SINGAPORE UNIVERSITY OF TECHNOLOGY AND DESIGN

Weekly Discovery

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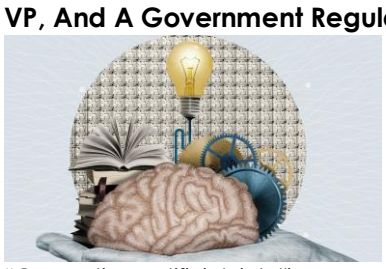
10 June – 14 June 2024

AI

How Large Language Models Are Changing My Job: The AI Revolution as Seen by A Dean, A Semiconductor VP, And A Government Regulator



"Generative artificial intelligence, and large language models in particular, are starting to change how countless technical and creative professionals do their jobs. Programmers, for example, are getting code segments by prompting large language models. And graphic arts software packages such as Adobe Illustrator already have tools built in that let designers conjure illustrations, images, or patterns by describing them.

But such conveniences barely hint at the massive, sweeping changes to employment predicted by some analysts. And already, in ways large and small, striking and subtle, the tech world's notables are grappling with changes, both real and envisioned, wrought by the onset of generative AI. To get a better idea of how some of them view the future of generative AI, IEEE Spectrum asked three luminaries—an academic leader, a regulator, and a semiconductor industry executive—about how generative AI has begun affecting their work. The three, Andrea Goldsmith, Juraj Čorba, and Samuel Naffziger, agreed to speak with Spectrum at the 2024 IEEE VIC Summit & Honors Ceremony Gala, held in May in Boston."

Source: IEEE Spectrum (6 Jun 2024)

AI

How Game Theory Can Make AI More Reliable

"Researchers are drawing on ideas from game theory to improve large language models and make them more correct, efficient, and consistent. To make a language model's answers more consistent—and make the model more reliable overall—Jacob and his colleagues devised a game where the model's two modes are driven toward finding an answer they can agree on. Dubbed the consensus game, this simple procedure pits an LLM against itself, using the tools of game theory to improve the model's accuracy and internal consistency.

"Research exploring self-consistency within these models has been very limited," said Shayegan Omidshafiei, chief scientific officer of the robotics company Field AI. "This paper is one of the first that tackles this, in a clever and systematic way, by creating a game for the language model to play with itself."

"It's really exciting work," added Ahmad Beirami, a research scientist at Google Research. For decades, he said, language models have generated responses to prompts in the same way. "With their novel idea of bringing a game into this process, the MIT researchers have introduced a totally different paradigm, which can potentially lead to a flurry of new applications."

Source: Wired (9 Jun 2024)

ARCHITECTURE

Architecture For Glamping: Embracing Nature with Comfort

"Camping, as defined in dictionaries, involves temporarily staying outdoors, setting up makeshift accommodations, and settling in natural surroundings. In architecture, tents symbolize these aspects, representing a typology that has endured across centuries and cultures, often linked with notions of impermanence and vulnerability.

In light of this common understanding, the term 'glamping' emerged in the early 2000s, blending 'camping' with 'glamour,' suggesting a fusion of camping with luxurious amenities. However, despite its recent popularization, the concept is far from original. Camping has not always been seen as the antithesis of luxury.

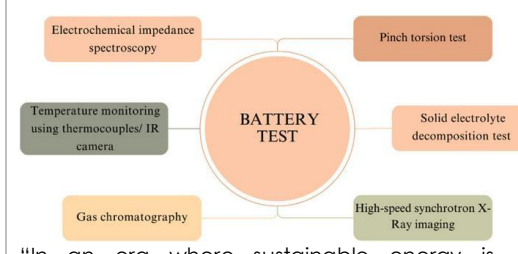
The Mongols were famous for their yurts. Historical accounts depict Genghis Khan's tent as exceptionally grand and elaborate, mounted on a platform with 9-meter diameter wheels and pulled by a cart drawn by 22 oxen. Centuries later, even the British royal family camped in luxurious structures during hunting safaris in India and Africa, complete with bathrooms and comfortable furniture. This tradition inspired the development of campaign furniture, also known as Bivouac furniture, characterized by its compact and minimalist design, often foldable or stackable for easy transport.

In this context, it is important to highlight that contemporary glamping, while not a novel idea, distinguishes itself in many aspects from the luxurious camps of yesteryears. These structures are meticulously crafted, emphasizing sustainability, aesthetics, and user experience. From solar panels to rainwater collection systems or natural materials, these structures are purposefully crafted to have a minimal carbon footprint. This ethos resonates with many glampers who seek a comfortable yet environmentally conscious experience."

Source: Archdaily (2 Jun 2024)

BATTERY

Sustainable Battery Technology: Innovations In Design, Manufacturing, And Fault Detection



"In an era where sustainable energy is paramount, a groundbreaking study provides critical insights into battery health management. It meticulously examines the design, optimization, fault detection, and recycling of Lithium-ion, Lead Acid, and Nickel Metal Hydride (NiMH) batteries—crucial components for the next generation of portable devices, electric vehicles, and renewable energy systems.

As our reliance on electric vehicles and renewable energy systems grows, so does the demand for efficient and sustainable battery technologies. The challenges of performance degradation, safety concerns, and environmental impact loom large. The need of the hour is to innovate in battery design, optimization, and fault detection, and to develop effective recycling strategies to minimize ecological footprint. The urgency calls for in-depth research to propel battery health management forward and foster sustainable energy storage solutions.

Researchers from the Industrial Tribology Laboratory have unveiled a comprehensive study on battery health management. Their work, published (DOI: 10.1016/j.enss.2024.04.001) on April 16, 2024, in the esteemed Energy Storage and Saving journal, presents an in-depth analysis of battery design, manufacturing processes, fault detection strategies, and cutting-edge recycling techniques."

Source: Eurekalert! (10 Jun 2024)

BIOTECHNOLOGY

Scientists Engineer Yellow-Seeded Camelina with High Oil Output

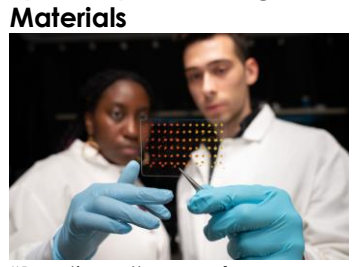
"Efforts to achieve net-zero carbon emissions from transportation fuels are increasing demand for oil produced by nonfood crops. These plants use sunlight to power the conversion of atmospheric carbon dioxide into oil, which accumulates in seeds. Crop breeders, interested in selecting plants that produce a lot of oil, look for yellow seeds. In oilseed crops like canola, yellow-seeded varieties generally produce more oil than their brown-seeded counterparts. The reason: The protein responsible for brown seed color—which yellow-seeded plants lack—also plays a key role in oil production.

In a paper just published in The Plant Biotechnology Journal, they describe how they used tools of modern genetics to produce a yellow-seeded variety of Camelina sativa, a close relative of canola, that accumulates 21.4% more oil than ordinary camelina."

Source: Phys.Org (11 Jun 2024)

COMPUTER VISION

New Computer Vision Method Helps Speed Up Screening of Electronic Materials



"Boosting the performance of solar cells, transistors, LEDs, and batteries will require better electronic materials, made from novel compositions that have yet to be discovered.

To speed up the search for advanced functional materials, scientists are using AI tools to identify promising materials from hundreds of millions of chemical formulations. In tandem, engineers are building machines that can print hundreds of material samples at a time based on chemical compositions tagged by AI search algorithms.

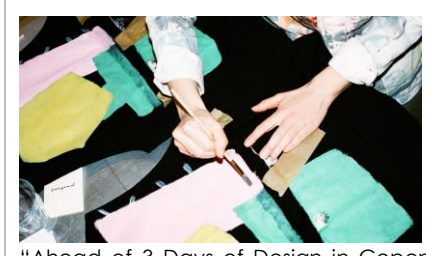
Now, a new computer vision technique developed by MIT engineers significantly speeds up the characterization of newly synthesized electronic materials. The technique automatically analyzes images of printed semiconducting samples and quickly estimates two key electronic properties for each sample: band gap (a measure of electron activation energy) and stability (a measure of longevity).

The new technique accurately characterizes electronic materials 85 times faster compared to the standard benchmark approach. The researchers intend to use the technique to speed up the search for promising solar cell materials. They also plan to incorporate the technique into a fully automated materials screening system."

Source: MIT News (11 Jun 2024)

DESIGN

Twelve Must-See Exhibitions and Events At 3 Days of Design



"Ahead of 3 Days of Design in Copenhagen, we've rounded up 12 unmissable events, including a show on a historic yacht and an exhibition that explores people's perception of plastic.

The festival, which has been dubbed the "second biggest destination for design" – after Milan design week – will be held in the Danish capital from 12 to 14 June.

As its reputation and impact grows, the event has begun attracting big brands from outside Scandinavia as well as local Danish brands.

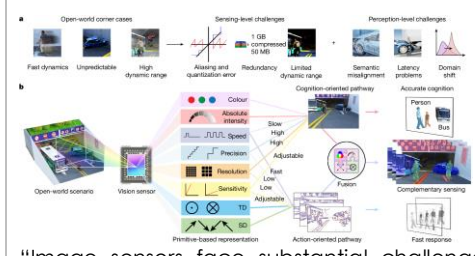
But 3 Days of Design also hosts a number of exhibitions that showcase emerging designers and focus on collectible and sustainable design.

Here, we have collected 12 events and installations not to be missed during 3 Days of Design and see Dezeen Events Guide's guide to 3 Days of Design 2024 for details of many of the events taking place across the city."

Source: Dezeen (5 Jun 2024)

IMAGING TECHNIQUES

A Vision Chip with Complementary Pathways for Open-World Sensing

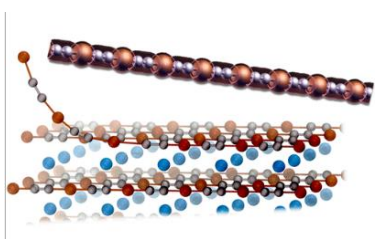


"Image sensors face substantial challenges when dealing with dynamic, diverse and unpredictable scenes in open-world applications. However, the development of image sensors towards high speed, high resolution, large dynamic range and high precision is limited by power and bandwidth. Here we present a complementary sensing paradigm inspired by the human visual system that involves parsing visual information into primitive-based representations and assembling these primitives to form two complementary vision pathways: a cognition-oriented pathway for accurate cognition and an action-oriented pathway for rapid response. To realize this paradigm, a vision chip called Tianmouc is developed, incorporating a hybrid pixel array and a parallel-and-heterogeneous readout architecture. Leveraging the characteristics of the complementary vision pathway, Tianmouc achieves high-speed sensing of up to 10,000 fps, a dynamic range of 130 dB and an advanced figure of merit in terms of spatial resolution, speed and dynamic range. Furthermore, it adaptively reduces bandwidth by 90%. We demonstrate the integration of a Tianmouc chip into an autonomous driving system, showcasing its abilities to enable accurate, fast and robust perception, even in challenging corner cases on open roads. The primitive-based complementary sensing paradigm helps in overcoming fundamental limitations in developing vision systems for diverse open-world applications."

Source: Nature (29 May 2024)

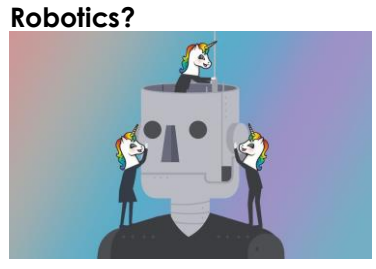
NANOMATERIALS

Searching For the Thinnest Metallic Wire



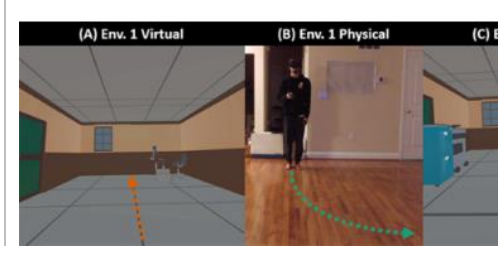
ROBOTICS

The Mythical Non-Roboticist: Wouldn't It Be Great If Everyone Could Do Robotics?



VIRTUAL REALITY

This Computer Scientist Is Making Virtual Reality Safer



WEARABLES

Melanin-Spiked Bodysuits Provide Sun Protection in Melwear Concept

"One-dimensional materials have gained much attention in the last decades: from carbon nanotubes to ultrathin nanowires to few-atom atomic chains, these can all display unique electronic properties and great potential for next-generation applications. Exfoliable bulk materials could naturally provide a source for one-dimensional wires with a well-defined structure and electronics. Here, we explore a database of one-dimensional materials that could be exfoliated from experimentally known three-dimensional van der Waals compounds, searching for metallic wires that are resilient to Peierls distortions and could act as vias or interconnects for future downscaled electronic devices. As the one-dimensional nature makes these wires particularly susceptible to dynamical instabilities, we carefully characterize vibrational properties to identify stable phases and characterize electronic and dynamical properties. Our search discovers several stable wires; notably, we identify what could be the thinnest possible exfoliable metallic wire, CuC2, coming a step closer to the ultimate limit in material downscaling."

Source: ACS Nano (7 Jun 2024)

"The idea goes something like this: Programming robots is hard. And there are some people with really arcane skills and PhDs who are really expensive and seem to be required for some reason. Wouldn't it be nice if we could do robotics without them? 1 What if everyone could do robotics? That would be great, right? We should make a software framework so that non-roboticists can program robots.

This idea is so close to a correct idea that it's hard to tell why it doesn't work out. On the surface, it's not wrong: All else being equal, it would be good if programming robots was more accessible. The problem is that we don't have a good recipe for making working robots. So we don't know how to make that recipe easier to follow. In order to make things simple, people end up removing things that folks might need, because no one knows for sure what's absolutely required. It's like saying you want to invent an invisibility cloak and want to be able to make it from materials you can buy from Home Depot. Sure, that would be nice, but if you invented an invisibility cloak that required some mercury and neodymium to manufacture would you toss the recipe?

In robotics, this mistake is based on a very true and very real observation: Programming robots is super hard. Famously hard. It would be super great if programming robots was easier. The issue is this: Programming robots has two different kinds of hard parts."

Source: IEEE Spectrum (9 Jun 2024)

"Virtual reality (VR) headsets aren't without their risks. Users can bump into walls, furniture or even other people. Niall Williams is looking to fix that. This computer scientist makes programs that keep people safer while using VR. He works at the University of Maryland in College Park.

Williams works with redirected walking. This technique nudges users along a path in the real world by subtly changing their virtual display. Developers can tweak how VR programs represent traveling distance, says Williams. For example, algorithms can make two feet of walking in the real-world cover more virtual ground. This lets users walk naturally while exploring large digital spaces.

His algorithms stopped more collisions than other redirected walking programs. By using slower changes, they also lower the odds of motion sickness. Williams is exploring other ways to use natural walking in virtual spaces, he says.

Read the paper here on IEEE Transactions on Visualization and Computer Graphics."

Source: Science News Explores (4 Jun 2024)

"Developed as part of Maca Barrera's graduate degree in biodesign, Melwear is based on two emerging technologies: the biosynthesis of melanin within bacteria and the bioprinting of artificial tissues with living cells.

With Melwear, Barrera explores one of the most unique properties of melanin – its UV absorbency. This absorbency would create sun protection for the wearer of the garment.

Bioprinting, the other key technology explored in the piece, is mainly used for the creation of artificial tissues, with the goal of one day replicating whole organs. By incorporating bioprinting into her project, Barrera is able to imagine additional functionalities for it.

"It's an opportunity to create future scenarios and solutions that can contribute to scientific advancements to address sustainable challenges," she said. "In this context, Melwear is a speculative project that aims to push the boundaries of what we currently know as UV protection and explore solutions that consider a balance between human and environmental health."

Source: Dezeen (10 Jun 2024)