SINGAPORE UNIVERSITY OF TECHNOLOGY AND DESIGN

Weekly Discovery

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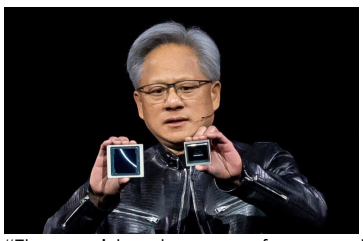
6 May – 10 May 2024

AI

Who's Making Chips For AI? Chinese Manufacturers Lag Behind US Tech Giants



"The rapid advance of generative artificial intelligence (AI) has sparked a global technological race to produce computer chips that power the models. A US ban on selling high-quality computer chips to China is stifling the country's progress in key technologies, according to researchers both inside and outside the country.

The chips have become increasingly crucial to power the latest advances in generative artificial intelligence (AI). "Generative AI could change society," says Yiran Chen, an electrical and computer engineer at Duke University in Durham, North Carolina. "If China is isolated, it's not able to catch up."

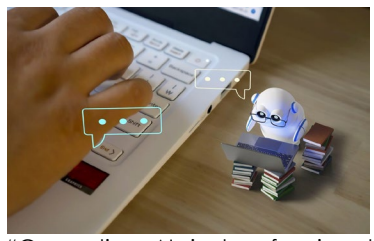
In the past few years, interest in AI has exploded as a result of progress in generative AI tools — large language models that can produce original text, video or audio content based on human-generated input. Such models underlie technology including OpenAI's chatbot ChatGPT and Microsoft's digital assistant Copilot.

The AI boom has also sparked a global race to produce increasingly powerful computer chips that can cope with the large data sets needed to train and execute models. Nvidia, one of the leading developers of such chips, based in Santa Clara, California, saw its market value shoot past US$2 trillion for the first time last March. "The US is ahead of almost every single country because of companies like Nvidia and AMD," says Ahmed Banafa, an engineer at San Jose State University in California."

Source: Nature (3 May 2024)

AI

AI Copilots Are Changing How Coding Is Taught: Professors Are Shifting Away from Syntax and Emphasizing Higher-Level Skills



"Generative AI is transforming the software development industry. AI-powered coding tools are assisting programmers in their workflows, while jobs in AI continue to increase. But the shift is also evident in academia—one of the major avenues through which the next generation of software engineers learn how to code.

Computer science students are embracing the technology, using generative AI to help them understand complex concepts, summarize complicated research papers, brainstorm ways to solve a problem, come up with new research directions, and, of course, learn how to code.

"Students are early adopters and have been actively testing these tools," says Johnny Chang, a teaching assistant at Stanford University pursuing a master's degree in computer science. He also founded the AI x Education conference in 2023, a virtual gathering of students and educators to discuss the impact of AI on education.

So as not to be left behind, educators are also experimenting with generative AI. But they're grappling with techniques to adopt the technology while still ensuring students learn the foundations of computer science.

"It's a difficult balancing act," says Ooi Wei Tsang, an associate professor in the School of Computing at the National University of Singapore. "Given that large language models are evolving rapidly, we are still learning how to do this."

Source: IEEE Spectrum (2 May 2024)

AI

With Huge Patient Dataset, AI Accurately Predicts Treatment Outcomes

"Scientists have designed a new artificial intelligence model that emulates randomized clinical trials at determining the treatment options most effective at preventing stroke in people with heart disease.

The model was front-loaded with de-identified data on millions of patients gleaned from health care claims information submitted by employers, health plans and hospitals – a foundation model strategy similar to that of generative AI tools like ChatGPT.

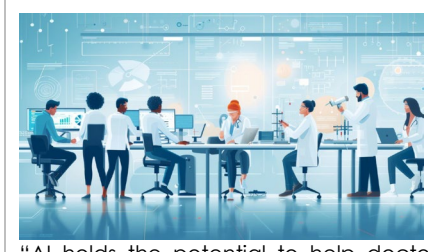
By pre-training the model on a huge cache of general data, researchers could then fine-tune the model with information concerning specific health conditions and treatments – in this case, focusing on stroke risk – to estimate the causal effect of each therapy and determine which therapy would work best based on individual patient characteristics.

The team from The Ohio State University reported today (May 1, 2024) in the journal Patterns that their model outperformed seven existing models and came up with the same treatment recommendations as four randomized clinical trials."

Source: OSU (1 May 2024)

AI

Science Has an AI Problem. This Group Says They Can Fix It.



"AI holds the potential to help doctors find early markers of disease and policymakers to avoid decisions that lead to war. But a growing body of evidence has revealed deep flaws in how machine learning is used in science, a problem that has swept through dozens of fields and implicated thousands of erroneous papers.

Now an interdisciplinary team of 19 researchers, led by Princeton University computer scientists Arvind Narayanan and Sayash Kapoor, has published guidelines for the responsible use of machine learning in science.

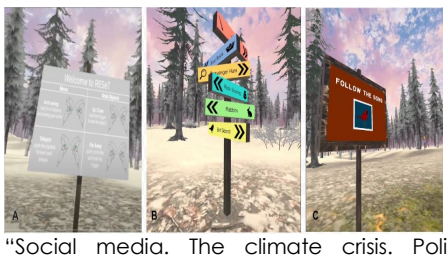
"When we graduate from traditional statistical methods to machine learning methods, there are a vastly greater number of ways to shoot oneself in the foot," said Narayanan, director of Princeton's Center for Information Technology Policy and a professor of computer science. "If we don't have an intervention to improve our scientific standards and reporting standards when it comes to machine learning-based science, we risk not just one discipline but many different scientific disciplines rediscovering these crises one after another."

The authors say their work is an effort to stamp out this smoldering crisis of credibility that threatens to engulf nearly every corner of the research enterprise. A paper detailing their guidelines appeared May 1 in the journal Science Advances."

Source: PRINCETON (1 May 2024)

ARCHITECTURE

Virtual Reality Environment for Teens May Offer an Accessible, Affordable Way to Reduce Stress



"Social media. The climate crisis. Political polarization. The tumult of a pandemic and online learning. Teens today are dealing with unprecedented stressors, and over the past decade their mental health has been in sustained decline. Levels of anxiety and depression rose after the onset of the COVID-19 pandemic. Compounding the problem is a shortage of mental health providers — for every 100,000 children in the U.S., there are only 14 child and adolescent psychiatrists.

In response to this crisis, University of Washington researchers studied whether virtual reality might help reduce stress for teens and boost mental health. Working with adolescents, the team designed a snowy virtual world with six activities — such as stacking rocks and painting — based on practices shown to improve mental health.

In a 3-week study of 44 Seattle teens, researchers found that teens used the technology an average of twice a week without being prompted and reported lower stress levels and improved mood while using it, though their levels of anxiety and depression didn't decline overall."

Source: WASHINGTON (1 May 2024)

ARCHITECTURE

When Is Architectural Symbolism Hypocrisy?

"Architecture mirrors the culture it is built from, while simultaneously aspiring to lead that culture. This is almost oxymoronic, since reflecting and projecting our values is an essential part of every human life, and architecture is exquisitely human. Our buildings embody us, with all of our mixed messages.

The city of New Haven, Connecticut, has several "gateways" where those passing by and through it are welcomed. Architecture students of a certain age remember the New Haven Coliseum (now gone) and the Knights of Columbus Tower, buildings designed by Kevin Roche that heroically defied precedents to create iconic symbols of arrival as the then-new Route 34 (now Martin Luther King Boulevard) funneled traffic from I-91 and I-95 into and out of New Haven's downtown.

Across the street, another intentional urban demarcation is close to completion. Elkus Manfredi Architects was selected by Winstanley Enterprises to design a new multitenant life sciences center located at 101 College St. It's as proud as Roche's tower, but much of corporate architecture built in the 21st century has new formal complexities that convey relevance beyond the statements that mid-20th century icons aspired to."

Source: Archdaily (3 May 2024)

DESIGN

How Retail Design Builds Brand Communities

"To differentiate themselves in competitive markets, the world's favorite retailers are tapping into retail design to cultivate communities of brand enthusiasts. Since traditional marketing methods no longer engage customers, physical spaces offer an avenue for more immersive and personalized experiences that match their values and lifestyles. Evolving customer preferences have led to the creation of authentic retail experiences that serve now as areas of recreation and entertainment. Designing outlets that encourage engagement, exploration, and a sense of belonging enables brands to foster loyal followings.

The idea of "brand communities" has long been acknowledged as a powerful marketing and branding asset. It describes a group of consumers who are passionate about a brand's products and its purpose, and they actively participate in its ecosystem. Popular examples include Apple enthusiasts purchasing entire suites of products and Harley-Davidson motorcycle owners regularly attending rallies. These communities enjoy a sense of belonging from association with the brand and other enthusiasts. The notion of "community retailing" takes this concept a step further by integrating the retail environment itself into the local community.

This approach is driven by the recognition that, despite the digital world's dominance, there is a growing shift back to face-to-face interaction and a craving for human connection. Physical retailers can benefit in competition with virtual marketplaces with community building and personalized experiences. Consumers seek to feel part of something larger and may find opportunities to do so in retail environments."

Source: Archdaily (29 Apr 2024)

DESIGN

"Food Production Is an Ideal Place to Start Rethinking How We Design"

"Design has become unfit for purpose. Humanity shares one small planet with a large number of other lifeforms and catastrophes happen to everything and everyone on it. From the destruction of ecosystems and climate to the chronic effects of the exploitation of people and resources, design has been complicit in creating the state the world now finds itself in.

The majority of what passes for design doesn't so much solve problems as cause a whole load of new ones. Can it be that the universal model of design thinking, so embraced by capitalism, is not the right approach at this watershed moment in the planet's history?

Taking a problem-solving approach, as designers are mostly taught to do, implies something is "wrong" and that the designer's job is to fix or improve it. The difficulty with looking at the world like this is it puts the designer and the user on a closed-loop binary seesaw. It is not contextually aware.

A human-centred, iterative approach like design thinking heavily echoes the traditional Western science model: empirical observation, systematic experimentation and the formulation of hypotheses and theories based on evidence. It's all about conquering a "problem" through a mindset of experimentation and rational discussion until the "right" answer is arrived at."

Source: Dezeen (1 May 2024)

MATERIALS

This Highly Reflective Black Paint Makes Objects More Visible to Autonomous Cars

RENEWABLE ENERGY

A Cost-Efficient Path to A Renewable Energy Grid for Australia

ROBOTICS

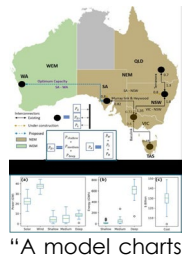
Stretchable E-Skin Could Give Robots Human-Level Touch Sensitivity

ROBOTICS

This Algorithm Makes Robots Perform Better

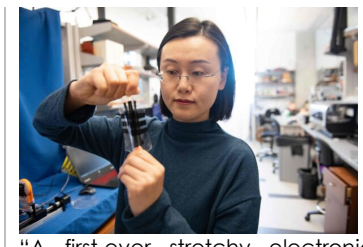
"To produce the new paint, the team first formed a thin layer of titanium dioxide (TiO2) on small fragments of glass. Then the glass was etched away with hydrofluoric acid, leaving behind a hollow layer of white, highly reflective TiO2. This was reduced with sodium borohydride to produce a black material that maintained its reflective qualities. By mixing this material with varnish, it could be applied as a paint. The team next tested the new paint with two types of commercially available lidar sensors: a mirror-based sensor and a 360-degree rotating type sensor. For comparison, a traditional carbon black-based version was also evaluated. Both sensors easily recognized the specially formulated, TiO2-based paint but did not readily detect the traditional paint. The researchers say that their highly reflective material could help improve safety on the roads by making dark objects more visible to autonomous vehicles already equipped with existing lidar technology."

Source: ACS (1 May 2024)



"A model charts the most cost-efficient path to a fully renewable electricity grid for Australia. Raheel Ahmed Shaikh and colleagues modeled possible scenarios for Australia's eastern and western grids, using solar and wind generation, short-to-long-term energy storage, and financial input data to explore low-cost capacity mix. Going completely renewable would require significant expansion of both generation and storage. Interconnecting the two grids would reduce generation capacity needs by 6% and storage power capacity needs by 14%. The least cost renewable-only grid would be dominated by wind, with between 50–75% of energy contributed by turbines. Storage would be mandatory for any fully renewable grid. Australia would need the ability to store up to four days of demand. That represents 13 times more storage power capacity and over 40 times more storage energy capacity than the country has at present, considering batteries, pumped hydro, and hydrogen storage. An 82% renewable grid would only require a fourfold increase in storage power capacity and a threefold increase in energy capacity. According to the authors, the optimal route to a fully renewable grid would require an investment of approximately A$130–150 billion, around 8–10% of the country's Gross Domestic Product, assuming future technology development and cost reduction."

Source: EurekAlert! (3 May 2024)



"A first-ever stretchy electronic skin could equip robots and other devices with the same softness and touch sensitivity as human skin, opening up new possibilities to perform tasks that require a great deal of precision and control of force.

The new stretchable e-skin, developed by researchers at The University of Texas at Austin, solves a major bottleneck in the emerging technology. Existing e-skin technology loses sensing accuracy as the material stretches, but that is not the case with this new version.

"Much like human skin has to stretch and bend to accommodate our movements, so too does e-skin," said Nanshu Lu, a professor in the Cockrell School of Engineering's Department of Aerospace Engineering and Engineering Mechanics who led the project. "No matter how much our e-skin stretches, the pressure response doesn't change, and that is a significant achievement."

The new research is published in Matter."

Source: UTEXAS (2 May 2024)

"Northwestern University engineers have developed a new artificial intelligence (AI) algorithm designed specifically for smart robotics. By helping robots rapidly and reliably learn complex skills, the new method could significantly improve the practicality — and safety — of robots for a range of applications, including self-driving cars, delivery drones, household assistants and automation.

Called Maximum Diffusion Reinforcement Learning (MaxDiff RL), the algorithm's success lies in its ability to encourage robots to explore their environments as randomly as possible in order to gain a diverse set of experiences. This "designed randomness" improves the quality of data that robots collect regarding their own surroundings. And, by using higher-quality data, simulated robots demonstrated faster and more efficient learning, improving their overall reliability and performance."

Source: NORTHWESTERN (2 May 2024)