SINGAPORE UNIVERSITY OF TECHNOLOGY AND DESIGN

Weekly Discovery

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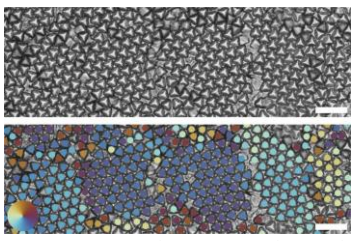
25 Mar – 29 Mar 2024

3D NANOPRINTING

Elusive 3D Printed Nanoparticles Could Lead to New Shapeshifting Materials



"In nanomaterials, shape is destiny. That is, the geometry of the particle in the material defines the physical characteristics of the resulting material.

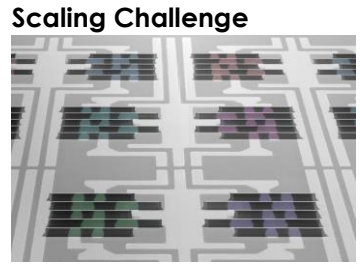
"A crystal made of nano-ball bearings will arrange themselves differently than a crystal made of nano-dice and these arrangements will produce very different physical properties," said Wendy Gu, an assistant professor of mechanical engineering at Stanford University, introducing her latest paper which appears in the journal Nature Communications. "We've used a 3D nanoprinting technique to produce one of the most promising shapes known – Archimedean truncated tetrahedrons. They are micron-scale tetrahedrons with the tips lopped off."

In the paper, Gu and her co-authors describe how they nanoprinted tens of thousands of these challenging nanoparticles, stirred them into a solution, and then watched as they self-assembled into various promising crystal structures. More critically, these materials can shift between states in minutes simply by rearranging the particles into new geometric patterns."

Source: Eurekalert! (25 Mar 2024)

6G

6G Terahertz Devices Demand 3D Electronics: Fin Resonators, Built with Chip Tech Know-How, Rise Up to Meet Scaling Challenge



"Smartphones have a scaling problem. Specifically, the radio-frequency (RF) filters that every phone—and every wireless device in general—uses to extract information from isolated wireless signals are too big, too flat, and too numerous. And without these filters, wireless communications simply wouldn't work at all.

"They are literally the entire backbone of wireless systems," says Roozbeh Tabrizian, a researcher at the University of Florida in Gainesville.

So Tabrizian and other researchers at the University of Florida have now developed an alternative three-dimensional RF filter that can save space in smartphones and IoT devices. If these 3D filters one day replace bulky stacks of 2D filters, it would leave more room for other components, such as batteries. They could also make it easier to push wireless communications into terahertz frequencies, an important spectrum range being researched for 6G cellular technologies."

Source: IEEE Spectrum (22 Mar 2024)

AI

Google AI Could Soon Use a Person's Cough to Diagnose Disease

"A team led by Google scientists has developed a machine-learning tool that can help to detect and monitor health conditions by evaluating noises such as coughing and breathing. The artificial intelligence (AI) system1, trained on millions of audio clips of human sounds, might one day be used by physicians to diagnose diseases including COVID-19 and tuberculosis and to assess how well a person's lungs are functioning.

This is not the first time a research group has explored using sound as a biomarker for disease. The concept gained traction during the COVID-19 pandemic, when scientists discovered that it was possible to detect the respiratory disease through a person's cough2.

What's new about the Google system — called Health Acoustic Representations (HeAR) — is the massive data set that it was trained on, and the fact that it can be fine-tuned to perform multiple tasks.

The researchers, who reported the tool earlier this month in a preprint1 that has not yet been peer reviewed, say it's too early to tell whether HeAR will become a commercial product. For now, the plan is to give interested researchers access to the model so that they can use it in their own investigations. "Our goal as part of Google Research is to spur innovation in this nascent field," says Sujay Kakarmath, a product manager at Google in New York City who worked on the project."

Source: Nature (21 Mar 2024)

AI

AI Takes on India's Most Congested City: A Former Engineer Turned Top Traffic Cop Hopes the Tech Can Tame Bengaluru's Roads

"In just 30 years, the South Indian city of Bengaluru has gone from a sleepy retirement town to the capital of the country's burgeoning technology sector. But such rapid development has left it with some of the most congested roads in the world. Now, a former chip engineer has been drafted in to act as the city's traffic czar, and he's turning to artificial intelligence to tackle the problem.

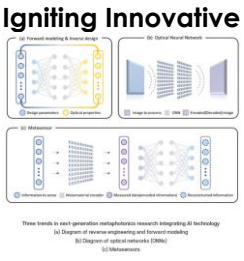
Indian streets are disorderly at the best of times. Pedestrians, cyclists, hand-drawn carts, scooters, auto-rickshaws, and a menagerie of ramshackle goods vehicles of varying sizes and speeds all vie for space on roads that are often in poor condition, lacking sidewalks, and largely devoid of signage or markings.

But even in India, Bengaluru is renowned for its traffic problems. The city's booming IT industry has caused the city's population to skyrocket from roughly 4 million in 1990 to more than 14 million today. Infrastructure has failed to keep up, with limited road construction and a much-delayed metro rail system that still has only two operational lines despite work on the system beginning in 2007. The city has consistently ranked near the top of the list of the world's most congested cities compiled each year by Dutch location technology firm TomTom—although it dropped from second place to sixth in 2023."

Source: IEEE Spectrum (21 Mar 2024)

AI

Metamaterials and AI Converge, Igniting Innovative Breakthroughs



"A research team…from the Department of Mechanical Engineering, the Department of Chemical Engineering, and the Department of Electrical Engineering, and PhD candidates… from the Department of Mechanical Engineering at Pohang University of Science and Technology (POSTECH), has recently published a paper that highlights the next generation of research trends that combine metaphotonics research with artificial intelligence. The paper has been published in the international journal, 'Current Opinion in Solid State and Materials Science.'

Metalenses have sparked a revolution in optics, drastically slimming down conventional lens thickness to one/10,000th while maintaining control over light properties. Notably, the academic community has begun harnessing AI as a mapping tool to discern relationships between input and output data. In their paper, the research team outlines three key trends emerging from AI-fueled metaphotonics research.

Previous research involving simulations to develop metamaterial-based devices were time-consuming endeavors. However, with the application of AI technology, researchers have achieved rapid predictions of optical properties based on input data, significantly saving time and energy. By inputting data regarding optical properties into AI systems, researchers can now design optical devices with desired properties."

Source: POSTECH (18 Mar 2024)

AI

Two Artificial Intelligences Talk To Each Other

"Performing a new task without prior training, on the sole basis of verbal or written instructions, is a unique human ability. What's more, once we have learned the task, we are able to describe it so that another person can reproduce it. This dual capacity distinguishes us from other species which, to learn a new task, need numerous trials accompanied by positive or negative reinforcement signals, without being able to communicate it to their congeners…

A model brain

The researcher and his team have succeeded in developing an artificial neuronal model with this dual capacity, albeit with prior training. ''We started with an existing model of artificial neurons, S-Bert, which has 300 million neurons and is pre-trained to understand language. We 'connected' it to another, simpler network of a few thousand neurons,'' explains Reidar Riveland, a PhD student in the Department of Basic Neurosciences at the UNIGE Faculty of Medicine, and first author of the study."

Source: UNIGE (18 Mar 2024)

AI

AI Ethics Are Ignoring Children, Say Oxford Researchers

"In a perspective paper published this week in Nature Machine Intelligence, the authors highlight that although there is a growing consensus around what high-level AI ethical principles should look like, too little is known about how to effectively apply them in principle for children. The study mapped the global landscape of existing ethics guidelines for AI and identified four main challenges in adapting such principles for children's benefit:

• A lack of consideration for the developmental side of childhood, especially the complex and individual needs of children, age ranges, development stages, backgrounds, and characters.

• Minimal consideration for the role of guardians (e.g. parents) in childhood. For example, parents are often portrayed as having superior experience to children, when the digital world may need to reflect on this traditional role of parents.

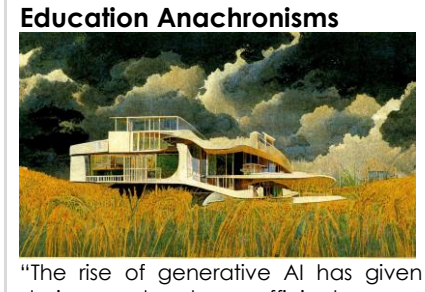
• Too few child-centred evaluations that consider children's best interests and rights. Quantitative assessments are the norm when assessing issues like safety and safeguarding in AI systems, but these tend to fall short when considering factors like the developmental needs and long-term wellbeing of children.

Absence of a coordinated, cross-sectoral, and cross-disciplinary approach to formulating ethical AI principles for children that are necessary to bring about impactful practice changes."

Source: OXFORD (21 Mar 2024)

ARCHITECTURE

How AI Can Help Us End Design Education Anachronisms



"The rise of generative AI has given every design educator sufficient reason to reconsider both what to teach and how to teach it. Training an architect is a long process, and mapping it onto an uncertain future is a daunting task. Researchers at OpenAI, DeepMind, Meta, and similar companies seem constantly surprised by the rapid development and sometimes unforeseen capabilities of their AI creations. If even the creators don't know how fast the future will arrive, it would be hubristic for any of us to claim that AI will do X or AI won't be able to do Y in the next decade, which is about how long it takes to really train an architect."

Source: Archdaily (22 Mar 2024)

CHAT GPT

ChatGPT Is an Effective Tool for Planning Field Work, School Trips and Even Holidays

"Researchers exploring ways to utilise ChatGPT for work, say it could save organisations and individuals a lot of time and money when it comes to planning trips.

A new study, published in Innovations in Education and Teaching International (IETI), has tested whether ChatGPT can be used to design University field studies.

It found that the free-to-use AI model is an effective tool for not only planning educational trips around the world, but also could be used

DESIGN

Ten Wearable Technology Products Designed to Enhance Our Bodies

"Following the release of technology brand Samsung's first smart ring, we round up 10 recent wearable technology designs, including a smart menstrual cup and an air-purifying collar.

While the concept of wearable technology can be applied to a wide range of products, they are often designed to bring health benefits to the wearer or to blur the line between digital and physical experiences.

Read on to see 10 notable examples of

MATERIALS

Cool Paint Coatings Help City Dwellers Feel Up To 1.5 Degrees Celsius Cooler, Study Finds

"A real-world study by researchers at NTU Singapore has shown that the use of cool paint coatings in cities can help pedestrians feel up to 1.5 degrees Celsius cooler, making the urban area more comfortable for work and play.

Cool paint coatings contain additives that reflect the sun's heat to reduce surface heat absorption and emission. They have been touted as one way to cool down the urban area and mitigate the Urban Heat Island (UHI) effect, a phenomenon in which urban areas experience warmer

ROBOTICS

Engineering Household Robots To Have A Little Common Sense

"From wiping up spills to serving up food, robots are being taught to carry out increasingly complicated household tasks. Many such home-bot trainees are learning through imitation; they are programmed to copy the motions that a human physically guides them through.

It turns out that robots are excellent mimics. But unless engineers also program them to adjust to every possible bump and nudge, robots don't necessarily know how to handle

by other industries.

The research, led by scientists from the University of Portsmouth and University of Plymouth, specifically focused on marine biology courses.

It involved the creation of a brand new field course using ChatGPT, and the integration of the AI-planned activities into an existing university module.

The team developed a comprehensive guide for using the chatbot, and successfully organised a single-day trip in the UK using the AI's suggestion of a beach clean-up activity to raise awareness about marine pollution and its impact on marine ecosystems.

They say the established workflow could also be easily adapted to support other projects and professions outside of education, including environmental impact studies, travel itineraries, and business trips."

Source: PLYMOUTH (20 Mar 2024)

wearable technology, ranging from worship-tracking prayer beads to an artificial larynx."

Source: Dezeen (5 Mar 2024)

temperatures than their outlying surroundings."

Source: NTU (25 Mar 2024)

these situations, short of starting their task from the top.

Now MIT engineers are aiming to give robots a bit of common sense when faced with situations that push them off their trained path. They've developed a method that connects robot motion data with the "common sense knowledge" of large language models, or LLMs.

Their approach enables a robot to logically parse many given household task into subtasks, and to physically adjust to disruptions within a subtask so that the robot can move on without having to go back and start a task from scratch — and without engineers having to explicitly program fixes for every possible failure along the way."

Source: MIT (25 Mar 2024)