

## LinkedIn Learning Invest in Yourself

Did you know 1 cent doubled for 30 days = **\$5.368 Million**

Similarly, your actions everyday can amount to much more!

Learn a new skill today with **LinkedIn Learning** and start investing in yourself!

[Activate your free LinkedIn Learning Account and get started!](#)



### Featured Course

Rediscovering Your Joy, Energy, and Purpose **47m**

[Click Here to Start Learning](#)

### 6G 6G-AI Mashups Will Reshape the Telecom Industry



"Beyond faster data speeds and more reliable service, the next generation of wireless networks—6G—is expected to meet surging demands for data rate and coverage, plus new applications resulting from artificial intelligence. Telecommunications is one of the many industries expected to be affected by AI.

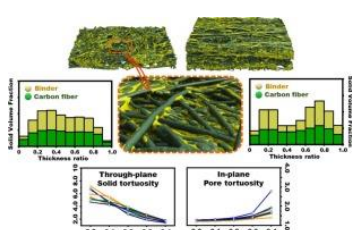
Thanks to AI, 6G will include connected intelligence, exchanging and aggregating data for localization and sensing applications with communications.

That entails moving from timely and reliable data delivery to adaptive and efficient information processing, as well as computer-and-communication systems.

AI also will introduce more flexible network architectures that use software-defined elements such as open radio access networks (ORANs), dynamic and programmable networking architecture. Integrating AI within the flexible networking architecture of ORANs offers opportunities for wireless innovation in 6G but demands strong collaborations and engagement from telecommunication operators."

Source: [Spectrum IEEE](#) (26 Dec 2024)

### AI AI replaces humans in identifying causes of fuel cell malfunctions



"Dr. Chi-Young Jung's research team from the Hydrogen Research & Demonstration Center at the Korea Institute of Energy Research (KIER) has successfully developed a method to analyze the microstructure of carbon fiber paper, a key material in hydrogen fuel cells, at a speed 100 times faster than existing methods. This was achieved by utilizing digital twin technology and artificial intelligence (AI) learning.

Carbon fiber paper is a key material in hydrogen fuel cell stacks, playing a crucial role in facilitating water discharge and fuel supply. It is composed of materials such as carbon fibers, binders (adhesives), and coatings. Over time, the arrangement, structure, and coating condition of these materials change, leading to a decline in the performance of the fuel cell. For this reason, analyzing the microstructure of carbon fiber paper has become an essential step in diagnosing the condition of fuel cells.

However, real-time analysis of the high-resolution microstructure of carbon fiber paper has been impossible until now. This is because obtaining accurate analysis results requires a process in which the carbon fiber paper sample is damaged and then subjected to detailed examination using an electron microscope.

To address the limitations of existing analysis methods, the research team developed a technology that analyzes the microstructure of carbon fiber paper using X-ray diagnostics and an AI-based image learning model. Notably, this technology enables precise analysis using only X-ray tomography, eliminating the need for an electron microscope. As a result, it allows for near real-time condition diagnosis."

Source: [EurekaAlert!](#) (20 Dec 2024)

### AVIATION GPS Spoofing Attacks Are Dangerously Misleading Airlines



"In 2023, at least 20 civilian aircraft flying through the Middle East were misled by their onboard GPS units into flying near Iranian airspace without clearance—situations that could have provoked an international incident. These planes were victims of GPS spoofing, in which deceptive signals from the ground, disguised as trustworthy signals from GPS satellites in orbit, trick an aircraft's instruments into reporting the aircraft's location as somewhere that it isn't. Spoofing is a more sophisticated tactic than GPS jamming, in which malicious signals overwhelm a targeted GPS receiver until it can no longer function.

Long theorized, GPS spoofing attacks have increasingly cropped up in civilian airspace in recent years, prompting concerns about this new frontier in electronic warfare. IEEE Spectrum spoke with Todd Humphreys of the University of Texas at Austin about how spoofing works and how aircraft can be protected from it."

Source: [Spectrum IEEE](#) (29 Dec 2024)

### CARBON AI predicts that most of the world will see temperatures rise to 3C much faster than previously expected



"Three leading climate scientists have combined insights from 10 global climate models and, with the help of artificial intelligence (AI), conclude that regional warming thresholds are likely to be reached faster than previously estimated.

The study, published in Environmental Research Letters by IOP Publishing, projects that most land regions as defined by the Intergovernmental Panel on Climate Change (IPCC) will likely surpass the critical 1.5°C threshold by 2040 or earlier. Similarly, several regions are on track to exceed the 3.0°C threshold by 2060—sooner than anticipated in earlier studies.

Regions including South Asia, the Mediterranean, Central Europe and parts of sub-Saharan Africa are expected to reach these thresholds faster, compounding risks for vulnerable ecosystems and communities.

The research, conducted by Elizabeth Barnes, professor at Colorado State University, Noah Diffenbaugh, professor at Stanford University, and Sonia Seneviratne, professor at the ETH-Zurich, used a cutting-edge AI transfer-learning approach, which integrates knowledge from multiple climate models and observations to refine previous estimates and deliver more accurate regional predictions."

Source: [IOP](#) (20 Dec 2024)

### ARCHITECTURE Public square renovation in Ukraine demonstrates "impetus for city life" amid ongoing conflict



"Local architects Dmytro Volyk and Ksenia Donetska have completed the renovation of Uspenska Square in Dnipro, Ukraine, dividing multipurpose space with wave-like benches informed by the nearby river.

Volyk and Donetska were tasked with renovating the square in 2021, and sought to rekindle what they describe as having become a "transit area with no meaning".

After delays to the project due to the invasion of Ukraine by Russia in February 2022, the square re-opened to the public at the end of 2023.

One of the oldest squares in the city, Uspenska Square was originally designed in the 19th century, and once sat at the centre of public life between the Assumption Cathedral to the west and the Dnipro river to the east. Over time, the square's importance dwindled. After the original cathedral building burnt down and its replacement was closed during the Soviet era, the square became a neglected through-route between the city and the river.

"Our task as architects was to restore the historical significance of the square as part of the city's pedestrian framework, to make it more humanistic and architecturally high-quality," Donetska told Dezeen.

"The renovated Uspenska Square has become another impetus for the city life of Dnipro, showing that despite the war, people want to live at home, in Ukraine," she continued."

### ARCHITECTURE The top 10 building renovations of 2024



"Renovations and adaptive reuse continue to be key trends in contemporary architecture. Here, Dezeen editor-at-large Amy Frearson names 10 that exceeded expectations in 2024, including a museum with rotating walls and a plant-covered shopping centre."

### ARCHITECTURE Philippe Starck creates "strange and surrealist" olive oil mill and museum



"French architect Philippe Starck has created a red cube to house the LA Almaraza olive oil mill, museum and restaurant in Andalusia, decorated with symbols referencing the area's heritage.

Surrounded by groves on a 25-hectare estate near Rona, the building was designed for oil producer LA Organic as part of a wider project to boost oleotourism – tourism based on olive oil production – in the region.

Starck finished the otherwise plain building in large symbols celebrating the "magic and poetry" of the area, including a bull's horn in Corten steel and a carved eye referencing the area's historic connection with the surrealist movement."

### HABITAT In 2025, People Will Try Living in This Underwater Habitat



"The future of human habitation in the sea is taking shape in an abandoned quarry on the border of Wales and England. There, the ocean-exploration organization Deep has embarked on a multiyear quest to enable scientists to live on the seafloor at depths up to 200 meters for weeks, months, and possibly even years.

Deep's agenda has a major milestone this year—the development and testing of a small, modular habitat called Vanguard. This transportable, pressurized underwater shelter, capable of housing up to three divers for periods ranging up to a week or so, will be a stepping stone to a more permanent modular habitat system—known as Sentinel—that is set to launch in 2027. "By 2030, we hope to see a permanent human presence in the ocean," says Krack. All of this is now possible thanks to an advanced 3D printing-welding approach that can print these large habitation structures.

How would such a presence benefit marine science? Krack runs the numbers for me: "With current diving at 150 to 200 meters, you can only get 10 minutes of work completed, followed by 6 hours of decompression. With our underwater habitats we'll be able to do seven years' worth of work in 30 days with shorter decompression time. More than 90 percent of the ocean's biodiversity lives within 200 meters' depth and at the shorelines, and we only know about 20 percent of it." Understanding these undersea ecosystems and environments is a crucial piece of the climate puzzle, he adds: The oceans absorb nearly a quarter of human-caused carbon dioxide and roughly 90 percent of the excess

heat generated by human activity."

Source: [Dezeen](#) (30 Dec 2024)

Source: [Dezeen](#) (22 Dec 2024)

Source: [Dezeen](#) (10 Dec 2024)

Source: [IEEE Spectrum](#) (31 Dec 2024)

### HEALTH TECH VR-haptics-enhanced training holds potential to transform dental education



"According to the study, VR-haptic simulation has demonstrated significant value as a complementary tool in dental simulation practice. However, validation was identified as a key factor for the acceptance of VR-haptic simulators, and further research and verification is needed before VR-haptics could be considered a primary method of learning hand skills in dental education. The researchers conclude that in the future, VR-haptic simulation could be used as an assessment tool for students' and clinicians' credentialing process.

"Despite the digital nature of VR-haptics-enhanced training, students have shown the ability to transfer hand skills effectively to real-world scenarios. Educators now have more options in structuring preclinical and clinical practical education, thanks to VR-haptic technology. The individualised training and feedback provided by VR-haptic systems help students master essential techniques while boosting engagement and motivation," says Dr Szabolcs Felszeghy of the University of Eastern Finland, the first author of the study.

"VR-haptics-supported dental education offers significant potential in addressing challenges in preclinical and clinical training. It may help mitigate certain limitations of current educational methods. However, continued research and validation are essential before VR-haptics can be considered a primary method for developing hand skills in dental education. As the technology advances, it may play an increasingly important role in both learning and assessment within the dental profession," says Professor Murat Mutluay of the University of Eastern Finland."

Source: [UFE](#) (18 Dec 2024)

### HEALTHCARE How Amazon Is Changing the Future of Robotics and Logistics



"Amazon's fulfillment centers handle millions of items daily, each destined for a customer expecting precision and speed. The scale and complexity of these operations are unparalleled. Items vary widely in size, shape, and weight, creating an unpredictable and dynamic environment where traditional robotic systems often falter.

"Robots are great at consistency," Jason Messinger, robotics senior manager explained. "But what happens when every task is different? That's the reality of our fulfillment centers. Robin had to be more than precise—it had to be adaptable."

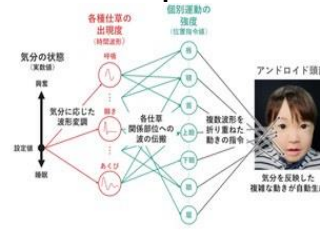
Robin was designed to pick and sort items with speed and accuracy, but its capabilities extend far beyond basic functionality. The system integrates cutting-edge technologies in artificial intelligence, computer vision, and mechanical engineering to learn from its environment and improve over time. This ability to adapt was crucial for operating in fulfillment centers, where no two tasks are ever quite the same.

"When we designed Robin, we weren't building for perfection in a lab," Messinger said. "We were building for the chaos of the real world. That's what makes it such an exciting challenge."

The Collaborative Process of Innovation Robin's development was a collaborative effort involving teams of roboticists, data scientists, mechanical engineers, and operations specialists. This multidisciplinary approach allowed the team to address every aspect of Robin's performance, from the algorithms powering its decision-making to the durability of its mechanical components."

Source: [IEEE Spectrum](#) (16 Dec 2024)

### ROBOTICS Crossing the Uncanny Valley: Breakthrough in technology for lifelike facial expressions in androids



"Even if an android's appearance is so realistic that it could be mistaken for a human in a photograph, watching it move in person can feel a bit unsettling. It can smile, frown, or display other various, familiar expressions, but finding a consistent emotional state behind those expressions can be difficult, leaving you unsure of what it is truly feeling and creating a sense of unease.

Until now, when allowing robots that can move many parts of their face, like androids, to display facial expressions for extended periods, a 'patchwork method' has been used. This method involves preparing multiple pre-arranged action scenarios to ensure that unnatural facial movements are excluded while switching between these scenarios as needed.

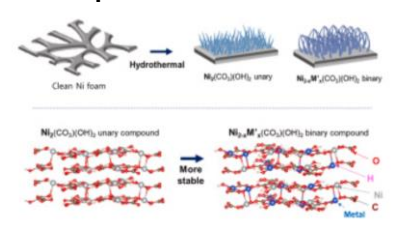
However, this poses practical challenges, such as preparing complex action scenarios beforehand, minimizing noticeable unnatural movements during transitions, and fine-tuning movements to subtly control the expressions conveyed.

In this study, lead author Hisashi Ishihara and his research group developed a dynamic facial expression synthesis technology using "waveform movements," which represents various gestures that constitute facial movements, such as "breathing," "blinking," and "yawning," as individual waves. These waves are propagated to the related facial areas and are overlaid to generate complex facial movements in real time. This method eliminates the need for the preparation of complex and diverse action data while also avoiding noticeable movement transitions.

Furthermore, by introducing "waveform modulation," which adjusts the individual waveforms based on the robot's internal state, changes in internal conditions, such as mood, can be instantly reflected as variations in facial movements."

Source: [Osaka](#) (23 Dec 2024)

### SOLAR Solar-powered charging! Korea's first self-charging supercapacitors developed



"Jeongmin Kim, Senior Researcher at DGIST (President Kunwoo Lee), in joint research with Damin Lee, Researcher at the RLRC[1] of Kyungpook National University (President Young-woo Heo), has developed a high-performance self-charging energy storage device capable of efficiently storing solar energy. The research team has dramatically improved the performance of existing supercapacitor devices by utilizing transition metal-based electrode materials and proposed a new energy storage technology that combines supercapacitors with solar cells.

The research team designed the electrodes using a nickel-based carbonate and hydroxide composite material and maximized the conductivity and stability of the electrodes by adding transition metal ions such as Mn, Co, Cu, Fe, and Zn. This technology has greatly improved the performance of energy storage devices, demonstrating significant advancements in energy density, power density, and charge and discharge stability.

Particularly, the energy density achieved in this study is 35.5 Wh kg<sup>-1</sup>, which is significantly higher than the energy storage per unit weight in previous studies (5-20 Wh kg<sup>-1</sup>). The power density is 2555.6 W kg<sup>-1</sup>, significantly exceeding the values from previous studies (-1000 W kg<sup>-1</sup>), demonstrating the ability to release higher power rapidly, enabling immediate energy supply even for high-power devices. Additionally, the performance showed minimal degradation during repeated charge and discharge cycles, confirming the long-term usability of the device.

Furthermore, the research team developed an energy storage device that combines silicon solar cells with supercapacitors, creating a system capable of storing solar energy and utilizing it in real time. This system achieved an energy storage efficiency of 63% and an overall efficiency of 5.17%, effectively validating the potential for commercializing the self-charging energy storage device."

Source: [EUREKALERT](#) (18 Dec 2024)

To view past Weekly Alerts [CLICK HERE](#)  
For more articles or in-depth research, contact us at [library@sutd.edu.sg](mailto:library@sutd.edu.sg)  
A SUTD Library Service©2024