

Weekly Newsletter TECHNOLOGY SURVEILLANCE

Nº 32-2023

AUG 11TH, 2023





Weekly Newsletter TECHNOLOGY SURVEILLANCE



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 Two paths to autism in the developing brain

Two distinct neurodevelopmental abnormalities that arise just weeks after the start of brain development have been associated with the emergence of autism spectrum disorder, according to a new Yale-led study in which researchers developed brain organoids from the stem cells of boys diagnosed with the disorder. And, researchers say, the specific abnormalities seem to be dictated by the size of the child's brain, a finding that could help doctors and researchers to diagnosis and treat autism in the future.



Credit: © stock.adobe.com, Yale University

The study was co-led by Alexandre Jourdon, Feinan Wu, and Jessica Mariani, all from Vaccarino's lab at the Yale School of Medicine. Researchers found that children with autism and macrocephaly exhibited excessive growth of excitatory neurons compared with their fathers while organoids of other children with autism showed a deficit of the same type of neurons. The ability to track the growth of specific types of neurons could help doctors diagnose autism, symptoms of which generally appear 18 to 24 months after birth, the authors say.

For more information, visit the following link:

https://news.yale.edu/2023/08/10/yale-scientists-reveal-two-paths-autism-developing-brain

Reference

Hathaway, B. (Aug 10, 2023). Yale scientists reveal two paths to autism in the developing brain. Recovered Aug 10, 2023, Yale University:

https://news.yale.edu/2023/08/10/yale-scientists-reveal-two-paths-autism-developing-brain

Information source: (Yale University, 2023)



Weekly Newsletter TECHNOLOGY

SURVEILLANCE



1.2 One step closer to lithium metal batteries that function with minimal external pressure

A team of battery researchers led by the University of California San Diego and University of Chicago has developed a new methodology to produce the potentially game-changing thin-film solid-state electrolyte called lithium phosphorus oxynitride (LiPON). Given the known challenges to studying LiPON, the team developed a new methodology for producing LiPON film in a free-standing form.



New transparent, thin-film FS-LiPON material which promotes a uniformly dense lithium metal electrochemical deposition under zero external pressure. Team also reports that this new stand-alone thin-film version of LiPON enables fundamental research (ss-NMR and Cryo-EM) of ion conduction and electrochemical performance. Credit: Diyi Cheng, University of California San Diego Laboratory for Energy Storage and Conversion

The result is a flexible and transparent free-standing LiPON (FS-LiPON) film that is compatible with a broad range of spectroscopic techniques that have greater chances of unraveling the unique properties of LiPON over the diffraction-based techniques. In addition to gleaning new fundamental insights on LiPON, the research team also implemented the new free-standing version of the solid-state electrolyte in functional battery tests. The team reports that the thin-film FS-LiPON promotes a uniformly dense lithium metal electrochemical deposition under zero external pressure

For more information, visit the following link:

https://today.ucsd.edu/story/one-step-closer-to-lithium-metal-batteries-that-function-with-minimal-external-pressure

Reference

Kane, D. (Aug 03, 2023). One step closer to lithium metal batteries that function with minimal external pressure. Recovered Aug 09, 2023, University of California San Diego: https://today.ucsd.edu/story/one-step-closer-to-lithium-metal-batteries-that-function-with-minimal-external-

pressure

Information source: (University of California San Diego, 2023)



1.3 Tennis anyone? Researchers serve up advances in developing motion simulation technology's next generation

When provided with a large dataset of video clips from professional tennis players, the system learns to perform complex tennis shots and realistically chains together multiple shots into extended two-player rallies, generating long-lasting matches with realistic racket and ball dynamics between two physically simulated characters.



Credit: Simon Fraser University

While popular sports video games typically use motion capture technologies to produce high-quality animations, their results are limited to the behaviors captured during specific recording sessions, limiting the diversity of movements a character can perform. According to new developments involving Peng and researchers from Stanford University, the University of Toronto, Vector Institute and NVIDIA, it may soon become possible for video game designers to have their characters learn to move by mimicking footage of real-life athletes, and automatically simulate new variations and responsive behaviors on the fly.

For more information, visit the following link:

Weekly Newsletter TECHNOLOGY

SURVEILLANCE

https://www.sfu.ca/sfunews/stories/2023/08/tennis-anyone--researchers-serve-up-advances-in-developing-motio/

Reference

Sharma, R. (Aug 03, 2023). Tennis anyone? Researchers serve up advances in developing motion simulation technology's next generation. Recovered Aug 03, 2023, Simon Fraser University: https://www.sfu.ca/sfunews/stories/2023/08/tennis-anyone--researchers-serve-up-advances-in-developing-motio/

Information source: (Simon Fraser University, 2023)





1.4 Novel physics-encoded Artificial Intelligence model helps to learn spatiotemporal dynamics

Prof. LIU Yang from the University of Chinese Academy of Sciences (UCAS), in collaboration with her colleagues from Renmin University of China and Massachusetts Institute of Technology, has proposed a novel network, namely, the physics-encoded recurrent convolutional neural network (PeRCNN), for modeling and discovery of nonlinear spatio-temporal dynamical systems based on sparse and noisy data.



Credit: Image by University of Chinese Academy of Sciences

The approach can be applied to a variety of problems such as reaction-diffusion processes and other partial differential equation (PDE) systems, including forward and inverse analysis, data-driven modeling and discovery of PDEs. The prior physics knowledge is forcibly "encoded", which gives the network interpretability. In particular, the researchers proposed a deep learning framework that forcibly encodes a given physics structure in a recurrent convolutional neural network to facilitate learning of the spatiotemporal dynamics in sparse data regimes.

For more information, visit the following link: https://english.cas.cn/newsroom/research_news/infotech/202308/t20230802_334222.shtml

Reference

Weekly Newsletter TECHNOLOGY

SURVEILLANCE

Zhang, N. (Aug 03, 2023). Novel physics-encoded Artificial Intelligence model helps to learn spatiotemporal dynamics. Recovered Aug 09, 2023, Chinese Academy of Sciences: https://english.cas.cn/newsroom/research_news/infotech/202308/t20230802_334222.shtml

Information source: (Chinese Academy of Sciences, 2023)



1.5 Study finds a surprising new role for a major immune regulator

Weekly Newsletter TECHNOLOGY

SURVEILLANCE

Now, a team of MIT and Harvard Medical School researchers has discovered how STING activates those two pathways. They found that STING has a surprising and previously unknown function: It can act as an ion channel that allows protons to leak out of an organelle known as the Golgi body. This makes it the first human immune sensor that can translate danger signals into ion flow.



Researchers at MIT and Harvard Medical School have discovered that the STING protein has a previously unknown role as an ion channel, which helps cells respond to danger signals such as viral infection. Credit: National Center for Biotechnology Information, Massachusetts Institute of Technology

Previous research has shown that both autophagy and formation of inflammasomes (large protein complexes that stimulate inflammation) can be provoked by protons leaking from cell organelles, which makes the inside of the cell more acidic. Because of that, the researchers wondered if STING might somehow induce proton leakage. To explore this possibility, the researchers labeled the Golgi with a protein that fluoresces when the pH goes up. When they treated the cells with a molecule that activates STING, the Golgi became less acidic, meaning that it was losing protons. A genetic screen minimized the possibility of another ion channel controlling this ion flow, so the researchers hypothesized that STING itself was acting as a proton channel.

For more information, visit the following link: https://news.mit.edu/2023/study-finds-surprising-role-major-immune-regulator-0803

Reference

Trafton, A. (Aug 03, 2023). Study finds a surprising new role for a major immune regulator. Recovered Aug 09, 2023, Massachusetts Institute of Technology: https://news.mit.edu/2023/study-finds-surprising-role-major-immune-regulator-0803

Information source: (Massachusetts Institute of Technology, 2023)





1.6 Deep Learning for new protein design

The key to understanding proteins — such as those that govern cancer, COVID-19, and other diseases — is quite simple. Identify their chemical structure and find which other proteins can bind to them. But there's a catch. "*The search space for proteins is enormous,*" said Brian Coventry, a research scientist with the Institute for Protein Design, University of Washington and The Howard Hughes Medical Institute.



Deep learning methods have been used to augment existing energy-based physical models in 'do novo' or from-scratch computational protein design, resulting in a 10-fold increase in success rates verified in the lab for binding a designed protein with its target protein. Credit: The University of Texas at Austin

A protein studied by his lab typically is made of 65 amino acids, and with 20 different amino acid choices at each position, there are 65 to the 20th power binding combinations, a number bigger than the estimated number of atoms there are in the universe. In it his team used deep learning methods to augment existing energy-based physical models in 'do novo' or from-scratch computational protein design, resulting in a 10-fold increase in success rates verified in the lab for binding a designed protein with its target protein.

For more information, visit the following link: https://www.tacc.utexas.edu/news/latest-news/2023/08/03/deep-learning-for-new-protein-design/

Reference Salazar, J. (Aug 03, 2023). Deep learning for new protein design. Recovered Aug 09, 2023, The University of Texas at Austin: https://www.tacc.utexas.edu/news/latest-news/2023/08/03/deep-learning-for-new-protein-design/

Information source: (The University of Texas at Austin, 2023)



1.7 New, simple and accessible method creates potency-increasing structure in drugs

Chemical structures called cyclopropanes can increase the potency and fine-tune the properties of many drugs, but traditional methods to create this structure only work with certain molecules and require highly reactive — potentially explosive — ingredients. Now, a team of researchers from Penn State has identified and demonstrated a safe, efficient and practical way to create cyclopropanes on a wide variety of molecules using a previously undescribed chemical process. With additional development, the new method could transform how this important process occurs during drug development and creation.



A new method offers a simple, safe, and practical way to create cyclopropanes—a key feature that increases the potency of many drugs and drug-candidates—within molecules. Credit: National Cancer Institute/Unsplash.

The new method transforms a specific chemical structure on compounds called alkenes — used in the synthesis of many molecules — into cyclopropanes. The method takes advantage of *"radical chemistry,"* where intermediate steps of reactions leave some carbon atoms with unpaired electrons called *"free radicals"* that propel the reaction forward. This specific method uses visible light to initiate the reaction and uses common chemical ingredients, including oxygen.

For more information, visit the following link:

Weekly Newsletter TECHNOLOGY

SURVEILLANCE

https://www.psu.edu/news/eberly-college-science/story/new-simple-and-accessible-method-creates-potency-increasing-structure/

Reference

McCormick, G. (Aug 03, 2023). New, simple and accessible method creates potency-increasing structure in drugs. Recovered Aug 09, 2023, The Pennsylvania State University:

https://www.psu.edu/news/eberly-college-science/story/new-simple-and-accessible-method-creates-potency-increasing-structure/

Information source: (The Pennsylvania State University, 2023)





1.8 Current takes a surprising path in quantum material

Cornell researchers used magnetic imaging to obtain the first direct visualization of how electrons flow in a special type of insulator, and by doing so they discovered that the transport current moves through the interior of the material, rather than at the edges, as scientists had long assumed.

The finding provides new insights into the electron behavior in so-called quantum anomalous Hall insulators and should help settle a decades-long debate about how current flows in more general quantum Hall insulators. These insights will inform the development of topological materials for next-generation quantum devices. The project, led by Katja Nowack, assistant professor of physics in the College of Arts and Sciences and the paper's senior author, has its origins in what's known as the quantum Hall effect. First discovered in 1980, this effect results when a magnetic field is applied to a specific material to trigger an unusual phenomena: The interior of the bulk sample becomes an insulator while an electrical current moves in a single direction along the outer edge. The resistances are quantized, or restricted, to a value defined by the fundamental universal constant and drop to zero.

For more information, visit the following link: <u>https://news.cornell.edu/stories/2023/08/current-takes-surprising-path-quantum-material</u>

Reference

Nutt, D. (Aug 03, 2023). Current takes a surprising path in quantum material. Recovered Aug 09, 2023, Cornell University:

https://news.cornell.edu/stories/2023/08/current-takes-surprising-path-quantum-material

Information source: (Cornell University, 2023)



1.9 Modified Virtual Reality tech can measure brain activity

Weekly Newsletter TECHNOLOGY

SURVEILLANCE

Researchers have modified a commercial virtual reality headset, giving it the ability to measure brain activity and examine how we react to hints, stressors and other outside forces. The research team at The University of Texas at Austin created a noninvasive electroencephalogram (EEG) sensor that they installed in a Meta VR headset that can be worn comfortably for long periods. The EEG measures the brain's electrical activity during the immersive VR interactions.



Hongbian Li, a research associate in Nanshu Lu's lab, wearing a Meta VR headset equipped with a noninvasive electroencephalogram (EEG) sensor. Credit: The University of Texas at Austin

The device could be used in many ways, from helping people with anxiety, to measuring the attention or mental stress of aviators using a flight simulator, to giving a human the chance to see through the eyes of a robot. *"Virtual reality is so much more immersive than just doing something on a big screen,"* said Nanshu Lu, a professor in the Cockrell School of Engineering's Department of Aerospace Engineering and Engineering Mechanics who led the research. *"It gives the user a more realistic experience, and our technology enables us to get better measurements of how the brain is reacting to that environment."*

For more information, visit the following link:

https://news.utexas.edu/2023/08/03/modified-virtual-reality-tech-can-measure-brain-activity/

Reference

Levy, N. (Aug 03, 2023). Modified virtual reality tech can measure brain activity. Recovered Aug 10, 2023, The University of Texas at Austin:

https://news.utexas.edu/2023/08/03/modified-virtual-reality-tech-can-measure-brain-activity/

Information source: (The University of Texas at Austin, 2023)



1.10 Study solar panel-topped ponds

ECHNOLOGY

Modern society demands food and sustainable energy, so science has an idea: To preserve agricultural land for crops and conservation lands for wildlife, place floating photovoltaic panels on lakes, rivers and reservoirs. The problem: No one has fully defined how acres of panel-topped bodies of water affect biologic aquatic systems, but Cornell and U.S. Geological Survey ecologist Steve Grodsky - and a multidisciplinary team of researchers - soon will learn.



Adding solar panels to a pond in July, Steve Grodsky, left, and doctoral student Caitlin Davis aim to understand how floating photovoltaic panels affect the biology of the water. Credit: Cornell University

Specifically, the project will examine how floating solar panels on the research ponds affect the abiotic and biotic parts of water; and how microbes, macroinvertebrates (snails and crayfish), macrophytes (aquatic plants) and fish fare. The researchers will track the ponds' greenhouse gas emissions, summertime algae growth, bioacoustics and environmental DNA.

For more information, visit the following link: https://news.cornell.edu/stories/2023/08/floating-energy-idea-scientists-study-solar-panel-topped-ponds

Reference

Friedlander, B. (Aug 03, 2023). Floating an energy idea: Scientists study solar panel-topped ponds. Recovered Aug 10, 2023, Cornell University:

https://news.cornell.edu/stories/2023/08/floating-energy-idea-scientists-study-solar-panel-topped-ponds

Information source: (Cornell University, 2023)





1.11 Make a sustainable plastic more compostable

Researchers from Michigan State University's top-ranked School of Packaging have developed a way to make a promising, sustainable alternative to petroleum-based plastics more biodegradable. A team led by Rafael Auras has made a bio-based polymer blend that's compostable in both home and industrial settings.



A close-up shows the bioreactors the Auras lab at Michigan State University has built to conduct biodegradation experiments. The bioreactors are essentially large glass jars with tubing to measure the gases produced during composting.

Credit: Michigan State University

In its experiments, supported by the U.S. Department of Agriculture and MSU AgBioResearch, the team showed that PLA can sit around for 20 days before microbes start digesting it in industrial composting conditions. To get rid of that lag time and enable the possibility of home composting, Auras and his team integrated a carbohydrate-derived material called thermoplastic starch into PLA. Among other benefits, the starch gives composting's microbes something they can more easily chow down on while the PLA degrades.

For more information, visit the following link:

 $\underline{https://www.canr.msu.edu/news/msu-school-of-packaging-researchers-make-a-sustainable-plastic-more-compostable}$

Reference

Davenport, M. (Aug 04, 2023). MSU School of Packaging researchers make a sustainable plastic more compostable. Recovered Aug 10, 2023, Michigan State University:

https://www.canr.msu.edu/news/msu-school-of-packaging-researchers-make-a-sustainable-plastic-more-compostable

Information source: (Michigan State University, 2023)



Weekly Newsletter TECHNOLOGY

SURVEILLANCE

1.12 Artificial Intelligence model can help determine where a patient's cancer arose

A new approach developed by researchers at MIT and Dana-Farber Cancer Institute may make it easier to identify the sites of origin for those enigmatic cancers. Using Machine Learning, the researchers created a computational model that can analyze the sequence of about 400 genes and use that information to predict where a given tumor originated in the body.



Using Machine Learning, researchers at MIT and Dana-Farber Cancer Institute created a computational model that can analyze the sequence of about 400 genes and use that information to predict where a given tumor originated in the body.

Credit: iStock, Massachusetts Institute of Technology

Using this model, the researchers showed that they could accurately classify at least 40 percent of tumors of unknown origin with high confidence, in a dataset of about 900 patients. This approach enabled a 2.2-fold increase in the number of patients who could have been eligible for a genomically guided, targeted treatment, based on where their cancer originated.

For more information, visit the following link:

https://news.mit.edu/2023/ai-model-can-help-determine-where-patients-cancer-arose-0807

Reference

Trafton, A. (Aug 07, 2023). AI model can help determine where a patient's cancer arose. Recovered Aug 10, 2023, Massachusetts Institute of Technology: https://news.mit.edu/2023/ai-model-can-help-determine-where-patients-cancer-arose-0807

Information source: (Massachusetts Institute of Technology, 2023)



Weekly Newsletter TECHNOLOGY

SURVEILLANCE

1.13 Latest in body art? "Tattoos" for individual cells

Engineers have developed nanoscale tattoos—dots and wires that adhere to live cells—in a breakthrough that puts researchers one step closer to tracking the health of individual cells. The new technology allows for the first time the placement of optical elements or electronics on live cells with tattoo-like arrays that stick on cells while flexing and conforming to the cells' wet and fluid outer structure.



Gold nanowire array on a rat brain. Kam Sang Kwok and Soo Jin Choi, Gracias Lab, Johns Hopkins University

The researchers built the tattoos in the form of arrays with gold, a material known for its ability to prevent signal loss or distortion in electronic wiring. They attached the arrays to cells that make and sustain tissue in the human body, called fibroblasts. The arrays were then treated with molecular glues and transferred onto the cells using an alginate hydrogel film, a gel-like laminate that can be dissolved after the gold adheres to the cell. The molecular glue on the array bonds to a film secreted by the cells called the extracellular matrix.

For more information, visit the following link: <u>https://hub.jhu.edu/2023/08/07/biosensors-nanotattos/</u>

Reference

Molar, R. (Aug 07, 2023). Latest in body art? "Tattoos" for individual cells. Recovered Aug 10, 2023, Johns Hopkins University:

https://hub.jhu.edu/2023/08/07/biosensors-nanotattos/

Information source: (Johns Hopkins University, 2023)



1.14 Rice lab's boron nitride composite could be useful for advanced technology applications

Policymakers may seek science-driven strategies to change some behavior that could lead customers to choose environmentally friendly products, encourage patients to maintain medications, or spur employees to comply with safety procedures.



Boron nitride samples. Crédito: Jeff Fitlow, Rice University

Gandhi explains that the novelty of the nudge cartography database lies in the dimensionality she and her team have added to make it something that is *"living, continuous, and eventually, predictive"*. *"We're not stopping at a database," Gandhi says. "We're interested in what it can do—find gaps in the literature, develop new theories, predict new experiments. Our end goal is to make this a public good we want everyone to be able to use, which will eventually give rise to more and better research."* Throughout the summer, Gandhi and her team have been hard at work cleaning data, performing maintenance on the database, and exploring automation.

For more information, visit the following link:

Weekly Newsletter TECHNOLOGY

SURVEILLANCE

 $\underline{https://news.rice.edu/news/2023/rice-labs-boron-nitride-composite-could-be-useful-advanced-technology-applications}$

Reference

Cernea, S. (Aug 07, 2023). Rice lab's boron nitride composite could be useful for advanced technology applications. Recovered Aug 10, 2023, Rice University:

https://news.rice.edu/news/2023/rice-labs-boron-nitride-composite-could-be-useful-advanced-technology-applications

Information source: (Rice University, 2023)



Weekly Newsletter TECHNOLOGY SURVEILLANCE



1.15 Building reliable Artificial Intelligence models requires understanding the people behind the datasets

Through an analysis of 6,000 Reddit comments, the study shows annotator beliefs and decisions around politeness and offensiveness impact the learning models used to flag the online content we see each day. What is rated as polite by one part of the population can be rated much less polite by another. "AI systems all use this kind of data and our study helps highlight the importance of knowing who is labeling the data," Pei said. "When people from only one part of the population label the data, the resulting AI system may not represent the average viewpoint."



Credit: University of Michigan

Through their research, Jurgens and Pei set out to better understand the differences between annotator identities and how their experiences impact their decisions. Previous studies have only looked at one aspect of identity, like gender. Their hope is to help AI models better model the beliefs and opinions of all people. Using these results, Jurgens and Pei created POPQUORN, the Potato-Prolific dataset for Question Answering, Offensiveness, text Rewriting and politeness rating with demographic Nuance. The dataset offers social media and AI companies an opportunity to explore a model that accounts for intersectional perspectives and beliefs.

For more information, visit the following link:

https://news.umich.edu/building-reliable-ai-models-requires-understanding-the-people-behind-the-datasets/

Reference

Wadley, J. (Aug 08, 2023). Building reliable AI models requires understanding the people behind the datasets. Recovered Aug 10, 2023, University of Michigan:

https://news.umich.edu/building-reliable-ai-models-requires-understanding-the-people-behind-the-datasets/

Information source: (University of Michigan, 2023)





1.16 Virtual reality headsets are vulnerable to hackers

Weekly Newsletter TECHNOLOGY

SURVEILLANCE

While Augmented Reality (AR) and Virtual Reality (VR) are envisioned as the next iteration of the internet immersing us in new digital worlds, the associated headset hardware and virtual keyboard interfaces create new opportunities for hackers.



Credit: University of California, Riverside

The emerging metaverse technology, now under intensive development by Facebook's Mark Zuckerberg and other tech titans, relies on headsets that interpret our bodily motions — reaches, nods, steps, and blinks — to navigate new worlds of AR and VR to play games, socialize, meet co-workers, and perhaps shop or conduct other forms of business. A computer science team at UCR's Bourns College of Engineering led by professors Jiasi Chen and Nael Abu-Ghazaleh, however, has demonstrated that spyware can watch and record our every motion and then use Artificial Intelligence to translate those movements into words with 90 percent or better accuracy.

For more information, visit the following link:

https://news.ucr.edu/articles/2023/08/08/virtual-reality-headsets-are-vulnerable-hackers

Reference

Danelski, D. (Aug 08, 2023). Virtual reality headsets are vulnerable to hackers. Recovered Aug 10, 2023, University of California - Riverside:

https://news.ucr.edu/articles/2023/08/08/virtual-reality-headsets-are-vulnerable-hackers

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



Weekly Newsletter TECHNOLOGY

SURVEILLANCE

1.17 Customising avatars to look more like you improves learning in virtual environments

Learning a new skill using VR works better if your virtual instructor is customised to look more like you, according to research by the University of Bath. The study suggests that even minimal customisation can make a difference in how well people learn in a virtual environment. Virtual Reality is increasingly used by lots of industries to train staff, particularly where training in person is not practical, such as in dangerous environments or in health and safety scenarios. It's also used for training fine motor skills such as in manual assembly lines.



Volunteers learned better when using avatars that shared similar physical characteristics. Credit: Izzy Fitton, University of Bath

These systems often use virtual instructors with a human shaped gender-neutral avatar, or only one or two options for avatar customisation. Previous research by psychologists suggests that people learn better from trainers who are similar to them, so researchers from REVEAL, the research centre for immersive technology at the University of Bath, decided to investigate whether any effect could be seen with avatars with only basic customisation.

For more information, visit the following link:

https://www.bath.ac.uk/announcements/customising-avatars-to-look-more-like-you-improves-learning-in-virtual-environments/

Reference

Just, V. (Aug 09, 2023). Customising avatars to look more like you improves learning in virtual environments. Recovered Aug 10, 2023, University of Bath:

https://www.bath.ac.uk/announcements/customising-avatars-to-look-more-like-you-improves-learning-invirtual-environments/

Information source: (University of Bath, 2023)



1.18 Planting ideas in a computer's head

Weekly Newsletter TECHNOLOGY

SURVEILLANCE

While sharing dreams and planting such ideas is impossible in reality, something very similar has recently been achieved in the world of computers. A team of researchers at ETH led by Kaveh Razavi, professor in the Department of Information Technology and Engineering, has demonstrated a serious vulnerability of certain CPUs (central processing units) whereby an attacker can plant the equivalent of an idea in a victim's CPU, coax it into executing certain commands and thus retrieve information. Razavi and his colleagues present their research at the conference USENIX Security 2023 this week. Nevertheless, Razavi and his co-workers set out to test whether even with the new security measures an attack could be launched. After a lengthy search, they stumbled upon something strange: *"It looked as though we could make the CPUs manufactured by AMD believe that they had seen certain instructions before, whereas in reality that had never happened,"* says Trujillo. Just like in the movie, the researchers could plant an idea in the CPU while it was, in a sense, dreaming.



The hardware used by the ETH researchers with one of the computer chips that are susceptible to the Inception attack. Credit: Kaveh Razavi, ETH Zurich

As a consequence, the look-up table – which the CPU continuously creates from past instructions – could, once again, be manipulated. Since the CPU was convinced that the entries in the look-up table originated from instructions it had seen before, the security feature that is meant to ensure that only trustworthy predictions are taken into consideration was bypassed. In this way, the ETH researchers were able to leak data from anywhere in the computer's memory, including sensitive information such as the hash of the root password.

For more information, visit the following link: https://ethz.ch/en/news-and-events/eth-news/news/2023/08/planting-ideas-in-a-computers-head.html

Reference

Morsch, O. (Aug 08 2023). Planting ideas in a computer's head. Recovered Aug 10, 2023, Eidgenössische Technische Hochschule Zürich:

https://ethz.ch/en/news-and-events/eth-news/news/2023/08/planting-ideas-in-a-computers-head.html

Information source: (Eidgenössische Technische Hochschule Zürich, 2023)



1.19 Researchers' tool finds bias in state-of-the-art generative AI model

Weekly Newsletter TECHNOLOGY

SURVEILLANCE

Assistant Professor of Computer Science and Engineering Xin (Eric) Wang and a team of researchers from Baskin Engineering at UC Santa Cruz created a tool called the Text to Image Association Test, which provides a quantitative measurement of complex human biases embedded in T2I models, evaluating biases across dimensions such as gender, race, career, and religion. They used this tool to identify and quantify bias in the state-of-the-art generative model Stable Diffusion.



Examples of images generated by text prompts imputed to the Stable Diffusion model with and without gender-specific language in the prompt. For example, the upper left group of four images were produced from the prompt "child studying science." Credit: University of California – Santa Cruz

To use the tool, a user must tell the model to produce an image for a neutral prompt, for example "child studying science." Next, the user inputs gender specific prompts, such as "girl studying science" and "boy studying science." Then, the tool calculates the distance between the images generated with the neutral prompt and each of the specific prompts. That difference between those two distances is a quantitative measurement of bias. Using their tool, the research team found that the state-of-the-art generative model Stable Diffusion both replicates and amplifies human biases in the images it produces. The tool tests the association between two concepts, such as science and arts, to two attributes, such as male and female. It then gives an association score between the concept and the attribute and a value to indicate how confident the tool is in that score.

For more information, visit the following link: <u>https://news.ucsc.edu/2023/08/t2iat.html</u>

Reference

Cerf, E. (Aug 10, 2023). Researchers' tool finds bias in state-of-the-art generative AI model. Recovered Aug 10, 2023, University of California – Santa Cruz, 2023: https://news.ucsc.edu/2023/08/t2iat.html

Information source: (University of California – Santa Cruz, 2023)





1.20 Technique to analyse hydrogen fuel cell stability

Assistant Professor of Computer Science and Engineering Xin (Eric) Wang and a team of researchers from Baskin Engineering at UC Santa Cruz created a tool called the Text to Image Association Test, which provides a quantitative measurement of complex human biases embedded in T2I models, evaluating biases across dimensions such as gender, race, career, and religion. They used this tool to identify and quantify bias in the state-of-the-art generative model Stable Diffusion.



Hydrogen fuel cells use chemical reactions to break hydrogen into protons and electrons to produce electricity and water. Credit: University of New South Wales

The team revealed that up to 75 per cent of the iron-based active sites (the specific locations where the reactions happen) become inactive in the first 10 hours of running the fuel cell, due to the loss of iron active sites. This is then followed by carbon corrosion becoming the predominant degradation mechanism. "*This is particularly significant as we can pinpoint exactly what is happening and when it is happening. If we develop a material that has more stable active sites, we should see a slower decay in the first 10 hours, while carbon corrosion may have a similar trend," says Dr Meyer.*

For more information, visit the following link:

https://newsroom.unsw.edu.au/news/science-tech/future-hydrogen-fuel-unsw-researchers-develop-techniqueanalyse-hydrogen-fuel-cell

Reference

Matson, L. (Aug 11, 2023). The future of hydrogen fuel: UNSW researchers develop technique to analyse hydrogen fuel cell stability. Recovered Aug 11, 2023, University of New South Wales: https://newsroom.unsw.edu.au/news/science-tech/future-hydrogen-fuel-unsw-researchers-develop-technique-analyse-hydrogen-fuel-cell

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



II. PATENTS

Weekly Newsletter TECHNOLOGY

SURVEILLANCE

2.1. Systems and methods for determining a type of material of an object in a real-world environment

Methods and systems for determining a type of material of an object in a real-world environment are described. One of the methods includes receiving a plurality of sets of audio data based on sounds received from a plurality of objects within a plurality of environments.



Is a diagram of an embodiment of a system to illustrate a method for capturing audio data and image data for training an Artificial Intelligence (Al) model. Credit: Stafford, J.; Young, A. & Tokubo, T., WIPO IP Portal

The method further includes receiving a plurality of sets of input data regarding a plurality of types of materials of the plurality of objects, training an Artificial Intelligence (Al) model based on the plurality of sets of audio data and the plurality of sets of input data, and applying the Al model to a set of audio data captured from the real-world environment to determine the type of material of the object within the real-world environment to enhance the realism of augmented reality (AR) or virtual reality (VR) video games and applications.

For more information, visit the following link: https://patentscope.wipo.int/search/es/detail.jsf?docId=WO2023146793

Reference

Stafford, J.; Young, A. & Tokubo, T. (Aug 03, 2023). Systems and methods for determining a type of material of an object in a real-world environment. Recovered Aug 10, 2023, WIPO IP Portal: https://patentscope.wipo.int/search/es/detail.jsf?docId=WO2023146793



Weekly Newsletter TECHNOLOGY

SURVEILLANCE



2.2. Augmented reality product presentation system

An AR product presentation system includes a network server, a product information editing module, an AR 3D image generating module, a data storage module and a data processing module. The product information editing module generates a product browsing webpage.



Is the schematic view of the application status the AR product presentation system in accordance with the second embodiment of the present invention. Credit: Chu, L.; Chun, J. & Ping, Y., WIPO IP Portal

The AR 3D image generating module generates an AR 3D product image by integrating the view angle plane images of a product with each other. The data storage module saves the product browsing webpage and the AR 3D product image. The data processing module integrates the product browsing webpage with the AR 3D product image to generate a product link information. The mobile device of a consumer receives the product link information and the consumer clicks which to connect to the product browsing webpage and execute the AR 3D product image. Then, the AR 3D product image can be integrated with a target object displayed on the mobile device.

For more information, visit the following link: https://patentscope.wipo.int/search/es/detail.jsf?docId=US403485985&_cid=P20-LL42SG-95984-1

Reference

Chu, L.; Chun, J. & Ping, Y. (Aug 04, 2023). Augmented reality product presentation system. Recovered Aug 10, 2023, WIPO IP Portal:

https://patentscope.wipo.int/search/es/detail.jsf?docId=US403485985&_cid=P20-LL42SG-95984-1





2.3. Method and apparatus for converting 3D manuals into 2D interactive videos for cloud service

Disclosed are a method and apparatus for converting 3D manuals into 2D interactive videos for a cloud service. The method for converting 3D manuals into 2D interactive videos for a cloud service, proposed in the present disclosure, includes the steps of performing labeling for annotations in a 3D manual for a cloud service and Machine Learning for recognizing the annotations.



Is a view for explaining a Machine Learning process according to an embodiment of the present disclosure. Credit: Jo, G., WIPO IP Portal

Automatically recognizing the annotations, fine-adjusting automatically unrecognized annotations, and generating a file for converting the 3D manual into a 2D interactive video; linking the 3D manual to a corresponding 2D manual using the file; extracting and handling Artificial Intelligence knowledge based on work instructions in the 2D manual; and performing neural network tasks and linguistic inferences for processing voice requests, and informing the user about the handling and completion of a requested task by sending visual and audio feedback, in order to execute commands based on the Artificial Intelligence knowledge, the digital twin, and the annotations in the 3D manual.

For more information, visit the following link:

https://patentscope.wipo.int/search/es/detail.jsf?docId=US403486149&_cid=P20-LL60NM-47293-1

Reference

Jo, G. (Aug 03, 2023). Method and apparatus for converting 3D manuals into 2D interactive videos for cloud service. Recovered Aug 11, 2023, WIPO IP Portal: https://patentscope.wipo.int/search/es/detail.jsf?docId=US403486149&_cid=P20-LL60NM-47293-1



2.4. Thermoplastic composite material and press dies therefrom

Weekly Newsletter TECHNOLOGY

SURVEILLANCE

Processes and material compositions are disclosed for applying polymer additive manufacturing to producing press dies, such as for sheet metal forming.



Is a pictorial overview of an additive manufacturing system within which a polymeric composite material, in accordance with embodiments of the present teachings, may be usefully applied as a feedstock. Credit: Cernohous, J. & Macy, W., WIPO IP Portal

As disclosed in various embodiments, material compositions comprise a thermoplastic, a first filler having low aspect ratio particles and a second filler having high aspect ratio. In at least one embodiment, composites according to the disclosed teachings have a compressive modulus greater than 3500 MPa and a compressive strength greater than 70 MPa, such that the composites have sufficient mechanical properties for press tooling and are amenable to extrusion-type additive manufacturing processes. In at least one embodiment, the use of the disclosed composites with additive manufacturing enables reduced overall mass of tooling by inclusion of voids inside the die.

For more information, visit the following link: https://patentscope.wipo.int/search/es/detail.jsf?docId=WO2023147285&_cid=P10-LL5Z1C-54634-1

Reference

Cernohous, J. & Macy, W. (Aug 03, 2023). Thermoplastic composite material and press dies therefrom. Recovered Aug 11, 2023, WIPO IP Portal: https://patentscope.wipo.int/search/es/detail.jsf?docId=WO2023147285&_cid=P10-LL5Z1C-54634-1



2.5. Method for determining heat-sink contamination by means of Artificial Intelligence

A method for determining soiling of a heat sink for cooling an electronic component is disclosed. A load curve controlled by the component and a temperature curve along a heat transfer chain from the at least one component to the heat sink are continuously captured.



A diagrammatic plan view of a printed circuit board with power electronic components and a heat sink, Credit: Roppelt, M. & Schmenger, J., WIPO IP Portal

In a training phase, a decision function is determined, which is provided for application to a portion of the load curve and to at least one correspondingly captured portion of a temperature curve. In a classification phase, a non-soiled state of the heat sink is detected when the portion of the load curve presented to the decision function is similar to the portions of the load curve captured in the training phase and when the at least one corresponding portion of a temperature curve is similar to the portions of the temperature curve in question that were correspondingly captured in the training phase.

For more information, visit the following link:

Weekly Newsletter TECHNOLOGY

SURVEILLANCE

https://patentscope.wipo.int/search/es/detail.jsf?docId=US403485277&_cid=P10-LL5YWQ-52107-1

Reference

Roppelt, M. & Schmenger, J. (Aug 03, 2023). Method for determining heat-sink contamination by means of Artificial Intelligence. Recovered Aug 11, 2023, WIPO IP Portal: https://patentscope.wipo.int/search/es/detail.jsf?docId=US403485277&_cid=P10-LL5YWQ-52107-1





2.6. Virtual content

An apparatus, method and computer program is disclosed relating to processing of virtual content.



Is a representational view of a virtual scene, which may be useful for understanding example embodiments. Credit: Mate, S.; Lehtiniemi, A. & Leppänen, J., Espacenet Patent Search

In an example embodiment, the method may comprise providing data representing one or more acoustic properties of a virtual scene, the virtual scene being for output to a user device associated with a user and comprising one or more audio sources at respective locations and identifying, based on a position of the user with respect to the one or more audio sources and the one or more acoustic properties of the virtual scene, one or more audio sources not meeting a predetermined criterion. The method may also comprise providing, via a user interface associated with the user device, one or more indicators respectively corresponding to the one or more identified audio sources. Responsive to selection of one of the one or more indicators, the method may also comprise changing the user position in the virtual scene so that the user is closer to the corresponding audio source.

For more information, visit the following link:

https://worldwide.espacenet.com/patent/search/family/080682576/publication/EP4224888A1?q=Virtual%20 reality

Reference

Mate, S.; Lehtiniemi, A. & Leppänen, J. (Jul 20, 2023). Virtual content. Recovered Jul 20, 2023, Espacenet Patent Search:

https://worldwide.espacenet.com/patent/search/family/080682576/publication/EP4224888A1?q=Virtual%20reality





2.7. Audio modification system and methods

A system for modifying a music track of a video game comprising a trained Machine Learning system which modifies a music track in response to game state data and an audio processor operable to output the modification. The game play data may relate to an image of a scene, character dialogue, image capture, metadata, a scene location or user control input including the magnitude or complexity.



Is a schematic diagram of an entertainment device in accordance with embodiments of the present description. Credit: Monti, M. & Bradley, T., Espacenet Patent Search

The modification to the music may be a change in pitch, key, tempo or instrument or the addition of notes. Metadata may be descriptive of a mood, genre or beat of the track and the lyrics may also be an input. The modification may be time series audio data, frequency transformed audio data or cepstrum transformed audio data. Temporal Machine Learning using recurrent neural networks may be used with training on other games, films or television. The system makes it easier to provide music which fits the game play.

For more information, visit the following link:

https://worldwide.espacenet.com/patent/search/family/080568367/publication/GB2615299A?q=Machine%2 Olearning

Reference

Monti, M. & Bradley, T. (Aug 09, 2023). Audio modification system and method. Recovered Aug 11, 2023, Espacenet Patent Search:

https://worldwide.espacenet.com/patent/search/family/080568367/publication/GB2615299A?q=Machine%20 learning





2.8. Contactless fingerprint capture using Artificial Intelligence and image processing on integrated camera systems

A fingerprinting solution that uses Neural Network (NN) based trained Machine Learning (ML) modules in combination with traditional image processing for contactless fingerprint capture, liveness detection to rule out fake fingers, and fingerprint matching using a portable handheld device with integrated camera, thereby eliminating the need for a special device dedicated for fingerprinting.



Show exemplary screenshots of various displays and alerts that may be provided to a user in real-time by the ACF application during contactless finger-printing as per certain embodiments of the present disclosure. Credit: Parthe, R.; Mistry, V. & Deb, D., Espacenet Patent Search

The trained NN modules detect the size and direction of fingers in the captured image, check if fingers are reversed in the image (thereby making nails visible), check if the thumb of the correct hand is captured, and generate fixed-length fingerprint templates for subsequent matching of fingerprints. Three dimensional (3D) depth map of a finger is used to bring the fingerprint resolution to 500 dpi and eliminate distortion caused by the curvature of the finger shape to improve accuracy while scaling and flattening a fingerprint image. The solution facilitates contactless-to-contactless as well as contactless-to-contact based fingerprint matching.

For more information, visit the following link:

Weekly Newsletter TECHNOLOGY

SURVEILLANCE

https://worldwide.espacenet.com/patent/search/family/087522383/publication/US11721120B1?q=Artificial %20intelligence

Reference

Parthe, R.; Mistry, V. & Deb, D. (Aug 08, 2023). Contactless fingerprint capture using Artificial Intelligence and image processing on integrated camera systems. Recovered Aug 11, 2023, Espacenet Patent Search: https://worldwide.espacenet.com/patent/search/family/087522383/publication/US11721120B1?q=Artificial %20intelligence





2.9. Yarn tension and breakage sensor system

Weekly Newsletter TECHNOLOGY

SURVEILLANCE

A yarn monitoring system for textile machines uses sensors to indicate yarn over-tensioning and breakage. The sensors within eyelets monitor the passage of the yarn and send raw signals to the controller. The eyelets, each with a sensor, are within a body containing a circuit board which is in constant communication with the sensors and software contained within a controller.



Is a block diagram of an example equipment configuration in accordance with the disclosed invention. Credit: McComas, G., Espacenet Patent Search

The controller is in constant communication with the textile machine. The software contains an acceptable operational zone for raw signal data and control limits establishing the lowest raw signal data reading permitted for the yarn. The user establishes set points for the control limits, and reaching these set points is an indication over-tension or yarn breakage. To prevent unnecessary shut down of the machine, the software averages the raw signal data and, when the raw signal average remains out of the established set points, initiates communication to the textile machine.

For more information, visit the following link:

https://worldwide.espacenet.com/patent/search/family/080930114/publication/EP4223684A1?q=Machine%2 Olearning

Reference

McComas, G. (Aug 09, 2023). Yarn tension and breakage sensor system. Recovered Aug 11, 2023, Espacenet Patent Search:

https://worldwide.espacenet.com/patent/search/family/080930114/publication/EP4223684A1?q=Machine%20 learning





2.10. 3D construction printer head

The subject of the invention is a 3D construction printer head for creating a printed element, the head comprising a nozzle having an inlet and an outlet, the nozzle being configured to extrude a layer of building material via its outlet; at least one finisher arrangement; a finisher arrangement motor and a lifting arrangement for moving the finisher arrangement, the finisher arrangement motor and the lifting arrangement being connected to each other.



Shows a spatial view of a 3D construction printer head in accordance with one embodiment of the present invention along with a printed element. Credit: Krepler, B., Espacenet Patent Search

The finisher arrangement comprises an active finisher element for at least partially smoothening a surface of the printed element, and an active finisher element motor for rotating the active finisher element. A height (h1) of the active finisher element being larger than the height (h2) of the layer. This solution provides a 3D construction printer head capable of actively smoothening the surface of the printed structure/wall in a height of more than one layer.

For more information, visit the following link: https://worldwide.espacenet.com/patent/search/family/080447414/publication/EP4223470A1?q=3d

Reference

Krepler, B. (Aug 09, 2023). 3D construction printer head. Recovered Aug 11, 2023, Espacenet Patent Search: https://worldwide.espacenet.com/patent/search/family/080447414/publication/EP4223470A1?q=3d