



Show Notes January 5, 2024

Story 1: This AI Robot Just Taught Itself How to Walk

Source: WonderfulEngineering.com

Story by Taimur

Link: <https://wonderfuleengineering.com/this-ai-transformer-robot-just-taught-itself-how-to-walk/>

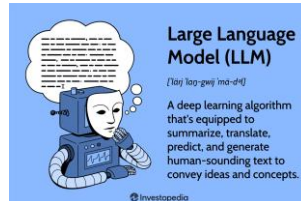


See video here: <http://tinyurl.com/549ykn78>

- *Personal note – the article’s headline uses word “transformer” – This robot is not a transformer, so I’m not going to use that description.*
- Researchers at the [University of California](#), Berkeley [i.e. Berkeley Robotics & Human Engineering Laboratory] have developed a humanoid robot using artificial intelligence techniques that autonomously learned how to walk in the physical world.
 - The teal-colored robot has demonstrated the ability to navigate varied terrains on the university campus, showcasing its potential for operation in diverse environments. However, the robot has not yet mastered the skill of navigating steps.
- The UC Berkeley researchers explored the application of “reinforcement learning,” a concept popularized by large language models (LLMs), to teach the

robot adaptive behaviors. They chose walking as the basic human function to test their theory.

- **Time out, what is a large language model?** [A large language model](#) is a large-scale language model notable for its ability to achieve [general-purpose language understanding and generation](#).



- The researchers initiated the learning process in a simulated environment, using [Isaac Gym](#), a high-performance GPU-based physics simulation. Billions of scenarios were run in the simulation, where the algorithm rewarded actions that mimicked human-like walking and penalized those that did not. Once perfected in the simulation, the learned behavior was transferred to the real-world humanoid robot without requiring further fine-tuning.
 - **Side note, what is GPU?** The latest [graphics processing units](#) (GPUs) unlock new possibilities in gaming, content creation, machine learning, and more.
 - **Side note, what is Isaac Gym?** Isaac Gym offers a high-performance learning platform to train policies for wide variety of robotics tasks directly on GPU.
 - **Deeper dive** - Both physics simulation and neural network policy training reside on GPU and communicate by directly passing data from physics buffers to PyTorch tensors without ever going through any CPU bottlenecks. This leads to blazing fast training times for complex robotics tasks on a single GPU with 1-2 orders of magnitude improvements compared to conventional RL training that uses a CPU based simulator and GPU for neural networks. Isaac gym can be downloaded at <https://developer.nvidia.com/isaac-gym>
- The core of the learning system is a deep-learning model known as a [causal transformer](#), widely used in large language models to predict sequences of data elements. Deploying this model allowed the robot to learn from observations and

actions, predicting the consequences of its actions in new landscapes it had never encountered before.

- Over the past year [*this article was published December 22, 2023*], the humanoid robot has successfully traversed the UC Berkeley campus, adapting to patches of grass and roads. Notably, the researchers observed the emergence of unintended traits in the robot's behavior.
 - For instance, the robot exhibited human-like traits such as swinging its left arm while moving its right foot forward or taking smaller steps to maintain balance on slopes. Impressively, the robot achieved this without relying on sensors to perceive its environment.
- While the robot showcased resilience by maintaining balance when subjected to external disturbances like pokes or thrown exercise balls, there are areas for improvement. The robot's gait is not as refined as a human's, appearing jerky, especially on harder surfaces like concrete or asphalt. Moreover, the robot lacks awareness of obstacles until it physically encounters them.
- The researchers plan to address these limitations in future developments. While the robot may not yet be an ideal home or factory bot, its self-learning capabilities mark a promising start for the development of adaptive humanoid robots.

Story 2: Company unveils bladeless 'honeycomb' wind turbines

Source: The Cool Down

Story by Allison Hunt

Link: <https://www.msn.com/en-us/money/technology/company-unveils-bladeless-honeycomb-wind-turbines-here-s-how-this-super-efficient-technology-could-let-clean-energy-take-another-leap-forward/ar-AA1IHuHW>





See video here: <https://www.youtube.com/watch?v=TLjHdbaTOG4> *fast forward 30 seconds into the video. And the animations at the company's [website](#) are great!

- [Katricks Technologies](#) out of Glasgow, Scotland, has developed a honeycomb-shaped wind turbine.
- Traditional wind turbines — the large ones with the fan rotary at the top — are costly to install and maintain. They require a substantial amount of land as well.
- Katricks Technologies has a solution: Their new honeycomb-shaped wind turbines are significantly more compact, making them better suited for urban areas with the capability to sit on already existing buildings and similar structures.
- **But how do they work?** They utilize “oscillating aerofoils” to capture wind instead of the typical rotations of the old-school fan design. These aerofoils enable even lower levels of wind to be captured, and therefore create even more sustainable energy.
- Katricks explains the process as “the aerofoils convert kinetic energy from wind to mechanical oscillations which are converged and converted into electricity.” To put it in layman’s terms, the aerofoils catch the movement of the wind and then turn that movement into energy.
- Katricks’ honeycomb-shaped wind turbines are designed more like hexagonal fans, with those oscillating aerofoils moving fairly slowly in limited sections of the honeycomb design.
 - The company has yet to comment on the safety of this in relation to birds, but even an untrained eye can see that grates could easily be placed around these turbines to prevent animals and debris from entering.

- In addition to being more compact, this design cuts costs, is “unobtrusive” — per its maker — has a “small footprint” with “minimal impact on the environment and wildlife,” and is long-lasting.

Story 3: Innovative solar-powered clothing acts as personal air conditioning

Source: Techspot

Story by Rob Thubron

Link: <https://www.techspot.com/news/101237-beat-heat-innovative-solar-powered-clothing-acts-personal.html>

- In a paper titled '[Self-sustaining personal all-day thermoregulatory clothing using only sunlight](#)' published December 14 in the journal Science, a team of Chinese researchers describe how they created solar-powered smart clothing using flexible solar cells and an electronic device.
- The team developed a thermoregulatory clothing system that combines an organic photovoltaic module with bidirectional electrocaloric devices that are capable of heating or cooling. Not only are both components flexible, which is important in clothing, but they also run off sunlight, meaning there's no need to carry around an external power source.
 - **Side note, what is meant by organic photovoltaic?** Organic Photovoltaic devices convert solar energy to electrical energy. A typical organic photovoltaic device consists of one or several photoactive materials sandwiched between two electrodes. *Figure 1 [below] depicts a typical bilayer organic photovoltaic device.*

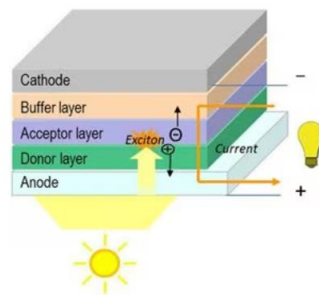


Figure 1. Structure of a bilayer organic photovoltaic device

- **Side note, define electrocaloric** - Electrocaloric materials are a class of materials that exhibit a change in temperature in response to an applied electric field. This phenomenon is known as the electrocaloric effect, which is the basis for the development of solid-state refrigeration systems.
- The clothing is designed to extend the standard human thermal comfort zone from a range of 22° – 28°C (71.6 – 82.4 F) to a range of 12.5° – 37.6°C (54.5 – 99.6 F).
- The device is efficient enough to give 24 hours' worth of power from 12 hours of sunlight. According to the description, it also has a simple structure, compact design, and can be integrated into existing clothing.
- The researchers wrote in a separate article, *"It is possible to imagine a future of all-weather thermal management that is not limited by an energy supply and where extra collected energy might even power electronic devices under special conditions."*



Story 4: A novel 3D body-on-chip printed device that could replace the need for drug and chemical safety testing on animals

Source: Interesting Engineering

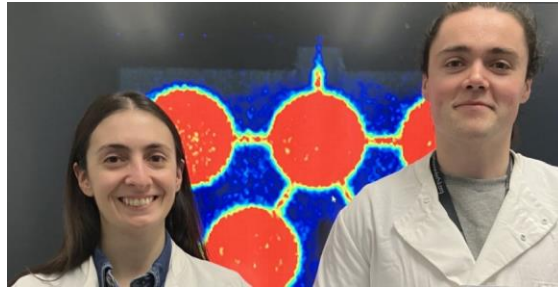
Story by Mrigakshi Dixit

Link: <https://interestingengineering.com/innovation/3d-printed-body-on-chip-may-replace-animal-models-in-drug-testing>

Also check out the official press release here: <https://edinburgh-innovations.ed.ac.uk/news/new-device-could-replace-animals-used-in-drug-and-chemical-safety-testing>

See video here: <https://www.youtube.com/watch?v=miF7hAeUUSg>





Dr Adriana Tavares and Liam Carr

- *Note, the researcher's video calls the device we'll talk about a "chip" – Yet the official University press release does not - I can't see why "chip" was part of the video title!*
- 3D bioprinting has made significant strides in recent years, allowing scientists to create intricate three-dimensional structures using living cells.
 - *My comment – remember our recent news about a firm in Israel that has made significant advances in 3D muscle tissue generation for lab grown meat – same technology is part of the research at play here.*
- This technology now offers the prospect of replacing live animal models in drug testing.
- A team of scientists from the University of Edinburgh has developed a 3D-printed device that may be used instead of animals in pharmaceutical research and development.
- In Europe, around 80,000 animals are used in the early stages of drug research each year, with no subsequent therapeutic advantages.
 - *My side note - According to the Humane Society of the United States, it is estimated that more than 50 million animals are used in [all forms of] experiments each year in the United States .*
- The 3D-printed device features five compartments that mimic the human heart, lungs, kidney, liver, and brain. These compartments are linked by tubes that mimic the human circulatory system, allowing for regulated medication pumping.
 - As the photo with the article shows, it's a 3D printed plastic array of 5 compartments, each containing lab grown replicants of heart,

lung, kidney, liver, and brain tissue – all connected to a “circulatory system”.

- The Medical Research Council (MRC) has awarded £260,000 [\$328,000] for advancing this device.
- As per [the official news release](#), the funding was granted after the device demonstrated “its ability to replicate drug perfusion.”
 - **Side note – what do they mean by “drug perfusion”?** In medical terms, [perfusion means the flow of blood or fluid to tissues and organs](#). This can occur naturally through the circulatory and lymphatic systems. It can also occur synthetically through the administration of intravenous therapy and pharmaceutical drugs.
- Simply put, this plastic-based device demonstrated how a drug is circulated and dispersed among the tissues and organs of the human body.
- The device uses positron emission tomography (PET) scanning to produce comprehensive 3D pictures of drug movement throughout the body.
 - **Side note, what is positron emission tomography?** - Positron emission tomography is a functional imaging technique that uses radioactive substances known as radiotracers to visualize and measure changes in metabolic processes, and in other physiological activities including blood flow, regional chemical composition, and absorption. Source: https://en.wikipedia.org/wiki/Positron_emission_tomography
- Scientists may use this approach to learn about and evaluate how various organs react to different medications.
- Beyond drug testing, this device could be used in aerosols, food, and household products.



HONORABLE MENTIONS:

Story: The first EV with a lithium-free sodium battery hits the road in January

Source: Engadget.com

Link: <https://www.engadget.com/the-first-ev-with-a-lithium-free-sodium-battery-hits-the-road-in-january-214828536.html>



JAC via CarNewsChina

- JAC Motors, a Volkswagen-backed Chinese automaker, is set to launch the first mass-produced electric vehicle (EV) with a sodium-ion battery through its new Yiwei brand. Although sodium-ion battery tech has a lower density (and is less mature) than lithium-ion, its lower costs, more abundant supplies and superior cold-weather performance could help accelerate mass EV adoption. CarNewsChina reports that the JAC Yiwei EV hatchback deliveries will begin in January.

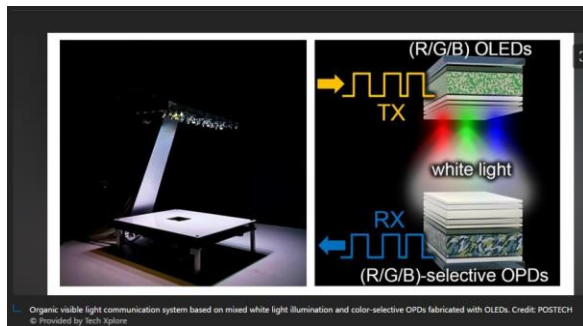
Story: Electric light transmits data 100 times faster than Wi-Fi

Source: Tech Xplore

Story by staff

Link: <https://techxplore.com/news/2023-12-electric-transmits-faster-wi-fi.html>

See also: <https://onlinelibrary.wiley.com/doi/10.1002/adma.202309416>



- Recently, a collaborative team led by Professor Dae Sung Chung, from the Department of Chemical Engineering at Pohang University of Science and Technology (POSTECH), with researcher Dowan Kim, Professor Dong-Woo Jee and Hyung-Jun Park from the Department of Intelligence Semiconductor Engineering at Ajou University, and Professor Jeong-Hwan Lee from the Department of Materials Science and Engineering at Inha University, succeeded in utilizing indoor lighting for wireless communication by reducing light interference with a novel light source. Their findings were published in Advanced Materials.

Story: Company makes history with plan to open the country's first 'true' high-speed train line

Source: The Cool Down

Story by Jeremiah Budin

Link: <https://www.msn.com/en-us/money/companies/company-makes-history-with-plan-to-open-the-country-s-first-true-high-speed-train-line-it-will-serve-as-the-blueprint/ar-AA1gb0gm>



- The construction of a bullet train between Las Vegas and Southern California is planned to begin later this year [article appeared in September 2023]. If successful, it would become “the first true high-speed rail system in America,” according to the CEO of the company behind the project, per Las Vegas’ FOX5.

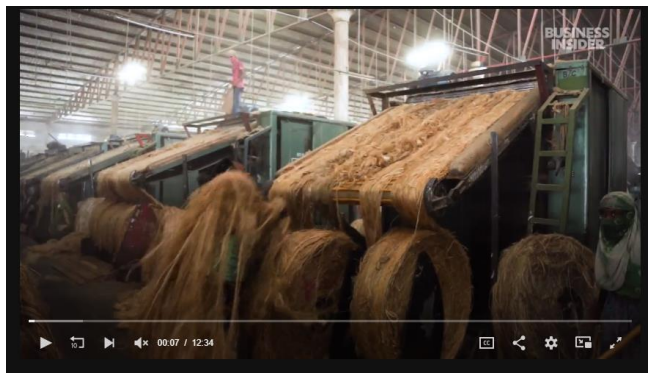
Story: Can "golden fiber" [jute] from swamp reeds replace plastic?

Source: Business Insider

Story by Brittany Stephabnis and Grant Tyler

Link: <https://www.businessinsider.com/jute-swamp-reeds-can-replace-plastic-bag-pollution-2023-12>

***Great video at this link!



- About 20 years ago, Bangladesh became the first nation on Earth to ban single-use plastic bags. Since then, plastic pollution has gotten worse. To find a biodegradable replacement, the government turned to jute, a cash crop grown here for centuries. Can one scientist bring more of this "golden fiber" to a country drowning in plastic?