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6G

It's Time to Rethink 6G: It's not more bandwidth that users need

"Is the worldwide race to keep expanding mobile bandwidth a fool's errand? Could maximum data speeds—on mobile devices, at home, at work—be approaching "fast enough" for most people for most purposes?

These heretical questions are worth asking, because industry bandwidth tracking data has lately been revealing something surprising: Terrestrial and mobile-data growth is slowing down. In fact, absent a dramatic change in consumer tech and broadband usage patterns, data-rate demand appears set to top out below 1 billion bits per second (1 gigabit per second) in just a few years.

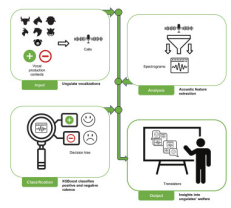
This is a big deal. A presumption of endless growth in wireless and terrestrial broadband data rates has for decades been a key driver behind telecom research funding. To keep telecom's R&D engine rooms revving, research teams around the world have innovated a seemingly endless succession of technologies to expand bandwidth rates, such as 2G's move to digital cell networks, 3G's enhanced data-transfer capabilities, and 5G's low-latency wireless connectivity.

Yet present-day consumer usage appears set to throw a spanner in the works. Typical real-world 5G data rates today achieve up to 500 megabits per second for download speeds (and less for uploads). And some initial studies suggest 6G networks could one day supply data at 100 Gb/s. But the demand side of the equation suggests a very different situation."

Source: IEEE Spectrum (10 Feb 2025)

AI

AI Unlocks the Emotional Language of Animals



"By analysing thousands of vocalisations from ungulates in different emotional states, the researchers identified key acoustic indicators of emotional valence. The most important predictors of whether an emotion was positive or negative included changes in duration, energy distribution, fundamental frequency, and amplitude modulation. Remarkably, these patterns were somewhat consistent across species, suggesting that fundamental vocal expressions of emotions are evolutionarily conserved.

The study's findings have far-reaching implications. The AI-powered classification model could be used to develop automated tools for real-time monitoring of animal emotions, transforming the way we approach livestock management, veterinary care, and conservation efforts."

Source: Eurekalert! (21 Feb 2025)

AI

Biggest-Ever AI Biology Model Writes DNA On Demand

"Scientists today released what they say is the biggest-ever artificial-intelligence (AI) model for biology.

The model — which was trained on 128,000 genomes spanning the tree of life, from humans to single-celled bacteria and archaea — can write whole chromosomes and small genomes from scratch. It can also make sense of existing DNA, including hard-to-interpret 'non-coding' gene variants that are linked to disease.

Evo-2, co-developed by researchers at the Arc Institute and Stanford University, both in Palo Alto, California, and chip maker NVIDIA, is available to scientists through web interfaces or they can download its freely available software code, data and other parameters needed to replicate the model.

The developers see Evo-2 as a platform that others can adapt to their own uses. "We're really looking forward to how scientists and engineers build this 'app store' for biology," Patrick Hsu, a bioengineer at the Arc Institute and the University of California, Berkeley, said at a press briefing announcing Evo-2's launch.

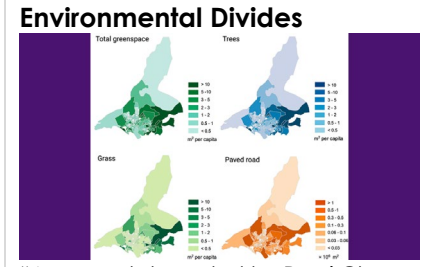
Other scientists are impressed with what they've read about the model — which is described in a paper posted to the Arc Institute website and submitted to the bioRxiv preprint server. But they say they will need to kick the tyres before coming to firm conclusions.

"We'll have to see how it holds up in independent benchmarks after the preprint is out," says Anshul Kundaje, a computational genomicist at Stanford University in Palo Alto. So far, he is impressed by the engineering that underpins the model."

Source: Nature (19 Feb 2025)

AI

New AI System Accurately Maps Urban Green Spaces, Exposing Environmental Divides



"A research team led by Rumi Chunara — an NYU associate professor with appointments in both the Tandon School of Engineering and the School of Global Public Health — has unveiled a new artificial intelligence (AI) system that uses satellite imagery to track urban green spaces more accurately than prior methods, critical to ensuring healthy cities.

To validate their approach, the researchers tested the system in Karachi, Pakistan's largest city where several team members are based. Karachi proved an ideal test case with its mix of dense urban areas and varying vegetation conditions.

Accepted for publication by the ACM Journal on Computing and Sustainable Societies, the team's analysis exposed a stark environmental divide: some areas enjoy tree-lined streets while many neighborhoods have almost no vegetation at all."

Source: NYU (19 Feb 2025)

AI

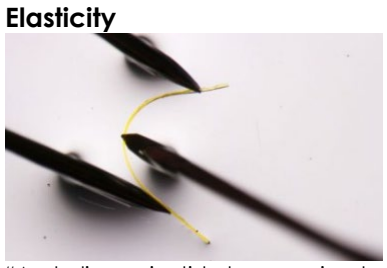
AI Unlocks the Emotional Language of Animals

"Can artificial intelligence help us understand what animals feel? A pioneering study suggests the answer is yes. Researchers from the Department of Biology at the University of Copenhagen have successfully trained a machine-learning model to distinguish between positive and negative emotions in seven different ungulate species, including cows, pigs, and wild boars. By analysing the acoustic patterns of their vocalisations, the model achieved an impressive accuracy of 89.49%, marking the first cross-species study to detect emotional valence using AI.

'This breakthrough provides solid evidence that AI can decode emotions across multiple species based on vocal patterns. It has the potential to revolutionise animal welfare, livestock management, and conservation, allowing us to monitor animals' emotions in real time," says Élodie F. Briefer, Associate Professor at the Department of Biology and last author of the study."

ARCHITECTURE

Flexible Crystals Reveal Secrets of Elasticity



"Australian scientists have gained new insights into the fundamental behaviour of flexible materials, allowing for the design of new building materials and technology.

A team involving researchers at The University of Queensland and QUT has identified the origin of the restoring force that lets elastic crystals return to their original shape.

Professor Jack Clegg from UQ's School of Chemistry and Molecular Biosciences said the team bent flexible crystals – including one developed at UQ which can be tied in a knot – to calculate how intermolecular interactions changed under compressive and expansive strain.

"Elasticity is a property that underpins a myriad of existing technologies including optical fibres, aeroplane components and load-bearing bridges," Professor Clegg said.

"We looked at how and where the energy was stored as the crystals contracted and went back to their original shape and size."

The experiments showed the potential energy that allowed the crystal to spontaneously straighten out was stored in the interactions between molecules.

"Under strain, the molecules reversibly rotate and reorganise in a way that stores energy differently on the inside and the outside of the bend," Professor Clegg said.

"We were able to show that enough energy was stored in our bent flexible crystals to lift something 30 times the weight of the crystal a metre into the air.

"The new understanding of this common phenomenon could lead to new hybrid materials for applications from components of spacecraft to new building materials or

ARCHITECTURE

The 15 Winners of The Archdaily 2025 Building of The Year Awards

"Sixteen years ago, we launched the ArchDaily Building of the Year Awards with a simple yet powerful idea: to let our readers choose their favorite buildings from our ever-growing library of projects. Thanks to your engagement, this award has grown into one of the most democratic and influential recognitions in architecture. Year after year, your collective insight has highlighted architectural excellence across cultures, economies, and landscapes worldwide.

This year was no exception. The 75 finalists have already showcased an outstanding range of spatial solutions, reflecting the power of collective intelligence in crafting a snapshot of today's most compelling architecture. Now, it's time to unveil the winners."

DESIGN

Ten Plastic Alternatives Designed to Trump Paper Straws

"US president Donald Trump has signed an order to abandon paper straws for single-use plastic. In light of his critique, we've rounded up 10 other examples of plastic alternatives that probably won't "break" or "explode".

The executive order signed by the president on Monday stipulates that the federal government must fade out purchases of paper straws for its own operations and advocates for the development of a National Strategy to End the Use of Paper Straws.

"These things don't work," Trump complained of paper straws. "I've had them many times, and on occasion, they break, they explode. If something's hot, they don't last very long, like a matter of minutes, sometimes a matter of seconds."

In response to the news, we've collected 10 alternatives to single-use petroleum-based plastic for the food industry, including a dissolvable drink bottle and reusable takeaway containers."

Source: KU (21 Feb 2025)

electronic devices."

Source: UQ (24 Feb 2025)

Source: Archdaily (20 Feb 2025)

Source: Dezeen (14 Feb 2025)

GPS

Microcomb Chips Help Pave the Way for Thousand Times More Accurate GPS Systems

"Optical atomic clocks can increase the precision of time and geographic position a thousandfold in our mobile phones, computers, and GPS systems. However, they are currently too large and complex to be widely used in society. Now, a research team from Purdue University, USA, and Chalmers University of Technology, Sweden, has developed a technology that, with the help of on-chip microcombs, could make ultra-precise optical atomic clock systems significantly smaller and more accessible – with significant benefits for navigation, autonomous vehicles, and geo-data monitoring.

The core of the new technology, described in a recently published research article in Nature Photonics, are small, chip-based devices called microcombs. Like the teeth of a comb, microcombs can generate a spectrum of evenly distributed light frequencies.

"This allows one of the comb frequencies to be locked to a laser frequency that is in turn locked to the atomic clock oscillation," says Minghao Qi.

While the optical atomic clocks offer much higher precision, the oscillation frequency is at hundreds of THz range – a frequency too high for any electronic circuits to "count" directly. But the researchers' microcomb chips were able to solve the problem - while enabling the atomic clock system to shrink considerably.

"Fortunately, our microcomb chips can act as a bridge between the optical signals of the atomic clock and the radio frequencies used to count the atomic clock's oscillations. Moreover, the minimal size of the microcomb makes it possible to shrink the atomic clock system significantly while maintaining its extraordinary precision."

Source: CHALMERS (10 Feb 2025)

MEMORY

Brown University Researchers Show How Humans Learn to Optimize Working Memory

"Working memory is what allows humans to juggle different pieces of information in short-term scenarios, like making a mental grocery list and then going shopping or remembering and then dialing a phone number.

While scientists agree that the capacity of working memory is limited, they offer competing theories about how and why this is true. But new research from scientists at the Carney Institute for Brain Science at Brown University shows why limits on working memory exist.

Michael Frank, a professor of cognitive and psychological sciences affiliated with the Carney Institute, and Aneri Soni, a graduate student in his lab, developed a new computer model of the basal ganglia and the thalamus — the parts of the brain relevant to working memory — that shows why limits on working memory exist.

According to their study published in eLife, the answer has to do with learning.

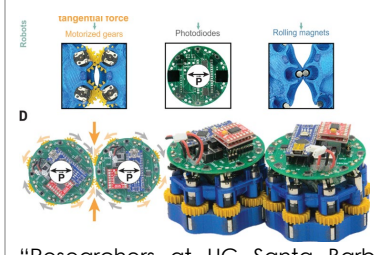
"The simulations we ran show that if we did hold more than just a few items at a time, it becomes too difficult to learn how to manage so many pieces of information at once, such that the brain gets confused and can't use the information it does store," Soni said. "At the same time, our research demonstrates that when faced with these limitations, the brain responds by learning to strategically tap into a mechanism to help conserve space."

Because the neurotransmitter dopamine plays an important role in how learning relates to working memory, the researchers said these findings shed new light on dopamine-related disorders such as Parkinson's disease, attention deficit-hyperactivity disorder (ADHD) and schizophrenia."

Source: BROWN (24 Feb 2025)

ROBOTICS

How To Get a Robot Collective to Act Like a Smart Material



"Researchers at UC Santa Barbara and TU Dresden are blurring the lines between robotics and materials, with a proof-of-concept material-like collective of robots with behaviors inspired by biology.

"We've figured out a way for robots to behave more like a material," said Matthew Devlin, a former doctoral researcher in the lab of UCSB mechanical engineering professor Elliot Hawkes, and the lead author of a paper published in the journal Science. Composed of individual, disk-shaped autonomous robots that look like small hockey pucks, the members of the collective are programmed to assemble themselves together into various forms with different material properties.

Of particular interest to the research team was the challenge of creating a robotic material that could both be stiff and strong, yet be able to flow when a new form is needed. Rather than responding to exterior forces to attain a form, robotic materials ideally would respond to internal signals, Hawkes explained, able to take a shape and hold it, "but also able to selectively flow themselves into a new shape.""

Source: Eurekalert! (21 Feb 2025)

STATIC ELECTRICITY

An Electrifying Turn in An Age-Old Quest. Contact Electrification Depends on Materials' Contact History, ISTA Physicists Show

"For centuries, static electricity has been the subject of intrigue and scientific investigation. Now, researchers from the Waitukaitis group at the Institute of Science and Technology Austria (ISTA) have uncovered a vital clue to this enduring mystery: the contact history of materials controls how they exchange charge. The groundbreaking findings, now published in Nature, explain the prevailing unpredictability of contact electrification, unveiling order from what has long been considered chaos.

From a tiny electric jolt when touching a doorknob to styrofoam peanuts that cling to a mischievous cat's fur—the well-known and seemingly simple phenomenon of static electricity has puzzled people since antiquity. How could this ubiquitous effect, frequently demonstrated to bedazzled children by rubbing a balloon on their hair, still not be completely understood by scientists?

Static electricity goes by multiple names, but scientists prefer to call it 'contact electrification'. As opposed to what the name 'static electricity' might imply, the essence of the effect is not static but includes movement, as some charge is transferred whenever two electrically neutral materials touch. "There is no escaping contact electrification; everyone experiences it. That's why it might come off as a surprise to us that we don't understand how exactly it happens," says Scott Waitukaitis, Assistant Professor at the Institute of Science and Technology Austria (ISTA) who led this work together with ISTA PhD student Juan Carlos Sobarzo. Now, the team has uncovered a key piece of the puzzle that had remained unknown for centuries: "We tested different parameters that might affect contact electrification, but none of them could soundly explain our results. That's where we stopped to think: what if it's contact itself that's affecting the charging behavior? The word 'contact' is already in the name, yet it has been widely overlooked," says Sobarzo."

Source: IST (19 Feb 2025)

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