Updates

Over the last decade, we have heard a lot about artificial intelligence, machine learning, robotics, blockchain, and other disruptive digital technologies and how they are transforming the world.

With the current coronavirus outbreak causing unprecedented social and economic upheaval and suffering, we take a look at the leading disruptive IT-related technologies to see what impact—positive, negative, or none at all—these technologies are having in our efforts to combat the effects of the coronavirus and what role these technologies could play in identifying and mitigating future pandemics.

Artificial Intelligence and Machine Learning

For all of the many artificial intelligence (AI) and machine learning (ML) breakthroughs in recent years, it is difficult to find examples of how these technologies have played a significant role thus far in combatting COVID-19. This may be at least partly due to the fact that, to be effective, AI and ML require large pools of data, and, because the coronavirus is new and fast-moving, it will take time to create comprehensive and reliable databases related to the virus.

The promise of AI and ML, however, is clear. For example, efforts are underway to use AI to analyze the growing volume of coronavirus-related research papers to identify patterns that could lead to potential treatments and a cure, and researchers in the United States and China have recently developed an AI tool that attempts to predict which coronavirus patients are likely to develop severe lung disease. An AI-generated chatbot has been developed to assist ill individuals in determining whether they may need to go to the hospital. Isaac Godfried, a deep learning engineer, has observed that ML "can help expedite the drug development process, provide insight into which current antivirals might provide benefits, forecast infection rates, and help screen patients faster." The algorithms needed to power pandemic-related AI and ML applications already exist; what is needed is the compiling and sharing of massive datasets against which to run and train these algorithms.

Autonomous Vehicles

By helping to limit human interaction, autonomous vehicles, such as self-driving cars, are a particularly promising technology for curtailing the spread of the coronavirus. Indeed, the need for social distancing during the pandemic is spurring greater interest in autonomous vehicles, particularly for delivery services and transporting first responders, healthcare professionals, and infected or potentially infected individuals. Currently, however, ridesharing services are not automated, and have had to suspend service in some cities. Further, even automated services will often employ a back-up driver for safety or liability purposes, undercutting their value for minimizing disease transmission. There's also the possibility that deployment of fully automated, truly driverless passenger vehicles could backfire by tempting individuals subject to stay-at-home orders to violate such orders. Because coronavirus may adhere to surfaces for as long as 72 hours, the vehicles themselves could spread infection even if there is no more than one person in the vehicle at a time. Plus, a patchwork of restrictive laws is likely to further hinder the broad use of autonomous vehicles for transporting people during the current pandemic or the near future.

As a result, the more immediate impact of autonomous vehicles will likely be in connection with delivery services. In China, for example, self-driving delivery vans are being used in cities under quarantine. And at least one company has recently obtained regulatory approval to begin limited delivery services in the United States, with more expected to follow.

Blockchain and Cryptocurrencies

Leveraging distributed ledger technology could alleviate concerns relating to the manipulation of information, such as donation misuse, lack of transparency in medical supply volume and transportation tracking, and alteration (governmental or otherwise) of outbreak data. Medical and other supplies can be tracked and monitored via blockchain technology, which would ensure that data is up-to-date and accurate. IBM has announced that its blockchain technology will be used in a new platform that will utilize data analytics and privacy tools for the public health analysis of COVID-19, based on data from the World Health Organization, Centers for Disease Control and Prevention, and similar agencies.

Although likely farther off than other uses of blockchain technology, cryptocurrencies may offer a faster and more efficient solution to providing economic relief while the economy is halted. As a "touch free" technology,

cryptocurrency payment systems could also reduce the use of cash, which may be a disease transmission vector. In the United States, lawmakers briefly considered—but ultimately set aside—the creation and use of a U.S. "digital dollar" to distribute relief payments to certain Americans under the recently enacted economic relief plan, the CARES Act.

Cloud Computing

Servers located in data centers all over the world, commonly referred to as the cloud, allow files and applications to be accessed from anywhere. As a result of the stay-at-home orders issued by governments throughout the world, the use of cloud services has spiked as more people than ever before rely on the cloud to work remotely, stay connected to friends and family, and find diversion. The major cloud providers have so far weathered this stress test of their systems. However, due to the difficulty of migrating on-premise resources to the cloud in the midst of the COVID-19 outbreak, the benefits of cloud, at least early in the pandemic, may be accruing largely to companies that had migrated to the cloud before the outbreak; that being said, cloud-computing providers are seeing increased demand for the services, from new customers as well as existing customers, as companies, educational institutions, and government agencies scramble to remain connected to, respectively, their employees and customers, teachers and students, and constituents.

In addition to supporting us while we stay at and work from home, the cloud is being utilized to support COVID-19 research and eventually get us back out of our homes. For example, the COVID-19 High Performance Computing Consortium, a private-public partnership, currently has pooled cloud resources with combined computing power of over 366 petaflops; these resources are being made available to COVID-19 researchers.

Pooling computing resources is not restricted to big cloud providers. Folding@home, a distributed computing project based at the Washington University in St. Louis School of Medicine, allows anyone to use their idle processing power to help researchers model the possible shapes and folding pathways of COVID-19 viral proteins. As people have turned their gaming and cryptocurrency mining equipment to the cause, folding@home has amassed a pool of computing power that dwarfs even the COVID-19 High Performance Computing Consortium.

Drones

Unmanned aerial vehicles, or drones, have generated much buzz over the past several years, but commercial adoption and use in the United States has been slowed by payload limitations, privacy and safety concerns, and regulatory hurdles. Outside of the United States, however, drones have seen greater acceptance, and are increasingly being enlisted in the fight against the coronavirus. For example, drones are being used in Spain to warn individuals to remain indoors during lockdown and in China to transport medical supplies and samples. In some countries, agricultural drones are being repurposed to spray disinfectant in public places.

In this country, the coronavirus is spurring potential new uses for drones. For example, drone manufacturer Draganfly is seeking to deploy decked-out "pandemic drones" to detect potentially infected individuals by monitoring for coughs and sneezes in public places, while another company is working with regulators to deploy its technology for delivering masks, gloves, and other PPE to hospitals and other healthcare providers. And we anticipate, in the aftermath of this pandemic, if not sooner, increased pressure on federal and state regulators to ease legal hurdles on the delivery of packages to consumers via drones, at least during periods of crisis.

Robotics

Robots can ease the burdens on medical workers, including hospital staff, who are in closest contact with the coronavirus, by taking over a number of tasks that require physical proximity to coronavirus patients or potentially infected surfaces. For example, robots are currently being used to deliver medical supplies, disinfect rooms, and dispense sanitizer. Given the stay-at-home orders issued by governments throughout the world, robots can assist with many tasks that are now risky for humans to perform, such as food and grocery delivery. Moreover, as concerns mount over the stalled global economy and disrupted supply lines, robotics can be employed to further automate manufacturing processes.

The current pandemic has provided, over the course of just a few weeks, a vision of the massive unemployment and societal disruption hypothesized by Martin Ford and other futurists as a result of growing automation of the workplace. Of course, these futurists typically envision a 10- to 20-year time frame before automation would result in large portions of the world's population being jobless—ironically, the COVID-19 outbreak could potentially accelerate the adoption of robotics and other automation technologies, and yet, at the same time, the outbreak is forcing society to take a hard look at universal basic income and other ideas designed to address the potential coming upheaval resulting from widespread automation.

Smart Phones and Mobile Apps

The iPhone is only 13 years old. As horrific as the current pandemic has been and will be, the devastation almost certainly would have been worse if the same outbreak occurred prior to smart phones becoming ubiquitous. More than any of the other technologies discussed, smart phones have played a critical role in our efforts to cope with the coronavirus, helping to keep us informed, connected, at home, and, hopefully, safe.

As many of us are rarely farther than arm's reach away from our smart phones, governments around the world, including Israel, Germany, Singapore, and China, have launched mobile apps that use phone location data in an effort to identify who may have come into contact with a coronavirus-infected individual. Cell phone location data collected for advertising purposes is similarly being used. Such contact tracing can reveal potential hot spots, inform predictions about how the virus will spread, and deliver warnings to individuals who may have been exposed to the virus. However, phone location data, which is typically no more accurate than 23 feet in urban areas, may be too imprecise for a time when we are social distancing six feet apart. Conversely, the aggregation of this data by governments offers a picture of our daily movements that worries some privacy advocates. The proliferation of COVID-19 tracking apps has also allowed criminals to distribute ransomware apps.

Smart phone apps are also being used to report the readings of over a million internet connected thermometers. These readings have been compiled and compared against historic data to create a real-time heatmap of influenza-like illnesses in the United States. This real-time data source is in sharp contrast to the CDC's traditional reliance on weekly reports from doctors' offices and emergency rooms.

Social Media

Social media is also playing an important role in efforts to combat the coronavirus. In recent years, social media has been blamed for countless societal ills—the current pandemic, however, is a reminder of how invaluable social media has become during emergencies and times of crisis. Social media, among other things, is helping to direct people to accurate sources of information regarding COVID-19, is reinforcing social distancing and other safety messages from governments, is facilitating coordination among first responders and healthcare providers, and is facilitating remote learning. Moreover, with millions of people under "stay-at-home" orders, social media has allowed us to remain connected and to combat loneliness and isolation, cure boredom and to stay in touch

with family members and friends, including those who are at a high risk of serious health risks if they were to be exposed to the virus through in-person meetings. Of course, social media has also been used to spread misinformation about the coronavirus, treatments, and risks, but social media platform providers have taken unprecedented steps to curb such misinformation.

3D Printing

In the wake of the coronavirus outbreak, growing media attention is being paid to 3D printing technology. In response to the epidemic, industrial manufacturers, 3D printing companies, and enthusiasts are seeking to address supply shortages confronting the medical community by printing nasal swabs, face shields, and ventilator components. Face masks have been a particular priority, with the 3D printing community racing to design 3D-printed face masks that might serve as a stopgap until traditional manufacturers are able to meet the unprecedented demands for their products. Government agencies are seeking to fast-track these efforts. For example, the U.S. Food and Drug Administration has granted emergency authorization for a company to 3D print a ventilator expansion device that allows a single ventilator to support up to four patients. Other companies are developing 3D-printed household items to further reduce the spread of coronavirus, such as hands-free door openers.

VR and AR

Virtual reality and augmented reality can be used for the same purposes as social media described above: connecting people socially while physically maintaining distance. Yet these technologies have distinct capabilities that can further facilitate social bonds, provide people with opportunities to virtually explore landmarks or museums, and offer live entertainment. For example, pre-pandemic, many people relied on the outdoors or their gyms to stay healthy. While workout videos now offer an outlet, virtual reality is making it possible for those sheltering at home to take their exercise "outside" or even to another world. Users are also able to engage with the outside world and scratch the itch to travel by "visiting" landmarks, such as art museums and national parks, and attending live events, such as lectures, conferences, and concerts. Additionally, while virtual reality and augmented reality can ease the strain of social distancing, they are also key tools in the medical battle against the coronavirus. One use of augmented reality has allowed health workers the ability to better visualize the impact of COVID-19 on patients' lungs.

What's not quite here yet is the "OASIS"—the fully immersive, ubiquitous VR environment contemplated by the visionary science fiction novel *Ready Player One*, a virtual space where society collectively escapes from a dystopian "real world"—so, as Rizwan Virk, the founder of Play Labs @ MIT has observed, might the current pandemic accelerate efforts to create the OASIS?

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To borrow a phrase from the singer-songwriter Paul Simon, we live in an age of "miracle and wonder," largely thanks to unceasing advancements in digital technologies. Although the current pandemic has highlighted the promise of our most cutting-edge technologies, it has also revealed their shortcomings. For all of their miracle and wonder, they have so far been powerless to stop the destruction created by the coronavirus. Our technology community—entrepreneurs and CEOs, venture capitalists and angel investors, developers and engineers, lawmakers and lawyers—will need to study these shortcomings and collectively work to ensure that, when the next deadly viral outbreak inevitably arrives, we will have the tools in place to identify, track, and halt its progress.

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