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WHAT'S HOT

AI is Ushering In a New Scientific Revolution

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- The Psychology Of Algorithms: The Intersection Of Chatbots And Humans
- The EU AI Act Will Have Global Impact, but a Limited Brussels Effect
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INDUSTRY FOCUS

# HOW AI CAN HELP OVERCOME THE "GREAT SUPPLY CHAIN DISRUPTION"

AI IS USHERING IN A NEW SCIENTIFIC REVOLUTION

In 2020, Google's AI team DeepMind announced that its algorithm, AlphaFold, had solved the protein-folding problem. At first, this stunning breakthrough was met with excitement from most, with scientists always ready to test a new tool, and amusement by some. The algorithm far outpaced its human rivals, posting scores that predicted the final shape within an angstrom, the width of a single atom. Soon after, AlphaFold passed its first real-world test by correctly predicting the shape of the SARS-CoV-2 'spike' protein, the virus' conspicuous membrane receptor that is targeted by vaccines.

And while the protein-folding problem may be the highest profile achievement of AI in science to date, artificial intelligence is quietly making discoveries in a number of scientific fields.

By turbocharging the discovery process and providing scientists with new investigative tools, AI is also transforming how science is done. The technology upgrades research mainstays like microscopes and genome sequencers , adding new technical capacities to the instruments and making them more powerful. AI-powered drug design and gravity wave detectors offer scientists new tools to probe and control the natural world.

Off the lab bench, AI can also deploy advanced simulation capabilities and reasoning systems to develop real-world models and test hypotheses using them. With manifold impacts stretching the length of the scientific method, AI is ushering in a scientific revolution through groundbreaking discoveries, novel techniques and augmented tools, and automated methods that advance the speed and accuracy of the scientific process.
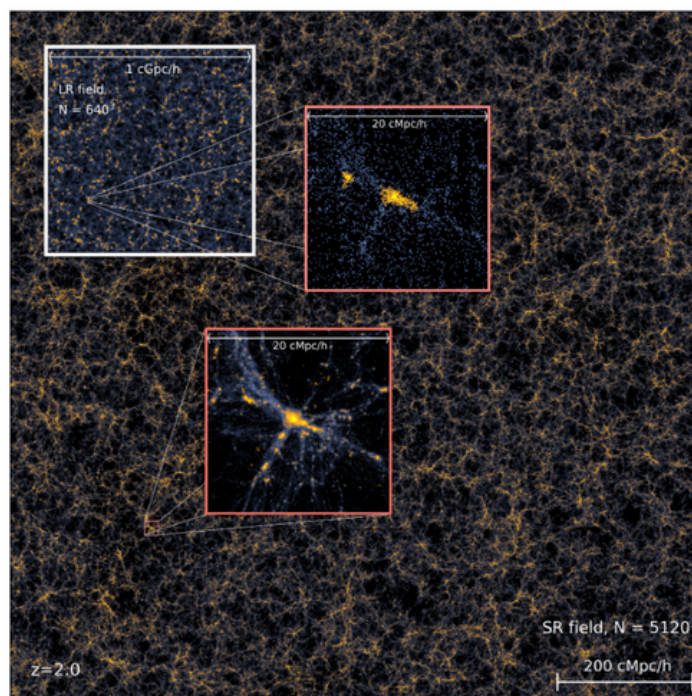
Source: AI-assisted superresolution cosmological simulations

Beyond the protein-folding problem, AI has proven its scientific worth with discoveries in a number of fields, from cosmology and chemistry to semiconductor design and materials science.

AI's impact on science extends beyond the new finds by the technology in four key ways.

First, AI can quickly read through the scientific literature, allowing it to learn the fundamental rules, facts, and equations of science, and help scientists manage the flood of papers and data that is drowning every field. In 2020 alone, between 100,000 and 180,000 articles were published in scientific journals about COVID-19. And while it makes sense that researchers would focus on something as urgent as an ongoing global pandemic, papers about COVID-19 only made up about 4-6% of the total articles on the largest biomedical database. The wave of papers and data being produced far exceeds any scientists' ability to read them, leaving researchers unable to truly keep pace with innovations in their fields.
That is where AI comes in.

Second, scientists are also faced with a deluge of data as their instruments get more precise and their findings dig deeper into nature. AI can help here, too. A team of scientists at Argonne National Laboratory developed an algorithm that can make sense of gravitational waves–ripples in the fabric of the space-time continuum that was predicted by Einstein but not discovered until 2015. This algorithm processed a month's worth of data in just seven minutes, providing an accelerated, scalable, and reproducible detection of gravitational waves. Even better, the algorithm can also be run on a standard graphics processing unit (GPU), freeing researchers from needing specialized equipment to collect and interpret gravitational waves data. '"What's exciting to me about this project,"' said Ian Foster, director of Argonne's Data Science and Learning (DSL) division, "is that it shows how, with the right tools, AI methods can be integrated naturally into the workflows of scientists – allowing them to do their work faster and better – augmenting, not replacing, human intelligence."' With AI, what was once a flood of data is now a controllable stream of information that accelerates the pace of science.

Third, AI has been quietly upgrading some of the longtime mainstays of any lab: microscopes and DNA sequencers. At Argonne National Labs, researchers have found a way to boost what information an electron microscope can retrieve about the sample, while also increasing the resolution and sensitivity of the instrument. Electron microscopes differ from the kind many are familiar with in high school or college biology classes in that they do not rely on visible light to construct images. Instead, as the name suggests, they use electrons, which allows them to take images at higher resolutions and finer detail than other microscopes. Researchers at Argonne National Labs devised a way to record the phase data, which relays key information about a sample's physical and chemical properties, on an electron microscope using AI, boosting the power and capacity of the instrument.

Somewhat similarly, another upgrade courtesy of AI is found in so-called light-field microscopy, which takes moving images in high-definition 3-D. It typically takes scientists days to reconstruct the movies, but with AI, the time it takes to process such high-resolution data in motion shrinks to just seconds without losing resolution or detail. DNA sequencers, the workhorses of the genomic era, have also been augmented by AI. Earlier this year, a team of scientists used AI to halve the time it takes to sequence DNA and hope to halve it again soon. Put simply, AI is upgrading even the most basic of scientific tools.

Finally, where AI really shines in the lab is simulating complex systems, making it an increasingly standard tool in basic science research. Last year, researchers showed off AI's multidisciplinary capability by building groundbreaking simulations in ten scientific fields from physics and astronomy to geology and climate science. All ten emulators were trained from the same deep neural network, called DENSE, and sped up simulations by as much as a billion times when compared to other methods—all while remaining just as accurate. Crucially, emulators can be used to solve "inverse problems," where a researcher know the result but wants to find out what variables would cause the output. AI excels at this kind of calculation and can easily unravel the path to a particular answer.
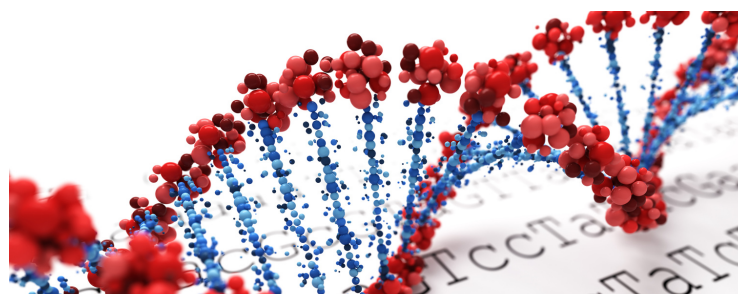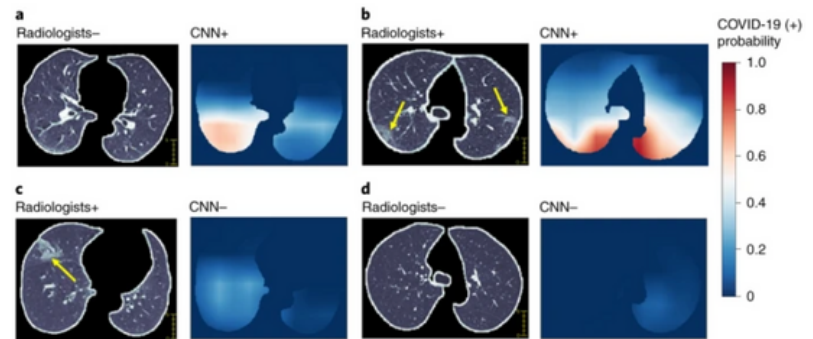
As useful as simulations are, researchers also want to ensure their models hold up in the real world. Two of the leading tech companies, Google and Samsung, recently turned to AI to plan the layout of some of their chips. Google concluded that the AI-designed chip was, '"superior or comparable to those produced by humans in all key metrics, including power consumption, performance, and chip area."'
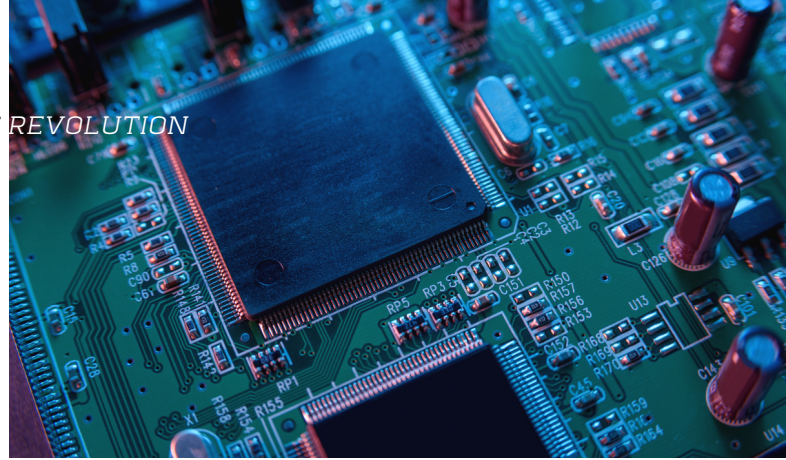
Artificial intelligence–enabled rapid diagnosis of patients with COVID-19

Source: Artificial intelligence–enabled rapid diagnosis of patients with COVID-19
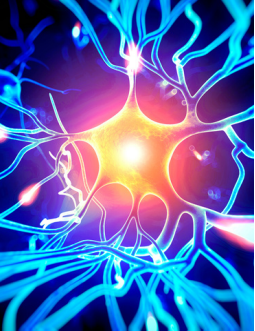
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Going further, the company used that AI to design its next generation of AI accelerators (TPUs, chips made for AI rather than the standard CPU or GPU). Likewise, Samsung relied on AI chip design software to create Exynos, a chip in their wearable products and cars. With its high-fidelity simulations, AI is delivering scientists a powerful tool that is revolutionizing how they model and experiment with the natural world.

There has been no better real-world test for AI's modeling capacity than the COVID-19 pandemic. First, AlphaFold, the protein-folding algorithm, correctly predicted the prominent 'spike' protein, showing how AI could accelerate the development of vaccines or therapeutics in a future pandemic. But perhaps even more impressive, in the summer of 2020, Japanese scientists used the world's most powerful supercomputer, Fugaku, to model the spread of COVID-19 in the air. Backed by deep neural networks and thousands of GPUs, Fugaku provided the world with decisive evidence that the virus was air-borne and convinced the WHO to change its guidance for controlling COVID-19 accordingly (e.g., masking, ventilation, and the risk of indoor vs outdoor activities). In the real world, AI has proved its worth by informing global mitigation strategies during a crisis.

Science may be best described as an exploration of the unknown. And on this journey, AI is a partner that perceives the natural world and its unexplored parts differently than we do, opening new ways of understanding and harnessing the power of our world.

Source: The Gradient

HEADLINE NEWS IN A FLASH

ISRAELI SCIENTISTS SOLVE MYSTERY: HOW HUMAN BRAIN PROCESSES, STORES MOVEMENT

Prof. Jackie Schiller from the Rappaport Faculty of Medicine at the Technion-Israel Institute of Technology in Haifa and her team focused on the brain at a single-neuron level to explain this mystery. They found that computation occurs not just in the interaction among nerve cells but also within each individual neuron. They discovered that each of these microscopic cells is not a simple switch, but rather a complicated calculating machine like a tiny biological computer. Their discovery has just been published in the prestigious journal Science under the title "Dynamic compartmental computations in tuft dendrites of layer 5 neurons during motor behavior."

Source: The Jerusalem Post

THE EU AI ACT WILL HAVE GLOBAL IMPACT, BUT A LIMITED BRUSSELS EFFECT

The European Union's (EU) AI Act (AIA) aspires to establish the first comprehensive regulatory scheme for artificial intelligence, but its impact will not stop at the EU's borders. In fact, some EU policymakers believe it is a critical goal of the AIA to set a worldwide standard, so much so that some refer to a race to regulate AI. This framing implies that not only is there value in regulating AI systems, but that being among the first major governments to do so will have broad global impact to the benefit of the EU—often referred to as the "Brussels Effect." Yet, while some components of the AIA will have important effects on global markets, Europe alone will not be setting a comprehensive new international standard for AI.

Source: Brookings

AI SYSTEM FACILITATES PLANT IMAGING FROM GERMINATION TO ROOT DEVELOPMENT

For plant biologists, understanding how plants grow and interact with soil is vital for selecting resilient crops that can efficiently take up water and nutrients. But how do you monitor what is happening underground? To address this challenge, a team from KAUST has developed a low-cost system for imaging plant growth dynamics, noninvasively and at high throughput. Unlike other imaging tools, which are costly and stationary, the new system called MutipleXLab, is modular, mobile and, at a low cost, can continuously monitor thousands of seeds, from germination to root development. "Our system combines high-throughput phenotyping with high resolution, a common bottleneck in plant phenomics," says Ph.D. student Vinicius Lube. "It has exceptional resolving power at both large field-of-view and high resolution when compared to other optical systems."

Source: Phys.org

THE PSYCHOLOGY OF ALGORITHMS: THE INTERSECTION OF CHATBOTS AND HUMANS

In modern commerce, humans are not the only ones alluring buyers and providing after-sales support. Today, artificial intelligence-backed chatbots have gained impetus. Human psychological attributes are being used to program lifelike chatbots that align with our empathy spectrums. These futuristic chatbots can provide expert customer support and effectively market products. When human behavioral imprints are used to evolve artificial chatbots, machine learning modalities power them to exhibit a nearly human-level interaction. According to Drift's 2020 State of Conversational Marketing report, about 25 per cent of consumers used the chatbot functionality to communicate with brands in 2020 instead of other traditional tools such as emails, phone calls, and social media interactions.

Source: Entrepreneur.

WHY IT'S TIME FOR 'DATA-CENTRIC ARTIFICIAL INTELLIGENCE'

The last 10 years have brought tremendous growth in artificial intelligence. Consumer internet companies have gathered vast amounts of data, which has been used to train powerful machine learning programs. Machine learning algorithms are widely available for many commercial applications, and some are open source. Now it's time to focus on the data that fuels these systems, according to AI pioneer Andrew Ng, SM '98, the founder of the Google Brain research lab, co-founder of Coursera, and former chief scientist at Baidu. Ng advocates for "data-centric AI," which he describes as "the discipline of systematically engineering the data needed to build a successful AI system."

Source: Fortune

CAN AI MARKETING TRANSFORM YOUR BUSINESS?

AI marketing typically fits into two categories: task automation and intelligent/machine learning. And these two use categories can operate either as standalone or integrated programs. Task automation is pretty straightforward – AI programs carry out structured, repetitive tasks. They operate according to a pre-determined set of rules or programmed sequence of events. This use of AI is not, and need not be, intelligent. Intelligent AI marketing, however, takes advantage of machine learning – a type of AI that can become more accurate over time, learning as it goes, essentially. Intelligent AI runs large quantities of data through its pre-programmedalgorithms to make complex predictions and decisions. Intelligent AI places customers in verticals that best reflect their interests and anticipates how they will respond to promotions, discounts or seeing a product or service that corresponds to their customer preference profile.

Source: CMSWIRE

HOW AI CAN HELP OVERCOME THE "GREAT SUPPLY CHAIN DISRUPTION"

As the mayhem at ports persists with no end in sight, a troubling realization is sinking in: This chaos will not subside with time alone, and the impacts of the "Great Supply Chain Disruption" are being felt across the country. For example, about 30% of baby formula brands could be sold out soon, causing retailers to ration how many containers customers can buy and leaving parents worried that they won't have enough food to feed their babies. This issue spans industries, impacting automotive, healthcare, hospitality, IT, manufacturing, apparel, and more.

So, what's the problem? Infrastructure and a lack of truck drivers are often blamed. U.S. trucking companies experienced a record deficit of 80,000 drivers in 2021. It's a logical explanation because truck drivers move a considerable portion of American freight. However, it's not the only cause of the supply chain issues.

Reasons for Supply Chain Challenges

Current inventory and planning systems operate on fixed lead times and demand forecasting, while the real world operates on dynamic lead times. As a result, poor decision-making and bad planning by procurement leaders and financial executives are driving the port congestion. To correct this, leaders must forgo planning initiatives and actively manage their shipments. Every time a transportation medium is changed when shipping goods, there are long queues due to changeover, further aggravating the problem. Although it might seem logical to think new means of transportation can help alleviate the congestion, this isn't a practical solution.

How to Plan Shipments More Accurately

Retailers need real-time inventory visibility across their enterprises to plan more accurately. Ideally, stowage plan information can be shared with terminal and third-party logistics companies exiting the gate as one value chain. This helps improve the efficiency of the first-in, first-out process.

AI can help determine changes in transportation or routes early enough to ensure on-time delivery for critical items.

Although AI implementation is still new to supply chain management, early adopters see success. According to McKinsey & Co., enterprises that utilized AI-enabled supply chain management improved logistics costs by 15% and inventory levels by 35%. As AI technology continues to improve, more companies are interested in benefiting from its capabilities. As a result, Infoholic Research predicts that AI in the logistics and supply chain markets will grow at a compound annual growth rate of 42.9% until 2023

Use Cases for AI to Overcome Supply Chains Disruption

As AI adoption increases, there's hope that it can help ease supply chain issues. Here are a few critical use cases;

1. Predict on-time, in-full rate drops

Customers are used to receiving purchased goods in a matter of days. However, World Economic Forum data shows that delivery times across the U.S. and Europe will hit record highs toward the end of 2021. Moreover, the current environment indicates that those increased time frames will likely continue. AI can help companies predict on-time, in-full drops early using historical data to identify how vendors fulfill orders. This allows companies to set deadlines to switch modes of transportation for customers who generate the most significant profit margins.
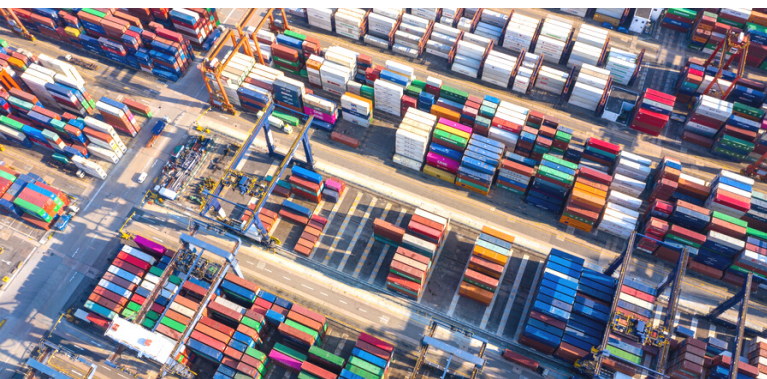
2. Deprioritize high-cost, poor-fit customers

Not all business relationships are a great fit. Gartner predicts that 75% of companies will drop poor-fit customers by 2025. Although some companies might not be ready to break up with costly clients, these loss leaders shouldn't take up space at the top of their priority lists.

However, it can be challenging for businesses to identify these customers. With the help of sorting algorithms, AI can automatically identify customers at scale who are bad for market-share gains and drain precious capacity. Additionally, AI can identify new opportunities for improvement and uncover how these opportunities will impact the bottom line.

3. Increase profit margins

Without a clear understanding of consumer demand, companies risk pushing products that don't sell, costing businesses millions of dollars. AI-powered forecasting can help companies sense demand changes early, allowing them to optimize products for the best profit margins.

According to McKinsey, AI-enhanced supply chain management provides a 65% reduction in lost sales caused by out-of-stock products. On the sales side, AI can help sales teams identify upsell and cross-sell opportunities for key accounts. Often, companies have limited knowledge of whom they should be upselling. However, because most sales tasks happen digitally, sales teams constantly collect data. AI can leverage this information to help teams sell more efficiently.

4. Ship faster

In a survey by Convey, 28.6% of respondents said they are more likely to place an order with companies that can deliver products within a week of purchase. That's a pretty small window of time, so faster shipping is critical if companies want to encourage consumers to shop with them.

AI can identify shippers who slow down the supply chain. Once identified, companies can remove the players who aren't keeping the pace and replace them with someone more efficient. Furthermore, suppliers can use AI to create simulations based on bottlenecks and disruptions.

Once the AI knows that a specific portion of the supply chain is bottlenecked, it can anticipate when companies can expect a shortage based on inventory stock levels or extending lead times.

It will take more than time to move past the "Great Supply Chain Disruption." If businesses truly want to deliver products efficiently, they'll need to change how they plan. By implementing AI technology, companies will be better equipped with the information necessary to ease today's supply chain challenges.

About the Author

Ali Hasan R. is the co-founder and CEO of ThroughPut Inc., the artificial intelligence supply chain pioneer that enables companies with predictive replenishment for complex supply chains.

Source: readwrite

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