AI
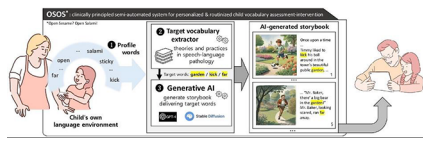### Generative AI Pioneers the Future of Child Language Learning

The Open Sesame? Open Salami! system profiles each child's daily language environment by automatically extracting target vocabulary based on speech pathology principles. It then generates personalized stories that seamlessly incorporate these target words, providing customized storybooks to support effective language assessment and intervention

"Professor Inseok Hwang from the Department of Computer Science and Engineering, along with students… have created an innovative system for generating personalized storybooks. This system utilizes generative artificial intelligence and home IoT technology to assist children in language learning. Their research was showcased at the "ACM CHI (ACM SIGCHI Conference on Human Factors in Computing Systems)", the leading conference in human-computer interaction, where it earned an "Honorable Mention Award," recognizing it as one of the top 5% of submissions.

Children's language development is crucial as it impacts their cognitive and academic growth, their interactions with peers, and overall social development. It is essential to regularly evaluate language progress and provide timely language interventions*1 to support language acquisition. The issue is that children grow up in diverse environments, leading to variations in their exposure to vocabulary. However, traditional approaches often rely on standardized vocabulary lists and pre-made storybooks or toys for language skill assessments and interventions, lacking the diversity support.

Recognizing the shortcomings of conventional, one-size-fits-all approaches that fail to address the diverse backgrounds of children, the team created an innovative educational system tailored to each child's unique environment. They began by employing home IoT devices to capture and monitor the language children hear and speak in their daily lives. Through speaker separation*2 and morphological analysis techniques*3, the researchers examined the vocabulary children were exposed to, the words they spoke, and those they heard but did not vocalize. They then assessed each word by calculating scores for each word based on key factors relevant to speech pathology.

Source: Postech (26 Jul 2024)

AI
Researchers Leveraging AI To Train (Robotic) Dogs to Respond to Their Masters
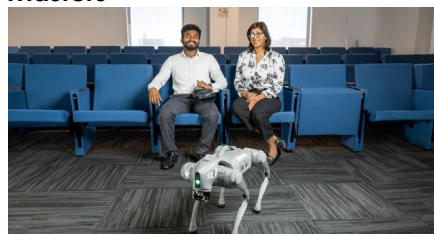
"An international collaboration seeks to innovate the future of how a mechanical man's best friend interacts with its owner, using a combination of AI and edge computing called edge intelligence.

The project is sponsored through a one-year seed grant from the Institute for Future Technologies (IFT), a partnership between New Jersey Institute of Technology (NJIT) and Ben-Gurion University of the Negev (BGU).

Assistant Professor Kasthuri Jayarajah in NJIT's Ying Wu College of Computing is researching how to design a socially assistive model of her Unitree Go2 robotic dog that will dynamically adapt its behavior and nature of interactions based on the characteristics of the people with whom it interacts.

The overarching project goal is to make the dog come "alive" by adapting wearable-based sensing devices that can detect physiological and emotional stimuli inherent to one's personality and traits, such as introversions, or transient states, including pain and comfort levels.

The invention will have an impact on home and healthcare settings in battling loneliness in the elderly population and be an aid in therapy and rehabilitation. Jayarajah's initial work where robotic dogs understand and respond to gestural cues from their partners will be presented at the International Conference on Intelligent Robots and Systems (IROS) later this year."

Source: NJIT (15 Jul 2024)

AI
Large Language Models Don't Behave Like People, Even Though We May Expect Them To
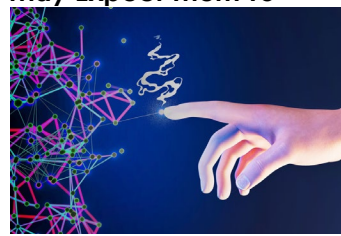
"One thing that makes large language models (LLMs) so powerful is the diversity of tasks to which they can be applied. The same machine-learning model that can help a graduate student draft an email could also aid a clinician in diagnosing cancer.

However, the wide applicability of these models also makes them challenging to evaluate in a systematic way. It would be impossible to create a benchmark dataset to test a model on every type of question it can be asked.

In a new paper, MIT researchers took a different approach. They argue that, because humans decide when to deploy large language models, evaluating a model requires an understanding of how people form beliefs about its capabilities.

For example, the graduate student must decide whether the model could be helpful in drafting a particular email, and the clinician must determine which cases would be best to consult the model on.

Building off this idea, the researchers created a framework to evaluate an LLM based on its alignment with a human's beliefs about how it will perform on a certain task.

They introduce a human generalization function — a model of how people update their beliefs about an LLM's capabilities after interacting with it. Then, they evaluate how aligned LLMs are with this human generalization function.

Their results indicate that when models are misaligned with the human generalization function, a user could be overconfident or underconfident about where to deploy it, which might cause the model to fail unexpectedly. Furthermore, due to this misalignment, more capable models tend to perform worse than smaller models in high-stakes situations."

Source: MIT (23 Jul 2024)

AI
Study: When Allocating Scarce Resources With AI, Randomization Can Improve Fairness
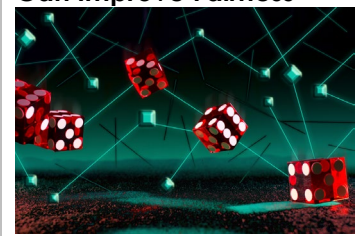
"Organizations are increasingly utilizing machine-learning models to allocate scarce resources or opportunities. For instance, such models can help companies screen resumes to choose job interview candidates or aid hospitals in ranking kidney transplant patients based on their likelihood of survival.

When deploying a model, users typically strive to ensure its predictions are fair by reducing bias. This often involves techniques like adjusting the features a model uses to make decisions or calibrating the scores it generates.

However, researchers from MIT and Northeastern University argue that these fairness methods are not sufficient to address structural injustices and inherent uncertainties. In a new paper, they show how randomizing a model's decisions in a structured way can improve fairness in certain situations.

For example, if multiple companies use the same machine-learning model to rank job interview candidates deterministically — without any randomization — then one deserving individual could be the bottom-ranked candidate for every job, perhaps due to how the model weighs answers provided in an online form. Introducing randomization into a model's decisions could prevent one worthy person or group from always being denied a scarce resource, like a job interview.

Through their analysis, the researchers found that randomization can be especially beneficial when a model's decisions involve uncertainty or when the same group consistently receives negative decisions.

They present a framework one could use to introduce a specific amount of randomization into a model's decisions by allocating resources through a weighted lottery. This method, which an individual can tailor to fit their situation, can improve fairness without hurting the efficiency or accuracy of a model."

Source: MIT (24 Jul 2024)

AI
AI Models Fed AI-Generated Data Quickly Spew Nonsense

"Training artificial intelligence (AI) models on AI-generated text quickly leads to the models churning out nonsense, a study has found. This cannibalistic phenomenon, termed model collapse, could halt the improvement of large language models (LLMs) as they run out of human-derived training data and as increasing amounts of AI-generated text pervade the Internet.

"The message is, we have to be very careful about what ends up in our training data," says co-author Zakhar Shumaylov, an AI researcher at the University of Cambridge, UK. Otherwise, "things will always, provably, go wrong". he says." The team used a mathematical analysis to show that the problem of model collapse is likely to be universal, affecting all sizes of language model that use uncurated data, as well as simple image generators and other types of AI.

The researchers began by using an LLM to create Wikipedia-like entries, then trained new iterations of the model on text produced by its predecessor. As the AI-generated information — known as synthetic data — polluted the training set, the model's outputs became gibberish. The ninth iteration of the model completed a Wikipedia-style article about English church towers with a treatise on the many colours of jackrabbit tails (see 'AI gibberish')."

AI
Deepfake Porn Is Leading to A New Protection Industry: Regulations Haven't Caught Up to This New Kind of Sexual Abuse


"It's horrifyingly easy to make deepfake pornography of anyone thanks to today's generative AI tools. A 2023 report by Home Security Heroes (a company that reviews identity-theft protection services) found that it took just one clear image of a face and less than 25 minutes to create a 60-second deepfake pornographic video—for free.

The world took notice of this new reality in January when graphic deepfake images of Taylor Swift circulated on social media platforms, with one image receiving 47 million views before it was removed. Others in the entertainment industry, most notably Korean pop stars, have also seen their images taken and misused—but so have people far from the public spotlight. There's one thing that virtually all the victims have in common, though: According to the 2023 report, 99 percent of victims are women or girls.

This dire situation is spurring action, largely from women who are fed up. As one startup founder, Nadia Lee, puts it: "If safety tech doesn't accelerate at the same pace as AI development, then we are screwed." While there's been considerable research on deepfake detectors, they struggle to keep up with deepfake generation tools. What's more, detectors help only if a platform is interested in screening out deepfakes, and most deepfake porn is hosted on sites dedicated to that genre."

AI
Google AI Predicts Long-Term Climate Trends and Weather — In Minutes
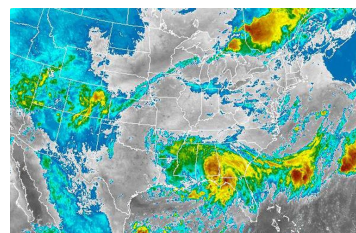
"A computer model that combines conventional weather-forecasting technology with machine learning has outperformed other artificial intelligence (AI)-based tools at predicting weather scenarios and long-term climate trends.

The tool, described in Nature on 22 July, is the first machine-learning model to generate accurate ensemble weather forecasts — ones which present a range of scenarios. Its development opens the door for forecasting that is faster and less energy-intensive than existing tools, and more detailed than approaches based solely on AI.

"Traditional climate models need to be run on supercomputers. This is a model you can run in minutes," says study co-author Stephan Hoyer, who studies deep learning at Google Research in Mountain View, California.

Current forecasting systems typically rely on general circulation models (GCMs), programmes that draw on the laws of physics to simulate processes in Earth's oceans and atmosphere and predict how they might affect the weather and climate. But GCMs require a lot of computing power, and advances in machine learning are starting to provide a more efficient alternative. "We have terabytes or petabytes (one million times larger than a gigabyte) of historical weather data" says Hoyer. "By learning from those patterns, we can build better models."

There are already some machine-learning forecasting models available, such as Pangu-Weather, built by the technology conglomerate Huawei, based in Shenzhen, China, and GraphCast by DeepMind, headquartered in London. These models have similar accuracy levels to typical GCMs for deterministic forecasting — an approach that generates a single weather forecast. But GCMs aren't as reliable for ensemble forecasting, or for long-term climate predictions."

ARCHITECTURE
"Life Changes Every Second, But Architecture Never Changes": In Conversation with Tatiana Bilbao

"These days, it is common to hear multiple voices addressing the diverse issues of contemporary architecture. The topics are numerous, ranging from sustainability and inclusion to social justice and the crisis in land use. At first glance, there is no common ground where all these concepts can coexist transversally. However, if we look back, we can see that beyond the formal architectural concepts, the true purpose of architecture (probably) lies in the people and the lives that develop within it.

Thus, many would argue that life is likely more important than architecture, which could open up a broad debate. What is certain is that currently, narratives and voices are emerging and consolidating, aimed at renewing architectural tools and languages. This transformation seeks to turn the built environment into a space that promotes a more equitable and optimistic future for all. One of these voices is that of Tatiana Bilbao, recognized for her process-centered approach where life and human interactions play a crucial role in defining habitats.

In the framework of Inflections 2024, organized by the Association of Collegiate Schools of Architecture (ACSA), the School of Architecture, Art, and Design (EAAD) of the Tecnológico de Monterrey, along with the Association of Architecture Education Institutions of the Mexican Republic (ASINEA), Tatiana Bilbao presented the inaugural lecture. Furthermore, in conversation with ArchDaily, she reflected on identity, locality, and the role of housing and human relations in architecture."

DESIGN
Architectural Landmarks Star In "Utopian" Poster for Paris 2024 Olympics

French artist Ugo Gattoni has created a duo of intricately hand-drawn posters for the Paris 2024 Olympic and Paralympic Games, which can function independently or combine seamlessly to create a single composition.

It marks the first time that posters for both summer games were designed together as a diptych, according to the Paris 2024 Organising Committee.

The posters tell a singular story about the games via a hyperreal depiction of Paris incorporating 47 Olympic and Paralympic sports alongside various architectural landmarks.

"When I was asked to design the iconic posters for Paris 2024, I immediately imagined a city-stadium open to the world, a suspended time in which you can wander through microcosms where Parisian monuments and sporting disciplines joyfully coexist," Gattoni said.

His aim was to create a series of micro-stories based around familiar Paris monuments such as the Eiffel Tower, the Grand Palais, the Arc de Triomphe and the Trocadéro, where British studio Gustafson Porter + Bowman is adding an amphitheatre and a green corridor in preparation for the games.

In Gattoni's condensed version of Paris, these landmarks rub shoulders with some of the sporting venues that will be used for the games including the Stade de France, which will host the athletics, Para athletics and rugby sevens."

POWER DISTRIBUTION
Engineers Use Data to Manage Grid Transformers, Boosting Reliability to Homes, Farms

"AMES, Iowa – Pay attention the next time you drive near your home, farm or business. You'll notice small, green utility boxes all over the place. They're distribution transformers. If they're not working properly, electricity won't flow to your lights and appliances.

Those boxes take kilovolts of electricity (that's high voltage, measured in 1,000s of volts) from transmission lines and step it down to the safer, practical 120 or 240 volts that power our daily lives.

"Utilities have plenty of them," said Zhaoyu Wang, an Iowa State University professor of electrical and computer engineering. "Most of them only supply two to 10 customers."

The city of Ames, for example, with a population of about 66,000, has about 5,500 distribution transformers on its grid serving about 29,000 customers, according to the city's Electric Department.

These are not smart devices. There are no sensors attached to let utilities know if there's any kind of problem. Utilities have been in the habit of keeping a large inventory of the boxes that had cost $1,000 to $2,000 apiece.

But that's no longer a good option. Costs of the boxes have tripled. Boxes are on long back orders. And the boxes are getting overloaded and overheated as we all depend on more and more electricity to run vehicles, heat pumps, tools and devices.

"Every time the temperature of distribution transformers goes up, the lifetime of the boxes decreases," Wang said.

Wang has an idea to fix that burnout problem, one that would help utilities move from a "passive 'broken-fix' cycle" of managing distribution transformers to a "proactive 'monitoring-prediction-maintenance' cycle," according to summary of his research. That idea could minimize service disruptions while advancing distribution reliability and resilience, while also lowering grid capital and operating costs."

ROBOTICS
Shape-Shifting 'Transformer Bots' Inspired by Origami
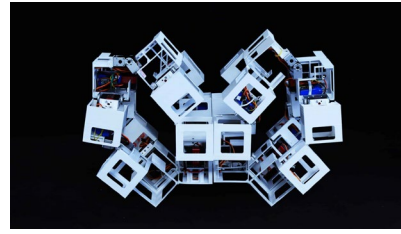
"Inspired by the paper-folding art of origami, North Carolina State University engineers have discovered a way to make a single plastic cubed structure transform into more than 1,000 configurations using only three active motors. The findings could pave the way for shape-shifting artificial systems that can take on multiple functions and even carry a load – like versatile robotic structures used in space, for example.

"The question we're asking is how to achieve a number of versatile shapes with the fewest number of actuators powering the shapeshifting," said Jie Yin, associate professor of mechanical and aerospace engineering and co-corresponding author of a paper describing the work. "Here we use a hierarchical concept observed in nature – like layered muscle fibers – but with plastic cubes to create a transforming robot."

The NC State researchers assembled hollow, plastic cubes using a 3D printer and assembled 36 of them together with rotating hinges; some hinges were fixed with metal pins, while others were activated wirelessly with a motor.

The researchers were able to move the cubes into more than 1,000 shapes using only three active motors. Those shapes included tunnel-like structures, bridge-like structures and even multi-story architectures.

The untethered transformer bots can move forward, backward and sideways – without feet – merely by controlling the ways the structure's shape changes. The bots can also transform relatively quickly from flat, or fully open, to a boxlike larger cube, or fully closed. The bots also can carry a load about three times their own weight."

WEARABLES
Wearable Sensors Help Athletes Achieve Greater Performance
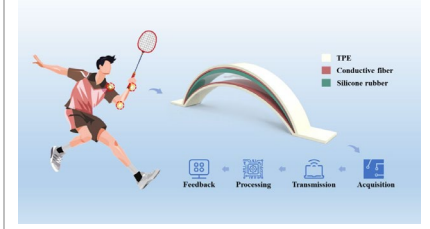
"Today's athletes are always on the lookout for new techniques and equipment to help them train more effectively. Modern coaches and sports trainers use intelligent data monitoring through videos and wearable sensors to help enhance athletic conditioning. However, traditional video analysis and wearable sensor technologies often fall short when tasked to produce a comprehensive picture of an athlete's performance.

In APL Materials, by AIP Publishing, researchers from Lyuliang University developed a low-cost, flexible, and customizable sensor that overcomes current monitoring constraints.

Badminton is known for its many technical movements and the dynamic speed and precision required to play successfully. Monitoring the postures, footwork, arm swings, and muscle strength shown by badminton players is limited by video shooting angles and the discomfort of rigid wearable sensors.

"We integrated our expertise in flexible sensor technology and intelligent perception systems into badminton motion monitoring for a quantitative analysis of badminton techniques, to provide more professional guidance for badminton players," said author Yun Yang.

The team used triboelectric sensors to construct their intelligent monitoring system because they are easy to adapt for flexible, wearable devices. A triboelectric sensor transfers charge from one material to another when the materials come into contact and slide past each other. No external power supply is required."