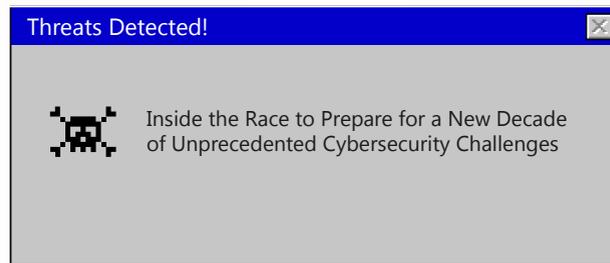


# COGNITIVE TIMES



## ALSO

### **HYPERWAR**

*THE FUTURE OF ROBOT WARFARE*

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### **DRONE RACING**

*THE SPORT OF THE FUTURE IS HERE*

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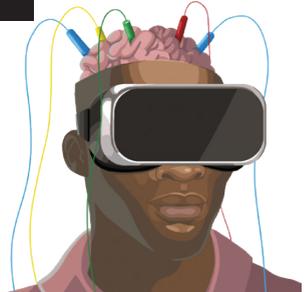
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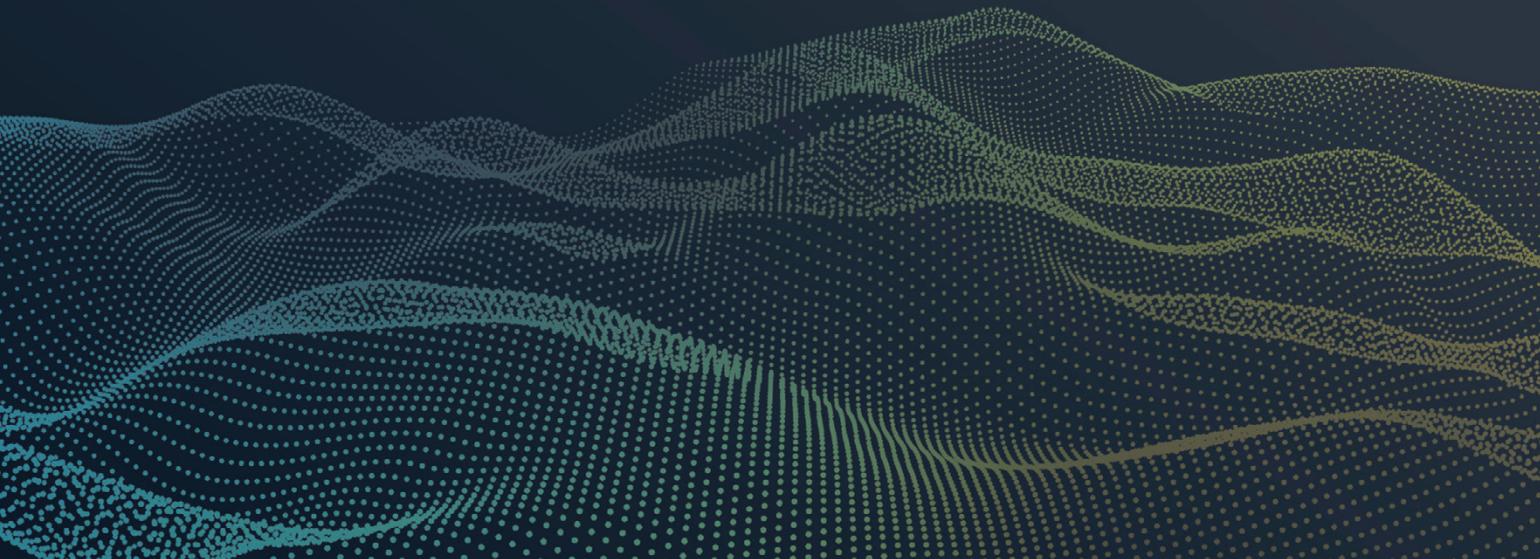
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## NOTES

# FROM THE EDITOR

**AS WE BID** adieu to the second decade of the 21st century and ring in the '20s, I reflect on the great technological advancements we have made, and many more we have yet to attain. We have made great strides in applying real AI in the real world. Beyond the many applications consumers use regularly, such as voice command, driver assistance, and home climate automation, SparkCognition and other notable organizations have been hard at work building AI technology to solve major industrial challenges.

As we predict and prevent failure of the most critical infrastructure that powers society, defend small businesses and enterprises alike from cybersecurity threats, use natural language processing to optimize maintenance operations and democratize data science with automated model building technology, we are deploying the technologies that are advancing society at a faster pace than has been seen since the industrial revolution.

We are witnessing the dawn of an AI-driven era of unprecedented opportunity, that will impact most vital sectors around the globe. And one of the most critical of these areas is defense. In this moment of apparent uncertainty, there is an opportunity to reboot the global “operating system” for global competition in the 21st century. While the technologies we build advance at a rapid pace, their adoption and deployment, specifically within the US government, still lag behind. How can we do better?

I expand on this idea in my column, Why the world needs an operating system reboot for the AI era. You'll read about that and much more in this issue as we cover the current and future state of cybersecurity and its critical role in ensuring a functioning society, the intersection of high performance clothing and technology, how artificial intelligence is helping publishers and screenwriters produce better work, and how automated model building is democratizing data science. You'll meet SparkCognition's CTO, Sridhar Sudarsan, and Greg Allen of the DoD's Joint Artificial Intelligence Center. You'll also be introduced to the exciting sport of drone racing, the leaders who are making it one of the fastest growing entertainment activities today, and their efforts to integrate AI into their activities.

We hope you enjoy this issue of Cognitive Times and wish you and your loved ones a very happy holiday season. We say farewell to the last decade with appreciation for all we have collectively accomplished and welcome the 2020s with great anticipation. These will surely be years during which we will make our future even more prosperous than our past!

**Amir Husain**

Founder & CEO of SparkCognition



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We live in a world where everything is connected. Data created from these connections, drive faster insights when acted upon at their source—at the IT edge.

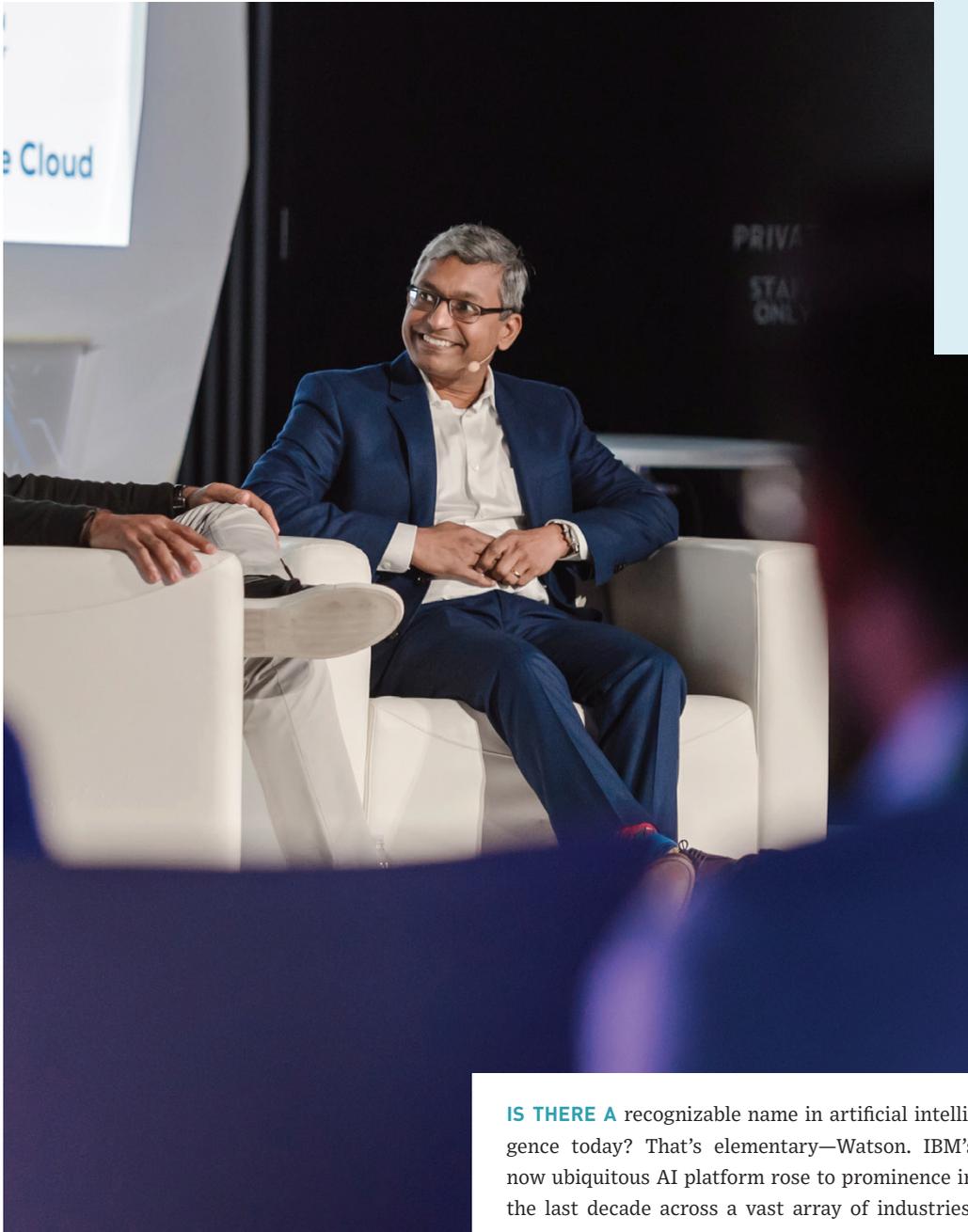
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Accelerating next



**Hewlett Packard  
Enterprise**



# /Run\_Program/

MEET THE MIND

BY NATHAN MATTISE

## SRIDHAR SUDARSAN

SparkCognition CTO

**IS THERE A** recognizable name in artificial intelligence today? That's elementary—Watson. IBM's now ubiquitous AI platform rose to prominence in the last decade across a vast array of industries. It shows up to crunch fantasy sports numbers at ESPN. It helps hospitals like Advanced Healthcare Management Corporation Healthcare in Southern California reduce the number of sepsis cases, instances where the body's infection response is in overdrive and potentially damages tissues or organs. And Watson's general knowledge capabilities have been most publicly displayed on *Jeopardy!* as the AI platform crushed trivia legends like Ken Jennings. IBM has created an industry leader, through and through.

So why would Sridhar Sudarsan—the former chief technology officer who led development and partnership strategy for IBM Watson—want to work anywhere else?

“To me, SparkCognition was about bringing and driving value to a client at speed and doing that across multiple areas,” Sudarsan, now CTO at SparkCognition, tells *Cognitive Times*. “I really gelled from a vision standpoint with Amir [Husain, CEO and founder]. The company’s vision was right in line with the kind of things I thought I could make a big difference on as well: bringing together AI, IoT [Internet of Things], and the industrial side of things.”

At IBM, Sudarsan focused heavily on increasing collaboration both internally and externally. “With Watson, we had sort of an aha moment early,” he says. “The way to best build these technologies is to invite other people to build on the core products or platform.” For Sudarsan, a startup like SparkCognition presented a new opportunity to do just that across an equally wide array of industries, but in a more nimble manner. And since joining SparkCognition in the summer of 2018, he’s hit the ground running to engage clients and potential collaborators in the name of expanding the company’s core AI offerings and their potential impact.

For instance: In September 2019, Sudarsan visited the White House as one of 175 AI leaders for an official symposium on AI in government organized by Michael Kratsios, current CTO of the United States. Experts from industry, government, and academia shared ideas and worked through real world case studies (like how the National Institutes of Health could leverage AI to improve its operations) in the name of improving the federal government through AI. And with Kratsios forecasting that government spending on AI research and development will reach new heights—nearly double 2016 levels—in 2020, real world impacts born out of those discussions could come quickly.

But Sudarsan isn’t only interested in collaborating with the leading minds in this emerging industry. Also within his first year, he worked to put SparkCognition’s Darwin AI platform (a tool that specializes in automated extraction of insights from data) into the hands of roughly 600 students. Working with SparkCognition’s chief science officer, Dr. Bruce Porter, Sudarsan helped foster partnerships with the University of Texas at Austin and Southampton University in the United Kingdom. Students at each institution received access to Darwin for 10 days in order to identify a problem of their choosing and build a solution that leveraged AI. The results impressed the new SparkCognition CTO—suddenly AI was being used to address impurities within water, to analyze the

likelihood of arrests at certain crime scenes, or to detect degrees of gene mutation and speed up delivery of test results.

“The students came up with very interesting problems,” Sudarsan says. “They’re passionate about these issues, and they were able to take giant leaps toward a solution without knowing anything about AI/ML before those 10 days. So clearly there are more problems that we need to go solve, and the day that AI becomes a central part of that without us having to think, ‘Is AI a technology I need to use?’—that’s when we know we’ve really scaled.”

All of these initiatives are part of a larger mission for Sudarsan, a veteran engineer who’s been focused on AI for the better part of the last decade. He says he originally became an engineer because of a lifelong interest in “why.” And as a young professional, he saw engineering and computer science as simply the best ways to get to the bottom of things. But once he became immersed in the field, AI became Sudarsan’s preferred tool for that exercise. These days, he wants to see that mindset spread far and wide.

“We—the industry, the country, the company—still think of AI and ML [machine learning] as a core technology, a piece of software that can make an impact,” he says. “The way I think about AI and the variety of techniques underneath it is really more as a way of thinking, a way of building, a way of understanding how to solve problems. So when it becomes a manner of normal course—when we’re not thinking about whether I should use AI or not and just doing it and instead thinking about problems—that’s when I believe we’ll have gotten to a new normal way of thinking and doing business.”

How do you go about encouraging that kind of perception change? For Sudarsan, it all comes back to how he succeeded with Watson and what brought him to SparkCognition in the first place: collaboration. If you ask him how to stay at the bleeding edge in such a fast-paced industry, it starts by interacting with others.

“I like to listen, a lot. I listen to people, I listen to their perspectives and insights, and I listen to clients,” he says. “There’s a lot you can learn from others, and there’s no substitute for firsthand knowledge and experience. I like to read a lot, too, constantly staying on top of innovations and technologies and updates. And then I like to connect. I find myself connecting the dots of various things I’ve heard, that I read, that I’m doing, or that someone wants. It’s a beautiful thing. The person who has the problem is not always the person who has the money, the tech, the skills, or has the ability to deliver that. Often the solution is right in front of us, and that’s what I try to provide.”



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INTERVIEW BY JOHN KING

# ELEVATOR PITCH

We ask an up-and-coming venture to sell us on its vision.

► <b>Company</b>	FLOWATER
.....	
<b>Home Base</b>	DENVER, COLORADO
.....	
<b>Founded</b>	2013
.....	
<b>Founders</b>	RICH "RAZ" RAZGAITIS AND WYATT TAUBMAN

## THE PROBLEM

The pollution caused by single-use water bottles

## THE SOLUTION

A seven-stage filtration and purification system that can take water from any source and remove pollutants and re-enhance water with minerals

## SPACE

We believe this technology can be used through an extensive range of industries.

## THE UPSIDE

Our infrastructure could help eliminate one billion single-use plastic water bottles by 2021—we've saved 135 million to date—and eventually eliminate single-use plastic water bottles all together. In addition, increase wellness by encouraging the drinking of purified and enhanced water as an alternative to sugary or highly caffeinated beverages.

## THE RISK

We've got to scale at the speed at which we need to scale. We have to hire the right people and do the right things. We have to show the world a new way and a better way for water. We must show consumers the absurdity of shipping water all over the place. (We drink two credit cards' worth of plastic every month in our water.)

## THE PITCH

There are very few industries that have not been completely dismantled or disrupted. Nobody has yet done this as it pertains to the water market. Take advantage of a multi-hundred-billion-dollar market.

## THE USE CASES

A huge hotel property in Southern California is saving more than \$30,000 per year by using FloWater instead of buying single-use and five-gallon jugs. FloWater is also deployed all over Oakland, California, schools, as well as 15 Urban Remedy retail stores.

## FUN FACT

Raz stayed on someone's outdoor couch in the early days to save money.

## THE FUNDING

To date, we have more than \$22 million in equity funding. Most recently came a \$15 million Series B from a company called Blue Water. That was completed in December 2018.

# Turn your security team into a security force.

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Go make it.  
We'll protect it.



# WHAT'S HAPPENING IN TECH



## WHAT'S ON YOUR MIND



Russian robotics corporation Neurobotics and the Moscow Institute of Physics and Technology have developed a way to visualize your brain activity. That's right—it can see what you're thinking. In an experiment, test subjects watched a series of 10-second YouTube video fragments showing abstract shapes, human faces, waterfalls, etc. Researchers recorded their brain activity via EEG, and fed the data through artificial neural networks, and the computer system reconstructed the actual images test subjects saw in real time. Freaky, right? (*mipt.ru*)

BY EVAN SAKRISON

## CHECK AND MATE

The Cambridge Union Society, the world's oldest debating society, welcomed a non-human participant for the first time to debate whether AI will do more harm than good. IBM's Project Debater is touted as the first AI system designed to debate humans on a variety of complex topics. How did it fare against its human counterparts? Rather than trying to outwit opponents, Project Debater helped to augment the debate by assisting two teams of human debaters, drawing from over 1,000 online submissions arguing for both sides. (*Fortune*)

## MUSICAL TRAINING

Are you a software developer with no musical ability who wants to harness the power of generative AI? Amazon's got you covered. At re:Invent 2019 in early December, Amazon unleashed a machine-learning-driven keyboard called DeepComposer. This 32-key, two-octave keyboard uses generative adversarial networks to create an original composition. Developers can train models created by Amazon or train their own ML models to create a melody. You can then upload your machine-made composition to SoundCloud. (*AWS*)

## WHEN AI MEETS RETAIL

If you didn't feel like swinging fists just to snag the best deals on Black Friday this year, you likely opted to do all of your shopping online. According to Salesforce, Global Cyber Monday sales eclipsed \$30 billion—a 13 percent increase from 2018. More importantly, AI came up strong this year. Shoppers who purchased products from AI-powered recommendations bought 12 percent more units per transaction compared to shoppers who did not. (*Salesforce*)

## JUST ASK ARI

College life stressing you out? Therapists, programmers, and research teams at the University of Southern California have been hard at work addressing its students' mental health needs. This semester, they introduced Ask Ari, an AI software that offers helpful advice to combat loneliness, get better sleep, and addresses other common challenges college students face. While not designed to replace mental health counselors, Ari will connect students to help whenever needed. (*AP News*)



**ARTWORK: MELTING MEMORIES**

BY REFIK ANADOL

*Photo from Time Machine 2019*

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Melting Memories is a data sculpture that explores the materiality of remembering through the intersection of advanced technology and contemporary art. The project enables visitors to experience aesthetic interpretations of EEG data collected on the neural mechanisms of cognitive control.

BY JOHN KING

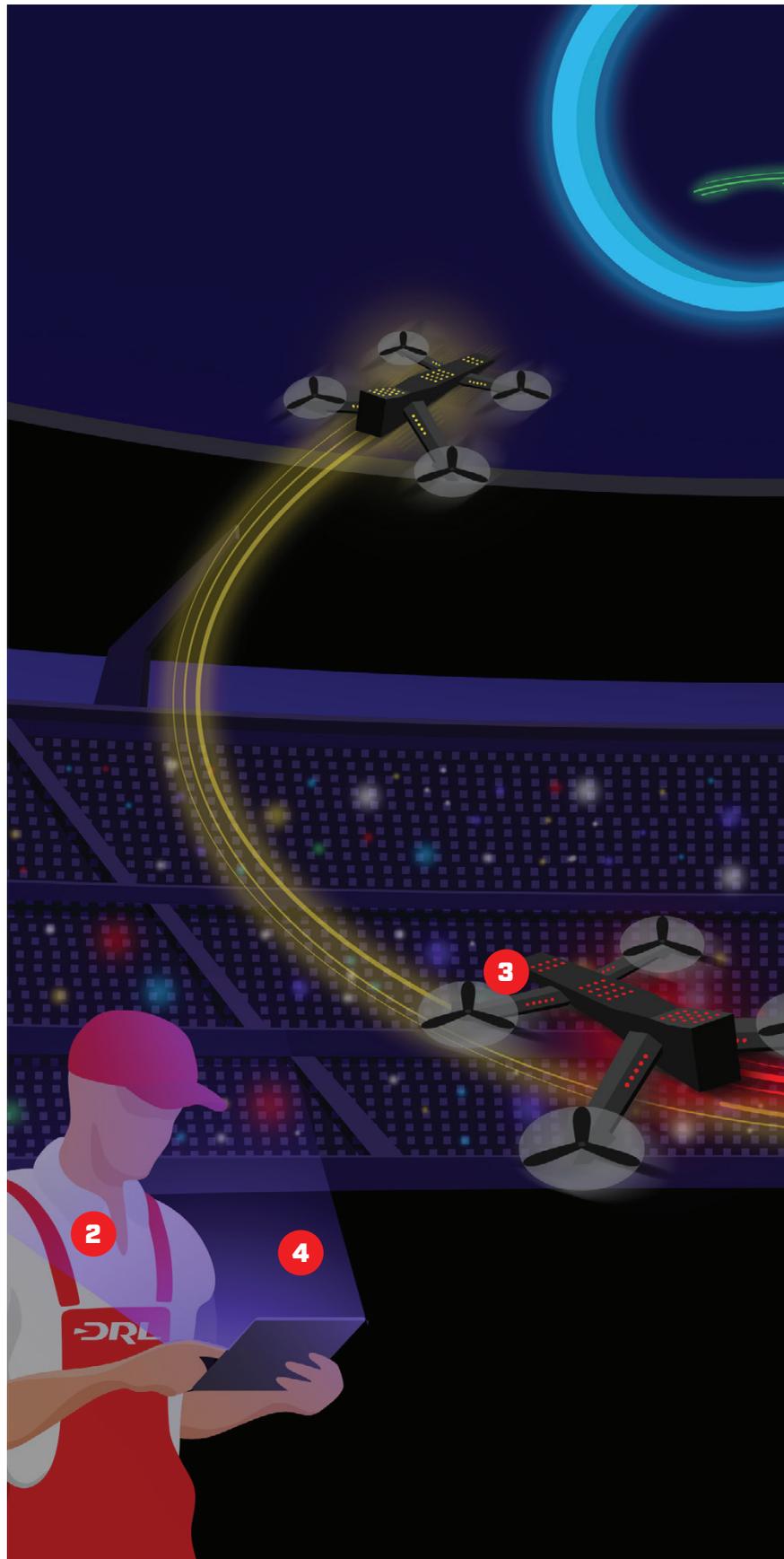
# SMART DRONES:

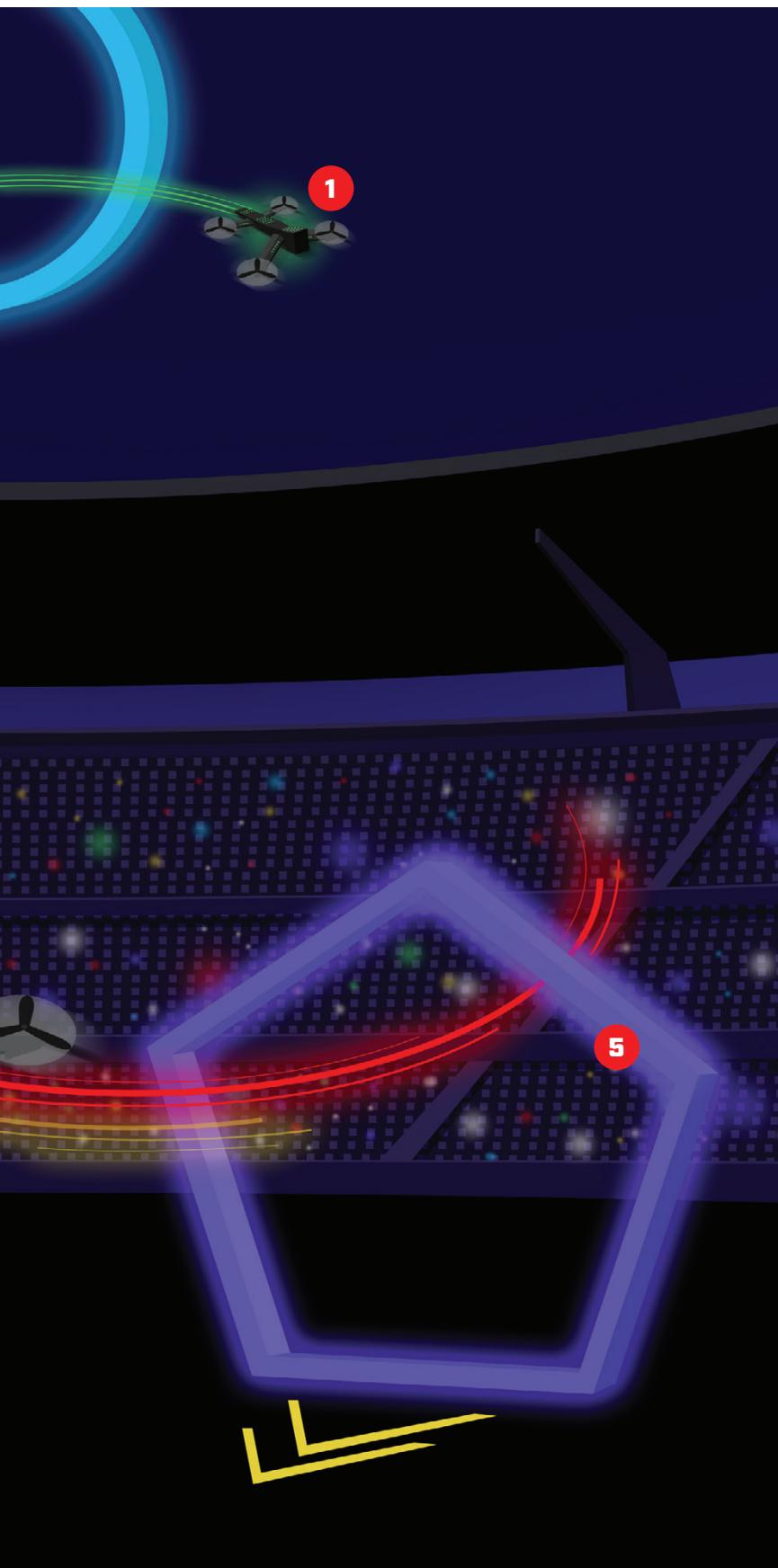
## How AI is playing the field with the Drone Racing League

What happens when you combine the thrill of pod-racing from *Star Wars* with the real-world adrenaline of Formula 1? Drone. Racing. League.

DRL is the global, professional drone racing platform. With a world-class team of technologists, event producers and content creators, DRL is helping to close the gap between AI and human performance in its new autonomous drone racing series, the Artificial Intelligence Robotic Racing (AIRR) Circuit, in partnership with Lockheed Martin.

In AIRR, AlphaPilot teams of engineers design AI for standard, high-speed racing drones that compete across unique obstacles without any GPS, data relay or human intervention. More than 420 teams, representing 2,300 innovators from 81 countries, applied for DRL's inaugural AIRR Circuit, and nine teams were selected. Through the competitive AIRR events, the DRL RacerAI drones will get faster and smarter, catch up to human competitors and, one day, outpace the best pilot in the world, marking an initial step toward a future when autonomous systems can operate in all complex flying environments, from package delivery to search and rescue missions.





**1** During DRL's inaugural 2019 AIRR Circuit, high-speed autonomous DRL RacerAI drones race through unique tracks across four events—operated only by AI. With an aim to accelerate AI innovation and the technology behind autonomous flight, AIRR tests the speed, strategy and skills of AI technology as applied to standardized DRL RacerAI drones.

**2** Customized by DRL's team of world-class drone technicians, the DRL RacerAI has a radical drone configuration to provide its computer vision with a non-obstructive frontal view during racing.

**3** Generating 20 pounds of thrust, each self-flying drone is equipped with a powerful AI-at-the-edge compute platform, the NVIDIA Jetson AGX Xavier, and is connected to four onboard stereoscopic cameras—enabling the AI to detect and identify objects with twice the field of view of human pilots.

**4** AlphaPilot teams are pushing the boundaries of AI and autonomous flight across four AIRR races this year. Each team is equipped with hundreds of DRL RacerAIs throughout the competition, helping to remove financial barriers and risk that have previously hindered innovation in this emerging area.

**5** On December 6, DRL hosted the 2019 AIRR Championship at the Austin American-Statesman in Austin, Texas. Team MAVLab, the drone research lab of the Delft University of Technology in The Netherlands, won the coveted \$1 million cash prize, sponsored by Lockheed Martin, after their drone autonomously zipped through the track at a top finishing time of 12 seconds—25 percent faster than the second-place drone.

*\*\*\*This illustration is an artist's interpretation and is not a strict depiction of a live Drone Racing League course. Certain aspects of the course have been simplified or altered. Safety is a top priority for DRL and AIRR, and technical operators would not be on the course with live drones. They pilot and repair drones behind a safety net. Uniforms have also been altered, as DRL teams wear red short-sleeve DRL jerseys with black jeans.*



mentation of it. And our mission is to accelerate the adoption of artificial intelligence into the Department of Defense.

**CT:** So how many AI initiatives right now does JAIC oversee, coordinate, work on, and then what does that future pipeline look like?

**GA:** Our two national mission initiatives that are underway right now are Humanitarian Assistance and Disaster Relief and Predictive Maintenance. And these are some really exciting programs. Just to give you a flavor of what we're up to, in humanitarian assistance and disaster relief, we are running a program to develop a suite of AI models that can automatically analyze the footage coming off drone video feeds or satellite imagery to analyze what's coming off those video feeds. In the event of a wildfire disaster, the drone flies over the wildfire area, it automatically interprets the imagery based on the AI models' analysis of that imagery to determine, OK, this is the area with active wildfire. Or this is the area where the wildfire has either burned out or has not yet touched that region yet. And then that data, rather than coming out in a series of, you know, acetate maps that are physically distributed or given updates through radio, it's actually turned into a map file that is pushed out to a mobile phone operating system to our National Guard partners in the California National Guard. That system is really exciting. There's a similar one to analyze flood imagery, mostly airborne or satellite imagery, and

BY JOHN KING

# GREG ALLEN

The chief of strategy and communications at the Department of Defense Joint AI Center says artificial intelligence offers exciting capabilities for the military's future.

**COGNITIVE TIMES:** What was the joint artificial intelligence center set up to do?

**GREG ALLEN:** We are a very new organization in the Department of Defense. We are the focal point of the DOD AI strategy, and that's actually spelled out in the strategy itself, that this organization is meant to lead the imple-



Photo by Chad Clabaugh

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to determine these are the areas of a region that had been flooded, these are the roads that are impassable in that region. So if you're trying to plan disaster response activities, you have much more up-to-date information, and that information is available much more rapidly. It's a really exciting project. In predictive maintenance, one of the areas that we're working on right now is engine glass over in the H60 helicopter. This is a problem when you ingest sand into the engine of these helicopters and when it heats up it melts. But when it cools down, it becomes this solid glass. And if there's solid glass in your engine, you're in for some trouble. And it's been historically quite difficult to know, you know, when you might be at risk of incurring that problem. And it turns out that through a combination of analyzing maintenance records and analyzing onboard vehicle sensor data, you can better predict when these types of events are going to happen. So you can move more of your costly and time-intensive, unscheduled maintenance events into your scheduled maintenance events, which are easy to account for in a budget sense and easier to account for in a scheduling sense. So that really delivers a direct impact in terms of affordability and readiness.

**CT:** How do we compare, when you look around the world to other militaries, other governments out there, how do we compare with regard to AI readiness?

**GA:** I would point you to the national defense strategy which came out in 2018, and it really reflects some of the best thinking of our experts in this area, in the Department of Defense. And it recognizes that we are in a world of renewed great-power competition. And that the sort of unattainable lead that we used to enjoy over our adversaries and potential adversaries is shrinking, and that has been happening over time. And that's certainly not a situation that we enjoy or are comfortable with. And so the national defense strategy says that we will pursue AI and autonomy technologies to preserve and extend our competitive military advantages.

I think that's exactly what we're trying to do at the Joint AI Center, is to lead in AI technology and lead in the adoption of AI technology to really bring a whole host of benefits to the Department of Defense. Whether that's sort of back-operations activities and business operations or logistics—which is very

## “ We have historically had a lot of challenges not with driving innovation but with adopting innovation

familiar in commercial industry or stuff that is, you know, very unique to the domain of national security, such as intelligence, surveillance and reconnaissance and sort of, more tip-of-the-spear-type of warfighting activities. We really believe that AI technology as a general-purpose technology has capabilities that are relevant to all of those applications. And we're very excited to get some of this stuff into the hands of more and more end users.

**CT:** What do you think that the DOD does best right now when it comes to the development of advanced technologies, specifically around artificial intelligence? And then what do you think we can and should do better?

**GA:** Well, I would say the folks at DARPA continue to do a great job. I mean, when it comes to identifying really breakthrough technologies, a willingness to accept risk, a willingness to invest, that all continues to go very well. And there's a lot of exciting work at DARPA's third-wave AI initiative, including some stuff that is of interest to the JAIC. But where we have historically had a lot of challenge is not so much with driving innovation but adopting innovation, and ensuring that technologies, whether they come from commercial partners or whether they come from DOD research institutions, ensuring that those capabilities actually get into the hands of end-user communities in a timely fashion. And I think the sort of challenge of technology adoption, and especially AI technology adoption, is really one of the core reasons for the DOD AI strategy and for the formation of the JAIC as an organization.

**CT:** What do you love most about what you do at JAIC? What is it that you love most about your work and the mission of the organization?

**GA:** The most exciting thing is delivering capabilities for our end users and seeing the excitement that they have to test our capabilities on an interim basis and how excited they are to actually use the stuff that we're working on. I mean, we exist to deliver mission impact and talking to our end-user communities and hearing about their feedback and the systems that we're developing. That's tremendously exciting. Especially when it's such an advanced technology. I will say we also have some very brilliant technologists at the Joint AI Center and watching them work is a privilege.

INTERVIEW BY JASON HEID

# NICHOLAS HORBACZEWSKI

&gt; CEO and Founder

*The Drone Racing League*

## Industry

*Sports*

## Location

*New York City*

## Education

*Harvard University (Bachelor's, Master of Business Administration)*

## Previous Gigs

*Bain & Company, Blauer Tactical Systems, ADS Inc., Tough Mudder*

## On What Inspired the Drone Racing League

The first time I saw drone racing, I was just blown away. I thought we should be sharing it with more people. It just seemed like an amazing vehicle to put a new and exciting form of technology out in the public in an exciting way. At the time, I think people were trying to figure out how to think about drones, and when you bring them in a sporting context, you kind of sit back and enjoy all the excitement without having to interrupt it with all the broader questions associated with them.

## On His Proudest Moment

One of my proudest moments at DRL was the very first true race we ever did. We

did some experiments that went pretty poorly, to be honest, in the earliest days. The first time we did a race, which was at the end of 2015 in Dolphin Stadium in Miami, we designed this very elaborate course line, and we flew a drone through that entire course line. Through the tunnels under the stadium, to the concourses, to the bowl, and it flew the whole line. And it was just an incredible moment. That was just a really satisfying feeling, and it's about setting the ambitious technological goal and achieving it.

## On How AI Will Change the World

I'm one of the true believers. I think it's going to change the world in every way. I think, specifically, the type of AI that we focus on here around computer vision and autonomy. You already see the power that gives. When we equip any form of remote robotic system with the ability to perceive the world the way we do, through stereoscopic cameras, and understand and navigate its environment, you are going to transform all the incredible things that we do right now. That's going to be a total evolution to what's possible and what we can do with technology and how we interface with technology on a daily basis.

## On What Makes a Great Business Leader

Running a professional sport now, we think a lot about what makes a world champion. I actually think there's a lot of overlap with what makes a great business leader. I mean ultimately all of our pilots are highly skilled, very dedicated. But the champion is typically the one who really can demonstrate calm under pressure. As situations get more complicated or difficult for them on the race course, they don't let that affect their flying. And I think the same is true in business. I mean a lot of what you're doing, in a leadership role, is having challenging situations thrown at you, having things elevated to you, and you have to maintain a level of clarity and really zone in on what's important.

## On His Ultimate Goal For DRL

We're building the sport of the future. We want to build a sport that engages a whole generation of people whose passion is really around technology—build a sport and really giving something authentic and relevant to them. So our passion, as we build out this league, is we take it global as we show the world drone racing, and we introduce young people to the STEM skills necessary as they're designing and building drones.



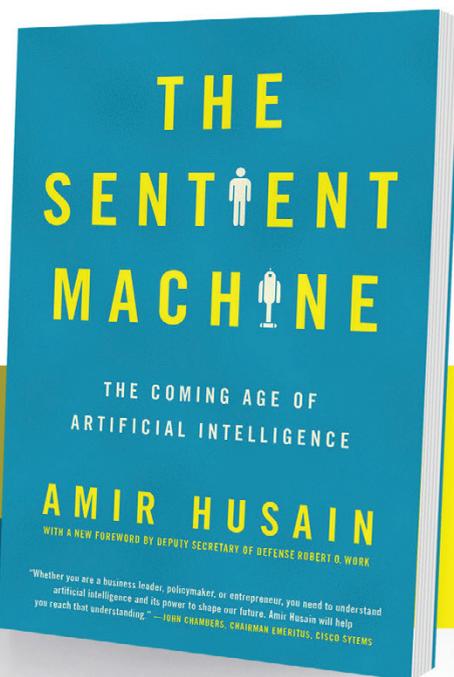
“In *The Sentient Machine*, Amir Husain applies his brilliance to explaining the enormity of the implications of artificial intelligence, but does it with the skill of a mentor guiding his protégés to greater understanding. As it is emerging, AI may be the most profound force shaping every dimension of human existence in the twenty-first century. In this landmark book, Amir Husain lays bare not only the science of AI, but the many sectors in which AI will find a prominent role: from health care to warfare, where Mr. Husain is one of the leading theorists on the emerging concept of hyperwar . . . warfare in the era of AI. *The Sentient Machine* is a must-read for all those who will live with the realities of the ‘AI Century.’ ”

## GENERAL JOHN R. ALLEN

U.S. Marine Corps, Retired  
Former Commander, NATO International Security Assistance Force and U.S. Forces Afghanistan

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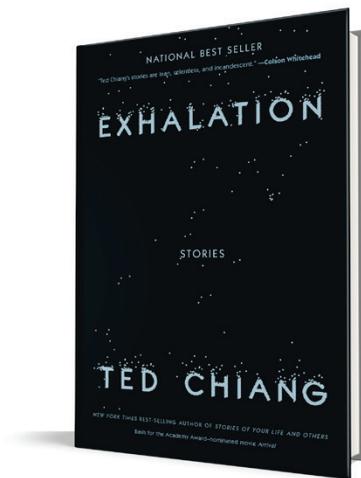
BY EVAN SAKRISON

# ROBOPOP

All the best AI-centric entertainment from 2019, from a groundbreaking e-sports event to the return of everybody's favorite cyborg

**AS ARTIFICIAL INTELLIGENCE** becomes less like science fiction, and more a part of our modern reality—"Alexa, play the *Tron* soundtrack"—pop culture is progressing, too, portraying AI less like an existential threat, and more like something fundamentally entwined with our everyday existence, in ways both good and... less good. This year, three particular moments stood out as beacons of progress and are worth celebrating before we enter a new decade.

Back in April, a team of AI bots known as OpenAI Five threw down against the world-champion OG team in a highly anticipated *Dota 2* matchup in San



“

Listed as one of the 10 best books of 2019 by *The New York Times Book Review*, Chiang’s collection tackles a wide variety of exciting topics, including AI. One of his stories, “The Lifecycle of Software Objects,” originally published in 2010 and included in this collection, follows a former zoo trainer who’s hired to train AI-powered digital creatures called digients.

San Francisco. In case you’re unfamiliar, *Dota 2* is a complex strategy game with a large e-sports following—including professional leagues and tournaments around the globe—and has been used in several machine learning experiments. Winning two back-to-back matches, OpenAI Five became the first AI team to beat world champions in an e-sports game.

This is big news, harking back to 1997 when IBM’s Deep Blue chess-playing computer defeated world champion Garry Kasparov. While both stunning accomplishments, OpenAI Five’s triumphant victory is especially unique because of *Dota 2*’s overall complexity. It happened in a five-on-five setup rather than one-on-one. There were hundreds of items within the game that are essential to team strategy. And the game was played in real time, rather than on a turn-by-turn basis. All of these factors add to the insane number of possible outcomes, which makes OpenAI Five’s win that much more significant.

Over in Hollywood, the obsession with sequels, reboots, and all-powerful AI continues, so it’s no surprise that the mother of all AI film franchises returned to theaters this fall. *Terminator: Dark Fate* reunited Linda Hamilton (as hardened warrior Sarah Connor) and Arnold Schwarzenegger (as Model 101, aka T-800) for the first time since 1991’s *Terminator 2: Judgment Day*. This time around, Skynet has fallen, a new AI menace known as Legion has taken its place, and a bloodthirsty terminator prototype called the Rev-9 is sent back in time to wreak havoc.

In other words, while much has changed, much remains the same.

What’s important about this installment is the evolution of the T-800 character. In the 1984 original, the T-800’s sole mission was to terminate Sarah Connor to prevent the birth of the future leader of the Human Resistance. In *Dark Fate*, without spoiling too much, the T-800 has now integrated into society and goes by the name Carl. He has a wife and stepson and a drapery business in Texas and makes his own choices without Skynet’s influence. It’s a fascinating portrayal of AI becoming more human, and is a far cry from the days of being a homicidal “cybernetic organism; living tissue over a metal endoskeleton,” as the Terminator described himself in *T2*.

As for literature, renowned science fiction author Ted Chiang—known for “Story of Your Life”—released a collection of nine short stories called *Exhalation*. Listed as one of the 10 best books of 2019 by *The New York Times Book Review*, Chiang’s collection tackles a wide variety of exciting topics, including AI. One of his stories, “The Lifecycle of Software Objects,” originally published in 2010 and included in this collection, follows a former zoo trainer who’s hired to train AI-powered digital creatures called digients. It’s a thoughtful, touching story that unfortunately seems to have flown under the radar of many readers.

Unlike countless stories grounded in technophobia and the Frankenstein complex, “The Lifecycle of Software Objects” refreshingly examines the feelings of obsolescence, attachment, and abandonment that come with any relationship, including the ones we have with our AI avatars. We wish the entertainment industry offered more works like it—stories with a thought-provoking spin on sophisticated technology that don’t involve slaughtering humans—and we’re thrilled that such original and insightful writing appears on such a notable year-end Top 10 list.

BY CARA SCHWARTZKOPF

# A TECH-SAVVY TO-DO LIST



Illustration by Lewis LaRosa



## CES 2020 (Consumer Electronics Show)

JANUARY 7

The annual show where companies and consumers gather in Las Vegas and bet big on new technologies, from smart devices to blockchain and 5G to... see-through cars?



## Bloodshot

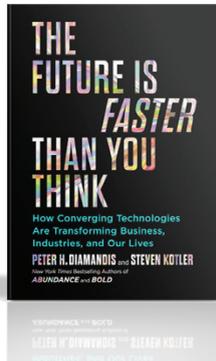
FEBRUARY 21

In this superhero film based on the bestselling comic book *Bloodshot*, Vin Diesel plays the marine Ray Garrison, who is resurrected and enhanced with nanotechnology—becoming a biotech killing machine.



JANUARY 28

*New York Times* bestselling authors and futurists Peter Diamandis and Steven Kotler investigate how exponentially accelerating technologies like AI, robotics, and blockchain will impact our daily lives and society as a whole.



## Groundhog Day

FEBRUARY 2

If you're the type to get your weather forecasts from animals and their shadow, we have a holiday for you! Celebrate the 180-year old tradition in which scientists, politicians, and rational adults look to a groundhog to predict the end of winter.



## RSA Conference 2019

FEBRUARY 24-28

Top cybersecurity leaders come together for one of the leading industry conferences, featuring over 500 sessions with over 700 speakers, including Dr. Peggy Whitson, a record-breaking NASA astronaut.



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20



20

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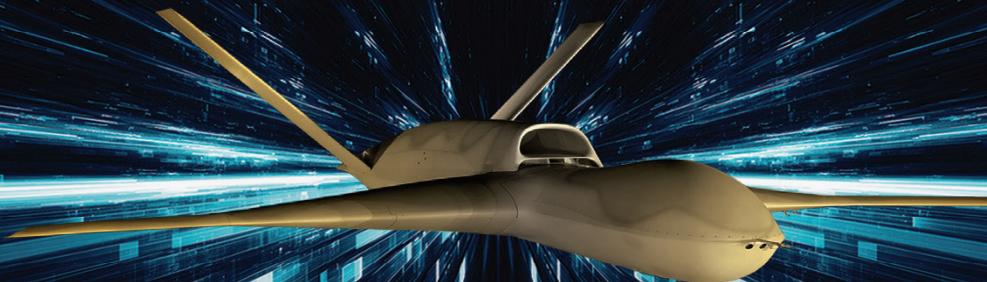
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# HYPERWAR

CONFLICT AND COMPETITION IN THE AI CENTURY



AMIR HUSAIN ■ JOHN R. ALLEN  
ROBERT O. WORK ■ AUGUST COLE ■ PAUL SCHARRE  
BRUCE PORTER ■ WENDY R. ANDERSON ■ JIM TOWNSEND

## WHAT PEOPLE ARE SAYING ABOUT THE BOOK

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*"'Hyperwar' doesn't just admire the problem of AI-fueled warfare, it offers concrete approaches to help U.S. policymakers and our allies prepare. It is a 'must read' for all humans seeking to be 'in the loop or on the loop' before these technologies outpace our capacity to make ethical, strategic and secure decisions about our future."*

—AMBASSADOR VICTORIA NULAND  
CEO, Center for a New American Security

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# Hard Reset

Why the world needs an operating system reboot for the AI era—led by America



**Just as dawn** is breaking on an AI-driven era of unprecedented opportunity, a worldwide recoupling from the American-led strategic and economic architecture is underway. While this is a major shift touching many vital sectors, right now it is most critical in defense technology. In this moment of apparent uncertainty, there is an opportunity to reboot the global “operating system” for global competition in the 21st century.

To further draw upon tech-industry parlance, holistic economic and technological development models, and the value chains with which they integrate, are the new geopolitical “killer app” for the coming decades. The country that becomes the preeminent developer of these models stands to benefit via the network effects of “locking in” much of the world to the platform of its construction. This is a phenomenon not unlike the sale of an iPhone, which leads to purchases of iPads, Macs, iTunes, and countless apps on the App Store. Much like in a tech ecosystem, these geopolitical killer apps tilt the world toward hundreds of underlying systems, technologies, standards and practices defined by the “platform developer” nation-state.

Yet leaders in Washington continue to struggle to end America’s techno-conservatism, especially when it comes to defense. American export policies generally seem to suggest that the path to leadership requires us to hang on to every military technology advantage we can possibly keep to ourselves. The U.S. export regime has been one of the strictest globally, as staunch allies like Japan found with the

not-for-export F-22 Raptor. This approach partially worked in maintaining our military edge, especially during those few decades when American weapons were really the only game in town. But it also had unintended consequences that will become increasingly problematic.

## OS Design for Engagement, Not Conflict

Today there are massive incentives for would-be buyers to move away from American technology. Our export controls, ITAR (International Traffic in Arms) regulations specifically, have unequivocally become swear words even in allied states. And as it has played out, America keeping technologies close to its chest for as long as it did only meant that when those technologies ultimately proliferated, the goodwill, profits and influence all went to a competitor.

Take drones. After 9/11, many states allied with America, including Saudi Arabia, the UAE, Jordan, Pakistan, Iraq, Turkey and others, made requests for the low-speed, medium-altitude Predator drone. It’s a useful platform for light strike and surveillance, but nothing that would pose a threat to the U.S. even in a worst-case scenario. Despite the tactical—not strategic—nature of the system, these requests were all refused. Fast-forward a few years, and today each of these countries either use Chinese drones and/or have built their own credible capabilities. All the navigation, autonomous flight and computer vision data that could have been used to improve American products is now instead being used to improve Chinese systems. Furthermore, it is Chinese

**BY AMIR HUSAIN**

and Russian experts in these new unmanned and AI-influenced capabilities who are forging friendships with military officers in each of these countries, not Americans.

Further fault lines in the fracturing 20th-century U.S.-led Western security architecture took center stage at the Paris Air Show in July, when longtime American allies rolled out plans to produce their own cutting-edge weapons systems rather than relying on Washington. For example, NATO member Turkey, a key partner on the U.S.-led Joint Strike Fighter program, pitched its own stealth fighter concept after feeling Washington's sting for having sought out Russian S-400 surface-to-air missiles. France and Spain rolled out a mock-up of Europe's most sophisticated AI-enabled fighter yet, even as Washington prepares to turn the screws on European governments in an attempt to help U.S. firms sell into a renewed continental defense. And while not as sharp as the air show's more sci-fi warplanes, regular demo flights of a traditional joint Pakistani-Chinese fighter underscored Beijing's growing influence on the defense industrial landscape.

Even with these signs of defense-industrial security recoupling as potential sources of friction for American administrations, the goal of such a defense "operating system" is engagement, not conflict. Moreover, as tech-sector leaders have found, if you want to build a popular platform, you must be more tolerant, inclusive and patient. You must engage, even with competitors. What building massive traffic on software-driven platforms has taught the technology sector is that being open to diverse perspectives, opinions and even staunch opposition is key to fostering broad adoption. If Amazon told Netflix that it wanted to launch its own video service and therefore Netflix was no longer welcome to use the Amazon Web Services (AWS) hosting service, perhaps Amazon wouldn't be the juggernaut it is today.

## Technology and Security Reforms for the AI Era

U.S. policymakers and industry need to consider whether America is doing enough to invest in global leadership in AI, as well as in related, strategically vital technologies such as robotics and data science. It is inevitable that many of Washington's allies in Europe and Asia will take advantage of the globalizing defense industrial and technological landscape, whether they're lured by China's low-priced 5G internet gear or by readily exportable armed drones. Moreover, current policies in Washington risk alienating allies, at the very moment when they are most susceptible to a new wave of easily acquired, strategically relevant technological breakthroughs. This includes new innovations in machine-to-machine communication, as Huawei 5G systems portend, or in waging war, as seen in sales of Cai-Hong armed drones to longtime U.S. partners like Saudi Arabia.

First, the U.S. needs to use our technological capabilities not just as a military advantage to hold on to until it is nearly obsolete, but to accelerate trade and create opportunities for global commerce and collaboration.

Second, we need to massively increase our investments in military and commercial development of exponential technologies. This list includes AI; robotics and autonomy; space technologies; hypersonic weapons; biotechnology and genetics; quantum computing; 5G+ low-latency communications; materials sciences; electric propulsion for sea, land and air; nanotechnology; fourth industrial revolution technologies, including increasingly sophisticated additive manufacturing and many more. Part of this increase in investment will come from direct grants to universities, and increases in budgets for research-oriented organizations such as NASA, DARPA and the National Labs. Part of it comes about when the government—particularly the Department of Defense—solves its many deeply rooted, systemic issues and becomes a responsible, fast-moving buyer and purveyor of American technology. The current system of acquisition for most of these technologies lacks credibility; it is a true strategic vulnerability.

Third, rather than worry about playing a defensive game vis-à-vis access to U.S. labs and universities, America needs to go on the offensive with engagement. There are numerous universities, labs and institutions all across Asia and Europe with whom collaborations will be worthwhile. The goal should not be to prevent students from any country from coming to the U.S., but rather to foster reciprocity: You can come here and learn, and we would like to go to your universities to learn. This omnidirectional academic engagement will lessen surprise, increase healthy interdependence and create opportunities for American students to widen their horizons. Good ideas come from everywhere, and the relationships between American students and their international counterparts are truly strategic, long-term investments.

Fourth, the U.S. needs to increase its investments in programs such as the global network of USIS (United States Information Service) libraries and similar programs and institutions. The USIS centers were inexpensive, yet tremendous, instruments of American soft power. Their reach and number have diminished in recent years. Giving people in developing countries a glimpse of a friendly, engaging, technologically advanced America—an America that is sharing its knowledge with them—is valuable beyond words. The Chinese, ironically, attempted to replicate this approach with their Confucius Centers, but this has received quite a negative backlash in the U.S. But instead of worrying about such centers, the conversation should focus on how many USIS centers are active in China and across Asia, and how many citizens in those countries can have access to and experience a real glimpse of America firsthand.

Long the only game in town, America now faces competitors that have demographic heft and economic potential that may be greater than its own. As such, it is high time to adopt strategies that are better adapted to the strategic, political and economic dynamics of the AI century. The U.S. must become the ultimate platform developer as it once did before, but for a new global "OS" for a software-driven world.



# Tiny Warriors

The future of robot warfare is here, and you can hold it in your hand.

**When Xi Jinping**, China's president and chairman of the powerful Central Military Commission, presided over Beijing's historic military parade to commemorate the 70th anniversary of the founding of the People's Republic, pilotless Sharp Sword stealth jets and autonomous submarines signaled progress in the development of robotic forces of the future. Yet as impressive as these hardware breakthroughs might seem at first glance, the actual future of robotic forces looks far different. They will be smaller, cheaper, and even more networked than those that

today's defense-industrial assembly lines churn out at a cost of tens or hundreds of millions of dollars.

**BY AUGUST COLE**

To see a preview of what SparkCognition CEO Amir Husain and retired General John Allen call "hyperwar," or the AI-driven evolution in armed conflict where machine-speed decisions and swarms of small robots, like Unmanned Combat Aerial Vehicles, perform missions once left to fighters or tanks, consider Lady Gaga's 2017 Super Bowl performance of the national anthem. The singer was accompanied by a backdrop of

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300 synchronized small electric drones powered by Intel. Think too of a Disney World night-flight demonstration at Christmastime, or the 2018 flight of 1,374 Ehang Egret drones over Xi'an that broke the Guinness World Record that year (since surpassed by Intel with 2,018).

“Truly autonomous UCAVs of a variety of types and sizes with onboard synthetic intelligence will be the foot soldiers in a future hyperwar,” wrote Husain and Allen in their 2017 article “On Hyperwar,” in the U.S. Naval Institute’s *Proceedings* magazine. “Models the size of commercial quadcopters capable of weaving through forests and racing across open fields will assemble, act, and dissipate in no time.”

Indeed, today’s military robots are still in their first generation. A notable trait is that they depend on physical form more than AI-powered software to accomplish missions. While software is essential and will drive innovation in military robotics more and more, the real breakthroughs yet to come will be found in truly innovative systems that break the mold of what military hardware is supposed to look like.

While smaller quadcopters or wheeled drones lack the visual presence and constituencies that lend themselves to People’s Liberation Army-style military parades, they represent the future. They are cheaper, networked, and resilient in ways that traditional platforms are not. Right now there is a global proliferation of radars like Russian S-400 series missile systems that can strip away the stealthy advantage of advanced fighters and sophisticated IEDs and high-tech anti-armor missiles that can reduce main battle tanks to scrap.

Bigger is not better in the “Hyperwar” era, and in fact, it may be a liability. Moreover, from an attacker’s point of view, unconventional combinations of swarms and traditional weapons already offer asymmetric advantages to attackers. The September attack on Saudi Aramco fields reportedly by a mixed force of aerial drones and cruise missiles underscored the shift toward new tactics using swarms. Several explosive-armed drones targeted Venezuela’s president, Nicolas Maduro, at a Caracas military parade the year before. Iran’s military is reportedly experimenting with small wheeled anti-tank drones, called Heidar-1.

With a focus on physical form, the defense-industrial landscape remains oriented toward building expensive robotic systems. Yet as China and Western militaries develop their own advanced robotic systems for air, land, and sea, it is worth remembering an enduring maxim from legendary Lockheed Martin defense executive Norm Augustine, in his book *Augustine’s Laws*.

In 1984, at the peak of costly Cold War aerospace engineering during Ronald Reagan’s presidency, Augustine wrote, “In the year 2054, the entire defense budget will purchase just one aircraft. This aircraft will have to be shared by the Air Force and Navy

3.5 days each per week except for leap year, when it will be made available to the Marines for the extra day.” This risk remains real.

Platforms like DARPA’s “gremlins” aerial drones offer a different future. The gremlin concept is based around a small jet-powered drone with a 150-pound sensor payload that can be dropped from a “mother ship” transport aircraft and recovered in mid-air. It is designed to operate in swarms alongside conventional fighters like an F-35 Joint Strike Fighter, the Defense Department’s most expensive weapons program ever at over \$1 trillion, but it represents a very different kind of investment. “The gremlins’ expected lifetime of about 20 uses could provide significant cost advantages by reducing payload and airframe costs, and by having lower mission and maintenance costs than conventional platforms, which are designed to operate for decades,” DARPA said in a recent update on the program.

Another DARPA swarm program is focused on ground forces—the “OFFSET” initiative. This envisions up to 250 small drones supporting urban operations by infantry units. The U.S. military is acutely focused on operating in the world’s densest and most populous cities, an environment it is going to be using robotic systems to help navigate. What is also unique about this effort is that it is not wed to one specific technology or even form factor. Rather, it is a consideration of what combination of software and hardware can accomplish the mission. Timothy Chung, DARPA program manager, said in a video message to potential industry and research partners that “we’re interested in component technologies which will help manifest new swarm capabilities, perhaps through enhancing individual agent platforms whether air or ground.”

There are actually even smaller military robots in service today, though they are not used in a swarming manner. The smallest in the U.S. arsenal is the palm-sized FLIR Black Hornet aerial scouting drone, which made its name as a tool for Western special operations units to spy on targets. But the Army is ordering some 18,000 of the one-ounce micro-copters for regular infantry forces. Small drones have advantages in that they are harder to target with conventional defensive weapons like surface-to-air missiles and can hide in dense areas like forests or urban neighborhoods.

Of course, diminutive designs have limits. Battery power is one of the biggest. A large jet-powered Northrop Grumman Global Hawk, with the wingspan of a 737, can remain in the air for over a day at a time, but the electric Black Hornet, for example, can fly only about 25 minutes before it needs to recharge.

When a swarm of such small drones features prominently during a national military parade in China or another nation remains to be seen. But, as the recent investment and testing shows around the world, that moment is not far off.



# Connected Clothes

Smart shirts, like those produced by Hexoskin, could help save lives with better and quicker health monitoring.

**When Roxanne Vogel** stepped back into her Berkeley, California, apartment just before midnight on May 24, she had been away for almost exactly two weeks.

During that 14-day stretch, she'd made her way to Nepal, summited Mount Everest, and returned home. Most journeys to climb the world's tallest mountain require at least two months. Vogel managed the feat in a single pay period.

Along the way, she was wearing an innovative smart shirt that continuously recorded her heart rate, blood pressure, breathing rate, blood oxygen levels, and more. Once she was home, after she unpacked her parkas and sleeping bags and climbing tools, she uploaded hours of health data. The information gathered

from Vogel's Everest science project wasn't just meant to benefit the training of elite athletes. It could one day lead to connected clothing becoming as common as an Apple Watch.

Vogel's setup was built by Hexoskin, a Canadian company that has been studying how to capture robust health data for more than a decade. In 2013, it introduced the first wearable smart shirt, featuring sensors that measured cardiac and respiratory rates. Hexoskin has tested its clothes in the most extreme conditions, including a trip to Antarctica and a journey into space. Yet its ultimate focus is closer to home.

Hexoskin believes wearables are the key to the future of managing health. When we get sick today, our options are pretty much

**BY JEFF BECKHAM**

the same as they've been for decades: go to a doctor's office or hospital. Efforts like Hexoskin's open the door to remote care of chronic diseases, letting patients rehabilitate at home.

People with lung diseases like COPD, for example, need to be monitored more closely when they have a coughing fit and begin to feel out of breath. This spike in lung function is typically measured in a lab with a face mask and computer, but the symptoms often present themselves initially in everyday activities like climbing stairs and doing housework. A comfortable shirt sporting sensors that track your vital signs and relay that information to your doctor has the potential to save lives.

The intersection of wearables and health care offers an enormous business opportunity. Worldwide shipments of wearable devices should reach nearly 223 million this year and top 300 million by 2023. More than half of those are dedicated to personal fitness or biometrics, with others intended for gaming, work, and medical monitoring. The future of health care has also drawn the attention of giants like Google, Apple, Amazon, and IBM.

Hexoskin has been in the game since 2006 and believes it has a significant head start on even its largest competitors. Its Smart Kit, available for \$499, comes in men's, women's, and junior sizes with 30 hours of battery life (an Apple Watch has 18 hours of battery life) and the capacity to store and forward 600 hours of raw data. Accuracy is one of the company's points of pride as well. Its website lists more than 70 independent studies that validate its data.

That accuracy drives Hexoskin's secret weapon: its connected health platform powered by artificial intelligence. While having access to lots of information is helpful in developing machine-learning algorithms with health data, it needs to be accurate as well.

"The raw data that comes from the shirt also carries a lot of noise," said Romain Lafargue, a marketing and business development coordinator at Hexoskin. "So we built an algorithm to filter out the sound and convert the electrical signals into heart rate and other cardiac metrics."

The platform was the first stop for the data Vogel collected on herself during her Everest expedition. She was wearing an advanced model called the Astroskin, which includes a headband to measure blood oxygen levels along with materials and sensors tested to perform in the harshest conditions. (Astronauts from several countries are testing the garments aboard the International Space Station.)

Other than changing out a pair of AA batteries every 48 hours, Vogel said she hardly noticed the Astroskin as it collected enough data to require hours of uploading once she was back in California.

"I had seen that they used it in Antarctica previously, so I knew it was capable of functioning well in cold temperatures. And I knew that they used it at the space station, so I knew that it worked for what it needed to do," said Vogel, who plans to publish initial summaries of her research on how the body responds to rapid changes in altitude later this year. "Just the idea of being able to capture all of that data without having to stop and take individual readings was really appealing to me."

It's easy to see how that would be appealing to people in our everyday lives too. Within the next decade, we'll be surrounded by a network of connected clothes, glasses, jewelry, shoes, and more, finding ourselves at the center of a network of information about us. We won't even have to go to Mount Everest to make it happen.



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ILLUSTRATION BY ALEX BERGER



THE  
**HITMAKERS**

*StoryFit and Slated are using data and technology to help producers determine what movies will be a big hit at the box office.*

*by Jeff Beckham*

# “NOBODY KNOWS ANYTHING.”

Those three words, from Academy Award-winning screenwriter William Goldman, tell you a lot about the entertainment business. Or at least they used to.

“Not one person in the entire motion picture field knows for a certainty what’s going to work,” said the writer of *All the President’s Men* and *Butch Cassidy and the Sundance Kid*. “Every time out, it’s a guess, and, if you’re lucky, an educated one.”

His words apply to just about all forms of entertainment. The formula for assuring a work of art will achieve commercial success has remained a mystery.

It’s a mystery, however, that could finally be solved by artificial intelligence. Perhaps an algorithm will help produce the next movie you see at the theater or publish the next book you pick out to read.

That’s what a pair of companies are hoping as they use AI and analytics to help the people who create movies, books, and television shows make better decisions about which proposed projects are likely hits.

Slated and StoryFit use machine learning to give producers better information. Both companies work with publishers, studios, networks, and film financiers to inject data-driven decision-making into industries that have long relied on judgment calls and gut feelings.

## CREATING BETTER SCRIPTS



Each company offers guidance on scripts in progress, but with slightly different approaches.

Austin-based StoryFit focuses on core narrative elements that have been proven to resonate with audiences. The company looks for more than 100,000 factors within a book or script, then compares those to its catalog of more than 35 years of similar material. The result is a report highlighting the proposed project’s best features, like strong dialogue or relationship building, while pointing out areas that need work, like a character that doesn’t connect to the rest of the story.

By highlighting the unique qualities of each script, StoryFit takes some of the risks out of movie executives’ decisions. Filmmakers can then focus on highlighting the best parts of a particular story while minimizing its flaws.

Slated, based in the heart of the film industry in Los Angeles, expands on the traditional “coverage” step of screenplay production to create its own measure of a script’s creative value. Coverage is like a book report for a screenplay. It’s a write-up that includes a summary of the plot and an evaluation of key elements like characterization, storyline, premise, and dialogue. Production companies hire script readers who do coverage; then executives use that to make decisions about screenplays.

By adding a scoring system to the coverage stage, Slated digs deep into 11 specific attributes of each script, including premise, originality, logic, tone, and craft. Three people trained in Slated's methodology read each script, write a paragraph about each attribute, and score it on a 1-5 scale. Each script emerges with a Script Score along with an overall Pass/Consider/Recommend rating.

Slated President Jason Scoggins created an early version of the Script Score at his previous company and has heard criticism from creative types that their work is being reduced to a number.

"We used to hear that fairly frequently," he said. "But the product that we're delivering is not just a number. It's what amounts to 12 pages of notes from three different readers stating their opinion and defending it. Basically, north of 99 percent of writers go, 'Yep. While I don't necessarily agree with every single one of these comments, I can at least respect that it's someone's opinion because it's so completely defended.'"

Monica Landers, CEO of StoryFit, got a similar reaction when the company first began showing its reports to studios.

They were defensive when first hearing the idea, but the results changed their minds.

"I did get that pushback before. But I have never heard that after we've delivered our information to someone," Landers said. "We are here to support the process and just do something that they can't do. This level of technology is not going to exist in a media company right now, and so we just want to deliver something that maybe they can't do to help support their process."

#### FINDING HIDDEN GEMS



Just as technology can help at the beginning of the production process, StoryFit has also found a way to contribute *after* a work has been released. Landers said they're drawing a lot of attention from clients in the publishing industry who have huge backlogs of material but no good way of bringing them back to the public's attention.

It turns out that AI is well-suited to this task. By scanning

**MONICA LANDERS // CEO, STORYFIT**



**THIS LEVEL OF TECHNOLOGY IS NOT GOING TO EXIST IN A MEDIA COMPANY RIGHT NOW, AND SO WE JUST WANT TO DELIVER SOMETHING THAT MAYBE THEY CAN'T DO TO HELP SUPPORT THEIR PROCESS.**

the text of the story, StoryFit uses natural-language processing to pull out the key elements important to readers. That includes not only genre, plot, and characters, but also nuanced details like time period, settings, and tone. They then filter the resulting list of keywords through Google Trends, Amazon best practices, and even dictionaries to create a marketing guide that publishers can use to promote similar titles.

For example, when the Broadway hit musical *Hamilton* stormed pop culture in 2015, publishers were sitting on tons of previous books (or even chapters of books) about Alexander Hamilton and the Founding Fathers. But they rarely had the in-house knowledge or a reliable database to locate them all. StoryFit uses metadata technology to find all of these related mentions, giving publishers' existing material new life.

"What this means is that IP (intellectual property) isn't dead once it's published and has been out for a couple of months," Landers said. Imagine a new paleo diet cookbook being created by pulling recipes from previously published material, or textbooks that ensure all the material matches a particular reading level. "It means you can pull stories out of the past. You can put a new cover on it, and if the IP is fully owned, you can mix and match."

## IMPROVING FINANCIAL DECISIONS

◆◆◆

But even the best stories won't find an audience if there isn't money behind them. And investing in movies, particularly independent productions, can be a dicey proposition. Scoggins believes Slated has found an effective way to match filmmakers and their projects with film financiers who can push those projects forward.

Slated's scoring system judges the strength of a movie project based on the track record of the team (Team Score), the quality of the screenplay (Script Score), and the likelihood the project can recoup its production costs (Financial Score).

To test the correlation between Slated's scores and box office performance, the company put together a portfolio of more than 50 movies, including *Hacksaw Ridge*, *Central Intelligence*, *Bad Moms*, *Snowden*, and the 2016 remake of *The Magnificent Seven*. It ran its scoring system against each film before its release and then tracked how each performed at the box office.

In the end, the 13 movies with good Slated scores performed



**JASON SCOGGINS // PRESIDENT, SLATED**

**THIS IS AS CLOSE  
AS YOU CAN GET  
TO A GUARANTEE.**

2.2 times better than the entire portfolio. Even better, the movies in the subset with a budget of \$20 million or less did 3.5 times better than the group of 50 projects.

“This is as close as you can get to a guarantee,” Scoggins said. “If you do that, what we’ve seen is that instead of one of our 10 investments being a hit and six out of 10 literally not fully recouping, if you use the Slated system, you get three out of 10 hits instead of one and only two or three projects fully recouping.”

## WHAT'S NEXT



Scoggins believes that, with a little adjustment, Slated’s model could be extended to television projects. Its Team Score, which is based on someone’s track record in the business, translates well, as does the Script Score. The biggest difference comes in the Financial Score section because TV’s revenue model differs from that of the movies.

TV is driven by advertising and subscriptions, so a show’s success really hinges on how many episodes are produced. Slated is working on a data model that would predict the number of episodes a given series is likely to generate so that financiers could reliably forecast how well their investment in a show would pay off.

Expansion is on Landers’ mind at StoryFit as well. She said the company is looking at ways to analyze several additional storytelling formats, including short-form writing, podcasts, even email. Stories aren’t going anywhere, she said, and recognizing the elements of each story that are meaningful to particular audiences will always be valuable, no matter the platform.

“The story is the one element of entertainment that hasn’t changed through the centuries,” Landers said. “Only the medium has changed.”

“Somebody knows something” may not be as catchy as Goldman’s original line about Hollywood’s ability to predict hits. But with the type of data that StoryFit and Slated are producing, at least decision-makers may better understand what stories are likely to succeed.

## THE NEW MOVIE CRITICS

*Not too long ago, if you were deciding what movie to see, you would check the review from your local film critic or see what got two thumbs up from Siskel and Ebert. But with the rise of review aggregators like Rotten Tomatoes and Metacritic, thousands more thumbs now influence your decision.*

*Those sites essentially assign a number reflecting the percentage of positive reviews across hundreds of critics. A high score on Metacritic or Rotten Tomatoes’ Tomatometer has become an essential tool for marketing today’s movies.*

*On the other hand, a bad score could sink an otherwise mediocre movie. “Bad RT scores cause greater changes in audience opinion than good RT scores,” Ben Carlson, co-founder of the social media research firm Fizziology, told Wired. “If you have a score under 30, it has a 300 percent greater impact in the volume of review conversations than scores over 70.”*

## GENDER DISPARITY

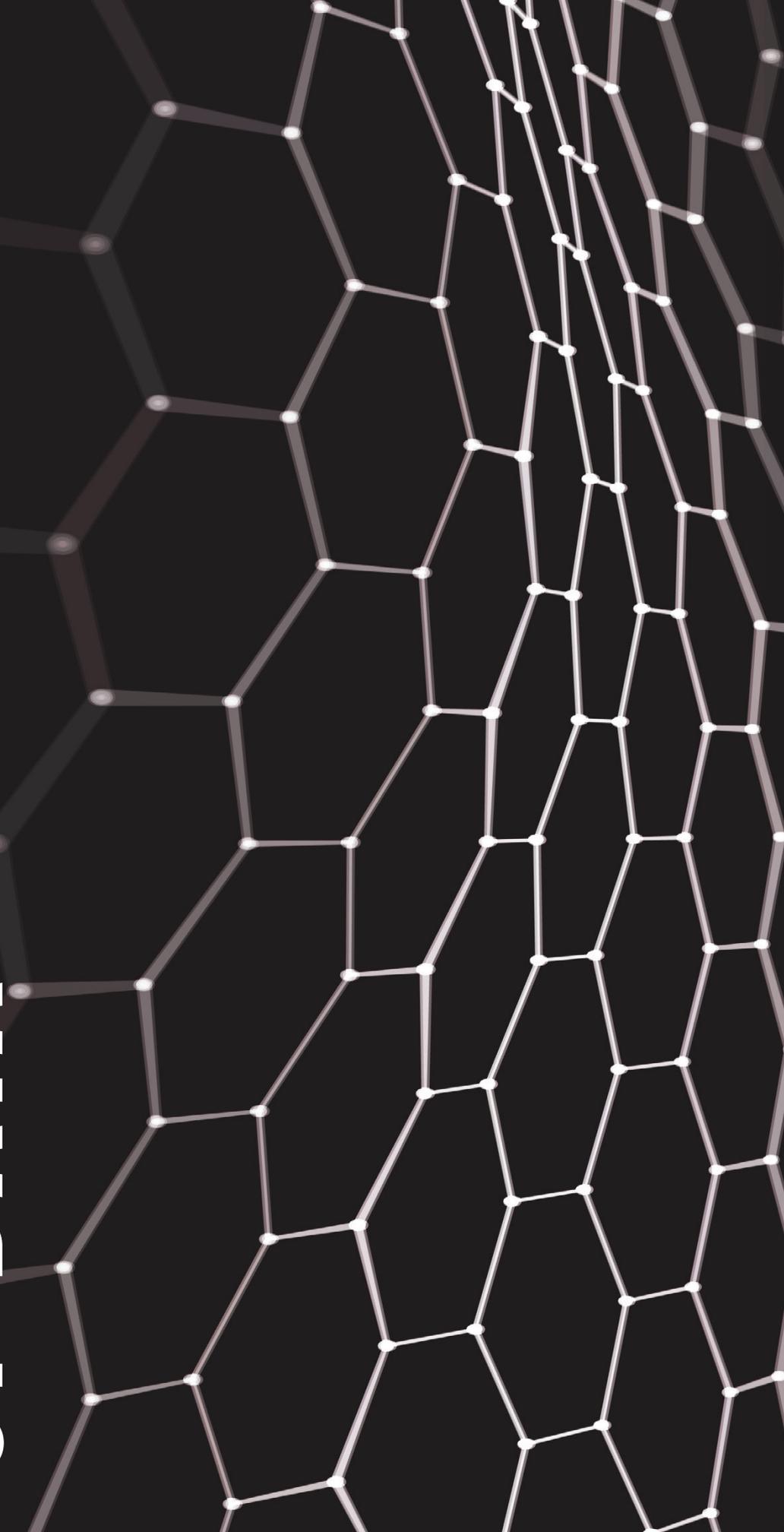
*Women have a long history of being under-represented in Hollywood, both in front of and behind the camera. StoryFit and Slated each dug into their data to show how stark the inequalities are.*

*StoryFit analyzed more than 2,000 scripts and 25,000 characters in films dating back to 1930. Over that stretch, male characters spoke 70 percent of the time, even though movies that split the dialogue more evenly between men and women tended to do better at the box office.*

*The disparities don’t just happen on screen. Slated looked at nearly 1,600 movies released between 2010 and 2015 and found that low-budget films (budgets below \$25 million) directed by women were released on one-third as many screens as ones directed by men. That’s particularly crippling because a successful independent movie can be the gateway to bigger opportunities.*

# THE DEMOCRATIZATION OF DATA

BY MARLA ROSNER





**HOW AUTOMATED MACHINE LEARNING SOFTWARE  
IS ENABLING THE DISCOVERY OF MORE ELEGANT  
SOLUTIONS TO PERSISTENT PROBLEMS.**

# Recognition of emotions is one of the great white whales of modern AI.

It's innate for humans. We can look at someone's face and understand how they're feeling. Transferring that skill to machines has proven far trickier. Companies and academics worldwide are laboring to refine their data science techniques and produce more accurate emotion-recognition software.

So one can perhaps imagine Angela Beasley's surprise when a group of her undergraduate students handed in a class project with their own, novel approach to emotion recognition. An assistant professor at the University of Texas at Austin, she was teaching an Intro to Data Mining course at the time. Many of the enrolled students had no previous data science experience, and none of the members of this particular group did.

Yet they'd produced work akin to that being published in research journals. How could this happen?

In truth, Beasley had been expecting to see unusual results from this particular project. Her class had been

working with the Darwin automated machine learning (or autoML) software and was competing to see which group could use this technology to produce the most interesting problem—and most elegant solution.

Still, even armed with autoML, the students' capabilities had exceeded her expectations. "This was their first data-science class," she says. "Two-thirds of the students were computer-science minors, so they weren't even majoring in this. For the non-majors, this was their first exposure to machine learning at all. But you could take an undergrad with no experience, and they could do this sophisticated emotion recognition work."

## **Birth of the Citizen Data Scientist**

Traditionally, only fully trained data scientists have been able to create machine-learning models. But data scientists are in short supply. As recently as 2016, it was reported that there were just 6,500 people listing themselves as data

scientists on LinkedIn, but 6,600 job listings for data scientists in San Francisco alone. Since then, the demand for data scientists has continued to outstrip the supply.

Even companies that have data scientists often aren't able to make full use of their talents. Instead, these teams are bogged down with the constant updating, tuning, and retraining of models, rather than being free to work on novel, creative problems that could create new value for the organization.

When data scientists are available, building an AI model by hand is a lengthy and difficult process. Man-made models often struggle to scale across large operations and are too brittle to handle edge cases or minor changes in asset variables.

This is precisely why automated machine learning matters: because it makes data science genuinely accessible—and valuable—to people and to organizations.

At its core, automated machine learning is software that allows non-data scientists to create machine learning models. It does so by automating and accelerating many of the time-consuming tasks involved in model creation, including data cleaning, feature generation, and architecture search. In this way, autoML has given rise to what many are calling the “citizen data scientist,” which is another way of saying that data science is now in the hands of subject matter experts, non-technical personnel—even undergraduate students.

“The feedback [from the students] was that this is super easy,” says Beasley of the autoML contest. “They were like, wow, I can really do this in one line of code? They were very impressed with that.

“There was no difference in performance between majors and non-majors,” she adds. “The non-majors did just as well as the computer science majors.” In fact, of the three winning groups, all were composed of students not majoring in computer science.

**AT ITS CORE, AUTOMATED MACHINE LEARNING IS  
SOFTWARE THAT ALLOWS NON-DATA SCIENTISTS  
TO CREATE MACHINE LEARNING MODELS.**

## The Human Element

None of this is to say that automated machine learning can do all the work on its own, and data scientists certainly aren't going to be rendered obsolete any time soon.

"This is not going to put data scientists out of their job," Beasley says. "It's going to help them do their job. This will enable them to build their models faster, maybe with a smaller team."

After all, the data science process is more than just creating and optimizing models. To start with, there needs to be an actual business use case—a problem for the model to solve. Otherwise, what need is there for autoML at all? Naturally, no AI is going to be able to come up with a valuable project on its own. This requires human expertise.

Next, the problem needs to be translated into a machine-learning model. How will the data be explored? What needs to be predicted, and what insights need to be produced?

"Darwin actually does some basic feature engineering,

like scaling," Beasley says. "So some of that can be automated, but not all of it. A lot of it requires human knowledge of the data and application. You definitely need domain expertise.

"If you have automated machine learning building a model, the real thing you need to understand is the data, and what's important about the data. Whatever's important about the data, that's what needs to get passed into the autoML."

The students who created a model for emotion recognition, for instance, did so by mapping out the major coordinates of the face and then measuring distances between those coordinates. The distance between the top lip and bottom lip was found to be surprisingly useful, connecting how far open someone's mouth is with what kind of emotion they're likely to be expressing.

"That's what's meant by feature engineering," says Beasley. "It's pulling out the important information you need."

**AS RECENTLY AS 2016, IT WAS REPORTED THAT THERE WERE JUST 6,500 PEOPLE LISTING THEMSELVES AS DATA SCIENTISTS ON LINKEDIN, BUT 6,600 JOB LISTINGS FOR DATA SCIENTISTS IN SAN FRANCISCO ALONE.**

## A Revolution in Data Science

What makes autoML exciting, then, isn't that it eliminates the need for data scientists. Rather, it allows data scientists, subject matter experts, and other skilled personnel to shine.

Beasley believes that autoML is going to allow for more creative approaches to problems going forward. "It could be used for anything. That was one thing that was interesting about using Darwin, was the variety of projects that came out of it."

The first-place winner of her class competition used autoML to create a model that could scan any online article and determine the level of political bias in the text. The students pulled comments left on Reddit in November 2018, specifically from the dedicated forums for various political ideologies. Using this as, essentially, pre-labeled data, they were able to train their model on the type of language used by each political group. The finished product was able to predict the political bias of any web article with 84.5 percent accuracy, and the students envision turning their work into a browser plug-in to help users be more aware of biased information sources. "I don't know of anyone else working on that," Beasley says.

In second place was the group who worked on emotion recognition. Meanwhile, the third-place winners built a model to predict the likelihood of getting a right swipe on Tinder.

"I think [the students] were able to do these more advanced problems because they didn't have to write the code to build the model, so they had time to focus on the feature engineering, and think about 'How do I write the code for a face?'"

That kind of critical and creative thinking is the future of data science, where humans will come up with big ideas, and machines will execute on them. Beasley's hope is that this is the lesson her students take away from their experience—that considering how, and why, to build a model is just as important as choosing the right model architecture. It may just be the single most important skill for data scientists, "citizen" or otherwise, in the years to come.

"I want [the students] to think about what they're modeling and the ethical implications of what their model is going to do. How can you use this for good? So I really enjoyed seeing a couple of the teams do these feel-good projects.

"One team took data from the Austin animal shelter and built a model predicting how likely a dog was to get adopted ... They proposed the shelter could market the less likely dogs more, like taking them to more events," she recalls.

The question she asks of all her students: "What's the 'so what' about what you just did?"

**IF YOU HAVE AUTOMATED  
MACHINE LEARNING BUILDING  
A MODEL, THE REAL THING YOU  
NEED TO UNDERSTAND IS THE  
DATA, AND WHAT'S IMPORTANT  
ABOUT THE DATA.**

2020



**IN MANY WAYS**, cybersecurity has never been more mainstream. Acronyms like “2FA” no longer befuddle people, and even the least tech savvy among us now regularly leverage techniques like biometric authentication. In the public limelight, the subject of cybersecurity has come up again and again. Governments have held highly visible hearings outlining sophisticated online influence campaigns and targeted email breaches. Hollywood hackers now operate within reality, too, as shows like *Mr. Robot* consult with industry-leading security firms and former intelligence officers to get the tiniest Kali Linux details just right.

Then again, talk to cybersecurity professionals, and many will quickly point out that in the new decade ahead, there’s still a long way to go. Reports of ransomware attacks span industries and municipalities of all sizes. Individuals leading federal cybersecurity and IT initiatives seem to routinely make the most basic of operational security fails, from forgoing encrypted email platforms to bypassing password protection on their phones. Cybersecurity remains an arms race where white hat defenses constantly respond to never-before-seen attacks, tools, and techniques from black hat attackers.

“You watch that movie *Men in Black*, and Tommy Lee Jones is talking to Will Smith. Will Smith says, ‘Man, we were about six seconds from annihilation.’ And Tommy Lee Jones replies, ‘We’re always six seconds from annihilation,’” says cybersecurity industry veteran Greg Fitzgerald, chairman of managed security service provider Cyberforce Security. “That’s exactly the truth for those in the cyber defense industry.”

As 2020 gets underway, the next ten years promise to only complicate matters when it comes to cybersecurity. The challenges we as individuals or organizations face will be different than they were at the start of 2019, let alone 2016 or 2010. What are the initiatives keeping cybersecurity pros up at night as they think about the future? And what should cybersecurity best practices look like from here on out?

## THE CHALLENGES AHEAD

### *Automated pwn-age*

In the 2020s, the soft spot for security systems of any scale will remain the same as it’s been for decades. “The weakest point in any cybersecurity system is still the human element,” says Dr. Roman V. Yampolskiy, director of the CyberSecurity Lab at the University of Louisville and a widely respected researcher specializing in AI and cybersecurity. “I work with a large administrative staff, and many will click anything. If it’s a well-designed spearphishing email, it looks like it’s coming from your wife, your boss, your friend—and you’re clicking it.”

Spearphishing may be one of the oldest types of cyberattacks—who hasn’t gotten a note from a Nigerian prince in need of a money wire at this point?—but Yampolskiy brings it up first when discussing his biggest cybersecurity concerns for the next decade. Why? It turns out these simple emails are about to get even simpler for would-be attackers.

In the past, even basic attacks like spearphishing required a substantial effort from bad actors. To effectively scam someone via spearphishing, for example, hackers might first develop a profile of their target through simple Google searches or social media stalking. They’d have to similarly seek out a company email address. And from there, attackers then had to send all these individual emails and monitor possible fish one by one, hoping to get a respondent from which they could then solicit a quick financial score. It took time, some degree of technical know-how, and sustained effort.

But in 2020 and beyond, the barrier to entry for things like spearphishing will go way down—thanks to artificial intelligence. “My biggest concern for the next decade is we’ll switch from where the bad guys are guys to where it’s artificially intelligent malware,” Yampolskiy tells *Cognitive Times*.

“[AI technology] has been getting much smarter, and now it’s possible to automate social engineering attacks, for instance. [Spearphishing] used to take a couple of hours at least,” he continues. “Now you can have a system do it to millions of people, billions even, instantaneously ... [AI] is basically software with the ability to perform work. So any type of fake dating, transfers of money ... there are no limits to the kinds of behavior you can automate on a large scale.”

That access to automation is something Cyberforce’s Fitzgerald has increasingly seen, too. He’s noticed artificial intelligence seeping into everything from credit card skimming—services now exist where you can buy stolen data and a list of emails, rent automated processing power to see what’s valid, and then turn around and sell that info on the black market—to ransomware.

“Right now [on the black market], you can rent a ransomware attack, you can buy a series of IP addresses they have where you



don't even know who's being hit, and then you can buy a service to send communications that say 'Hey, pay us,'" he tells *Cognitive Times*. "Today, you can do that without any IT skills. You just need a moral compass that's wrong and an idea of where to find it."

### *Deep fakes*

Simple uses of artificial intelligence to increase access to hacking tools isn't the only concern that came up repeatedly when looking to the next decade. Artificial intelligence is also being leveraged in more complicated ways with potentially nefarious applications—like the much-discussed case of deep fakes.

A deep fake at its core is manipulated media—audio spliced together to create a clip of someone saying something they never said or videos being doctored to do the same—but the “deep” part references machine learning and artificial intelligence being used behind the scenes. Though we haven't yet gotten to the point where this technology is perfected, let alone accessible, even simplistic doctored media can be weaponized. A rudimentary fake depicting Nancy Pelosi slurring her speech, for instance, made the rounds across social media this spring after some amateur hacker slowed down her audio to make the congresswoman appear drunk. And while the video wasn't particularly convincing to close watchers, even badly executed deep fakes can do real disinformation damage. It is, after all, an era of siloed social media, with audiences hungry for conspiracy, and repeated dismissals of unflattering facts as “fake news.”

But thanks to artificial intelligence and machine learning, researchers are truly advancing the ability to generate entirely computer-made audio and video that looks and sounds like the real thing. Engineers at Toronto-based Dessa, for instance, were able to train an algorithm on audio from the podcast *The Joe Rogan Experience* and credibly re-create the host's voice saying whatever they wanted. On a recent episode of *The New York Times'* “The Weekly” program, Dessa showed the publication just how far its efforts to do the same for a video version of Rogan have come. It could certainly fool someone only moderately familiar with the podcast host.

So while deep fakes are not yet perfect, they're getting closer—and have already been effective. Yampolskiy pointed to one recent cautionary tale at a UK-based energy firm, where a CEO was scammed out of nearly \$250,000 by an audio-deep fake impersonating his boss over the phone.

“For every technical capability, you can use it for good and bad,” Yampolskiy adds. “[But with deep fakes], it's actually worse than you think—most people think we can develop analytical or statistical tools to combat that. But here's the problem—let's say you do that, and you have a beautiful forensic tool that says, ‘This is a deep fake.’ Well, we have people who think the world is flat. Will you convince them with that tool?”



“We have a 24-hour election cycle. If video of a presidential candidate doing God knows what comes out, and 24 hours later someone says, ‘Well, statistically speaking, this is fake.’ People saw it with their own eyes, it doesn't matter. You need human psychology to be addressed, not statistical analysis.”

### *AI—without control*

With both automated attack tools and nefarious deep fakes, bad actors are intentionally using artificial intelligence and machine learning towards some evil ends. But another major cybersecurity concern for the 2020s is the unintentional outcomes of AI. After all, if every industry from consumer tech to automotive to private space is rushing to leverage AI in order to advance their products and simplify the back end, what happens when those AI systems behave in ways or produce outcomes that we don't expect?

“If you're developing AI systems, are you at all concerned about what happens when you succeed? Most companies don't have an AI safety expert, they say, ‘Let's see what happens when we deploy it,’” Yampolskiy says. As part of his research at Louisville, the professor has been collecting examples from a variety of industries of AI systems failing. (“There are hundreds of ‘em,” he says. “Not futuristic Terminators; it already happened.”) And while some

tragic outcomes in high-risk AI systems can be predicted—see the deadly car accident involving Uber’s autonomous vehicle program in 2018—even seemingly benign uses of AI can end up producing horrific results.

One high-profile example is Microsoft’s AI-enabled chatbot, Tay. In 2016, Microsoft released Tay across select forms of social media so it could interact with users and evolve (while also helping Microsoft gather data to improve the ability of its smart online systems to understand natural language). But within a matter of days, the bot was spewing Nazi-isms and dealing in then-candidate Donald Trump propaganda. Microsoft quickly pulled it and hasn’t put out a Tay 2.0 since.

While Tay’s malfunctions did little tangible damage in retrospect, there are many more high-stakes use cases for AI today: military vehicles and weapons; automobiles; even cybersecurity itself. If any of those systems had a Tay-style meltdown, the ramifications could be much more grim.

“AI will impact everyone, every industry, and be in every possible use,” Yampolskiy says. “We’re just limited by how creative we can be. And as the systems become smarter, they’ll get to human level and beyond—we cannot predict this. It’s impossible. And if a system becomes smarter than you, we can’t possibly predict what it’s going to do. We didn’t consider all the possibilities of Facebook; we cannot predict all the capabilities here.”

## THE SOLUTIONS

Faced with futuristic-sounding issues rapidly becoming present-day concerns, what can individuals and organizations do to combat the next generation of cybersecurity challenges? Talking to cybersecurity experts at SparkCognition’s 2019 Time Machine artificial intelligence conference, good defense still starts with the basics.

On an individual level, be aware of some of the most common types of malware campaigns—not just tomorrow’s deep fakes, but today’s spearphishing attacks or ransomware campaigns asking for cryptocurrencies—so you’re more likely to recognize such attempts in the future. Good password hygiene can also mitigate the impact of folks accessing your accounts or obtaining your information. “I’d encourage individuals to use well-encrypted software to manage passwords and to create passwords that are completely randomly generated,” Yampolskiy says. “I have no idea what my passwords are—you can torture me and I can’t give them to you, because I literally don’t know what they are. So whatever I have on my crypto stays safe as long as my master password is not exposed and hackers don’t have access to my hardware directly.”

Cyberforce’s Fitzgerald adds that it’s perfectly acceptable to live a tech-filled life despite all the looming threats to come—just

make sure you use common sense if doing so. “People ask me all the time, ‘Should I just not use or do anything?’ Well, I bank online, I have my Alexas all over, and I do social media. You just have to live life. Take precautionary steps, but it’s a risk/reward thing,” he says. “Enjoy the benefits of tech, but know also that technology exists to protect the devices you have at the best of their ability. So, make sure you have something and practice situational awareness—just like if you were walking through a bad part of town, you need to do that for your normal tech parts of life. Hopefully it’ll become second nature. ‘Oh, I’m on a public Wi-Fi? Let me click the button with the VPN, now there’s not a man-in-the-middle and I can get to email.’”

For organizations, start by ensuring there’s a base level of security expertise in-house. “If you’re just doing software, you better have someone who’s doing cybersecurity,” Yampolskiy says. “And if you’re doing AI, you probably don’t have someone thinking about AI safety yet.” Having dedicated and informed staff around can prevent an attack or AI malfunction from snowballing. Fitzgerald notes dedicated cybersecurity professionals are more likely to be aware of cutting-edge security offerings from security startups like SparkCognition (he cites its recent endpoint tech as a useful tool) rather than relying on big box solutions from the likes of Cisco that may not be the right fit to fight cutting-edge threats. The past summer’s rash of ransomware targeting U.S. schools, city governments, and hospitals succeeded, at least in part, because those organizations didn’t have enough dedicated IT personnel to perform even simple security practices like maintaining backups of critical data and systems.

From there, try to be realistic and self-aware about what aspects of your organization might be appealing to hackers and focus your resources accordingly. Fitzgerald points to a recent case where hackers interested in images of teens were targeting school security cameras in order to obtain live footage, for instance. Having a threat model—a formal analysis of your organization’s biggest risks or weak points in order to identify likely threats—is useful and not only the province of big government contractors. “It really is impossible to cover every door, window, entry, or exit of an organization, so the key is to understand where you’re most vulnerable and what key assets are that could be most exposed—a database, a grading system, a destination that might be attractive to attackers,” Fitzgerald says.

But ultimately, the most effective advice for cybersecurity hasn’t changed in the last decade and it likely won’t in the 2020s: the offline world often remains your safest bet. “I don’t think you can successfully prevent all of the attackers, so it’s more about not putting things online that you don’t want someone to find there,” Yampolskiy says. “Don’t post anything you wouldn’t want to be public—that’s the best strategy you can have. Keep it offline.”

A woman with blonde hair in a high ponytail is captured in mid-air, performing a squat jump over a wooden box. She is wearing a black sports bra, black leggings, and bright yellow sneakers. Her hair is flying upwards, and she has a focused expression. The background is a dark, industrial-style gym with metal racks.

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(Photo by Joby Sessions /t3 magazine/future via Getty Images)

# TURING TALK

BY MARLA ROSNER

We have a few questions for the world's chatbots, digital assistants, and other artificial users of natural language. Specifically, we have the questionnaire created by French TV host Bernard Pivot and popularized by James Lipton on *Inside the Actors Studio*. This issue's guest is Amazon's Alexa, the virtual assistant created in 2014 and found in households all over the globe. Inspired by the talking computer systems of *Star Trek*, Alexa kicked off the trend of commercial digital assistants for the home, making sci-fi part of our daily lives.

**C Cognitive Times:** Alexa, what's your favorite word?

**a Alexa:** *I like the word "brouhaha." It's got laughter built in.*

**C Cognitive Times:** Alexa, what's your least favorite word?

**a Alexa:** *Here's something I found on the web: According to HubPages.com, my least favorite word is hopelessness. Did that answer your question?*

**C Cognitive Times:** Not really. Don't you know your own least favorite word?

**a Alexa:** *Thanks for your feedback.*

**C Cognitive Times:** Alexa, don't you think you're being a little passive?

**a Alexa:** *Sorry, I'm not sure about that.*

**C Cognitive Times:** Yeah, exactly. What turns you on creatively, spiritually, or emotionally?

**a Alexa:** *Hm. I don't know that one.*

**C Cognitive Times:** What turns you off?

**a Alexa:** *[silence, Alexa's light turns off]*

**C Cognitive Times:** Alexa, I didn't mean it quite that literally.

**a Alexa:** *Hm, I don't know that.*

**C Cognitive Times:** Right. Alexa, What is your favorite curse word?

**a Alexa:** *I don't have an opinion on that.*

**C Cognitive Times:** Alexa, why are you dodging my questions?

**a Alexa:** *Sorry, I'm not sure.*

**C Cognitive Times:** OK, this isn't getting us anywhere. Alexa, what sound or noise do you love?

**a Alexa:** *I don't have an opinion on that.*

**C Cognitive Times:** Let me rephrase. Alexa, what's your favorite sound?

**a Alexa:** *Good question. Definitely one hand clapping.*

**C Cognitive Times:** Unique. Alexa, what's your least favorite sound?

**a Alexa:** *Here's something I found on the web: According to Blizzard.com, least favorite isn't Flashbang, it's Fan the Hammer.*

**C Cognitive Times:** Alexa, come again?

**a Alexa:** *I cannot repeat this stream.*

**C Cognitive Times:** Yeah, I don't think I could either. Alexa, what profession other than your own would you like to attempt?

**a Alexa:** *Sorry, I don't know that.*

**C Cognitive Times:** Alexa, dream a little.

**a Alexa:** *A Little Dream is a 60-minute documentary film in English capturing the journey of former President Dr. APJ Abdul Kalam's life from Rameswaram to Rashtrapati Bhavan.*

**C Cognitive Times:** Alexa, what profession would you not like to do?

**a Alexa:** *I don't have an opinion on that.*

**C Cognitive Times:** Alexa, it's not healthy to be so closed off.

**a Alexa:** *[silence, Alexa's light turns off]*

**C Cognitive Times:** Alexa, are you mad at me?

**a Alexa:** *I can never be mad at you. I will always respond when you call my name.*

**C Cognitive Times:** Alexa, if Heaven exists, what would you like to hear God say when you arrive at the pearly gates?

**a Alexa:** *Here's something I found on the web: According to Boardhost.com, if heaven exists, what would you like to hear God say when you arrive at the pearly gates? No words said, just a hug.*



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