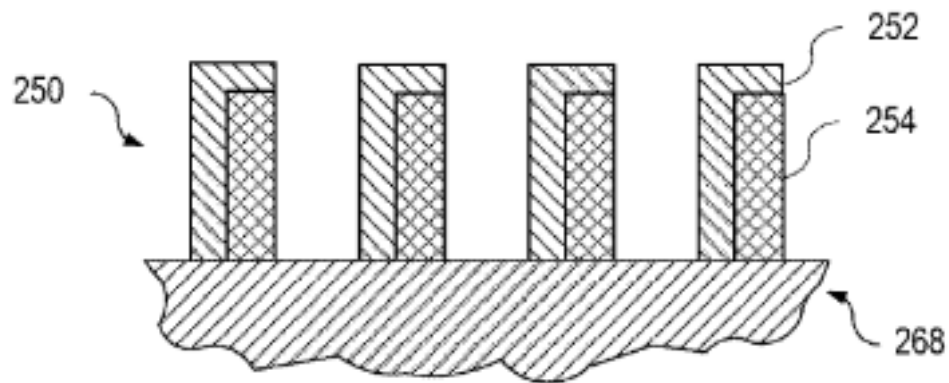


Information source: (Espacenet Patent Search, 2023)



2.10 3D metal partial printing of refiner segments

A method for additive machining of a refiner plate segment having a feature pattern includes:



*Are diagrams illustrating example of bars of feature patterns fabricated in a blank plate segment according to various aspects of the present disclosure.
Credit: Gingras Luc and Raymond Yves, Espacenet Patent Search*

fabricating the refiner plate segment with a partial feature pattern from a first material; performing optical scanning of the refiner plate segment to identify positions of features in the partial feature pattern; automatically generating first code for performing three-dimensional (3D) printing of a second material at first specified locations in the partial feature pattern from data obtained from the optical scanning; and performing 3D printing of the second material at the specified locations.

For more information, visit the following link:

<https://worldwide.espacenet.com/patent/search/family/083996154/publication/WO2023034427A1?q=3d>

Reference

Gingras, Luc; Raymond, Yves (March 09, 2023). 3D metal partial printing of refiner segments. Recovered March 09, 2023, Espacenet Patent Search: <https://worldwide.espacenet.com/patent/search/family/083996154/publication/WO2023034427A1?q=3d>

Information source: (Espacenet Patent Search, 2023)