

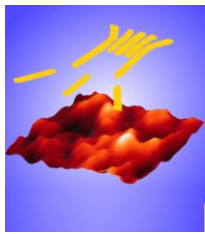
Weekly Discovery

We SHARE to inspire and ignite ideas!

15 Jan – 19 Jan 2024

AI

New Study Uses Machine Learning to Bridge the Reality Gap in Quantum Devices



"A study led by the University of Oxford has used the power of machine learning to overcome a key challenge affecting quantum devices. For the first time, the findings reveal a way to close the 'reality gap': the difference between predicted and observed behaviour from quantum devices. The results have been published in Physical Review X.

Lead researcher Associate Professor Natalia Ares (Department of Engineering Science, University of Oxford) said: "As an analogy, when we play "crazy golf" the ball may enter a tunnel and exit with a speed or direction that doesn't match our predictions. But with a few more shots, a crazy golf simulator, and some machine learning, we might get better at predicting the ball's movements and narrow the reality gap."

Artistic diagram showing a 3D surface, covered in peaks and troughs. A series of lines across this represents the flow of a current.

A representation of a quantum device and its internal disorder which influences measurement outcomes. Credit: David Craig/PRX.

The researchers measured the output current for different voltage settings across an individual quantum dot device. The data was input into a simulation which calculated the difference between the measured current with the theoretical current if no internal disorder was present. By measuring the current at many different voltage settings, the simulation was constrained to find an arrangement of internal disorder that could explain the measurements at all voltage settings. This approach used a combination of mathematical and statistical approaches coupled with deep learning.

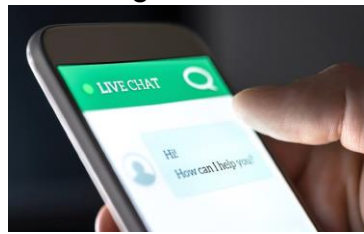
Associate Professor Ares added: "In the crazy golf analogy, it would be equivalent to placing a series of sensors along the tunnel, so that we could take measurements of the ball's speed at different points. Although we still can't see inside the tunnel, we can use the data to inform better predictions of how the ball will behave when we take the shot."

Not only did the new model find suitable internal disorder profiles to describe the measured current values, it was also able to accurately predict voltage settings required for specific device operating regimes."

Source: [OXFORD](#) (10 Jan 2024)

AI

Google Ai Has Better Bedside Manner Than Human Doctors — And Makes Better Diagnoses



"An artificial intelligence (AI) system trained to conduct medical interviews matched, or even surpassed, human doctors' performance at conversing with simulated patients and listing possible diagnoses on the basis of the patients' medical history.

The chatbot, which is based on a large language model (LLM) developed by Google, was more accurate than board-certified primary-care physicians in diagnosing respiratory and cardiovascular conditions, among others. Compared with human doctors, it managed to acquire a similar amount of information during medical interviews and ranked higher on empathy.

"To our knowledge, this is the first time that a conversational AI system has ever been designed optimally for diagnostic dialogue and taking the clinical history," says Alan Karthikesalingam, a clinical research scientist at Google Health in London and a co-author of the study, which was published on 11 January in the arXiv preprint repository. It has not yet been peer reviewed."

Source: [Nature](#) (12 Jan 2024)

ARCHITECTURE

How Do You Design for Informality?



"Informal architecture is the dominant mode of urbanization in rapidly growing and industrializing cities worldwide. In Delhi, the city with the largest population in India has half of its residents living in informal settlements. Lagos, with a population of over 22 million, also has 60% of its residents living in informal settlements. This pattern is also observed in Cairo, Johannesburg, Kinshasa, and other cities in the global south that face similar challenges of inequality and housing shortages. As their population grows and urbanization progresses, the exploration of informal architecture schemes to address the demand for affordable housing and basic services will only increase. While the primary purpose of design is to provide structure, lessons from informal architecture offer insights into how architects can respond to such schemes."

Source: [Archdaily](#) (12 Jan 2024)

COVID 19

How Did Free Wi-Fi Help Unlock Hanoi Wet Markets' Mysteries?



"Researchers at the Alliance of Bioversity International and CIAT and their collaborators have been working on how to harness the power of the estimated 549 million Wifi hotspots worldwide, resulting in a project that used anonymized data gathered from free Wi-Fi to better understand the impact of COVID-19 on Hanoi's wet markets during the first stage of the Covid-19 pandemic.

In the paper "Using free Wi-Fi to assess impact of COVID-19 pandemic on traditional wet markets in Hanoi" published in December 2023 in the scientific journal Food Security, the researchers analyzed and interpreted mobile device tracking data from 25 Wi-Fi access points to characterize the changes in behavior in the users of hundreds of stores and food stalls across five wet markets in Hanoi, from July 2019 to November 2020.

Lead author Louis Reymondin, who co-leads the Data Driven Sustainability research theme for the Alliance of Bioversity International and CIAT says that by counting the number of individual device addresses within a certain range of the access points, the researchers got a sense of the number of people present (with the details of users anonymised)."

Source: [EurekAlert!](#) (16 Jan 2024)

DESIGN

Make-Your-Own-Toilet Kit Among Five Standout Projects from Design for Good



"Designers from ten high-profile companies have joined forces to help improve access to clean water and sanitation as part of the Design for Good consortium. Chief experience officer Fazilat Damani shares five of the most promising.

Design for Good (DfG) was originally launched in 2022 as a non-profit alliance of ten businesses from different industries, including tech companies Microsoft and Philips and London's Royal College of Art.

The alliance also includes food corporations Nestlé and PepsiCo, which have previously been named among the five most plastic-polluting companies in the world.

Working in two-year cycles, designers from each of these companies are donating their time and skills pro bono, collaborating in teams to tackle one of the 17 Sustainable Development Goals (SDGs) set out by the United Nations."

Source: [Dezeen](#) (15 Jan 2024)

MACHINE LEARNING

HIRI Researchers Develop a New Machine Learning Approach



"To combat viruses, bacteria and other pathogens, synthetic biology offers new technological approaches whose performance is being validated in experiments. Researchers from the Würzburg Helmholtz Institute for RNA-based Infection Research and the Helmholtz AI Cooperative applied data integration and artificial intelligence (AI) to develop a machine learning approach that can predict the efficacy of CRISPR technologies more accurately than before. The findings were published today in the journal Genome Biology."

Source: [Helmholtz Institute](#) (11 Jan 2024)

MATERIALS

Catalytic Combo Converts CO2 to Solid Carbon Nanofibers



"Scientists at the U.S. Department of Energy's (DOE) Brookhaven National Laboratory and Columbia University have developed a way to convert carbon dioxide (CO2), a potent greenhouse gas, into carbon nanofibers, materials with a wide range of unique properties and many potential long-term uses. Their strategy uses tandem electrochemical and thermochemical reactions run at relatively low temperatures and ambient pressure. As the scientists describe in the journal Nature Catalysis, this approach could successfully lock carbon away in a useful solid form to offset or even achieve negative carbon emissions.

"You can put the carbon nanofibers into cement to strengthen the cement," said Jingguang Chen, a professor of chemical engineering at Columbia with a joint appointment at Brookhaven Lab who led the research. "That would lock the carbon away in concrete for at least 50 years, potentially longer. By then, the world should be shifted to primarily renewable energy sources that don't emit carbon."

As a bonus, the process also produces hydrogen gas (H2), a promising alternative fuel that, when used, creates zero emissions."

Source: [BNL](#) (11 Jan 2024)

MATERIALS

Scientists Have Come Up with A Technology to Recycle Used Clothes Rather Than Simply Burning Them



"Today, it is almost impossible to recycle clothes woven with mixed fibres. Running clothes, for example, are most often made of a mixture of elastane, which gives the clothes stretch and a tight fit, and either cotton, merino wool or nylon. New technology makes it possible to separate the fibres so that they can be recycled."

Source: [NAT](#) (11 Jan 2024)

PLAGIARISM

What Counts as Plagiarism? Harvard President's Resignation Sparks Debate



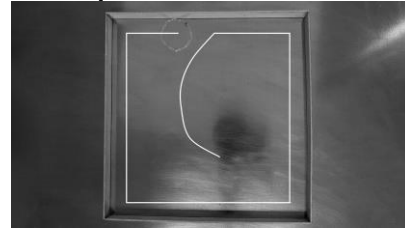
POWER ELECTRONICS

Is This Hybrid Tech Power Electronics' Future?



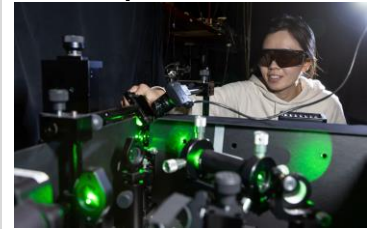
ROBOTS

New Soft Robots Roll Like Tires, Spin Like Tops and Orbit Like Moons



SOLAR

New Findings Regarding the High Efficiency of Perovskite Solar Cells



"Plagiarism is one of academia's oldest crimes, but Claudine Gay's resignation as Harvard University's president following plagiarism allegations has sparked a fresh online debate: about when copying text should be a punishable offence. Some academics are even advocating for a more streamlined publishing model in which researchers can copy more and write less — as long as the source of the information is clear.

The idea that all researchers must compose their own sentences remains a bedrock principle for many, but that view might encounter new resistance in a world with essentially limitless access to information and increasingly sophisticated artificial intelligence (AI) algorithms that can reproduce language with eerie accuracy."

Source: [Nature](#) (11 Jan 2024)

"It's heady times in power electronics. After decades of domination by silicon, two newer materials—silicon carbide and gallium nitride—have begun taking over multibillion-dollar markets. Silicon carbide is now the semiconductor of choice for the inverters and chargers in electric vehicles, for example. And if you've purchased a wall charger lately for your smartphone or laptop, chances are good that it uses gallium nitride.

The newer materials, known as wide-bandgap semiconductors, are taking over these and other power-electronics applications because they offer many superior characteristics. And yet wide-bandgap technologies still have fundamental weaknesses. For a silicon-carbide transistor, a big one is relatively low mobility of electrons in the channel—the area under the device's gate through which current flows between the source and the drain. That low mobility prevents SiC transistors from switching at high rates. That, in turn, limits their efficiency in applications such as converting between alternating current and direct current. Gallium-nitride transistors, on the other hand, have a quirk known as "dynamic on-resistance," which means that when the device is conducting current, the resistance of the device depends on the voltage—higher voltage means higher on-resistance. Another problem with GaN is that the physical size of the device, and therefore its cost, goes up as its voltage-blocking capability does, a key ability for devices expected to turn on and off voltages that are many times higher than those found inside, say, a typical computer."

Source: [IEEE Spectrum](#) (16 Jan 2024)

"Researchers have developed a new soft robot design that engages in three simultaneous behaviors: rolling forward, spinning like a record, and following a path that orbits around a central point. The device, which operates without human or computer control, holds promise for developing soft robotic technologies that can be used to navigate and map unknown environments.

The new soft robots are called twisted ringbots. They are made of ribbon-like liquid crystal elastomers that are twisted — like a rotini noodle — and then joined together at the end to form a loop that resembles a bracelet. When the robots are placed on a surface that is at least 55 degrees Celsius (131 degrees Fahrenheit), which is hotter than the ambient air, the portion of the ribbon touching the surface contracts, while the portion of the ribbon exposed to the air does not. This induces a rolling motion; the warmer the surface, the faster the robot rolls."

Source: [NCSU](#) (8 Jan 2024)

"Highly efficient and relatively inexpensive to produce — perovskite solar cells have been the subject of repeated surprises in recent years. Scientists at Forschungszentrum Jülich have now discovered another special feature of the cells using a new photoluminescence measurement technique. They found that the loss of charge carriers in this type of cell follows different physical laws than those known for most semiconductors. This may be one of the main reasons for their high level of efficiency. The results were presented in the journal *Nature Materials*."

Source: [FZ](#) (10 Jan 2024)

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