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Daniel Burrus'

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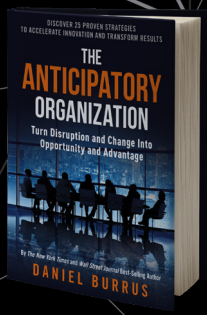
TECHNOTRENDS® NEWSLETTER

The biggest ideas that are changing everything

IN THIS ISSUE

MY NEW BOOK



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Smart Construction: How AI and Machine Learning Will Change the Construction Industry

By Daniel Burrus, CEO of Burrus Research

These days, seemingly everyone is trying to learn about and apply Artificial Intelligence (AI) and a powerful subcategory of AI, machine learning. Since the construction industry makes up at least 7% of the global workforce, providing both jobs and services that heavily influence and impact the global economy, it is safe to assume that AI and machine learning will be used to make some incredible productivity improvements that will transform the industry for the better.

> *AI and Machine Learning can help mitigate safety risks for construction workers*

I have written about how the manufacturing industry has been impacted by the likes of Industry 4.0 and other types of digital disruptions, and have likewise have pointed out how to recognize and use Hard Trends to seeing where improvements that haven't been made yet will be made in the near future. But in stark contrast to the manufacturing industry, the construction industry has progressed quite slowly as the world moves into the age of AI and machine learning.

General growth in the construction industry has occurred at a staggeringly low rate of 1% over the course of a few decades — compare this to the 3.6% growth rate of its blue collar counterpart industry, manufacturing. With total worker output growth at almost a standstill in the construction industry, it probably comes as no surprise to learn that machine learning and AI have not been used much yet to improve these statistics. But that is finally starting to change.

The same AI improvements seen in manufacturing are finally starting to pop up in the construction industry, improving the workflow of job sites and increasing overall output. For those who need a refresher in what Artificial Intelligence and machine learning are exactly, let's explore them quickly.

Artificial Intelligence (AI) is when a computer mimics specific attributes of human cognitive function, while machine learning gives the computer the ability to learn from data, as opposed to being specifically programmed by a human. Given the understanding of what these two types of digital disruptors can bring to the table, and what they have already done to (and for) the manufacturing industry, we can anticipate what is to come in the construction and engineering industry. And we can see how companies operating in those spaces will soon need to pay better attention to Hard Trends in order to stay ahead of the curve.

So how can AI and machine learning improve facets of the construction industry? The most obvious answer is by increasing workflow efficiency and improving safety. Following are ten ways that AI and machine learning will revive the flatlined construction industry and transform

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TECHNOLOGY NEWS HIGHLIGHTS

Campaign Hologram

As the 2020 presidential campaign gathers steam, one candidate will be underscoring a message about the future of disruptive technologies by campaigning in a totally innovative way: as a three-dimensional, full-body hologram.

Andrew Yang, an entrepreneur, philanthropist and, now, presidential hopeful, is reportedly working with a hologram developer to beam his image onto a flatbed truck (similar to the system that allowed Tupac to perform at a music festival in 2012). But the new technology will be able to do more than deliver a pre-recorded stump speech.

In an interview with an Iowa newspaper, the candidate explained that the system would enable him to interact with the audience in real time to answer questions from a remote studio location. It would also allow other virtual campaign participants to appear alongside the candidate.

It's another great example of how technology allows us to do more with less, by being in two or three places at once while interacting in real time.

Although the hologram developer was not disclosed, it's anticipated that the system could be debuted as early as June. So, stay tuned.

For information: Carroll Times Herald, P.O. Box 546, Carroll, IA 51401; website: http://www.carrollspaper.com/Content/Local-News-Archive/Politics/Article/Beam-him-to-the-White-House/1/335/27139

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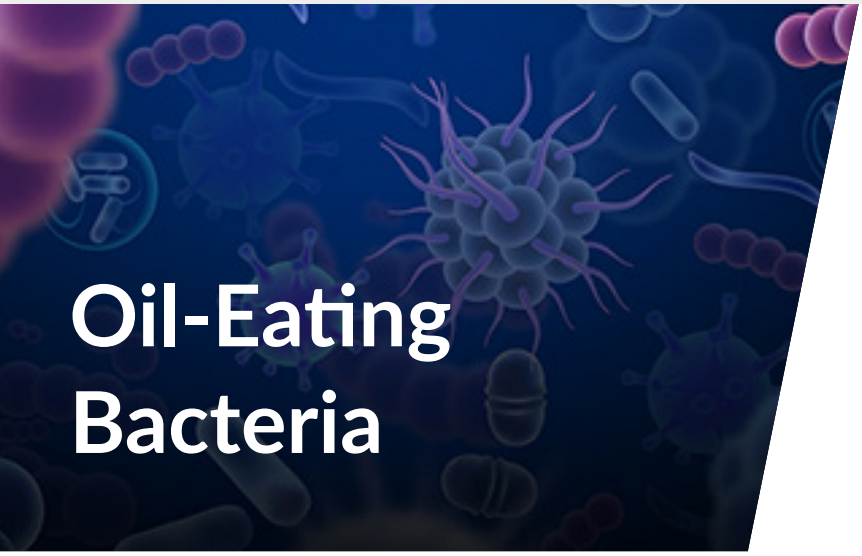


Oil-Eating Bacteria

Since it was first surveyed in 1875, the Mariana Trench has been a subject of interest to scientists around the globe. At nearly 7 miles (11 kilometers) in depth, it is the deepest known trench in the world. In fact, if Mount Everest was placed inside of it, its peak would still be a mile below the rim. Only a handful of expeditions have studied this unique ecosystem and the organisms that inhabit it, but recently, a team of researchers discovered a group of microorganisms that consume hydrocarbons for "food." This led to an obvious question: where are the hydrocarbons coming from?

The team proceeded to collect samples of seawater from the surface all the way down to the bottom of the trench. They discovered that hydrocarbons (likely from surface pollution) exist nearly 4 miles (6,000 meters) below the surface. However, they also discovered high levels of biologically produced hydrocarbons and an abundance of oil-consuming microbes at the bottom of the trench.

Further research will help to identify the role of hydrocarbons in enabling these bacteria to survive the extremely high pressure at the bottom of the trench (which is more than 1,000 times standard atmospheric pressure). It will also lead to a better understanding of the quantity of hydrocarbons being released into the environment, as well as the biological processes that enable microbes to consume these pollutants.

For information: Xiao-Hua Zhang, Ocean University of China, 5 Yushan Road, Shinan Qu, Qiingdao Shi, Shandon Sheng, China, 266024; phone: +86-532-66786653; fax: +86-532-85901868; website: http://eweb.ouc.edu.cn/

Biosolar Leaf

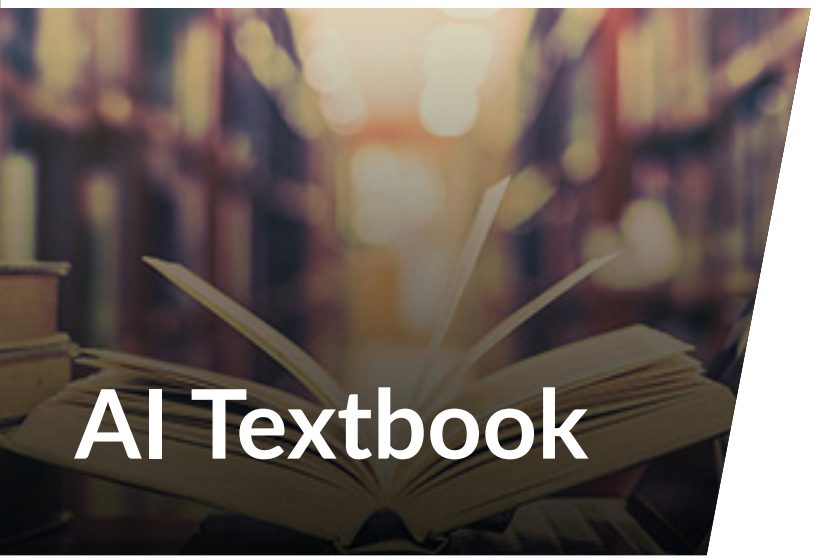
A new technology that converts solar energy into food is aimed at developing a sustainable food supply while cleaning up the environment. The panels, which look similar to solar panels, are covered with algae that pull carbon dioxide out of the air and produce fresh oxygen. The microscopic organisms are so efficient that 1 acre of panels can produce 100 times more oxygen than the equivalent area planted in trees.

In addition, as the algae grow, they can be harvested to replace synthetic food additives with ones that are produced naturally and organically. Micro plants like blue-green algae and plankton are excellent sources of phytonutrients and also provide proteins, vitamins, antioxidants, minerals and essential fatty acids. Although microalgae are already being used in food, this proprietary process is less expensive and more scalable.

The Biosolar Leaf system is an excellent alternative in areas where the soil cannot support traditional farming. But the panels can also be placed on rooftops or the sides of

buildings, making them adaptable for urban areas as well. The company has even built a chandelier using the technology to trap carbon dioxide and produce oxygen indoors. An outdoor pilot of their system is scheduled for installation at Imperial College in London.

For information: Arborea Ltd., Translation & Innovation HUB, 8 Wood Lane, W12 0BZ, London, United Kingdom; email: info@arborea.io; website: http://arborea.io/ or https://www.imperial.ac.uk/news/191026/worlds-first-biosolar-leaf-tackle-pollution/



AI Textbook

In what is believed to be the first example of using artificial intelligence (AI) to write a book, academic publishing company Springer Nature recently released Lithium Ion Batteries: A Machine-Generated Summary of Current Research. While it's not likely to make the bestseller list, it does represent a new era in scientific publishing.

With vast numbers of studies generating literally thousands of papers per year on any given topic, using AI to scan and summarize the information could save scientists valuable time by enabling them to keep abreast of new developments while continuing to do what they do best – research. If they feel a need to explore a subject further, links within the book provide easy access to the original source material.

This type of "robot writing" is probably not suitable for all types of books, but for formulaic texts and extractive summaries (for example, financial news or sports summaries), machine learning would definitely reduce the drudgery of poring over thousands of pages of scientific data. The method still needs some fine-tuning before it can be relied on to generate consistently coherent prose, and it may never be able to mimic the structure that human writers can generate, but this important milestone will provide publishers with much-needed information regarding the challenges and potential risks of AI publishing, and it will undoubtedly get better over time (as machine learning always does).

For information: Springer Nature, Tiergartenstrasse 17, 69121 Heidelberg, Germany; phone: +49-6221-4870; website: https://group.springernature.com/gp/group or https://group.springernature.com/gp/group/media/press-releases/springer-nature-machine-generated-book/16590134

High-Strength Plastic Film

Researchers recently discovered a way to make a lightweight plastic film that's as strong as aluminum, a breakthrough that could lead to windows and displays with greater impact resistance than ever before. Unlike other transparent plastics, such as polycarbonate (PC) and polymethyl methacrylate (PMMA), which are heavy and often brittle, the new material is made of high-density polyethylene (HDPE).

To create a film, HDPE is heated to a temperature below the melting point and drawn into sheets. But this process can create voids and defects that produce an opaque appearance, so additives are often used to enhance transparency. The goal of this research was to eliminate the need for additives in the manufacturing process. It was found that fine-tuning the drawing temperature to be between 90 and 110 degrees Centigrade successfully achieved a transparency of 90 percent while also optimizing mechanical strength.

The researchers surmise that the mobility of the polymer chains is greater at these temperatures, leading to fewer defects, less light scattering and, ultimately, greater clarity. In addition, the new films have a resilience rating and a tensile strength that is 10 times higher than PC and PMMA plastics.

The new material will be suitable for a wide range of applications that require both transparency and resilience, including windows, windshields, visors and displays.

For information: Ton Peijs, University of Warwick, Coventry, CV4 7AL, United Kingdom; phone +44-024-7652-3523; fax: +44-024-7646-1606; email: t.peijs@warwick.ac.uk; website: https://warwick.ac.uk/ or https://warwick.ac.uk/newsandevents/pressreleases/new_technique_to

Robotic Firefighters

A pair of robots has been designed to work together fighting fires in extremely hazardous environments where human intervention would be too dangerous or difficult. The duo is integrated with surveillance and command systems to create a "firefighting robot system" that can be sent autonomously to the scene of the blaze on a dedicated transport vehicle, where they proceed to work in tandem to extinguish the fire.

The Water Cannon Robot is equipped with a nozzle that can discharge water or foam at a rate of over 1,000 gallons (4,000 liters) per minute at a pressure of 1.0 MPa, or 10 times standard atmospheric pressure.

The Hose Extension Robot is designed to deploy up to 1,000 feet (300 meters) of hose as needed to the Water Cannon.

After attaching to the water source, it lays the six-inch (150 millimeter) diameter hose on the ground, automatically extending and rewinding the right length to ensure that its partner can maneuver properly.

Both bots are equipped with GPS sensors and lasers to precisely control their movements. The chassis frames are designed with extra-strong suspension systems for off-road performance.

The system was developed in cooperation with the Japanese Fire and Disaster Management Agency.

For information: Mitsubishi Heavy Industries Ltd., 2- Marunouchi 3-chome, Chiyoda-ku, Tokyo, 100-8332, Japan; phone: +81-3-6275-6200; website: https://www.mhi.com/ or https://www.mhi.com/news/story/190325.html

Autonomous Bus

The world's first autonomous bus was recently unveiled in Singapore. The introduction of the Volvo AB7900 represents a key milestone for the industry in general as well as an important step forward in creating cleaner, safer and smarter cities.

The newly designed vehicle is 12 meters long and has a capacity of 93 passengers. The fully electric vehicle produces zero emissions and will use 80 percent less energy than an equivalent-sized diesel bus. It also includes light detection and ranging sensors (LIDAR), 3D stereo-vision cameras, a global navigation satellite system and an operating system with artificial intelligence (AI) that is backed up by cybersecurity measures to ensure accurate navigation and safety.

Singapore is rated second only to the Netherlands as one of the best-prepared countries in the world for autonomous vehicles. With its high urban density, autonomous electric buses, which can transport much larger numbers of people than cars and taxis, will have a tremendous impact on overall mobility, accessibility and sustainable development within the city while improving air quality.

The vehicle will undergo extensive testing before being placed into operation.

For information: Volvo Buses; website: https://www.volvobuses.com/en-en/home.html

Influenza Cure?

The reason current vaccines are only effective for a short period of time is that the antibodies tend to break down, making additional injections necessary. But a new approach, using the gene-editing tool known as CRISPR, could someday make people immune to the flu, requiring antibodies to be injected only once.

The technique involves editing the DNA of B cells – the white blood cells in the human immune system that are responsible for creating antibodies. In an initial study on 15 mice, the method provided a full 82 days of protection against a virus known as RSV (Respiratory Syncytial Virus) – the most common cause of bronchiolitis and pneumonia in children.

In addition to RSV and influenza, the researchers believe that the modified B cells could be programmed to fight other diseases, including human immunodeficiency virus (HIV) and Epstein-Barr virus (EBV). Although much research remains to be done, such a breakthrough could prevent thousands of hospital visits, deaths and disabilities each year.

For information: Howell Moffett, Fred Hutchinson Cancer Research Center, 1100 Fairview Avenue, N. Seattle, WA 98109; email: hmoffett@fredhutch.org; website: http://www.fredhutch.org/en.html or https://www.biorxiv.org/content/biorxiv/early/2019/02/06/541979.full.pdf

Smart Construction: How AI and Machine Learning Will Change the Construction Industry

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it into what we'll call "smart construction."

Cost Overrun Prevention and Improvement

Even with some of the most efficient construction teams, cost overruns plague larger-scale projects. AI can use machine learning to better schedule realistic timelines from the start, learning from such data as project type and contract type. AI can be even be used to boost the competence of project managers by providing augmented thinking and elements of real-time training that can enhance skill and improve team leadership.

Generative Design for Better Design

Generative design is accomplished using a process called "building information modeling." When a building is constructed, for example, the sequence of architectural, engineering, mechanical, electrical, and plumbing tasks must be accounted for in order to prevent the teams that work on these specific tasks from stepping out of sequence or clashing, causing a massive delay in the construction process. Construction companies can and will increasingly use generative design to plot out alternative designs and processes in order to prevent rework.

Risk Mitigation

The construction process involves risk, including significant quality and safety risks. AI machine learning programs can take into account large amounts of data, including the size of the project, which can be used to determine the potential impact of each risk — thereby helping the project team to pay closer attention to bigger risk factors and avoid waste. Likewise, this AI software can assign risk scores so that high-risk workers take precedence over low-risk ones.

More Productive Project Planning

A recent startup utilized 3D scanning, AI and neural networks that can learn over time to scan a project site and determine the progress of specific sub-projects in order to prevent late and over-budget work. In the future, there will increasingly exist algorithms capable of identifying small problems that management can jump in and help solve before they become detrimental to the finished project. Likewise, "reinforcement learning," better known as the trial-and-error process by which a machine learns, will help collate small issues and improve the preparation phase of project planning.

More Productive Job Sites

On the surface, many professionals see AI, machine learning, and advanced robotic automation as ways in which autonomous machines will replace their jobs. While it is true that these types of intelligent machines can and will be used to take over repetitive tasks, such as pouring concrete or bricklaying, and then migrating to jobs with increasing cognitive complexity, this certainly does not translate into a lack of jobs for people. What it does mean is that workers will be repositioned into new, more fulfilling and highly productive roles to save time and stay on budget. And apart from taking over mundane tasks, AI will be used to monitor human productivity on job sites and provide real-time guidance for improving each operation.

Safety First

Manual labor not only has the potential to be taxing on the body, but also to be incredibly dangerous. So how can AI and machine learning help to mitigate safety risks for construction workers? One general contractor is currently developing an algorithm that can analyze safety hazards seen in imagery taken from a job site, making it possible to hold safety briefings to eliminate elevated danger and improve overall safety on construction sites.

Addressing Job Shortages

AI and machine learning make it possible to plot out more accurate distribution of labor and machinery across different job sites, eliminating overbooking of laborers and thus preventing wild budget overruns. If computer evaluation of one construction site reveals that it has adequate coverage while evaluation of another reveals that it is short staffed, workers can easily be repositioned to where they are most needed.

Remote Construction

When structures can be partially assembled off-site and then completed on-site, construction goes faster. While this is not a new concept in residential construction, the concept of using advanced robots and AI to accomplish these jobs is. Assembly line production of something like a wall can be completed while the human workforce focuses more intently on the finish work, such as HVAC or plumbing.

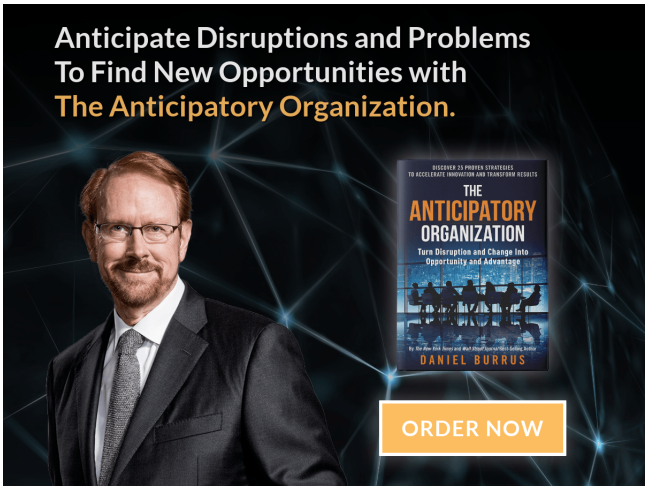
Construction Sites as Data Sources

A lot of data can be generated from construction sites — both from ones that use AI and machine learning and from ones that do not. In any case, the data gathered, and the digital lessons learned, are all tools that can be used to improve the productivity of the next project. In this way, each construction site becomes a virtual textbook of information helpful to all facets of the industry.

The Finishing Touches

Just as the foundation of a simple residential home moves a little over time, larger structures are always settling and shifting slightly. Wouldn't it be beneficial to be able to dive back into data collated by a computer and track in real time the changes and even potential problems faced by a structure? With AI and machine learning, it can be done. The possibilities are truly endless.

So given these coming changes, plus the potential for building costs to drop up to 20% or more as a result of increases in productivity, professionals in the construction industry must ask themselves how they can pay attention to these Hard Trends, become more anticipatory, and ultimately learn to use and benefit from the ever-evolving capabilities of AI and machine learning. Construction workers will increasingly be required to work alongside new technology including AI, machine learning systems, and advanced robotics — so to progress in their careers, they must anticipate change and actively turn it into opportunity and advantage.



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