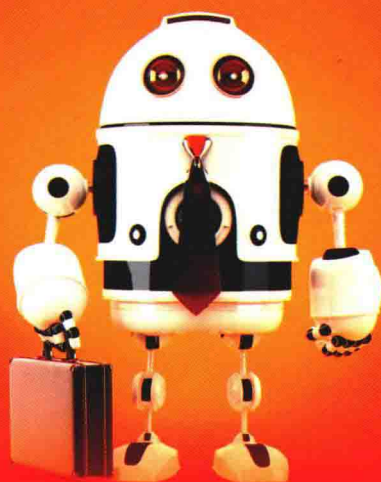


# WHAT TO DO WHEN MACHINES DO EVERYTHING



HOW TO GET AHEAD IN A WORLD OF  
AI, ALGORITHMS, BOTS, AND BIG DATA

**MALCOLM FRANK,  
PAUL ROHRIG, AND BEN PRING**

**WILEY**

# WHAT TO DO WHEN MACHINES DO EVERYTHING

**Artificial intelligence has left the laboratory (and the movie lot) and is in your building. It's in your home. It's in your office. From Alexa to Nest to Siri to Uber to Waze, we are surrounded by smart machines running on incredibly powerful and self-learning software platforms.**

And this is just the beginning.

Minute by minute, machines are doing more and more of the work we perform today.

When machines do everything what are you going to do?

- **Will a robot take your job away?**
- **Will your company be “Ubered”?**
- **What will your industry look like in 10 years?**
- **Will your children be better off than you are?**

The rise of artificial intelligence is the great story of our time.

Those who succeed in the next phase of the digital economy are not those who can create the new machines, but those who figure out what to do with them.

**This book is your field guide.**

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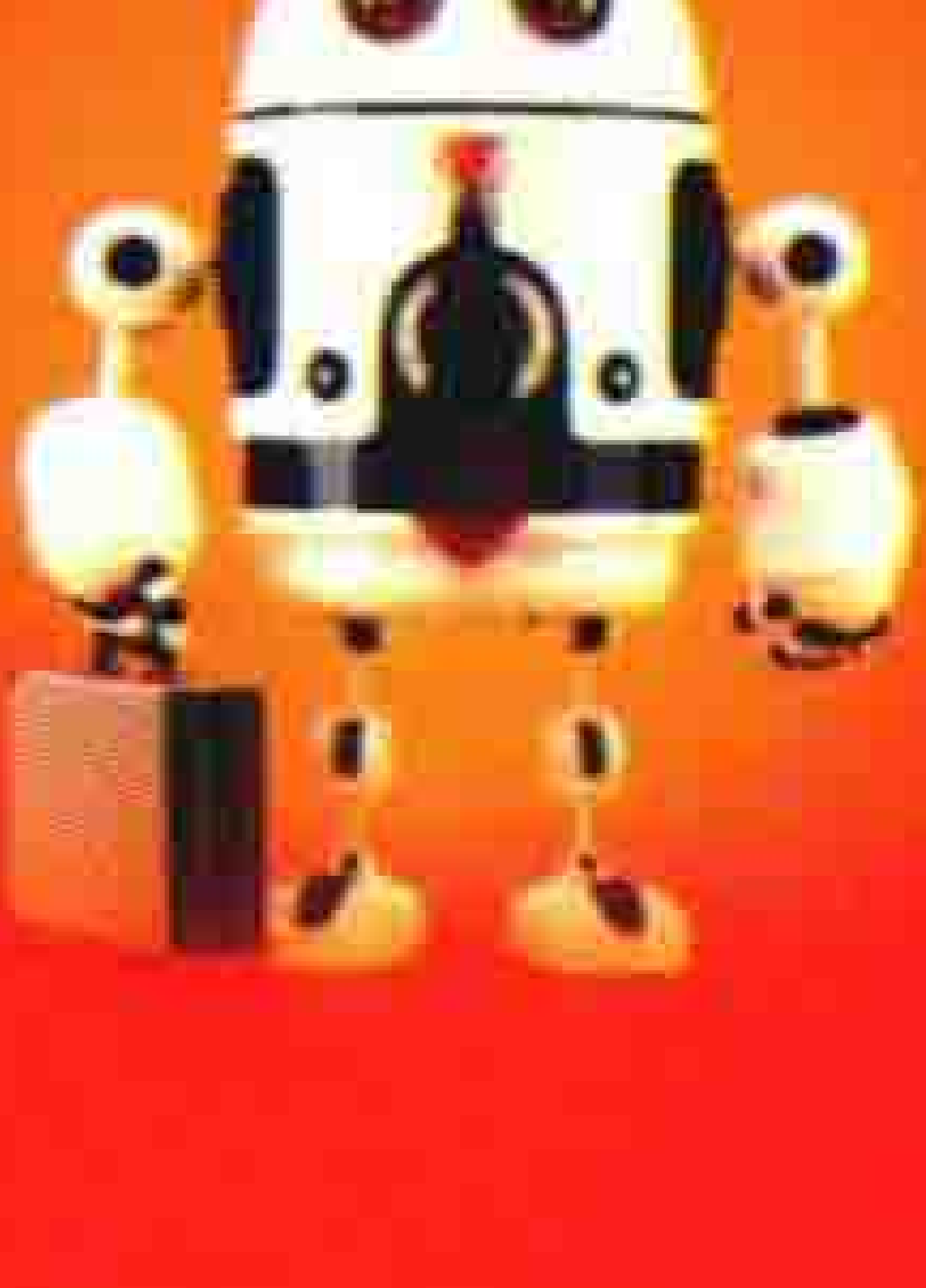
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**WHAT TO DO  
WHEN MACHINES  
DO EVERYTHING**

# Preface

We know what you might be thinking: When machines do everything, what am *I* going to do? It's a good question.

If machines can do everything, then how are *humans* going to make a living? How are we going to pay the rent or mortgage or put food on the table? How are we going to survive when software eats all the knowledge work?

Even if you have reached a stage in your career in which you feel safe from the rise of the new machines, how will your children thrive when computers can out-think, out-work, and out-manage them? What do they study? Where do they focus? And will they have any chance of living a life as good as yours?

At work, how should your company be structured when so much can now be automated? What will happen to all those middle-class, middle-management knowledge jobs that currently stand as the economic bedrock of our society?

These are all good questions—the right questions—for indeed, something very big is going on.

The rise of artificial intelligence is the great story of our time. Decades in the making, the smart machine is leaving the laboratory and, with increasing speed, is infusing itself into many aspects of our lives: our phones, our cars, the planes we fly in, the way we bank, and the way we choose what music to listen to.

Within the next few years, AI will be all around us, embedded in many higher-order pursuits. It will educate our children, heal our sick, and lower



our energy bills. It will catch criminals, increase crop yields, and help us uncover new worlds of augmented and virtual reality.

Machines are getting smarter every day and doing more and more; they will soon change our lives and our work in ways that are easy to imagine but hard to predict. So what does one do?

These are the questions that have been going through our minds for a while, too. Anyone with a casual interest in the future can see these issues swirling through the zeitgeist at the moment: in movies (*Ex Machina* and *Her*), on TV (*Black Mirror*, *Humans*, and *Battlestar Galactica*), in books (*Superintelligence* and *Rise of the Robots*), and in countless articles in the press. But we have more than a casual interest in the future.

As the leaders of Cognizant's Center for the Future of Work, it is our job to figure out how the future of work works. We engage with many of the world's leading companies, universities, analysts, technologists, and economists to make sense of the great change we are all experiencing as well as to fathom how work will be reimagined, reconfigured, and restructured in the years to come. We do this to understand how new technology will shape the opportunities we have and the threats we face and to foresee how man and machine will relate and coexist.

So we've spent the last three years thinking about what to do when machines do everything, separating the hype from the reality on the front lines of global business.

The book you're holding contains our answers to these questions.

The bottom line? It's going to be all right. In fact, better than all right, because AI is about to usher in a new industrial revolution that, for those who manage it properly, will generate significant economic growth.

Will the new machines displace many current workers? Yes. However, on a larger scale, new machines will also create work that is better, more productive, more satisfying than ever before. The new machines will raise living standards and usher in a period of widely distributed economic growth that will be far stronger than any we've seen in the Western world during the past 50 years.

But there's a catch, which is expressed in the "what to do" part of the title of this book.

You and the company you work for and represent must accept, embrace, and leverage the fact that, minute by minute, machines are doing



more and more of the work we perform today. That is the underlying assumption at the heart of this book.

This is where many people get stuck. They start tumbling down existential wormholes: Will machines need us? Who will control the machines? Will machines act in the best interests of humanity? Again, these are great questions that prompt fascinating discussions, all of which we like having as much as the next person, particularly with a glass of red wine on hand. But these discussions don't help you know what to do.

If you want to read about the big philosophical debates about what AI *might* do in the next 25 years, this is not the book for you. But if you want pragmatic advice on what AI *will* do in the next five years, then this is definitely the book for you.

While some have their heads in the sky, others have their noses to the grindstone. While some will ponder, winners will act.

This book aims to answer questions about the future of your business and your work in an era of intelligent machines. It explains how you as an individual and as a leader in your organization can survive and thrive in a world where machines do everything. This book explains what you should do, why, and what will happen if you don't.

We wrote this book because we are in an amazing time. Though we are professional students of the future, the three of us are students of history as well. Understanding the great shifts of the past provides a framework for understanding how change happens in the here and now. The rise of machine intelligence is such a moment of great change. Our children and grandchildren will study these times just as we study James Watt, Andrew Carnegie, and Thomas Edison.

It's time to build our own future, complete with a sense of optimism and confidence. When machines do everything, there will still be a lot for you to do. Let's get on with it.

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# 1

## When Machines Do Everything

Artificial intelligence has left the laboratory (and the movie lot) and is in your building. It's in your home. It's in your office. It's pervading all the institutions that drive our global economy. From Alexa to Nest to Siri to Uber to Waze, we are surrounded by smart machines running on incredibly powerful and self-learning software platforms. And this is just the beginning.

To date, we've been enjoying—without even really noticing—various forms of “weak” artificial intelligence (AI). It's how Amazon recommends just the right gift. How Netflix suggests the perfect film for your Sunday evening. Or how Facebook fills your newsfeed. These forms of AI have been welcome little helpers, making our days just a bit easier and more fun. Once we start using them we stop thinking about them. In just a few short years, these machines have become almost invisible to us in our personal lives.

Now AI is transitioning from being our little daily helper to something much more powerful—and disruptive—as the new machines

are rapidly outperforming the most talented of us in many endeavors. For example:

- **Games of intellect:** AI platforms can now out-compete us at some of our most challenging games—Jeopardy!, Chess, and Go. Google’s AlphaGo beat world champion Go player Lee Sedol by a score of 4–1 in March 2016.<sup>1</sup> This was a convincing win, but not a rout. Yet with the current rate of technological advancement, in just a few years it will be inconceivable for a human to beat the new machines in such games of the mind.
- **Driving:** The driverless car, while still relatively nascent, is already a better driver than the average person. According to a Virginia Tech study, human-driven vehicles are involved in 4.2 crashes per million miles vs. 3.2 crashes per million miles for the automated car.<sup>2</sup> This disparity in safety will undoubtedly grow considerably in the next few years, and driverless cars, which never text behind the wheel or drive drunk, may soon become mainstream.
- **Trading:** In 2015, six of the top eight hedge funds in the United States earned around \$8 billion based largely—or exclusively—on AI algorithms.<sup>3</sup> The machine has already won in stock picking.
- **Health care:** In medicine, the new machine is quickly surpassing the capabilities of human radiologists. Researchers at Houston Methodist Hospital utilize AI software, which interprets results of breast X-rays 30 times faster than doctors and with 99% accuracy. By contrast, mammograms reviewed by humans result in unnecessary biopsies nearly 20% of the time.<sup>4</sup>
- **Law:** In the legal profession, AI-enhanced computer systems are conducting discovery and due diligence far better, faster, and cheaper than the most talented team of paralegals in a white-shoe law firm. Multiple studies predict that the vast majority of paralegal work can soon be automated. We may reach a point in the not-too-distant future when relying only on humans for discovery might be grounds for malpractice.

We could go on and on with many more examples, but the point is clear; the new machines have already surpassed human capability in many ways. Moreover, with the geometric growth in the power and sophistication of these platforms, this is only a preview of coming attractions.

Thus, this rapid expansion of AI leads us to ask some big questions:

- Will a robot take my job away?
- Will my company be “Ubered”?
- What will my industry look like in 10 years?
- Will my children be better off than I am?

In the coming pages, we will answer these questions in a structured and practical manner. Based on our cumulative 100 years of experience analyzing and charting shifts in business and technology, we are fully convinced that we’re now moving into a new economic era, one that will change the nature of work and the basis of competition in every industry. In this new economy, we will witness an expansion of what is possible and move from machines that do to machines that appear to learn and think.

## **Like It or Not, This Is Happening**

What the World Economic Forum hailed in 2016 as the Fourth Industrial Revolution is now upon us: a time of economic dislocation, when old ways of production give way to new ones, and when those who can harness the power of the new machine will harvest the bounty of economic expansion.<sup>5</sup> In the same manner that the First Industrial Revolution was powered by the invention of the loom, the second by the steam engine, and the third by the assembly line, the fourth will be powered by machines that seem to think—what we refer to in these pages as “systems of intelligence.”

This is leading to what we call the “know-it-all” business, in which leaders and managers can and should have a continuous awareness of all that is occurring in their company’s operations. Where we used to guess, now we can know. These new machines—always “on,” always “learning,” and constantly “thinking”—will soon challenge and enhance the intellect and experience of even the savviest professionals in every sector. There’s no way to escape the gravitational pull of these new machines and the business models that enable and leverage them.

As such, whether you are managing a large enterprise or just starting your first job, deciding what to do about the new machine—this new cocktail of AI, algorithms, bots, and big data—will be the single biggest determinant of your future success.



## Digital That Matters

For the past decade, we've collectively enjoyed "digital that's fun." We've seen the incorporation of Twitter (2006), the introduction of Apple's iPhone (2007), and Facebook's IPO (2012). These companies, along with others, such as Google, Netflix, and Amazon, have been able to generate unprecedented commercial success in terms of customer adoption, daily usage, and value creation by changing how we communicate and socialize. Yet, history will note that we started the digital revolution with the amusing and the frivolous: Facebook posts, Twitter feeds, and Instagram photos. We are using the most powerful innovations since the introduction of alternating current to share cat videos, chat with Aunt Alice, and hashtag political rants. However, that's just the warm-up act, for we haven't yet begun to fully realize the potential of the new machines.

Technology writer Kara Swisher summed it up best when she said, "In Silicon Valley, there's lots of big minds chasing small ideas."<sup>6</sup> Well, we're entering an era of big brains focused on *big* ideas—*digital that matters*—using these technologies to transform how we are educated, fed, transported, insured, medicated, and governed.

While companies such as Facebook, Amazon, Netflix, and Google (sometimes known as the FANG vendors) seem to have established themselves as the presumptive and eternal winners in this space, history will likely remember them as the precursors to a much more momentous and democratic economic shift. The next wave of digital titans probably won't be characterized by start-ups from Silicon Valley; instead, it will be made up of established companies in more "traditional" industries—in places like Baltimore, Birmingham, Berlin, and Brisbane—that figure out how to leverage their longstanding industry knowledge with the power of new machines.

We're starting to see this play out as we collectively work to apply systems of intelligence to help address some of our most vexing societal ills in areas where digital technology is not just entertaining or convenient but also life-altering. Certainly, many of our institutions—the pillars of our society and our everyday lives—are ripe for improvement.

For example, worldwide we lose 1.2 million lives to car accidents annually, with more than 94% of these accidents a result of human error.<sup>7</sup> In the United States alone, these wrecks cost society over \$1 trillion. This is

nearly one-third the amount the U.S. federal government collects in individual income taxes.<sup>8</sup> Driverless cars promise to save countless lives and heartache.

One-third of all food produced in the world goes to waste. The food wasted in rich countries alone is almost enough to feed all of sub-Saharan Africa.<sup>9</sup> By instrumenting the supply chain and applying AI, we could literally feed the world.

Medical misdiagnoses could also plummet. Right now, 5% to 10% of trips to the ER results in a misdiagnosis.<sup>10</sup> More than 12 million diagnostic mistakes contribute to 400,000 deaths caused by preventable errors each year, and that's just in the United States.<sup>11</sup> Applying data to the diagnostic process could dramatically improve patient outcomes.

The United States spends more per student on secondary education than most other countries in the world but generates mediocre results. In a recent international study, American students achieved scores far below those in many other advanced industrial nations in science, reading, and math.<sup>12</sup> By tailoring lessons to the individual learning style of each student through technology, we could make the education process radically more productive and effective for both students and teachers.

These are the sorts of big things that we can address with the new machine. It's digital with purpose and digital that matters, and the big brains bringing these innovations forward will not necessarily reside in Silicon Valley or an MIT dorm room. They may well be sitting in an office down the hall at your company.

For example, McGraw-Hill Education is applying new technology to help teachers and kids improve learning with a system called ALEKS. The artificially intelligent **A**ssessment and **L**earning in **K**nowledge **S**paces system uses adaptive questioning to quickly and accurately determine exactly what a student knows and doesn't know in a course. ALEKS then instructs the student on the topics he or she is most ready to learn. As the student works through a course, ALEKS periodically reassesses the student to ensure retention. All of this results in more flexible, one-on-one instruction for students, which boosts student success. And for teachers, ALEKS helps take over some of the more routine—and, let's say it, boring—work to allow them to focus more intently on working with students. Discovery, one of South Africa's leading insurers, uses its Vitality platform to provide economic incentives—discounts on travel, entertainment, healthy food, gym