SINGAPORE UNIVERSITY OF TECHNOLOGY AND DESIGN

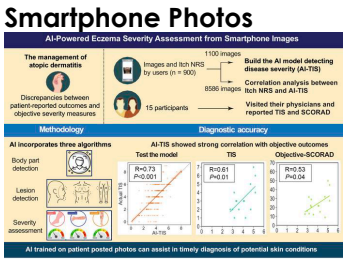
Weekly Discovery

We SHARE to inspire and ignite ideas!

19 May - 23 May 2025

AI

AI Tool Enables Real-World Assessment of Eczema Severity Via Smartphone Photos



"Tokyo, Japan – [May 9, 2025] – A team of researchers from Keio University School of Medicine, Kyoto Prefectural University of Medicine, and Teikyo University, in collaboration with Atopiyo LLC, has developed a novel artificial intelligence (AI) model that can objectively assess eczema severity using smartphone images uploaded by patients. Their findings were recently published in Allergy, the official journal of the European Academy of Allergy and Clinical Immunology.

Atopic dermatitis (AD) is a common chronic skin condition that flares repeatedly and often requires long-term monitoring and treatment adjustments. In recent years, smartphone apps and social media platforms have made it easier for patients to track their symptoms, learn about their condition, and document changes over time. However, patient-reported symptoms like itch or sleep loss don't always align with visible disease severity. This gap underscores the need for more standardized, objective evaluation tools—and highlights the growing potential of digital biomarkers to fill that role.

To address this, the research team leveraged data from Atopiyo, Japan's largest AD platform, where over 28,000 users have shared more than 57,000 symptom photos and personal comments since 2018. The AI model developed in this study integrates three key algorithms: body part detection, eczema lesion detection, and severity scoring using the Three Item Severity (TIS) scale, which evaluates redness, swelling, and excoriation."

Source: Eurekalert! (20 May 2025)

ARCHITECTURE

Vernacular Building and AI: Can Data Alone Bridge the Gap?

"As artificial intelligence (AI) becomes increasingly embedded in society, it's essential to pause and reflect on the foundations that sustain it—and the dimensions to which it extends. At the heart of AI's learning are datasets, whose structure and content shape how these systems interpret and respond to the world. This reliance creates a deep interdependence—one that not only informs AI's capabilities but also defines its potential blind spots. In light of this, we must ask: What forms of understanding might this process exclude, especially those not easily captured in digital form?

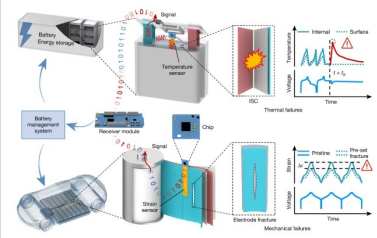
Indigenous wisdom, passed down orally or embedded in daily practices, conveys a deep connection to place and history. Vernacular construction technologies, local materials, and ways of inhabiting—rooted in specific conditions—embody a collective memory and intelligence that algorithms may struggle to grasp fully in their cultural and material depth. Are we capturing this material memory? And if so, what might still be missing or diluted in translation? Organizations such as UNESCO have raised questions around AI, especially in the context of increasing digitization of content on the Internet, which brings to the forefront the complex and often tenuous intersection with traditional knowledge systems.

The gap between technology and the vernacular was evident not so long ago. Today, with the rapid acceleration driven by AI, that gap persists—and may even be widening. While innovation moves in one direction, local materials and vernacular techniques lie on the other side, generating an increasingly marked disparity. It's true that generative AIs can recognize visual patterns and accurately replicate the fractal designs of the Kassena tribe or the self-supporting tents of Mongol nomads. But can it truly understand the techniques or narratives behind them?"

Source: Archdaily (20 May 2025)

BATTERIES

Wireless Transmission of Internal Hazard Signals in Li-Ion Batteries

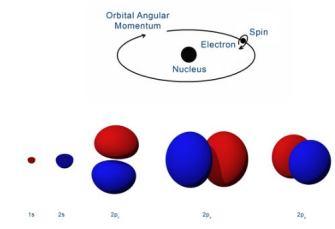


"High-capacity lithium-ion batteries (LIBs) play a critical role as power sources across diverse applications, including portable electronics, electric vehicles (EVs) and renewable-energy-storage systems. However, there is growing concern about the safety of integrated LIB systems, with reports of up to 9,486 incidents between 2020 and 2024 (ref.). To ensure the safe application of commercial LIBs, it is essential to capture internal signals that enable early failure diagnosis and warning. Monitoring non-uniform temperature and strain distributions within the jelly-roll structures of the battery provides a promising approach to achieving this goal. Here we propose a miniaturized and low-power-consumption system capable of accurate sensing and wireless transmission of internal temperature and strain signals inside LIBs, with negligible influence on its performance. The acquisition of internal temperature signals and the area ratio between initial internal-short-circuited regions and battery electrodes enables quantitative analysis of thermal fusing and thermal runaway phenomena, leading to the evaluation of the intensity of battery thermal runaway and recognition of thermal abuse behaviours. This work provides a foundation for designing next-generation smart LIBs with safety warning and failure positioning capabilities."

Source: Nature (14 May 2025)

BATTERIES

Forgotten Property of the Electron: Physical Discovery Opens up New Avenues for "Orbitronics"



"In so-called chiral materials such as the cobalt silicide (CoSi) studied, this is different, as the team led by Christian Tusche, together with partners in Taiwan, Japan, Italy, the US, and Germany, has now been able to show. The word "chiral" comes from the ancient Greek "cheir" for hand. "These crystal structures lack mirror symmetry and are either left- or right-handed – just like the human hand. You can turn them around and they remain mirror images of each other," explains Dr. Tusche. Chirality occurs frequently in nature. Sugar molecules, amino acids, and DNA all exhibit chiral structures.

Using high-resolution momentum microscopy and circularly polarized light, the researchers were able to resolve the orbital angular momentum in the chiral semiconductor for the first time – both inside the crystal and on its surface. For the measurements, they used the NanoESCA momentum microscope operated by Forschungszentrum Jülich at the Elettra synchrotron in Trieste, Italy. They discovered that the handedness of the crystal – left- or right-handed – predictably affects the orbital angular momentum of the electrons.

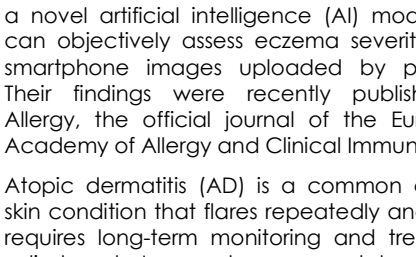
New link between crystal structure and electron

"Our results show that the structure of the crystal directly influences the angular momentum of the electrons – an effect that we were able to measure directly. This opens up a whole new door for materials research and information processing," emphasizes Jülich experimental physicist Dr. Ying-Jiun Chen."

Source: Juelich (20 May 2025)

DESIGN

Apple Developing Iphones That Will Be Controlled by Users' Thoughts



"Apple has partnered with neurotechnology company Synchron to develop products including iPhones and iPads that will be controlled using brain implants.

Designed to allow users with physical disabilities to operate their devices just by thinking, the software would allow Apple devices to be controlled by Synchron's stent-like implant placed on top of the brain's motor cortex.

Called Stentrode, the implant works by detecting motor signals from the user's brain before transmitting them to an external wireless processor, which converts the signals into commands for electronic devices.

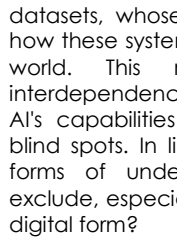
This would allow people living with physical disabilities to control their smartphones or tablets with their thoughts rather than their hands, potentially revolutionising everyday technology for those with immobilising spinal cord injuries or conditions such as amyotrophic lateral sclerosis (ALS).

Stentrode would work in tandem with Apple's existing assistive switch control technology, which allows users with limited mobility to create hands-free "switches" on their iPhone to command action, including performing a head movement or making a voiceless sound.

According to Synchron, Stentrode is a minimally invasive and scalable brain-computer interface (BCI) because its implementation requires no open brain surgery."

DESALINATION

Rice Engineers Tackle Sunlight Intermittency in Solar Desalination



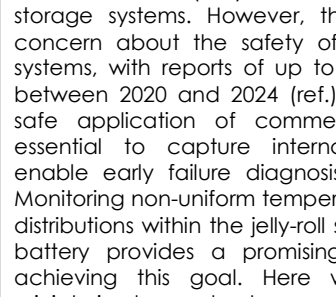
"Fresh drinking water is a vital yet limited resource that will only grow scarcer over the next few years, according to the World Resources Institute. Desalination, the process of removing salt from water, is an established method used to increase the fresh water supply, especially in coastal regions. However, current desalination systems are dependent on large-scale centralized infrastructure and filtration membranes prone to fouling and degradation.

A team of Rice University engineers has developed a system that could transform desalination practices, making the process more adaptable, resilient and cheaper. The new system, described in a study published in Nature Water, is designed to be powered by sunlight and uses a creative approach to heat recovery for extended water production – with and without sunshine. In contrast to conventional systems, the setup is made from nondegradable materials and can handle high-salinity brines.

"Access to clean fresh water is a particularly challenging problem in off-grid communities," said William Schmid, a doctoral student in electrical and computer engineering at Rice and National Science Foundation Fellow researching methods to increase the efficiency of light-driven desalination. "We wanted to focus on decentralized, modular desalination systems."

DIODES

Resistance Is Futile: Superconducting Diodes Are the Future



"What would happen if you combined the unparalleled efficiency of a superconductor with the flexibility and controllability of a semiconductor? Thanks to a new breakthrough in quantum materials, we may be getting an answer soon.

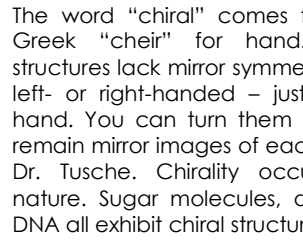
In an article soon to be published in Communications Physics, a multi-institutional research team led by The University of Osaka announces the successful observation of the so-called superconducting diode effect in an Fe(Se,Te)/FeTe heterostructure. The article describes a series of experiments in which the material developed a preference for current to flow in a particular direction, a phenomenon known as rectification, under a broad range of temperature and magnetic fields.

Essentially every electronic device in use today involves semiconductors, which can either inhibit or enhance the flow of electrons in one direction, allowing precise control over electrical signals. A longtime goal of physicists has been to merge this technology with superconductors, which have effectively no electrical resistance and can thus transport charges with perfect efficiency. However, to date, success has been limited.

"When it comes to superconductors, the choice of material is critical," explains Junichi Shiogai. "Iron selenide telluride has ideal properties such as a high transition temperature, critical magnetic field, and critical current density. This means that the

ROBOTS

Remotely Controlled Robots at Your Fingertips: Enhancing Safety in Industrial Sites



"A research team led by Professor Keehoon Kim and Ph.D. candidate Jaehyun Park from the Department of Mechanical Engineering at POSTECH has developed a novel haptic device designed to enhance both safety and efficiency for workers in industrial settings. This research was recently published in the international robotics journal IEEE Transactions on Industrial Informatics.

Robotic automation is rapidly advancing in high-risk industrial environments such as factories and steel mills. However, there remain many tasks that still require human intervention, despite advances in robotics. The challenge lies in the fact that operating robots can be more complex than anticipated, and even minor mistakes may lead to accidents.

To address this, the research team developed two types of haptic devices that allow users to feel interaction at their fingertips while controlling robots remotely.

The 'POstick-KF (Kinesthetic Feedback)' device transmits the precise force changes a robot experiences when pushing or pulling objects directly to the user, enabling delicate and accurate manipulation. Meanwhile, the 'POstick-VF (Visuo-tactile Feedback)' device provides a combination of tactile and visual feedback, making it effective for use in larger workspaces. Both devices are modeled after the actual size and shape of real tools, allowing even novices to adapt quickly, and can be selected according to the work

Source: Dezeen (16 May 2025)

Source: RICE (14 May 2025)

range of parameters for which the effect can appear is large, giving us the best chance for success."

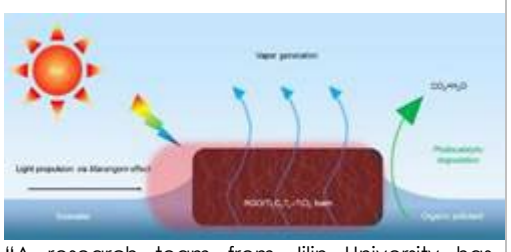
Source: Uni of Osaka (16 May 2025)

environment or the operator's skill level."

Source: Postech (16 May 2025)

ROBOTS

Light-Powered Evaporator Robot



"A research team from Jilin University has developed a solar-powered floating robot that purifies water and autonomously navigates on its surface, offering a new strategy for smart, energy-free water treatment in complex environments. Their findings, published in PhotoniX, are reported in a study titled "Light-propelled photocatalytic evaporator for robotic solar-driven water purification."

The system—designed as a lightweight, porous foam structure—integrates three critical functions: photocatalytic degradation, solar steam generation, and self-propulsion under light. It is composed of a hybrid material that combines reduced graphene oxide, $Ti_3C_2T_x$, and in situ grown TiO_2 nanoparticles, enabling the structure to respond efficiently to sunlight across a broad spectrum.

Unlike conventional solar-driven water purification devices, which are typically static and location-bound, this light-powered robot can move across the water surface by harnessing the Marangoni effect. When light is unevenly applied to one side of the device, it creates a surface tension gradient that propels the robot forward. This motion is entirely light-controlled—no batteries, wires, or motors are needed. By steering the light, researchers can direct the robot along programmable paths, enabling it to navigate obstacles or locate specific contaminated regions.

Simultaneously, the device purifies water through two mechanisms. The TiO_2 nanoparticles catalyze the breakdown of organic pollutants, while the foam structure efficiently converts sunlight into heat to drive evaporation. The dual-action approach enhances water purification capacity and energy utilization, all within a single, self-contained platform."

Source: EurekAlert! (19 May 2025)

ROBOTICS

Giant Robotic Bugs Are Headed to Farms: Ground Control Robotics' Legged Bots Could Weed Crops Better Than Humans

"Being long and skinny and wiggly is a strategy that's been wildly successful for animals, ever since there have been animals, more or less. Roboticists, eternally jealous of biology, have taken notice of this, and have spent decades trying to build robotic versions of snakes, salamanders, worms, and more. There's been some success, of a sort, although most of the robotic snakes and whatnot that we've seen have been for things like disaster relief, which is kind of just what you do when you have a robot with a novel movement strategy but without any other obvious practical application.

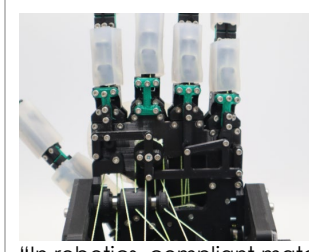
Dan Goldman at Georgia Tech has been working on bioinspired robotic locomotion for as long as anyone, and as it turns out, that's exactly the amount of time that it takes to develop a long and skinny and wiggly robot with a viable commercial use case. Goldman has a new Atlanta-based startup called Ground Control Robotics (GCR) that's bringing what are essentially giant robotic arthropods to agricultural crop management."

I'm not entirely sure what you'd call this—a robotic giant centipede might be the easiest description to agree on, I guess? But Goldman tells us that he doesn't consider his robots to be bioinspired as much as they're "robophysical" models of living systems. "I like the idea of carefully studying the animals," Goldman says. "We use the models to test biological principles, discover new phenomena with them, and then bring those insights into hardened robots which can go outside of the lab."

Source: IEEE Spectrum (16 May 2025)

ROBOTICS

Robotic Hand Moves Objects with Human-Like Grasps



"In robotics, compliant materials are those that deform, bend, and squish. In the case of the CREATE Lab's robotic ADAPT hand (Adaptive Dexterous Anthropomorphic Programmable sTiffness), the compliant materials are relatively simple: strips of silicone wrapped around a mechanical wrist and fingers, plus spring-loaded joints, combined with a bendable robotic arm. But this strategically distributed compliance is what allows the device to pick up a wide variety of objects using "self-organized" grasps that emerge automatically, rather than being programmed.

In a series of experiments, the ADAPT hand, which can be controlled remotely, was able to pick up 24 objects with a success rate of 93%, using self-organized grasps that mimicked a natural human grasp with a direct similarity of 68%. The research has been published in Nature Communications Engineering."

Source: EPFL (13 May 2025)

ROBOTICS

Empowering Robots with Human-Like Perception to Navigate Unwieldy Terrain

The wealth of information provided by our senses that allows our brain to navigate the world around us is remarkable. Touch, smell, hearing, and a strong sense of balance are crucial to making it through what to us seem like easy environments such as a relaxing hike on a weekend morning.

An innate understanding of the canopy overhead helps us figure out where the path leads. The sharp snap of branches or the soft cushion of moss informs us about the stability of our footing. The thunder of a tree falling or branches dancing in strong winds lets us know of potential dangers nearby.

Robots, in contrast, have long relied solely on visual information such as cameras or lidar to move through the world. Outside of Hollywood, multisensory navigation has long remained challenging for machines. The forest, with its beautiful chaos of dense undergrowth, fallen logs and ever-changing terrain, is a maze of uncertainty for traditional robots.

Now, researchers from Duke University have developed a novel framework named WildFusion that fuses vision, vibration and touch to enable robots to "sense" complex outdoor environments much like humans do. The work was recently accepted to the IEEE International Conference on Robotics and Automation (ICRA 2025), which will be held May 19-23, 2025, in Atlanta, Georgia.

"WildFusion opens a new chapter in robotic navigation and 3D mapping," said Boyuan Chen, the Dickinson Family Assistant Professor of Mechanical Engineering and Materials Science, Electrical and Computer Engineering, and Computer Science at Duke University. "It helps robots to operate more confidently in unstructured, unpredictable environments like forests, disaster zones and off-road terrain."

Source: Duke (19 May 2025)