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SCIENCE & TECHNOLOGY

GLOBAL

Self-Healing Electrical Grids: University of Texas Researchers Develop AI System

Researchers at the University of Texas, USA have developed an AI-enabled system which can self-repair damaged electrical grids. According to the statement released from the university, the system can fix grids completely autonomously and requires no human intervention. The system reportedly demonstrated "near optimal real time performance" during the testing phase and can reroute electricity in a matter of milliseconds. The study published in Nature Communications further reveals that the system employs a machine learning technique known as graph reinforcement learning to assess and manage powergrids. Researchers expect that the system could potentially play a major role in addressing power outages.

Jumping Genes: Scientists Discover New Gene Editing Tool

Scientists have discovered a new gene editing tool which can enhance humanity's capability to perform large scale gene editing. The method involves the use of the "jumping gene" which has been named IS110. Jumping genes are essentially mobile genetic elements present in all living organisms. They internally perform DNA manipulation through "cutting and pasting themselves into genomes", thereby inserting certain DNA segments into others. While binding segments together, extra DNA at the ends of jumping genes combine together to form a single stranded RNA molecule. It is this molecule that combine the target and the donor DNA segments together. Modification is done through inserting the desired genes through the donor DNA to alter the target DNA. The tool purportedly exceeds the potential of CRISPR (Clustered Regularly Interspaced Palindromic Repeats) in performing gene editing. Key findings on the discovery have been published in the Nature magazine.

German Researchers Develop New Lens Which Can Detect the Presence of Gas

Researchers at the Friedrich Schiller University Jena have reportedly developed a new optical lens which changes its refractive behaviour in the presence of gas. As per the details published in a Nature Communications article, the micro lens is made out of hybrid glass material. Only a few millimeters thick, the lens is made up of a "multiresponsive material" consisting of a three-

dimensional lattice which can fit gas molecules and thereafter exhibit a change in optical properties. Depending on the amount of gas absorbed, the lens shall reflect light either "more or less strongly". The lens can potentially be employed in sensor technology to render it more efficient and accurate. The study has been reported in the Nature Communications journal.

Common Plastics Hold Key to Energy-Efficient Buildings

Researchers from UCLA and Princeton University have created a passive system that allows buildings to be heated in the winter and cooled in the summer. Coatings made of common materials can achieve thermal comfort and energy savings beyond what can be achieved by traditional building envelopes by limiting radiant heat flows between buildings and their surroundings to particular wavelengths**.**

AI-based Blood Test to Predict Parkison's

Researchers at the university College London and University Medical Center Goettingen, Germany, have developed a blood test that uses artificial intelligence (AI) to predict Parkinson's disease upto seve years before the onset of symptoms. The research found that when a branch of AI called machine learning, analysed a panel of eight blood based biomarkers whose concentrations are altered in patients with Parkinson's, it could provide a diagnosis with 100 per cent accuracy. The team then experimented to see whether the test could predict the likelihood that a person would go on to develop Parkinson's. They did this by analysing blood from 72 patients with Rapid Eye Movement Behaviour Disorder (iRBD). When the machine learning tool analysed the blood of these patients it identified that 79 per cent of the iRBD patients had the same profile as someone with Parkinson's. The patients were followed up over the course of ten years and the AI predictions have so far matched the clinical conversion rate. The team is now continuing to follow up on those predicted to develop Parkinson's, to further verify the accuracy of the test.

INDIA

ISRO Conducts Third and Final Test for Reusable Launch Vehicle

The Indian Space Research Organisation has successfully conducted the third and final test of its reusable launch vehicle (RLV-LEX3), also known as "Pushpak". Simply put, an RLV is a space launch vehicle which is designed to return to earth following a launch and therefore "reusable". The test conducted by ISRO at the Aeronautical Test Range, Chitradurga, simulate the approach and landing interface as well as the ability of the RLV to perform under high-speed landing conditions. The project which was led by the Vikram Sarabhai Space Centre, Thiruvananthapuram has termed RLVs as "a sustainable option to accomplish low-cost, on-demand space missions".

IISc Researchers Develop New Biocatalyst

Researchers at the Department of Inorganic and Physical Chemistry (IPC) at the Indian Institute of Sciences (IISc), Bengaluru have developed a new biocatalyst which can accelerate sustainable fuel production. According to the IPC, the enzymatic platform has been can transform fatty acids into

hydrocarbons known as 1-alkelenes. These have a potential to serve as alternatives to biofuels and are also employed in the lubricant, detergent and polymer industries. The biocatalyst was derived by combining two enzymes: UndB and catalese, which were fused together by introducing genetic code to E.coli bacteria. The research has been published in the journal Science Advances.

Synthetic Method for Hydrogen Generation Developed by IISER Tirupati

Researchers at IISER Tirupati have developed an innovative synthetic method to produce hydrogen gas from a mixture of methanol and paraformaldehyde under mild conditions. This method has proven particularly effective for the transfer hydrogenation of alkynes to alkenes and the combination could be a hydrogen carrier, paving the way for advancements in chemical synthesis and sustainable energy solutions. They utilized commercially available nickel catalysts to produce hydrogen from methanol and paraformaldehyde without the need for bases or activators. This efficient catalytic system has demonstrated remarkable efficiency under mild conditions, and the generated hydrogen was successfully employed in chemo- and stereo-selective partial transfer hydrogenation of alkynes. This process enabled access to bioactive molecules with enhanced synthetic value.

Energy Harvesting & Power Generation: JNCASR Study Provides New Insights

Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR) scientists in a new study have provided groundbreaking insights into a new class of materials for energy harvesting and power generation. The study unravels the electronic mechanisms governing the chemical bonding of a new class of materials called incipient metals with metavalent bonding (MVB) within a single 2D layer of Group IV chalcogenides that can boost energy harvesting and power generation due to their high electrical conductivity and effective conversion of thermal energy into electrical energy through the thermoelectric effect.

IISc Researchers Evolve New Way to Calculate the Value of Pi

In a major development, researchers at IISc have evolved a new series representation to calculate the value of the mathematical constant pi (π). The new representation is purportedly based on String Theory and provides “an easier way to derive pi from calculations involved while deciphering phenomena such as the quantum scattering of high energy particles”. According to IISc, the formula close to pi as represented by the 15th Century Indian mathematician Sangamagrama Madhava. IISc further noted that “the series combines specific parameters in a way that allows scientists to quickly arrive at the value of pi” The study can potentially lead to important practical applications in the future.

GLOBAL CHALLENGES

New AI Model Can Track Glacier Melts and Rate of Sea level Rise

Scientists at the Massachusetts Institute of Technology (MIT) have developed "the first usable" AI model that can help track ice flows in the Antarctic ice sheet. Glacier flows refer to the deformation that a glacier undergoes when it is under stress. Scientists regard glacier flow as the primary contributor to rise in sea levels. The scientsts based the model on data drawn from two types of deformations: dislocation creep and grain boundary sliding. The model can reportedly provide key insights into the process of glacier melts and how it contributes to sea level rise. This in turn can help enables more accurately projections with respect to the "speed and severity" of sea level rise in the coming decades.

New Process Succeeds in Trapping Nearly Half of CO2 Emissions in Concrete Production

An innovative new technique has succeeded in achieving a 45% carbon dioxide sequestration rate in the production of concrete. The cement and concrete industry is a significant contributor to global CO2 emissions. The new process developed by researchers led by Northwestern University and published in the Communications Materials journal, uses a carbonated water-based solution rather than a still one to trap nearly half the CO2 released during concrete production. The researchers have found that this new process has succeeded both in trapping a significant amount of emitted CO2 and has achieved this without compromising on the strength and endurance of the concrete produced. Both these areas had been a challenge for existing carbonation processes being tested since the 1970s.

AI Models Used in Medical Imaging Shown to Have Demographic Biases

Researchers at the Massachusetts Institute of Technology (MIT) have found that certain AI-models used in medical image analysis can produce biased diagnoses dependent on the patient's demographics. These AI-models tend to use their predictive abilities of determining a patient's age, race and gender as shortcuts informing its diagnoses, leading to significant discrepancies in results produced for women, people of colour and other groups. The same team of researchers had in 2022 found that certain AI-models used in medical image analysis had developed a surprising ability to determine a patient's race, age, gender and other demographic details merely through studying X-rays and other such images. The new study has found that the better the model was at predicting such details, the greater was the fairness gap observed when it came to determining diagnoses for patients from varying demographic groups. The research went on to find that the AI-models could be retrained to eliminate this bias by using images from the same facility, although when data from other hospitals was used for the retraining, the fairness gap reappeared. The findings of the study could provide a keen insight to avoid such biases in the development of future AI-models used for medical image analysis.

RESOURCES & EVENTS

UN Security Council Holds High Level Meeting on Cyber Security

The UN Security Council held a high-level meeting on Evolving Cyber Threat Landscape and Its Implications for The Maintenance of International Peace And Security." on 20 June 2024. The meeting convened by the Republic of Korea and co-hosted by Japan and the USA deliberated upon a range of threats including the misuse of cryptocurrency and commercially available intrusion tools. Meanwhile, states including the USA, Ecuador, Slovenia, Qatar and Italy brought attention to the threats emanating from artificial intelligence in the information domain. The discussions also revolved around the kind of role the UNSC could play in addressing the threats to cybersecurity.

SDSN Releases Annual Report on SDG Progress

The Sustainable Development Solutions Network (SDSN) has published a report titled which captures the world's annual progress with respect to achieving Sustainable Development Goals (SDG). Titled "The SDGs and the UN Summit of the Future", the report presents five key findings. It notes that "only 16% of the SDG targets are on track to be achieved by 2030, with the remaining 84% showing limited progress or reversal". The report further urges the UN Summit of the Future to reform the UN on the basis of five Ps- People, Planet, Prosperity, Peace, and Partnerships.

UNICEF Report: Air Pollution Growing Increasingly Dangerous for Human Health

The State of Global Air (SoGA) report published by the UN Children's Fund (UNICEF) has presented key findings on how air pollution is increasingly posing dangers to human health. Identifying air pollution as the "second leading risk factor for premature death", the report finds children under five as particularly at risk. It further finds 90% of deaths to have resulted from fine particulate matter (PM 2.5), which is released from the burning of fossil fuels and biomass. The report draws attention to the urgency of improving air quality which it terms "practical and achievable.

UN Holds First Ever Meeting on Sustainable Lunar Activities

The UN Office of Outer Space Affairs (UNOOSA) held its first-ever meeting on sustainable lunar activities at Vienna on 18 June 2024. The meeting saw attendance from multiple stakeholders including heads of space agencies, astronauts, private space companies as well as scientific and legal committees. The delegates exchanged their views on their visions on the future of lunar exploration including commercial prospects and the possibilities of permanent lunar settlements. The conference also urged the signatories of US-led Artemis Accords and the China-led International Lunar Research Station to exchange views on their lunar ambitions and the objectives of their respective programs. Discussions at the conference also highlighted the importance of mutual consultations, transparency and interoperability.

WEF Report Identifies 10 Emerging Technologies to Address Global Challenges

The World Economic Forum (WEF) has identified ten emerging technologies including privacy-enhancing tools, carbon-capturing microbes, alternative livestock feeds, genomics for transplants and Artificial intelligence for scientific discovery as breakthroughs in 2024.The report added that these emerging technologies can make a positive impact by addressing global challenges in the coming three to five years. The report also identified other technologies poised to significantly influence societies and economies in future.

GoI releases National Indicator Framework Report on SDGs

The Ministry of Statistics and Programme Implementation has released the 2024 progress report on Sustainable Development Goals. The report has been prepared through a consultative process involving concerned ministries, UN agencies and other stakeholders. The NIF consists of 306 indicators that draw from global SDG monitoring frameworks and those that have been created for the unique needs of India. The report is also intended as a tool for policymakers to identify areas which require focused interventions. Among other things, the report notes over a 10% decrease in the percentage of individuals below poverty line from 2015-16. Reduction has also been observed in Maternal Mortality Ratio "from 130 per 1,00,000 live births in 2014-16 to 97 per 1,00,000 live births in 2018-20". Meanwhile, a steady improvement has also been noted with respect to India's renewable energy generation capacity which has increased from 63.25 watts per capita in 2014-15 to 136.56 watts per capita in 2023-24.

SCIENCE POLICY AND DIPLOMACY

India- USA Enhance Human Spaceflight Cooperation

India and the United States agreed to step up cooperation in the outer space arena during the recently held iCET (US-India Initiative on Critical & Emerging Technologies) dialogue. Participating in the dialogue were Jake Sullivan and Ajit Doval, the national security advisors for India and the USA respectively. In a major milestone, both countries agreed on the Strategic Framework for Human Spaceflight Cooperation. Under the terms of this framework Indian astronauts would be trained at NASA's Johnson Space Center. One of the astronauts is reportedly scheduled to make his flight to the International Space Station this year.

Paraguay Becomes 100th Member of International Solar Alliance

Paraguay has become the 100th country to join the International Solar Alliance (ISA) as a full member. The South American nation officially handed over its Instrument of Ratification to the ISA in New Delhi on 26 June. The ceremony took place during a meeting between Paraguay's Ambassador to India, Fleming Raul Duarte, and Abhishek Singh, Joint Secretary of Economic Diplomacy and States Division at India's Ministry of External Affairs. Singh, who serves as the Head of Depository for the ISA, received the ratification document.

European Commission to Rethink Science Diplomacy Strategy

The science diplomacy strategy of the European Commission is reportedly undergoing a revision amid the Russia-Ukraine war. The rethink has been purportedly driven by an effort to address vulnerabilities that are emerging from a rapidly changing geopolitical and scientific-technological environment. For this purpose, five working groups are currently looking into recommendations

that can be put together for a report. The Commission shall assess this report and decide on how the science diplomacy policy is to be revised. The report is scheduled to be released in October 2024.

We welcome your comments and valuable suggestions. Please write to us for receiving publications, updates and notices regarding seminars, conferences etc. Contact us at science.diplomacy@ris.org.in