



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 Artificial Intelligence screens for autism in the blink of an eye

With a single flash of light to the eye, artificial intelligence (AI) could deliver a faster and more accurate way to diagnose autism spectrum disorder (ASD) in children, according to new research from the University of South Australia and Flinders University. Using an electroretinogram (ERG) - a diagnostic test that measures the electrical activity of the retina in response to a light stimulus – researchers have deployed AI to identify specific features to classify ASD.



Credit: University of South Australia

Measuring retinal responses of 217 children aged 5-16 years (71 with diagnosed ASD and 146 children without an ASD diagnosis), researchers found that the retina generated a different retinal response in the children with ASD as compared to those who were neuro typical. The team also found that the strongest biomarker was achieved from a single bright flash of light to the right eye, with AI processing significantly reducing the test time. The study found that higher frequency components of the retinal signal were reduced in ASD. Conducted with University of Connecticut and University College London, the test could be further evaluated to see if these results could be used to screen for ASD among children aged 5 to 16 years with a high level of accuracy. ASD is a neurodevelopmental condition characterised by difficulties in reciprocal social interactions, communication, and repetitive/restrictive behaviours.

For more information, visit the following link:

<https://www.unisa.edu.au/media-centre/Releases/2023/ai-screens-for-autism-in-the-blink-of-an-eye/>

Reference

Mansfield, A. (Dec 18, 2023). AI screens for autism in the blink of an eye. Recovered Dec 18, 2023, University of South Australia:

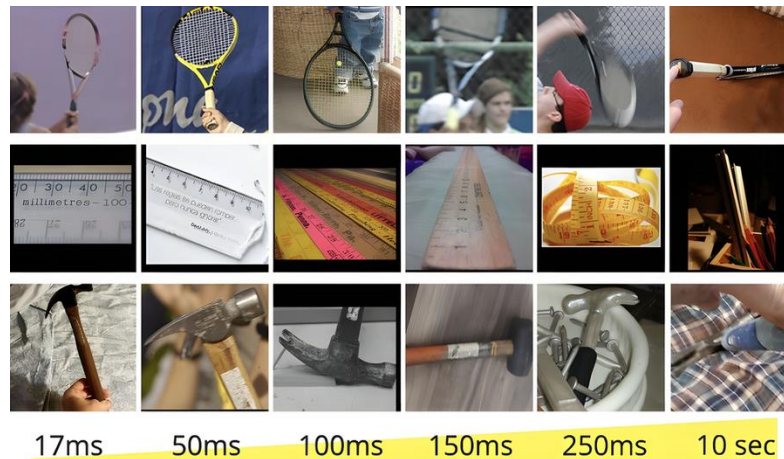
<https://www.unisa.edu.au/media-centre/Releases/2023/ai-screens-for-autism-in-the-blink-of-an-eye/>

Information source: (University of South Australia, 2023)



1.2 Image recognition accuracy

Imagine you are scrolling through the photos on your phone and you come across an image that at first you can't recognize. It looks like maybe something fuzzy on the couch; could it be a pillow or a coat? After a couple of seconds it clicks — of course! That ball of fluff is your friend's cat, Mocha. While some of your photos could be understood in an instant, why was this cat photo much more difficult? MIT Computer Science and Artificial Intelligence Laboratory (CSAIL) researchers were surprised to find that despite the critical importance of understanding visual data in pivotal areas ranging from health care to transportation to household devices, the notion of an image's recognition difficulty for humans has been almost entirely ignored.



MVT, minimum viewing time, is a dataset difficulty metric measuring the minimum presentation time required for an image to be recognized.

Credit: courtesy of the researchers, Massachusetts Institute of Technology

One of the major drivers of progress in Deep Learning-based AI has been datasets, yet we know little about how data drives progress in large-scale Deep Learning beyond that bigger is better. In real-world applications that require understanding visual data, humans outperform object recognition models despite the fact that models perform well on current datasets, including those explicitly designed to challenge machines with debiased images or distribution shifts.

For more information, visit the following link:

<https://news.mit.edu/2023/image-recognition-accuracy-minimum-viewing-time-metric-1215>

Reference

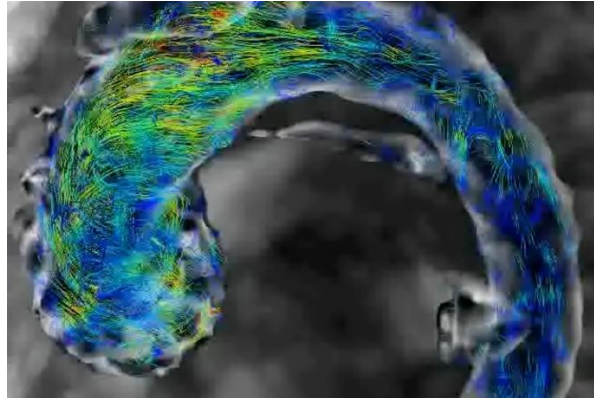
Gordon, R. (Dec 15, 2023). Image recognition accuracy: An unseen challenge confounding today's AI. Recovered Dec 15, 2023, Massachusetts Institute of Technology:
<https://news.mit.edu/2023/image-recognition-accuracy-minimum-viewing-time-metric-1215>

Information source: (Massachusetts Institute of Technology, 2023)



1.3 Unstable “fluttering” predicts aortic aneurysm

Northwestern University researchers have developed the first physics-based metric to predict whether or not a person might someday suffer an aortic aneurysm, a deadly condition that often causes no symptoms until it ruptures. In the new study, the researchers forecasted abnormal aortic growth by measuring subtle “fluttering” in a patient’s blood vessel. As blood flows through the aorta, it can cause the vessel wall to flutter, similar to how a banner ripples in the breeze. While stable flow predicts normal, natural growth, unstable flutter is highly predictive of future abnormal growth and potential rupture, the researchers found.



*A 4D flow MRI scan of a human aorta. Called the “flutter instability parameter” (FIP), the new metric predicted future aneurysm with 98% accuracy on average three years after the FIP was first measured.
Credit: Ethan Johnson, Northwestern University*

Called the “flutter instability parameter” (FIP), the new metric predicted future aneurysm with 98% accuracy on average three years after the FIP was first measured. To calculate a personalized FIP, patients only need a single 4D flow magnetic resonance imaging (MRI) scan. Using the clinically measurable, predictive metric, physicians could prescribe medications to high-risk patients to intervene and potentially prevent the aorta from swelling to a dangerous size.

For more information, visit the following link:

<https://news.northwestern.edu/stories/2023/12/unstable-fluttering-predicts-aortic-aneurysm/>

Reference

Morris, A. (Dec 15, 2023). Unstable “fluttering” predicts aortic aneurysm. Recovered Dec 15, 2023, Northwestern University:

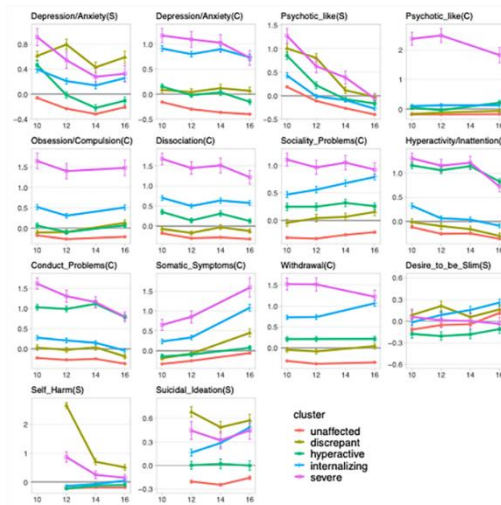
<https://news.northwestern.edu/stories/2023/12/unstable-fluttering-predicts-aortic-aneurysm/>

Information source: (Northwestern University, 2023)



1.4 Using Deep Learning to identify teens most in need of mental health support

In Japan, suicide is sadly the leading cause of death for young people. Researchers, including from the University of Tokyo, have carried out a six-year study to better understand the myriad of factors which can impact adolescent mental health. After surveying 2,344 adolescents and their caregivers, and using computer-based Deep Learning to process the results, they were able to identify five categories which the young people could be grouped into. Nearly 40% of those involved were classified as groups with some problems. Of these, almost 10% lived with mental health problems which had not been identified by their caregivers. This group were most at risk of self-harm and suicidal ideation. Identifying the factors which may lead young people to suicide and who is most at risk is key to supporting preventive efforts and early intervention.



*Trajectories for the five groups identified by Deep Learning.
Credit: © 2023, Daiki Nagaoka, The University of Tokyo*

Last year in Japan, 514 youths and children aged 18 and younger tragically lost their lives to suicide. This was the highest number for this age group since records began in 1978. Suicide is sadly the leading cause of death for people aged 15 to 34 years old, according to data from Japan's Ministry of Health, Labor and Welfare. Officials speculate that school-related issues, difficult personal and family relationships, and lingering impacts of the pandemic may have contributed to the high number of deaths.

For more information, visit the following link:

https://www.u-tokyo.ac.jp/focus/en/press/z0508_00324.html

Reference

Ando, S. (Dec 14, 2023). Using Deep Learning to identify teens most in need of mental health support. Recovered Dec 15, 2023, The University of Tokyo: https://www.u-tokyo.ac.jp/focus/en/press/z0508_00324.html

Information source: (The University of Tokyo, 2023)



1.5 Upcycling leftover cardboard to make a new type of foam packaging

With the holiday season in full swing, gifts of all shapes and sizes are being shipped around the world. But all that packaging generates lots of waste, including cardboard boxes and plastic-based foam cushioning, such as Styrofoam™. Rather than discard those boxes, developed a cushioning foam from cardboard waste. Their upcycled material was stronger and more insulating than traditional, plastic foam-based cushioning.



*This cardboard-based foam reinforced with gelatin could make packaging materials more sustainable.
Credit: American Chemical Society*

Among the many kinds of trash that accumulate within a home, wastepaper is one of the most common. Everything from newspapers and junk mail to paperboard envelopes and cardboard boxes can pile up, especially as internet shopping has exploded in popularity. Researchers are interested in turning these containers and paper waste into something else that's useful — sturdy but light mailing materials. Currently, to keep electronics and toys nestled tightly inside of a box, molded cushioning materials, such as Styrofoam, are typically used. A sustainable alternative could be lightweight, cellulose aerogels, but current methods to produce them from wastepaper require several chemical pretreatment steps. So, Jinsheng Gou and colleagues wanted to find a simpler way to make a wastepaper-based foam material that could withstand the roughest of deliveries.

For more information, visit the following link:

<https://www.acs.org/pressroom/presspacs/2023/december/upcycling-leftover-cardboard-to-make-new-type-of-foam-packaging.html>

Reference

American Chemical Society. (Dec 14, 2023). Upcycling leftover cardboard to make a new type of foam packaging. Recovered Dec 18, 2023, American Chemical Society:

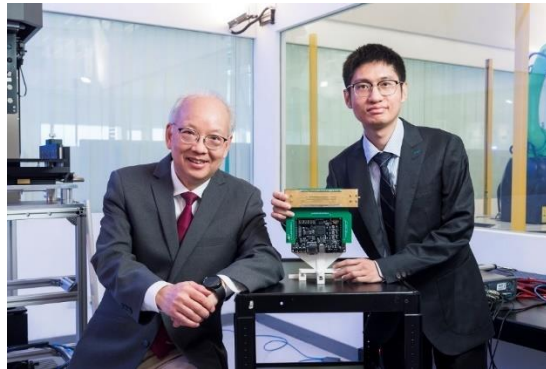
<https://www.acs.org/pressroom/presspacs/2023/december/upcycling-leftover-cardboard-to-make-new-type-of-foam-packaging.html>

Information source: (American Chemical Society, 2023)



1.6 Universal metasurface antenna for high-security 6G communications

A research team led by Professor Chan Chi-hou, Chair Professor of Electronic Engineering at City University of Hong Kong (CityU), achieved an unprecedented advance in antenna technology by making possible the manipulation of all five fundamental properties of electromagnetic waves through software control. In a world first, the team developed a universal metasurface antenna that allows the independent and simultaneous manipulation of amplitude, phase, frequency, polarisation and direction of electromagnetic radiation.



Professor Chan Chi-hou (left) and Professor Wu Gengbo (right) showcase the universal metasurface antenna developed at CityU, which allows unprecedented manipulation of electromagnetic waves.

Credit: City University of Hong Kong

“A universal component capable of manipulating all the fundamental wave properties is the Holy Grail for physicists and engineers,” said Professor Chan, who is also Director of the State Key Laboratory of Terahertz and Millimeter Waves (SKLTMW). As research on 6G wireless communication systems progresses worldwide, the universal metasurface antenna holds immense potential for various applications in 6G systems. Its advanced waveform manipulation capabilities and enhanced security features are crucial for integrating sensing and communications. The universal metasurface antenna can be used for next-generation, large-capacity, high-security information systems, real-time imaging, and wireless power transfer.

For more information, visit the following link:

<https://www.cityu.edu.hk/research/stories/2023/12/14/cityu-develops-worlds-first-universal-metasurface-antenna-high-security-6g-communications>

Reference

City University of Hong Kong. (Dec 14, 2023). CityU develops the world’s first universal metasurface antenna for high-security 6G communications. Recovered Dec 18, 2023, City University of Hong Kong:

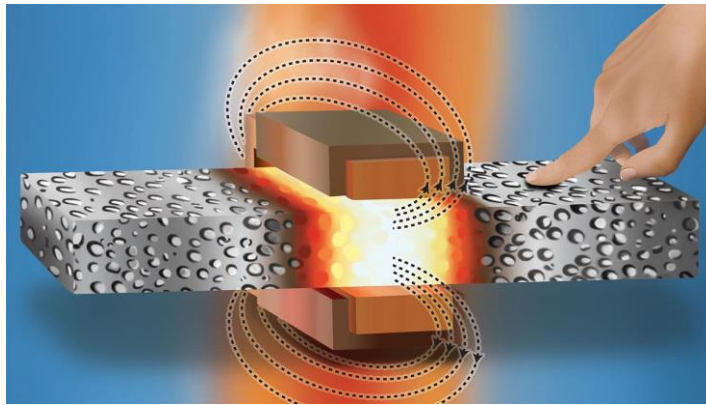
<https://www.cityu.edu.hk/research/stories/2023/12/14/cityu-develops-worlds-first-universal-metasurface-antenna-high-security-6g-communications>

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



1.7 Find way to weld metal foam without melting its bubbles

Researchers at North Carolina State University have now identified a welding technique that can be used to join composite metal foam (CMF) components together without impairing the properties that make CMF desirable. CMFs hold promise for a wide array of applications because the pockets of air they contain make them light, strong and effective at insulating against high temperatures. CMFs are foams that consist of hollow, metallic spheres – made of materials such as stainless steel or titanium – embedded in a metallic matrix made of steel, titanium, aluminum or other metallic alloys. The resulting material is both lightweight and remarkably strong, with potential applications ranging from aircraft wings to vehicle armor and body armor.



Credit: North Carolina State University

In addition, CMF is better at insulating against high heat than conventional metals and alloys, such as steel. The combination of weight, strength and thermal insulation means that CMF also holds promise for use in storing and transporting nuclear material, hazardous materials, explosives and other heat-sensitive materials. However, in order to realize many of these applications, manufacturers would need to weld multiple CMF components together. And that has posed a problem.

For more information, visit the following link:
<https://news.ncsu.edu/2023/12/welding-metal-foam>

Reference

Shipman, M. (Dec 14, 2023). Researchers find way to weld metal foam without melting its bubbles. Recovered Dec 18, 2023, North Carolina State University:
<https://news.ncsu.edu/2023/12/welding-metal-foam>

Information source: (North Carolina State University, 2023)



1.8 Biofuels and carbon crops take flight

Every year, airplanes crisscrossing U.S. skies burn 23 billion gallons of fuel, leaving contrails and 8% of the nation's transportation-related greenhouse gas (GHG) emissions in their wake. A recent study by researchers from the U.S. Department of Energy's (DOE) Lawrence Berkeley National Laboratory (Berkeley Lab) and Sandia National Laboratories reveals which crop-based feedstocks offer the greatest potential for a plentiful, cost-competitive, renewable alternative to petroleum-based jet fuel, while also maximizing atmospheric carbon removal.



Credit: Jenny Nuss, Lawrence Berkeley National Laboratory

While electric cars are replacing gasoline powered vehicles on U.S. roads, currently only liquid jet fuels can reliably propel the planes needed to keep hundreds of passengers and tons of cargo in the air. It is estimated that replacing the nation's current fleet of more than 167,000 aircraft with new aviation technology would take 20-30 years, based on the average plane lifespan. Production of sustainable aviation fuel (SAF) from renewable biomass can make it possible to meet the ambitious national goal of cutting the aviation sector's GHG emissions in half by 2050, and it will power existing plane engines.

For more information, visit the following link:

<https://newscenter.lbl.gov/2023/12/14/biofuels-and-carbon-crops-take-flight/>

Reference

Breitenbach, A. (Dec 14, 2023). Biofuels and carbon crops take flight. Recovered Dec 18, 2023, Lawrence Berkeley National Laboratory:

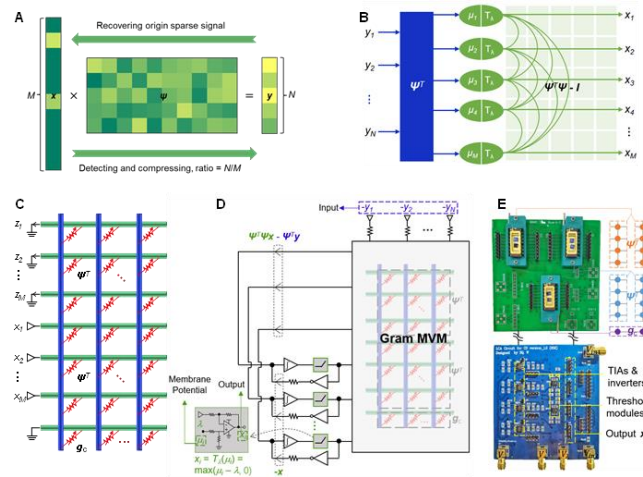
<https://newscenter.lbl.gov/2023/12/14/biofuels-and-carbon-crops-take-flight/>

Information source: (Lawrence Berkeley National Laboratory, 2023)



1.9 Pushing compressed sensing to real-time edge applications

Recently, a research team led by Prof. Sun Zhong at Peking University reported an analog hardware solution for real-time compressed sensing recovery. In this work, a design based on a resistive memory (also known as memristor) array for performing instantaneous matrix-matrix-vector multiplication (MMVM) is first introduced. Based on this module, then an analog matrix computing circuit that solves compressed sensing (CS) recovery in one step (within few microseconds) is disclosed.



*The design of MMVM and LCA circuits.
Credit: Peking University*

CS has been the cornerstone of modern signal and image processing, across many important fields such as medical imaging, wireless communications, object tracking, and single-pixel cameras. In CS, sparse signals can be highly undersampled in the front-end sensor, which breaks through the Nyquist rate and thus significantly improving sampling efficiency. In the back-end processor, the original signals can be faithfully reconstructed by solving a sparse approximation problem. However, the CS recovery algorithm is usually very complicated and involves high-complexity matrix-matrix operations and pointwise nonlinear functions. As a result, CS recovery in the back-end processor has become the accepted bottleneck in the CS pipeline, which prevents its application in high-speed, real-time signal processing scenarios.

For more information, visit the following link:

https://newsen.pku.edu.cn/news_events/news/research/13855.html

Reference

Peking University. (Dec 14, 2023). Pushing compressed sensing to real-time edge applications. Recovered Dec 18, 2023, Peking University:

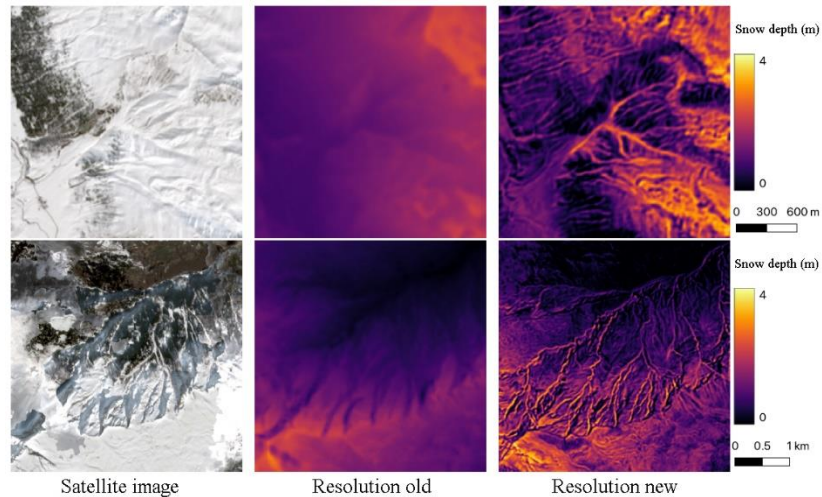
https://newsen.pku.edu.cn/news_events/news/research/13855.html

Information source: (Peking University, 2023)



1.10 Accurate snow measurement thanks to Artificial Intelligence and satellites

How much snow is there up in the mountains, and where exactly is it? The answer is of just as much interest to the winter tourism industry and operators of hydropower plants as it is to winter sport enthusiasts looking to gauge the risk of avalanches. But measuring snow depth is a challenging task for a host of reasons: it can change fast depending on the weather, it varies greatly according to terrain and is not immediately discernible on overhead-images.



The ETH researchers' technology generates higher-resolution snow maps for the whole of Switzerland than was previously possible.

Crédito: Eidgenössische Technische Hochschule Zürich

Today, snow monitoring in Switzerland is based mainly on data provided by meteorological stations. But as there are only around 400 of these in the entire country, snow data for many places is rather imprecise. This is now set to change: ETH researchers led by Konrad Schindler, Professor of Photogrammetry and Remote Sensing at ETH Zurich, teamed up with the Swiss company ExoLabs, a University of Zurich spin-off, to develop a technology that uses satellite images and artificial intelligence to determine snow depth faster and more accurately than before.

For more information, visit the following link:

<https://ethz.ch/en/news-and-events/eth-news/news/2023/12/accurate-snow-measurement-thanks-to-ai-and-satellites.html>

Reference

Elhardt, C. (Dec 14, 2023). Accurate snow measurement thanks to AI and satellites. Recovered Dec 19, 2023, Eidgenössische Technische Hochschule Zürich:

<https://ethz.ch/en/news-and-events/eth-news/news/2023/12/accurate-snow-measurement-thanks-to-ai-and-satellites.html>

Information source: (Eidgenössische Technische Hochschule Zürich, 2023)



1.11 New transparent magnetic material created by adding heat with a laser

In a significant advancement in optical technology, researchers from Tohoku University and Toyohashi University of Technology have developed a new method for creating transparent magnetic materials using laser heating. This breakthrough, recently published in the journal *Optical Materials*, presents a novel approach to integrating magneto-optical materials with optical devices, a long-standing challenge in the field.



Credit: Tohoku University

"The key to this achievement lies in creating 'Cerium-substituted Yttrium Iron Garnet (Ce:YIG)', a transparent magnetic material, employing a specialized laser heating technique," points out Taichi Goto, associate professor at Tohoku University's Electrical Communication Research Institute and co-author of the study. *"This method addresses the key challenge of integrating magneto-optical materials with optical circuits without damaging them - a problem that has hindered advancements in miniaturizing optical communication devices."* Magneto-optical isolators are vital for ensuring stable optical communication. They act like traffic directors for light signals, allowing them to move in one direction but not the other. Integrating these isolators into silicon-based photonic circuits is challenging due to the high-temperature processes typically involved. As a result of this conundrum, Goto and his colleagues focused their attention on laser annealing - a technique that selectively heats specific areas of a material by laser. This allows for precise control, influencing only the targeted regions without affecting surrounding areas.

For more information, visit the following link:

https://www.tohoku.ac.jp/en/press/new_transparent_magnetic_material_created_by_adding_heat_with_a_laser.html

Reference

Goto, T. (Dec 14, 2023). New transparent magnetic material created by adding heat with a laser. Recovered Dec 19, 2023, Tohoku University:

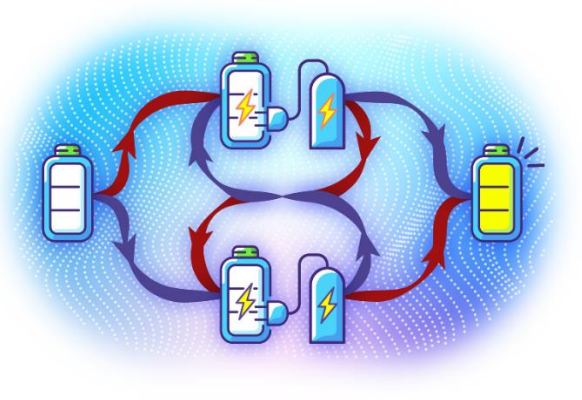
https://www.tohoku.ac.jp/en/press/new_transparent_magnetic_material_created_by_adding_heat_with_a_laser.html

Information source: (Tohoku University, 2023)



1.12 Quantum batteries break causality

Batteries that exploit quantum phenomena to gain, distribute and store power promise to surpass the abilities and usefulness of conventional chemical batteries in certain low-power applications. For the first time, researchers including those from the University of Tokyo take advantage of an unintuitive quantum process that disregards the conventional notion of causality to improve the performance of so-called quantum batteries, bringing this future technology a little closer to reality.



*Charging quantum batteries in indefinite causal order.
Credit: The University of Tokyo*

When you hear the word “*quantum*,” the physics governing the subatomic world, developments in quantum computers tend to steal the headlines, but there are other upcoming quantum technologies worth paying attention to. One such item is the quantum battery which, though initially puzzling in name, holds unexplored potential for sustainable energy solutions and possible integration into future electric vehicles. Nevertheless, these new devices are poised to find use in various portable and low-power applications, especially when opportunities to recharge are scarce. At present, quantum batteries only exist as laboratory experiments, and researchers around the world are working on the different aspects that are hoped to one day combine into a fully functioning and practical application. Graduate student Yuanbo Chen and Associate Professor Yoshihiko Hasegawa from the Department of Information and Communication Engineering at the University of Tokyo are investigating the best way to charge a quantum battery, and this is where time comes into play. One of the advantages of quantum batteries is that they should be incredibly efficient, but that hinges on the way they are charged.

For more information, visit the following link:

https://www.u-tokyo.ac.jp/focus/en/press/z0508_00323.html

Reference

Yoshihiko, H. (Dec 14, 2023). Quantum batteries break causality. Recovered Dec 19, 2023, The University of Tokyo:

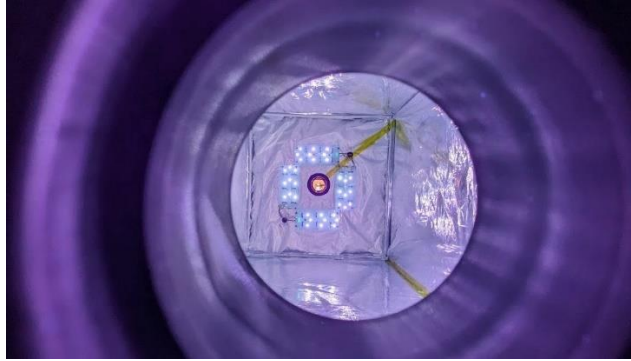
https://www.u-tokyo.ac.jp/focus/en/press/z0508_00323.html

Information source: (The University of Tokyo, 2023)



1.13 "Methane cleaner", could become a permanent fixture in cattle and pig barns

In a spectacular new study, researchers from the University of Copenhagen have used light and chlorine to eradicate low-concentration methane from air. The result gets us closer to being able to remove greenhouse gases from livestock housing, biogas production plants and wastewater treatment plants to benefit the climate.



A look inside the MEPS reactor (Methane Eradication Photochemical System), where chlorine atoms are formed by UV light and react with methane gas
Credit: Morten Krogsbøll, University of Copenhagen

The Intergovernmental Panel on Climate Change (IPCC) has determined that reducing methane gas emissions will immediately reduce the rise in global temperatures. The gas is up to 85 times more potent of a greenhouse gas than CO₂, and more than half of it is emitted by human sources, with cattle and fossil fuel production accounting for the largest share. A unique new method developed by a research team at the University of Copenhagen's Department of Chemistry and spin-out company Ambient Carbon has succeeded in removing methane from air. *"A large part of our methane emissions comes from millions of low-concentration point sources like cattle and pig barns. In practice, methane from these sources has been impossible to concentrate into higher levels or remove. But our new result proves that it is possible using the reaction chamber that we've have built,"* says Matthew Stanley Johnson, the UCPH atmospheric chemistry professor who led the study.

For more information, visit the following link:

<https://science.ku.dk/english/press/news/2023/researchers-invent-methane-cleaner-could-become-a-permanent-fixture-in-cattle-and-pig-barns>

Reference

Stanley, M. (Dic 18, 2023). Researchers invent "methane cleaner": Could become a permanent fixture in cattle and pig barns. Recovered Dic 19, 2023, University of Copenhagen:

<https://science.ku.dk/english/press/news/2023/researchers-invent-methane-cleaner-could-become-a-permanent-fixture-in-cattle-and-pig-barns>

Information source: (University of Copenhagen, 2023)



1.14 A picking robot for the greenhouse

Working in a greenhouse is both strenuous and time-consuming. The picking robot from ETH spin-off Floating Robotics takes on particularly repetitive tasks, thereby alleviating the strain on human pickers. It is currently undergoing testing at Beerstecher AG in Hinwil.



Credit: Nicole Davidson, Eidgenössische Technische Hochschule Zürich

The work in the greenhouse at Beerstecher AG in Hinwil is demanding. With humidity levels of 80 percent and temperatures of up to 35 degrees Celsius, those working in it very soon find themselves exhausted. The family business in Hinwil is consequently faced with a challenge when finding and retaining suitable labour for its vegetable harvests. The picking robot from ETH spin-off Floating Robotics addresses these challenges. It automates crucial tasks such as defoliating, harvesting and boxing vegetables. *“The robot primarily takes over strenuous and repetitive activities, allowing our employees to focus on more demanding tasks that require a creative and critical mindset,”* explains Bianca Curcio, who is responsible for production management in the Beerstecher greenhouse and is an ETH Zurich alumna.

For more information, visit the following link:

<https://ethz.ch/en/news-and-events/eth-news/news/2023/12/a-picking-robot-for-the-greenhouse.html>

Reference

Davidson, N. (Dec 18, 2023). A picking robot for the greenhouse. Recovered Dec 19, 2023, Eidgenössische Technische Hochschule Zürich:

<https://ethz.ch/en/news-and-events/eth-news/news/2023/12/a-picking-robot-for-the-greenhouse.html>

Information source: (Eidgenössische Technische Hochschule Zürich, 2023)



1.15 A micro-ring resonator with big potential

The team at EPFL's Photonic Systems Laboratory has developed a chip-scale laser source that enhances the performance of semiconductor lasers while enabling the generation of shorter wavelengths. The team's approach involves coupling commercially available semiconductor lasers with a silicon nitride chip. This tiny chip is created with industry-standard, cost-efficient CMOS technology. Thanks to the material's exceptional low-loss properties, there is little to no light that is absorbed or escapes. The light from the semiconductor laser flows through microscopic waveguides into extremely small cavities, where the beam is trapped. These cavities, called micro-ring resonators, are intricately designed to resonate at specific frequencies, selectively amplifying the desired wavelengths while attenuating others, thereby achieving enhanced coherence in the emitted light.



Credit: École Polytechnique Fédérale de Lausanne

The other significant achievement is the hybrid system's ability to double the frequency of the light coming from the commercial semiconductor laser— enabling a shift from the near-infrared spectrum to the visible light spectrum. The relationship between frequency and wavelength is inversely proportional, meaning that if the frequency is doubled, the wavelength is reduced by half. While the near infrared spectrum is exploited for telecommunications, higher frequencies are essential for building smaller, more efficient devices where shorter wavelengths are needed, such as in atomic clocks and medical devices.

For more information, visit the following link:

<https://actu.epfl.ch/news/a-micro-ring-resonator-with-big-potential-3/>

Reference

David, M. (Dec 18, 2023). A micro-ring resonator with big potential. Recovered Dec 20, 2023, École Polytechnique Fédérale de Lausanne:

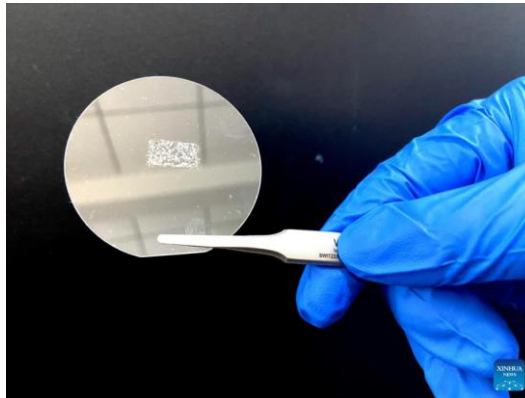
<https://actu.epfl.ch/news/a-micro-ring-resonator-with-big-potential-3/>

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



1.16 Invent ultrathin optical crystal for next-generation laser tech

A team of Chinese researchers used a novel theory to invent a new type of ultrathin optical crystal with high energy efficiency, laying the foundation for next-generation laser technology. Prof. Wang Enge from the School of Physics, Peking University, recently told Xinhua that the Twist Boron Nitride made by the team, with a micron-level thickness, is the thinnest optical crystal currently known in the world. Compared with traditional crystals of the same thickness, its energy efficiency is raised by 100 to 10,000 times.



Credit: Xinhua/Wei Mengjia, Peking University

Wang, also an academician of the Chinese Academy of Sciences, said this achievement is an original innovation by China in the theory of optical crystals, and has created a new field of making optical crystals with two-dimensional thin-film materials of light elements. Laser is one of the underlying technologies of the information society. Optical crystals can realize the functions of frequency conversion, parametric amplification and signal modulation, to name a few, and are the key parts of laser devices. In the past 60 years, the research and development of optical crystals has been mainly guided by two phase-matching theories proposed by scientists in the United States. However, due to the limitations of traditional theory models and material systems, the existing crystals have struggled to meet the future requirements for developing laser devices, such as miniaturization, high integration and functionalization. The development of new-generation laser technology needs breakthroughs in optical crystal theory and materials.

For more information, visit the following link:

https://newsen.pku.edu.cn/news_events/news/research/13872.html

Reference

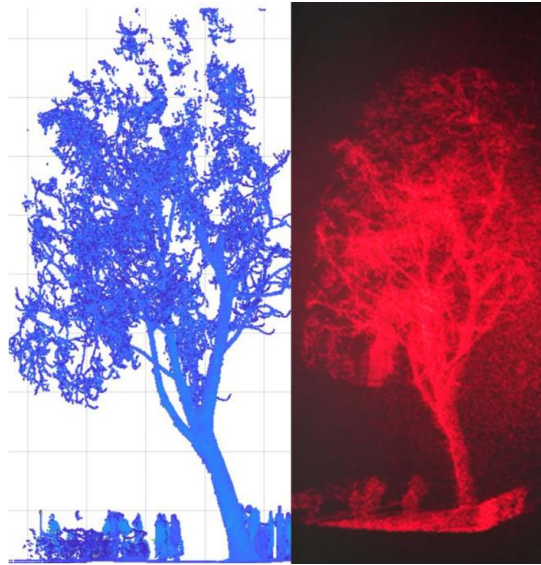
Peking University. (Dec 20, 2023). PKU scientists and collaborators invent ultrathin optical crystal for next-generation laser tech. Recovered Dec 20, 2023, Peking University: https://newsen.pku.edu.cn/news_events/news/research/13872.html

Information source: (Peking University, 2023)



1.17 360-degree head-up display view could warn drivers of road obstacles in real time

Researchers have developed an augmented reality head-up display that could improve road safety by displaying potential hazards as high-resolution three-dimensional holograms directly in a driver's field of vision in real time. Current head-up display systems are limited to two-dimensional projections onto the windscreen of a vehicle, but researchers from the Universities of Cambridge, Oxford and University College London developed a system using a 3D laser scanner and LiDAR data to create a fully 3D representation of London streets.



*LiDAR data (left), Holographic result (right)
Credit: University of Cambridge*

The system they developed can effectively 'see through' objects to project holographic representations of road obstacles that are hidden from the driver's field of view, aligned with the real object in size and distance. For example, a road sign blocked from view by a large truck would appear as a 3D hologram so that the driver knows exactly where the sign is and what information it displays. The 3D holographic projection technology keeps the driver's focus on the road instead of the windscreen, and could improve road safety by projecting road obstacles and potential hazards in real time from any angle.

For more information, visit the following link:

<https://www.cam.ac.uk/stories/lidar-holograms-for-driving>

Reference

Collins, S. (Dec 20, 2023). 360-degree head-up display view could warn drivers of road obstacles in real time. Recovered Dec 20, 2023, University of Cambridge:
<https://www.cam.ac.uk/stories/lidar-holograms-for-driving>

Information source: (University of Cambridge, 2023)



1.18 Final color of efficient OLEDs finally viable in lighting

Lights could soon use the full color suite of perfectly efficient organic light-emitting diodes, or OLEDs, that last tens of thousands of hours, thanks to an innovation from physicists and engineers at the University of Michigan. The U-M team's new phosphorescent OLEDs, commonly referred to as PHOLEDs, can maintain 90% of the blue light intensity for 10-14 times longer than other designs that emit similar deep blue colors. That kind of lifespan could finally make blue PHOLEDs hardy enough to be commercially viable in lights that meet the Department of Energy's 50,000-hour lifetime target. Without a stable blue PHOLED, OLED lights need to use less-efficient technology to create white light.



Credit: Joseph Xu, University of Michigan

The lifetime of the new blue PHOLEDs currently is only long enough to use as lighting, but the same design principle could be combined with other light-emitting materials to create blue PHOLEDs hardy enough for TVs, phone screens and computer monitors. Display screens with blue PHOLEDs could potentially increase a device's battery life by 30%.

For more information, visit the following link:

<https://news.umich.edu/blue-pholeds-final-color-of-efficient-oleds-finally-viable-in-lighting/>

Reference

Smith, D. (Dec 20, 2023). Blue PHOLEDs: Final color of efficient OLEDs finally viable in lighting. Recovered Dec 20, 2023, University of Michigan:

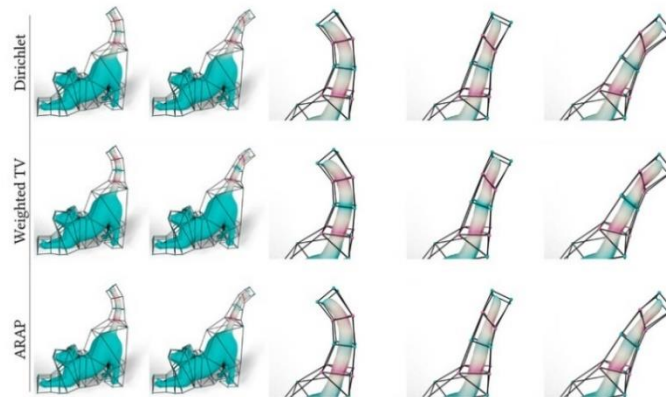
<https://news.umich.edu/blue-pholeds-final-color-of-efficient-oleds-finally-viable-in-lighting/>

Information source: (University of Michigan, 2023)



1.19 A flexible solution to help artists improve animation

Artists who bring to life heroes and villains in animated movies and video games could have more control over their animations, thanks to a new technique introduced by MIT researchers. Their method generates mathematical functions known as barycentric coordinates, which define how 2D and 3D shapes can bend, stretch, and move through space. For example, an artist using their tool could choose functions that make the motions of a 3D cat's tail fit their vision for the "look" of the animated feline.



MIT researchers have introduced a versatile technique that gives an animator the flexibility to see how different mathematical functions deform complex 2D or 3D characters. The new technique lets animators choose the function that best fits their vision for the animation.

Credit: Courtesy of the researchers, Massachusetts Institute of Technology

Many other techniques for this problem are inflexible, providing only a single option for the barycentric coordinate functions for a certain animated character. Each function may or may not be the best one for a particular animation. The artist would have to start from scratch with a new approach each time they want to try for a slightly different look. "As researchers, we can sometimes get stuck in a loop of solving artistic problems without consulting with artists. What artists care about is flexibility and the "look" of their final product. They don't care about the partial differential equations your algorithm solves behind the scenes," says Ana Dodik, lead author of a paper on this technique. Beyond its artistic applications, this technique could be used in areas such as medical imaging, architecture, virtual reality, and even in computer vision as a tool to help robots figure out how objects move in the real world.

For more information, visit the following link:

<https://news.mit.edu/2023/flexible-solution-help-artists-improve-animation-1220>

Reference

Zewe, A. (Dec 20, 2023). A flexible solution to help artists improve animation. Recovered Dec 20, 2023, Massachusetts Institute of Technology:

<https://news.mit.edu/2023/flexible-solution-help-artists-improve-animation-1220>

Information source: (Massachusetts Institute of Technology, 2023)



1.20 New brain-like transistor mimics human intelligence

Taking inspiration from the human brain, researchers have developed a new synaptic transistor capable of higher-level thinking. Designed by researchers at Northwestern University, Boston College and the Massachusetts Institute of Technology (MIT), the device simultaneously processes and stores information just like the human brain. In new experiments, the researchers demonstrated that the transistor goes beyond simple machine-learning tasks to categorize data and is capable of performing associative learning.



*An artistic interpretation of brain-like computing.
Credit: Xiaodong Yan, Northwestern University*

Although previous studies have leveraged similar strategies to develop brain-like computing devices, those transistors cannot function outside cryogenic temperatures. The new device, by contrast, is stable at room temperatures. It also operates at fast speeds, consumes very little energy and retains stored information even when power is removed, making it ideal for real-world applications. *“The brain has a fundamentally different architecture than a digital computer,”* said Northwestern’s Mark C. Hersam, who co-led the research. *“In a digital computer, data move back and forth between a microprocessor and memory, which consumes a lot of energy and creates a bottleneck when attempting to perform multiple tasks at the same time. On the other hand, in the brain, memory and information processing are co-located and fully integrated, resulting in orders of magnitude higher energy efficiency...”*

For more information, visit the following link:

<https://news.northwestern.edu/stories/2023/12/new-brain-like-transistor-mimics-human-intelligence/>

Reference

Morris, A. (Dic 20, 2023). New brain-like transistor mimics human intelligence. Recovered Dec 20, 2023, Northwestern University:

<https://news.northwestern.edu/stories/2023/12/new-brain-like-transistor-mimics-human-intelligence/>

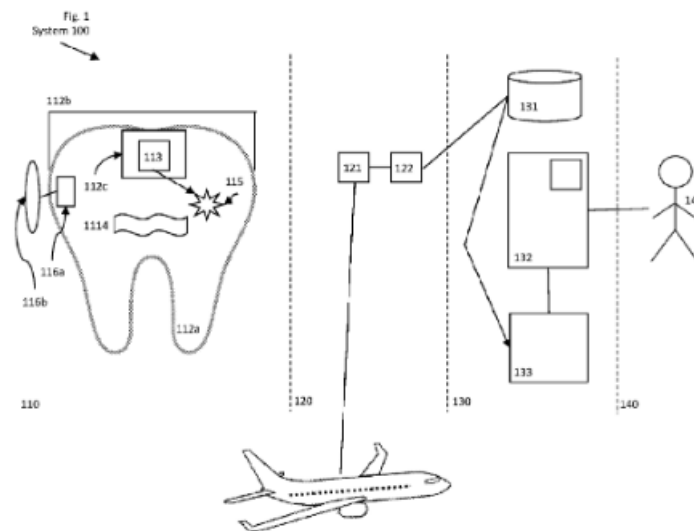
Information source: (Northwestern University, 2023)



II. PATENTS

2.1. Dental sensor

A system includes a sensor disposed in a dental location, coupled to a blood vessel or to dental matter or a void therein, measuring medical conditions or information, responsive to a user gesture or speaking motion. A computing device coupled to the sensor can encode / decode information in exchange with the sensor, communicate with the external device, or perform processes regarding the medical conditions or information.



*Shows a conceptual drawing of an example system, including a sensor disposed in a dental position.
Credit: Lewis, S., WIPO IP Portal*

A communication device coupled to the sensor or the computing device can exchange information with devices internal/ external to the user. An internal device can include: a medical device or sensor, or another device disposed to stimulate the user's anatomy. An external device can include: an augmented reality or virtual reality system, an activity monitor, digital eyewear, a smartphone, vehicle controls, or remote computing devices. A power source includes energy storage, rechargeable using noninvasive techniques.

For more information, visit the following link:

https://patentscope.wipo.int/search/es/detail.jsf?docId=WO2023239350&_cid=P11-LQRHVE-41915-1

Reference

Lewis, S. (Dec 14, 2023). Dental sensor. Recovered Dec 14, 2023, WIPO IP Portal:

https://patentscope.wipo.int/search/es/detail.jsf?docId=WO2023239350&_cid=P11-LQRHVE-41915-1

Information source: (WIPO IP Portal, 2023)



2.2. System and method for mixed reality

A mixed A mixed reality system, comprising: a sensor configured to acquire readings of real-world data, and display, on an output device, a real-world visualization of the real-world data based on the readings to a user, wherein the sensor has one or more parameters affecting the real-world visualization; and a processing circuitry configured to: obtain (a) information of one or more virtual entities located within an area from which the readings are acquired, the information defining, for each of the virtual entities, one or more simulated physical properties, and (b) values of one or more situational parameters indicative of a state of the sensor during acquisition of the readings, wherein the values of the one or more situational parameters are readings of one or more situational sensors, sensing the state of the sensor and its surroundings during acquisition of the readings.



*Depicts an image taken of the Eiffel tower by the sensor
Credit: Sheffer, A.; Mashiah, A.; Livneh, O. & Ophir, Y., WIPO IP Portal*

Determine, for at least one given virtual entity of the virtual entities, a virtual entity visualization of the given virtual entity, the virtual entity visualization determined by manipulating a simulated reading of the simulated physical properties based on (a) the parameters affecting the real-world visualization, and (b) the values of the situational parameters; and display the virtual entity visualizations in combination with the real-world visualization, thereby enabling a user viewing the output device to view the virtual entity visualizations and the real-world visualization.

For more information, visit the following link:

https://patentscope.wipo.int/search/es/detail.jsf?docId=US417444535&_cid=P11-LQRHVE-41915-1

Reference

Sheffer, A.; Mashiah, A.; Livneh, O. & Ophir, Y. (Dec 14, 2023). System and method for mixed reality.

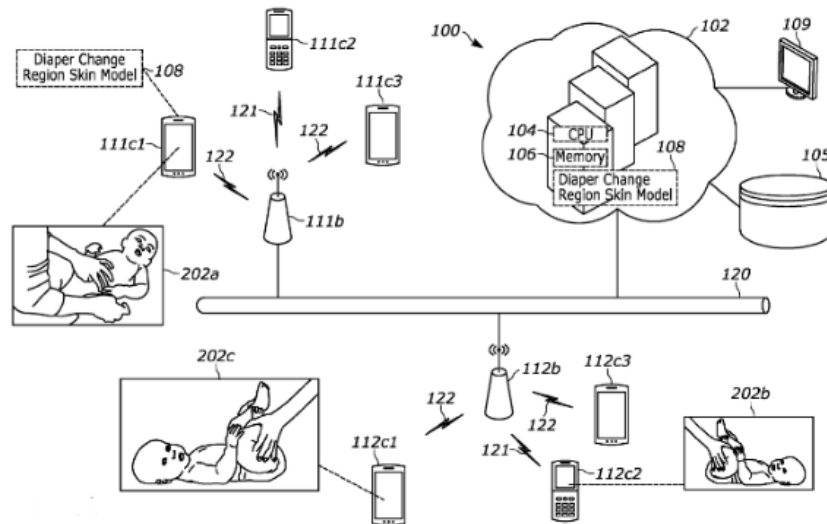
Recovered Dec 14, 2023, WIPO IP Portal:

https://patentscope.wipo.int/search/es/detail.jsf?docId=US417444535&_cid=P11-LQRHVE-41915-1

Information source: (WIPO IP Portal, 2023)

2.3. Artificial Intelligence based system and methods for predicting skin analytics of individuals

A digital imaging method of analyzing pixel data of an image of a diaper change region associated with an individual for determining an individual-specific diaper change region skin characteristic is provided, including aggregating training images of diaper change regions of individuals; training, with pixel data of the training images, a diaper change region skin model operable to determine diaper change region skin characteristics associated with a diaper change region based on the pixel data of the diaper change region.



Illustrates an example digital imaging system configured to analyze pixel data of an image of an individual's diaper change region for determining a diaper change region skin characteristic.

Credit: Gustin, J.; Brink, S.; Hu, P.; Sun, L.; Carr, A.; Kressmann, F. & Roe, D., WIPO IP Portal

Receiving an image of an individual captured by a digital camera; analyzing, by the diaper change region skin model, the image captured by the digital camera to determine an individual-specific diaper change region skin characteristic; generating an individual-specific recommendation designed to address a feature identifiable within pixel data of the individual's skin based on the individual-specific diaper change region skin characteristic; and providing the individual-specific recommendation via a user interface.

For more information, visit the following link:

<https://patentscope.wipo.int/search/es/detail.jsf?docId=US415958112>

Reference

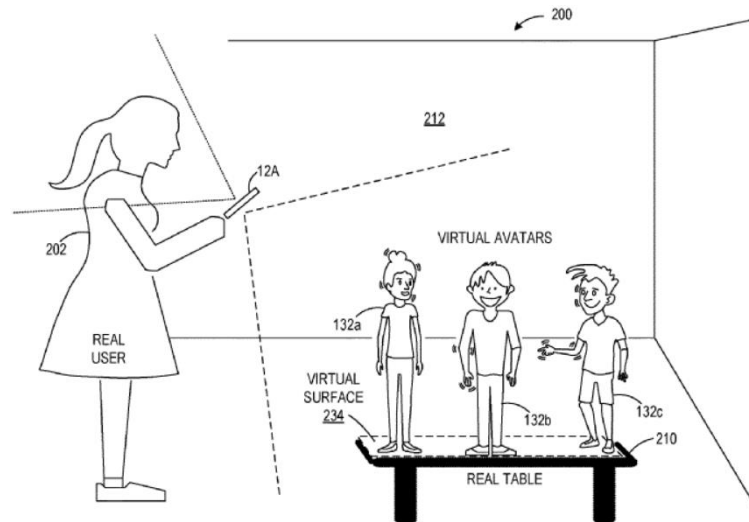
Gustin, J.; Brink, S.; Hu, P.; Sun, L.; Carr, A.; Kressmann, F. & Roe, D. (Dec 07, 2023). Artificial Intelligence based system and methods for predicting skin analytics of individuals. Recovered Dec 11, 2023, WIPO IP Portal:

<https://patentscope.wipo.int/search/es/detail.jsf?docId=US415958112>

Information source: (WIPO IP Portal, 2023)

2.4. Computing system and method for rendering avatars

A computing system is provided comprising a processor is configured to execute an augmented reality avatar program to receive a second-user avatar-data object and second-user pose information, via a computer network, receive an image from a live image feed captured by a camera of the computing device, identify a virtual surface corresponding to a physical surface that appears in the image.



*Example use case for the computing system, schematically showing a real user viewing three avatars displayed on a virtual surface that is world locked to a top of a real-world table.
Credit: Meng, J.; Liao, T.; Crichton, M.; Chen, S. & Tanguturi, V., WIPO IP Portal*

Calculate a position and a pose of a second-user avatar relative to the virtual surface based on the second-user pose information, render the second-user avatar-data object to thereby display the second-user avatar of the second user superimposed upon the image. The second-user avatar is anchored to the virtual surface according to the calculated position and pose of the second-user avatar. The virtual surface is world-locked to the physical surface in the image in a real world 3-D environment.

For more information, visit the following link:

https://patentscope.wipo.int/search/es/detail.jsf?docId=US417444550&_cid=P11-LQRHVE-41915-1

Reference

Meng, J.; Liao, T.; Crichton, M.; Chen, S. & Tanguturi, V. (Dec 14, 2023). Computing system and method for rendering avatars. Recovered Dec 14, 2023, WIPO IP Portal:
https://patentscope.wipo.int/search/es/detail.jsf?docId=US417444550&_cid=P11-LQRHVE-41915-1

Information source: (WIPO IP Portal, 2023)



2.5. Extended Reality system with body-centric pose estimation using altimeter relative elevation

An extended reality (XR) system, comprises a head-mounted display (HMD) configured for displaying virtual content to a user, a first altimeter carried by the HMD, a hand-held control, and a second altimeter carried by the hand-held control.



Is a pictorial illustrating the placement of the hand-held control next to a compute pack of the XR system in order to calibrate the relative error of an altimeter carried by a compute pack and the altimeter carried by the HMD..

Credit: Allen, C.; Munoz, F.; Rodriguez, J. & Shee, K., WIPO IP Portal

The first altimeter configured for outputting first atmospheric pressure data indicative of an elevation of the HMD, while the second altimeter is configured for outputting second atmospheric pressure data indicative of an elevation of the hand-held control. The XR system further comprises at least one processor configured for determining a relative elevation between the first altimeter and the second altimeter based on the first atmospheric pressure data and the second atmospheric pressure data.

For more information, visit the following link:

https://patentscope.wipo.int/search/es/detail.jsf?docId=WO2023240279&_cid=P11-LQRHVE-41915-1

Reference

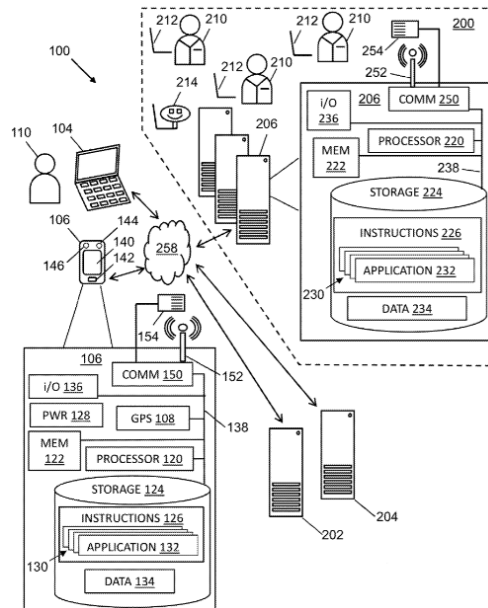
Allen, C.; Munoz, F.; Rodriguez, J. & Shee, K. (Dec 14, 2023). Extended Reality (XR) system with body-centric pose estimation using altimeter relative elevation. Recovered Dec 14, 2023, WIPO IP Portal: https://patentscope.wipo.int/search/es/detail.jsf?docId=WO2023240279&_cid=P11-LQRHVE-41915-1

Information source: (WIPO IP Portal, 2023)



2.6. Leveraging multiple disparate Machine Learning model data outputs to generate recommendations for the next best action

A system determines a priority service context specific (SCS) channel among multiple SCS channels, according to a priority status metric (PSM), and sends an advisory message to the priority channel. The system includes at least one processor, a communication interface communicatively coupled to the at least one processor, and a memory device storing executable code.



*Illustrates an enterprise system, and environment thereof, according to at least one embodiment.
Credit: Mistor, P., WIPO IP Portal*

The system monitors signals in multiple bidirectional SCS channels between multiple system devices and at least one user device, each SCS channel conveying signals to and from a respective system device of the multiple system devices, and identify a respective PSM for each SCS channel. The system further determines a priority SCS channel having a PSM higher than at least some of the other SCS channels, generates an advisory message for the priority SCS channel, and sends, the advisory message to the respective system device of the priority SCS channel.

For more information, visit the following link:

<https://worldwide.espacenet.com/patent/search/family/089077476/publication/US2023401416A1?q=artificial%20intelligence>

Reference

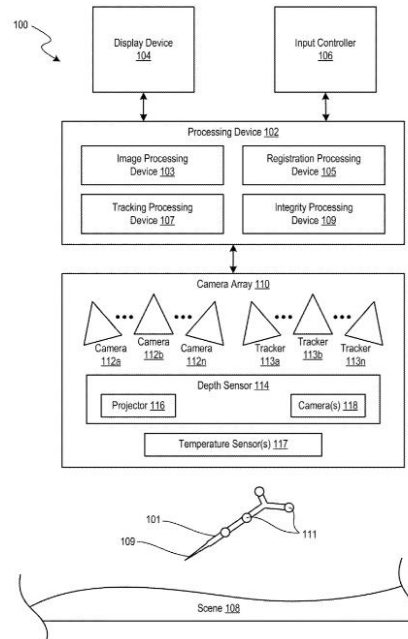
Mistor, P. (Dec 14, 2023). Leveraging multiple disparate Machine Learning model data outputs to generate recommendations for the next best action. Recovered Dec 14, 2023, Espacenet Patent Search: <https://worldwide.espacenet.com/patent/search/family/089077476/publication/US2023401416A1?q=artificial%20intelligence>

Information source: (Espacenet Patent Search, 2023)



2.7. Light field capture, compression, transmission and reconstruction

Systems, devices, and methods for collection, editing, and playback of data collected from an imaging system for generating a virtual perspective of a scene are disclosed. In one example perspective, an imaging system includes a camera array configured to capture multiple images of a scene.



*Is a schematic view of an imaging system in accordance with embodiments of the present technology.
Credit: Nonn, T.; Cheng, T. & Youngquist, J., Espacenet Patent Search*

Each of the multiple images includes color data represented in a Bayer pattern that includes a blue channel, two green channels, and a red channel. The system also includes an image processing device configured to receive the multiple images captured by the camera array, split each of the multiple images represented in the Bayer pattern into four individual color planes, form at least one set of data by combining the four individual color planes of the multiple images, and compress the at least one set of data.

For more information, visit the following link:

<https://worldwide.espacenet.com/patent/search/family/089076937/publication/US2023403477A1?q=blockchain>

Reference

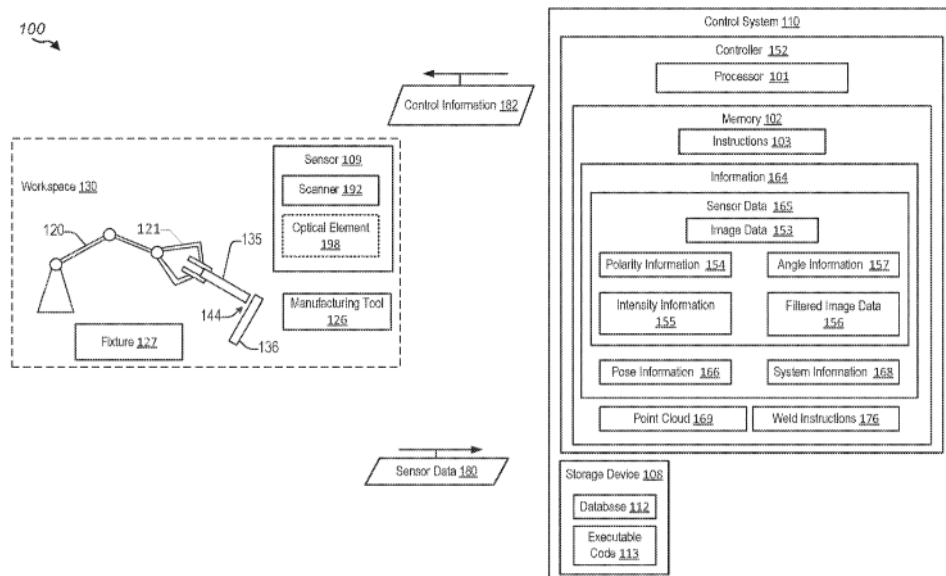
Nonn, T.; Cheng, T. & Youngquist, J. (Dec 14, 2023). Light field capture, compression, transmission and reconstruction. Recovered Dec 15 2023, Espacenet Patent Search:
<https://worldwide.espacenet.com/patent/search/family/089076937/publication/US2023403477A1?q=blockchain>

Information source: (Espacenet Patent Search, 2023)



2.8. Reflection refuting laser scanner

This disclosure provides systems, methods, and apparatuses, including computer programs encoded on computer storage media, that provide for optical techniques for manufacturing robots, such as for filtering certain reflections when scanning an object. For example, the techniques may include receiving, from a detector, sensor data based on detected light, the detected light including reflections of light projected by one or more emitters and reflected off of an object.



*Is a block diagram illustrating a system configured to implement an optical system according to one or more aspects.
Credit: Huang, W.; Dhagat, A.; Gandhi, T.; Robinson, J. & Lonsberry, A., Espacenet Patent Search*

The techniques may further include determining, based on the sensor data, a first-order reflection and a second-order reflection. The techniques may also include determining, based on the first-order reflection and a second-order reflection, a difference, the difference includes a polarity difference, an intensity difference, or a combination thereof. The techniques may include filtering the second-order reflection based on the difference. Other aspects and features are also claimed and described.

For more information, visit the following link:

<https://worldwide.espacenet.com/patent/search/family/087158170/publication/US2023403475A1?q=3d>

Reference

Huang, W.; Dhagat, A.; Gandhi, T.; Robinson, J. & Lonsberry, A. (Dec 14, 2023). Reflection refuting laser scanner. Recovered Dec 15, 2023, Espacenet Patent Search:

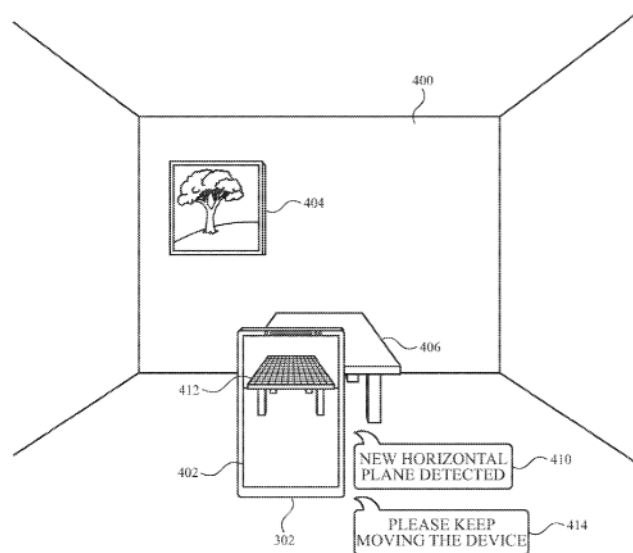
<https://worldwide.espacenet.com/patent/search/family/087158170/publication/US2023403475A1?q=3d>

Information source: (Espacenet Patent Search, 2023)



2.9. Accessible mixed reality applications

An example process for placing virtual objects in an environment includes: displaying a first view of the environment, the first view including a virtual object displayed at a first location on a first surface of the environment, the first location corresponding to a current location of the electronic device; detecting movement of the electronic device from the current location to an updated location.



*Illustrate accessible techniques for scanning a MR environment, according to some embodiments.
Credit: Bigham, J.; Herskovitz, J.; White, S. & Wu, J., Espacenet Patent Search*

In accordance with detecting the movement from the current location to the updated location: displaying a second view of the environment, the second view including the virtual object displayed at a second location on the first surface of the environment, the second location corresponding to the updated location; and receiving user input to place the virtual object; and in response to receiving the user input, placing the virtual object at the second location.

For more information, visit the following link:

<https://worldwide.espacenet.com/patent/search/family/089077884/publication/US2023401798A1?q=virtual%20reality>

Reference

Bigham, J.; Herskovitz, J.; White, S. & Wu, J. (Dec 14, 2023). Accessible mixed reality applications. Recovered Dec 15, 2023, Espacenet Patent Search:

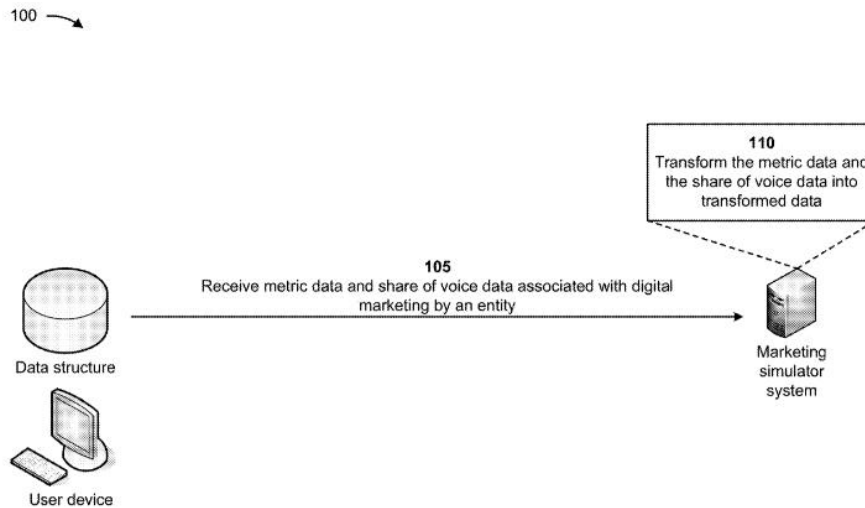
<https://worldwide.espacenet.com/patent/search/family/089077884/publication/US2023401798A1?q=virtual%20reality>

Information source: (Espacenet Patent Search, 2023)



2.10. Utilizing Machine Learning models to generate an optimized digital marketing simulation

A device may receive and transform metric data and share of voice data, associated with digital marketing by an entity, into transformed data, may generate model data from the transformed data, and may divide the model data into training data, test data, and validation data.



*Are diagrams of an example implementation described herein.
Credit: Rastogi, K.; Dey, A.; Chhabra, L. & Sharma, S., Espacenet Patent Search*

The device may train models, with the training data, to generate training results, and may process the test data, with the models, to generate test results. The device may process the validation data, with the models, to generate validation results, and may select a first model, a second model, and a third model based on the results. The device may utilize the first model to predict a share of voice, and may utilize the second model to predict a click through rate. The device may utilize the third model to predict a conversion rate, and may perform actions based on the predicted data.

For more information, visit the following link:

<https://worldwide.espacenet.com/patent/search/family/089077787/publication/US2023401607A1?q=machine%20learning>

Reference

Rastogi, K.; Dey, A.; Chhabra, L. & Sharma, S. (Dec 14, 2023). Utilizing Machine Learning models to generate an optimized digital marketing simulation. Recovered Dec 15, 2023, Espacenet Patent Search: <https://worldwide.espacenet.com/patent/search/family/089077787/publication/US2023401607A1?q=machine%20learning>

Information source: (Espacenet Patent Search, 2023)