SINGAPORE UNIVERSITY OF TECHNOLOGY AND DESIGN

Weekly Discovery

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23 Jun - 27 Jun 2025

AI

Some Of Your AI Prompts Could Cause 50 Times More CO2 Emissions Than Others

"Every query typed into a large language model (LLM), such as ChatGPT, requires energy and produces CO2 emissions. Emissions, however, depend on the model, the subject matter, and the user. Researchers have now compared 14 models and found that complex answers cause more emissions than simple answers, and that models that provide more accurate answers produce more emissions. Users can, however, to an extent, control the amount of CO2 emissions caused by AI by adjusting their personal use of the technology, the researchers said.

No matter which questions we ask an AI, the model will come up with an answer. To produce this information – regardless of whether than answer is correct or not – the model uses tokens. Tokens are words or parts of words that are converted into a string of numbers that can be processed by the LLM.

This conversion, as well as other computing processes, produce CO2 emissions. Many users, however, are unaware of the substantial carbon footprint associated with these technologies. Now, researchers in Germany measured and compared CO2 emissions of different, already trained, LLMs using a set of standardized questions.

"The environmental impact of questioning trained LLMs is strongly determined by their reasoning approach, with explicit reasoning processes significantly driving up energy consumption and carbon emissions," said first author Maximilian Dauner, a researcher at Hochschule München University of Applied Sciences and first author of the Frontiers in Communication study. "We found that reasoning-enabled models produced up to 50 times more CO_2 emissions than concise response models."

Source: frontiersin (19 Jun 2025)

AI

AI Innovation at UBC Okanagan Helps Shipping Ports See What's Coming—Literally

"A UBC Okanagan research team has developed an innovative artificial intelligence system that can accurately predict where ships are heading and arriving, potentially helping Canadian ports better prepare for incoming vessels and respond more efficiently to global supply chain disruptions.

Dr. Zheng Liu, a Professor with UBCO's School of Engineering, and doctoral student Chengkai Zhang have created TrajReducer, a framework that increases prediction accuracy and computational efficiency by analyzing ship trajectories through advanced spatial clustering and cross-dimensional metadata ranking.

The research, published recently in Ocean Engineering, addresses a critical need in maritime logistics where accurate predictions of a vessel's arrival time are essential for improving port operations, says Dr. Liu."

"Maritime shipping represents more than 80 per cent of global trade and the ability to accurately predict where cargo vessels are headed and when they will arrive, has never been more important," he says. "Recent years have shown us how quickly global supply chains can be disrupted—whether by pandemic-related delays, geopolitical tensions or incidents like a shipping container getting stuck in the Suez Canal for several days. Canadian ports need tools to help them adapt quickly and efficiently."

Traditional methods for predicting where ships are going have been slow and often inaccurate, he says, with about 30 per cent of data omitting the ship's estimated time of departure and arrival."

Source: EurekAlert! (24 Jun 2025)

AI

Medical AI Can Transform Medicine — But Only If We Carefully Track The Data It Touches

"The practice of modern medicine is built on pattern recognition — whether in a patient's history, physical examination, laboratory results or response to treatment. A skilled physician can identify crucial patterns early and distinguish them from others that appear deceptively similar.

But some patterns are too chaotic, too subtle or too fleeting to raise red flags. No doctor can reliably catch early-stage pancreatic cancer from routine blood tests, for example. Answers to many questions of profound importance that demand knowledge of the future1, such as whether a tumour will spread or how long a person might live, are thus subjective — often coming down to a physician's cumulative experience or 'gut feeling'.

One approach to reducing subjectivity in medicine is through supervised machine learning — a technique based on creating computer models that can detect patterns by learning from labelled data. For instance, by examining many mammogram images that either include or lack tumours, models can learn how to recognize the statistical features that tend to go with one label or the other, even when those features aren't obvious to the human eye.

Unsurprisingly, interest in predictive modelling has exploded. In cases involving tumour spread, organ failure or narrow treatment windows, accurate knowledge of how someone's condition might unfold can conserve resources, reduce suffering and save lives. In 2024 alone, the citation database PubMed indexed more than 26,000 studies mentioning artificial intelligence (AI), machine learning or deep learning in patient health care and clinical medicine. The global market for AI in health care is projected to exceed US$46 billion by the end of this year, and $200 billion by 2030."

Source: Nature (23 Jun 2025)

ARCHITECTURE

Built To (Not) Last: How Reversible Architecture Is Redefining the Way We Build

"What if we imagined buildings as living systems, designed for assembly and disassembly with minimal impact? A form of open, modular, and adaptable architecture designed to evolve with its surroundings, responding to seasonal changes and on-demand needs instead of remaining static. At first glance, the idea seems paradoxical, as many buildings were constructed to last, designed to endure, resist the effects of time, and avoid demolition. Because of this, reversing or undoing could be seen as a setback. But what if that way of thinking no longer fits every scenario?

Reversible architecture refers to a design and construction approach in which the structures and components of a building can be easily assembled, disassembled, modified, or reconfigured with minimal waste. It assumes that nothing will be lost: units are not conceived as permanent elements but are designed for reuse or relocation once their intended function or operational cycle is complete.

The Crystal Palace, designed by Joseph Paxton in 1851, could be considered an early historical precedent. Built for the Great Exhibition, this temporary structure placed temporality at the core of its design, making reversibility a pragmatic and almost instinctive response to economic and time constraints. Unlike contemporary approaches, which align with circular models, this case was driven primarily by industrial and functional motivations. Its prefabricated modular structure of cast iron and glass enabled rapid assembly within the event's deadlines. It later allowed for easy disassembly and relocation to South London, where it remained until a fire destroyed it."

Source: Archdaily (24 Jun 2025)

ARCHITECTURE

The New Ghibli Park in Japan: Redefining Theme Parks Through Adaptive Reuse and Sustainability

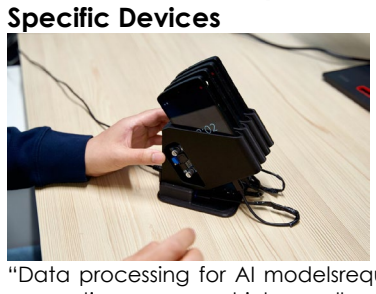
"Studio Ghibli and its co-founder Hayao Miyazaki have become household names in the West, thanks to their impressive body of work, which includes over 10 feature films, 2 Oscars, and more than 100 awards worldwide. Films such as "Spirited Away" and "Howl's Moving Castle" showcase their mastery of world-building, story telling and compelling visuals which have earned them global acclaim. This has created a devoted fan base that previously only had the Studio Ghibli Museum in Tokyo to experience the films in real life. As the studio's popularity and movie portfolio grew, it became inevitable for them to expand into a larger space. That is why November 2022 marked the beginning of a new phase as the Ghibli Park opened its gates in Nagoya, Japan.

The opening caused global excitement, drawing enthusiasts keen to explore the meticulously crafted environments recreated in the park. However, instead of creating a Disney-like theme park with adrenaline-filled rides and character meet-and-greets, Studio Ghibli chose a different path. Staying true to its principles of respecting and harmonizing with nature, central to their films, they repurposed several areas and existing buildings of the 2005 Aichi World Expo Park (today known as Moricoro Park).

Fully completed in March 2024, the new Ghibli Park allows people to experience the environments inspired by their films, in a much more subtle way than what we are used to seeing in other theme parks. The whole concept for it is a symbiosis with the

COMPUTING

Old Smartphones Get New Life as Tiny Data Centers: Even 15-Year-Old Phones Can Still Outperform IoT-Specific Devices



"Data processing for AI modelsrequires a lot of computing power, which usually means bulky, expensive data centers. But researchers are studying how to distribute complex computing tasks among a range of affordable, not-so-powerful devices for more flexibility and ease of use. The approach is especially handy for IoT applications that need to crunch data at unusual or out-of-the-way locations.

In a recent experiment, Estonian engineers found that 15-year-old smartphones, when hacked to work together as a single self-organized unit, can handle many such tasks, including image recognition, with unexpected ease. The researchers think the approach could reduce the cost of IoT computing and open a new avenue for electronics recycling to help tackle the world's growing electronic waste problem.

"Smartphones are really well designed for high-energy processing," says Huber Flores, an associate professor of pervasive computing at the University of Tartu in Estonia. "They are also very well optimized to not overheat and are very efficient in handling heavy data processing applications." Flores and his colleagues published their results in an early access paper published in IEEE Pervasive Computing."

DESIGN

"Ancient Cooling Techniques" Allow 3D-Printed Partitions to Regulate Temperature

"A team of researchers at US university Virginia Tech has developed a concept for a 3D-printed, evaporative cooling system made of hollow clay columns that can be filled with sand and water.

The system, which can cool the surrounding air by up to 10 degrees Fahrenheit (5.56 degrees Celsius), has been formatted into a wall partition and is currently undergoing testing.

It could also be formatted into different interior objects, such as a "cooling chair" made from the same materials. The hollow clay brick could also form the basis of a cooling building facade, a bit like a breeze block.

"The beauty of this technology is you have free cooling, all you need to do is put water through it," said Stefan Al, an architect, urban designer, and assistant professor of architecture at Virginia Tech, who came up with the concept.

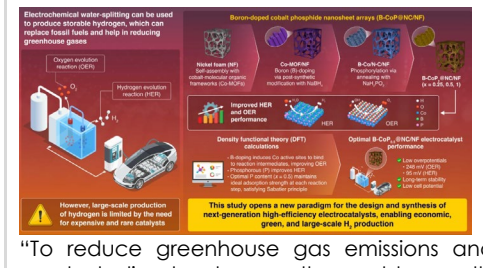
The columns function by having warm air pass through them, where water stored in the internal sand will evaporate, working to cool the air that passes through it.

To develop the concept, the architect collaborated with Brook Kennedy, an industrial designer and fellow faculty member at Virginia Tech, who in 2019 designed a passive water-harvesting system called the Fog Harp.

Al envisions the system cooling system as a hybrid between the muscatese, a type of evaporative window design that originated in Oman, and the zeer pot, a centuries-old cooling device that acts as a fridge by placing

ENERGY

New Breakthrough Catalyst for Cheaper Green Hydrogen Production



"To reduce greenhouse gas emissions and combat climate change, the world urgently needs clean and renewable energy sources. Hydrogen is one such clean energy source that has zero carbon content and stores much more energy by weight than gasoline. One promising method to produce hydrogen is electrochemical water-splitting, a process that uses electricity to break down water into hydrogen and oxygen. In combination with renewable energy sources, this method offers a sustainable way to produce hydrogen and can contribute to the reduction of greenhouse gases.

Unfortunately, large-scale production of hydrogen using this method is currently unfeasible due to the need for catalysts made from expensive rare earth metals. Consequently, researchers are exploring more affordable electrocatalysts, such as those made from diverse transition metals and compounds. Among these, transition metal phosphides (TMPs) have attracted considerable attention as catalysts for the hydrogen generating side of the process, known as hydrogen evolution reaction (HER), due to their favorable properties. However, they perform poorly in the oxygen evolution reaction (OER), which reduces overall efficiency. Previous studies suggest that Boron (B)-doping into TMPs can enhance both HER and OER performance, but until now, making such materials has been a challenge.

In a recent breakthrough, a research team led by Professor Seunghyun Lee, including Mr. Dun Chan Cha, from the Hanyang University

surrounding nature, starting with the choice of the site itself, as the 2005 World Expo's main theme was "Nature's Wisdom"."

Source: Archdaily (24 Jun 2025)

Source: IEEE Spectrum (24 Jun 2025)

a smaller clay pot inside a larger one and filling the space between them with water that ends up evaporating through sand."

Source: Dezeen (24 Jun 2025)

ERICA campus in South Korea, has developed a new type of tunable electrocatalyst using B-doped cobalt phosphide (CoP) nanosheets. Prof. Lee explains, "We have successfully developed cobalt phosphides-based nanomaterials by adjusting boron doping and phosphorus content using metal-organic frameworks. These materials have better performance and lower cost than conventional electrocatalysts, making them suitable for large-scale hydrogen production." Their study was published in the journal Small on March 19, 2025."

Source: ericaresearch (8 Jun 2025)

HEALTH TECH

Ear Wax as a Possible Screening Medium for Parkinson's Disease

"Previous research has shown that changes in sebum, an oily substance secreted by the skin, could help identify people with PD. Specifically, sebum from people with PD may have a characteristic smell because volatile organic compounds (VOCs) released by sebum are altered by disease progression — including neurodegeneration, systemic inflammation and oxidative stress. However, when sebum on the skin is exposed to environmental factors like air pollution and humidity, its composition can be altered, making it an unreliable testing medium. But the skin inside the ear canal is kept away from the elements. So, Hao Dong, Danhua Zhu and colleagues wanted to focus their PD screening efforts on ear wax, which mostly consists of sebum and is easily sampled.

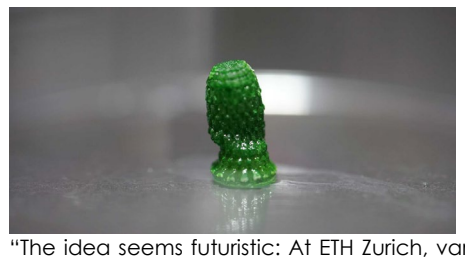
To identify potential VOCs related to PD in ear wax, the researchers swabbed the ear canals of 209 human subjects (108 of whom were diagnosed with PD). They analyzed the collected secretions using gas chromatography and mass spectrometry techniques. Four of the VOCs the researchers found in ear wax from people with PD were significantly different than the ear wax from people without the disease. They concluded that these four VOCs, including ethylbenzene, 4-ethyltoluene, pentanal, and 2-pentadecyl-1,3-dioxolane, are potential biomarkers for PD.

Dong, Zhu and colleagues then trained an artificial intelligence olfactory (AIO) system with their ear wax VOC data. The resulting AIO-based screening model categorized with 94% accuracy ear wax samples from people with and without PD. The AIO system, the researchers say, could be used as a first-line screening tool for early PD detection and could pave the way for early medical intervention, thereby improving patient care."

Source: ACS (18 Jun 2025)

MATERIALS

A Building Material That Lives and Stores Carbon



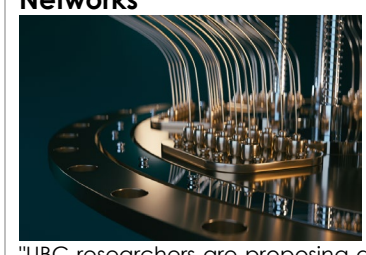
"The idea seems futuristic: At ETH Zurich, various disciplines are working together to combine conventional materials with bacteria, algae and fungi. The common goal: to create living materials that acquire useful properties thanks to the metabolism of microorganisms – "such as the ability to bind CO2 from the air by means of photosynthesis," says Mark Tibbitt, Professor of Macromolecular Engineering at ETH Zurich.

An interdisciplinary research team led by Tibbitt has now turned this vision into reality: it has stably incorporated photosynthetic bacteria – known as cyanobacteria – into a printable gel and developed a material that is alive, grows and actively removes carbon from the air. The researchers recently presented their "photosynthetic living material" in external pagea study in the journal Nature Communications."

Source: ethz (20 Jun 2025)

QUANTUM NETWORKS

UBC Scientists Propose Blueprint For 'Universal Translator' In Quantum Networks



"UBC researchers are proposing a solution to a key hurdle in quantum networking: a device that can "translate" microwave to optical signals and vice versa.

The technology could serve as a universal translator for quantum computers—enabling them to talk to each other over long distances and converting up to 95 per cent of a signal with virtually no noise. And it all fits on a silicon chip, the same material found in everyday computers.

"It's like finding a translator that gets nearly every word right, keeps the message intact and adds no background chatter," says study author Mohammad Khalifa, who conducted the research during his PhD at UBC's faculty of applied science and the Blusson Quantum Matter Institute (QMI).

"Most importantly, this device preserves the quantum connections between distant particles and works in both directions. Without that, you'd just have expensive individual computers. With it, you get a true quantum network."

Source: ubc (19 Jun 2025)

ROBOTTICS IN HEALTHCARE

New Permanent Magnet Configurations Deliver Strong and Homogeneous Fields

"In their work, Dr. Peter Blümler and Professor Ingo Rehberg present optimal three-dimensional arrangements of very compact magnets, idealized by point dipoles. With a view to possible applications, they investigated, among other things, the optimal orientation of the magnets for two geometries relevant to practical use: a single ring and a stacked double ring. A so-called focused design additionally allows the generation of homogeneous fields outside the magnet plane, for example in an object positioned above the magnets.

For these new arrangements, Rehberg and Blümler developed analytical formulas, which they subsequently validated experimentally. To this end, they constructed magnet arrays from 16 FeNdB cuboids mounted on 3D-printed supports. The resulting magnetic fields were measured and compared with theoretical predictions, revealing excellent agreement. In terms of both magnetic field strength and homogeneity, the new configurations clearly outperform the classical Halbach arrangement as well as its modifications described in the literature…

The new design concepts offer great potential for applications in which strong and homogeneous magnetic fields are required. In conventional magnetic resonance imaging (MRI), for example, powerful superconducting magnets are used to polarize hydrogen nuclei in tissue. These nuclei are then excited by radio waves, generating measurable voltages in detectors surrounding the body. Algorithms use these signals to calculate detailed cross-sectional images that allow physicians to distinguish tissue types based on properties such as density, water or fat content, and diffusion. However, superconducting magnets are technically complex and extremely costly, making this technology hardly available in many parts of the world. For such cases, intensive research is underway to develop alternative methods for generating homogeneous magnetic fields using permanent magnets – a field to which the present study makes a promising contribution. Further potential areas of application include particle accelerators and magnetic levitation systems."

Source: JGU (18 Jun 2025)