Weekly Discovery
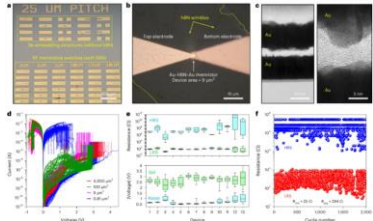
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6G

Key Electronic Device Developed for The Massive Arrival Of 6G Networks

"UAB researchers were involved in the development of a switch, an essential device in telecommunications, capable of operating at very high frequency with lower power consumption than conventional technologies. The technology has applications in the new 6G mass communication systems and is more sustainable in terms of energy consumption than current devices. The study was published recently in Nature Electronics.

The new switch uses a non-volatile material, called hBN (Hexagonal Boron Nitride), which allows its ON or OFF state to be activated by applying an electrical voltage pulse instead of a constant signal. In this way, the energy savings that can be attained are very significant.

Our research team from the Department of Telecommunications and Systems Engineering at the UAB was involved in the design of the devices and their experimental characterisation in the laboratory," explains researcher Jordi Verdú. "For the first time we have been able to demonstrate the operation of a switch based on hBN, a non-volatile material, in a frequency range of up to 120 GHz, which suggests the possibility of using this technology in the new 6G mass communications systems, where a very high number of these elements will be required". For Verdú, this is a "very important contribution, not only from the point of view of device performance, but also towards a much more sustainable technology in terms of energy consumption."

Source: UAB (9 Jul 2024)

AI

Innovative, Highly Accurate AI Model Can Estimate Lung Function Just by Using Chest X-Rays
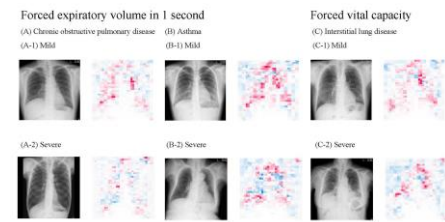
"In findings published in The Lancet Digital Health, a research group led by Associate Professor Daiju Ueda and Professor Yukio Miki at Osaka Metropolitan University's Graduate School of Medicine has developed an artificial intelligence model that can estimate lung function from chest radiographs with high accuracy.

Conventionally, lung function is measured using a spirometer, which requires the cooperation of the patient, who is given specific instructions on how to inhale and exhale into the instrument. Accurate evaluation of the measurements is difficult if the patient has a hard time following instructions, which can occur with infants or persons with dementia, or if the person is prone.

Professor Ueda and the research group trained, validated, and tested the AI model using over 140,000 chest radiographs from a nearly 20-year period. They compared the actual spirometric data to the AI model's estimates to fine-tune its performance. The results showed a remarkably high agreement rate, with a Pearson's correlation coefficient (r) of more than 0.90, indicating that the method is sufficiently promising for practical use.

The AI model developed in this study has the potential to expand the options for pulmonary function assessment for patients who have difficulty performing spirometry.

"Highly significant is the fact that just by using the static information from chest X-rays, our method suggests the possibility of accurately estimating lung function, which is normally evaluated through tests requiring the patients to exert physical energy," Professor Ueda explained. "This AI model was built through the cooperation of many people, from physicians, researchers, and technicians to patients at several institutions. If it can help lessen the burden on patients while also reducing medical costs, that would be a wonderful thing."

Source: OMU (9 Jul 2024)

AI

More Complaints, Worse Performance When AI Monitors Work

"Organizations using AI to monitor employees' behavior and productivity can expect them to complain more, be less productive and want to quit more – unless the technology can be framed as supporting their development, Cornell research finds.

Surveillance tools, which are increasingly being used to track and analyze physical activity, facial expressions, vocal tone and verbal and written communication, cause people to feel a greater loss of autonomy than oversight by humans, according to the research.

Businesses and other organizations using the fast-changing technologies to evaluate whether people are slacking off, treating customers well or potentially engaging in cheating or other wrongdoing should consider their unintended consequences, which may prompt resistance and hurt performance, the researchers say. They also suggest an opportunity to win buy-in, if the subjects of surveillance feel the tools are there to assist rather than judge their performance – assessments they fear will lack context and accuracy.

"When artificial intelligence and other advanced technologies are implemented for developmental purposes, people like that they can learn from it and improve their performance," said Emily Zitek, associate professor of organizational behavior in the ILR School. "The problem occurs when they feel like an evaluation is happening automatically, straight from the data, and they're not able to contextualize it in any way.""

Source: Cornell (2 July 2024)

AI

MIT Researchers Introduce Generative AI For Databases

"A new tool makes it easier for database users to perform complicated statistical analyses of tabular data without the need to know what is going on behind the scenes.

GenSQL, a generative AI system for databases, could help users make predictions, detect anomalies, guess missing values, fix errors, or generate synthetic data with just a few keystrokes.

For instance, if the system were used to analyze medical data from a patient who has always had high blood pressure, it could catch a blood pressure reading that is low for that particular patient but would otherwise be in the normal range.

GenSQL automatically integrates a tabular dataset and a generative probabilistic AI model, which can account for uncertainty and adjust their decision-making based on new data.

Moreover, GenSQL can be used to produce and analyze synthetic data that mimic the real data in a database. This could be especially useful in situations where sensitive data cannot be shared, such as patient health records, or when real data are sparse.

This new tool is built on top of SQL, a programming language for database creation and manipulation that was introduced in the late 1970s and is used by millions of developers worldwide.

"Historically, SQL taught the business world what a computer could do. They didn't have to write custom programs, they just had to ask questions of a database in high-level language. We think that, when we move from just querying data to asking questions of models and data, we are going to need an analogous language that teaches people the coherent questions you can ask a computer that has a probabilistic model of the data," says Vikash Mansinghka '05, MEng '09, PhD '09, senior author of a paper introducing GenSQL and a principal research scientist and leader of the Probabilistic Computing Project in the MIT Department of Brain and Cognitive Sciences.

When the researchers compared GenSQL to popular, AI-based approaches for data analysis, they found that it was not only faster but also produced more accurate results. Importantly, the probabilistic models used by GenSQL are explainable, so users can read and edit them."

Source: MIT (8 Jul 2024)

ARCHITECTURE

Perfect Days: An Ode to Tokyo's Public Toilets

""A bathroom is a place where everyone is equal—there is no rich or poor, no old or young; everyone is part of humanity." This reflection was shared by Wim Wenders, exponent of New German Cinema and director of the film Perfect Days (2023) when asked about the striking sets of his most recent work. Wenders selected Tokyo's public restrooms to craft a narrative that deeply explores themes of solitude, simplicity, and the beauty of everyday life.

The story follows Hirayama, a middle-aged man working as a public toilet cleaner in Tokyo. His life is simple and routine yet filled with small pleasures and moments of reflection. This modest lifestyle contrasts with the technological, colorful, and innovative designs of the public restrooms he cleans every day.

It is no coincidence that these facilities play a prominent role in the film. Initially, the project was conceived as a documentary about Tokyo's impeccable public toilet system, designed by renowned architects. However, when the Tokyo government invited Wenders to visit the country and see the locations, he was impressed by the national sanitation culture and saw the potential to transform the idea into fiction. Instead of a documentary, photo series, or short film, the director created a feature film, believing that 'the ideal way to preserve a place is through fiction.'"

AUTONOMOUS VEHICLES

Self-Driving Technology: Improving Safety Through Sound

"Calyo, Benedex Robotics and Cranfield University have joined forces to improve safety in self-driving vehicles.

The new partnership, part of the DRIVEN BY SOUND project led by Calyo, will develop a functional safety sensing platform based on 3D ultrasound, capable of operating effectively in even the most challenging environmental conditions.

The new technology allows autonomous vehicles to detect their surroundings in 3D in real time. It complements existing sensing and safety detection systems, providing an additional layer of safety and reliability.

The platform will be available to Tier 1 companies, automotive manufacturers, and start-up mobility ventures as a reliable and functional safety module. It serves as a crucial redundancy mechanism, enabling vehicles to perform minimum risk manoeuvres (MRMs) and safely stop in the event of a fault or severe road conditions."

AUTONOMOUS VEHICLES

Trust, More Than Knowledge, Critical for Acceptance of Fully Autonomous Vehicles

"While not yet on the market, fully autonomous vehicles are promoted as a way to make road travel dramatically safer, but a recent study found that knowing more about them did not improve people's perception of their risk. They needed to have more trust in them too.

This study adds to the evidence from other research that knowledge alone is not enough to sway people's attitudes toward complex technology and science, such as gene editing or climate change. In this case, Washington State University researchers found that trust in the autonomous vehicles' reliability and performance played the strongest role in improving perceptions of the technology's risk.

That may be critical to whether this technology will ever be realized, said Kathryn Robinson-Tay, lead author of the study published in the Journal of Risk Research.

"Autonomous vehicles are such consumer-oriented products. Whether they are used or not is really dependent on whether people will buy them," said Robinson-Tay, a doctoral student in WSU's Murrow College of Communication. "We found there was no significant relationship between people's knowledge and their risk perceptions of autonomous vehicles — without the mediation of trust."

While some cars with autonomous features, like Tesla's adaptive cruise control, are on the roads now, fully driverless vehicles are not yet available. By some estimates, if they do

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CHATGPT

How Good Is ChatGPT at Coding, really? Study Finds That While AI Can Be Great, It Also Struggles Due to Training Limitations

"Programmers have spent decades writing code for AI models, and now, in a full circle moment, AI is being used to write code. But how does an AI code generator compare to a human programmer?

A study published in the June issue of IEEE Transactions on Software Engineering evaluated the code produced by OpenAI's ChatGPT in terms of functionality, complexity and security. The results show that ChatGPT has an extremely broad range of success when it comes to producing functional code—with a success rate ranging from anywhere as poor as 0.66 percent and as good as 89 percent—depending on the difficulty of the task, the programming language, and a number of other factors.

While in some cases the AI generator could produce better code than humans, the analysis also reveals some security concerns with AI-generated code.

Yutian Tang is a lecturer at the University of Glasgow who was involved in the study. He notes that AI-based code generation could provide some advantages in terms of enhancing productivity and automating software development tasks—but it's important to understand the strengths and limitations of these models.

"By conducting a comprehensive analysis, we can uncover potential issues and limitations that arise in the ChatGPT-based code generation... [and] improve generation

become available, they could improve traffic safety by 90%. But that likely depends on their wide-adoption, and currently, perceptions of their safety are very low. A 2022 Pew Research poll showed 44% of Americans have a negative view of autonomous vehicles.

For this study, Robinson-Tay and her advising Professor Wei Peng conducted a representative, cross-sectional survey of 323 adults in the U.S. using Census-based quotas for age, gender and race to ensure a diverse sample. The participants answered questions about their knowledge and perceptions of autonomous vehicles and their risk. While trust emerged as the most influential factor, people's desire to experience using fully autonomous vehicles also indirectly led to improved perceptions of risk."

techniques," Tang explains.

To explore these limitations in more detail, his team sought to test GPT-3.5's ability to address 728 coding problems from the LeetCode testing platform in five programming languages: C, C++, Java, JavaScript, and Python."

DESIGN

Barbie Exhibition Aims to Show Toy Is "Worthy Proposition from A Design Point of View"

"The Barbie dolls and Dreamhouses featured in Barbie: The Exhibition at London's Design Museum reflect shifts in visual culture over the famed toy's 65 years.

With over 250 objects on display, Barbie: The Exhibition opens today and examines the history of the doll since it was created by Mattel co-founder Ruth Handler in 1959.

According to curator Thom, the exhibition was conceived to unpack the toy's design influence over the last 65 years and explore the "myriad technical, aesthetic and cultural decisions that go into creating Barbie".

"What I would really like visitors to take away from the show, whether they've come as Barbie fans or Barbie skeptics but with an interest in design, is that there is actually a very complex and intentional set of design processes that go into creating the dolls and the accessories," said the curator.

"And that intentionality does reflect the social context in which any given Barbie is being produced," she told Dezeen at the Design Museum.

"I want people to realise that Barbie is a worthy proposition from a design point of view," she added."

ENGINEERING

How Do You Make Salty Water Drinkable? The Hunt for Fresh Solutions to A Briny Problem

"People have been separating salt from water for millennia, harvesting both salt and fresh drinking water from salty seawater. But there are limits to what can be done — sometimes with drastic consequences. When people in ancient Mesopotamia couldn't work out how to desalinate their irrigation water and prevent salts from accumulating in their soils, their society collapsed. "It's kind of the world's oldest, most boring, but serious problem," says Sujay Kaushal, a hydrologist at the University of Maryland in College Park.

This problem is now growing more pressing, as salinity levels creep up in fresh waters for a slew of reasons. Rising sea levels are pushing salt into coastal groundwaters, while excessive groundwater extraction in other places is drawing deeper, saltier waters up into aquifers. And human activities — from deicing roads to washing clothes and fertilizing fields — are polluting surface waters with many kinds of salt. Last October, Kaushal and his colleagues reported that salt levels in major streams and rivers around the world are booming; some bodies of water are now several times saltier than they were a few decades ago1. Freshwater salinization is a massive global problem, not just a regional one, he says.

A second, related issue is the growing burden of problematic waste brines. A variety of industries — from oil and gas extraction to the desalination plants that produce drinking water — create salty waste waters that are costly to dispose of. "We need to do something with the brine," says Menachem Elimelech, an environmental engineer at Yale University in New Haven, Connecticut."

SUSTAINABILITY

New Carbon Storage Technology Is Fastest of Its Kind
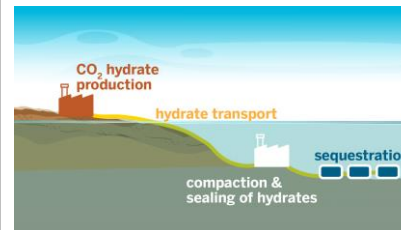
"A new way to store carbon captured from the atmosphere developed by researchers from The University of Texas at Austin works much faster than current methods without the harmful chemical accelerants they require.

In new research published in ACS Sustainable Chemistry & Engineering, the team developed a technique for ultrafast formation of carbon dioxide hydrates. These unique ice-like materials can bury carbon dioxide in the ocean, preventing it from being released into the atmosphere.

"We're staring at a huge challenge — finding a way to safely remove gigatons of carbon from our atmosphere — and hydrates offer a universal solution for carbon storage. For them to be a major piece of the carbon storage pie, we need the technology to grow them rapidly and at scale," said Vaibhav Bahadur, a professor in the Walker Department of Mechanical Engineering who led the research. "We've shown that we can quickly grow hydrates without using any chemicals that offset the environmental benefits of carbon capture."

SUSTAINABILITY

Is Paris Ready for The Olympics? Exploring The City-Wide Implications of Hosting Global Events

"At the beginning of the 20th century, the Olympic games included some unusual medal competitions, including architectural design and town planning. While these are no longer awarded Olympic events, architecture and urban planning continues to continue to have a crucial effect on the development of the global sporting event. Cities that bid to host face an important challenge in adapting their infrastructure to accommodate not only the venues and facilities, but all the support structures needed for a safe and enjoyable edition. Paris is no different. While the city hosted 2 previous editions of the games over a century ago, the challenges of the modern-day Games have proven significant. However, the city's expansive infrastructures have enabled officials to adjust the measures in an effort to have sustainable development for and after the Games. With less than a month to go until the opening ceremony, explore the measures taken by city officials and the long-lasting effects of hosting an Olympic event.

Paris's history intertwines closely with the Olympic Games. Hosting its second edition in 1900 prompted significant urban and architectural advancements, including the inauguration of Metro Line 1 to connect sites of the Universal Exhibition and Olympic Games in Vincennes. Just 24 years later, Paris hosted a pivotal Games, the first broadcast on airwaves, which greatly boosted the event's global appeal and introduced the concept of the Olympic Village."