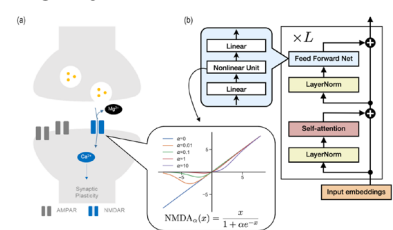


AI
AI's Memory-Forming Mechanism Found to Be Strikingly Similar to That of The Brain



"An interdisciplinary team consisting of researchers from the Center for Cognition and Sociality and the Data Science Group within the Institute for Basic Science (IBS) revealed a striking similarity between the memory processing of artificial intelligence (AI) models and the hippocampus of the human brain. This new finding provides a novel perspective on memory consolidation, which is a process that transforms short-term memories into long-term ones, in AI systems.

In the race towards developing Artificial General Intelligence (AGI), with influential entities like OpenAI and Google DeepMind leading the way, understanding and replicating human-like intelligence has become an important research interest. Central to these technological advancements is the Transformer model [Figure 1], whose fundamental principles are now being explored in new depth.

The key to powerful AI systems is grasping how they learn and remember information. The team applied principles of human brain learning, specifically concentrating on memory consolidation through the NMDA receptor in the hippocampus, to AI models."

Source: [IBS](#) (28 Nov 2023)

AI
Deepmind AI Outdoes Human Mathematicians on Unsolved Problem



"The card game Set has long inspired mathematicians to create interesting problems.

Now, a technique based on large language models (LLMs) is showing that artificial intelligence (AI) can help mathematicians to generate new solutions.

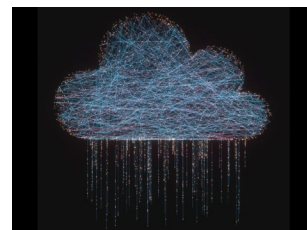
The AI system, called FunSearch, made progress on Set-inspired problems in combinatorics, a field of mathematics that studies how to count the possible arrangements of sets containing finitely many objects. But its inventors say that the method, described in Nature on 14 December, could be applied to a variety of questions in maths and computer science.

"This is the first time anyone has shown that an LLM-based system can go beyond what was known by mathematicians and computer scientists," says Pushmeet Kohli, a computer scientist who heads the AI for Science team at Google Deepmind in London. "It's not just novel, it's more effective than anything else that exists today."

This is in contrast to previous experiments, in which researchers have used large language models to solve maths problems with known solutions, says Kohli."

Source: [Nature](#) (14 Dec 2023)

AI
AI Sharpens Rainfall Estimates from Satellites



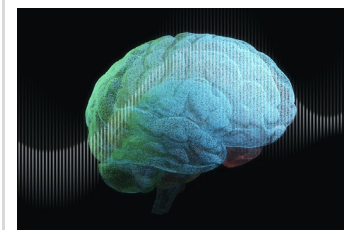
"Weather satellites can track every movement of a storm from orbit. However, the algorithms that analyze satellite readings currently don't estimate precipitation levels as well as the algorithms that have been fed ground-based radar data. Now, a new study finds AI can help greatly improve satellite-based estimates.

Accurate estimates of how much rain, snow and hail has fallen on an area is important to refining weather forecasts, managing vital water supplies, and investigating climate change. But developing accurate precipitation estimates from raw satellite data "is not an easy task," explains study co-author Haonan Chen, a remote sensing scientist at Colorado State University in Fort Collins. Satellites essentially scan cloud tops instead of detecting what has fallen on the surface. "Extracting surface-level precipitation information from measurements on top of the clouds requires sophisticated models that can bridge the gap," he says.

In the new study, Chen and his colleagues analyzed data from the Geostationary Operational Environmental Satellites (GOES) operated by the U.S. National Oceanic and Atmospheric Administration. The researchers focused on the GOES-R satellites, which scan visible and infrared light from Earth."

Source: [IEEE Spectrum](#) (23 Nov 2023)

DEEP NEURAL NETWORKS
Deep Neural Networks Show Promise as Models of Human Hearing



"Computational models that mimic the structure and function of the human auditory system could help researchers design better hearing aids, cochlear implants, and brain-machine interfaces. A new study from MIT has found that modern computational models derived from machine learning are moving closer to this goal.

In the largest study yet of deep neural networks that have been trained to perform auditory tasks, the MIT team showed that most of these models generate internal representations that share properties of representations seen in the human brain when people are listening to the same sounds.

The study also offers insight into how to best train this type of model: The researchers found that models trained on auditory input including background noise more closely mimic the activation patterns of the human auditory cortex."

Source: [MIT](#) (13 Dec 2023)

DESIGN
10 Interior Design Trends of 2023



"As we head towards the end of 2023, an eventful year that could be defined as the year of "shifts", we take a look at how global events and trends impacted the design of interior spaces. Looking back, people questioned everything, and the architectural practice was no exception. A new voice was given to nations often forgotten as architects searched for alternative ways of designing and building. We questioned colonialism, consumer culture, waste, tradition, and authenticity, bringing about new perspectives within the discipline. Interior design in 2023, however, was reserved; explorative, but a lot more modest and subtle compared to previous years. Following years of constant changes, it seems as though people felt the need to pause, slow down, and embrace simplicity, while expressing their individuality through acupuncture interventions."

Source: [Archdaily](#) (18 Dec 2023)

INTERNET
Amazon Fires Up Its Space Lasers Kuiper Internet Satellites Will Form a Mesh Network Using Optical Links



"A shoot-out featuring thousands of lasers is about to break out in low earth orbit. Luckily, no one will get hurt—the lasers' targets are the protagonists' own communications satellites.

Amazon has just announced that two of its prototype internet satellites equipped with infrared lasers transferred data at 100 gigabits per second over a distance of nearly 1000 kilometers. The company says all of its upcoming 3236 Project Kuiper satellites will include such interlinks, forming a high-speed mesh network to route data around the world.

SpaceX's rival Starlink system, which already boasts over 1.5 million customers including the Ukrainian military, has been experimenting with optical interlinks for about a year. It recently claimed to have more than 8,000 space lasers on its newest generation of satellites, which began launching earlier this year.

Now the race is on to build the first complete optical inter-satellite link (OISL) constellation, at a price that's competitive with terrestrial 5G and fiber networks."

Source: [IEEE Spectrum](#) (18 Dec 2023)

MATERIALS
Dezeen's Top 10 Innovative Materials of 2023



"Dezeen's design and environment editor Jennifer Hahn has rounded up 10 of this year's most significant material innovations, including bricks made from toxic soil and a 3D printer for wool.

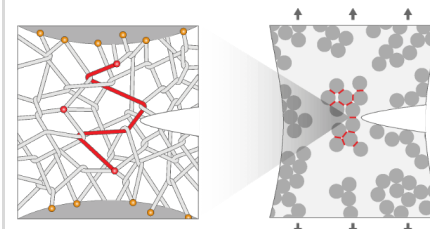
Over the last 12 months, designers found new uses for bacteria, using the microorganisms to colour textiles, grow a leather alternative and turn plastic waste into vanilla ice cream.

In architecture, researchers continued to reinvent concrete, with some using algae instead of cement as a binder while others rediscovered the secret to "self-healing" Roman concrete.

Energy efficiency was an ongoing concern in light of the recent energy crisis, with projects such as water-filled windows and colour-changing cladding aiming to passively heat and cool buildings without relying on fossil fuels."

Source: [Dezeen](#) (18 Dec 2023)

MATERIALS
Rubber That Doesn't Grow Cracks When Stretched Many Times



"Researchers from the Harvard John A. Paulson School of Engineering and Applied Sciences (SEAS) have increased the fatigue threshold of particle-reinforced rubber, developing a new, multiscale approach that allows the material to bear high loads and resist crack growth over repeated use. This approach could not only increase the longevity of rubber products such as tires but also reduce the amount of pollution from rubber particles shed during use."

Source: [Harvard](#) (14 Dec 2023)

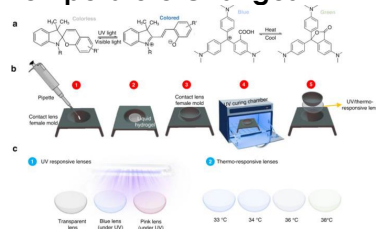
MATERIALS
Upcycling Leftover Cardboard to Make a New Type of Foam Packaging



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

To create their foam, the team broke down cardboard scraps in a blender to create a pulp, then mixed it with either gelatin or polyvinyl acetate (PVA) glue. The mixtures were poured into molds, refrigerated, then freeze-dried to form cushioning foams. Both paper-based foams served as good thermal insulators and strong energy absorbers — even better than some plastic foams. The team then created a heavy-duty version of their wastepaper foam by combining the pulp, gelatin, PVA glue, and a silica-based fluid that hardens as force is applied. This version of the cardboard-based foam withstood hits from a hammer without falling apart, and that result suggests the foam

OPTICAL SENSORS
Contact Lenses Developed by Khalifa University Team Respond to UV And Temperature Changes

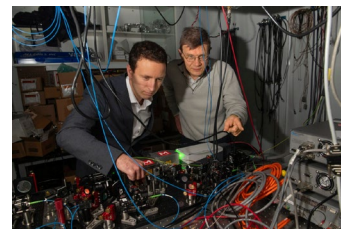


"The global rise in ocular diseases, largely due to insufficient ophthalmic diagnostics and monitoring, has emphasized the need for better treatment methods. Pioneering developments in therapeutic and diagnostic contact lenses are now offering hope in treating these diseases.

Cataracts, which cloud the lens of the eye, are a prime example, affecting 94 million people and leading to 10 million surgeries annually. A significant factor in the rise of cataracts and other ocular conditions, such as age-related macular degeneration (AMD) and photokeratitis, is excessive exposure to ultraviolet (UV) light.

In response, a team of researchers at Khalifa University has developed state-of-the-art UV protective contact lenses. Prof. Haider Butt and PhD student Ahmed Salih, both Department of Mechanical Engineering, developed their lenses using smart materials such as photochromic and thermochromic powders. They have unique optical attributes depending on their activated and inactivated states."

QUANTUM COMPUTING
Researchers Create First Logical Quantum Processor



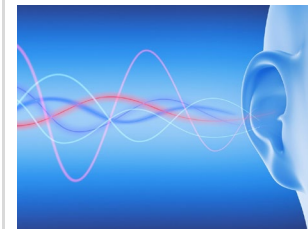
"Harvard researchers have realized a key milestone in the quest for stable, scalable quantum computing, an ultra-high-speed technology that will enable game-changing advances in a variety of fields, including medicine, science, and finance.

The team, led by Mikhail Lukin, the Joshua and Beth Friedman University Professor in physics and co-director of the Harvard Quantum Initiative, has created the first programmable, logical quantum processor, capable of encoding up to 48 logical qubits, and executing hundreds of logical gate operations, a vast improvement over prior effort.

Published in Nature, the work was performed in collaboration with Markus Greiner, the George Vasmer Leverett Professor of Physics; colleagues from MIT; and QuEra Computing, a Boston company founded on technology from Harvard labs.

The system is the first demonstration of large-scale algorithm execution on an error-corrected quantum computer, heralding the advent of

SENSORS
Tech Gives Sound Directionality to Hearing Aids



"Hearing aids can be critical for people suffering from hearing loss, yet these devices still have some flaws, including the fact that they lack adequate sound directionality. To overcome this issue, one research team in Taiwan has combined several technologies—such as computer vision, specialized algorithms, and microphone arrays—that provide users with a better ear for where sound is coming from.

The proposed design includes an innovative dual-layer microphone array placed on the ears, and a necklace-style wearable device, which incorporates a camera with computer vision AI. An algorithm helps the computer vision component find faces in the scene to predict which face the sound is coming from. When the speaker is out of range of the computer vision system, an algorithm that predicts that sound's origin based on the angle and time of arrival kicks in.

In the last step, a mixing algorithm helps modify the sound that users hear to help them better detect the sound's directionality, and subsequently adjusts the volume to achieve an immersive auditory experience."

could be used in force-intensive deliveries, such as parachute-free airdrops. The researchers say their work offers a simple yet efficient method to upcycle cardboard to create more environmentally friendly packaging materials."

Source: [ACS](#) (14 Dec 2023)

early fault-tolerant, or reliably uninterrupted, quantum computation.

Lukin described the achievement as a possible inflection point akin to the early days in the field of artificial intelligence: the ideas of quantum error correction and fault tolerance, long theorized, are starting to bear fruit."

Source: [EurekaAlert!](#) (27 Nov 2023)

Source: [HARVARD](#) (8 Dec 2023)

Source: [IEEE Spectrum](#) (18 Dec 2023)

To view past Weekly Alerts [CLICK HERE](#)
For more articles or in-depth research, contact us at library@sutd.edu.sg
A SUTD Library Service©2023