Weekly Discovery
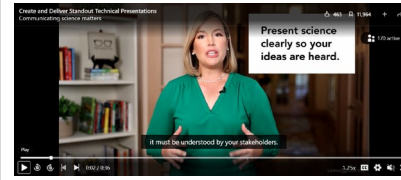We SHARE to inspire and ignite ideas!

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AI
What Are AI Agents? Here's How AI Agents Work, Why People Are Jazzed About Them, And What Risks They Hold

"The artificial intelligence world is abuzz with talk of AI agents. Microsoft recently released a set of autonomous agents that could help streamline customer service, sales, and supply chain tasks. Similarly, OpenAI unveiled Swarm, an experimental framework to explore better coordination between multi-agent systems. Meanwhile, Claude, the large language model (LLM) from Anthropic, is taking agentic AI to the next level with the beta stage of its computer use skills—from moving a mouse cursor around the screen to clicking buttons and typing text using a virtual keyboard.

So, what exactly are AI agents?

"AI agents are advanced artificial intelligence systems that are able to complete a task or make a decision," says Adnan Ijaz, director of product management for Amazon Q Developer, an AI-powered software development assistant from Amazon Web Services (AWS). "Humans set the goal, and agents figure out on their own, autonomously, the best course of action." The agents can interface with external systems to take action in the world.

In addition to this autonomy, agentic AI can also receive feedback and continually improve on a task, says Yoon Kim, an assistant professor at MIT's Computer Science and Artificial Intelligence Laboratory.

Think of AI agents as a more capable version of generative AI. While both technologies rely on LLMs as their underlying model, generative AI creates new content based on the patterns it learned from its training data. Agentic systems, on the other hand, are not only able to generate content but are also able to take action based on the information they gain from their environment. "So all of that is essentially a step further than generative AI," Ijaz says."

Source: *IEEE Spectrum* (19 Nov 2024)

AI
### Setting The Stage for Using AI In Language Tasks 50 Years Ago
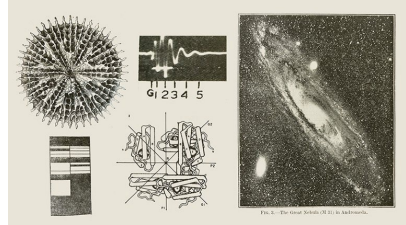
"50 years ago

To be able to communicate in ordinary English, a machine must have access to common sense information about the real world. The first computer systems to attempt such communication lived in very limited worlds. Now, with a "second generation" of programs, those worlds are widening, although the exact significance of the recent advances is still in dispute. In his report to the Science Research Council on the state of artificial intelligence (AI), Sir James Lighthill gave most of the field a rather bad prognosis. One of the few hopeful signs he saw was Winograd's computer system for natural language understanding. Yet now, only a year later, Winograd has stopped work on the system he constructed, and has begun a new one on entirely different principles. He went so far, in a survey lecture … of extraordinary modesty in a field not known for its small claims, to place his celebrated early work in only the "first generation" of computer systems designed to understand natural language, before going on to describe others' "second generation" systems … [W]hat is one to say in general terms of a field where yesterday's brightest spots are today's first generation systems, even though they have not been criticised in print, nor shown in any generally acceptable way to be fundamentally wrong? Part of the answer lies in the profound role of fashion in artificial intelligence in its present prescientific phase … In the field of natural language understanding … not only does anyone who can speak and write feel free to criticise on the corresponding grounds, but those trained in disciplines parasitic upon natural language, linguists and logicians, often have strong views on a priori grounds on how things must be done. It is this metaphysical aspect of the subject that gives its disputes their characteristically acrimonious flavour."

Source: *Nature* (19 Nov 2024)

AI
Mass General Brigham and BIDMC Researchers Unveil an AI Protein Engineer Capable of Making Proteins 'Better, Faster, Stronger'
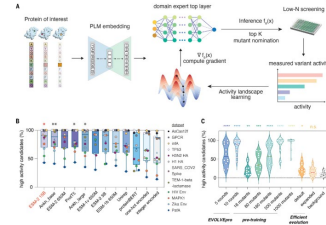
"Nature is pretty good at designing proteins. Scientists are even better. But artificial intelligence holds the promise of improving proteins many times over. Medical applications for such "designer proteins" range from creating more precise antibodies for treating autoimmune conditions or cancers to more effective vaccines against viruses. Applications may extend beyond medicine to, for example, growing better crops that could be more nutritious or absorb more carbon dioxide from the atmosphere. Investigators from Mass General Brigham and Beth Israel Deaconess Medical Center (BIDMC) have developed an artificial intelligence (AI) tool known as EVOLVEpro that may represent a leap forward in protein engineering. In a paper published in Science, the research team demonstrates the tool's ability to make proteins more stable, precise, and efficient by applying the model to engineer six proteins with different applications."

Source: *massgeneralbrigham* (25 Nov 2024)

ARCHITECTURE
Utopia Vs. Public Reality: Lessons From 20th Century Urban Planning

"Kenzo Tange's 1960 Tokyo Bay Plan reflected the zeitgeist of a society enamored by rapid technological advancement and post-war optimism. Buckminster Fuller's 1959 dome concept over Manhattan was developed on a belief in humanity's ability to shape its environment on an unprecedented scale. All throughout the mid-20th century, utopian urban planning ideas sprouted in various parts of the world, driven by a unique combination of societal factors and psychological motivations.

While these visions were often marked by hope and ambition, they also reflected the broader economic growth and technological innovation of the time—factors that contributed to the bold fantasies of architects and urban designers eager to transform the urban landscape. Many saw an opportunity to redesign cities from the ground up, often bypassing the complexities of existing urban fabrics in favor of futuristic ideals. However, while these visions provoked forward-thinking practices, they often surprised the public and seemed distant or unattainable. How might these concepts have evolved if shaped by today's participatory planning, which prioritizes public engagement and community input?

The disconnect between these grand visions and public acceptance brings to light a fundamental challenge in urban planning - bridging the gap between architectural ambition and community needs. The mid-20th century's top-down approach to urban planning, while producing bold theories, often failed to consider the human scale of city life. Le Corbusier's Ville Radieuse, for instance, proposed a "reorganized urban life" that is argued to have ignored the organic nature of community development and social interaction that makes cities vibrant."

Source: *Archdaily* (18 Nov 2024)

DESIGN
Eight Must-See Design Installations to Visit During Miami Art Week 2024

"A beachside installation made of 3D-printed concrete stars by artist Carlos Betancourt and a series of giant jewellery by designer Nicole Nomsa Moyo will be on view as part of Miami art week 2024.

Running from 2 to 8 December, the week plays host to a variety of exhibitions, fairs, and installations, including Art Basel and Design Miami, distributed throughout Miami Beach, the Design District and other areas.

This year will also host the second edition of Alcova Miami, the Milan-based design fair that debuted its first American edition in the city last year.

Exhibitions throughout will range from a large-scale installation by Betancourt that will eventually be submerged under water to an "immersive pop-surrealist experience" showcasing iconic furniture by the Memphis Group."

ENERGY
### Quantum-Inspired Design Boosts Efficiency of Heat-To-Electricity Conversion
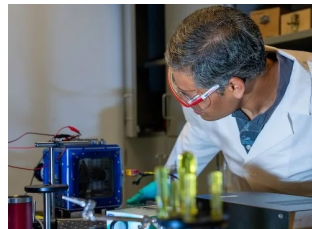
"Researchers at Rice University have found a new way to improve a key element of thermophotovoltaic (TPV) systems, which convert heat into electricity via light. Using an unconventional approach inspired by quantum physics, Rice engineer Gururaj Naik and his team designed a thermal emitter that can deliver high efficiencies within practical design parameters.

The research could inform the development of thermal-energy electrical storage, which holds promise as an affordable, grid-scale alternative to batteries. More broadly, efficient TPV technologies could facilitate renewable energy growth – an essential component of the transition to a net-zero world. Another major benefit of better TPV systems is recouping waste heat from industrial processes, making them more sustainable. To put this in context, up to 20-50% of the heat used to transform raw materials into consumer goods ends up being wasted, costing the United States economy over $200 billion annually.

TPV systems involve two main components – photovoltaic (PV) cells that convert light into electricity and thermal emitters that turn heat into light. Both of these components have to work well in order for the system to be efficient, but efforts to optimize them have focused more on the PV cell.

"Using conventional design approaches limits thermal emitters' design space, and what you end up with is one of two scenarios: practical, low-performance devices or high-performance emitters that are hard to integrate in real-world applications," said Naik, associate professor of"

ERGONOMICS
Standing At Work Can Be Detrimental to Blood Pressure

Standing at work can be detrimental to blood pressure
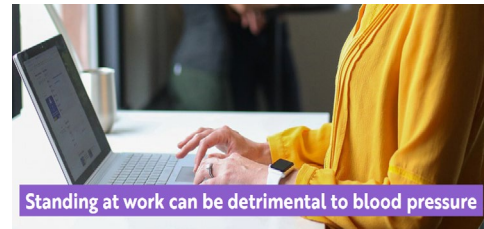
"A new study found that prolonged standing at work had a negative impact on the research participants' 24-hour blood pressure. In contrast, spending more time sitting at work was associated with better blood pressure. The study suggests that activity behaviour during working hours may be more relevant to 24-hour blood pressure than recreational physical activity.

Regular exercise is important for controlling blood pressure. In particular, more vigorous, aerobic exercise is effective for lowering blood pressure, but also everyday physical activity can have a beneficial impact. Previous studies have shown that exercise in leisure time is more beneficial for the cardiovascular system than physical activity at work, which can even be detrimental to health."

FOREST 4.0
Managing Forests with Smart Technologies

"Deforestation has remained a significant issue globally, with primary forests contributing to 16 per cent of the total tree cover loss in the last two decades, driven by climate change and intensive human activity. This threatens natural resources, biodiversity, and people's quality of life. To protect forests, Lithuanian scientists, in collaboration with Swedish experts, have developed Forest 4.0, an intelligent forest data processing model integrating blockchain, Internet of Things (IoT), and Artificial Intelligence (AI) technologies. The system enables real-time monitoring of forest conditions, sustainable resource accounting, and a more transparent forest governance model."

electrical and computer engineering.

In a new study published in npj Nanophotonics, Naik and his former Ph.D. student Ciril Samuel Prasad – who has since earned a doctorate in electrical and computer engineering from Rice and has taken on a role as a postdoctoral research associate at Oak Ridge National Laboratory – demonstrated a new thermal emitter that promises efficiencies of over 60% despite being application ready."

HEALTHCARE

## Hear This! Transforming Health Care with Speech-To-Text Technology #ASA187

"Speech-to-text programs are becoming more popular for everyday tasks like hands-free dictation, helping people who are visually impaired, and transcribing speech for those who are hard of hearing. These tools have many uses, and researcher Bożena Kostek from Gdańsk University of Technology is exploring how STT can be better used in the medical field. By studying how clear speech affects STT accuracy, she hopes to improve its usefulness for health care professionals.

"Automating note-taking for patient data is crucial for doctors and radiologists, as it gives the doctors more face-to-face time with patients and allows for better data collection," Kostek says."

RECYCLING

Using Sunlight to Recycle Black Plastics
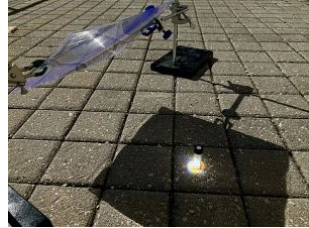
"Not all plastics are equal — some types and colors are easier to recycle than others. For instance, black foam and black coffee lids, which are often made of polystyrene, usually end up in landfills because color additives lead to ineffective sorting. Now, researchers report in ACS Central Science the ability to leverage one additive in black plastics, with the help of sunlight or white LEDs, to convert black and colored polystyrene waste into reusable starting materials.

"Simple, visible light irradiation holds the potential to transform the chemical recycling of plastics, using the additives already found in many commercial products," say the paper's authors, Sewon Oh, Hanning Jiang and Erin Stache.

An emerging strategy for plastic recycling involves using light to help break down plastic into chemically useful materials that can be recycled into new products. This process requires a helper compound to convert light into the heat needed to break apart polymer bonds. However, finding the right helper that won't create more waste and is easily incorporated into recycled materials remains a challenge for researchers. Seeking to create a circular economy for plastic recycling, Stache and a team of researchers took advantage of something already found in black polystyrene waste — an additive known as carbon black.

The researchers tested a method to recycle lab-made black polystyrene: They ground a mixture of polystyrene and carbon black to a fine powder, placed the powder in a sealed glass vial and then set the vial under high-intensity white LEDs for 30 minutes. The carbon black converted the LED light into heat. The heat then broke apart the polystyrene's molecular structure, creating a mixture of shorter one-, two- and three-styrene units. And these three components cleanly separated within the reaction apparatus. In experiments, the team recycled the leftover carbon black and styrene monomer into polystyrene, demonstrating the circularity of the new method."

ROBOT AI

Robot Photographer Takes the Perfect Picture: Photobot Works with Users to Bring Their Imagination to Life
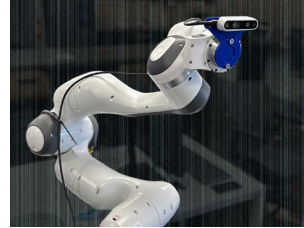
"Finding it hard to get the perfect angle for your shot? PhotoBot can take the picture for you. Tell it what you want the photo to look like, and your robot photographer will present you with references to mimic. Pick your favorite, and PhotoBot—a robot arm with a camera—will adjust its position to match the reference and your picture. Chances are, you'll like it better than your own photography.

"It was a really fun project," says Oliver Limoyo, one of the creators of PhotoBot. He enjoyed working at the intersection of several fields; human robot interaction, large language models, and classical computer vision were all necessary to create the robot.

Limoyo worked on PhotoBot while at Samsung, with his manager Jimmy Li. They were working on a project to have a robot take photographs but were struggling to find a good metric for aesthetics. Then they saw the Getty Image Challenge, where people recreated famous artwork at home during the COVID lockdown. The challenge gave Limoyo and Li the idea to have the robot select a reference image to inspire the photograph.

To get PhotoBot working, Limoyo and Li had to figure out two things: how best to find reference images of the kind of photo you want and how to adjust the camera to match that reference."

VR

Reality Check: Making Indoor Smartphone-Based Augmented Reality Work
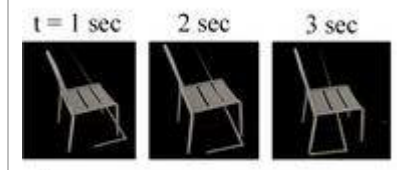
"Osaka, Japan – Smartphone-based augmented reality, in which visual elements are overlaid on the image of a smartphone camera, are extremely popular apps. These apps allow users to see how furniture would look in their house, or navigate maps better, or to play interactive games. The global phenomenon Pokémon GO, which encourages players to catch digital creatures through their phone, is a well-known example.

However, if you want to use augmented reality apps inside a building, prepare to lower your expectations. The technologies available now to implement augmented reality struggle when they can't access a clear GPS signal. But after a series of extensive and careful experiments with smartphones and users, researchers from Osaka University have determined the reasons for these problems in detail and identified a potential solution. The work was recently presented at the 30th Annual International Conference on Mobile Computing and Networking.

"To augment reality, the smartphone needs to know two things," says Shunpei Yamaguchi, the lead author of the study. "Namely, where it is, which is called localization, and how it is moving, which is called tracking."

To do this, the smartphone uses two main systems: visual sensors (the camera and LiDAR) to find landmarks such as QR codes or AprilTags in the environment, and its inertial measurement unit (IMU), a small sensor inside the phone that measures movement."

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