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Daniel Burrus'

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TECHNOTRENDS[®] NEWSLETTER

*The biggest ideas that are
changing everything*

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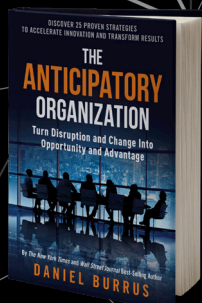
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Don't Miss AR's Amazing Opportunities

By Daniel Burrus, CEO of Burrus Research

There is an entirely new industry that is about to take off and grow at an exponential rate. It's loaded with amazing opportunities for job creation, and it provides a field day for entrepreneurs who want to use the certainty of Hard Trends to grow rapidly. That industry is augmented reality (AR).

What excites me most about AR is that it is much easier to develop than virtual reality (VR). Virtual reality requires a lot of programming and photo-realistic graphics in order to create a fully immersive 3-D virtual world. That means you have to invest a lot of time and money to develop a great program.

Both AR and VR have a bright future, but AR represents a much bigger and broader opportunity

In addition, to make VR work, you have to close out the real world by either putting on a headset that blocks off your current reality, or by entering a special room that allows you to enter a virtual three-dimensional world. That means you can't do two things at once like you can with AR. AR requires much less programming and therefore less time and money to develop because you are basically overlaying data onto a live view of something. And you can do two things at once, allowing users to do their work as they access important information about whatever they are looking at, as I will describe below.

Both AR and VR have a bright future, but AR represents a much bigger and broader opportunity because AR can be used for just about anything, if you think about it. For example, for the past several years, I have used an AR app that allows me to hold my smartphone camera up to any mountain, and the app will tell me the height of the mountain, the length of the trails, and other useful data when I'm looking at the mountain. When I'm on a vacation in the mountains, I've found this very useful in determining where I might want to hike, climb or bike.

AR could also be used for engaging tourists who are in a new city for the first time. If I'm on a street in New York, and I tell the app what type of shoes I'm looking for, all I have to do is hold the camera of my smartphone up and pan around to see if any nearby stores have what I want. Now let's suppose you're in a large store, and you're on the hunt for a specific item. Simply use the AR app by panning your smartphone camera around, and it will show you exactly where the item is or pinpoint a salesperson who might know where the item is.

Best of all, soon we'll be wearing AR glasses that are connected via Bluetooth to smartphones and AR apps. I give a lot of keynote speeches, and I know that soon I will be able to use my AR glasses to not only see the people I'm talking to, but also see their names as I scan the audience.

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TECHNOLOGY NEWS HIGHLIGHTS

Brain-to-Speech Interface

In an unprecedented advancement for neuroscience, engineers have created a computer interface that can monitor and decode brain activity, and reconstruct the signals directly into intelligible speech. The breakthrough development could help people who have lost their ability to speak – such as stroke victims or those living with amyotrophic lateral sclerosis (ALS) – to once again communicate with the outside world.

For decades, researchers have been working on ways to decode the patterns of brain activity that appear when people speak – or think about speaking. Similar patterns are also apparent when we listen to others speak – or think about listening. So the first step was to monitor the brain activity in patients undergoing brain surgery while they listened to spoken sentences and numerical digits from zero to nine. These

signals were used to “train” a vocoder – a computer algorithm that synthesizes speech from recordings of human voices, which is similar to that used by the Amazon Echo and Apple Siri. The voice output was tested by asking individuals to listen to recordings of a sequence of numbers and repeat what they heard. The results indicated an intelligibility rate of about 75 percent, which is well above previous technologies.

The next step will be to test more complicated sentences on brain signals generated when a person speaks or imagines speaking. Ultimately the system may become part of an implantable device to translate a wearer’s thoughts into words.

For information: Nima Mesgarani, Columbia University, Department of Electrical Engineering, Jerome L. Greene Science Center, 3229 Broadway, New York, NY 10027; phone: 212-854-8013; email: nima@ee.columbia.edu; Web site: <http://naplab.ee.columbia.edu/> or <https://www.columbia.edu/>

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AI Lie Detector

A new artificial intelligence (AI) algorithm has been developed that can determine whether a robbery report is legitimate or fake, with a high degree of accuracy. Known as VeriPol, the system was developed to deal with a growing number of spurious theft reports that consume valuable police time and resources.

The reasons people file phony robbery complaints are many – some are looking to cash in on insurance claims, while others are simply trying to avoid disclosing the fact that they have lost or damaged some item of value. In any case, catching them requires hours of review by seasoned investigators. But the new AI system – which is based on natural language processing – analyzes a number of features in the text to identify which cases have likely been fabricated.

Historical police reports were fed into VeriPol so that it could “learn” specific patterns that were common among false reports. A number of themes emerged, including: a greater focus on the property than the incident, a lack of precise detail about the incident or the attacker, a lack of witnesses, and a failure to contact authorities immediately following the incident.

It was then tested on more than 1,000 reports from the Spanish National Police

and compared to analysis by two police experts. The results indicated that VeriPol correctly discriminated between real and false statements with greater than 80 percent accuracy, which was 15 to 20 percent better than the humans.

The new system is already being deployed throughout Spain in the hopes of deterring people from filing fake claims. Although it is currently specific to personal robberies, the developers hope that it will eventually be able to detect inconsistencies in other falsified crime reports, including car theft and home burglary.

For information: Jose Camacho-Collados, Cardiff University, School of Computer Science and Informatics, Cardiff, CF10 3AT, United Kingdom; phone: +44-(0)29-2087-9108; email: camachocolladosj@cardiff.ac.uk; Web site: <https://www.cardiff.ac.uk/>



Building Blood Vessels

Scientists recently developed a method for growing human blood vessels from stem cells in a laboratory setting. This game-changing technology will allow clinicians to more closely study the causes and treatments for a variety of vascular diseases. More importantly, these studies can be carried out directly on human tissue without involving human subjects.

Organoids – three-dimensional structures that can be grown from stem cells in a petri dish – mimic actual organs and are used to study various aspects of organ function in the lab.

In this experiment, not only were the vascular organoids successfully cultivated, they were also able to be transplanted into mice, where they developed into fully functional arteries and capillaries. Since every organ in the body is linked to the circulatory system, the applications for study are vast; however, the initial research will be centered on diabetes.

Despite the fact that more than 400 million people suffer from diabetes worldwide, and the fact that many of the symptoms of diabetes are due to changes in blood vessels that impair circulation and reduce oxygenation of the tissues, little is known about the mechanisms responsible for these vascular changes. In this study, when the blood vessel organoids were exposed to a “diabetic” environment, they displayed thickening similar to that seen in diabetic patients.

The researchers were subsequently able to determine that none of the currently used anti-diabetes medications had any positive effects on the vasculature, but that inhibiting a specific enzyme prevented the thickening of the blood vessel walls in mice. These new findings could lead to a better understanding of vascular disease as well as new treatments in the future.

For information: Josef Penninger, Austrian Academy of Sciences, Institute of Molecular Biotechnology, Dr. Bohr-Gasse 3, 1030 Vienna, Austria; phone: +43-1-790-44; email: office@imba.oeaw.ac.at; Web site: <https://www.imba.oeaw.ac.at/>

Bluetooth Without Battery

Technology hasn't fully realized the potential of the Internet of Things (IoT) due in large part to the fact that in order to connect billions of devices, each one needs a battery. But now, a new Bluetooth chip has been developed that's paper thin and needs no batteries, because it harvests energy from the air.

The use of nanowatt computing enables the new chip to operate solely on power that is scavenged from ambient radio frequency (RF) energy. The chip and its associated antenna is the size of a postage stamp and can be printed on plastic or paper to be mounted on virtually anything. And by eliminating most of the components associated with typical Bluetooth, the cost is drastically reduced.

The device can be programmed with a vast array of information from tracking information to usage instructions. It can also be combined with sensors. For example, temperature sensors could detect when food has been exposed to too much heat or cold. Most importantly, unlimited power means unlimited lifespan, enabling real-time interconnectivity with thousands of items that could not previously be connected to the IoT.

The company plans a limited release of the new chip in 2019 before making it broadly available in 2020.

For information: Wiliot, Ha-Tokhen St 6, Caesarea, Israel; Web site: <https://www.wiliot.com/>

A close-up photograph of a white card with the word "ANTIBIOTICS" printed in bold, black, sans-serif capital letters. Several blue and white capsules are scattered on the card, some near the text and others further away. The lighting is soft, and the background is slightly blurred.

Overcoming Antibiotic Resistance

In the U.S. alone, antibiotic resistance in disease-causing pathogens endangers millions of lives and costs over \$2 billion each year. But recently, researchers have found a way to utilize a repurposed version of the gene-editing tool CRISPR to study how antibiotics act on bacteria, with the goal of improving existing antibiotics and even creating new ones.

CRISPR works by targeting a specific gene within the DNA sequence and cutting it in two so that a new gene can be inserted. The new version – called Mobile-CRISPRi – is not able to cut DNA but attaches to a particular gene and blocks other proteins from accessing it. As a result, the expression of that particular gene and the amount of protein it codes for are reduced. When applied to bacteria, the research showed that decreased amounts of antibiotic-specific proteins cause those bacteria to become sensitive to lower levels of the drugs.

All of this means that we now have a tool to study how antibiotics directly inhibit the growth of pathogens and, eventually, to overcome their resistance to drugs. The developers have offered the Mobile-CRISPRi tool to other researchers to allow study of a wider range of bacteria.

For information: Jason Peters, University of Wisconsin-Madison, School of Pharmacy, Rennebohm Hall, 777 Highland Avenue, Madison, WI 53705; phone 608-265-6744; email: Jason.peters@wisc.edu; Web site: <https://www.wisc.edu/>

A stylized, glowing blue DNA double helix structure against a dark background. A single segment of the helix is highlighted in bright yellow, suggesting a specific point of interest or a mutation. The overall aesthetic is futuristic and scientific.

Better Than DNA Sequencing?

A new computer program known as DeepGestalt was recently developed to identify and quantify hundreds of genetic syndromes using facial analysis. The artificial intelligence (AI) system was “trained” using a public database comprising more than 17,000 images of patients with more than 200 rare genetic disorders. By breaking the images down into mathematical facial descriptors and comparing them to patterns of markers for known genetic syndromes, the program can generate a prioritized list of diagnoses.

The system was tested with over 500 images of individuals with Noonan syndrome (a genetic disorder that is characterized in part by wide-set eyes) or Bain type intellectual disability (which is sometimes indicated by almond-shaped eyes and a small chin). The program included the correct diagnosis in a list of top ten diagnoses 91 percent of the time. It was also better than doctors at identifying subtypes of Noonan syndrome and spotting other inherited mutations that are revealed by characteristics such as low-set ears and an upturned nose. In comparison, it has been estimated that the odds of identifying specific genetic disorders through DNA sequencing has been estimated to be about 25 percent because the relevant variants are not currently well defined.

When used in combination with genome

testing, this system could help physicians more accurately diagnose genetic disorders while reducing the time and cost. However, such a tool will need to be strictly regulated to prevent exploitation by employers, insurance providers and other entities.

For information: Yaron Gurovich, FDNA, Inc., 186 South Street, Boston, MA 02111; phone 617-412-7000; Web site: <http://fdna.com/>

Good News for Carbon Fuels

Researchers at Berkeley Lab may have found a way to convert carbon dioxide into useful chemicals inexpensively and without producing harmful by-products. The process utilizes a traditional copper catalyst, but adds a new twist that makes the method product-specific.

Since the '80s, copper has been used to synthesize a variety of carbon-based chemicals such as ethanol (for fuel), ethylene (for plastics) and propanol (an alcohol used in pharmaceutical manufacturing) through a process known as electrocatalysis. Electrons from the surface of the copper interact with carbon dioxide and water at "active sites" to produce a broad range of chemicals. However, the method was non-specific so there was no way to control what compounds were produced. Consequently, several additional steps were required to separate the unwanted residual chemicals from the desired end product.

What the scientists recently discovered is that these active sites are actually product-specific. Through the use of carbon isotopes, they were able to track which active sites produce which chemicals. The next step will be to determine whether they can drive specific active sites using electrons from solar cells to make the process selective and more efficient. If it works, it may one day lead to solar-powered oil refineries that can create useful products by pulling carbon dioxide out of the air.

For information: Joel Ager, Lawrence Berkeley National Laboratory, 1 Cyclotron Drive, Berkeley, CA 94720; phone: 510-486-6715; email: jwager@lbl.gov; Web site: <https://www.lbl.gov/>

Lithium-Ion Alternative

Lithium-ion batteries have pretty much taken over the electric vehicle (EV) market because they charge more quickly than their nickel-metal hydride counterparts and are less prone to developing a charge-discharge "memory." But they also have some disadvantages.

Mining the raw materials needed to produce them (lithium and cobalt) causes damage to the environment that is not easily reversed. In addition, the cells themselves can catch fire, and when they

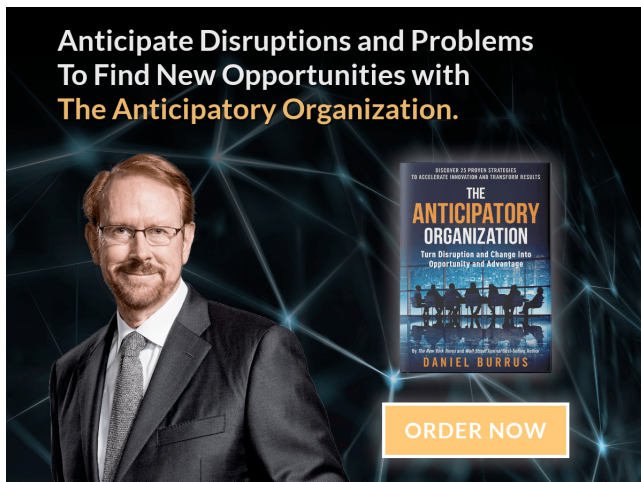
do, are very difficult to extinguish.

As engineers continue to look for alternatives, one technology that incorporates fluoride chemistry is showing some promise. Fluoride-ion batteries are potentially more energy dense than lithium-ion, meaning that EVs could go farther on smaller battery packs.

But early versions required the electrolyte to be heated as high as 300 degrees Fahrenheit for optimal function. Now a collaborative research team has created a room-temperature fluoride electrolyte that works in combination with a newly developed cathode to produce a functional fluoride-ion cell.

Although the technology is likely years away from commercialization, it represents an exciting alternative for EVs down the road.

For information: Thomas Miller, CalTech, Division of Chemistry and Chemical Engineering, 1200 East California Blvd., Pasadena, CA 91125; phone: 626-395-6588; email: tfm@caltech.edu; Web site: https://millergroup.caltech.edu/Miller_Group/Home.html or <http://www.caltech.edu/>



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Don't Miss AR's Amazing Opportunities

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By moving my finger along the earpiece of the glasses, I can go from no data to full data and adjust to find just the right view.

The Augmented Reality Job Market

We are currently in the beginning stages of a burgeoning AR market. For anyone interested in entering the world of augmented reality and making a career in it, I would highly recommend taking the leap immediately. The wide-scale application of AR is only limited by our imaginations. Early entrepreneurs and programmers in the field have only begun scratching the surface of what is possible. Careers in AR will be on a very fast-moving trajectory.

Given the wide range of industries that could benefit from mixing information with the real world, I predict that in the next few years we will see a large number of AR usages, especially when AR glasses hit the market. And AR glasses won't be as clunky as the original Google Glasses were.

They will look more like ordinary glasses—and soon, thanks to the exponential growth of miniaturization. If you already wear prescription glasses, no problem! AR glasses can be made with prescriptions as well. At first, most people will still be using their mobile devices for AR applications, but once AR glasses get going, that will be the preferred way to use AR.

If you are considering going into a career in augmented reality, it's important to think about the ideal industry that would benefit from its

use. Employees who work in large warehouses would benefit greatly. If they are looking for something, they can quickly find it.

How about functions like sales, service, maintenance and repair, or industry groups like factories, retail stores, real estate offices? These glasses will allow them to see the latest information in real time. I also see a massive benefit in the trades, as AR glasses can be used to help people train quickly to become plumbers and electricians—positions that are not being filled fast enough due to retiring baby boomers.

Within five years, we will see high-fashion AR glasses that will be worn by many people. Data will be more frequently overlaid on our surrounding environment. We will also see another addition to your AR glasses: video. It is already possible to 3-D print a 4K camera that is the size of a fly's eye—you wouldn't even see it on your glasses. Batteries will also get much smaller, lighter and more powerful, and with exponential advances in solar charging, AR glasses will get energy from ambient light and avoid the concern of charging your glasses.

The Positives and the Negatives

With every new industry, there will always be pluses and minuses. In the case of augmented reality, the positive is quite clear: It is increasing humankind's ability to make better decisions faster. The idea that it will help employees and customers in hospitals, industrial centers and everywhere else will be very positive. Think of a doctor being able to always stay on top of their patient's situation by seeing their vital signs without having to look away from the surgical field.

However, there is always a downside that we must be aware of, and we must look for ways

to solve such problems before we encounter them. The most obvious is the risk that you might be paying more attention to the data than to the visual reality, and you might walk into a building—or worse.

Let's face it, when it comes to using technology, there is a time to plug in and a time to unplug. There is also the risk of misinformation, where the data overlaying your environment could be hacked and could misinform you or put you in danger. Always remember to anticipate risks and think critically.

The future is very bright for augmented reality, and ultimately, the market for AR, both for consumers and for entrepreneurs, as the industry will develop practical uses much faster than in the world of virtual reality. Virtual reality business applications will find many great niche markets, but augmented reality can be used by anyone anywhere due to the user's ability to multitask.

What I love most about augmented reality is that you can be using it while still interacting with the real world, which is very powerful. Unlike virtual reality, it does not encourage us to close ourselves off from the real, physical world. Rather, it allows us to see insightful information in real time, ultimately spending less time having to stop and Google every little detail while on a hike or doing our work. It will give us a new way to discover the hidden facts that bring the things in our world to life.

We're only at the base of the mountain of change, and the time to start your climb upward is now!

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