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AI
Microsoft Builds AI That Creates 'Impressive' Video-Game Worlds

"Generative artificial intelligence (AI) tools have upended creative industries from music and film to scientific publishing. Now they're upending the world of video games, too.

In a study published in Nature on 19 February, a team of researchers reveals a generative AI engine that can create coherent, immersive video-game worlds that respond to player inputs.

"I knew that this could be done, but it's still impressive," says Julian Togelius, a researcher at New York University specializing in AI in video games.

Last year, researchers at Google showed that an AI engine could simulate the 1990s video game DOOM. But the ability for generative AI tools to generate fresh ideas in complex worlds has been limited. When a team led by Microsoft game-intelligence researcher Katja Hoffman interviewed game developers to find out what they wanted in AI tools, they suggested engines that can generate gameplay sequences that remain consistent with the rules and physics of the game. They also wanted the ability to tweak outputs throughout development.

The team built and trained WHAM, a generative AI system focusing on these capabilities. The researchers took the online multiplayer game Bleeding Edge, developed by a Microsoft-owned studio named Ninja Theory, and extracted video frames and controller inputs from 500,000 anonymized game sessions, which equated to more than seven years of continuous play. They trained the engine on one-second slices of gameplay involving up to 1.6 billion parameters.

The team showed that WHAM could perform well in three crucial areas. It could act within the rules of the original game (consistency) and generate a range of gameplay slices (diversity), with anything that was added to the world by the user remaining there (persistency). Together, these features demonstrate WHAM's potential for creative ideation, the authors say."

Source: Nature (19 Feb 2025)

AI
Why GPT Can't Think Like Us
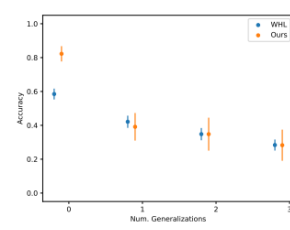
"Artificial Intelligence (AI), particularly large language models like GPT-4, has shown impressive performance on reasoning tasks. But does AI truly understand abstract concepts, or is it just mimicking patterns? A new study from the University of Amsterdam and the Santa Fe Institute reveals that while GPT models perform well on some analogy tasks, they fall short when the problems are altered, highlighting key weaknesses in AI's reasoning capabilities.

Analogical reasoning is the ability to draw a comparison between two different things based on their similarities in certain aspects. It is one of the most common methods by which human beings try to understand the world and make decisions. An example of analogical reasoning: cup is to coffee as soup is to ??? (the answer being: bowl)

Large language models like GPT-4 perform well on various tests, including those requiring analogical reasoning. But can AI models truly engage in general, robust reasoning or do they over-rely on patterns from their training data? This study by language and AI experts Martha Lewis (Institute for Logic, Language and Computation at the University of Amsterdam) and Melanie Mitchell (Santa Fe Institute) examined whether GPT models are as flexible and robust as humans in making analogies. 'This is crucial, as AI is increasingly used for decision-making and problem-solving in the real world', explains Lewis."

Source: Eurekalert! (21 Feb 2025)

ARCHITECTURE
Not Just a Train Stop: The Evolution of Transit-Oriented Developments in East Asia

"Transit-Oriented Development (TOD) is a comprehensive urban planning strategy aimed at creating dense, walkable, and vibrant neighborhoods centered around public transportation hubs. By seamlessly integrating residential, commercial, and recreational facilities within close proximity to transit nodes, TODs seek to reduce automobile dependency, increase public transit ridership, and stimulate local economic development. Government agencies play a pivotal role in supporting these developments through zoning reforms, easing floor area ratios (FARs), selling air rights, and facilitating public-private partnerships to secure capital for public infrastructure. While TODs have gained global traction, East Asia boasts some of the most successful examples. Conversely, efforts to replicate these models in different contexts—such as New York City—highlight the importance of adapting TOD principles to local conditions, geographical characteristics, and community needs.

East Asia's urban environments offer fertile ground for TOD implementation due to a confluence of demographic, infrastructural, and policy-driven factors. High population density ensures steady transit ridership and foot traffic for new developments, making significant investments in public transportation and related developments economically viable. The region's commitment to modern technology and continuous infrastructure upgrades contributes to reliable, efficient transit systems, further reinforcing public reliance. In cities like Hong Kong and Singapore, policies also actively discourage private car ownership: Hong Kong imposes automobile taxes for new vehicles typically exceeding 80%, while Singapore requires a Certificate of Entitlement (COE) that can surpass USD 70,000 just to own a car. These measures make public transportation the practical choice for the majority of residents."

Source: Archdaily (24 Feb 2025)

BATTERY
Scientists Design Novel Battery That Runs on Atomic Waste

"Researchers have developed a battery that can convert nuclear energy into electricity via light emission, a new study suggests.

Nuclear power plants, which generate about 20% of all electricity produced in the United States, produce almost no greenhouse gas emissions. However, these systems do create radioactive waste, which can be dangerous to human health and the environment. Safely disposing of this waste can be challenging.

Using a combination of scintillator crystals, high-density materials that emit light when they absorb radiation, and solar cells, the team, led by researchers from The Ohio State University, demonstrated that ambient gamma radiation could be harvested to produce a strong enough electric output to power microelectronics, like microchips.

To test this battery, which is a prototype about 4 cubic centimeters small, researchers used two different radioactive sources, cesium-137, and cobalt-60, some of the most significant fission products that come from spent nuclear fuel. The battery was tested at Ohio State's Nuclear Reactor Laboratory. The NRL supports student and faculty research, student education, and service to industry – it does not produce electrical power.

Their results showed that when cesium-137 was used, the battery generated 288 nanowatts. Yet with the much stronger isotope cobalt-60, the battery produced 1.5 microwatts of power, about enough to switch on a tiny sensor."

Source: OSU (25 Feb 2025)

MATHEMATICS
Student Refines 100-Year-Old Math Problem, Expanding Wind Energy Possibilities
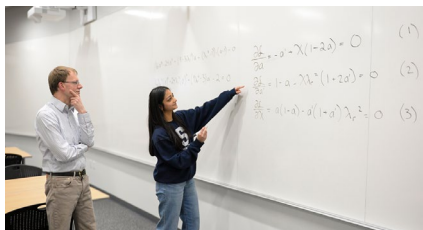
"A Penn State engineering student refined a century-old math problem into a simpler, more elegant form, making it easier to use and explore. Divya Tyagi's work expands research in aerodynamics, unlocking new possibilities in wind turbine design that Hermann Glauert, a British aerodynamicist and the original author, did not consider.

Tyagi, a graduate student pursuing her master's degree in aerospace engineering, completed this work as a Penn State undergraduate for her Schreyer Honors College thesis. Her research was published in Wind Energy Science.

"I created an addendum to Glauert's problem which determines the optimal aerodynamic performance of a wind turbine by solving for the ideal flow conditions for a turbine in order to maximize its power output," said Tyagi, who earned her bachelor's degree in aerospace engineering.

Her adviser, Sven Schmitz, the Boeing/A.D. Welliver Professor in the Department of Aerospace Engineering and co-author on the paper, said Glauert's original work focused exclusively on the maximum attainable power coefficient, which measures how efficiently a turbine converts wind energy into electricity. However, Glauert did not account for the total force and moment coefficients acting on the

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ROBOTICS
Morphing Robot Turns Challenging Terrain to Its Advantage

"From mountain goats that run up near-vertical rock faces to armadillos that roll into a protective ball, animals have evolved to adapt effortlessly to changes in their environment. In contrast, when an autonomous robot is programmed to reach a goal, each variation in its pre-determined path presents a significant physical and computational challenge.

Researchers led by Josie Hughes in the CREATE Lab in EPFL's School of Engineering wanted to develop a robot that could traverse diverse environments as adeptly as animals by changing form on the fly. With GOAT (Good Over All Terrains) they have achieved just that – and created a new paradigm for robotic locomotion and control in the process.

Thanks to its flexible yet durable design, GOAT can spontaneously morph between a flat 'rover' shape and a sphere as it moves. This allows it to switch between driving, rolling, and even swimming, all while consuming less energy than a robot with limbs or appendages.

"While most robots compute the shortest path from A to B, GOAT considers the travel modality as well as the path to be taken," Hughes explains. "For example, instead of going around an obstacle like a stream, GOAT can swim straight through. If its path is hilly, it can passively roll downhill as a sphere to save both time and energy, and then actively drive as a rover when

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ROBOTICS
A Self-Balancing Exoskeleton Strides Toward Market: Xomotion Gets People with Spinal Cord Injuries on Their Feet—And Dancing

"Many people who have spinal cord injuries also have dramatic tales of disaster: a diving accident, a car crash, a construction site catastrophe. But Chloë Angus has quite a different story. She was home one evening in 2015 when her right foot started tingling and gradually lost sensation. She managed to drive herself to the hospital, but over the course of the next few days she lost all sensation and control of both legs. The doctors found a benign tumor inside her spinal cord that couldn't be removed, and told her she'd never walk again. But Angus, a jet-setting fashion designer, isn't the type to take such news lying—or sitting—down.

Ten years later, at the CES tech trade show in January, Angus was showing off her dancing moves in a powered exoskeleton from the Canadian company Human in Motion Robotics. "Getting back to walking is pretty cool after spinal cord injury, but getting back to dancing is a game changer," she told a crowd on the expo floor.

ROBOTICS
Reinforcement Learning Triples Spot's Running Speed: The Robotics and AI Institute Is Teaching Robot Dogs to Run and Bicycles to Jump

"About a year ago, Boston Dynamics released a research version of its Spot quadruped robot, which comes with a low-level application programming interface (API) that allows direct control of Spot's joints. Even back then, the rumor was that this API unlocked some significant performance improvements on Spot, including a much faster running speed. That rumor came from the Robotics and AI (RAI) Institute, formerly The AI Institute, formerly the Boston Dynamics AI Institute, and if you were at Marc Raibert's talk at the ICRA@40 conference in Rotterdam last fall, you already know that it turned out not to be a rumor at all.

Today, we're able to share some of the work that the RAI Institute has been doing to apply reality-grounded reinforcement learning techniques to enable much higher performance from Spot. The same techniques can also help highly dynamic robots operate robustly, and there's a brand new hardware platform that shows this off: an autonomous bicycle that can jump."

rotor — the spinning unit with attached blades — or how turbine blades bend under wind pressure."

rolling is no longer beneficial."

ROBOTS

A Springtail-Like Jumping Robot

"Springtails, small bugs often found crawling through leaf litter and garden soil, are expert jumpers. Inspired by these hopping hexapods, roboticists in the Harvard John A. Paulson School of Engineering and Applied Sciences (SEAS) have made a walking, jumping robot that pushes the boundaries of what small robots can do.

Published in Science Robotics, the research glimpses a future where nimble microrobots can crawl through tiny spaces, skitter across dangerous ground, and sense their environments without human intervention.

The new Harvard robot was created in the lab of Robert J. Wood, the Harry Lewis and Marlyn McGrath Professor of Engineering and Applied Sciences at SEAS. It is a modification of the Harvard Ambulatory Microrobot (HAMR), a microrobotic platform originally modeled after the dexterous, hard-to-kill cockroach. Now, HAMR is outfitted with a robotic furcula – the forked, tail-like appendage tucked under a springtail's body that it pushes off the ground to send it Simone Biles-ing into the air.

"Springtails are interesting as inspiration, given their ubiquity, both spatially and temporally across evolutionary scales," Wood said. "They have this unique mechanism that involves rapid contact with the ground, like a quick punch, to transfer momentum and initiate the jump."

SELF DRIVING CARS

Self-Driving Cars Learn to Share Road Knowledge Through Digital Word-Of-Mouth
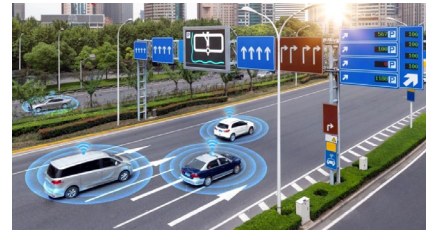
"An NYU Tandon-led research team has developed a way for self-driving vehicles to share their knowledge about road conditions indirectly, making it possible for each vehicle to learn from the experiences of others even when they rarely meet on the road.

The research, presented in a paper at the Association for the Advancement of Artificial Intelligence Conference on February 27, 2025, tackles a persistent problem in artificial intelligence: how to help vehicles learn from each other while keeping their data private. Typically, vehicles only share what they have learned during brief direct encounters, limiting how quickly they can adapt to new conditions.

"Think of it like creating a network of shared experiences for self-driving cars," said Yong Liu, who supervised the research led by his Ph.D. student Xiaoyu Wang. Liu is a professor in NYU Tandon's Electrical and Computer Engineering Department and a member of its Center for Advanced Technology in Telecommunications and Distributed Information Systems and of NYU WIRELESS.

"A car that has only driven in Manhattan could now learn about road conditions in Brooklyn from other vehicles, even if it never drives there itself. This would make every vehicle smarter and better prepared for situations it hasn't personally encountered," Liu said."

SUSTAINABLE DEVELOPMENT

Biobased Lignin Gels Offer Sustainable Alternative for Hair Conditioning

"Researchers at Stockholm University have developed a fully biobased hair conditioner using lignin gel emulsions, offering a sustainable and environmentally friendly alternative to conventional haircare products.

Hair conditioners typically contain 20–30 ingredients, many derived from petroleum and oleochemicals, raising concerns about sustainability and environmental impact. A new study published in Science Advances, demonstrates that micellar lignin gels can effectively stabilize emulsions with natural oils, reducing the need for synthetic surfactants and complex stabilizers commonly used in commercial formulations. The research team, led by Mika Sipponen at Stockholm University, sought to explore lignin, a common and renewable component in wood biomass, as a multifunctional component for hair conditioning.

"Our findings highlight lignin's potential as a stabilizer in oil-in-water emulsions, enabling a more natural and sustainable approach to hair conditioning," says Mika Sipponen. "By using wood-derived lignin directly without any chemical modification, we not only simplify the ingredient list but also eliminate the need for organic solvents, making the process more eco-friendly."

VR

New Device Could Allow You to Taste a Cake in Virtual Reality

"Novel technology intends to redefine the virtual reality experience by expanding to incorporate a new sensory connection: taste.

The interface, dubbed 'e-Taste', uses a combination of sensors and wireless chemical dispensers to facilitate the remote perception of taste – what scientists call gustation. These sensors are attuned to recognize molecules like glucose and glutamate — chemicals that represent the five basic tastes of sweet, sour, salty, bitter, and umami. Once captured via an electrical signal, that data is wirelessly passed to a remote device for replication.

Field testing done by researchers at The Ohio State University confirmed the device's ability to digitally simulate a range of taste intensities, while still offering variety and safety for the user.

"The chemical dimension in the current VR and AR realm is relatively underrepresented, especially when we talk about olfaction and gustation," said Jinghua Li, co-author of the study and an assistant professor of materials science and engineering at Ohio State. "It's a gap that needs to be filled and we've developed that with this next-generation system."

The system, whose development was inspired by previous biosensor work of Li's, utilizes an actuator with two parts: an interface to the mouth and a small electromagnetic pump. This pump connects to a liquid channel of chemicals that vibrates when an electric charge passes through it, pushing the solution through a special gel layer into the mouth of the subject.

Depending on the length of time that the solution interacts with this gel layer, the intensity and strength of any given taste can easily be adjusted, said Li."