Weekly Discovery

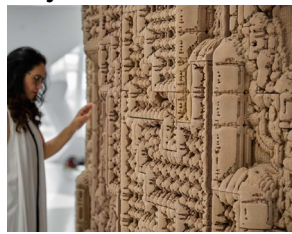We SHARE to inspire and ignite ideas!

25 Dec – 29 Dec 2023

3D PRINTING

From Decarbonization to Ornamental Expression: Innovative 3D Printed Projects From 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 (25 Dec 2023)

AI

Artificial Intelligence Can Predict Events in People's Lives

"ITU, and Northeastern University in the US shows that if you use large amounts of data about people's lives and train so-called 'transformer models', which (like ChatGPT) are used to process language, they can systematically organize the data and predict what will happen in a person's life and even estimate the time of death.

In a new scientific article, 'Using sequences of life-events to predict human lives', published in Nature Computational Science, researchers have analyzed health data and attachment to the labour market for 6 million Danes in a model dubbed life2vec. After the model has been trained in an initial phase, i.e., learned the patterns in the data, it has been shown to outperform other advanced neural networks (see fact box) and predict outcomes such as personality and time of death with high accuracy.

"We used the model to address the fundamental question: to what extent can we predict events in your future based on conditions and events in your past? Scientifically, what is exciting for us is not so much the prediction itself, but the aspects of data that enable the model to provide such precise answers," says Sune Lehmann, professor at DTU and lead author of the article."

Source: DTU (18 Dec 2023)

AI

New Brain-Like Transistor Mimics Human Intelligence

"Taking inspiration from the human brain, researchers have developed a new synaptic transistor capable of higher-level thinking.

Designed by researchers at Northwestern University, Boston College and the Massachusetts Institute of Technology (MIT), the device simultaneously processes and stores information just like the human brain. In new experiments, the researchers demonstrated that the transistor goes beyond simple machine-learning tasks to categorize data and is capable of performing associative learning.

Although previous studies have leveraged similar strategies to develop brain-like computing devices, those transistors cannot function outside cryogenic temperatures. The new device, by contrast, is stable at room temperatures. It also operates at fast speeds, consumes very little energy and retains stored information even when power is removed, making it ideal for real-world applications.

The study was published in the journal Nature."

Source: Northwestern (20 Dec 2023)

ARCHITECTS

Remembering The Architects and Designers We Lost In 2023

"Our review of 2023 pays tribute to the architects, designers and innovators who died in this year, including Pritzker Architecture Prize winner Balkrishna Doshi, Walkie Talkie architect Rafael Viñoly and fashion pioneer Mary Quant."

Source: Dezeen (21 Dec 2023)

BATTERIES

New Material Allows for Better Hydrogen-Based Batteries and Fuel Cells


"Researchers led by Genki Kobayashi at the RIKEN Cluster for Pioneering Research in Japan have developed a solid electrolyte for transporting hydride ions (H^-) at room temperature. This breakthrough means that the advantages of hydrogen-based solid-state batteries and fuel cells are within practical reach, including improved safety, efficiency, and energy density, which are essential for advancing towards a practical hydrogen-based energy economy. The study was published in the scientific journal Advanced Energy Materials."

Source: Eurekalert! (21 Dec 2023)

CHATBOT

These Scientists Aren't Using ChatGPT — Here's Why
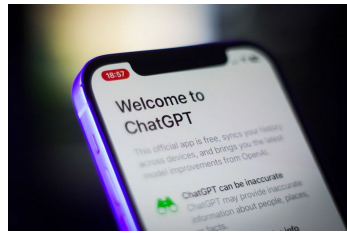
"Since its release a year ago, it has been impossible to escape the ChatGPT craze. The chatbot, which generates incredibly realistic human-like text and was released by OpenAI in November 2022, seems to have permeated every industry, including science. Researchers have used ChatGPT, and the broader technology known as generative AI, to brainstorm research ideas, create computer code and even write entire research papers.

But not all scientists are embracing the technology. According to a survey carried out by Nature, about 78% of researchers do not regularly use generative AI tools such as ChatGPT. Of those that do, many have used it only for fun activities not related to their research, or as an experiment. Some have chosen to steer clear of chatbots because of the potential pitfalls and limitations. Others fear that they are missing out.

Nature spoke to three researchers about why they are not using ChatGPT in their work."

Source: Nature (19 Dec 2023)

DESIGN

New Discovery Could Aid Regenerative Heart Therapies
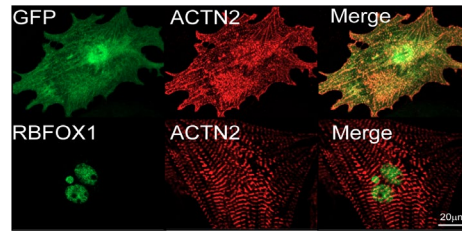
"Scientists led by Duke-NUS Medical School in Singapore and the University of California, Los Angeles, (UCLA) in the United States have discovered a new control mechanism that can drive the maturation of human stem cell-derived heart muscle cells, providing fresh insight into the maturation process of heart muscle cells from foetal to adult form.

After birth, heart muscle cells undergo extensive changes to become fully mature adult cells, altering their form, function and physiology. However, the regulatory processes governing this maturation have been poorly understood thus far. For regenerative therapies in particular, this lack of understanding has proven a major limitation as efforts to grow stem cell-derived heart muscle cells have not been successful at producing mature adult cells, capable of restoring or improving heart function.

Publishing in Circulation, the research team used transcriptomic analysis to pinpoint an RNA splicing regulator named RBFox1 that was highly elevated soon after birth in a newborn heart. Analyses of published single-cell data also showed dramatic RBFox1 increase in maturing heart cells."

Source: DUKE NUS (18 Dec 2023)

IMAGING

### Gentle X-ray Imaging of Small Living Specimens
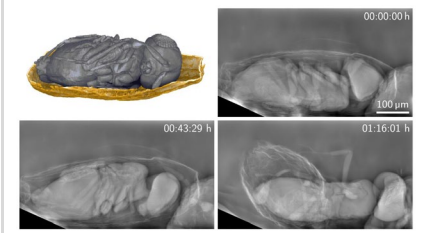
"Researchers from Karlsruhe Institute of Technology (KIT) and partners all over Germany have developed a new system for X-ray imaging, which is suited for both living specimens and sensitive materials. The system records images of micrometer resolution at a minimum radiation dose. In a pilot study, the researchers tested their method on living parasitic wasps and observed them for more than 30 minutes. They report in Optica.

X-ray imaging visualizes hidden structures and processes in living cells and organisms. The radiation that consists of highly energy-rich electromagnetic waves, however, has an ionizing effect and may damage the genetic material. This limits the possible observation period. While conventional X-ray images of soft tissue are of low contrast, phase contrast methods produce far better image contrasts at a reduced radiation dose. With higher resolution, however, gentle imaging becomes increasingly difficult, as a higher dose is required. Moreover, the efficiency of the usually applied high-resolution detectors decreases, as a result of which radiation exposure is further increased. So far, high-resolution X-ray phase contrast imaging of living biological specimens has been possible for a few seconds to minutes only, before severe damage is caused by the radiation."

Source: kit (8 Dec 2023)

MACHINE LEARNING

### This GPT-Powered Robot Chemist Designs Reactions and Makes Drugs — On Its Own
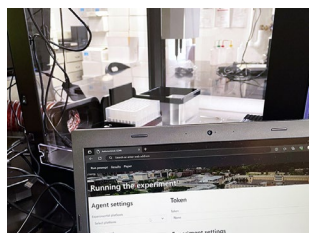
"When the latest version of the large language model (LLM) behind ChatGPT, called GPT-4, was unveiled in March, Gomes and his team set about making it work for chemists.

The result, Coscientist, uses the latest powerful LLMs, including GPT-4, to scour the chemical literature and design a reaction pathway to make a molecule when prompted by a human. The LLM reads through instruction manuals on the Internet and decides on the best kit and reagents in its arsenal to make the molecule in real time.

The AI also uses the LLM Claude, developed by the AI firm Anthropic in San Francisco, California, and one called Falcon-40B-Instruct built by the Technology Innovation Institute in Abu Dhabi."

MATERIALS

Cellhint Can Unify Different Single-Cell Data, Creating Harmonised, Applicable Datasets for The Study of Human Health and Disease
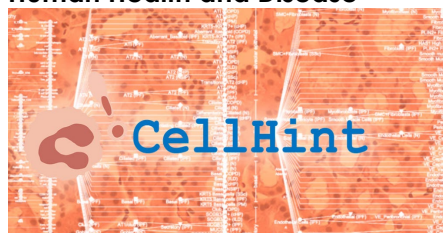
"A new methodology that allows for the categorisation and organisation of single-cell data has been launched. It can be used to create a harmonised dataset for the study of human health and disease.

Researchers at the Wellcome Sanger Institute, the University of Cambridge, EMBL's European Bioinformatics Institute (EMBL-EBI), and collaborators developed the tool, known as CellHint. CellHint uses machine learning to unify data produced across the world, allowing it to be accessed by the wider research community, potentially driving new discoveries.

In a new study, published today (21 December) in Cell, researchers applied CellHint to reveal underexplored connections between healthy and diseased lung cell states. They looked at"

ROBOTS

Scientists Develop 'Flying Dragon' Robot to Fight Fires from A Distance

"Imagine a flying dragon that doesn't spout fire, but instead extinguishes it with blasts of water. Thanks to a team of Japanese researchers, this new kind of beast may soon be recruited to firefighter teams around the world, to help put out fires that are too dangerous for their human teammates to approach.

The blueprint of this novel firefighter robot, called the Dragon Firefighter, has now been published in Frontiers in Robotics and AI. And as it has been published as Open Science, roboticists around the world may freely use the plans to build their own Dragon Firefighters, for the benefit of all.

"We here present a prototype of a four-meter-long, remotely controllable flying firehose robot, engineered to safely and efficiently extinguish fires in buildings by directly approaching the fire"

SEMICONDUCTORS

New Photonic Chip Is the Full Package

"Researchers at the University of Sydney have combined a photonic filter and modulator on a single chip in a way that allows them to precisely detect signals across a wide band of radiofrequency (RF) spectrum. The work brings photonic chips one step closer to one day potentially replacing bulkier and more complex electronic RF chips in fiber optic networks.

The Sydney team exploited stimulated Brillouin scattering, a technique which involves converting electrical fields into pressure waves in certain insulators, such as optical fibers. In 2011, the researchers reported that Brillouin scattering held potential for high-resolution filtering, and developed new manufacturing techniques to combine a chalcogenide Brillouin waveguide on a silicon chip. In 2023, they managed to combine a photonic filter and modulator on the"

The team prompted the system to plan a synthesis for several known molecules, including the painkillers paracetamol and aspirin, and the organic molecules nitroaniline and phenolphthalein. In the planning stage, Coscientist was able to work out the steps that would give the best reaction yields overall. It made the molecules correctly."

eight diseases, such as interstitial lung disease and chronic obstructive pulmonary lung disease, and showed the possible benefits of this tool. They also applied CellHint to 12 tissues from 38 datasets, providing a deeply curated cross-tissue database with around 3.7 million cells.

Cellhint is freely available worldwide and was created as part of the Human Cell Atlas initiative which aims to map every cell type in the human body to transform understanding of health and disease."

sources," said joint corresponding author Dr Yuichi Ambe, an assistant professor at Osaka University."

same type of chip. The combination gives the experimental chip a spectral resolution of 37 megahertz and a wider bandwidth than preceding chips, the team reported in a paper published 20 November in Nature Communications."

Source: Nature (20 Dec 2023)

Source: Sanger (21 Dec 2023)

Source: Eurekalert! (22 Dec 2023)

Source: IEEE Spectrum (25 Dec 2023)