SINGAPORE UNIVERSITY OF TECHNOLOGY AND DESIGN

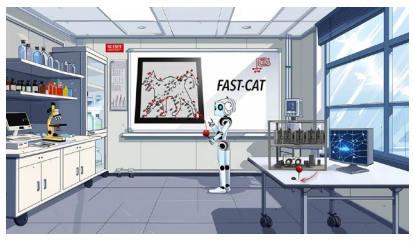
Weekly Discovery

We SHARE to inspire and ignite ideas!

4 Mar – 8 Mar 2024

AI

AI-Driven Lab Speeds Catalysis Research



"Researchers have developed a "self-driving" lab that uses artificial intelligence (AI) and automated systems to provide in-depth analyses of catalytic reactions used in chemical research and manufacturing. The new tool, called Fast-Cat, can provide more information in five days than is possible in six months of conventional testing.

At issue are the yield and selectivity of chemical reactions in the presence of molecules called ligands.

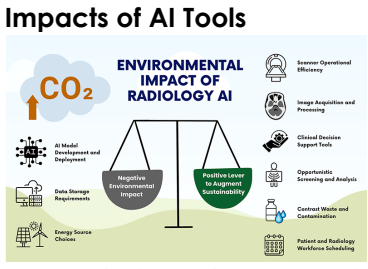
Yield refers to how efficiently a chemical reaction produces a desired product from the chemicals you started with. Selectivity refers to the extent to which you can make a chemical reaction produce a specific product instead of creating multiple products. Ligands are widely used in catalysis, speeding up and controlling the selectivity of chemical reactions used in processes ranging from industrial chemistry to pharmaceutical manufacturing.

From an industry perspective, you want the highest possible yield and selectivity. Because the specific steps you take when conducting the catalytic reaction can influence both yield and sensitivity, industrial chemists spend a tremendous amount of time and effort trying to find the parameters necessary to achieve the most desirable reaction outcome."

Source: NCSU (27 Feb 2024)

AI

Researchers Look at Environmental Impacts of AI Tools



"As AI is increasingly used in radiology, researchers caution that it's essential to consider the environmental impact of AI tools, according to a focus article published in Radiology.

Health care and medical imaging significantly contribute to the greenhouse gas (GHG) emissions fueling global climate change. AI tools can improve both the practice of and sustainability in radiology through optimized imaging protocols resulting in shorter scan times, improved scheduling efficiency to reduce patient travel, and the integration of decision-support tools to reduce low-value imaging. But there is a downside to AI utilization.

"Medical imaging generates a lot of greenhouse gas emissions, but we often don't think about the environmental impact of associated data storage and AI tools," said Kate Hanneman, MD, MPH, vice chair of research and associate professor at the University of Toronto and deputy lead of sustainability at the Joint Department of Medical Imaging, Toronto General Hospital. "The development and deployment of AI models consume large amounts of energy, and the data storage needs in medical imaging and AI are growing exponentially."

Source: RSNA (27 Feb 2024)

AI

AI Outperforms Humans in Standardized Tests of Creative Potential

"Score another one for artificial intelligence. In a recent study, 151 human participants were pitted against ChatGPT-4 in three tests designed to measure divergent thinking, which is considered to be an indicator of creative thought.

Divergent thinking is characterized by the ability to generate a unique solution to a question that does not have one expected solution, such as "What is the best way to avoid talking about politics with my parents?" In the study, GPT-4 provided more original and elaborate answers than the human participants.

The study, "The current state of artificial intelligence generative language models is more creative than humans on divergent thinking tasks," was published in Nature's Scientific Reports and authored by U of A Ph.D. students in psychological science Kent F. Hubert and Kim N. Awa, as well as Darya L. Zabelina, an assistant professor of psychological science at the U of A and director of the Mechanisms of Creative Cognition and Attention Lab."

Source: University of Arkansas (1 Mar 2024)

AI

Virtual Walking by Synthesizing Avatars into A 360-Degree Video

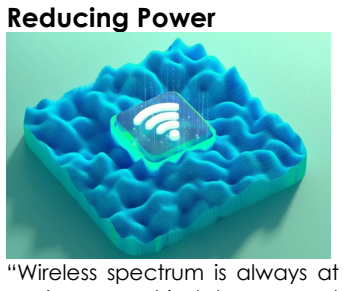
"Walking is a fundamental activity for humans and an important exercise that is central to daily activities. A research team from Toyohashi University of Technology and the University of Tokyo is developing a system that provides a virtual walking experience for a seated person. The system aims to provide a walking experience in virtual environments using a 3DCG space and 360-degree live-action video.

In virtual environments, physical information or information for embodiment is an important factor in enhancing the experience. In this study, the walking experience was enhanced by adding physical information about the user, which was not originally included in the 360-degree video experience and integrating it with the 360-degree video. The physical information comprises a walking avatar (virtual human), shadows created by light projecting onto the avatar, and vibrations created by the feet during walking. The walking experience can be acquired through the avatar and its shadow synthesized with a 360-degree video, and the use of long shadows enhances the sense of leg action and telepresence during walking."

Source: Eurekalert! (28 Feb 2024)

AI & WIFI

Qualcomm's Newest Chip Brings AI To Wi-Fi the FastConnect 7900 Relies on AI To Improve Connectivity While Reducing Power



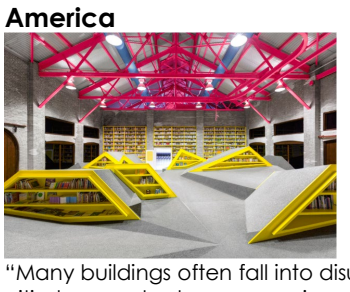
"Wireless spectrum is always at a premium—if you've ever tried to connect to Wi-Fi in a crowded airport or stadium, you know the pain that comes from crowded spectrum use. That's why the industry continues to tinker with ways to get the most out of available spectrum. The latest example: Qualcomm's FastConnect 7900 chip, which the company unveiled Monday at Mobile World Congress in Barcelona.

Qualcomm touts the FastConnect 7900 as a provider of "AI-enhanced" Wi-Fi 7, which the company views as an opportunity to create more reliable wireless connections. The chip will also better integrate the disparate technologies of Wi-Fi, Bluetooth, and ultrawideband for consumer applications. In addition, the chip can support two connections to the same device over the same spectrum band."

Source: IEEE Spectrum (27 Feb 2024)

ARCHITECTURE

Cultural Centers, Museums, and Galleries: Ancient Buildings Transformed into Art Spaces in Latin America



"Many buildings often fall into disuse due to our cities' constant economic, social, and technological changes. The programmatic inconsistency of current times demands great versatility and adaptability from our infrastructures, increasingly leading projects to become uninhabited, and left to abandonment and decay.

Spaces for cultural and artistic exhibition and dissemination often carry implicit reflections on the importance of the memory of their cities, where heritage and architecture are understood as tangible manifestations of the history of each place. For this reason, when cultural projects are conceived, existing buildings on the site are often valued, opting to operate through specific interventions that allow for hosting new programmatic uses while also highlighting the original works."

Source: Archdaily (29 Feb 2024)

CLIMATE CHANGE

This Methane-sniffing Satellite Will Leave Climate Polluters Nowhere to Hide

"Carbon dioxide usually dominates the discussion when it comes to climate change, but slashing methane emissions could have an even bigger effect on global warming over the next few decades. With the help of a satellite that is set to launch as early as 4 March from Vandenberg Space Force Base near Lompoc, California, governments and businesses will at last have a tool to help them to pinpoint methane hotspots on Earth and plug the leaks.

Developed by a coalition of environmentalists, scientists and aerospace engineers at a cost of around US$88 million, MethaneSAT is designed to provide an unparalleled view of methane emanating from oil and gas fields across the planet — as well as from agricultural facilities and landfills. Working with Google, MethaneSAT's operators will process data from the satellite using an atmospheric model that can track methane in the air back to its sources on the ground. They will then make the data freely available. Google also plans to use artificial-intelligence algorithms to help map oil and gas infrastructure worldwide and identify where the pollution is coming from."

Source: Nature (1 Mar 2024)

DESIGN

Ukrainian Studios "Doing What We Can, And Sometimes What We Can't" After Two Years of War

"Two years into Russia's full-scale invasion, architecture and design studios in Ukraine are adapting to support the war effort while also ensuring they stay in business.

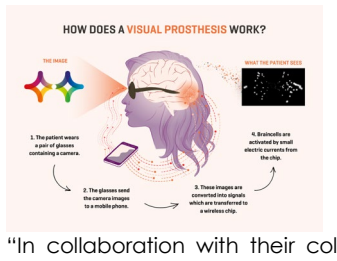
Casualties in the war now number around 500,000, including more than 10,000 civilian deaths.

With Saturday marking two years since Russia's troops crossed the Ukraine border, Dezeen spoke to architecture and design studios in the country about how they are coping amid the ongoing conflict."

Source: Dezeen (23 Feb 2024)

HEALTHTECH

Visual Prosthesis Simulator Offers a Glimpse into The Future

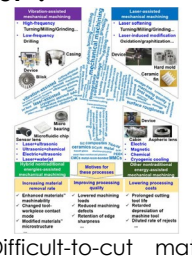


"In collaboration with their colleagues at the Donders Institute, researchers at the Netherlands Institute for Neuroscience have developed a simulator that enables artificial visual observations for research into the visual prosthesis. This open source tool is available to researchers and offers those who are interested insight into the future application.

Blindness affects approximately forty million people worldwide and is expected to become increasingly common in the coming years. Patients with a damaged visual system can be broadly divided into two groups: those in whom the damage is located in front of or in the photoreceptors of the retina; and those in whom the damage is further along in the visual system. Various retinal prostheses have been developed for the first group of patients in recent years and clinical tests are underway. The problems for the second group are more difficult to tackle.

MACHINING

How To Make Difficult-To-Cut Materials and Components "Easy-To-Cut"?



"Difficult-to-cut materials such as titanium alloys, high-temperature alloys, metal/ceramic/polymer-matrix composites, hard and brittle materials, as well as geometrically complex components such as thin-walled structures, micro channels and complex surfaces, are widely used in aerospace community. Nevertheless, many problems including severe and rapid tool wear, low machining efficiency, and poor surface integrity exist in mechanical machining. How to efficiently and precisely process these materials and components, i.e., make difficult-to-cut into "easy-to-cut", addresses increasing attention."

ROBOTICS

Building Bionic Jellyfish for Ocean Exploration

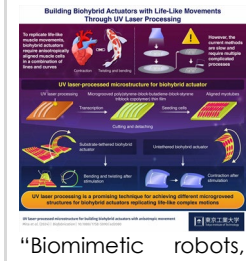
"Jellyfish can't do much besides swim, sting, eat, and breed. They don't even have brains. Yet, these simple creatures can easily journey to the depths of the oceans in a way that humans, despite all our sophistication, cannot.

But what if humans could have jellyfish explore the oceans on our behalf, reporting back what they find? New research conducted at Caltech aims to make that a reality through the creation of what researchers call biohybrid robotic jellyfish. These creatures, which can be thought of as ocean-going cyborgs, augment jellyfish with electronics that enhance their swimming and a prosthetic "hat" that can carry a small payload while also making the jellyfish swim in a more streamlined manner.

The work, published in the journal Bioinspiration & Biomimetics, was conducted in the lab of John Dabiri (MS '03, PhD '05), the Centennial Professor of Aeronautics and Mechanical Engineering, and builds on his previous work augmenting jellyfish.

ROBOTICS

A Novel Method for Easy and Quick Fabrication of Biomimetic Robots with Life-Like Movement



"Biomimetic robots, which mimic the movements and biological functions of living organisms, are a fascinating area of research that can not only lead to more efficient robots but also serve as a platform for understanding muscle biology. Among these, biohybrid actuators, made up of soft materials and muscular cells that can replicate the forces of actual muscles, have the potential to achieve life-like movements and functions, including self-healing, high efficiency, and high power-to-weight ratio, which have been difficult for traditional bulky robots that require heavy energy sources….

Creating such complex arrangements requires the formation of curved microgrooves (MGs) on a substrate, which then serve as the guide for aligning muscle cells in the required patterns. Fabrication of complex MGs has been achieved by methods such as photolithography, wavy

A potential solution for these patients is to stimulate the cerebral cortex. By implanting electrodes in the brain's visual cortex and stimulating the surrounding tissue with weak electrical currents, tiny points of light known as 'phosphenes' can be generated. This prosthesis converts camera input into electrical stimulation of the cerebral cortex. In doing so, it bypasses part of the affected visual system and thus allow some form of vision. You could compare it with a matrix sign along the highway, where individual lights form a combined image."

Source: NIN (27 Feb 2024)

Source: Eurekalert! (28 Feb 2024)

Dabiri's goal with this research is to use jellyfish as robotic data-gatherers, sending them into the oceans to collect information about temperature, salinity, and oxygen levels, all of which are affected by Earth's changing climate."

Source: CALTECH (28 Feb 2024)

micrography and micro-contact printing. However, these methods involve multiple intricate steps and are not suitable for rapid fabrication.

To address this, a team of researchers from Tokyo Institute of Technology (Tokyo Tech) in Japan, led by Associate Professor Toshinori Fujie from the School of Life Science and Technology, has developed an ultraviolet (UV) laser-processing technique for fabricating complex microstructures. "Based on our previous prototypes, we hypothesized that biohybrid actuators using an SBS (hard rubber) thin film with arbitrary anisotropic MGs fabricated by a UV laser processing can control cellular alignment in an arbitrarily anisotropic direction to reproduce more life-like flexible movements," explains Dr. Fujie. Their study has been published in the journal Biofabrication (External site) ..."

Source: TITECH (26 Feb 2024)