

Best of Last Year: The top Tech Xplore articles of 2021

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It was a good year for technology research of all kinds as a team of computer scientists at Rice University demonstrated [a CPU algorithm that trains deep neural networks up to 15 times faster than the top GPU](#)

trainers. The AI software is also able to run on commodity processors. As part of their demonstration at this year's MLSys conference, they noted that their efforts can reduce the cost of training, which they described as the real bottleneck in such systems.

Also, internet users experienced the largest data breach in history last summer as various entities reported that 3.2 billion passwords had been leaked from multiple databases. Named RockYou2021, the breach numbers suggested that nearly everyone on the internet might have been impacted. Users around the world were advised to change their passwords as it was believed the leaked passwords were likely to be sold to hackers.

And a team at Cornell University wondered why Spotify still did not have a "dislike" button, considering that its business model revolved around keeping listeners listening. To find out, the group developed an algorithm that showed that listeners were 20 percent more likely to "like" a song if the algorithm used by the music platform was trained on 400,000 likes and dislikes, compared to an algorithm trained only on the number of likes.

Also, many people around the world began to wonder this past year if the Metaverse is going to be the next big internet revolution. This came after Facebook head Mark Zuckerberg announced that the company that makes the social media platform was changing its name to Meta. Other entities had also recently begun touting products as a means for allowing users to get in on the virtual ground floor of the still evolving technology.

And a team at Martin Luther University Halle-Wittenberg found that a layer of three crystals produced a thousand times more power in solar cells, if the three materials were arranged periodically in a lattice. They proved their ideas by creating crystalline layers of barium titanate, strontium titanate and calcium titanate which they alternately placed on

top of one another to build a new kind of solar cell.

Colin Johnson, an associate professor at the University of Nottingham, [developed a deep-learning technique](#) that could learn a so-called "fitness function" from a set of sample solutions to a problem. It could be used to solve a Rubik's cube and other problems step by step. In speaking with TechXplore, Johnson noted that the Rubik's cube is a complex puzzle, but any of its huge number of combinations are at most 20 steps from a solution.

Last May, newly discovered Wi-Fi vulnerabilities called [FragAttacks](#) put all mobile devices at risk. The fragmentation and aggregation attacks allowed an attacker with the requisite skills and who was within radio range of a target to potentially exploit such flaws. Hackers could exploit programming vulnerabilities by adding frames into protected Wi-Fi networks.

Also, a team working at the South China University of Technology developed [a compound that might lead to sustainable, cost-effective, large-scale energy storage](#). Their work involved synthesizing a molecular compound that served as a low-cost electrolyte, thus enabling a stable flow battery that retained 99.98% of its capacity per cycle.

And Swiss startup Climeworks began operations at its Orca carbon removal plant near Reykjavik, Iceland. The plant cost \$10 to 15 million to build and [is expected to pull approximately 4,000 tons of CO₂ out of the air every year](#). The direct air capture technology plant converts the carbon to rock using a procedure that mimics the Carbfix method—a natural process that takes nature hundreds of thousands of years. The plant is powered by a nearby geothermal power plant.

Also, a team at Ecole Polytechnique Federale de Lausanne found evidence of [mass-scale manipulation of Twitter trends](#). They found that

almost half of all the local Twitter trending topics in Turkey were fake. They suggested that many viral trends are created solely by bots due to a vulnerability in Twitter's trends algorithm. They further noted that because the algorithm used by Twitter does not allow for deletions, attackers can push trends until they become widespread.

And German car parts company Mahle announced last May that it was in the process of developing [a durable and efficient magnet-free electric motor that does not require rare earth elements](#)—an important development as car makers turn their resources toward making electric vehicles.

Also, DuckDuckGo, an alternative search engine provider, announced in early spring that it had developed [an extension for the Chrome browser that blocks FLoC tracking](#). FLoC is a "feature" Google added to its browser to track user habits for targeted advertising. Many users have complained about the invasion of privacy, and that is why DuckDuckGo created an extension to block it.

Recently, a team of researchers from Trinity College Dublin and the University of Bath created [a deep learning method to automatically enhance dog animations](#). The system was designed to improve the quality of animations involving quadruped animals. They presented their findings at this year's MIG 2001 conference.

A combined effort by researchers from City University of Hong Kong, Nanjing University of Science and Technology and the Chinese Academy of Sciences [found a way to double the charging-recharging cycle of lithium batteries](#). They replaced the main cathode materials with manganese, which has higher capacity and is more durable than cathodes used in conventional batteries.

Milan Janosov, a researcher at the Central European University and

Flora Borsi, a digital artist, [merged data science and digital art in an innovative and intriguing way](#)—they turned an analysis of Asimov's "Foundation" into art. Put another way, they analyzed the text and used statistics to highlight key words. They then plotted that data on a graph, which resulted in an image resembling a sketch of the universe.

Also, last summer, a team of researchers at the security firm ThreatFabric reported on their blog that they had found [instances of a new kind of malware in Android apps downloaded from Google Play that attempted to steal banking login information](#). They named the new malware Vulture, after the birds that prey on wounded or dead targets.

Last spring, a team at Brown University announced that they had developed [DeepONet, a new neural network-based model that can learn both linear and nonlinear operators](#). It was inspired in part by a series of studies carried out by a research group at Fudan University. They described it as a totally new way of looking at neural networks and suggested it could prove extremely useful in autonomous vehicle applications.

Also, last summer, MIT News spoke with MIT's Jacopo Buongiorno, Robert Frida, founder of GenH, Steven Aumeier of the Idaho National Laboratory and Kevin Chilton, retired commander of the U.S. Strategic Command, to discuss [why they think nuclear batteries offer a new approach to carbon-free energy](#). They suggested that a new generation of relatively tiny, autonomous plug-and-play factory-built reactors could be on the horizon.

And last May, the U.S. Air Force [successfully tested an unmanned aerial vehicle called Skyborg for the first time](#). USAF officials suggested the UAV—operating on an autonomous hardware/software suite—was part of a collaborative effort to bring together manned and unmanned aircraft.

Recently, a small team of researchers from Lawrence Berkeley National Laboratory and the University of California reported that [battery-powered trains could soon be economically viable](#). They said that improved battery technology and cheap, renewable energy could allow battery power to compete with diesel fuel to power trains. The technology could drastically reduce the amount of CO₂ emitted into the atmosphere by freight trains.

And a team at MIT published a review paper summarizing [recent advances in battery technology and outlining strategies underway to process the solid electrolytes and electrolyte/cathode tandems that could be used in future solid state battery designs](#). They suggested that the new designs could soon compete with lithium-ion batteries, but also noted that before that can happen, researchers must identify cost-effective strategies to produce their individual components.

In November, the cargo ship Yara Birkeland made headlines when it departed a small port in Norway. It was [the first such ship to be powered by electricity and to run autonomously](#). Officials involved with the deployment described it as the first step toward reducing the maritime industry's climate footprint. On its maiden voyage, the ship hauled fertilizer from Porsgrunn to Brevik, a 12-kilometer journey. Officials also suggested that in the future, all ships could run autonomously, dramatically reducing shipping costs.

And a combined team from the University of Toronto and LG AI Research announced the development of [an "explainable" artificial intelligence algorithm](#) that could identify and eliminate defects in display screens. They claimed it outperformed comparable approaches on industry benchmarks and that it could potentially be applied to other areas, such as interpreting data from medical scans.

In July, Microsoft warned its user community of a [PrintNightmare](#)

vulnerability that was due to a flaw in Windows Print Spooler. Other entities also sounded the alarm as the vulnerability could allow criminals to hack into Windows computers and remotely execute code. Microsoft explained that there were two vulnerabilities, one that allowed local privilege escalation and another that allowed for remote code execution.

And finally, in February, a Romanian threat researcher announced that he had been able to hack into computer systems at 35 major technology firms. Alex Birsan, an independent threat researcher, claimed that he had been able to hack into computers run by some of the biggest names in the IT business—Paypal, Apple, Microsoft, Tesla and Netflix—even after he had warned them ahead of time that he would be trying.

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