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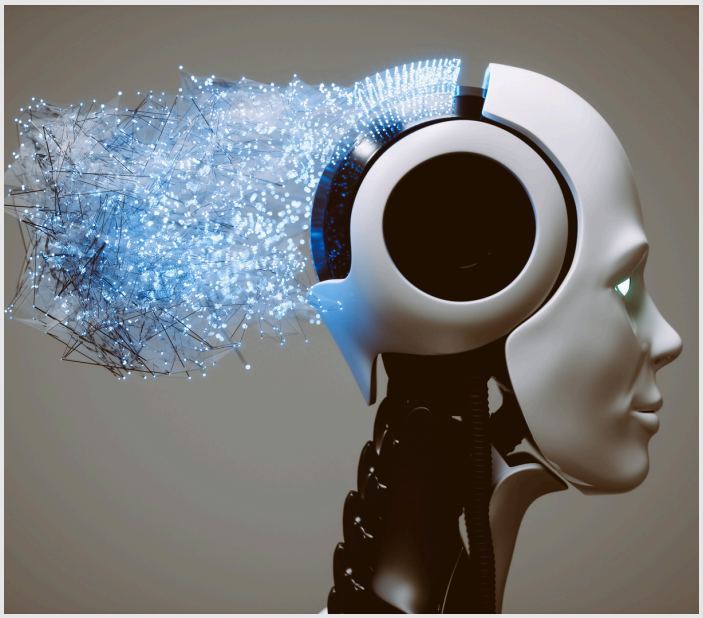
SPARC WEEKLY

MACHINE UNLEARNING: RESEARCHERS MAKE AI MODELS 'FORGET' DATA



Progress in AI has provided tools capable of revolutionising various domains, from healthcare to autonomous driving. However, as technology advances, so do its complexities and ethical considerations.

The paradigm of large-scale pre-trained AI systems, such as OpenAI's ChatGPT and CLIP (Contrastive Language–Image Pre-training), has reshaped expectations for machines. These highly generalist models, capable of handling a vast array of tasks with consistent precision, have seen widespread adoption for both professional and personal use.

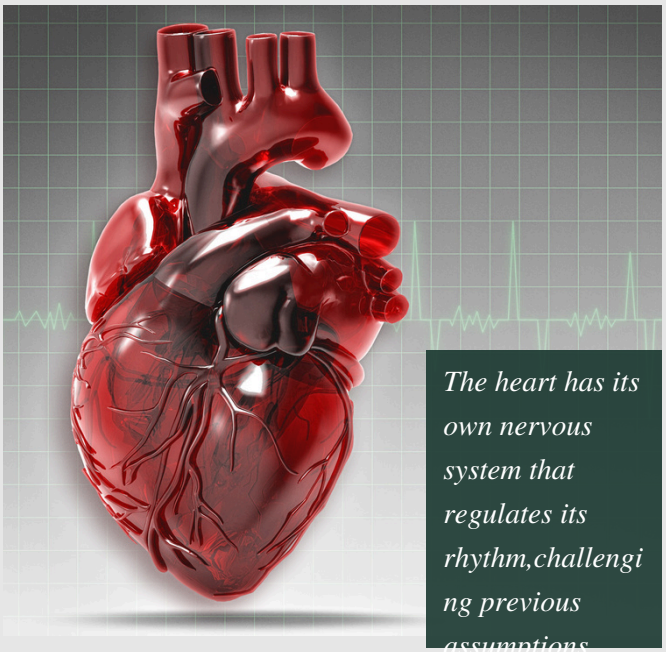
However, such versatility comes at a hefty price. Training and running these models demands prodigious amounts of energy and time, raising sustainability concerns, as well as requiring cutting-edge hardware significantly more expensive than standard computers.

A potential solution lies in training models to "forget" redundant or unnecessary information —streamlining their processes to focus solely on what is required. Researchers from the Tokyo University of Science have developed a method to enable large-scale AI models to selectively "forget" specific classes of data. For their experiments, the researchers targeted CLIP, a vision-language model with image classification abilities. The method they developed is built upon the Covariance Matrix Adaptation Evolution Strategy, an evolutionary algorithm designed to optimise solutions step-by-step.

Beyond its technical ingenuity, this innovation holds significant potential for real-world applications where task-specific precision is paramount. Simplifying models for specialised tasks could make them faster, more resource-efficient, and capable of running on less powerful devices. Perhaps most importantly, this method addresses one of AI's greatest ethical quandaries: privacy.

https://www.artificialintelligence-news.com/news/machine-unlearning-researchers-ai-models-forget-data/

SCIENTISTS HAVE DISCOVERED A "MINI-BRAIN" INSIDE THE HEART



The heart has its own nervous system that regulates its rhythm,challenging previous assumptions.

The proper functioning of the heart relies on the intricate interplay between the central nervous system and the local neuronal networks within the heart itself. While the central innervation of the heart has been extensively studied, the organization and functionality of the intracardiac nervous system (IcNS) remain largely unexplored. New research reveals that the heart has its own complex nervous system, or "mini-brain," which plays a critical role in controlling its rhythm, independent of the brain.

The heart has long been thought to be controlled solely by the autonomic nervous system, which transmits signals from the brain. The heart's neural network, which is embedded in the superficial layers of the heart wall, has been considered a simple structure that relays the signals from the brain. However, recent research suggests that it has a more advanced function than that.

Scientists have now discovered that the heart has its own complex nervous system that is crucial to controlling its rhythm. The researchers identified several types of neurons in the heart that have different functions, including a small group of neurons with pacemaker properties. The finding challenges the current view on how the heartbeat is controlled, which may have clinical implications.

The study was conducted on zebrafish, an animal model that exhibits strong similarities to human heart rate and overall cardiac function. The researchers were able to map out the composition, organization, and function of neurons within the heart using a combination of methods such as single-cell RNA sequencing, anatomical studies, and electrophysiological techniques.

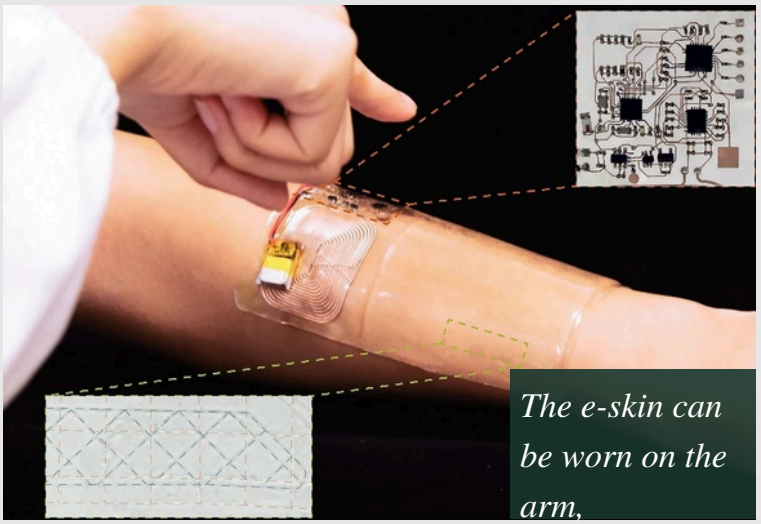
"We will now continue to investigate how the heart's brain interacts with the actual brain to regulate heart functions under different conditions such as exercise, stress, or disease," says Konstantinos Ampatzis, principal researcher and docent at the Department of Neuroscience, Karolinska Institutet, Sweden, who led the study. "We aim to identify new therapeutic targets by examining how disruptions in the heart's neuronal network contribute to different heart disorders."

https://www.nature.com/articles/s41467-024-54830-w
https://scitechdaily.com/scientists-have-discovered-a-mini-brain-inside-the-heart/

FISH-INSPIRED SENSOR "TOUCHES" USING ELECTRIC FIELDS: A SYNTHETIC E-SKIN USES CAPACITANCE TO DETECT NEARBY OBJECTS

The ability to detect a nearby presence without seeing or touching it may sound fantastical—but it's a real ability that some creatures have.A family of African fish known as Mormyrids are weakly electric, and have special organs that can locate a nearby prey, whether it's in murky water or even hiding in the mud. Now scientists have created an artificial sensor systeminspired by nature's original design. The development could find use one day in robotics and smart prosthetics to locate items without relying on machine vision.

The researchers developed a new strategy for 3D motion positioning by electronic skin, bio-inspired by 'electric fish,' The team described their sensor, which relies on capacitance to detect an object regardless of its conductivity. One layer of the sensor acts as a transmitter, generating an electrical field that extends beyond the surface of the device. Another layer acts as a receiver, able to detect both the direction and the distance to an object. This allows the sensor system to locate the object in three-dimensional space. The sensor electrode layers are made from a biogel that is printed on both sides of a dielectric substrate made of



The e-skin can be worn on the arm,

polydimethylsiloxane a silicon-based polymer that is commonly used in biomedical applications. The biogel layers receive their ability to transmit and receive electrical signals from a pattern of microchannels on their surface. The end result is a sensor that is thin, flexible, soft, stretchable, and transparent. These features make it suitable for a wide range of applications where an object-sensing system needs to conform to an irregular surface, like the human body.

The capacitive field around the sensor is disrupted when an object comes within range, which in turn can be detected by the receiver. The magnitude in the change of signal indicates the distance to the target. By using multiple sensors in an array, the system can determine the position of the target in three dimensions.

The researchers hope that this sensor could one day open up a new range of wearable sensors, including devices for human-machine interfaces and thin and flexible e-skin.

https://spectrum.ieee.org/electric-field-sensor

RESEARCHERS REVEAL KEY FACTORS BEHIND JAPAN'S PLASTIC WASTE REMOVAL RATES IN RIVERS

Plastic pollution is an ever-growing problem in today's world, as most societies have become overly dependent on plastics for packaging, medical supplies, and general goods. Plastic litter accumulation in the ocean, either through deliberate dumping or by being transported from a river, poses significant environmental challenges. Additionally, this plastic eventually degrades into small fragments called microplastics, which then impact diverse marine and land ecosystems by working their way up the food chain and into most living organisms. Though their negative effects on cell health are still under study, many nations have taken a cautionary stance, increasing efforts to curb plastic usage and prevent pollution.

Plastic pollution in river basins poses a significant environmental challenge, particularly in Japan, located in the northwestern North Pacific, often referred to as a hotspot for plastics. In a recent study, researchers from Japan conducted a nationwide analysis of plastic litter recovery in over 100 river basins, shedding light on the impact of climate change, population density, and natural disasters.

Their findings will help inform future cleanup strategies and improve plastic management.

Highlights

- Significant plastic pollution challenge in Japanese river basins.
- Annual recovery quantified using nationwide cleanup dataset.
- Average plastic recovery: 938 tons per year
- Moderate correlation with population and cleanup participants
- Extreme weather impacts plastic recovery rates.

https://www.sciencedirect.com/science/article/pii/S0025326X24011950?via%3Dihub
https://www.sciencedaily.com/releases/2024/12/241212120014.htm

WHO ARE WE?

SPARC Robotics Team's mission and vision is to make our environment the best it can be. On a volunteer basis, we look at the problems that are happening around us and make them our problems, both as SPARC and individually, and help as much as we can with appropriate projects. NASA ACCP (Astro Camp Community Partners) was only in the US until four years ago. This year they came to Turkey with us after four years of traveling to many countries. ACCP educates school-age children from kindergarten to high school on science-related topics of interest with practical knowledge and application, while also supporting children's craft development, general culture and questioning skills. As SPARC, we have brought this training provided by NASA to our country in the most comprehensive way and our continuous communication with NASA not only enables us to improve our trainings day by day, but also gives us the opportunity to learn about the innovations in the field of STEM instantly, from the most accurate source and to spread the knowledge we have around us.

EDITOR

Dear reader,

Greetings from SPARC Weekly, in which I gather latest scientific news.

I would be delighted to hear your comments or suggestions and I encourage you to write to us if you have any views or opinions on the stories in SPARC Weekly.
We look forward to hearing from you.
Have a nice week and enjoy the magazine.

Defne Şehidoğlu