

3D PRINTING A Blueprint for Building the Future: Eco-Friendly 3D Concrete Printing



"Buildings made of 3D-printed concrete are an exciting trend in housing, and they offer a slew of benefits: Quick, precise construction, possibly from recycled materials, reduced labor costs and less waste, all while enabling intricate designs that traditional builders would struggle to deliver.

The process uses a specialized printer that dispenses a cement-like mixture in layers to build the structure using computer-aided design software. But so far, printable material options are limited and questions about their sustainability and durability remain.

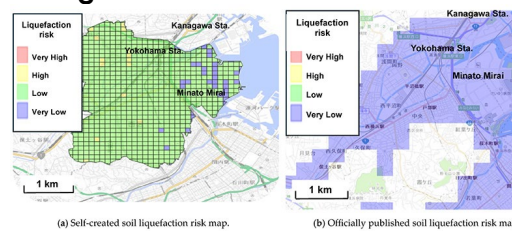
A research team led by engineers at the University of Virginia School of Engineering and Applied Science is the first to explore how an emerging plant-based material, cellulose nanofibrils, could amplify the benefits of 3D-printed concrete technology.

"The improvements we saw on both printability and mechanical measures suggest that incorporating cellulose nanofibrils in commercial printable materials could lead to more resilient and eco-friendly construction practices sooner rather than later," said Osman E. Ozbulut, a professor in the Department of Civil and Environmental Engineering.

His team's findings will be published in the September 2024 issue of Cement and Concrete Composites."

Source: [EurekaAlert!](#) (2 Aug 2024)

AI Towards Smart Cities: Predicting Soil Liquefaction Risk Using Artificial Intelligence



"The development of human societies is concurrent with infrastructural changes, evidenced by rapid urbanization in recent years. We are moving towards the era of 'smart cities' powered by advanced technology—such as artificial intelligence (AI), the Internet of Things, and big data analytics—for sustainable urban development. However, climate change has been hampering this growth—earthquakes and other natural hazards negatively impact buildings and other structures in their wake.

Soil liquefaction is an example of a natural hazard where saturated soil substantially loses strength and stiffness in response to stress, typically due to earthquake-related shaking or other rapid loading. This process causes the soil to behave like a liquid, reducing its ability to support infrastructure. Overcoming challenges such as soil liquefaction is, thus, the need of the hour.

Accordingly, researchers from the Shibaura Institute of Technology, Japan, developed a predictive model using AI capable of generating comprehensive soil liquefaction risk maps. The study was led by Professor Shinya Inazumi and involved Ms. Arisa Katsumi and Ms. Yuxin Cong. Their findings were published on 17 July 2024 in the journal Smart Cities.

Regarding his motivation to pursue this research, Prof. Inazumi says, "We were motivated to pursue this research after we recognized the urgent need to improve urban resilience to earthquakes, especially in rapidly urbanizing areas prone to seismic activity—there are critical weaknesses in existing geotechnical risk assessments and urban planning strategies. Since traditional methods for predicting soil liquefaction are often limited by the scale of data integration and speed of analysis, resulting in gaps in emergency preparedness and risk management, we decided to leverage advanced technologies such as AI and machine learning to develop a more dynamic and accurate predictive model."

Source: [Shibaura](#) (1 Aug 2024)

AI Healthy AI: Sustainable Artificial Intelligence for Healthcare



"Similar to other sectors around the world, the light speed development of artificial intelligence (AI) has made its way into healthcare, particularly the radiology field. As such, AI-based diagnostic systems are flourishing, with hospitals quickly adopting the technology to assist radiologists. In contrast, there are concerns about the environmental impact of increasingly complex AI models and the need for more sustainable AI solutions.

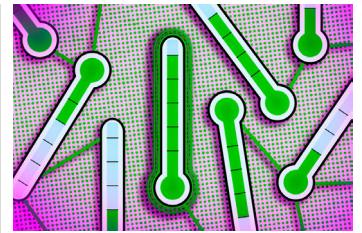
Therefore, Associate Professor Daiju Ueda of Osaka Metropolitan University's Graduate School of Medicine, a member of the Japan Radiological Society, led a research team in the investigation of the environmental costs of AI. In this research review, head members of the Japan Radiological Society and medical field researchers discussed the energy consumption of AI systems in the medical field, carbon emissions of data centers, and electronic waste issues. Specific solutions to mitigate these environmental impacts were discussed, including the development of energy-efficient AI models, the implementation of green computing, and the use of renewable energy.

In addition, the review proposes measures for the sustainable deployment of AI in the medical field. These are important guidelines for medical institutions, policymakers, and AI developers to operate AI systems in an environmentally responsible manner.

"AI has the potential to improve the quality of healthcare, but at the same time its environmental impact cannot be ignored. The best practices we have recommended are the first steps toward balancing these two factors," stated Professor Ueda. "The challenge for the future will be to verify and further elaborate these recommendations in actual medical practice. They are also expected to contribute to the standardization of methods for assessing AI's environmental impact and the development of an international regulatory framework."

Source: [OMU](#) (2 Aug 2024)

AI Method Prevents an AI Model from Being Overconfident About Wrong Answers



"People use large language models for a huge array of tasks, from translating an article to identifying financial fraud. However, despite the incredible capabilities and versatility of these models, they sometimes generate inaccurate responses.

On top of that problem, the models can be overconfident about wrong answers or underconfident about correct ones, making it tough for a user to know when a model can be trusted.

Researchers typically calibrate a machine-learning model to ensure its level of confidence lines up with its accuracy. A well-calibrated model should have less confidence about an incorrect prediction, and vice-versa. But because large language models (LLMs) can be applied to a seemingly endless collection of diverse tasks, traditional calibration methods are ineffective.

Now, researchers from MIT and the MIT-IBM Watson AI Lab have introduced a calibration method tailored to large language models. Their method, called Thermometer, involves building a smaller, auxiliary model that runs on top of a large language model to calibrate it.

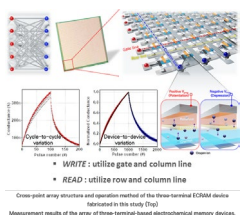
Thermometer is more efficient than other approaches — requiring less power-hungry computation — while preserving the accuracy of the model and enabling it to produce better-calibrated responses on tasks it has not seen before.

By enabling efficient calibration of an LLM for a variety of tasks, Thermometer could help users pinpoint situations where a model is overconfident about false predictions, ultimately preventing them from deploying that model in a situation where it may fail.

"With Thermometer, we want to provide the user with a clear signal to tell them whether a model's response is accurate or inaccurate, in a way that reflects the model's uncertainty, so they know if that model is reliable," says Maohao Shen, an electrical engineering and computer science (EECS) graduate student and lead author of a paper on Thermometer."

Source: [MIT](#) (31 Jul 2024)

AI "Smarter" Semiconductor Technology for Training "Smarter" Artificial Intelligence



"A research team... has recently demonstrated that analog hardware using ECRAM devices can maximize the computational performance of artificial intelligence, showcasing its potential for commercialization. Their research has been published in the esteemed international journal, "Science Advances."

The rapid advancement of AI technology, including applications like generative AI, has pushed the scalability of existing digital hardware (CPUs, GPUs, ASICs, etc.) to its limits. Consequently, there is active research into analog hardware specialized for AI computation... To address the limitations of analog hardware memory devices, the research team focused on Electrochemical Random Access Memory (ECRAM)*2, which manage electrical conductivity through ion movement and concentration. Unlike traditional semiconductor memory, these devices feature a three-terminal structure with separate paths for reading and writing data, allowing for operation at relatively low power.

In their study, the team successfully fabricated ECRAM devices using three-terminal-based semiconductors in a 64x64 array. Experiments revealed that the hardware incorporating the team's devices demonstrated excellent electrical and switching characteristics, along with high yield and uniformity. Additionally, the team applied the Tiki-Taka algorithm*3, a cutting-edge analog-based learning algorithm, to this high-yield hardware, successfully maximizing the accuracy of AI neural network training computations. Notably, the researchers demonstrated the impact of the "weight retention" property of hardware training on learning and confirmed that their technique does not overload artificial neural networks, highlighting the potential for

AI Breaking MAD: Generative AI Could Break the Internet



"Recent work by the Digital Signal Processing group at Rice University has found that a diet of synthetic data can have significant negative impacts on generative AI models' future iterations.

"The problems arise when this synthetic data training is, inevitably, repeated, forming a kind of a feedback loop — what we call an autophagous or 'self-consuming' loop," said Richard Baraniuk, Rice's C. Sidney Burrus Professor of Electrical and Computer Engineering. "Our group has worked extensively on such feedback loops, and the bad news is that even after a few generations of such training, the new models can become irreparably corrupted. This has been termed 'model collapse' by some — most recently by colleagues in the field in the context of large language models (LLMs). We, however, find the term 'Model Autophagy Disorder' (MAD) more apt, by analogy to mad cow disease."

Mad cow disease is a fatal neurodegenerative illness that affects cows and has a human equivalent caused by consuming infected meat. A major outbreak in the 1980-90s brought attention to the fact that mad cow disease proliferated as a result of the practice of feeding cows the processed leftovers of their slaughtered peers — hence the term "autophagy," from the Greek auto-, which means "self," and phagy — "to eat."

"We captured our findings on MADness in a paper presented in May at the International Conference on Learning Representations (ICLR)," Baraniuk said.

The study, titled "Self-Consuming Generative Models Go MAD," is the first peer-reviewed work on AI autophagy and focuses on generative image models like the popular DALL·E 3, Midjourney and Stable Diffusion."

AI These AI Firms Publish the World's Most Highly Cited Work



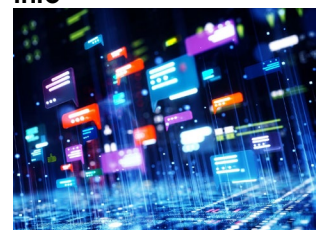
"US tech giants Alphabet and Microsoft produce more highly cited research papers on artificial intelligence (AI) than any other company — but Chinese firms Baidu and Tencent are ahead on patents.

That's according to PARAT, the Private-sector AI-Related Activity Tracker, a tool run by the Emerging Technology Observatory (ETO). The tool gathers data on AI trends and has received a major update.

PARAT's update includes data on the number of AI jobs at companies, as well as publication and patent outputs. AI research and its products — in particular generative models that create text and images — have become big business. Governments are working out how to regulate the technology as it disrupts industries and raises safety questions.

In a field where cutting-edge research happens as much in industry as it does in universities, monitoring commercial activity is important, says Ngor Luong, who tracks AI investment and corporate activities at the Center for Security and Emerging Technology, a think tank focusing on AI at Georgetown University in Washington DC, which hosts the ETO. Companies are at the forefront of innovation in AI, she says."

AI Can A Large Language Model Recognize Itself? Not Quite—But It Could Allow LLMs To Game Interactions and Extract Sensitive Info



"Given the uncannily human capabilities of the most powerful AI chatbots, there's growing interest in whether they show signs of self-awareness. Besides the interesting philosophical implications, there could be significant security consequences if they did, according to a team of researchers in Switzerland. That's why the team has devised a test to see if a model can recognize its own outputs.

The idea that large language models (LLMs) could be self-aware has largely been met with skepticism by experts in the past. Google engineer Blake Lemoine's claim in 2022 that the tech giant's LaMDA model had become sentient was widely derided and he was swiftly edged out of the company. But more recently, Anthropic's Claude 3 Opus caused a flurry of discussion after supposedly displaying signs of self-awareness when it caught out a trick question from researchers. And it's not just researchers who are growing more credulous: A recent paper found that a majority of ChatGPT users attribute at least some form of consciousness to the chatbot.

The question of whether AI models have self-awareness isn't just a philosophical curiosity either. Given that most people who are using LLMs are using those provided by a handful of tech companies, these models are highly likely to come across outputs produced by instances of themselves. If an LLM is able to recognize that fact, says Tim Davidson, a Ph.D. student at the École Polytechnique Fédérale de Lausanne in Switzerland, it could potentially be exploited by the model or its user to extract private information from others."

commercializing the technology.

This research is significant because the largest array of ECRAM devices for storing and processing analog signals reported in the literature to date is 10×10. The researchers have now successfully implemented these devices on the largest scale, with varied characteristics for each device."

Source: [POSTECH](#) (31 Jul 2024)

Source: [RICE](#) (30 Jul 2024)

Source: [Nature](#) (1 Aug 2024)

Source: [IEEE Spectrum](#) (2 Aug 2024)

ARCHITECTURE

Urban Farming: A Sustainable Pathway Out of Nigeria's Unfolding Food Crisis



"A recent report from Nigeria's Ministry of Agriculture predicts that at least 31.5 million citizens may experience a food and nutrition crisis between June and August of this year. This alarming data highlights the severity of the food crisis that has progressively escalated over the last few years. The high prices of fruits and vegetables and their dwindling supply in local markets are already evident, as major staples disappear from food tables. This situation portends a bleak future for Nigeria as most people struggle to make ends meet, even in better times.

The federal government here is desperately throwing everything at this problem. Among several stopgap measures to shore up the country's food security, it has declared a 150-day duty-free import window for food commodities and suspended duties, tariffs, and taxes for the importation of select food commodities. The country stands on the precipice of a full-blown food crisis, and the government is employing temporary measures, such as restrictions on import duties and offering grants and incentives to sub-national governments to grow their own food. However, it's still too early to determine the effectiveness of these initiatives, and they're short-term solutions that might not solve this problem sustainably over the long term."

Source: [Archdaily](#) (2 Aug 2024)

ARCHITECTURE

Visions Of the Future of Architectural Storytelling: In Conversation with BIG And Squint/Opera



"Architectural presentations to clients typically include renders, diagrams, and drawings. Interpreting these and envisioning the final product requires imagination and architectural insight to fill in the gaps and visualize a final product. BIG and Squint/Opera, a partnership between an architectural powerhouse and a creative digital studio, explore innovative methods to convey spatial and architectural design beyond traditional means. They reimagine architectural storytelling beyond static 2D visuals through cutting-edge video production and immersive technology, enabling clients and the general public to fully experience their futuristic visions of city planning and architectural design. Their notable collaborations include the video production for the Toyota Woven City Project and the creation of the VR collaborative design tool HyperForm.

In a conversation with ArchDaily, Daniel Sundlin, partner at BIG, and Matt Quinn, Commercial Director at Squint/Opera, discuss their insights on the future of architectural digital storytelling."

Source: [Archdaily](#) (2 Aug 2024)

CLIMATE CHANGE

Climate Change Will Bring More Turbulence to Flights in The Northern Hemisphere



"A type of invisible, hard-to-predict air turbulence is expected to occur more frequently in the Northern Hemisphere as the climate warms, according to new research. Known as clear air turbulence, the phenomenon also increased in the Northern Hemisphere between 1980 and 2021, the study found.

The research follows up on recent work predicting increases in moderate-to-severe clear air turbulence by analyzing extensive data sets and running comprehensive model simulations. The study was published in Journal of Geophysical Research: Atmospheres, an open-access AGU journal that publishes research advancing the understanding of Earth's atmosphere and its interaction with other components of the Earth system.

The results suggest clear air turbulence will increase in most regions affected by the jet stream, especially over North Africa, East Asia and the Middle East, and that the probability of clear air turbulence will increase with each degree of warming. While most people expect turbulence when flying in an airplane through a thunderstorm or over a mountain range, clear air turbulence hits aircraft unexpectedly. And unlike other, more obvious types of turbulence, there is no easy way to detect and avoid clear air turbulence.

"We know that clear air turbulence is the main cause of aviation turbulence, which causes approximately 70% of all weather-related accidents over the United States," said Mohamed Foudad, an atmospheric scientist at the University of Reading and the study's lead author. Recent well-publicized encounters with clear air turbulence caused injuries on Singapore Airlines and Air Europa flights.

Foudad added that aviation engineers should account for an increase in turbulence when designing aircraft in the future.

"We now have high confidence that climate change is increasing clear air turbulence in some regions," he said."

Source: [AGU](#) (25 Jul 2024)

DESIGN

Wearable Friend Device Aims to Fight Loneliness with AI Companionship



"A new vision for artificially intelligent devices has emerged from US start-up Friend, which is launching a necklace wearable that promises constant companionship.

The Friend device is an amulet-like pendant that listens to its wearer throughout their day and sends conversational text messages based on things that are happening in their life.

Friend launched for pre-order on 30 July with a blog post by company founder Avi Schiffmann titled "Happy International Friendship Day", beginning with the line "Friend is an expression of how lonely I've felt".

In several interviews with tech publications, Schiffmann discussed how he had become disillusioned with productivity optimisation as a de facto end goal for AI technology.

He started to develop Friend while feeling lonely on a business trip in Tokyo with his then productivity-focused AI prototype, Tab. He found he didn't just want to talk to the AI, he told Wired, he wanted it "to feel like this companion is actually there with me travelling".

His tweaks to that prototype became Friend, which has a stripped-down functionality focused purely on conversational companionship."

Source: [Dezeen](#) (2 Aug 2024)

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